



Cube Highways and Infrastructure
Pte. Ltd.

Environmental and Social Impact Assessment for Ghaziabad -Aligarh Road Section of NH-34 (km 23.600 to km 149.900) and Khurja realignment (9.285 km), Uttar Pradesh

ESIA Report

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ESIA Report



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Acronyms and Abbreviations

Name	Description
AAQ	Ambient Air Quality
ADB	Asian Development Bank
AiIB	Asian Infrastructure Investment Bank
AOI	Area of Influence
CALA	Competent Authority for Land Acquisition
CFE	Consent for Establishment
CFO	Consent for Operation
CGWA	Central Ground Water Authority

Name	Description
CH	Cube Highways
CHC	Community Health Centres
CHWTSDF	Common Hazardous Waste Treatment, Storage and Disposal Facility
CR	Critically Endangered
CT	Census town
DBFOT	Design, Build, Finance, Operation and Transfer
DPR	Detailed Project Report
EHS	Environment Health and Safety
EHSS	Environment, Health, Safety, Security
EIA	Environment Impact Assessment
EPC	Engineering, procurement and construction
ERM	ERM India Private Limited
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
FGD	Focus Group Discussion
FPIC	Free prior and Informed Consent
GAEPL	Ghaziabad Aligarh Expressway Pvt. Ltd
GAP	Gender Action Plan
GRM	Grievance Redressal Mechanism
HH	House Hold
HR	Human Resource
ICP	Informed Consultation and Participation
IE	Independent Engineer
IFC	International Finance Corporation
IP	Indigenous People
IPD	Indoor Patient Department
IPP	Indigenous Peoples Plan
IUCN	International Union for the Conservation of Nature
KSTPP	Khurja Super Thermal Power Plant
LA	Land Acquisition
LEP	Livelihood Enhancement Plan
MoEF&CC	Ministry of Environment, Forest and Climate Change
MORT&H	Ministry of Road Transport and Highways of India
NHAI	National Highways Authority of India
NoC	No Objection Certificate
NP	Nagar Palika/ Nagar Panchayat
NPP	Nagar Palika Parishad
O&M	Operations and routine maintenance
OPD	Out Patient Department
PAF	Project Affected Families
PAP	Project Affected Person
PCA	Primary Census Abstract
PCOD	Provisional Commercial Operation Date
PESO	Petroleum and Explosives Safety Organization
PHC	Public Health Centres
PHC	Primary Health Centre
PWD	Public Work Department
RAP	Resettlement Action Plan
RFCTLARR	Right to Fair Compensation Transparency and Resettlement & Rehabilitation
ROB	Railway Over Bridges
ROW	Right Of Way
SC	Scheduled Caste
SEP	Stakeholder Engagement Plan
SIA	Social Impact Assessment
SPCB	State Pollution Control Boards
SPS	Safety Policy statement
SPV	Special Purpose Vehicle

Name	Description
ST	Scheduled Tribe
THDCIL	THDC India Limited
TMS	Toll Management System
UPPCB	Uttar Pradesh Pollution Control Board
VUP	Vehicular Under Passes
WB	World Bank

1. INTRODUCTION

ERM India Private Limited (ERM) has been commissioned by Cube Highways and Infrastructure Pte. Ltd. (*hereinafter referred to as 'Cube' or 'Client'*) to undertake an Environmental and Social Impact Assessment (ESIA) for the six laning of 126.300 km long Ghaziabad -Aligarh Section of NH-34 from km 23.600 to km 149.900, along with realignment of a 9.285 km greenfield bypass road at Khurja for the upcoming Khurja Super Thermal Power Plant in the state of Uttar Pradesh (*hereinafter referred to as 'Project' or 'Project Road'*). This involves the following key components:

1. Taking over the operations and maintenance (O&M) concession;
2. Expanding the road from four to six lanes, noting that all existing bridges and structures are already compliant with a six-lane configuration; and
3. A realignment at Khurja will be constructed by EPC contractor appointed by NHAI and transferred to Cube highways upon completion of construction. It will become part of NH 34, from km 98+400 near Desehra Village to km 105+500 near Arnia Khurd village, leaving the presently operational, four-lane stretch of road, which will be used by the Khurja Thermal Power Project and no longer be used as a highway.

Cube Highways (CH) is a Singapore-based company, which invests in road and highway projects along with other related infrastructure in India. It has one of the largest portfolios of toll roads in India with backing and support from international investors consisting of I Squared Capital, Abu Dhabi Investment Authority, International Finance Corporation, and a consortium of Japanese investors including Mitsubishi Corporation, Japan Overseas Infrastructure Investment Corporation for Transport and Urban Development, East Nippon Expressway Company Ltd. and Japan Expressway Company International Ltd.

1.1 Background and Project Significance

Cube Highways is in the process of acquiring the Ghaziabad-Aligarh Section of NH-34, starting from Ghaziabad (km 23.600) to Aligarh (km 149.900). The Project Road traverses through four districts of Uttar Pradesh i.e. Ghaziabad, Gautam Buddha Nagar, Bulandshahar and Aligarh. Further, a re-routing of Ghaziabad Aligarh road section in THDC India Limited (THDCIL) area from km 98+400 near Desehra Village to km 105+500 near Arnia Khurd village (green field road), referred to as "Khurja Realignment" is also proposed. The length of the realignment is 9.285km.

Ghaziabad Aligarh Expressway Private Limited is a special purpose vehicle (SPV or GAEPL or the "Concessionaire") established to operate and maintain this 126.3 km road which needs to be expanded from a 4-lane configuration to 6-lane by November 2023. Cube proposes to commence this expansion as soon as they have closed the acquisition.

The Concession Agreement for the Project was signed on 20 May 2010, between National Highways Authority of India (NHAI) and GAEPL as part of NHDP Phase III on Design, Build, Finance, Operation and Transfer (DBFOT) Toll Basis. The concessionaire i.e. GAEPL was appointed on 25 February 2011. The Concession period of the road is 24 years.

The project will involve expanding from four to six lane effectively for about 83.45 km (as the remaining length includes: 14.7 km of structures which are already built as per six lane configurations; 20.3 km of Aligarh bypass which will be retained as 4-lane; 7.1 km of existing road which will be provided for development of Power plant at Khurja and 0.750 km toll plaza pavement length. (ii) operations and maintenance (O&M) of the road.

The initial scheduled date of completion of construction was 24 August, 2013. Provisional Commercial Operation Date (PCOD) for 106.55 km of the project road was granted on 23 June 2015. Later, PCOD

for 19.41 km of the project road was granted on 25 November 2016. However, the project road is yet to receive the final completion certification due to some pending construction works¹.

1.2 Project Road

In terms of land use, the Project Road traverses through predominantly agricultural land followed by built up area. Towns along the project road are Ghaziabad, Dadri, Sikandrabad, Bulandshahr, Khurja, Gabhana and Aligarh for which bypasses are provided. The important features of the Project road is as mentioned below in **Table 1.1**.

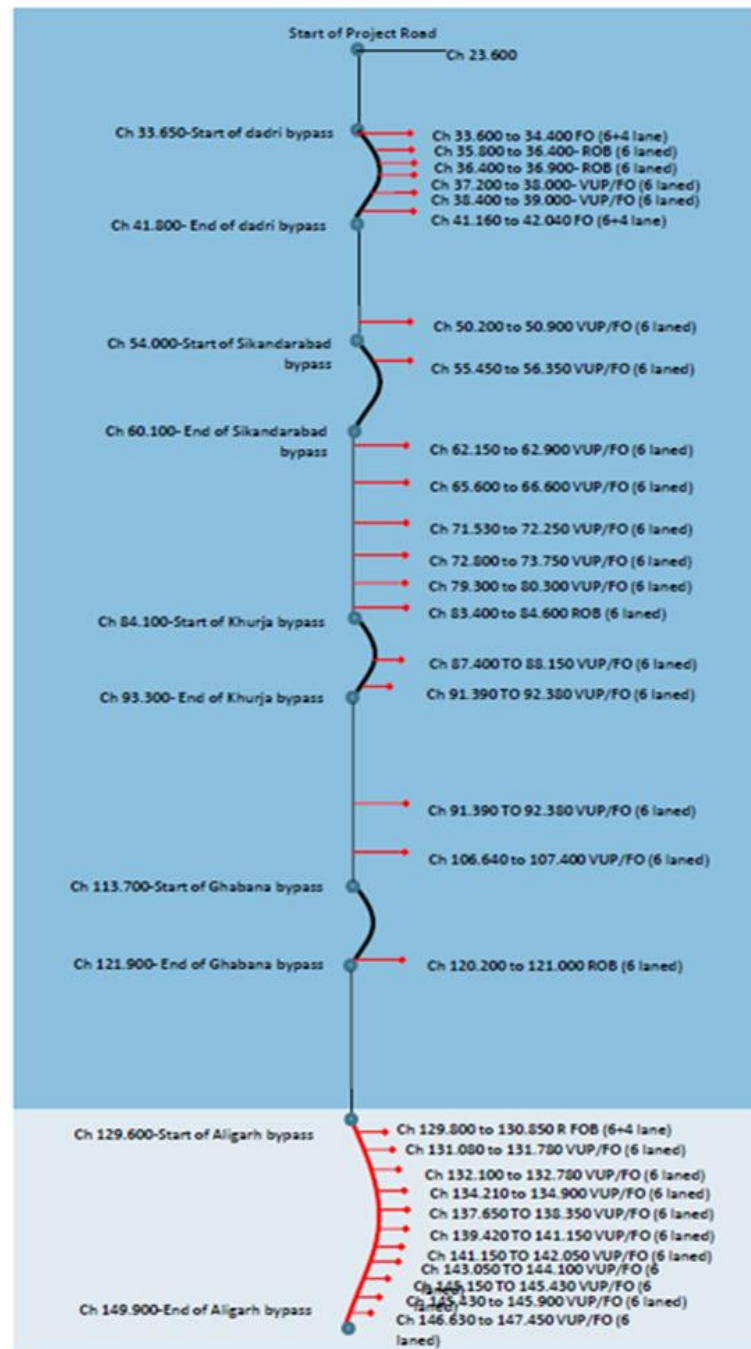
Table 1.1 Updated Schematic Road Map for 6 lane work

Sn	Description	Length in km
1	Total Length of MCW	126.300
2	Aligarh Bypass (1) to be retained (not to be widened)	20.300
3	Length of Existing Structures (already six laned)	14.700
4	Length of Toll Plaza Pavement Area	0.750
5	Length of Road covered under new alignment for THDC bypass (2)	7.100
	Length of Existing Four Lane to be widened to Six Lane	83.450

Notes: (1) Aligarh Bypass is excluded from the scope of six laning as per CA (2) NHAI has appointed EPC contractor for construction of bypass at section km 98+400 to km 105+500. The existing chainage will be provided for development of Power plant at Khurja. NHAI will provide a new road section which shall be free from encroachments, utilities for 6 lane. In addition, the concessionaire will get additional time as it will take NHAI some time to hand over the 4-lane constructed section for this chainage.

¹ It is understood that a portion of the works has been completed, NHAI may increase tollable length and will descope pending works.

Figure 1.1 Schematic Road Map of Existing Project Road



Source: Project information, received from CH team February 2021

Note: Includes existing road with bypasses and structures which are already six laned

1.3 Objective and Scope of Work

The objective of this assignment is to carry out Environment & Social Impact Assessment (ESIA) study for activities pertaining to six laning of existing four lane road and the proposed re-alignment between chainage 98.400 km and 105.500 km (9.285 km) due to the upcoming Khurja Super Thermal Power Plant (KSTP), and operational activities, along with formulation of Environmental and Social Management Plans (ESMP) for construction and operational phases of the project.

The detailed scope of the ESIA study is as provided below:

1. Environmental screening to assess the direct and induced impacts due to the project activities during construction and operational activities.
2. Document primary and secondary baseline conditions (Land, Air, Water, Biodiversity and Ecology and Socio-Economic aspects) relevant to the project with the objective to establish the benchmarks.
3. Check and report environmental compliance with various requirements and provisions under applicable Acts, Rules and Regulations of MoEF&CC and other statutory requirements relevant to the remaining construction activities and project operations.
4. Develop a stakeholder engagement strategy and plan with focus on the immediate activities
5. Review the existing Grievance Redressal Mechanism at the project level and propose short-term and implementable measures to cover the immediate activities of SIA.
6. Identify socio-economic impacts, based on consultations (FGDs, KIIs) and analysis of the socio-economic baseline survey. The baseline will include social features of the project area including socio-economic and cultural status of community in and around the project area and scope the potential project related displacement and other impacts, proposing mitigation and management measures.
7. Assessment of the potential significant impacts due to construction and operational activities and identify the mitigation measures to address these impacts adequately.
8. Assessment of noise quality, including following:
 - a. Conduct noise quality monitoring on working and non-working days along the Project Road and near point sources) within the area of influence;
 - b. Conduct noise modelling to predict future noise levels from the proposed project on sensitive receptors;
 - c. Suggest practical mitigation options for areas that do not comply with the requirements; and
 - d. Verify the effectivity of the proposed mitigation measures to achieve compliance with requirements.
9. Identification of environmental enhancement measures in the project for the following.
 - a. Cultural property enhancement in case of any interaction at pending/ongoing construction locations
 - b. Enhancement of highway side water bodies
10. Identification of borrow areas for redevelopment and their closure plan, mitigation measures and any residual negative impacts that cannot be mitigated. Also evaluate impacts and risks from associated facilities and other third-party activities.
11. Establish a suitable monitoring program w.r.t. air, water, soil and noise pollution, Analysis of monitoring results and suggestion of practical mitigation measures which can be implemented on operational road. Suggest areas of performance indicators and monitoring mechanisms for the environmental components during construction and operational phase of the project.
12. Formulation of ESMP for construction and operation phases along with relevant SOPs during lane expansion and realignment construction for KSTPP.
13. Developing targeted action plans or formulating guidelines for certain key areas as follows:
 - Waste (solid/hazardous waste) Management Plan
 - Green belt Development Plan
 - Roadside Drain Management Plan
 - Occupational Health and Safety Guideline for Construction Works
 - Contractor Management Plan
 - Labour Accommodation Plan
 - Emergency Preparedness Plan (SOP) including Oil/Chemical Spill Contingency Plan
 - Specific plan for closure/ redevelopment of borrow areas used for the Project Road;
 - Traffic Control and Safety during road operation and maintenance work; and
 - Noise Mitigation and Monitoring Plan.

The following is covered as part of the separate deliverable (RAP-LEP report):

- Identify gaps between IFC PS5 and land acquisition and rehabilitation process followed as per Govt. of Uttar Pradesh for alternative alignment for KSTPP by review of land acquisition process and legacy issues, compensation payment details (each 3G, Award Notification and 3H) to confirm PAPs/PAFs;
- Undertake consultations with the PAPs and PAFs and other community members (on opted/preferred way of LEP) to understand their views, obtain their input regarding social issues, and;
- To take these into account during the preparation of the management plans including livelihood enhancement plan (LEP);
- To prepare a livelihood enhancement plan (LEP), stakeholder engagement and information disclosure (SEP & IDP) including community grievance mechanism with the description of relevant activities, institutional responsibilities, budgetary allocations, timelines and reporting arrangements for the same.

1.4 Applicable Reference Framework

This section focuses on the legal and administrative framework under the purview of which the Project will fall and the ESIA study will be governed; they are namely:

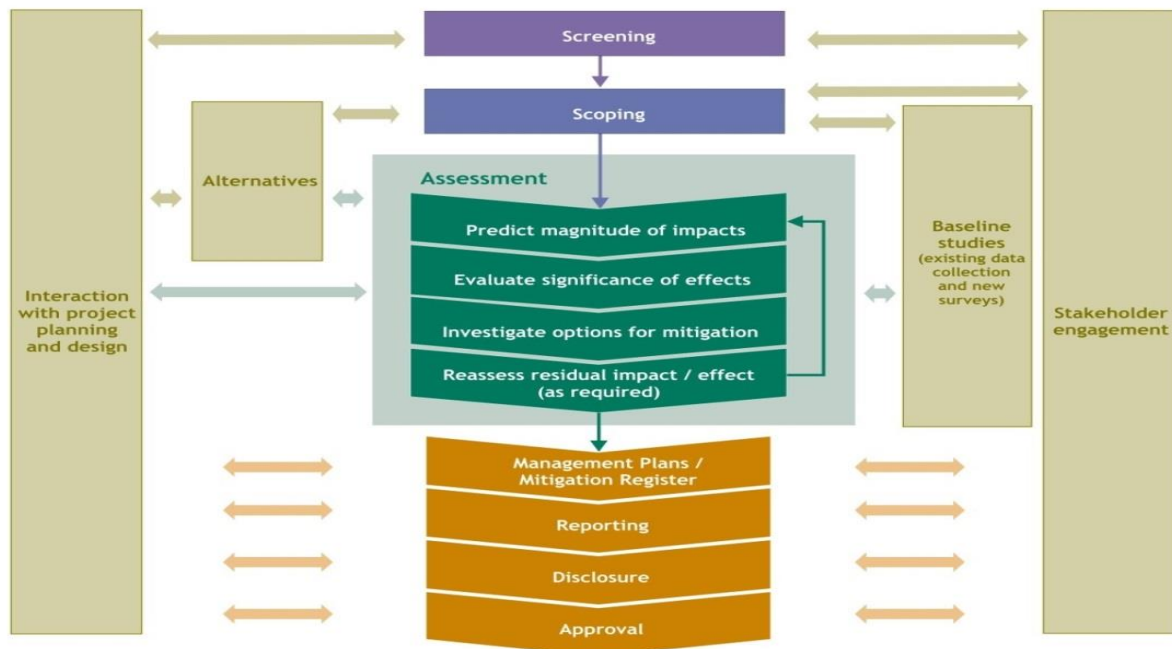
- Applicable local, national and international environmental and social (including occupational health and safety) legislations;
- IFC Performance Standards on Environmental and Social Sustainability (2012)
- World Bank Group / IFC Environmental, Health, and Safety Guidelines published on April 20, 2007, specifically the following:
 - IFC EHS General Guidelines
 - IFC EHS Guidelines for Toll Roads
- ADB Safeguard Policy Statements (SPS), 2009.
- AIIB Environmental and Social Policy (ESP) and Standard – ESS 1,2 and 3
- CDC E&S Management System

A detailed analysis of applicable framework has been provided in **Section 3** of this ESIA report.

1.5 ESIA Methodology

The ESIA methodology follows the overall ESIA approach illustrated in **Figure 1.2**. The ESIA has been undertaken following a systematic process that predicts and evaluates the impacts the Project could have on aspects of the physical, biological, socio-economic and cultural environment, and identifies measures that the Project will take to avoid, minimise/reduce, mitigate, offset or compensate for adverse impacts; and to enhance positive impacts where practicable. The stages of the ESIA process are described below:

Figure 1.2 The ESIA Process



Source: ERM

1.5.1 Screening

The Project screening study was conducted through a desktop study. It was conducted to gain a broad level understanding of the Project site and to determine applicable E&S impact assessment requirements. The screening for the Project is provided in **Section 4** of this ESIA report.

1.5.2 Scoping

The main objective of the scoping is to ascertain the environmental, social and ecological issues associated with the Project on which the ESIA study to be focused by reviewing the Project information and associated with the Project activities. This process helps in ensuring that all the relevant issues are identified and addressed in an appropriate manner in the ESIA study. For this ESIA study, scoping has been undertaken to identify the potential Area of Influence for the Project, to identify potential interactions between the Project and resources/receptors in the Area of Influence and the impacts that could result from these interactions, and to prioritize these impacts in terms of their likely significance. This stage is intended to ensure that the impact assessment focuses on issues that are most important decision-making and stakeholder interest.

The details of screening and scoping exercise are also reported in **Section 4** of this ESIA report.

1.5.3 Project Description

In order to set out the scope of the Project features and activities, with particular reference to the aspects, which can impact on the environment, a Project description is prepared. This is based on information as provided by the Cube Highways. The Project description has been provided in **Section 2** of this ESIA report.

1.5.4 Baseline Conditions

Environmental baseline data has been collected through primary baseline surveys and the information available in public domain through assessment of government policy and papers, departmental reports etc. of the project area. For environmental parameters viz., air, noise, surface water, groundwater and soil, monitoring was conducted from December 2019 to January 2020 to generate baseline data. Furthermore, survey was done to identify biodiversity and ecological features, road side water bodies and borrow areas, followed by GIS mapping for land use.

The socio-economic baseline for this project has been developed on the basis of available secondary data, reconnaissance visits conducted from December 2019 to January 2020 and detailed survey consultations conducted in the month of July-Sept 2021.

Secondary literature sources included:

- Village Census data, 2011 of Ghaziabad, Gautam Buddh Nagar, Bulandshahar and Aligarh Districts;
- Primary Census Abstract (PCA) data, 2011 of Ghaziabad, Gautam Buddh Nagar, Bulandshahar and Aligarh Districts;
- Town Amenities/ Census Data, 2011 of Ghaziabad, Gautam Buddh Nagar, Bulandshahar and Aligarh Districts;
- District Census handbook, Part A of Ghaziabad, Gautam Buddh Nagar, Bulandshahar and Aligarh Districts;
- District Census handbook, Part B of Ghaziabad, Gautam Buddh Nagar, Bulandshahar and Aligarh Districts;
- ESDD Report of Setu, 2019;
- Concession Agreement between NHA and GAEPL dated: May 2010
- Technical Due Diligence Report, February 2019
- Preliminary Safety Audit Report, July 2021

The detailed baseline characterization for the project is provided in **Section 5** of this ESIA report. A more detailed socio-economic baseline of the Project-affected Households has been included in the Resettlement Action Plan and Livelihoods Enhancement Plan (RAP-LEP) based on the field survey work, undertaken between June and Sept 2021.

1.5.5 Stakeholder Consultations and Analysis

The consultations with various stakeholders during site visit, has been guided by an internal stakeholder engagement strategy developed by ERM (that was based on review of available documentations, new project alignment and discussions with the CH, GAEPL team and reconnaissance site visits) engaged for various tasks, viz, ESIA, RAP and LEP. During site visit, the team undertook consultations with various stakeholders of the Project.

The summary of the stakeholder consultations undertaken for the Project has been provided in **Appendix D** and a detailed identification and categorization and analysis is provided in **Section 6** of this ESIA report.

1.5.6 Impact Identification (IA) /Prediction

Impact identification and assessment starts with scoping and continues through the remainder of the ESIA Process. It is an iterative process and completes only when the effects of all identified impacts arising out of the Project, including residual impacts, have been assigned a mitigation strategy. The IA comprises of four sequential steps:

- Impact Prediction;
- Impact Evaluation;
- Mitigation and Enhancement; and
- Residual Impact Evaluation.

The detailed IA is presented in **Section 8** of this ESIA report.

1.5.7 Environmental and Social Management Plan (ESMP)

The results of the ESIA study form the basis of the Project ESMP. The ESMP incorporates measures and procedures for the short and long-term environmental and social management of the Project during its various stages. The ESMP in tabular format with defined roles and responsibilities for implementation and supervision is developed for the Project and is presented in **Section 9** of this ESIA report.

1.6 Limitations

This report has been developed based on the basic project level information provided by the client and on field consultation in all four districts as well as primary socio-economic surveys carried out by ERM and is based on certain scientific principles and professional judgment to certain facts with resultant subjective interpretation. Professional judgment expressed herein is based on the available secondary data and information. If information to the contrary is discovered, the findings in this ESIA may need to be modified accordingly. This ESIA report has following limitations:

- The Project is presently at the pre-construction/planning stage and information with respect to water source, power requirement and other resource requirements during construction and operational phases has not been finalised by Cube Highways. Any assumptions made by ERM on these parameters are subject to discussions with Cube Highways team and assessment undertaken for projects of similar nature and scale;
- The technical information and details related to road expansion (median, turns, culverts etc.) as shared has not been reviewed as a part of this assessment as they are are being designed and finalised by the engineering teams;
- Detailed Project Report (DPR) covering project development related information including project design, cost, time schedule, facilities proposed has not been prepared by CH at present and therefore the project description has been extracted from different documents: the concession agreement of GAEPL and NHAI; the environmental and social due diligence document, technical DD report and preliminary safety audit report, the scope of work of the EPC contractor, and discussions with CH teams;
- The updated boundary mapping of the land required for the six-laning works, within the Right of Way was finalized by CH in September 2021 and the final TCS were shared after the completion of the field survey and have therefore not been included in the present report. It is to be noted that not much difference is considered in toe line for initial 10kms (design shared with ERM in August 2021 along with TCS) .Changes are expected to be minor and the process to address these along with due documentation are discussed in the RAP-LEP;
- Break down of workforce composition (male/female), permanent and temporary, migrant in the construction and operation phases is not available at this stage. Further, the exact locations pertaining to temporary facilities (batching plants, contractor facilities, labour accommodation and storage yards) were not determined at the time of the ESIA site visits;
- Detailed information regarding court cases in High Court, Aligarh Court (2020-21) has not been shared with ERM, therefore these are presented as aggregated tables and for background and context only;

- The consolidated list of project affected land owners based on 3G notification for Khurja Realignment was not available for review and therefore the information made available in this report is only up to 3D notification; this has been agreed with CH and the next steps will be described for the implementation stage in the RAP-LEP;
- It was found that few of the mentioned chainages of service roads and slip roads proposed in the CA could not be constructed. The total length of such service roads is 38.9 km (out of total 55.080 km) and slip roads is 3.37 km (out of total 14.350 km). Further, NHAI/IE, citing 'site conditions', in June 2014, issued order for relocating multiple service road and slip roads to new locations. Beyond the initial 10 km of project road (where land could not be possessed by NHAI), relocation proposed for 22.17 kms of service/slip roads i.e.18.8 km of service road and 3.37 km slip roads to new areas.
- The secondary data utilized for the purpose of baseline assessment is limited to that available in the public domain or made available during the discussions with Cube Highways. Census data is also very old (2011) and the new census has been delayed. ERM's past experience of conducting similar projects in the study area has been utilized to collate supplemental baseline information, along with primary information collection through consultations and surveys;

1.7 Uses of this Report

ERM is not engaged in consulting or reporting for the purpose of advertising, sales promotion, or endorsement of any client interests, including raising investment capital, recommending investment decisions, or other publicity purposes. Client acknowledges this report has been prepared for their and their clients' exclusive use and agrees that ERM reports or correspondence will not be used or reproduced in full or in part for such purposes, and may not be used or relied upon in any prospectus or offering circular. Client also agrees that none of its advertising, sales promotion, or other publicity matter containing information obtained from this assessment and report will mention or imply the name of ERM.

Nothing contained in this report shall be construed as a warranty or affirmation by ERM that the site and property described in the report are suitable collateral for any loan or that acquisition of such property by any lender through foreclosure proceedings or otherwise will not expose the lender to potential environmental or social liability.

1.8 Layout of the Report

The structure of the report and list of Appendices is as given in **Table 1.2** and **Table 1.3**.

Table 1.2 Structure of the ESIA Report

Section No.	Title	Description
1.	Introduction	<i>(This section)</i> Introduction to the Project and ESIA scope and methodology adopted.
2.	Project Description	Technical description of the Project, status of required land, related infrastructure and activities.
3.	Applicable Legal and Regulatory Framework	Discusses the applicable environmental and social regulatory framework and its relevance for the Project.
4.	Screening and Scoping	Discusses the project screening with respect to environmental and social risks and scoping outcomes undertaken as part of the ESIA process.
5.	Baseline settings - Environmental, Ecology and Social	Outlines Environmental, Ecology and Social Baseline status in the study area of the Project.

Section No.	Title	Description
6.	Analysis of Alternatives	Provides an overview of alternatives to current project location and alignment
7.	Stakeholder Engagement Identification, Information disclosure, consultation and Participation	Provides an overview of the stakeholder identification and engagement activities, undertaken during the ESIA preparation.
8.	Impact Assessment and Mitigation Measures	This section includes details of identified environmental impacts and associated risks due to project activities, assessment of significance of impacts and presents mitigation measures for minimizing and /or offsetting adverse impacts identified.
9.	Environmental and Social Management Plan	Outline of the ESMP taking into account identified impacts and planned mitigation measures and monitoring requirements.
10.	Impact Summary & Conclusion	Summary of impacts identified for the project and conclusion of the study.

Table 1.3 List of Appendices

Appendix	Details
A - Typical Cross Sections	The summary of design parameters for cross sections of road for upgradation have been provided in this Appendix.
B - Laboratory Report on Environmental Monitoring	Detailed results of the environmental baseline monitoring i.e. laboratory reports is presented in this Appendix.
C - Noise Quality Assessment	Presents the noise quality assessment and results of noise modelling for operation phase of Project.
D - Stakeholder Engagement Plan	Stakeholder consultations, analysis undertaken for the Project and engagement process to be implemented has been provided in this Appendix.
E - Grievance Redressal Mechanism	Detailed process of grievance management for project lifecycle is provided
F - Gender Action Plan	Action items based on gender assessment and women focussed engagement is presented.
G - Traffic Safety Management Plan	Provides management measures related to traffic safety provisions for construction phase
H – Roadside Drain Management Plan	Provides management measures related to maintenance of road side drains during O&M
I – Occupational health and safety plan	Gives provisions to be implemented by Contractor in order to ensure occupational health and safety of workers during construction and operation phase
J – Emergency Response Plan	Covers construction and operation phase emergency management measures
K - Specific Plan For Closure/ Redevelopment Of Borrow Areas Used For The Project Road	Covers measures related to Closure/ Redevelopment Of Borrow Areas planned to be used for the Project Road

Appendix	Details
L – Greenbelt Development Plan	Provides green belt development program related to the project.
M – Waste Management Plan	Provides management measures towards waste storage, handling, disposal, recycling, etc. for construction and operation phases

2. PROJECT DESCRIPTION

2.1 Introduction

This section provides a description of the project in terms of location, facilities and associated project infrastructure and activities during the project lifecycle and facilitates an identification of the potential impacts on resources and receptors that could result from Project activities during the planning, construction, operation and decommissioning stages.

2.2 Project Proponent

2.2.1 Cube Highways

Cube Highways and Infrastructure Pte Limited (also referred to as “Cube Highways”) was formed in Singapore in the year 2015, by leading international investors, consisting of I Squared Capital, International Finance Corporation (IFC.) Subsequently, other investors such as the Abu Dhabi Investment Authority and a consortium of Japanese investors including Mitsubishi Corporation, Japan Overseas Infrastructure Investment Corporation for Transport and Urban Development, East Nippon Expressway Company Ltd. and Japan Expressway Company International Ltd invested in Cube Highways.

Cube Highways currently has engaged ERM to undertake Environmental & Social Impact Assessment (ESIA) study, and to develop a Resettlement Action Plan with a Livelihood Enhancement Plan (RAP-LEP) for the six laning works of Ghaziabad-Aligarh Section of NH-34 from km 23.600 to km149.900 (or Ghaziabad Aligarh Expressway Private Limited (GAEPL, *the current concessionaire*), along with realignment of 9.285 km bypass road at Khurja for upcoming Khurja Super Thermal Power Plant in the State of Uttar Pradesh (hereinafter referred to as ‘Project’ or ‘Project Road’). It is to be noted that six laning will be undertaken for around 83.45 km road stretch in this section as structures are already six laned. This stretch also includes a 7 km stretch near Khurja Power plant area that will be not 6 laned, but will be used as a 4-lane section, until the Khurja Realignment (chainage km 98.400 to change km 107.685) of 9.285 km length is completed.

Key project components are summarised below:

- Initial 10 km (Chainage km 23.600 to Chainage km 33.600): All construction activities being planned will be within the currently available width (within the RoW) ranging between 33.200m and 35.000m, for this stretch with the objective of minimising impact over densely populated commercial and commercial cum residential structures in this stretch. This stretch also requires significant amount of utility re-routing works prior to road widening, which may have additional impacts on the receptors;
- Rest of the Project Road (Chainage km 33.600 to Chainage km 149.600): 116.6 km in length This stretch also includes a 7.1 km stretch near Khurja Power plant area that will not be 6 laned, but will be used as a 4-lane section, until the Khurja Realignment (chainage km 98.400 to change km 107.685) of 9.285 km length (described below) is completed. This section of the road 7.1 km between chainage 98.400 to 105.500, after the realignment is active, will be included under the land area for the Super Thermal Power Plant in Khurja. Major construction works will happen along other stretches of this 109km length of road where six-laning will be undertaken which shall include restructuring of major & minor junctions, reconstruction of bus bays/bus stops/bus shed, truck lay byes etc..
- Khurja Re-alignment: this stretch is currently being developed by NHAI under a separate contract and will be handed over to the project road concessionaire/GAEPL after completion of construction works. Land acquisition and compensation disbursement is currently underway for this stretch. Once complete and handed over, it will form part of the NH 34 project road

2.2.2 Ghaziabad Aligarh Expressway Private Limited

Ghaziabad Aligarh Expressway Private Limited (GAEPL) is a special purpose vehicle (SPV) created in 2013 for the construction and management of the Project Road. GAEPL was formed as an associate company of PNC Infratech, along with SREI Infrastructure Finance and Galfar Engineering & Contracting SAOG.

2.3 Project Background

The Project Road section is 126.3 km long between chainage 23.600 km at Lal Kuan (Ghaziabad) and 149.900 km at Bauner (Aligarh). This section passes through four districts – Ghaziabad, Gautam Budh Nagar, Bulandsahar and Aligarh. The road was constructed on existing alignment of 68.3 km and new bypasses of Dadri, Sikandrabad, Bulandsahar, Khurja, Gabhana and Aligarh were constructed in 58.3 km. The toll-able section has two toll collection points at Luharali and Somna located at Km. 47.600 and Km. 113.400, respectively. The toll operations commenced in June 2015.

As per information provided by Cube Highways, out of total 126.3 km of Project Road, 83.45 km of Project Road will be widened to six-lane from existing four lane (2015), except 20 km of Aligarh Bypass which will be retained as 4-lane; 14.7 km of structures which are already built as per six lane configurations; 20.3 km of Aligarh bypass which will be retained as 4-lane; 7.1 km of existing road which will be provided for development of Power plant at Khurja and 0.750 km toll plaza pavement length. In addition to the 6 flyovers which are already six laned, a realignment has been proposed between chainage 98.400 km to 105.500 km (9.285 km) due to the upcoming Khurja Super Thermal Power Plant (KSTPP), referred to as “Khurja Realignment”.

Table 2.1 Road section details

Sn	Description	Length in km
1	Total Length of MCW	126.300
2	Aligarh Bypass (1) to be retained (not to be widened)	20.300
3	Length of Existing Structures (already six laned)	14.700
4	Length of Toll Plaza Pavement Area	0.750
5	Length of Road covered under new alignment for THDC bypass (2)	7.100
	Length of Existing Four Lane to be widened to Six Lane	83.450

Notes: (1) Aligarh Bypass is excluded from the scope of six laning as per CA (2) NHAI has appointed EPC contractor for construction of bypass at section km 98+400 to km 105+500. The existing chainage will be provided for development of Power plant at Khurja. NHAI will provide a new road section. NHAI will provide a new road section which shall be free from encroachments, utilities for 6 lane. In addition, the concessionaire will get additional time as it will take NHAI some time to hand over the 4-lane constructed section for this chainage.

A realignment has been proposed between chainage 98.400 km and 105.500 km (9.285 km) due to the upcoming Khurja Super Thermal Power Plant (KSTPP), referred to as “Khurja Realignment”.

The key features of the Project Road are summarized in the table below:

Table 2.2 Key features of the Project

S. No	Parameter	Information
1.	Concessionaire	M/s. Ghaziabad Aligarh Expressway Private Limited, a company promoted by SREI, PNC and Galfar (consortium)
2.	Concessions Authority	National Highways Authority of India (NHA)
3.	Project	<p>The existing road is a 4-lane section of highway NH-34 between Ghaziabad and Aligarh (from chainage 23+600 to 149+900) in the State of Uttar Pradesh, for which Ghaziabad Aligarh Expressway Private Limited (GAEPL) is the concessionaire appointed by NHA. The concession for further six laning of NH-34 is awarded to GAEPL. Cube Highways have acquired the asset via GAEPL and will be responsible for six-laning as well as O&M of the road.</p> <p>The Concession Agreement between National Highways Authority of India (hereinafter referred as 'NHA') and M/s. GAEPL was signed on 20th May, 2010. The scope of work under the CA included Design, Construction, Development, Finance, Operation and Maintenance including widening of the existing 2-lane carriageway to 4-lane divided carriageway configuration. The 4 lane highway came into operation since 23rd June 2015 (PCOD obtained for section of 103.89 km). This carriageway has to be 6-laned by 2023.</p> <p>M/s. GAEPL have completed the 4-laning as per the requirements of the Concession Agreement and received the Provisional Completion Certificate from the Independent Engineer on 23.06.2015 and 25.11.2016 in 2 phases.</p> <p>Along with the six-laning, a realignment of the road is also proposed to be constructed at Khurja (from km 98+400 near Desehra Village to km 105+500 near Arnia Khurd village) by a third party in agreement with NHA. This realignment is due to development of the Khurja Super Thermal Power Project. Once completed, the realigned stretch will also be transferred to Cube Highways for O&M and become part of NH 34.</p>
4.	Length (in km)	<p>126.3 kms (from km 23+600 to km 149+900).</p> <p>The highway related structures along the road are already of six lane configuration and actual length to be expanded is 83.450 km. Also, a realignment between 98.400 km to 107.685 km (9.285 Km) of the Project Road is proposed requiring greenfield road to be constructed by NHA appointed EPC contractor for the upcoming Super Thermal Power Plant at Khurja which will replace existing highway length of around 7km.</p>
5.	Right of Way (RoW)	<p>Varies across different stretches of the highway ~45 - 60 m for existing highway stretch</p> <p>An area of 53.2844 hectares is being procured by NHA for Khurja realignment as per the 3D notification. Further details available in Table 2.11.</p>
6.	Toll Plazas	<p>Km 47+300 at Luharli:- (4+1) lanes in each direction</p> <p>Km 113+300 at Somna:- (4+1) lanes in each direction</p>

S. No	Parameter	Information
7.	Date of signing of Concession Agreement	20 th May 2010
8.	Appointed Date	25 th February 2011
9.	Commercial Operation Date of 4 laning	Provisional Commercial Operation date (PCOD) for 103.89 km of the project road was granted on 23 June 2015 for four laning. Later, PCOD for 19.41 km of the project road was granted on 25 November 2016. PCOD is yet to be obtained for 3 km length (some of the works have completed, NHA may increase tollable length and will descope pending works)
10.	Scheduled completion of six laning	November 2023
11.	End of Concession Period	24 Feb 2035 (24 years)

Source: 1) Environmental and Social Due Diligence (ESDD) report, February 2019; 2) Safety Audit Report, July 2021

2.4 Site Settings and Surrounding Features

The Project Road passes predominantly through agricultural areas followed by built up area. Current land use of the project area is primarily agricultural land mixed with settlements and open land without ROW any habitation. Also, canals, water bodies passes through the area supporting plantation (*Eucalyptus* sp. & *Populus* sp.) and orchards (Mango). The topography of the area is primarily flat in nature with a gradual decrease in elevation along the project road and the elevation ranges from 160m to 225 m above mean sea level (AMSL). The Lower elevation is observed towards south east direction, towards the end of the project road at Aligarh. Climate wise, the area faces extreme hot in summer and extreme cold in winters. The South west monsoon arrives in this region in summers. That is why this region is called as Monsoonal climatic region. In summers, maximum temperature rises to 41°C but sometimes in June it reaches upto 46°C. In the entire area fast and hot winds blow from the western sides which are locally called as 'Loo'.

Gas pipelines (Adani, Indraprastha Gas Limited and GAIL) and 11 KV electric cable are passing underground within 5 m from the edge of the road at select places.

The Khurja Super Thermal Power Project (KSTPP) is proposed at Khurja village between chainage km 98.400 and km105.500. In order to ensure connectivity, a new road connecting these chainage points is proposed. The realigned section length is 9.285 Km, an increase in the road length by 2.185 km.

An Environment clearance from MoEF&CC was obtained vide letter dated 03rd March 2009 (as per OM of MOEF&CC dated 18 December 2012, separate EC is not required for borrow pits for highway projects in case impacts of same are adequately included in EIA study).

The study area comes under the Upper Gangetic Plain Biological Province² as well as Agro-climatic Region³ and the represents Northern Tropical Dry Deciduous Forest (5B) vegetation as per Champion and Seth (1968)⁴. The study area majorly comprises of agricultural lands, open lands, water bodies, plantation (*Eucalyptus* sp. & *Populus* sp.) and orchards (Mango).

²Wildlife Institute of India - ENVIS Centre

³http://iasri.res.in/agridata/12data%5Cchapter1%5Cdb2012tb1_2.pdf

⁴Champion, H. G. and Seth, S. K. (1968). A Revised Survey of Forest Types of India, Govt. of India Press, New Delhi, p. 404.

2.5 Details of the Project

2.5.1 Scope of Six Laning and Realignment

As per Article 12.5.1 of Concessionaire Agreement, the Concessionaire shall undertake construction of Six – Laning as specified in Schedule B and Schedule C in conformity with the Specifications and Standards set forth in Schedule D, so that the Project Highway shall have six lanes on or before 12th Anniversary of the Appointed Date i.e. 25 Feb 2011 and Six Laning to be completed by 25 Feb 2023. As informed, extension of 9 months has been requested by present concessionaire from NHA approval committee before handing over to CH. Based on verbal approval received from NHA, the timeline for construction completion is November 2023.

In the event the Concessionaire has not been excused from its obligations of Six Laning on bypasses in accordance with Clause 3.1.1 or Clause 30.2, as the case may be, and it fails to complete Six Laning of Project Highway (excluding Aligarh Bypass) on or before the Scheduled Six Laning Date, it shall pay to the Authority Damages Equal to 3 % of the Average Daily for each day's delay until Six Laning of bypasses. Furthermore, in the event that Six Laning is not completed on or before the 12th (twelfth) anniversary of the Appointed Date, the Concession Period shall, notwithstanding anything to the contrary contained in this Agreement, be deemed to be 12 (twelve) years and accordingly such 12th Years shall be Transfer Date.

Table below summarizes the detailed scope of construction work shared by Cube Highways that needs to be carried out for 6-laning of Project Road.

Table 2.3 Detailed Scope of Construction Works for 6-laning of Project Road and realignment

S. No	Features	Units	Details
1.	Length of Project Road (including realignment)	Km	Total length - 126.3 km (starting chainage -23+600; end chainage – 149+900) Length of existing structures already 6-laned: 14.7km Aligarh bypass to be retained (not to widened) : 20.300 Length of toll plaza pavement area: 0.750m Length of Road covered under new alignment for THDC bypass (not to widen as it will be replaced taken over under Khurja TPP and replaced by a realignment of 9.285 km being developed by the NHA through another concessionaire): 7.1 km Length where 4 to 6 laning would be done: 83.45 km
2.	Carriageway	km	Six lane carriageway will be 2 X10.5 m
3.	Shoulder	M	1.5m paved shoulder in initial 10km 1.5m (paved)+1.5m (earthen) in rest section
4.	RoW	m	45 m at Urban Location and 60 m in balance length
5.	Length of Service Road/Slip Road	km	No service road will be constructed during six laning. Existing will be retained. The length of Service/slip Road as per CA - 73.080 km and Balance length of Service Road(3) as per IE -27.29 km. The ROW is not available for service road chainages as mentioned

S. No	Features	Units	Details
			in the CA. The IE suggested to construct service roads at different chainages, out of which about 27.29 km length of service road could not be constructed. Concessionaire is pursuing to descope the remaining service road length.
6.	Major Bridges	Nos.	-None
7.	Minor Bridges	Nos.	10 (existing – shall be retained) -4 minor bridges proposed for realignment stretch
8.	VUP/PUP/CUP	Nos.	24 (existing – shall be retained)
9.	Flyover/Grade Separator	Nos.	6 (existing – shall be retained)
10.	ROB	Nos.	4 (existing – shall be retained)
11.	Culvert - Pipe; Box; Slab	Nos.	-146 (shall be widened) -6 pipes and 10 box culverts for the proposed realignment
12.	Drain	Km	19.21 km (new construction)
13.	RCC drain	Km	-49.440 km (new construction) -RCC drain for entire stretch of realignmnet
14.	Major Junctions	Nos.	-14 and 1 clover leaf (Constructed) -2 proposed for realignment stretch
15.	Minor Junctions	Nos.	94 (Constructed) 5 proposed for realignment stretch
16.	Bus Bay/ Bus Stop	Nos.	37 (shall be reconstructed) 6 proposed for realignment stretch
17.	Bus Shelters	Nos.	37 (new)
18.	Truck lay-byes	Nos.	4 (Constructed)
19.	Toll Plaza	Nos.	2 (existing – shall be retained)

Source: Concession Agreement; Safety Audit Report, July 2021; Technical Due Diligence report, provided by client

As understood from detailed provided in above table, there are no major structures and service roads that are proposed as part of 6-laning of the Project Highway. Most of the structures will be retained, while new construction of 20km of drains are proposed. Other components such as truck layby, bus stops and junctions will be reconstructed as per six-lane. However for the proposed realignment new structures will be required as it is a new construction of 9.285 Km.

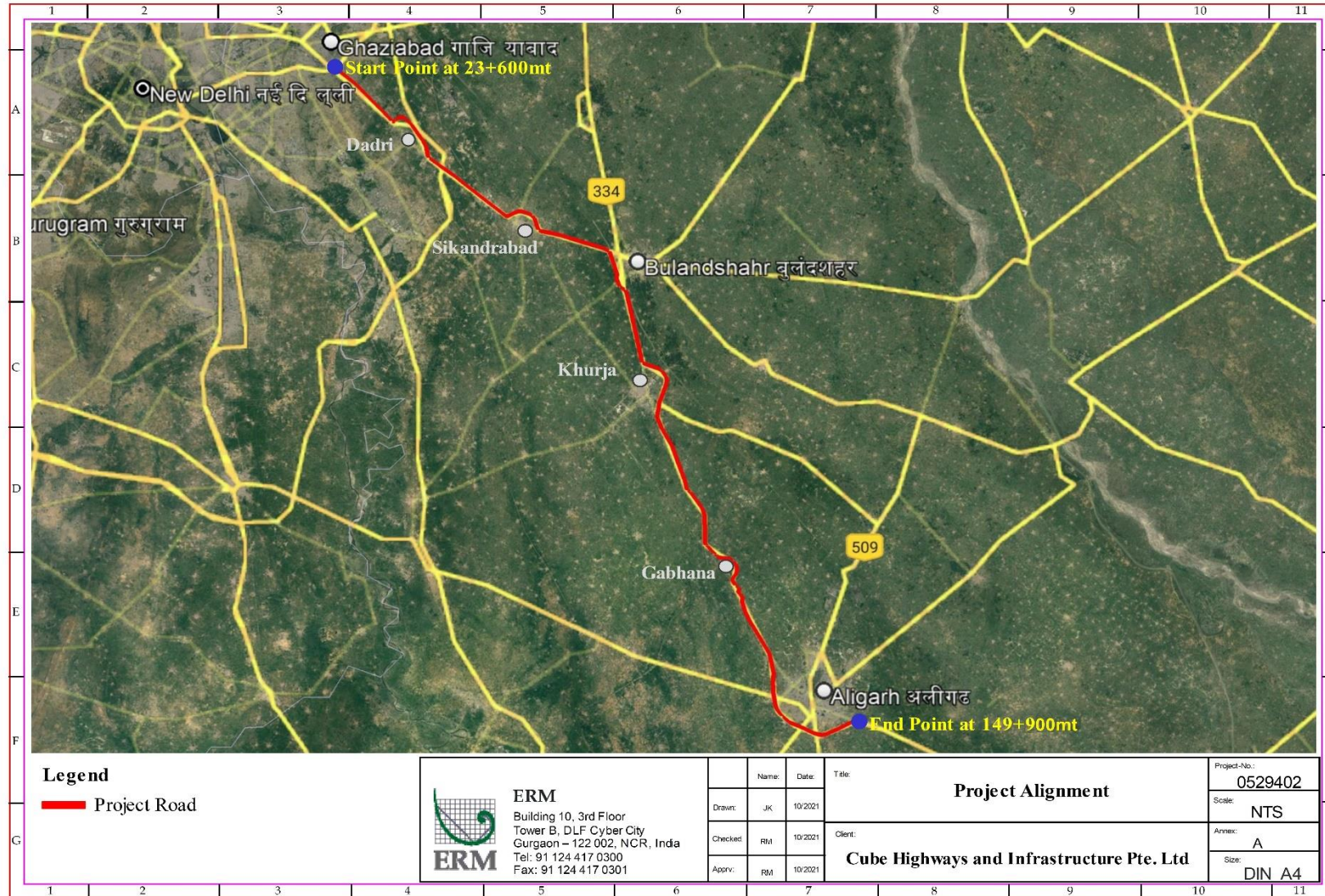
2.5.2 Corridor of Impact and Right of Way

The Project Road starts at km 23.600 (existing km 23.600) at Lal Kuan in Ghaziabad Town and ends at Km 149.900 (Existing km 140.200) at Aligarh. The total length of the project road is 126.30 kms. The towns likely to be impacted due to Project activities are Ghaziabad, Dadri, Sikanderabad, Bulandshahr, Khurja, Amiya and Aligarh.

The corridor of impact due to project activities is considered to be 500m on either side of the centre line of the Project Road. The six laning of the Project Road will be undertaken within the RoW, which varies from 45m at the initial road sections and 60m after that for the larger remaining stretch of road. The land required for six-laning Project activities is within the RoW as confirmed by Cube Highways. All displacement impacts assessed for this corridor through the household census, asset surveys and the social baseline for the RAP-LEP are within the RoW and no new land acquisition is envisaged.

The project corridor is shown in **Figure 2.1** below.

Figure 2.1 Indicative Location of Project Road



2.5.3 Project Components

2.5.3.1 Road Alignment and Bypass

The project road includes five by-passes at towns Dadri, Sikandrabad, Khurja, Gabhana and Aligarh, out of which four bypasses will be widened except Aligarh bypass which is already 6 laned. A realignment between 98.400 km to 105.500 km (9.285 Km) of the Project Road is proposed for the upcoming Super Thermal Power Plant at Khurja which will replace existing highway length of around 7km. Details of the bypasses have been provided in table below. As per information provided by Client, paved carriageway shall be 25m wide excluding the median. Proposed pavement structure is yet to be finalised by Cube Highways.

Table 2.4 List of Bypasses

S. No.	Location of Bypass	Chainage (From)	Chainage (To)	Length (Kms)
1.	Dadri Bypass	33+650	41+800	8.15
2.	Sikandarabad Bypass	54+000	60+100	6.10
3.	Khurja realignment	84+100	93+300	9.20
4.	Gabhana Bypass	113+700	121+900	8.20

Source: Draft EPC Contract

2.5.3.2 Flyover, Culverts and ROB

A flyover is a grade separated structure which is provided for crossing of vehicles under the Project Highway. As per the details shared in Technical DD report, 6 flyovers are present along the length of project road, all of which are 6 laned, the details of which are mentioned below in **Table 2.5**. The existing flyovers and ROBs will be retained and no new construction or reconstruction is proposed. No other work is required to be carried out during six laning except of strengthening and overlay.

Table 2.5 List of flyovers

S. No.	Chainage	Side	Span arrangement
1.	33+650	RHS	1 x 30.00
2.	41+800	RHS	1 x 30.00
3.	129+700	LHS	1 x 30.00
4.	140+620	LHS	2 x 30.00
		RHS	2 x 30.00
5.	141+260	LHS	1 x 30.00
		RHS	1 x 30.00
6.	143+980	LHS	1 x 30.00
		RHS	1 x 30.00

Source: Technical DD Report

There are four (4) Railway Over Bridges (ROB), all of which are 6 laned, present along the project road to carry the project expressway above railway lines, which will be retained as part of the six

laning. No other work is required to be carried out during six laning. except strengthening and overlay. Chainage wise details of ROBs are mentioned below in **Table 2.6**

Table 2.6 List of ROBs

S. No.	Chainage	Side	Span arrangement
1.	36+340	LHS	1x31.0 + 1x40.0 + 1x15.0m
		RHS	1x31.0 + 1x40.0 + 1x15.0m
2.	83+955	LHS	3x36.0 + 2x23.0m
		RHS	3x36.0 + 2x23.0m
3.	120+169	LHS	1x40.0 + 2x15.0m
		RHS	-
4.	145+825	LHS	1x40.0 + 2x15.0m
		RHS	1x40.0 + 2x15.0m

Source: Technical DD Report

As per information shared by Cube Highways in Draft EPC Contract, 32 numbers of box culverts and 53 numbers of pipe culverts have been considered for widening. Proposed size for pipe culverts are 1 x 1.2 m.

2.5.3.3 Vehicular Under Passes (VUP)

Vehicular Under Passes (VUP) are structures provided for crossing of vehicles under the Project road. As per the Technical DD shared by the client there are 19 VUPs present along the project road length, all of which are 6 laned. The VUPs will be retained and no new construction or reconstruction is proposed. The list is shared below.

Table 2.7 List of Vehicular under Passes

S. No.	Chainage (km)	Side	Span Arrangement (m)
1	37+705	LHS	1 x 10.0 x 5.5
		RHS	1 x 10.0 x 5.5
2	38+705	LHS	1 x 10.0 x 5.5
		RHS	1 x 10.0 x 5.5
3	50+600	LHS	1 x 10.0 x 5.5
		RHS	1 x 10.0 x 5.5
4	55+905	LHS	1 x 10.0 x 5.5
		RHS	1 x 10.0 x 5.5
5	62+250	-	-
		RHS	1 x 10.0 x 5.5
6	65+870	LHS	1 x 10.0 x 5.5

S. No.	Chainage (km)		Span Arrangement (m)
		RHS	1 x 10.0 x 5.5
7	71+800	LHS	1 x 10.0 x 5.5
		RHS	1 x 10.0 x 5.5
8	73+240	LHS	1 x 10.0 x 5.5
		RHS	1 x 10.0 x 5.5
9	79+500	LHS	1 x 10.0 x 5.5
		RHS	1 x 10.0 x 5.5
10	87+360	LHS	1 x 10.0 x 5.5
		RHS	1 x 10.0 x 5.5
11	91+330	LHS	1 x 10.0 x 5.5
		RHS	1 x 10.0 x 5.5
12	106+450	LHS	1 x 10.0 x 5.5
		RHS	1 x 10.0 x 5.5
13	131+010	LHS	1 x 10.0 x 5.5
		RHS	1 x 10.0 x 5.5
14	132+020	LHS	1 x 10.0 x 5.5
		RHS	1 x 10.0 x 5.5
15	134+186	LHS	1 x 10.0 x 5.5
		RHS	1 x 10.0 x 5.5
16	137+570	LHS	1 x 10.0 x 5.5
		RHS	1 x 10.0 x 5.5
17	139+700	LHS	1 x 10.0 x 5.5
		RHS	1 x 10.0 x 5.5
18	139+950	LHS	1 x 10.0 x 5.5
		RHS	1 x 10.0 x 5.5
19	147+430	LHS	1 x 12.5 x 5.5
		RHS	1 x 12.5 x 5.5
Proposed for Realignment			
1	100+515	-	10.5 x 4.5
2	103+285	-	12.5 x 5.5

Source: Technical DD Report

2.5.3.4 Service / slip roads

The existing service roads will be retained and no new construction / upgradation is envisaged. The details are as provided below:

- 24.140 km length of 8 m width service road
- 7.800 km length of 3 m width service road
- 14.630 km length of 7.65 m width service road

It is understood as per information shared by Cube that At Grade Intersections shall be improved to 6-lane standards at the intersections of service road and all intersecting roads as per Appendix BVI & Appendix BVII of Schedule B of Concession Agreement. The Concessionaire has proposed de -scoping of balanced service roads and finalization of descopeing will be considered by NHAI under settlement agreement

- For the Khurja realignment Service/slip road will be constructed at four locations with a length of 0.750 Km both side and a width of 7.00m

2.5.3.5 Embankment and cut sections

As per information shared by Cube Highways, it is understood that 95% of 4 lane road is at embankment of average filing of 1m. Turfing will be provided on the embankment slopes for embankment height in the range of 1.5m to 3m. Total 1,600,000 m³ of filling material will be required. Around 700,000 m³ of fill material will be obtained from cutting of shoulders whereas 900,000 m³ from adjacent filed/borrow areas. No cutting will be required. The total truck movements per day is anticipated to be approx. 360 (considering 10 m³ of truck load capacity) which can be easily accommodated within the existing traffic load of the highway.

The design and construction of the road in embankment shall be carried out in accordance with Section 300 of MORT&H Specifications and the requirements, and standards & specifications given in IRC: SP-99 latest version.

2.5.3.6 Pavement design

All required investigations and surveys have been carried out for the pavement design. Based on the findings, cold in-place/in-plant recycling, as may be applicable, will be proposed along with conventional Dense Bituminous Macadam (DBM) and Bituminous Concrete (BC) as per the payment design requirements to ensure adequate strength for the design life of 15 years. As per applicable standards, Project will be using RAP (reclaimed asphalt) in DBM.

There are 5 construction camps proposed along with HMP at each location. As informed, the paving material will be stored at same camps and transported through dumpers to the construction sites / locations. This material will be paved and rolled to final layer of road.

2.5.3.7 Drainage

Two types of drains are present in the project road viz.; lined drains on the edge of service road on the built-up stretch and earthen drain at few locations on the rural stretch (ditch, excavated longitudinally along the road at the edge of toe) were generally buried and not distinctly visible. About 20 km of RCC (Reinforced Concrete Cement) drains will be constructed in initial 10 kms. Natural / earthen drains will be provided in rural areas and lined drains will be provided in urban areas.

Location of drain as required and as constructed at site is given in the table below:

Table 2.8 Location of Drains

SN	Design Chainage (Km)		Length of RCC Drain Required — m		Length of Drain as Constructed - m	
	From	To	LHS	RHS	LHS	RHS
Service Road						
1	28.900	32.670	3,770	3,770		
4	44.625	45.635	1,010	1,010	1010	1010
5	48.780	53.050	4,270	4,270		4270
7	62.150	63.650	1,500	1,500	1250	700
8	65.600	66.600	1,000	1,000	1000	1000
10	79.300	80.300	1,000	1,000	1000	1000
12	99.850	100.340	490		300	
13	99.850	100.400		550		250
14	105.660	106.270	610	610	610	610
15	106.640	107.750	1,110	1,110	1100	1100
16	122.700	123.100		400		
17	123.200	123.950	750			
18	123.200	124.200		1,000		
19	124.700	125.300	600	600		
20	125.750	126.400	650	650		
21	126.900	127.250	350	350		
22	127.800	128.440	640			
23	127.800	128.600		800		

Source: Technical DD report; DPR

2.5.3.8 Toll Plazas

There are two toll plazas along project corridor at Km 47+500 (Luharli) and Km 113+300 (Somna). As per the Technical DD report shared by Cube Highways, both Luharli and Somna Toll Plaza has 5 lanes each on LHS and RHS. Toll Management System (TMS) has been installed by Infrovate in June 2015. Day to day operations as well as AMC is also taken care by Infrovate. The toll plazas have one administrative building having all basic requirements such as Control Room, Server Room, POS Room etc. The other facilities available at both Toll Plaza includes, Route Patrol Vehicle (1 no.s), Ambulance (1 no.s) and a Crane. No change is proposed in the infrastructure and facilities of toll plaza.

2.5.3.9 Traffic control devices and road safety devices

As per information shared by Cube Highways, traffic control devices and road safety devices will be as per Concession Agreement requirements and as per the applicable standards of MoRTH and IRC (for e.g., traffic management plan, lighting facilities etc.). Traffic Control Devices and Road Safety Devices shall comprise of road signs, road markings, object markers, hazard markers, studs, delineators, attenuators, safety barriers, boundary fences, boundary stones, kilometer stones, etc. Relevant IRC Guidelines (IRC 2, IRC:8, IRC:35, IRC:67, IRC SP 99, etc), MORT&H Guidelines for Expressways manual and Section 800 of MORT&H Specifications shall be followed.

IRC 55 will also be followed to ensure pedestrian safety, especially where the Project road traverses settlements.

Metal Beam Crash Barriers have been proposed at high embankment locations and at major bridge approaches. Crash barrier system absorbs impact of vehicle and laterally restrains a vehicle from veering off. This would ensure minimum damage to the vehicle and passengers.

Lighting shall be provided at all interchanges, tunnels, toll plazas/booths, bridges, overpasses/ underpasses etc. as specified in IRC:SP:99-2013.

A preliminary Road Safety Audit was undertaken for the Project Road in July 2021 on directions of Cube Highways and recommendations were provided, which will be implemented by Cube Highways as part of the widening.

The objective of the audit was to identify potential hazardous locations / stretches prone to accidents from point of view of all road users and to provide improvement measures to achieve safe road environment on proposed 6-lane facility for road users and local inhabitants. At this stage, major proposals such as grade separators, service roads.

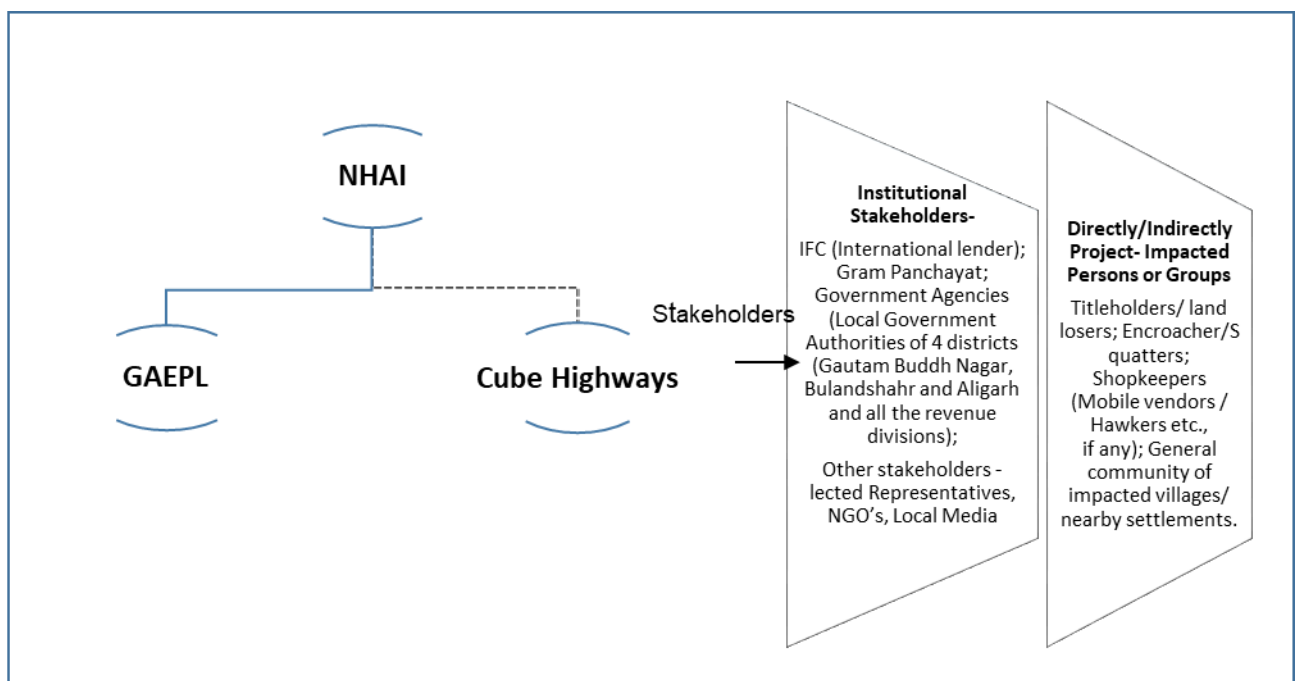
2.5.3.10 Typical Design Cross Sections

The summary of design parameters for cross sections of road for upgradation have been provided in **Appendix A**.

2.6 Project Organizational Structure

The various stakeholders involved in the project implementation and those directly/ indirectly impacted due to project activities are as provided in Figure below:

Figure 2.2 Project Stakeholders



Source: Developed by ERM based on discussions with CH Team and documents provided by them.

At corporate level, various teams of Cube Highways will be involved in the project planning and development activities, as well as for provided support during O&M phase of the project. During construction, Project Head, Monitoring team, F&A team, Legal team, Secretarial team, Public Relations Officer (PRO), E&S team and Traffic Safety team will be supporting various project activities. Similarly, during O&M phase, all departments from Cube Highways will be having roles (with representatives from each department) in ensuring smooth operations of the project road.

As per information provided by Cube Highways, during construction phase of the Project, the activities will be led by a Project Manager, who will be supported by Deputy Project Managers (2) and an entire set of Project Management Consultant (PMC) team. An EPC contractor will be engaged on turnkey basis for construction phase. Details on the team of the EPC Contractor will be subsequently available once the on-boarding process is complete.

In case of Khurja realignment, NHA1 appointed EPC contractor will undertake the work and Cube is not responsible for the same. As per information provided by Cube Highways, during construction phase of the Project, the activities will be led by a Project Manager, who will be supported by Deputy Project Managers (2) and an entire set of Project Management Consultant (PMC) team. An EPC contractor will be engaged on turnkey basis for construction phase. Details on the team of the EPC Contractor will be subsequently available once the on-boarding process is complete.

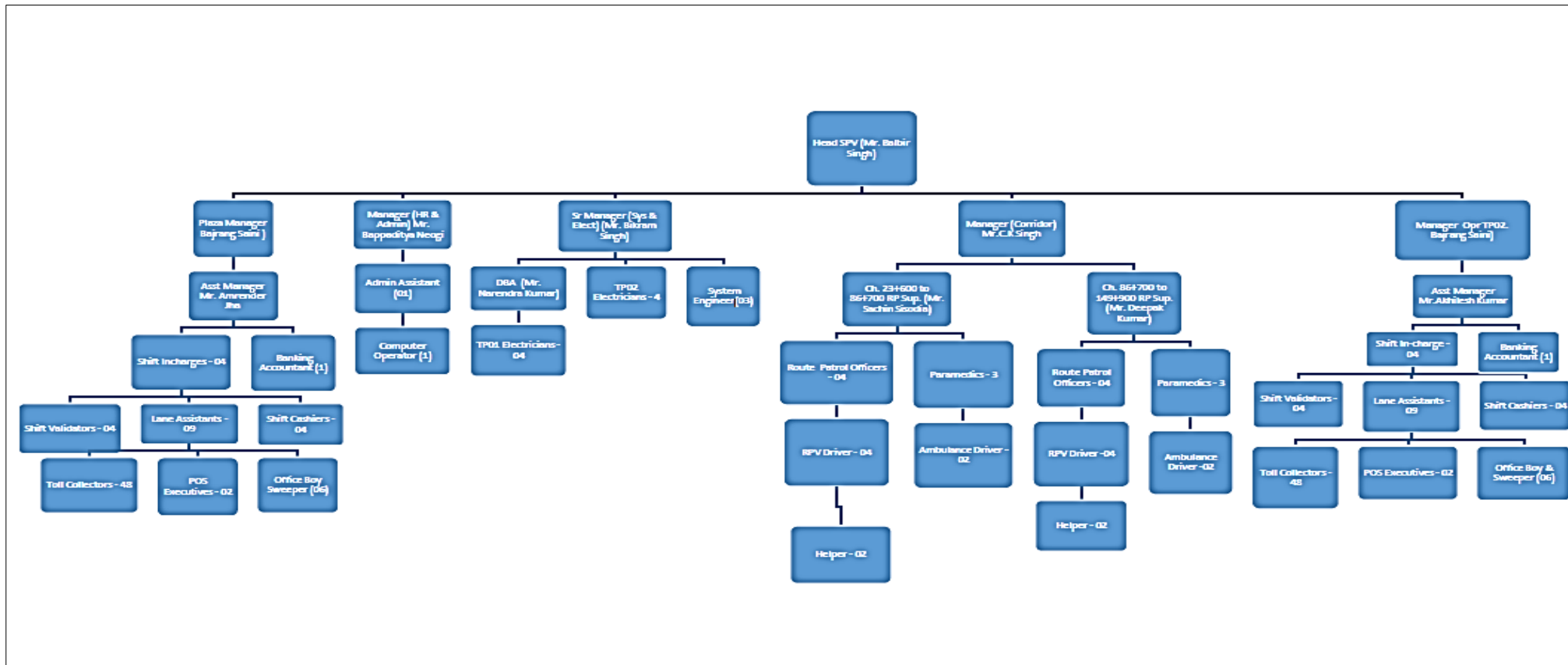
During O&M phase, the operations will be led by the SPV Head and support teams. At present, the team of existing staff of current concessionaire GAEPL is present at site. The same has been illustrated in Figure 2.3 below and in the Table 2.9 below. Cube Highways will retain the same organisation structure of GAEPL for O&M phase as provided in below Figure 2.3. There are also 52 vendors that have been engaged by current concessionaire (GAEPL) for Supply of Toll Plaza Stationery, Cables 305X35sqmm Aluminum, Installation of Plaza UPS Batteries, Toll Plaza IT Spares for Both Plaza, HPE Servers, Installation, Testing & Commissioning (ITC) for Executed 16 Sites in Aligarh Section etc.

Table 2.9 Role/ Functions of GAEPL

Position	Role/Functions
SPV Head	Overall management of the SPV
Plaza Manager	Management of Plaza related issues
EHSS Manager	Management of SPV level E&S issues
Manager HR & Admin	Financial and HR Management
Sr Manager (Sys and Elect)	System and Electrical utilities management
Corridor Manager	Management of the highway corridor
Manager Operation	Management of all operational issues

Source: Cube Highways

Figure 2.3 GAEPL Existing Organogram



Source: ESDD Report, 2019 provided by CH (inclusive of contractors engaged)

2.7 Land Acquisition process & status

Land Clearance and construction work for six laning for the project shall begin after the mitigation measures in the RAP-LEP are agreed and duly competed for the assets affected within Right of Way (hereinafter RoW)⁵. This section describes the process and status of land required by the project.

2.7.1 Land status for NH 34 RoW

This section describes the status of the land in the RoW of NH 34 from Chainage 23.600 km to Chainage 149.900 km.

The status of the land acquisition process for the Khurja Realignment is also described herein.

2.7.1.1 NH 34 from Chainage 23.600 km to Chainage 149.900 km (excluding Khurja Realignment)

As per the available information⁶, a total of 441 ha land was required (in addition to the existing road) for 4/6 laning of the project. In addition, a total of 247.86 ha was handed over by PWD to NHAI as existing road Right of Way.

As per the review of documents provided by CH, it is understood the process of 3A⁷ was initiated in the year 2009 and went on till 2013, where total land notified under 3A was 448.17 hectares. Out of this 448.17 hectares of notified area, NHAI had released 3D⁸ notification for 433.8342 hectares of land.

Based on the review of NH Notifications shared with ERM, 3G⁹ award was issued for 408.09 hectares of land. The 3G awards were approved however land possession could not take place in initial 10 kms of the road up to Dadri bypass in initial 6 villages of GB Nagar and one village in Ghaziabad. The widening (4 lane) was completed within available ROW without service roads and utility corridors. Further, some of the service roads and slip roads proposed under CA could not be constructed due to issue faced with respect to land possession at some of the chainages. The IE therefore suggested to construct service roads at different chainages, out of which about 27.29 km length of service road could not be constructed. As informed by CH these pending items would be descoped under the CA and become part of CPs with seller (Concessionaire). The same is being pursued by the Concessionaire with NHAI.

⁵ As per CA, it is obligation of the government to acquire and provide encumbrance free land to the Concessionaire for construction/ expansion of six-lane road. The ESIA is developed on the understanding that all required land is within the existing RoW.

⁶ Environmental and Social Due Diligence (ESDD Road Asset in UP - Ghaziabad-Aligarh Section of NH-34 (old 91) (Ghaziabad Aligarh Expressway Private Limited) By SETU Resources and livelihoods Solution Pvt Ltd, February 2019, Concessionaire Agreement and the updates from NHAI/CALA sent by CH.

⁷ **3A. Power to acquire land, etc.**—(1) Where the Central Government is satisfied that for a public purpose any land is required for the building, maintenance, management or operation of a national highway or part thereof, it may, by notification in the Official Gazette, declare its intention to acquire such land. (2) Every notification under sub-section (1) shall give a brief description of the land. (3) The competent authority shall cause the substance of the notification to be published in two local newspapers, one of which will be in a vernacular language.

⁸ **3D. Declaration of acquisition.**—(1) Where no objection under sub-section (1) of section 3C has been made to the competent authority within the period specified therein or where the competent authority has disallowed the objection under sub-section (2) of that section, the competent authority shall, as soon as may be, submit a report accordingly to the Central Government and on receipt of such report, the Central Government shall declare, by notification in the Official Gazette, that the land should be acquired for the purpose or purposes mentioned in sub-section (1) of section 3A. (2) On the publication of the declaration under sub-section (1), the land shall vest absolutely in the Central Government free from all encumbrances.

⁹ **3G. Determination of amount payable as compensation.**—(1) where any land is acquired under this Act, there shall be paid an amount which shall be determined by an order of the competent authority. (2) Where the right of user or any right in the nature of an easement on, any land is acquired under this Act, there shall be paid an amount to the owner and any other person whose right of enjoyment in that land has been affected in any manner whatsoever by reason of such acquisition an amount calculated at ten per cent, of the amount determined under sub-section (1), for that land. (3) Before proceeding to determine the amount under sub-section (1) or sub-section (2), the competent authority shall give a public notice published in two local newspapers, one of which will be in a vernacular language inviting claims from all persons interested in the land to be acquired.

Further it is understood that the difference in the 3G and 3D land area figure is due to measurement corrections and government land parcels that were not accounted in 3G land area calculations. It is understood that there is no pending land acquisition and the area acquired at the 3G stage of the LA process is the final requirement till date.

The entire land was acquired from 136 villages & towns falling within eight sub districts of Ghaziabad, Gautam Budh Nagar, Bulandshahar and Aligarh district.

The **Table 2.10** below gives the status and summary of land as per 3G award (excluding the land being acquired for Khurja realignment, currently underway).

Table 2.10 Land Acquisition status for NH34

3A Notification Year	Area under 3A Notification	3D Notification Year	Area under 3D Notification	3G Notification Year	Area under 3G Notification
2009	332.65	2010	397.75	2010	29.13
2010	78.13	2012	31.25	2011	326.33
2011	12.43	2013	4.83	2012	28.63
2012	23.99			2013	23.75
2013	0.97			2014	0.25
Total as per 3G Award	448.17		433.83		408.09
The 3G awarded land not handed over in initial 10 km (Chipyana Bujurg, Chapraula, Achcheja, Ibadullapur urf Badalpur, Sadopur, Dhoom Manikpur & Shahpur Bamhaita villages)					6.87
Total land (3G Awarded land- excluded land in 10 km)					401.22

Source: ESDD Report, 2019 provided by CH & further details shared by CH

Land Acquisition Process

Land acquisition for the Project Road commenced in September, 2009 under the “The National Highway Act, 1956” and the compensation matrix for the project affected households were developed on the basis of “The Land Acquisition Act, 1894”.

As per Section 4 (1) of LA Act 1894, Preliminary Notification regarding the need of land for “public purpose” is published in Official Gazette and other convenient places. Thereafter, the government undertakes land survey, sets out boundaries; where “public purpose” means the provision of land for town or rural planning as per Section 3f (ii) and the provision of land for any other scheme of development sponsored by Government or with the prior approval of the appropriate Government, by a local authority as per Section 3f (vii).

The LA Act 1894 provides for compensation determination in Sections 3(a). Further, as per the NH Act, 1956, Central Government had published 3A Notifications from the year 2009 to 2013 with an intention to acquire land 448.17 hectares. Further, 3D Notifications were published from year 2010 to 2013 for acquiring 433.83 hectares of area.

Currently, as per the review of ESDD report provided by CH and referring to land documents (i.e. NH Notifications), it is understood that 3G was awarded for 408.09 hectares of land required for the 6 laning/ expansion of NH34; however, the possession could not be completed in total 7 villages comprising of 6.87 hectares land due to issues from land owners and local community. Further during consultations with CH and GAEPL team and a further review of the ESDD report it was confirmed that no new land acquisition is pending for NH-34 stretch (excluding Khurja realignment). There are 39 villages where there are ongoing compensation issues, the details of which are given in the section below. These have been recorded as legacy issues where they are reported but are not included in the scope of work of the RAP-LEP. Cube highways has clarified that the land parcels associated with

the pending cases do not lie within the current area required for the six-laning works, covered in this ESIA.

Status of pending land compensation and “De-scoping”¹¹”

It is understood that a total of 6.78 ha of land required for constructing service roads, utility corridor (drain etc.) could not be completed due to pending litigation. This 6.78 ha of land falls within 6 villages of Gautam Buddha Nagar district including Chipyana Bujurg, Chapraula, Achcheja, Ibadullapur urf Badalpur, Sadopur and Dhoom Manikpur and 1 village in Ghaziabad district is Shahpur Bamhaita. The four laning was completed within the available land but service roads and utility corridor (drain etc.) could not be completed under this section. It is understood that these items would be descoped under the CA. The land acquisition process and related notifications (3A, 3D, 3G) have been issued as per project’s land requirements.

In addition to the above, as per the consultation with CH, NHAI officials and review of documents provided by CH (Dated 08/01/2019), it was noted that compensation disbursement is pending for certain stretches at 39 villages in Gabhana and Koil tehsil of Aligarh district. The discussion with the local community, also indicated that there are many landowners who have not received/accepted the due compensation either for land or their structures till now. This information is provided as context and was not part of ERM’s scope for this assessment as land parcels associated with these issues are not part of the land required for the six-laning works, as clarified by CH, other than villages where the Ex-gratia payment related circular (see below) will apply and is currently in process with NHAI. The villages that reported these issues include Kaurah Rustampur/Vidha Nagar, Palla Sallu, Bhankri Khans village in Aligarh district and Bilsuri, Daryapur village in Bulandshahar district.

As per the discussion with NHAI PIU Aligarh, it is understood that the pending compensation in Bankari Khas, Rustampur/Vidha Nagar, Palla Sallu village is due to the fact the people who occupied Abadi/Govt. land could not produce any ownership records thus were not found eligible for compensation. However, NHAI has now estimated ex-gratia payment that will be given to the identified people, for their assets. NHAI, as per the Circular issued in 2017 pertaining to Ex Gratia Payments. It is also indicated that the individuals do not possess any ownership or documentary proof. The box below provides details on the situation and conditions of ex-gratia payment.

¹¹ The Concessionaire (GAEPL) is in the process of getting formal written approval from NHAI on descoping of pending works of 4 lane.

Box 2.1 Ex-gratia Payment for Private Structures on Government Land

The Policy Circular (No.7.1.51) Reference No. NHAI/11013/DGM (LA)/ FTS-543/2017, Dated 10th April, 2017 gives the following clarifications/provisions regarding ex-gratia payment.

- (i) Ex-gratia compensation for private structures like houses & other buildings on Govt. land would be paid for the structures only on the recommendation of Competent Authority for Land Acquisition (CALA)/ State Govt.;
 - (ii) The Policy Circular also indicates that there may be cases where people have been living on the Govt. land for long period and State Govt. determine such persons as bonafide and genuine users of the said land. Other civic facilities like water supply, roads, electricity etc. are also provided to them by the Govt. but no ownership document is available with them, in such cases ex-gratia/ compensation may be paid for the structures based on the valuation done by the procedures given below; provided the proposal is received through CALA/ Govt.
- Process to carry out the valuation of Asset by the NHAI approved agency and vetted by the competent authority of Govt. duty recommended by CALA/ concerned Govt.

Issues of ex-gratia payment:

NHAI Policy guidelines/ LA (Structures)/2017, is applicable for all NH projects even retrospectively wherever land ownership is not clear and it is difficult to ascertain whether such disputed land is privately owned land or Government land, after examination and confirmation. There are instances where people are granted Patta/ ownership rights under any law of state government including Abadi/assigned land. In such cases, this NHAI 2017 policy states that compensation for privately owned structures may be paid as per the valuation process followed by CALA based on their recommendation (of CALA/State Government).

Based on discussion with NHAI PIU Aligarh, it was understood that NHAI policy 2017 helps in resolving the land ownership issue (whether land is privately owned or government land, especially in case of Abadi land). The ownership issue should be decided by the concerned Revenue Department and if it is established that disputed land parcels are privately owned, then compensation for affected land as well as structures located on such parcels would be due for payment. Otherwise only structure compensation will be considered in the form of ex-gratia payment.

ERM team identified certain structures (i.e. residential structures, commercial structures) in Bhankri khas and Palla sallu villages. These structures belong to the people who occupied Abadi/Govt. land and could not produce any ownership records thus were not found eligible for compensation. ERM team further during their household and Asset survey carried out a detailed survey with the project affected household and took the measurement of affected structure. The issue of their status as encroachers or as bona fide persons eligible for the ex-gratia payment, will need to be resolved based on the list finalised by NHAI.

2.7.2 Khurja Realignment

This realignment comprises of 9.285 km of length, which will be realigned between chainage km 98.400 to km 105.500. This realignment has been proposed due to the upcoming "Super Thermal Power Plant" located at Khurja which shall replace the existing highway length of around 7 km.

The construction work had not started at the time of ERM's site visit and the realignment work is proposed to be developed by 2022 (to be carried out by a separate EPC contractor appointed by NHAI) and will be handed over to the concessionaire/GAEP for operation and maintenance. As understood during discussion with Cube highways, NHAI is liable for obtaining all approvals including Environmental clearances and/ or Forest clearances or other related approvals from regulatory

agencies. Cube shall collect these permits & licenses from NHAI and maintain the same post takeover.

2.7.2.1 Land Acquisition Process for Khurja Realignment

Land acquisition for the Project Road commenced in September, 2018 under the “Right to Fair Compensation and Transparency in Land Acquisition and Resettlement and Rehabilitation Act, 2013 (referred as LARR Act 2013) and NH Act 1956. The LARR Act 2013 has been in effect since 1st January 2014 for all the land acquisition projects in India and NH Act 1956 is be applicable for all the National Highway projects in India.

As per Section 2 (1) of LARR Act 2013, the provisions of the given Act relating to land acquisition, compensation, rehabilitation, and resettlement shall apply, when the appropriate Govt. acquires land for its own use, hold and control, including for Public Sector Undertakings and for public purposes, and shall include:

(b) For infrastructure projects which includes

(i) Roads & Bridges, enlisted under “Transport Category” of the Notification given by “Government of India in the Department of Economic Affairs (Infrastructure Section) number 13/06/2009-INF, dated 27th March, 2012.

For the given “Khurja Realignment” of NH34, the Government has undertaken the determination of compensation for land acquisition under the LARR Act 2013. The LARR Act 2013 provides for compensation determination in Sections 26 through Section 31 of the said act. The aforementioned acts have enacted the compensation requirements as laid out in the LARR Act 2013.

Further, as per NH Act, 1956, Central Government has published 3A, 3D & 3G Notifications with an intention to acquire land for the realignment of Khurja Realignment project. The 3G Notifications the realignment project has also been done, however the details pertaining to it have not been shared with ERM. Hence the details regarding land notified/ required for Khurja realignment has been derived as per the review of 3A & 3D Notifications. The details of 3A & 3D Notifications are given in **Table 2.11** below:

Table 2.11 Status of 3A & 3D Notifications for Khurja Realignment

S. No	3A Notification Date	3D Notification Date	3G Award Date	Land Area as per 3D (in Ha)		
				Government	Private	Total
1	6 Sept 2018	27 Dec 2018	11 Oct 2019 23 Nov 2019	3.0767	44.6602	47.7369
2	NA	20 May 2020	NA	0.047	1.839	1.886
3	4 Dec 2020	16 Feb 2021	31 May 2021	0.3334	3.3281	3.6615
Total land				3.4571	49.8273	53.2844

Source: 3D notification copy & 3G summary table (provided by CH)

2.7.2.2 Details of 3G Summary

As reported by Cube Highway (CH), 3G award for entire 53.2844 ha land stands completed and CH is in the process of obtaining 3G award details from NHAI through the respective CALA (Competent Authority for Land Acquisition) offices. This 3G document with details will provide the final list of all affected families along with compensation details at an individual level.

2.7.3 Pending Court cases/ Issues for the Project Road

As per the review of documents shared for pending/ on-going Court cases with ERM by Cube Highways, it is understood that there are about 600 litigation cases that were filed, mostly related to the land acquisition for the 4/6 laning out of which 515 are pending. The details of pending Court cases are given below:

Table 2.12 Cases under Ghaziabad-Aligarh Section of NH34

SI No.	Districts	Arbitrator/ DM Court	District Court	High Court Allahabad	Total No. of Cases
1	Ghaziabad	Nil	Nil	Nil	Nil
2	Gautam Budhh Nagar	4	61	10	75
3	Bulandshahar	Nil	366	30	396
4	Aligarh	Nil	39	5	44
Total		4	466	45	515
Percentage (%)		0.97	90.49	8.74	100

Source: Data shared by CH on, 01/07/2021

The data above indicates that the total number of pending court cases are 515; of which 466 (90.49%) cases are pending in District level Courts. Bulandshahar has the highest number of pending court cases (76.89%) compared to other three districts.

Out of the remaining court cases 45 court cases (8.74 %) are pending in High Court of Allahabad and remaining 4 cases (0.97 %) are pending in the Court of Arbitrator/ DM. All the four (4) cases pending in the Court of / Arbitrator/ DM are from Gautam Buddha Nagar.

2.8 Construction Phase Resource Requirements

The resource requirement for construction phase of the proposed project have been estimated based on certain assumptions from the sector and projects of similar nature and scale, and discussions made with the Cube Highways. This is subject to updation / revision based on finalisation of project design and related technical plans.

2.8.1 Construction Workforce

The labour force requirement would vary over the construction period depending on the quantum and type of work involved. As per information provided by Cube Highways technical team on 17th September 2021, it is estimated that the Project will require approximately 2000 unskilled and semiskilled labour per day, and approximately 100 to 150 skilled labour per day for the duration of the construction phase. The construction needs to be completed by November 2023 (as per extension sought by GAEPL) total no. of anticipated construction duration would be around 15-18 months including non-working months (Fog/rains etc.). Further, the construction needs to be completed by November 2023 (as per extension sought by GAEPL), total no. of anticipated construction duration would be around 15-18 months including non-working months (Fog/rains etc.). The Project will also engage at least 50 % of its workforce from the local labour pool to maximise local hiring (where "local" is defined as people from Project affected districts and neighbouring districts). This clause will also be communicated to the EPC contractor (once finalised) and added in their contract agreement.

2.8.2 Labour Accommodation

Although the Project will try to maximise local hiring of their workforce, labour accommodation will be provided to all the migrant workers specifically unskilled and skilled workers. The labour camps with required facilities are proposed to be provided for construction workers at a total of 5 locations

identified along the Project Road stretch, at every 25 km distance. As per the broad description provided by CH, each labour camp will accommodate 100 workers. Further details on layout and facilities at each labour camp is currently not available.

The labour camps will be developed on approximately 15-20 acres of leased land. These will be located on private or government land that will be taken on lease from either private landowners or government department. Further details on number of landowners, lease period, rent etc. has not been finalised at this stage.

2.8.3 Water Requirement

During construction phase, approximately 2150 workers will be employed. Ministry of Housing and Urban Affairs has suggested 135 litre per capita per day (lpcd) as the benchmark for average water requirement, out of which 3 lpcd is considered as the drinking water requirement.¹³ Therefore, during construction phase a maximum of 6.45 KLD of drinking water will be required. In case of workers hired locally, the drinking water consumption is estimated to be around 3 KLDd.

It is estimated that for civil works about 10 KLD will be required that includes operation of works, dust suppression etc. The source of water has not been finalised yet, however there are two options depending upon availability, groundwater may be used after obtaining necessary approvals or alternatively water can be sourced through tankers supplied by the authorised contractors. For drinking water consumption, the contractor will provide packaged drinking water which is likely to be procured for use by workers at project site.

2.8.4 Power Requirement

Power will be required during the construction to run various equipment and machinery used at sites, through DG sets. It is understood that 12 nos. of 200KVA DG sets will be used, with three (3) units at each construction location (4 fronts).

Various equipment such as hot mix plant, concrete batching plant, excavator, grader, dumper, milling machine, WMM plant, DG sets, cold- in-place recyclers, soil compactors, sheep foot rollers and tandem rollers will be utilised during project construction. The number of equipments required will vary as per the requirement and capacity of EPC Contractor to be provided by Cube Highways.

2.8.5 Raw Material Requirement

As per the information shared by Cube Highways, major raw materials that are required for the construction phase i.e. asphalt, concrete, aggregates (fine aggregates or coarse aggregates obtained from rocks), and construction materials like cement and sand that will be sourced from local areas. The quantity of construction materials required is not estimated yet. The raw material will be transported from the source locations till the construction laydown areas. The total truck movements per day is anticipated to be approx. 360 (considering 10m³ of truck load capacity) which can be easily accommodated within the existing traffic load of the highway. Further, most of the transportation will be on the existing highway, however internal roads will also be used at certain areas for transportation of construction material.

Adequate borrow areas have been identified (within average 5 km lead) and the material has been already tested and approved. The following borrow areas have been identified along the Project Road stretch from where soil will be sourced from for use in embankment and sub-grade layer. Excavated material during road expansion works will also be refilled into these borrow areas.

¹³ <http://cgwa-noc.gov.in/landingpage/Guidelines/NBC2016WatRequirement.pdf>

Table 2.13 Identified Borrow Areas

Borrow Area Location No.	Location Coordinates	Nearby Location
1	28.330362, 77.880471	Achhejja
2	28.282713, 77.871823	Chiti
3	28.244880, 77.895940	Sanda Faridpur, Khurja Shikarpur Road
4	28.09844,77.934099	Ahmadpur Halpura
5	28.028922, 77.975564	Ogar
6	27.851949, 78.104066	Alinagar
7	27.99399, 77.96978	Chaumunha
8	28.2020,77.8977	Hazratpur Puthari
9	28.13834, 77.93177	Ghatal, Arnia Khurd
10	28.13746, 77.92947	Ghatal, Arnia Khurd
11	28.06003, 77.95145	Panihavar near Somna Toll
12	28.4967, 77.7177	Peerbiyabani
13	28.4971, 77.7056	Peerbiyabani
14	28.4503,77.7788	Veerkhara
15	28.5512, 77.8654	Kisoli
16	28.5662, 77.8645	Kisoli
17	28.5619,77.8665	Kisoli
18	28.5480, 77.8648	Ajitpur
19	28.5208,77.8270	Maholi
20	28.1953, 78.0643	Nagla, Bulandshar

Quarries have been identified at Nangal and Kotputli in Rajasthan. Finished goods (aggregate) will be directly procured from these authorised quarries. However, details on exact number and location of these quarries have not been finalised.

2.8.6 Construction Waste

It is envisaged that waste will be generated during construction phase from batching plant, hot mix plant and from the demolition of any structures within the ROW. Some of the waste would be recycled and used for back filling. Waste material which cannot be recycled would be considered as Construction and Demolition waste and will be disposed of as per the existing rules.

Sewage will be generated during this phase from toilets at construction camps which will be managed through septic tanks and which will be cleaned out through pumping when required and the waste will be disposed on treatment facility. Solid waste generated during the construction phase from the camps is expected to comprise of food waste and recyclables viz. packaging material etc. Hazardous waste in the form of used oil from DG sets, empty paint cans, contaminated cotton rags, etc. will be stored at a demarcated place at construction camps and will be disposed off as per existing regulations.

2.9 Operation and Maintenance Phase Details

The main activities in the operations and routine maintenance (O&M) phase are listed below:

- Maintenance activities like median plantation, avenue plantation, ROW cleaning, ROW clearing, lane marking, kerb painting, shoulder rectification, Metal Beam Crash Barrier (MBCB) & pre-screening and repairing (P&R) repairs and replacement, Drain chutes cleaning
- Bridge maintenance & repairs, cleaning/repairs of expansion joints

- Crash barriers painting, replacement of signage boards, erection / replacement of highway lights
- Chainage marking and milestone writing,
- Pot holes maintenance, maintenance of roadside drainage and rain water harvest structures,
- Shoulder gravelling, shoulder maintenance, debris removal
- Operation and maintenance of toll roads, bus/ truck lay byes
- Carriageway sweeping, cleaning of road side line/ unlined drains and removal of dead animals
- Monitoring of encroachments (temporary & permament – hawkers, stalls, construction) through regular patrolling

2.9.1 Estimated / Designed Traffic Load

The traffic projections are presented for the following four sections along the Project Road:

- NH-34 from Chainage 23.600 to 27.000 km referred to as the Lalkuan Section. This section has predominant commercial landuse on either side of the alignment.
- NH-34 from Chainage 27.000 to 33.600 km referred to as the Mankipur Section. This section also has predominant commercial landuse on either side of the alignment.
- NH-34 from Chainage 33.600 to 98.400 km referred to as the TP-1 Section. TP-1 (Toll Plaza-1) is located at Chainage 47.500 km. This section covers predominant rural mixed landuse including agriculture fields and some dwelling units located close by on either side of the alignment.
- NH-34 from Chainage 98.400 to 129.600 km referred to as the TP-2 Section. TP-2 (Toll Plaza-2) is located at Chainage 113.300 km. This section covers predominant rural mixed landuse including agriculture fields and some dwelling units located close by on either side of the alignment.

Speed surveys were conducted for morning, evening and late evening hours by officials of Cube Highways and accordingly projected average traffic volumes and related speeds (with respect to their types) for the traffic scenarios for the years 2020, 2025, 2030, 2035 and 2040 were worked out.

2.9.1.1 Projected Traffic Data along Lalkuan Section

Table 2.13 covers projected traffic data at Lalkuan Section of the Project Road.

Table 2.14 Projected Traffic Data for Ch. 23.600 to 27.000 km (Lalkuan Section)

Year [no. of Lanes]	Projected Traffic Description	Day Time (0700-2200 hrs) Traffic Type					Night Time (2200-0600 hrs) Traffic Type					Av. Daily Traffic 24hourly
		PCUs	Medium Trucks	Heavy Trucks	Buses	TWs	PCUs	Trucks	Heavy Trucks	Buses	TWs	
2020 [4 Lanes]	Average Traffic	25,319	1,776	7,56	1,247	35,269	4,122	892	372	614	5,742	76,240
	Traffic/hr	1585	115	50	80	2200	515	110	50	75	720	-
	Av. Speed km/h	20	15	15	15	20	20	15	15	15	20	-
2025 [6 Lanes]	Average Traffic	31,789	1,961	834	1,377	52,473	5,175	984	411	678	8,542	104,368
	Traffic/hr	1,985	125	52	90	3,280	650	125	52	85	1,070	-
	Av. Speed km/h	40	30	30	30	40	40	30	30	30	40	-
2030 [6 Lanes]	Average Traffic	39,361	2,202	937	1546	73,316	6,408	1,105	462	762	11,935	138,120
	Traffic/hr	2,460	140	60	100	4,580	800	140	60	95	1,490	-
	Av. Speed km/h	35	25	25	25	35	35	25	25	25	35	-
2035 [6 Lanes]	Average Traffic	48162	2470	1051	1734	95596	7840	1240	518	854	15562	175,080
	Traffic/hr	3010	155	65	110	5975	980	155	65	110	1945	-
	Av. Speed km/h	30	20	20	20	30	30	20	20	20	30	-
2040 [6 Lanes]	Average Traffic	59201	2775	1181	1949	121543	9637	1393	582	960	19786	219,080
	Traffic/hr	3700	175	75	120	7600	1205	175	70	120	2475	-
	Av. Speed km/h	20	15	15	15	20	20	15	15	15	20	-

Source: Developed from Cube Highways provided traffic data; PCUs = Passenger Car Equivalent Traffic; TW = Two wheelers.

2.9.1.2 Projected Traffic Data along Manikpur Section

Table 2.14 covers projected traffic data at Manikpur Section of the Project Road.

Table 2.15 Projected Traffic Data for Ch. 27.000 to 33.600 km (Manikpur Section)

Year [no. of Lanes]	Projected Traffic Description	Day Time (0700-2200 hrs) Traffic Type					Night Time (2200-0600 hrs) Traffic Type					Av. Daily Traffic 24 hourly
		PCUs	Medium Trucks	Heavy Trucks	Buses	TWs	PCUs	Trucks	Heavy Trucks	Buses	TWs	
2020 [4 Lanes]	Average Traffic	15,532	1,789	762	1,256	20,849	2,529	898	375	619	3,394	46,590
	Traffic/hr	970	110	50	80	1,305	320	115	50	75	425	-
	Av. Speed km/h	45	30	30	30	50	45	30	30	30	50	-
2025 [6 Lanes]	Average Traffic	20,372	1,986	845	1,395	31,019	3,316	998	416	687	5,050	63,993
	Traffic/hr	1275	125	52	90	1,940	415	125	52	85	630	-
	Av. Speed km/h	50	40	40	40	55	50	40	40	40	60	-
2030 [6 Lanes]	Average Traffic	26,174	2,239	953	1,572	43,340	4,261	1,124	469	774	7,055	104,610
	Traffic/hr	1635	140	60	100	2,710	535	140	60	100	880	
	Av. Speed km/h	40	35	35	35	45	40	35	35	35	45	
2035 [6 Lanes]	Average Traffic	33,067	2,518	1,071	1,768	56,511	5,383	1,264	528	871	9,199	108,345
	Traffic/hr	2,070	155	65	110	3,530	670	160	65	110	1,150	-
	Av. Speed km/h	40	30	30	30	40	40	30	30	30	40	-
2040 [6 Lanes]	Average Traffic	41,833	2,836	1,207	1,992	71,849	6,810	1,424	595	981	11,696	136,485
	Traffic/hr	2,615	180	75	125	4,490	850	180	75	125	1,460	
	Av. Speed km/h	35	25	25	25	35	35	25	25	25	35	

Source: Developed from Cube Highways provided traffic data; PCUs = Passenger Car Equivalent Traffic; TW = Two wheelers.

2.9.1.3 Projected Traffic Data along TP-1 Section

Table 2.15 covers projected traffic data for TP-1 Section of the Project Road.

Table 2.16 Projected Traffic Data for Ch. 33.100 to 98.400 km (TP-1 Section)

Year [no. of Lanes]	Projected Traffic Description	Day Time (0700-2200 hrs) Traffic Type					Night Time (2200-0600 hrs) Traffic Type					Av. Daily Traffic 24 hourly
		PCUs	Medium Trucks	Heavy Trucks	Buses	TWs	PCUs	Trucks	Heavy Trucks	Buses	TWs	
2020 [4 Lanes]	Average Traffic	16,553	457	2,390	1,148	14,692	2,473	68	357	172	2,195	40,528
	Traffic/hr	1,035	29	150	72	918	309	9	45	21	274	-
	Av. Speed km/h	60	40	40	40	60	60	40	40	40	60	-
2025 [6 Lanes]	Average Traffic	20,204	480	2,870	1,256	21,708	3,019	72	429	188	3,244	53,464
	Traffic/hr	1,263	30	179	78	1,357	377	9	54	24	405	-
	Av. Speed km/h	70	40	40	40	60	70	40	40	40	60	-
2030 [6 Lanes]	Average Traffic	26,108	492	3,511	1,354	2,9910	3,901	74	525	202	4,469	70,552
	Traffic/hr	1,632	31	219	85	1,869	488	9	66	25	559	-
	Av. Speed km/h	60	40	40	40	60	60	40	40	40	60	-
2035 [6 Lanes]	Average Traffic	32,970	509	4,216	1,436	38,466	4,927	76	630	215	5,748	89,224
	Traffic/hr	2,061	32	264	90	2,404	616	10	79	27	719	-
	Av. Speed km/h	60	40	40	40	60	60	40	40	40	60	-
2040 [6 Lanes]	Average Traffic	40,785	528	4,974	1,513	48,766	6,094	79	743	226	7,287	111,008
	Traffic/hr	2,549	33	311	95	3,048	762	10	93	28	911	-
	Av. Speed km/h	50	40	40	40	50	50	40	40	40	50	-

Source: Developed from Cube Highways provided traffic data; PCUs = Passenger Car Equivalent Traffic; TW = Two wheelers.

2.9.1.4 Projected Traffic Data along TP-2 Section

Table 2.17 covers projected Traffic data at TP-2 Section of the Project Road.

Table 2.17 Projected Traffic Data for Ch. 98.400 to 149.600 km (TP-2 Section)

Year [no. of Lanes]	Projected Traffic Description	Day Time (0700-2200 hrs) Traffic Type					Night Time (2200-0600 hrs) Traffic Type					Av. Daily Traffic 24 hourly
		PCUs	Medium Trucks	Heavy Trucks	Buses	TWs	PCUs	Trucks	Heavy Trucks	Buses	TWs	
2020 [4 Lanes]	Average Traffic	7,155	468	2,306	744	8,031	1,069	70	345	111	1,200	21,504
	Traffic/hr	447	29	144	47	502	134	9	43	14	150	-
	Av. Speed km/h	60	40	40	40	60	60	40	40	40	60	-
2025 [6 Lanes]	Average Traffic	9,321	431	2,759	814	11,866	1,393	64	412	122	1,773	28,968
	Traffic/hr	583	27	172	51	742	174	8	52	15	222	-
	Av. Speed km/h	70	40	40	40	60	70	40	40	40	60	-
2030 [6 Lanes]	Average Traffic	11,897	441	3,382	878	16,349	1,778	66	505	131	2,443	37,872
	Traffic/hr	744	28	211	55	1,022	222	8	63	16	305	-
	Av. Speed km/h	60	40	40	40	60	60	40	40	40	60	-
2035 [6 Lanes]	Average Traffic	14,848	457	4,129	932	21,026	2,219	68	617	139	3,142	47,577
	Traffic/hr	928	29	258	58	1,314	277	9	77	17	393	-
	Av. Speed km/h	60	40	40	40	60	60	40	40	40	60	-
2040 [6 Lanes]	Average Traffic	18,229	475	4,999	982	26,656	2,724	71	747	147	3,983	59,000
	Traffic/hr	1,139	30	312	61	1,666	341	9	93	18	498	-
	Av. Speed km/h	50	40	40	40	50	50	40	40	40	50	-

Source: Developed from Cube Highways provided traffic data; PCUs = Passenger Car Equivalent Traffic; TW = Two wheelers.

2.9.2 Labour force

During operations, a total of 600 employees and/or workers may be engaged at site. At least 20 percent of the labour force engaged during the operation phase is likely to be females. It is expected that about 200-250 workers will be responsible for overall project operations. Multiple contractors are expected to be engaged for different activities such as toll operations, route patrolling, RoW maintenance, security services, ambulance services, etc. The total number of daily workers, including those of contractors, is likely to be in the range of 400-500.

2.9.3 Water Requirement

Water requirement during operations will be limited to drinking, maintenance, road cleaning and horticultural activities. Currently groundwater is being used for O&M of the Project Road, which is sourced from the borewells installed at toll plazas, one each. Permission will be sought from CGWA in order to continue usage of groundwater.

2.9.4 Power Requirement

The power requirement during operation phase will be for operation of toll plazas and lighting of roadway. Power back up will be met through provision of DG sets, however the number and capacities are yet to be finalised. During road maintenance works, portable DG sets will be utilised to operate the various equipment and machinery used at sites where maintenance is taking place, which will be met using DG sets.

2.9.5 Solid and Hazardous Waste Generation

During operations, solid waste will be primarily generated from toll plaza and roadside areas. In case of maintenance activities, the bituminous layer would be excavated during the repair of pavements and road sections, and will be required to be disposed off. Hazardous waste in the form of used oil from DG sets, empty paint cans, contaminated cotton rags, etc. will be stored at toll plaza and disposed off as per existing regulations. Any e-waste likely to be generated in the form of damage lights, electronics from toll plaza, etc. will be recycled through authorised recyclers.

Toll plazas have been provided with septic tanks for collection of sewage generated. The septic tanks will be cleaned through pumping when required and the waste will be disposed off as per the applicable regulations.

2.9.6 Landscape Development

As per information shared by Cube Highways, it is understood that median plantation will be carried out and maintained as per the IRC standards. Avenue plantation in entire road section within the available RoW is planned. However, road side avenue plantation is under the purview of forest department in UP.

3. APPLICABLE LEGAL AND REGULATORY FRAMEWORK

3.1 Introduction

This section highlights the environmental and social regulations applicable to the Project. At the outset, it should be emphasized that this administrative framework focuses on:

- Applicable environmental and social regulations and policies in India and the State of Uttar Pradesh;
- Institutional Framework for the implementation of the regulations; and
- International Standards and Conventions including:
 - Applicable Indian national, state and local regulatory requirements;
 - IFC Performance Standards (2012);
 - IFC/World Bank General EHS Guidelines (2007);
 - IFC/World Bank EHS Guidelines for Toll Roads (2007);
 - ADB Safeguard Policy Statements (SPS);
 - AIIB Environmental and Social Policy (ESP) and Standard – ESS 1,2 and 3; and
 - CDC E&S Management System.

3.2 Permitting Status of the Project

3.2.1 EIA Notification (2006)

As per the EIA Notification (2006) and its amendments, schedule 7(f) Highways –

- New National Highway and Expansion of National Highways greater than 30 km, involving additional Right of way (ROW) greater than 20m involving land acquisition and passing through more than one state, falls under Category A; whereas,
- Expansion of National / State Highways greater than 30 km involving additional right of way greater than 20m involving land acquisition, falls under Category B.

Besides EIA Notification 1994 amended in 2006, National Highway improvement projects in India are also governed under Environmental Protection Act, 1986; Water Act, 1974; Air Act, 1981 and Rules made there under.

The Project Road was accorded Environment clearance from MoEF&CC vide letter dated 3rd March 2009. Since there is no additional land acquisition for the widening, requirement of Environmental Clearance of expansion activity will not be applicable.

3.3 National Administrative Requirements

In India, the national level laws are formulated by Ministry of Environment, Forests and Climate Change (MoEFCC) and state governments are required to consider these regulations as base level for implementation. The State Pollution Control Boards (SPCBs) are responsible for securing compliance under the Environmental Protection Act, 1986, the umbrella legislation regulating environmental issues in the country. A brief description of the relevant enforcement agencies both at central level and state level with respect to the institutional framework is described in Table below.

Table 3.1 Relevant Enforcement Agencies

S. No	Agency	Functions
Central Level		
1.	Ministry of Environment Forests and Climate Change (MoEFCC)	The Ministry of Environment and Forests (MoEFCC), Government of India is responsible for the environment management at Union of India level. The specific functions of MoEFCC are as follows: <ul style="list-style-type: none"> ■ Environmental policy planning; ■ Effective implementation of legislation; ■ Issuing guidelines under EP Act for environment protection;

S. No	Agency	Functions
		<ul style="list-style-type: none"> ■ Monitoring and control of pollution through Central Pollution Control Board and State Pollution Control Boards; ■ Environmental clearance for industrial and development projects covered under EIA Notification; ■ Monitoring of compliance conditions stipulated in Environmental clearance through its regional offices; ■ Promotion of environmental education, training and awareness; ■ Forest conservation, development, and wildlife protection; and ■ Protection of Coastal areas. <p>MoEFCC is responsible for the implementation and enforcement of the Environment Protection Act, 1986, and Rules issued under the Act, including the EIA notification. Under sections 3 and 5 of the EP Act, 1986, it retains enormous powers to issue directions in the interests of environment protection.</p>
2.	Ministry of Road Transport and Highways (MoRTH)	<p>The Ministry of Road Transport and Highways (MoRTH) is a ministry of the Government of India that is the apex body for formulation and administration of the rules, regulations and laws relating to road transport, transport research and in also to increase the mobility and efficiency of the road transport system in India. Through its officers of Central Engineering Services (Roads) cadre it is responsible for the development of National Highways of the country. Road transport is a critical infrastructure for economic development of the country. It influences the pace, structure and pattern of development.</p> <p>The Ministry has two wings: Roads wing and Transport wing. The Road Wing deals with development and maintenance of National Highway in the country. Its main Responsibilities includes:</p> <ul style="list-style-type: none"> ■ Planning, development and maintenance of National Highways in the country. ■ Extends technical and financial support to State Governments for the development of state roads and the roads of inter-state connectivity and economic importance ■ Evolves standard specifications for roads and bridges in the country. ■ Serves as a repository of technical knowledge on roads and bridges.
3.	Central Pollution Control Board	<p>The Central Pollution Control Board (CPCB) has been constituted for the control of water, air and noise pollution, land degradation and hazardous material and waste management. The specific functions of CPCB are as follows:</p> <ul style="list-style-type: none"> ■ Prevent pollution of streams and wells; ■ Advise the Central Government on matters concerning prevention, control and abatement of water and air pollution; ■ Co-ordinate the activities of SPCB's and provide them with technical and research assistance; ■ Establish and keep under review quality standards for surface and groundwater and for air quality; ■ Planning and execution of national programme for the prevention, control and abatement of pollution through the Water and Air Acts.

S. No	Agency	Functions
4.	The National Green Tribunal	<p>National Green tribunal was constituted in 2010 for effective and expeditious disposal of cases relating to environmental protection and conservation of forests and other natural resources including enforcement of any legal right relating to environment and giving relief and compensation for damages to persons and property and for matters connected therewith or incidental thereto. It is a specialized body equipped with the necessary expertise to handle environmental disputes involving multi-disciplinary issues.</p> <p>The tribunal will have jurisdiction over all civil cases relating to implementation of the following regulations:</p> <ul style="list-style-type: none"> ■ The Water Act, 1974; ■ The Water Cess Act, 1977; ■ The Forest Conservation Act, 1980; ■ The Air Act, 1981; ■ The Environment Protection Act, 1986; ■ The Public Liability Insurance Act, 1991; and ■ The Biological Diversity Act, 2002
5.	Central Ground Water Authority	<p>The Central Ground Water Authority (CGWA) was constituted in 1997 to regulate, control and manage groundwater development in the country, under the EP Act 1986. One of the main functions of CGWA is to regulate indiscriminate boring and withdrawal of groundwater and to issue necessary regulatory directions with a view to preserve and protect the groundwater.</p> <p>CGWA has declared certain areas of India as “notified areas” from the point of over-development of resource, or from groundwater quality point of view, or for registration of groundwater abstraction structures. In these so "notified areas" further extraction is regulated in order to prevent the depletion of groundwater levels and deterioration of its quality.</p>
6.	Petroleum and Explosives Safety Organization (PESO)	<p>The PESO is under, Ministry of Commerce and Industry, Department of Industrial Policy & Promotion, Government of India. The Chief Controller of explosives is responsible to deal with provisions of:</p> <ul style="list-style-type: none"> ■ The Explosive Act 1884 and Rules, 1983; ■ The Petroleum Act 1934 and the Rules 2002; ■ The Static and Mobile pressure vessels {Unfired} Rules, 1981 and amendment 2000, 2004; ■ Gas Cylinder Rules, 2004; and ■ Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 and amendment, 2000.
State Level		
1.	UP Pollution Control Board (UPPCB)	<p>U.P. Pollution Control Board is a statutory organization entrusted to implement Environmental Laws and rules within the jurisdiction of the state of Uttar Pradesh, India. U.P.</p> <p>Principal functions of the Board, as spelt out in the Water Act, 1974 and Air Act, 1981 is the prevention, control and abatement of water and air pollution. The main effort of the board is to assist the industries and entrepreneurs to discharge their daily basic obligations to safe guard environment. The Board was also entrusted with the powers and functions under the Water (Prevention and Control of</p>

S. No	Agency	Functions
		Pollution) Cess Act, 1977 along with other responsibilities under the Environmental Protection Act, 1986.
2.	UP Forest Department	Uttar Pradesh Forest Corporation was established on 25 November 1974 under the Uttar Pradesh Forest Corporation Act 1974 as a local authority for more effective conservation, development and scientific exploitation of forest produce of the forests of Uttar Pradesh. With this, work was started in Uttar Pradesh under the principles of Sustainable Yield to exploit the forest produce from the forests through scientific method.
3.	Labour Department	<p>The Department of Labour is responsible for formulation, implementation and enforcement of the labour laws in the Uttar Pradesh state. It also undertakes prevention and settlement of industrial disputes, Industrial safety, and health and promotes welfare of workers in the undertakings within the sphere of the State.</p> <p>Labours to be involved during the construction phase and few labours shall be required during in the operation phase. The labours (local and migrant) should be provided with wages and other facilities, which should be in compliance with the state laws and acts.</p>
4.	Gram Panchayat	<p>The local Panchayats are empowered with management of local resources like forests, groundwater, common land and infrastructure like roads, buildings etc.; and therefore, NoC have to be obtain from the Gram Panchayat before the development of the Project.</p> <p>Reportedly, the gram panchayat NOCs from all the villages are under process.</p>

3.4 Applicable Regulatory/Policy Framework

Table below summarizes the key regulations that are relevant to the project across its lifecycle. This table should be used to update/develop a comprehensive legal register for the project which can be regularly monitored for compliance as well as updated to reflect changes/non-applicability of regulations, policies and standards.

Table 3.2 Applicability of Key Legislations in India and Reference Framework in the different phases of life cycle of Project

Topic and Reference	Construction	Operations	Agency Responsible	Remarks
Environment Protection				
Environment Protection Act, 1986 and as amended; The Air (Prevention And Control Of Pollution) Act, 1981; The Water (Prevention And Control Of Pollution) Act 1974	☒	☒	<ul style="list-style-type: none"> ■ MoEFCC; ■ UPPCB; ■ CPCB 	Permissible limits for ambient air quality, water quality, noise limits has been laid down by CPCB under EP Act, 1986 which requires to be complied with.
The Noise (Regulation & Control) Rules, 2000 and as amended up to 2010 Ambient Noise Standards	☒	☒	UPPCB	Ambient noise levels are to be maintained as stipulated in the rules for different categories of areas – residential, commercial, and industrial and silence zones. Cube Highways need to abide by the limits prescribed for residential zones.
Solid Waste Management Rules 2016	☒	☒	Local authorities	Solid waste generated at site will be handled as per provisions of solid waste management rules, 2016.
Plastic Waste Management Rules 2016	☒	☒	Local authorities	Rules will be applicable for disposal of plastic waste at site.
Manufacture, Storage and Import of Hazardous Chemicals (MSIHC) Rules, 1989 and as amended	☒	☒	UPPCB	Rules will be applicable during construction and operation stages if chemicals stored at site satisfy the criteria laid down in the Rules.
Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016	☒	☒	UPPCB	Generation of waste oil and transformer oil at site attracts the provisions of Hazardous and Other Wastes Rules, 2016. The rules provide guidelines for the disposal and treatment of these wastes through approved recyclers or

Topic and Reference	Construction	Operations	Agency Responsible	Remarks
				discarded through an authorized transportation, storage and disposal facility (TSDF). The Hazardous and Other Wastes (Management and Transboundary Movement) Amendment Rules, 2019 was released on 1 st March 2019 that exempts white category industries from obtaining a hazardous waste authorization. The requirement to obtain a hazardous waste authorization is therefore no longer applicable for the Project but the requirements for storage, transportation and disposal in the 2016 rules need to be complied with. The maintenance of waste records indicated in the Hazardous and Other Wastes Rules, 2016 also needs to be complied with.
Building and Other Construction Workers Act, 1996; Inter-state Migrant Workers Act, 1979; Contract Labour Act, 1970	☒	☒	Local authorities	Construction waste generated at site will be handled as per the provisions of Construction and Demolition Waste Management Rules, 2016. This provides guidelines for disposal of waste through local authorities.
The Contract Labour (Regulation & Abolition) Act, 1970 & Uttar Pradesh contract labour (regulation and abolition) rules 1971	☒	☒	Labour & Employment Department, Government of Uttar Pradesh	The construction labours will be engaged at site during construction phase. This will require both principal labour licence and contractual labour licence for Cube Highways, GAEPL and other sub-contractors.
Inter-State Migrant Workmen (Regulation of Employment and Conditions of Service) Act, 1979.	☒	☒	Labour & Employment Department,	The migrant construction labours (if hired more than 5 workers), will be

Topic and Reference	Construction	Operations	Agency Responsible	Remarks
			Government of Uttar Pradesh	engaged at site during construction phase.
Factories Act 1948; Uttar Pradesh Factory Rules 1950	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Director Industrial safety & Health Department (DISH); Labour & Employment Department, Government of Uttar Pradesh	The Directorate of Industrial Safety and Health Department enforces the provisions of Factories Act 1948 and Rajasthan Factories Rule 1963 and the rules made there under to ensure safety health and welfare of the workers. It also plays a significant role in regularizing working hours, and working conditions and reducing the accident and dangerous occurrences in the factories, redressal of the grievances of the workers in respect of Safety Health and Welfare through a set of policies developed by both the Central and State Govt. Some of the functions of DISH are: Elimination inequality and discrimination in the work place; Enhancing occupational health and safety awareness and compliance in the workplace; Workforce and community participation, to employers, employees, workplaces, communities, businesses and unions; and Providing policy advice and analysis to government on labour and employment related matters.
The Child Labour (Prohibition and Regulation) Act, 1986; Bonded Labour (Abolition) Act 1976; Minimum Wages Act, 1948;	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Labour Department, Government of Uttar Pradesh	The Project and their contractors will need to comply with the requirements of these regulations.

Topic and Reference	Construction	Operations	Agency Responsible	Remarks
Equal Remuneration Act 1976; Workmen's Compensation Act, 1923; Maternity Benefit Act, 1961.				
Forest (Conservation) Act, 1980	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Forest Department	The project may need permit for removal of large trees from the RoW for the purpose of expansion.
Wild Life (Protection) Act, 1972.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Wild Life Department	In event of any mortality due to project activity of Schedule -I listed species of IWPA1972 Wildlife Department can take actions as per the regulations laid in this act.
International Standards and Guidelines				
IFC Performance Standards, 2012	<input type="checkbox"/>	<input checked="" type="checkbox"/>	IFC, Equator Principles Financing Institutions (EPFIs)	During the construction, operation and eventual decommissioning of the site, the following guidelines will need to be followed.
IFC/WBG General EHS Guidelines, 2007	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
IFC/WBG Environmental, Health, and Safety Guidelines for Toll Roads, 2007	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
IFC/WBG Air Emissions and Ambient Air Quality Standards	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
IFC/WBG Guidelines for treated sanitary sewage discharges	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
IFC/WBG Noise Standards	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		

3.5 National Environmental Standards

The Central Pollution Control Board (CPCB) has stipulated different environmental standards w.r.t. ambient air quality, noise quality, water and waste water for the country as a whole under EP Act, 1986. Following standards are applicable to the project and need to be complied with during the project life cycle.

- National Ambient Air Quality Standards (NAAQ Standards), as prescribed by MoEFCC vide, Gazette Notification dated 16th November, 2009;
- Drinking water quality- Indian Drinking Water Standard (IS 10500: 2012);
- General standards for discharge as prescribed under the Environment Protection Rules, 1986 and amendments (G.S.R 422 (E) dated 19.05.1993 and G.S.R 801 (E) dated 31.12.1993 issued under the provisions of E (P) Act 1986);
- Noise standards specified by the MoEFCC vide Gazette notification dated 14th February, 2000 (Noise Pollution (Regulation and control) Rules, 2000); and
- Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

3.6 International Safeguard Requirements

3.6.1 IFC Requirements

IFC applies the Performance Standards ⁽¹⁴⁾ to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing in its member countries eligible for financing. The Performance Standards may also be applied by other financial institutions choosing to support them in the proposed Project. 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. Together, the Client is required to meet the stipulations of all the eight Performance Standards throughout the life of an investment in the case such an investment is being sought either from IFC or any other institution which follows IFC standards (**Table 3.3**).

Table 3.3 IFC Performance Standards and their Applicability

IFC PS	Description	Objectives and Applicability to Project
PS 1	Assessment and Management of Environmental and Social Risks and Impacts	Applicable This PS aims to assess the existing social and environmental management systems of GAEPL/CH and to identify the gaps with respect to their functioning, existence and implementation of an environmental and social management plan (ESMP), organization chart with defined roles and responsibilities, risk identification and management procedures as well as processes like stakeholder engagement and grievance management
PS 2	Labour and Working Conditions	Applicable A number of international conventions and instruments guides this PS on labour and workers' rights. It recognises that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of fundamental rights of workers. The PS 2 covers following themes: human resource policy and management, workers' organization, non-discrimination and equal opportunity, retrenchment, protecting the workforce and occupational health and

(14) <http://www.ifc.org/ifcext/sustainability.nsf/Content/PerformanceStandards>

IFC PS	Description	Objectives and Applicability to Project
		<p>safety. This PS shall help in assessing the status of the employees and workers that may get engaged during construction and operations stage.</p> <p><i>The project activities will involve hiring of approx. 2000 skilled, semi-skilled and unskilled labourers during the construction phase, and more than 600 employees during the operation phase as toll plaza operators, security etc. The project shall have to develop a human resource policy or align with CH' corporate HR policy, and ensure non-discrimination and equal opportunity, protection of the workforce and occupational health and safety.</i></p>
PS 3	Resource Efficiency and Pollution Prevention	<p>Applicable</p> <p>PS-3 covers the use resources and materials as raw materials and generates wastes that could affect human health and environment. The objective 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, and to reduce project related GHG emissions. Key themes covered under PS-3 are: pollution prevention, resource conservation and energy efficiency, wastes, hazardous materials, emergency preparedness and response, greenhouse emissions, pesticide use and management. This PS will assess how Cube Highways intends to minimize pollution related impacts with what management plans and systems are in place, and what measures it plans to take to conserve and use resources more efficiently.</p> <p><i>The Project construction and operation activities will lead to increased fugitive dust emissions, especially in the area it is being developed due site clearance, excavation and construction related activities. The Project activities will also lead to increase in ambient noise level during the construction phase and operation phase, which may impact the nearest towns and villages the project road is passing through. The temporary offices and labour camps established for the proposed project will generate wastes. Also, impact is envisaged on the natural drainage system in the project area from project road development and temporary offices and labor camps construction. Therefore, PS 3 is applicable to the Project..</i></p>
PS 4	Community Health, Safety and Security	<p>Applicable</p> <p>This PS-4 requires due diligence to anticipate and avoid adverse impacts on the health and safety of the affected community during the project life from both routine and non-routine circumstances. It also requires to ensure that the 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. Key areas of compliance screened under PS-4 includes: traffic related safety infrastructure/equipment safety, hazardous material safety, natural resource issues, exposure to disease, emergency preparedness and response, and security personnel requirements. The project would affect the health and safety of the communities adjacent to it during construction and operations phase.</p> <p><i>During construction as well as operation phase, transportation/relocation of utilities, construction equipment t and increased traffic in the area may</i></p>

IFC PS	Description	Objectives and Applicability to Project
		<p><i>lead to accidents and other threats on community health and safety, therefore PS 4 is applicable to the Project.</i></p>
PS 5	Land Acquisition and Involuntary Resettlement	<p>Applicable</p> <p>(Private sector responsibilities under government managed resettlement)</p> <p>PS-5 requires project proponents to anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use. The key themes covered under this are: compensation and benefits for displaced persons, consultation and grievance mechanism, resettlement planning and implementation, physical displacement, economic displacement. The PS-5 also prescribes private sector responsibility to supplement government actions and bridge the gap between government's assigned entitlements, procedures, and the requirements of PS-5.</p> <p>In case of this Project, even though there is no new land acquisition, the removal of encroachments/squatters from the government-owned RoW, where land is required for construction works, will result in both physical and economic displacement of 28households. A RAP-LEP has been developed to address mitigation and management measures. The project may lead to physical and economic displacement as number of structures, i.e. residential, commercial, residential cum commercial, religious, institutional etc. were identified within toe-line. Thus PS5 is deemed applicable for this project</p> <p>A gap assessment between the compensation process being undertaken by NHAI for acquiring land for the Khurja Realignment and IFC PS5 shows that there are emerging gaps in terms of livelihoods restoration of the economically displaced (there is no physical displacement). These gaps have been included in the RAP-LEP being developed for the Project.</p>
PS 6	Biodiversity Conservation and Sustainable Management of Living Natural Resources	<p>Not Applicable</p> <p>The requirements of this Performance Standard are applied to projects (i) located in modified, natural, and critical habitats; (ii) that potentially impact on or are dependent on ecosystem services over which the client has direct management control or significant influence; or (iii) that include the production of living natural resources (e.g., agriculture, animal husbandry, fisheries, forestry). PS-6 screens relevant threats to biodiversity and ecosystem services, especially focusing on habitat loss, degradation and fragmentation, invasive alien species, overexploitation, hydrological changes, nutrient loading, and pollution. The key themes covered under PS-6 are: natural habitat, critical habitat, legally protected areas, international introduction of alien species, and living natural resources (natural and plantation forest, aquatic resources etc.) are sustainably managed.</p> <p><i>The immediate surrounding areas of the project road does not form part of any protected areas (National Park and Wildlife Sanctuary). The nearest IBA, (i.e. Surajpur Wetland) is about 5 km away from the study area that supports congregations of migratory bird species; three more IBAs, Dhanauri, Okhla and Sheikha Jheel are also present within the</i></p>

IFC PS	Description	Objectives and Applicability to Project
		<i>range of 20 km from the study area.</i> As the project is an expansion project, largely passing through agricultural land, plantation and orchards with low biodiversity values within the landscape which is predominantly semi-urban, the PS6 is not applicable here.
PS 7	Indigenous Peoples	Not Applicable Based on the review of secondary data it has been identified that the project area/ villages does not fall under Schedule V area as defined in the Indian Constitution. Therefore PS7 does not apply to the project. There are no ST households -confirmed on the basis of the survey.
PS 8	Cultural Heritage	Applicable PS 8 requires proponent to, <ul style="list-style-type: none"> ■ To protect cultural heritage from the adverse impacts of project activities and support its preservation; and ■ To promote the equitable sharing of benefits from the use of cultural heritage. This PS is applicable owing to sensitive receptors identified such as temples or other related structures within RoW and 500 meter from the main carriageway. The Project Road construction will require removal of more than 5-10 cultural structures including religious and non-religious structures. This will be done in consultation with the respective community.

3.6.2 Asian Development Bank (ADB) Safeguards Policy and Statement

In July 2009, ADB's Board of Directors approved the new Safety Policy statement (SPS) governing the environmental and social safeguards of ADB's operations (15). The SPS builds upon ADB's previous safeguard policies on the Environment, Involuntary Resettlement, and Indigenous Peoples, and brings them into one consolidated policy framework with enhanced consistency and coherence, and more comprehensively addresses environmental and social impacts and risks. The SPS also provides a platform for participation by affected people and other stakeholders in the Project design and implementation.

The SPS supersedes ADB's Involuntary Resettlement Policy (1995), Policy on Indigenous Peoples (1998), and Environment Policy (2002). In accordance with the SPS, these previous policies apply to all projects and tranches of multi-tranche financing facility projects that were reviewed by ADB's management before 20 January 2010.

The objectives of ADB's safeguards are to:

- avoid adverse impacts of projects on the environment and affected people, where possible;
- minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and
- Assist borrowers and clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

ADB's SPS sets out the policy objectives, scope and triggers, and principles for three key safeguard areas:

- Environmental safeguards;
- Involuntary Resettlement safeguards; and

(15) <http://www.adb.org/sites/default/files/institutional-document/32056/safeguard-policy-statement-june2009.pdf>

- Indigenous Peoples safeguards.

To help borrowers and clients and their projects achieve the desired outcomes, ADB adopts a set of specific safeguard requirements that borrowers and clients are required to meet in addressing environmental and social impacts and risks. These safeguard requirements are as follows:

- Safeguard Requirements 1: Environment (Appendix 1 of SPS);
- Safeguard Requirements 2: Involuntary Resettlement (Appendix 2 of SPS);
- Safeguard Requirements 3: Indigenous Peoples (Appendix 3 of SPS); and
- Safeguard Requirements 4: Special Requirements for Different Finance Modalities (Appendix 4 of SPS).

In addition, ADB does not finance activities on the prohibited investment activities list (Appendix 5 of SPS). Furthermore, ADB does not finance projects that do not comply with its safeguard policy statement, nor does it finance projects that do not comply with the host country's social and environmental laws and regulations, including those laws implementing host country obligations under international law.

3.6.2.1 Consultation and Disclosure Requirements of ADB

ADB's *Safeguard Policy and Public Communications Policy (2011)* sets out disclosure requirements for various ADB activities, including safeguard requirement. Safeguard Requirements 2: Involuntary Resettlement (Appendix 2 of SPS); and Safeguard Requirements 3: Indigenous Peoples (Appendix 3 of SPS) sets out the need for meaningful consultation and information disclosure during project preparation and operation to the affected population and other stakeholders. Key requirements include:

- Information Disclosure: The borrower/client will submit the following documents to ADB for disclosure on ADB's website as per the applicability with respect to the Project:
 - Draft EIA including draft EMP;
 - Final EIA/IEE;
 - Updated EIA/IEE and corrective active plan;
 - Environmental Monitoring Reports.
 - Resettlement Plan ("RP")
 - Indigenous Peoples Plan ("IPP")
- Information disclosure to affected people or stakeholders: The borrower/client will provide relevant environmental information in a timely manner, in an accessible place and in a form and language(s) understandable to affected people and other stakeholders. For illiterate people, other suitable communication methods will be used.
- Consultation and Participation: The borrower/client will carry out meaningful consultation with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation.
- Timing and Frequency for consultation and participation: Meaningful consultation begins early in the project preparation stage and is carried out on an on-going basis throughout the project cycle.

3.6.2.2 ADB project categorisation

The SPS, 2009 further outlines a classification system for the categorization of projects. The classification tentatively occurs at the project identification stage, during the initial screening of anticipated impacts. However, classification is an on-going process, and the classification can be changed at any time with the concurrence of the Chief Compliance Officer (CCO), as more detailed information becomes available and a project proceeds.

Environment

A project's environment category is determined by the category of its most environmentally sensitive component, including direct, indirect, induced, and cumulative impacts. Each proposed project is scrutinized as to its type, location, scale, sensitivity and the magnitude of its potential environmental impacts. The level of detail and comprehensiveness of the EIA or IEE are commensurate with the significance of the potential impacts and risks.

A proposed project is assigned to one of the following categories depending on the significance of the potential environmental impacts and risks:

- **Category A:** A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An EIA, including an environmental management plan ("EMP"), is required;
- **Category B:** A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category 'A' projects. An IEE, including an EMP, is required;
- **Category C:** A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. An EIA or IEE is not required, although environmental implications need to be reviewed; and
- **Category FI:** A proposed project is classified as category FI if it involves the investment of ADB funds to, or through, a financial intermediary (paragraphs 53–58).

Involuntary Resettlement

A project's involuntary resettlement category is determined by the category of its most sensitive component in terms of involuntary resettlement impacts. The involuntary resettlement impacts of an ADB-supported project are considered significant if 200 or more persons will experience major impacts, which are defined as (i) being physically displaced from housing, or (ii) losing 10% or more of their productive assets (income generating). The level of detail and comprehensiveness of the resettlement plan are commensurate with the significance of the potential impacts and risks. A project is assigned to one of the following categories depending on the significance of the probable involuntary resettlement impacts:

- **Category A:** A proposed project is classified as category A if it is likely to have significant involuntary resettlement impacts. A resettlement plan, including assessment of social impacts, is required;
- **Category B:** A proposed project is classified as category B if it includes involuntary resettlement impacts that are not deemed significant. A resettlement plan, including assessment of social impacts, is required;
- **Category C:** A proposed project is classified as category C if it has no involuntary resettlement impacts. No further action is required; and
- **Category FI:** A proposed project is classified as category FI if it involves the investment of ADB funds to, or through, a financial intermediary (*paragraphs 53–58*).

Indigenous Peoples

ADB also screen all projects to determine whether or not they have potential impacts on Indigenous Peoples¹⁶. For projects with impacts on Indigenous Peoples, an Indigenous Peoples Plan needs to

¹⁶ As per the working definition of indigenous peoples by ADB, two significant characteristics of indigenous peoples would be: descent from population groups present in a given area, most often before modern states or territories were created and before modern borders were defined; and

be prepared. The degree of impacts is determined by evaluating (i) the magnitude of the impact on Indigenous Peoples' customary rights of use and access to land and natural resources; socio-economic status; cultural and communal integrity; health, education, livelihood systems, and social security status; or indigenous knowledge; and (ii) the vulnerability of the affected Indigenous Peoples.

Indigenous people's or ethnic minorities' issues are likely to be significant when it is established that groups in the project area have one or more of the following attributes: (i) self-identification or identification by others as a distinct cultural group; (ii) a display of a desire to preserve such cultural identity; (iii) a linguistic identity distinct from that of the dominant society; (iv) distinct social, economic, and political traditions and institutions; (v) an economic system oriented more toward a traditional system of production; and (vi) a unique tie with and attachment to traditional habitat and ancestral territory and its natural resources; such groups are found to exhibit historical, socioeconomic, political, or demographic vulnerability; project intervention will be (positively or negatively) affecting one of these areas: customary rights to (ancestral) land and natural resources; their socioeconomic status; their health, education, livelihood, and social security status; indigenous people's knowledge; the project involves new construction, rehabilitation or expansion of large-scale infrastructure; or such interventions as water supply, sanitation, education, health, nutrition, or social protection target indigenous people; the project is located within or nearby the habitat of indigenous people; and/or project impacts are potentially long term, or irreversible or permanent, affecting a substantial portion of the indigenous community or the community as a whole.

A project is assigned to one of the following categories depending on the significance of the probable impact on the indigenous peoples:

Table 3.4 ADB Project Categorization

Category	Impact	Actions Required
Category-A	Expected to have significant impact	Both IPP and SIA are required
Category-B	Expected to have limited impact	Both IPP and SIA are Required. A specific action favourable to indigenous peoples/ethnic minority is required and addressed through a specific provision in RRP and in related plans such as a resettlement action plan, a gender action plan, or a general community participatory plan.
Category-C	Not expected to have any impact on ethnic minority	No specific action required.

(Source: Policy on Indigenous Peoples, ADB)

Maintenance of cultural and social identities; and social, economic, cultural, and political institutions separate from mainstream or dominant societies and cultures. In some cases, over recent centuries, tribal groups or cultural minorities have migrated into areas to which they are not indigenous, but have established a presence and continue to maintain a definite and separate social and cultural identity and related social institutions. In such cases, the second identifying characteristic would carry greater weight.

Additional characteristics often ascribed to indigenous peoples include self-identification and identification by others as being part of a distinct indigenous cultural group, and the display of a desire to preserve that cultural identity; a linguistic identity different from that of the dominant society; social, cultural, economic, and political traditions and institutions distinct from the dominant culture; economic systems oriented more toward traditional systems of production than mainstream systems; and Unique ties and attachments to traditional habitats and ancestral territories and natural resources in these habitats and territories.

4. SCREENING AND SCOPING

4.1 Screening Methodology

For the screening exercise, ERM undertook discussions with the Project team and reviewed available documents. The following sub sections provide an understanding of the methodology followed.

4.1.1 Kick-off Meeting

The ERM team had a brief kick-off meeting with the client in November 2019, prior to site reconnaissance visit. The project activities were then stopped briefly due to COVID outbreak and resumed by kick off meeting again in April 2021. A discussion was also held with regard to the expectations from this assessment in terms of scope of work, deliverables, timeline and the methodology to be followed for the same.

4.1.2 Document Review

Desk based review of the relevant documents of the Project and its surroundings, such as Environmental and Social Due Diligence (ESDD) report, toe line map on google earth, were undertaken to have a clear understanding of the Project and their impacts. Further, review of the secondary information available on the Project road, bypasses, realignment, road widening was undertaken to substantiate the primary data.

4.2 Project Categorisation

IFC's Environmental and Social Review Procedure Manual¹ has provided a categorization tool for projects. The tool assigns an E&S category based on risk inherent to the particular sector, as well as on the likelihood of a development taking place and on what can be reasonably ascertained about the environmental and social characterization of the Project's likely geographical setting. The categories are defined as follows:

- **Category A:** Projects with potential significant adverse environmental or social risks and/or impacts that is diverse, irreversible or unprecedented.
- **Category B:** Projects with potential limited adverse environmental or social risks and/or impacts that is few in number, generally site-specific, largely irreversible and readily addressed through mitigation measures.
- **Category C:** Projects with minimal or no adverse environmental or social risks and/or impacts.

4.3 Scoping Methodology

For this ESIA study, scoping has been undertaken to identify the potential Area of Influence for the project to identify potential interactions between the project and resources/receptors in the Area of Influence and the impacts that could result from these interactions, and to prioritize these impacts in terms of their likely significance. This stage is intended to ensure that the impact assessment focuses on issues that are most important decision-making and stakeholder interest.

The scoping exercise was undertaken on the basis of the information available on the project and the prior understanding of ERM of road over projects. Potential impacts have been identified through a systematic process whereby the features and activities (both planned and unplanned) associated with the operation and maintenance and decommissioning phases of the project have been considered with respect to their potential to interact with resources/ receptors. Potential impacts have each been classified in one of three categories:

¹ Environmental and Social Review Procedures Manual: Environment, Social and Governance Department (2012):

<http://www.ifc.org/wps/wcm/connect/190d25804886582fb47ef66a6515bb18/ESRP%2BManual.pdf?MOD=AJPERES>.

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- **No interaction:** where the project is unlikely to interact with the resource/ receptor (e.g., wholly terrestrial projects may have no interaction with the marine environment);
- **Interaction likely, but not likely to be significant:** where there is likely to be an interaction, but the resultant impact is unlikely to change baseline conditions in an appreciable/detectable way; and
- **Significant interaction:** where there is likely to be an interaction, and the resultant impact has a reasonable potential to cause a significant effect on the resource/receptor.

As a tool for conducting scoping, the various project features and activities that could reasonably act as a source of impact were identified, and these have been listed down the vertical axis of a Potential Interactions Matrix. The resources/receptors relevant to the Baseline environment have been listed across the horizontal axis of the matrix.

Each resulting cell on the Potential Interactions Matrix thus represents a potential interaction between a project feature/activity and a resource/ receptor.

Present project will involve key activities during its life cycle which will include planning and pre-construction, construction and operation & maintenance phases as detailed in **Section 2** of this report.

4.3.1 Scoping Matrix

All environmental and social impacts and risks described in IFC's Performance Standards and E&S Guidelines have been considered for the interaction matrix. The Potential Interactions Matrix for Project activities and likely impacted resources/ receptors is presented in **Table 4.1**.

The interaction matrix has been colour coded to indicate those interactions that are relevant to the Project (coloured in black), possible (coloured in grey) or scoped-out (coloured in white). Those interactions that are white are 'scoped out' and this ESIA report includes a discussion that presents the evidence base (e.g., past experience, documented data, etc.) used to justify the basis upon which this decision was made.

Interactions that are likely to lead to significant impacts are presented in **Table 4.2** and will be the focus of the impact assessment. Owing to site conditions there are certain possible interactions that will not take place. As a result these interactions have been "scoped out" and are presented in **Table 4.3**.

Table 4.1 Activity-Impact Interaction Matrix for Planning, Construction, Operation & Maintenance Phases

Project Activity/ Hazards	Environmental and Social Resources/Receptors														
	Topography and Drainage	Land Environment	Land scape – Visual Impact	Soil Environment	Groundwater resources	Surface Water	Air Environment	Noise Environment	Terrestrial Ecology	Loss of land based livelihood, assets	Employment Opportunity	Infrastructure and services	Occupational Health and safety	Community Health and safety	Climate Change
Pre-Construction															
Land procurement/clearance															
Construction															
Site clearance and site preparation (Ground levelling; Waste Handling, Soil Compaction)															
Transportation of construction materials															
Mobilising and operating construction equipment, batching unit, concrete mixer and DG sets															
Cleaning and widening of road															
Set-up and use of camps for overnight accommodation by labourers															
Operation and Maintenance															
Road and median maintenance															
Grass cutting/vegetation clearance															
Regular Inspection and Maintenance of drains, safety signs, blinkers, mast lights															




-  = Represents "no" interactions is reasonably expected.
-  = Represents interactions reasonably possible but none of the outcome will lead to significant impacts and/or may lead to positive impacts.
-  = Represents interactions reasonably possible with one of the outcomes leading to potential significant impact.

Table 4.2 Identified interactions with potential significant impacts

S. No	Interaction (between project activity and Resource/Receptor)	Justification for Expectation of Potentially Significant Impacts
1.	Changes in Land Use and ownership	<p>Pre-construction Phase: Only existing RoW land will be utilized for the project and no new land will be procured, therefore there will be a change in use of the encroached land, from, shops and establishments, or extensions of residential functions and some squatter housing, to infrastructural development.</p> <p>Construction Phase: No Permanent land procurement is required however, temporary access to land will be required (public or private, for setting up labour camps, laydown areas, storage areas, etc.) – since the locations are flexible, this will be based on avoidance of displacement and with willing parties only. A very small amount of agricultural functions may be displaced for a temporary period of time if private parties are willing to provide their land on land on lease/rent.</p>
2.	Alteration of Topography and drainage	<p>Study area of the project site exhibits gradual slope from north to south east direction and comprises of 51 culverts, as per the details provided in the ESDD report. Although the expressway is in operation and the proposed investment is for 6 laning of existing 4 laned expressway, it is likely that project activities (e.g., site preparation and development, construction of side drains) may cause alteration of the topography and drainage of this area. During operation phase, slight change in topography is likely to happen from roadside development.</p>
3.	Impact on Soil / Land Environment	<p>Vegetation clearance and construction can change the soil properties and negatively affect soil stability in the area. Vehicle movement can compact or erode soil further. Improper waste disposal can contaminate soil and groundwater. The project surrounding area is a mix of residential and agricultural land, and therefore any contamination of soil from improper waste disposal, spillage of oils on proposed project site may affect the surrounding land from leaching of chemicals.</p>
4.	Impact on Air Quality	<p>Major sources of PM/dust are movement of vehicles, wind, excavation, loading transport, and unloading of friable material, earthworks. Increased vehicle movements during operations will increase emissions during operations. Furthermore, operation of DG sets, batching plant, concrete mixer, vehicular movement and construction activities can cause fugitive and point source emission. The loss of vegetation cover because of site preparation can also contribute to a deterioration of air quality.</p>
5.	Impact on Water Environment	<p>Construction of the Project will require water from local sources of surface water or groundwater, to carry out its activities. Therefore, there will be impact on surface/ground water resources. Surface and ground water quality can also be impacted due to improper waste disposal or leaks/spills and runoff.</p>

S. No	Interaction (between project activity and Resource/Receptor)	Justification for Expectation of Potentially Significant Impacts
6.	Increased Ambient Noise Levels	Operation of construction equipment, machinery, batching plant, DG sets, vehicular movement and maintenance activities would increase the ambient noise levels. The project surrounding area is comprises of residential units in towns and therefore local communities may be disturbed due to higher than anticipated noise. During operations, vehicular movement will result in increased ambient noise levels.
7.	Occupational Health and Safety	Occupational health and safety hazards can include construction machinery, handling of hot drums and vessels containing bitumen and other construction material, electrical, noise pollution and dust pollution. In the case of spills/leaks there is a potential for fire hazards and some hazardous substances.
8.	Local Economy and Employment	As the Project will involve removal of various shops such as tyre puncture repair shops, petty shops, fruit/vegetable stalls, garment etc. the project impact the livelihood of many households that are dependent upon these. However, the project activity will also generate employment opportunity for local people mostly during construction phase as well as during operation phase for maintenance of roads, security and upkeep of the project road.
9.	Land Based Livelihoods	The Project does not involve any fresh land acquisition except except for construction of bypass, there is no permanent loss of land. However, the widening of the road will lead to economic and physical displacement off 28 assets and 30 households depended upon the land falling within the Project RoW, required for project activities.
10.	Community Health and Safety	Community health and safety hazards includes increase in noise pollution from increased traffic movement and subsequent increase in air pollution Also, activities during construction phase involving regular equipment movement and worker movement is the most significant risk. Influx of migrant labour may also increase the risk of communicable diseases, and safety, especially of young girls and women, near labour camps. This may also increase the risk of conflict between migrant labour and proximate communities, if not managed well.
11.	Cultural Heritage	There were few temples and other related structures identified within RoW and 500 meter from the main carriageway. The Project Road construction will require removal of more than 5-10 cultural structures including religious and non-religious structures. This will be done with consultation with the respective community.
12.	Labour Influx and Labour Welfare	All the casual workers required during the construction and operations phase will be hired through contractors/ third parties. It is not clear if the labourers hired will be local or migrant from other states. In case, there is labour influx, there is a high likelihood of regular interaction between the local community and migrant labourers. If not monitored; these interactions may create

S. No	Interaction (between project activity and Resource/Receptor)	Justification for Expectation of Potentially Significant Impacts
		<p>interpersonal and communal conflicts due to differences in cultures, beliefs, social practices, food habits etc. moreover, these interactions can also lead to spread of communicablediseases.</p> <p>Inadequate accommodation facilities provided to the migrant workers in the vicinity of local inhabitation can also result into unsafe and unhygienic conditions in the local areas. Such as an incident of fire in kitchen area of labour colony can cause damage to property and people in the neighbourhood, and likewise impacts.</p>
13.	Labour and Human Rights	<p>The internal policies of the developer, contractors and subcontractors will largely determine the labour and working conditions practiced in the project throughout its lifecycle. However, the scale of impacts either positive or negative will be observed mainly during the construction stage when the number of workers engaged is the highest compared to other stages of the project.</p> <p>Impacts on female workers and migrant workers may be a focused area of assessment.</p>
14.	Common property resources	<p>Common property resources including pathways of commute, meeting/gathering areas/religious structures etc. that were either developed by private parties or local panchayats that were used by the community at large are also anticipated to be impacted by the Project due to six laning. However, there are no CPRs affected by project activities in the Khurja realignment.</p>
15.	Ecology	<p>Habitat loss and habitat modification/ disturbance (for terrestrial as well as aquatic habitats) may occur due to vegetation clearance, sedimentation due to other construction activities (excavation, levelling, anthropogenic movement, etc.) may affect the surrounding vegetation. Also, the noise during construction period might affect the resident fauna. However, the proposed project activity is widening of existing expressway from 4 to 6 lane and therefore, the resultant increase and clearance may affect local ecology slightly.</p>

Table 4.3 Scoped-out Interactions

S. No.	Impact Title	Reason for Scoping-Out
1.	Indigenous People	<p>Based on the assessment of information available in public domain, site visit, stakeholder consultations, it is understood that proposed project area doesn't fall under the Schedule V area¹ and will not impact any traditional livelihood or any resources of cultural significance of any ST Community. .</p>

¹ <http://tribal.cg.gov.in/scheduled-areas>

4.3.2 Cumulative Impacts

A cumulative impact is one that arises from a result of an impact from the Project interacting with an impact from other similar activities to create an additional impact. Cumulative impact includes two components:

- The anticipated future condition, which is the total effect of the other existing, and predictable future developments and external natural environmental and social drivers, and
- The contribution of the development under evaluation to the cumulative impacts.

It is unrealistic to think that every environmental and social aspect that can be subject to cumulative impacts can be appropriately factored into a CIA, it is good practice to focus the assessment and management strategies on Valued Environmental and Social Components (VECs).

VECs are environmental and social attributes that are considered to be important in assessing risks; they may be:

- physical features, habitats, wildlife populations (e.g., biodiversity),
- ecosystem services, • natural processes (e.g., water and nutrient cycles, microclimate),
- social conditions (e.g., health, economics), or
- cultural aspects (e.g., traditional spiritual ceremonies).

While VECs may be directly or indirectly affected by a specific development, they often are also affected by the cumulative effects of several developments. VECs are the ultimate recipient of impacts because they tend to be at the ends of ecological pathways.

In the CIA context, the incremental impact of a development under review is the difference between the condition of the VEC when impacted only by the other developments in the future baseline and the condition of the VEC when impacted by both the development under review and the future baseline impacts

$$\text{Proposed action's impact on the VEC} + \text{Other past, present, and future impact on the VEC} = \text{Cumulative impact on the VEC}$$

4.3.3 Scoping for VECs

The VEC considered for the proposed widening and re-alignment of project are:

4.3.3.1 Construction Phase

- 1) Cumulative dust emissions from road construction, proposed thermal power plant construction and other smaller development activities in local stretches. The particulate levels observed are already exceeding the NAAQS, however the construction of a large thermal power plant at Khurja will coincide with the construction work road in the particular stretch. Therefore Airshed is scoped in as a VEC of concern
- 2) Influx of migrant workers : Multiple construction work in a concentrated area will attract labour force from adjoining and far off places, this can put pressure on local resources, water supply, transportation, rented accommodation and crowded local roads/markets etc. This can result in social conflicts, cultural conflicts and petty crimes. Also presence of many workers can expose the local community to transmissible diseases.
- 3) Community Health & Safety: Movement of construction machinery of multiple sub-contractors in a smaller area with limited coordination can lead to unwanted disruption in traffic movement, accidents and conflict with the community.

4.3.3.2 Operation Phase

- 1) **Unplanned development around the road:** Advent of road and other developments will attract more commercial development along the road, in semi urban areas it will be largely unplanned leading to decline in standard of living with poor sanitation, congestion in local roads as well as disruption to any planned growth. This may also lead to change in land use from agricultura to commercial /residential affecting a change in livelihood of the local community.
- 2) **Ambient Air Quality:** The existing particulate levels in the area are high, increase in traffic will enhance dust levels due to resuspension of dust, this will be further enhance by presence of a thermal power plant. The cumulative impact can be significant if not adequately mitigated.

Detailed assessment of cumulative impact is provided in the Impact section.

5. BASELINE SETTINGS – ENVIRONMENT, ECOLOGY AND SOCIAL

This section presents environment, ecological and socio-economic baseline of the study area. The Project footprint covers DadriDadri, Sikandarabad, Bulandsahar, Khurja, Gabhana and Aligarh.

Baseline refers to the physical, biological, cultural and human conditions that will prevail in the absence of the Project, including interactions amongst them. Establishing baseline helps in understanding the prevailing environmental, ecological and socio-economic status of the study area. It provides requisite information of the biophysical and social environment for decision makers to take appropriate measures regarding the Project.

Establishing the baseline also provides the background environmental and social conditions for prediction of the future environmental characteristics of the area before setting up of the Project (starting construction). It also helps in environmental and social management planning and provides a basis to finalize a strategy for minimizing any potential impact due on surrounding environment due to setting up of the Project.

5.1 Project Study Area

The area of up to 500 m from the median of the expressway has been demarcated as study area for the project, by considering the extent of project impact in terms of air quality, noise, water resources, human settlement, cultural heritage sites, location of labour sites, location of the access roads besides considering the actual land area which will be procured for the road widening and its utilities.

5.1.1 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 Project Footprint includes all land used (permanent / temporary) for Right of way (45 to 60 m) of the expressway;
- Land identified for borrow areas (typically identified at least 500m away from the road and 800 m away from the villages/settlement area and other infrastructures) which will be used as land fill areas for disposal of waste soils at the end of construction phase;
- Land for storage of materials and equipment; and
- Labour camps.

The Project footprint is the Right of Way of expressway and rerouting at Khurja i.e. 45m for build-up areas and 60m for rest as well as the land being acquired for Khurja realignment. Since, existing highway lanes will be used for bringing in and transportation of construction material, the footprint area for same is covered in project area.

5.1.2 Project Area of Influence

The effects of the Project and Project activities on a particular resource or receptor will have spatial (distance) and temporal (time) dimensions, the scale of which is dependent on a number of factors. These factors are incorporated in the definition of the Project's Area of Influence (Aol).

The Aol considered for the existing Project with respect to the environmental and social resources was based on the following reach of impacts:

- **Environmental Parameters:** Project road, immediate vicinity and surroundings, i.e. a study area of approximately 500m (hereafter referred to as the Aol) distance from Project line has been used to depict these parameters;
 - **Air Quality:** Dust emissions (which is a significant parameter), NO_x, SO₂, CO due to vehicular emissions and other domestic activities -typically up to 500 m from the median of the expressway;

- **Noise:** Noise impact area (defined as the area over which an increase in environmental noise levels due to the Project can be detected) –typically 500 m from the median of the expressway; and
- **Land environment:** The impacts on soil and land due to runoff during construction and maintenance of road, soil compaction during construction, leaks/ spills etc. - typically up to 500 m from Project footprint area.
- **Water environment:** Impacts are identified on water bodies in proximity to the existing road and ground water sources (borewells) in the vicinity, in terms of water quality. A 500m along the road has been considered.
- **Other aspects:** Borrow areas have been identified along the stretch of the road, and will be located at least 500m from the road and at a maximum distance of 5 km. Worker campsites will also be located along the road stretch within the AOI. *For borrow areas and traffic movement, separate management and restoration plan is prepared and Annexed with the report (Appendix G and Appendix K)*

5.1.3 Core and Buffer Zone

This Aol is in turn divided into a core and buffer zone. This division of the Aol into two (2) zones is based on the understanding that the majority of the impacts from the Project road (during the Project lifecycle) would be contained within a 45-60 m radius (core zone) from the Project Footprint in terms of spread and intensity, with the buffer zone (500 m radius) appearing to have limited interaction with the Project road.

For the purpose of socio- economic baseline assessment, core zone (136 villages from where land has been acquired for the project) and buffer zone (500 meters on the either side from the main carriageway) has been considered.

The Buffer Zone is the area which does not have direct impact on land or environment, however, it is demarcated in case the impact on core zone are sometimes/often extended to near-by areas. Usually the impact on buffer zone are more inclined towards, noise pollution, air pollution, water quality and change in drainage patterns. In cases it also has impact over labour, land ownership, migration and accessibility to any natural resources.

5.2 Environment Baseline

This section establishes the baseline environmental, ecological and socio-economic status of the proposed widening of road and realignment to provide a context within which the impacts of the Project are to be assessed.

Secondary Baseline Data Collection

Secondary baseline data collection involved identifying and collecting published material and documents. Information on various environmental aspects (like soil, geology, hydrogeology, hydrology, drainage pattern, ecology, meteorology etc.). Type of secondary data and sources were enlisted below:

Table 5.1 Secondary Baseline Data Collection

S.N	Attribute	Source
1.	Meteorological data	■ India Meteorological Department (IMD)
2.	Geology, geomorphology, hydrogeology and hydrology	■ Central Ground Water Board Groundwater information booklet for Aligarh district (May 2013) ■ Aquifer mapping and ground water Management plan for Parts of NCR and Aligarh district (2017)
3.	Land-use	■ Google Earth Satellite Imagery

4.	Eco-sensitive areas	<ul style="list-style-type: none"> ■ WII Envis Centre ■ Important Bird and Biodiversity Areas (IBAs) ■ IUCN Red List (2021-1) ■ Ebird.org India
5.	Natural Hazards	<ul style="list-style-type: none"> ■ Building Material and Technology Promotion Council of India (BMTPC) ■ National Disaster Management Authority ■ District Disaster Management Plan

5.2.1 Land use and land cover

Land use/ cover inventories are an essential component in land resource evaluation and environmental studies due to the changing nature of land use patterns. The current land use of the project Aol is primarily agricultural land mixed with settlements and open land that will be converted to non-agricultural land once road is widened.

On review of the land use in the Project Aol, it was observed that majority of the land is agricultural land (approximately 64% of the total area) followed by open land (approximately 15% of the total area) and settlement area (approximately 9.8 % of the total area). For Khurja realignment, land use statistics of the project Aol is mentioned in **Table 5.2** and for Khurja alignment, about 93 percent of the land is agricultural land, as mentioned in **Table 5.3** land use map has been shown in **Figure 5.1** below.

Table 5.2 Land use break-up of the Project Aol (Project Road)

Land use category	Area (sq. km)	% of Geographical Area.
Settlements Land	12.46	9.82
Industrial Land	4.95	3.90
Agricultural Land	81.56	64.28
Open Land	20.08	15.82
Canal	1.82	1.44
Waterbody	0.38	0.30
Roads	5.09	4.01
Railway Lines	0.54	0.43
Total are in sq. km	126.88	100.00

Source: GIS based assessments of the project project (Google Earth imagery, February 2021)

Note: Aol.is based on the observations from satellite images and as understood from the discussion with Cube Highways

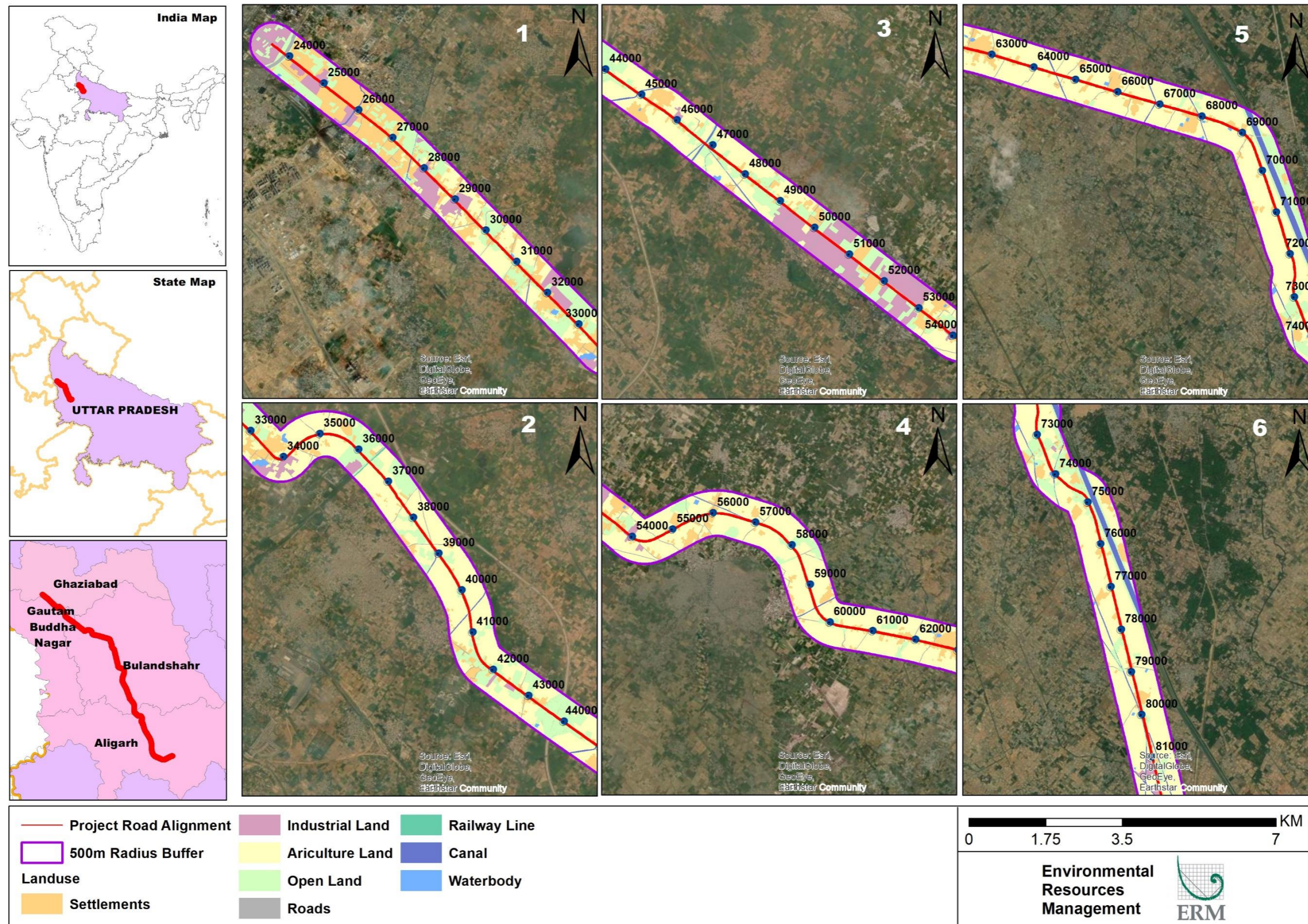
Table 5.3 Land use break-up of the Project Aol (including Khurja realignment)

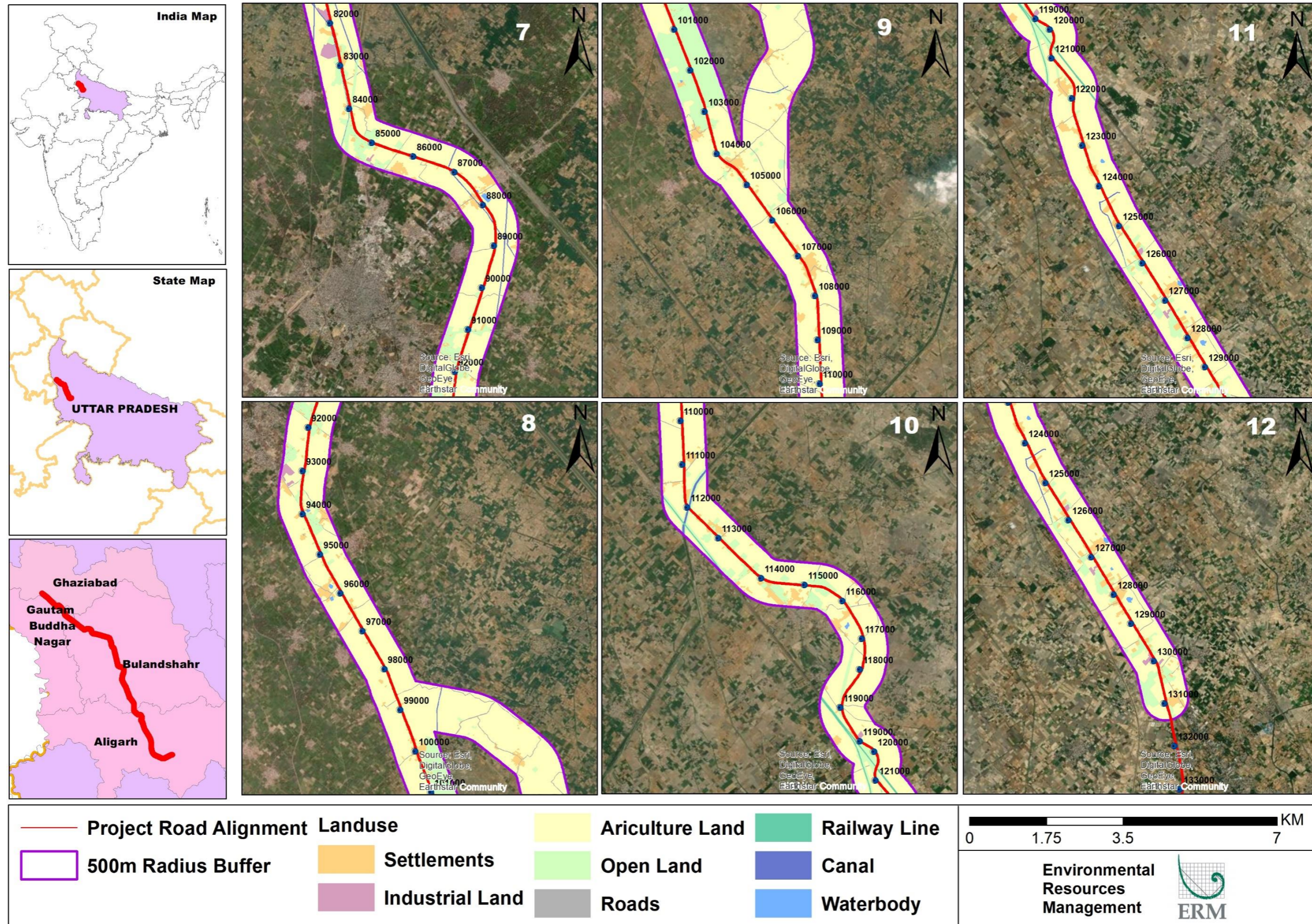
Land use category	Area (sq. km)	% of Geographical Area.
SettlementsSettlements	19.70	2.64
Agriculture Land	700.69	93.94
Open Land	9.51	1.28
CanalCanal	2.44	0.33
RoadsRoads	13.62	1.84
Total are in sq. km	745.97	100.00

Source: GIS based assessments

Note: Aol.is based on the observations from satellite images and as understood from the discussion with Cube Highways

Figure 5.1 Land use map





5.2.2 Topography

The topography of the study area is primarily flat in nature with a gradual decrease in elevation along the project road. The elevation in the study area ranges from 160m to 225 m above mean sea level (AMSL). Lower elevation is observed towards south east direction, towards the end of the project road at Aligarh. Topographically, Ghaziabad is a plain area established on the eastern side of river Hindon having higher elevation profile in the study area. The topographic map of the study area is shown in **Figure 5.2** and **Figure 5.3** below.

5.2.3 Drainage Pattern

The State forms a part of Ganga basin. The master drainage of the state is river Ganga and its tributaries. The Ramganga, Ghagra and Gomti are the main left bank tributaries, while the Yamuna is the main right bank tributary. All these rivers except Gomti originate from Himalayan ranges and are snow fed. Initially the rivers flow southward in the north-western part of the State, then turn south eastward and finally leave the state in an easterly direction.

Hindon river, a tributary of Yamuna River, originates in the Saharanpur district from Upper Shivalik in Lower Himalayan Range. The river is entirely rainfed and has a catchment area of 7,083 sq.km. It flows between Ganga and Yamuna rivers, for 400km. through Muzaffarnagar, Meerut, Baghpat, Ghaziabad districts, Noida and Greater Noida before it joins Yamuna River just outside Delhi. Kali river, which originates in the Doon Valley and travels for about 150 km passing through Saharanpur, Muzaffarnagar, Meerut and Bagpat districts, merges with Hindon River, before it merges with the Yamuna river. The Kali river is also highly polluted and adds to the pollution of the Hindon, as it passes through populated and industrial belt of Uttar Pradesh.

5.2.3.1 Presence of Surface Water Bodies

The Project AoI (500 m buffer on either side) has 41 small surface water bodies as observed from site reconnaissance survey and assessment of satellite imagery. These are primarily localised seasonal ponds which do not have any major community dependence but are significant in terms of maintaining the local drainage pattern of the project area. These ponds and surface water bodies represents modified habitat with regular interaction with anthropogen activities, ecologically these do not support any significant flora or fauna. It is observed that no aquaculture is practiced in these water bodies. The entire length of the alignment also crosses about 19 minor canals that serve for irrigation and drinking water supply contamination of which might pose a risk to population served by that affected canal. The water bodies within the Project AoI is depicted in Figure 5.5 and Figure 5.6.

Figure 5.2 Topographic map of the study area (chainage km 23+600 to km 81+00)

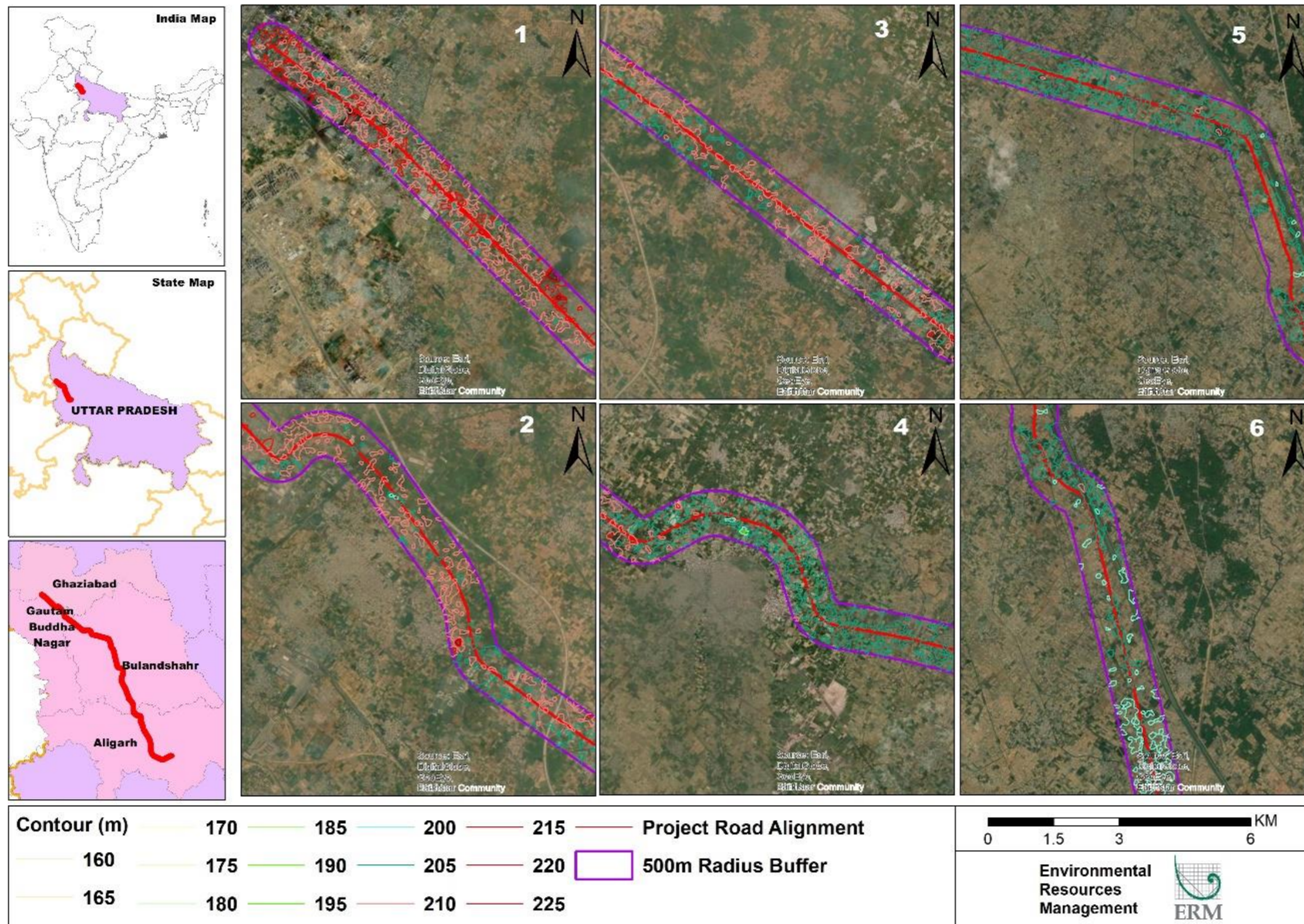


Figure 5.3 Topographic map of the study area (chainage km 81+000 to km 131+00)

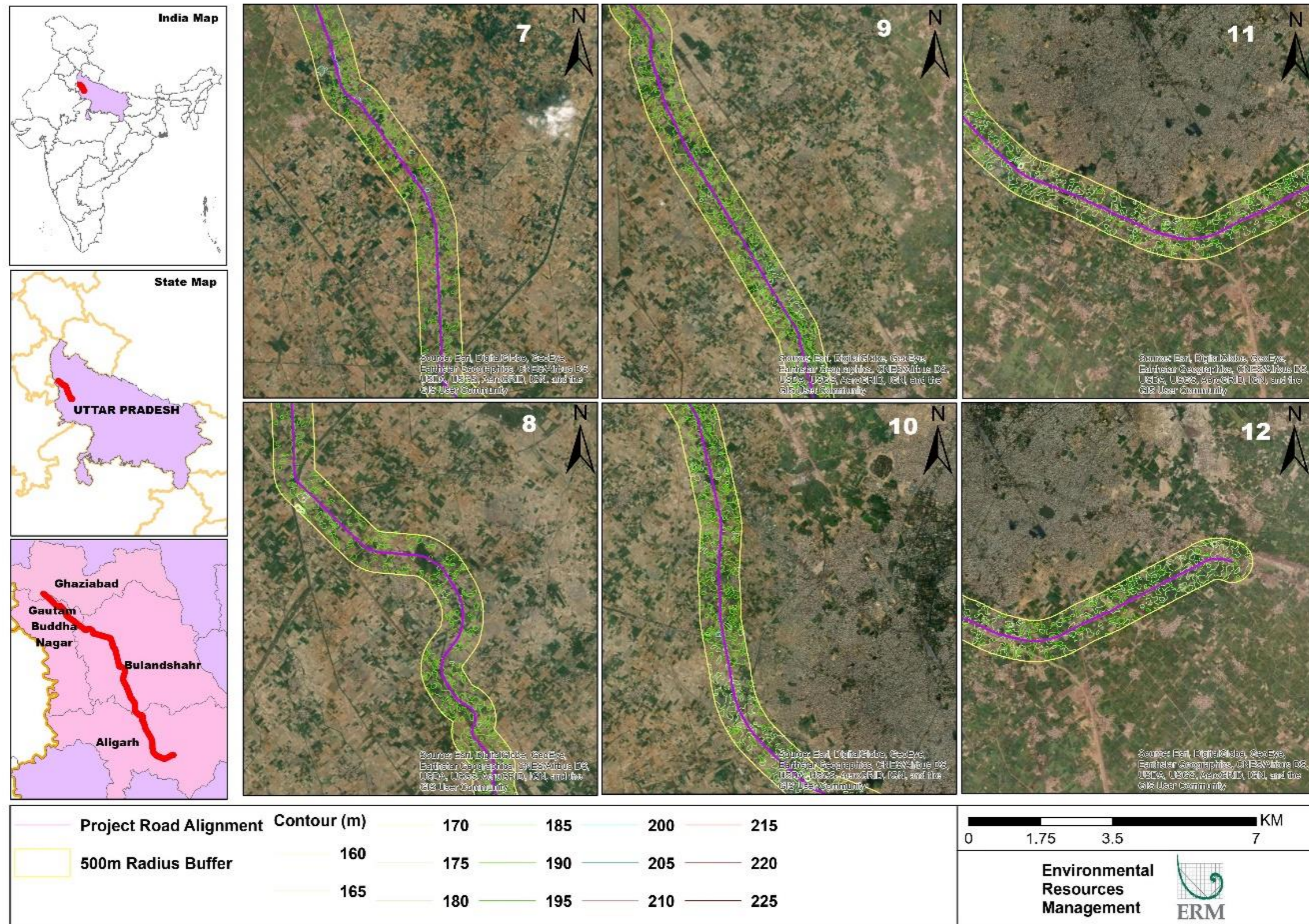


Figure 5.4 Drainage Map of the Study Area

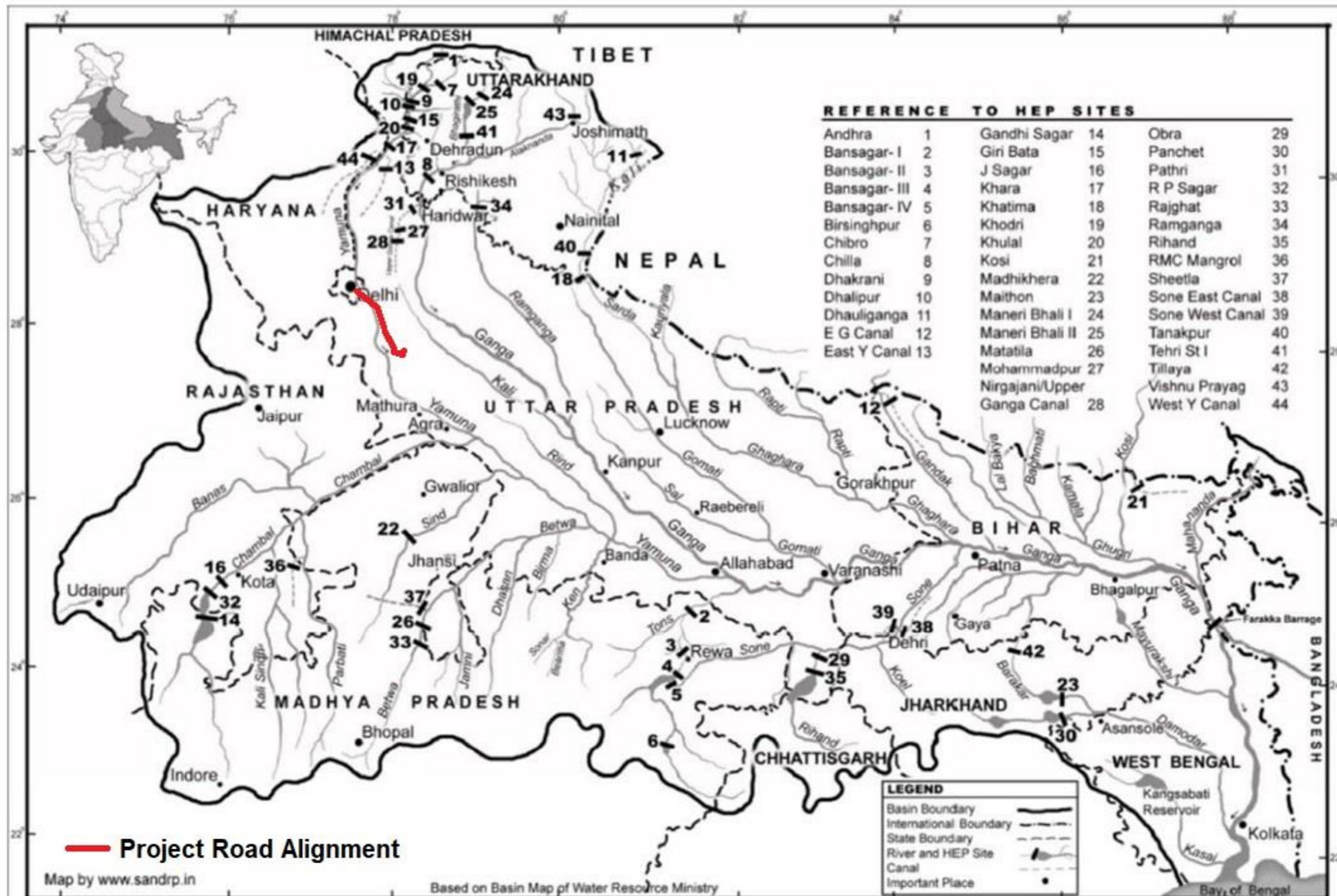


Figure 5.5 Map Showing Surface Water Bodies in the Aol (chainage km 23+600 to km 81+00)

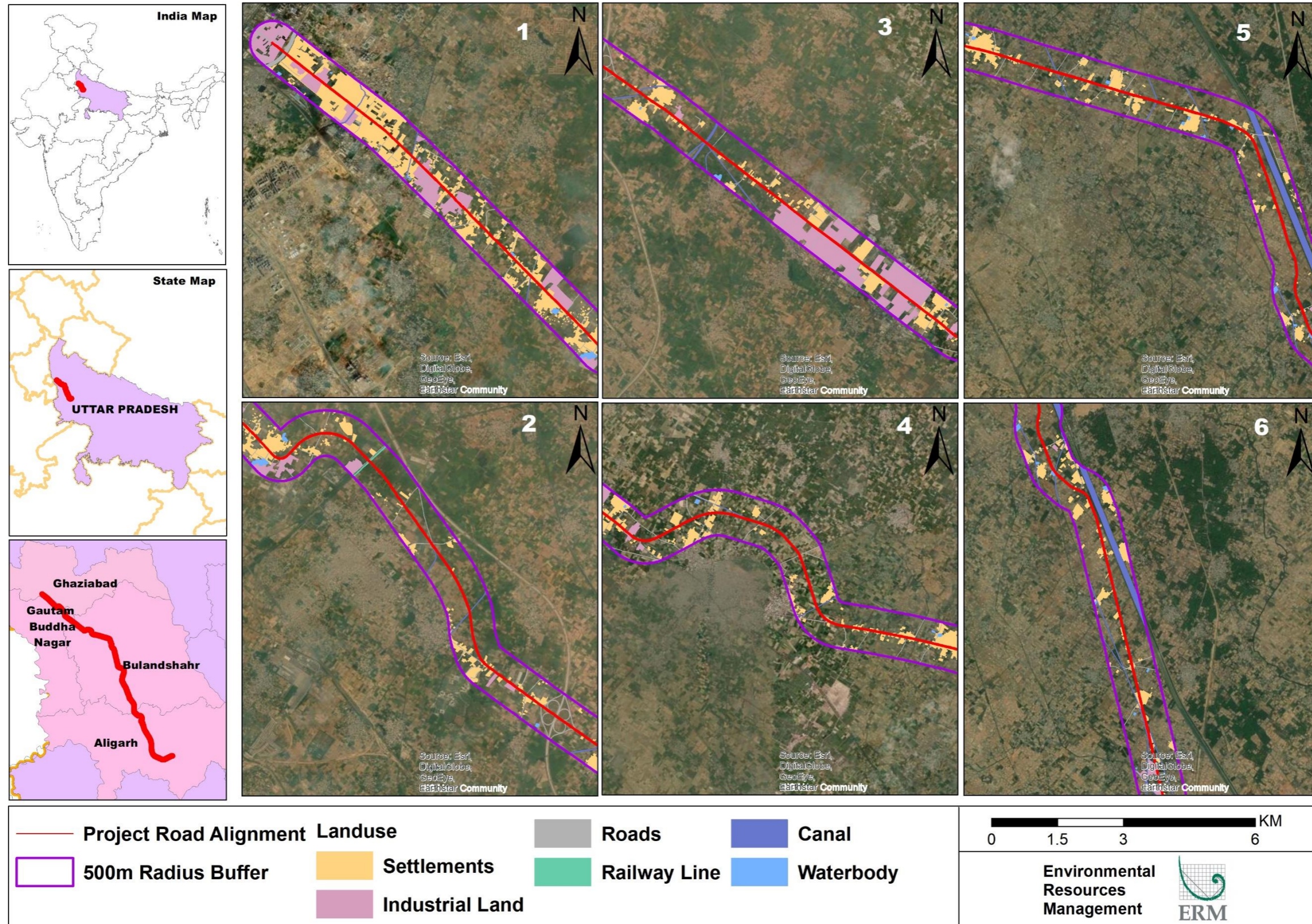
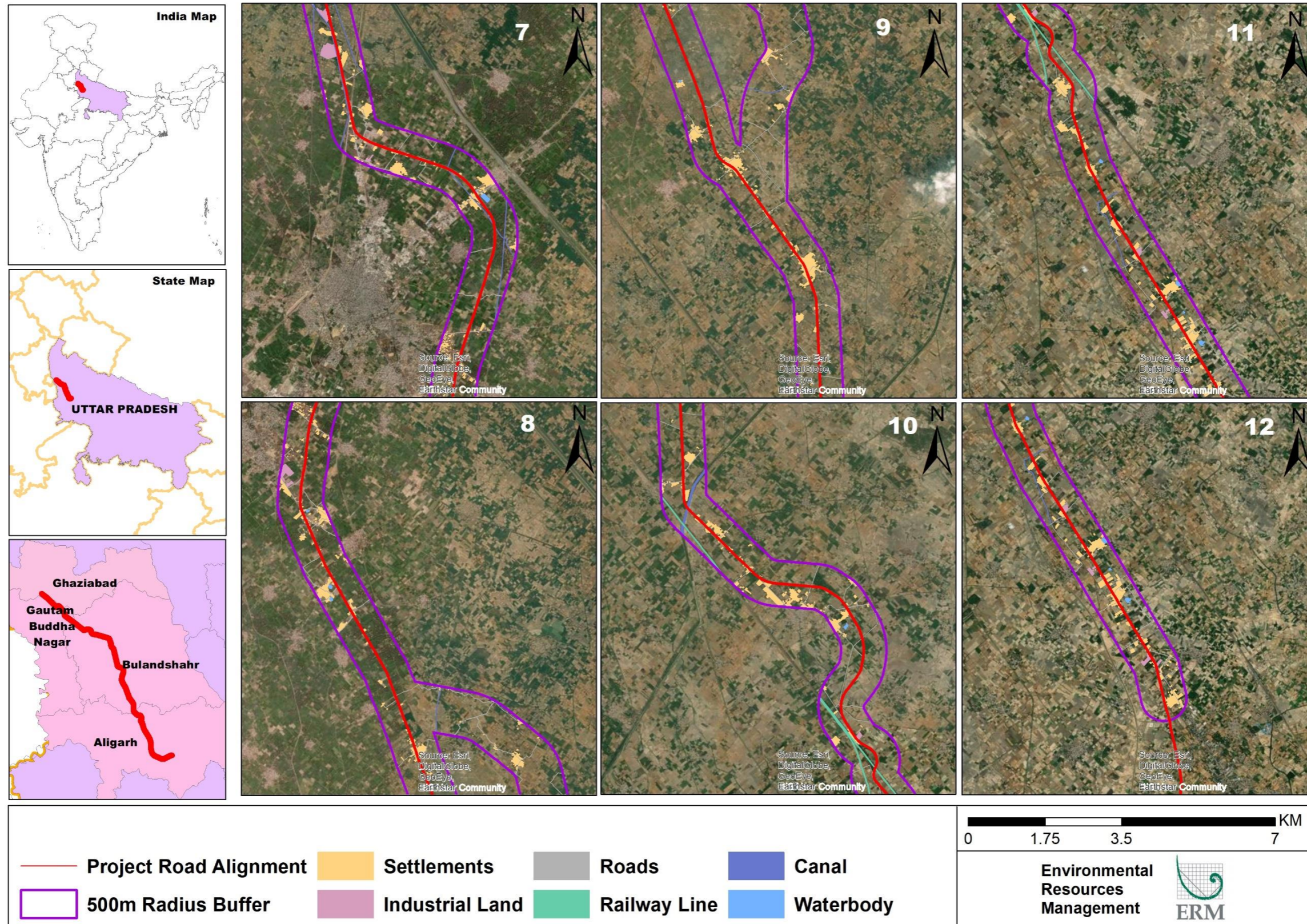


Figure 5.6 Map Showing Surface Water Bodies in the AoI (chainage km 81+00 to km 131+000)



5.2.4 Geology & Geomorphology

The geology and structure of the formations existing in an area control occurrence and movement of ground water. The geomorphic conditions also have a great impact on ground water scenario. The larger part of the State is underlain by fluvial sediments laid down in the fore deep between Plateau region in south and Himalayas in north during the Quaternary period by the Indus-

Hydrogeology

The State of Uttar Pradesh can broadly be divided into two physiographic units, the Ganga Plain and the Bundelkhand and Vindhyan Plateau.

Broadly, the State can be divided into two hydrogeological units.

1. Unconsolidated zone.
2. Consolidated, hard rock zone.

Unconsolidated Zone: covers nearly 85% of the State and sediments are an admixture of pebble, gravel, sand, silt, clay and kankar. The sediments are generally coarser in the north and gradually become finer south east ward along downstream of the drainage which is a typical feature of fluvial deposits. This zone consists of mainly two parts, the Terai and the Alluvial Plain. The Alluvial Plain occupies the area south of Terai and can further be divided in two sub units - Younger Alluvium and Older Alluvium. The younger alluvium occurs mostly along the present day flood plain area. The continuous shifting of the drainage network with time caused reworking of their earlier deposits giving rise to the younger alluvium. The older alluvium occupying comparatively high area covers major part of the Plain. A typical characteristic of older alluvium is formation of kankar within itself due to leaching of calcium carbonate under favourable climatic conditions. The kankar occasionally forms pans restricting downward movement of water.

The upper part of first aquifer down to 50 mbgl is the main source of drinking water through hand pumps and dug wells and is unconfined in nature. The first aquifer as a whole which is under unconfined to semi-confined conditions and is the most potential aquifer group which is the main source of groundwater in the State extensively exploited through private as well as Government tube wells to meet the drinking water and irrigation needs. The deeper aquifers are confined in nature being exploited to a very limited extent. The yield of second aquifer is limited while the third aquifer is potential. The shallow and phreatic aquifers are under heavy stress.

Through the districts in project area, the Yamuna is flowing through LHS and Upper Ganga Canal from RHS of the project area but at considerable distance from the alignment. The use of groundwater in the project AOI is largely domestic. Further as per data published by UP state government (groundwater department), recorded average pre-monsoon level in the district was 12.16 m and post monsoon level in the district was 11.85 m in 2020¹⁹.

5.2.5 Climate and Micro-meteorology

The climate of upper Ganga Yamuna Doab region is characterised by dry continental climate. As a result of which there is extreme hot in summer and extreme cold in winters. South west monsoon arrives in this region in summers. That is why this region is called as Monsoonal climatic region. In summers, maximum temperature rises to 41°C but sometimes in June it reaches upto 46°C. In the entire area fast and hot winds blow from the western sides which are locally called as 'Loo'. This region is divided into four climatic periods. The project area has four seasons, as explained below:

- Winter Season: The cold weather season commences in November and continues till March. Clear sky, pleasant weather, low temperature and humidity, high range of temperature, cool and

¹⁹ <https://jimup.org/wg/gwd.php>

slow northern winds are the chief characteristics of this season. Local winds blow in this region. Sometimes, the cold winds from mountainous area blow towards the plain areas and the temperature reaches upto 3-40°C. Average temperature of 10°C is found in this region.

- **Summer season:** The hot weather season commences from April end to June. This season is extremely hot and dry. Average temperature during this season varies from 20°C- 41°C. In summers hot winds blows from the western sides called as Loo winds increases the temperature upto 46°C in the month of June. As per the data recorded at research centre at Meerut which depicts the weather forecasting of the area around In the month of June average annual temperature upto 41°C is found. Day temperature is 20°C and night temperature is 8°C. Sometimes temperature reaches upto 45-46°C. In the month of May hot winds blows in the entire region locally known as 'Loo' winds.
- **Rainy Season:** The rainy season starts with the onset of the South- west monsoon in June and continues till middle of September. This is also called as monsoon season, the south-west monsoon season. High heat, high humidity, extensive clouding and several spells of moderate to heavy rain with strong surface winds are the chief characteristics of this season. The south - west monsoon covers the entire area and spells heavy rain. Rainfall occurs in summer month. Average annual rainfall reaches upto 720 cm. during this period. There is no rainfall in winters but sometimes rainfalls occurs due to western disturbances. This region do not receive any rainfall due to North- East monsoon in winters.
- **Cool season:** The cool season starts from the middle of September and continues upto November after which the winter season starts. Due to retreat of the monsoon this season is called the season of retreating monsoon. No severity of temperature (hot & cold) is found during this season. Pleasant weather conditions prevails over the entire region.

5.2.5.1 Rainfall

In 5 years i.e. from 2014 to 2018, district wise in Ghaziabad max. rainfall is 195.4 mm, and min was 0.6 mm, in Gautam Budh Nagar max. rainfall is 405 mm, and min was 1 mm, in Bulandshahr max. rainfall is 288.7 mm, and min was 1.3 mm, in Aligarh District max. rainfall is 344.5 mm, and min was 0.6 mm.

Figure 5.7 Rainfall data for Ghaziabad District, IMD, MoES

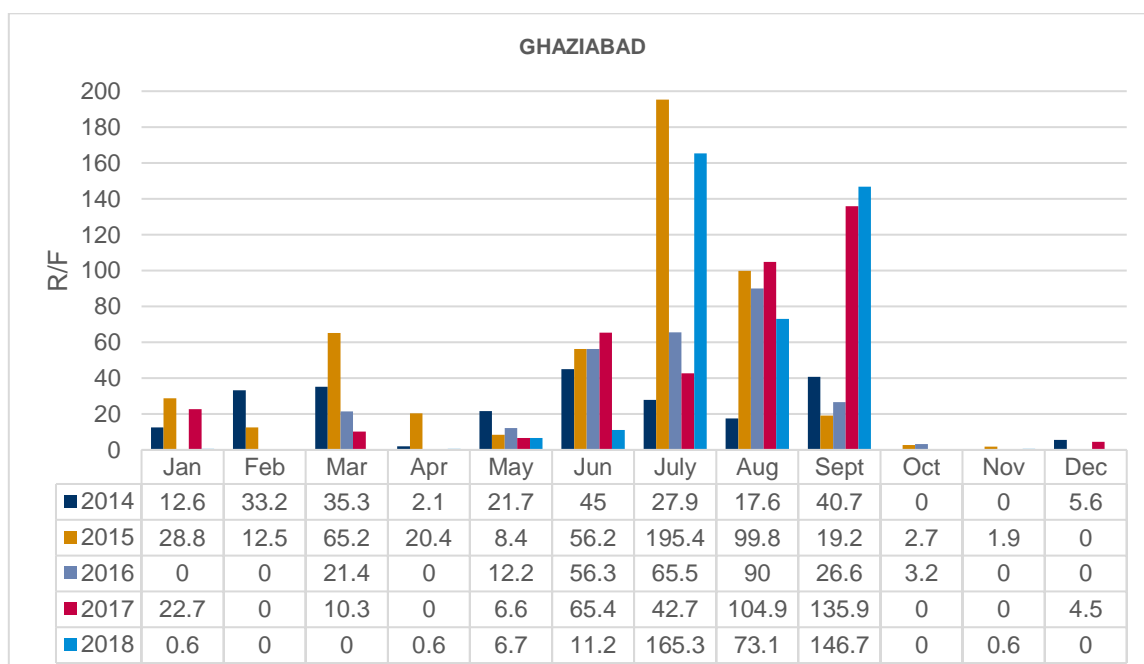


Figure 5.8 Rainfall data for G.B Nagar District, IMD, MoES

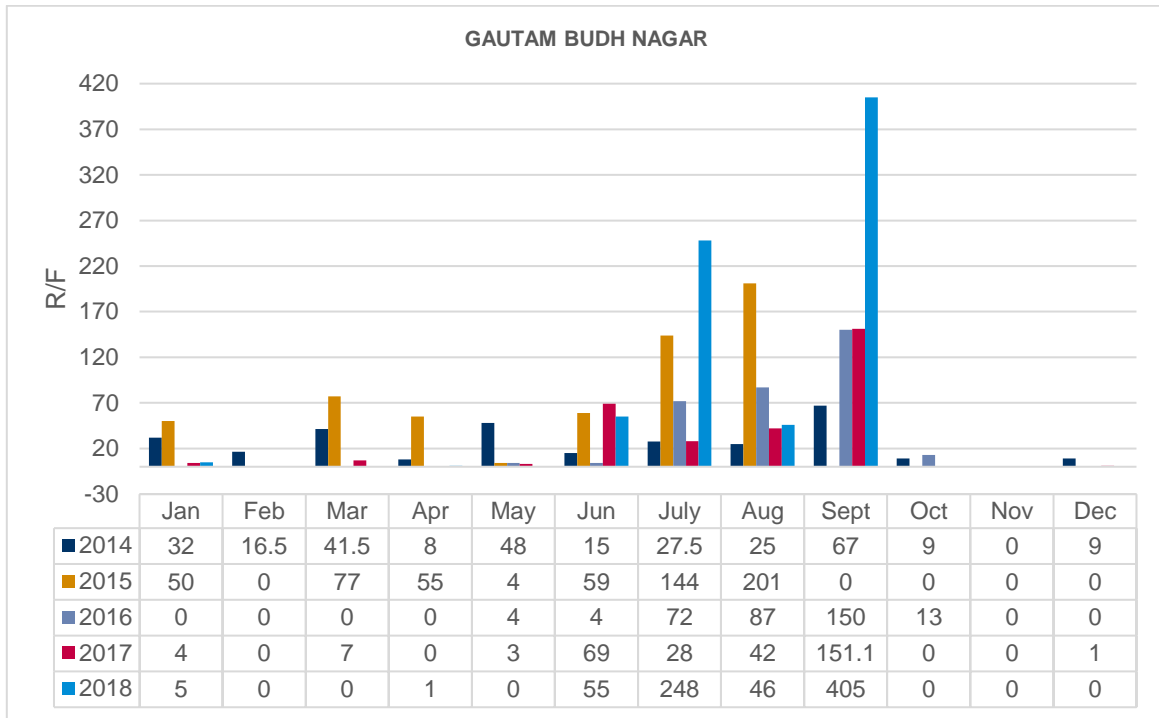


Figure 5.9 Rainfall data for Bulandshahr District, IMD, MoES

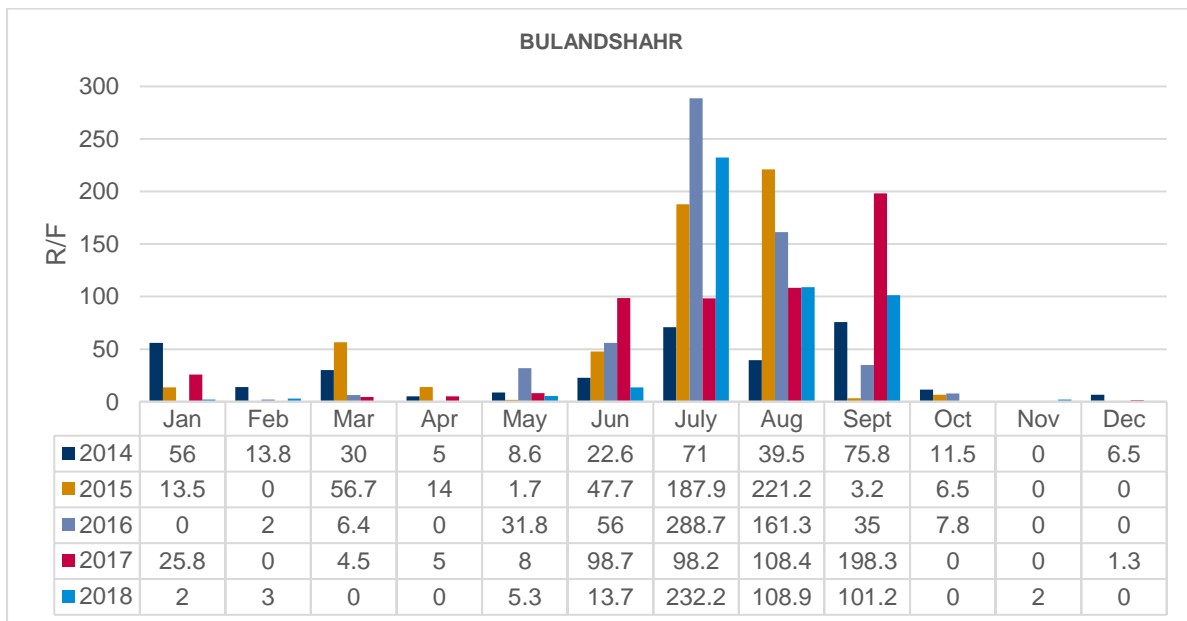
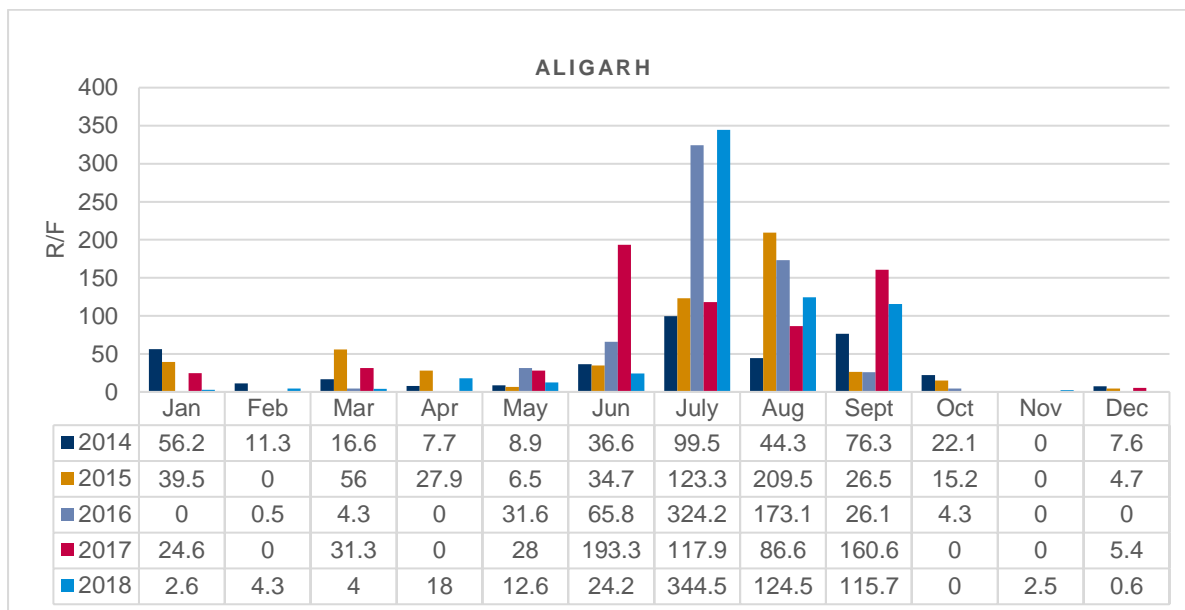


Figure 5.10 Rainfall data for Aligarh District, IMD, MoES



Note :(1) The District Rainfall in millimeters (R/F) shown below are the arithmetic averages of Rainfall of Stations under the District. (2) Blank Spaces show non-availability of Data.

Source- [http://hydro.imd.gov.in/hydrometweb/\(S\(xn1chg55uensmnjdljek3ij\)\)/DistrictRaifall.aspx](http://hydro.imd.gov.in/hydrometweb/(S(xn1chg55uensmnjdljek3ij))/DistrictRaifall.aspx).

Table 5.4 Climatological Data

Month	Temperature		Relative Humidity	Wind Speed	Rainfall
	Max daily	Min Daily	% at 08:30AM	kmph	mm
January	20.8	7.2	78	4.6	14.1
February	23.9	9.4	73	5.3	14.4
March	30.2	14.1	60	6.0	8.2
April	36.9	20.3	42	6.6	7.2
May	40.0	24.6	40	7.0	19.7
June	39.5	27.1	55	7.6	62.2
July	34.4	26.2	79	7.1	222.6
August	33	25.6	84	5.9	239.9
September	33.7	24	77	5.6	136.8
October	33.2	19.0	66	3.9	23.1
November	28.4	12.8	66	3.6	3.6
December	22.4	8.3	75	4.2	10.8
Average	31.4	18.2	66	5.6	762.6

Source: IMD Meteorological Data 1961-1990 (Aligarh)

5.2.6 Air Environment

The existing ambient air quality (AAQ) of the study area was monitored at eight locations, twice in a week at each location for 24 hours for two weeks during winter season December 2019 to January 2020. For the purpose, Avon Food Labs Private Limited (NABL accredited Lab) was engaged. The monitoring parameters include:

- PM₁₀ (particulate matter of particle size less than 10 micrometer);
- PM_{2.5} (particulate matter of particle size less than 2.5 micrometer);

- Sulphur Dioxide (SO₂);
- Nitrogen Dioxide (NO_x);
- Carbon Monoxide (CO);
- Ozone; and
- Hydrocarbon

5.2.6.1 Selection of Sampling Locations

The baseline status of ambient air quality has been established through AAQ monitoring and is based on the following considerations:

- Meteorological conditions of the area based on information of IMD;
- Topography of the study area; and
- Location of sensitive receptors such as settlements

The sampling and analysis of AAQ parameters was carried out as per the procedures detailed in relevant Parts of IS-5182 (Indian Standards for Ambient Air Quality Parameters). AAQ monitoring sampling locations are presented in Table below.

Table 5.5 Ambient Air Quality Monitoring Location

S. No	Sampling Location	Geographical Coordinates	Approximate distance from the median (m)
1	Near Royal Green Wine Shop, Lalkaun	N 28° 63'55.95", E 077° 46'21.86"	6.2
2	Dujana Gate, Patwari Bagh	N 28° 60'18.69", E 077° 50'39.14"	11.25
3	Dhoom Manikpur, Opp. Police Chauki	N 28° 57'64.07", E 077° 53'11.14"	9.25
4	Jay Durga Hardwares, Sikandrabad Industrial Area	N 28° 46'49.90", E 077° 67'28.36"	13.93
5	Lalpur Village	N 28° 43'85.29", E 077° 74'96.05"	19.72
6	Near Thandi Pyau Police Chauki	N 28° 33'81.72", E 077° 84'39.70"	23.25
7	Dasahara Kherli	N 28° 16'97.88", E 077° 90'09.38"	776.80
8	Bhankari Village	N 27° 95'54.22", E 78° 00'95.27"	21.05
9	Agwal Village	N 28° 29'13.44", E 77° 85'78.33"	307.25
10	Uchagaon	N 28° 15'25.99", E 077° 91'82.68"	951.60

Ambient Air quality monitoring results for all the stations have been presented below in Table below and detailed laboratory report is attached as **Appendix B**.

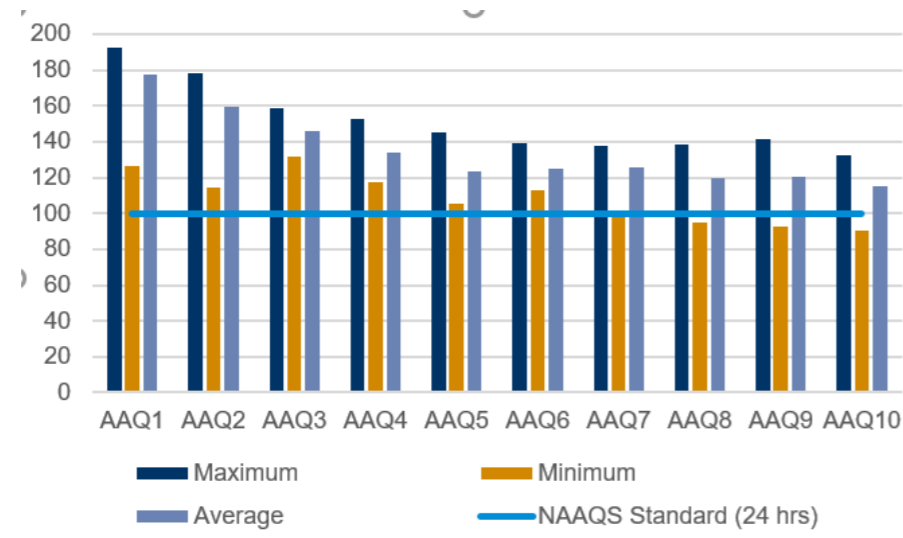
Table 5.6 Results of Ambient Air Quality in the Study Area

Parameter	Unit	Observed	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8	AAQ9	AAQ10
PM10	µg/m ³	Maximum	192.20	178.60	158.60	152.50	145.20	139.40	137.50	138.50	141.50	132.50
		Minimum	126.50	114.50	131.40	117.80	105.60	112.60	98.50	94.60	92.60	90.30
		Average	177.28	159.77	145.95	133.95	123.20	125.28	125.37	119.88	120.78	115.48
		98 Percentile	191.85	178.08	158.20	152.03	144.67	138.71	137.31	137.50	140.97	132.21

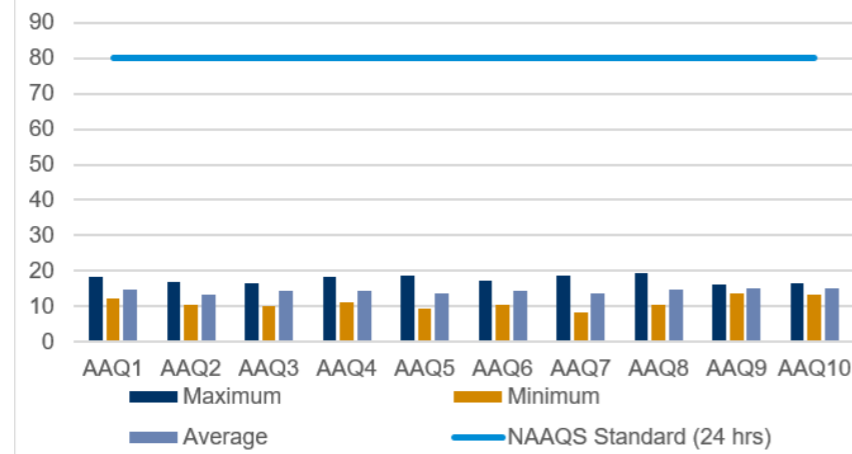
Parameter	Unit	Observed	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8	AAQ9	AAQ10
		NAAQS Standard (24 hrs)	100	100	100	100	100	100	100	100	100	100
PM2.5	µg/m ³	Maximum	96.30	92.60	87.50	85.20	84.50	83.60	96.40	93.50	88.40	85.20
		Minimum	71.20	69.80	72.40	73.90	69.50	71.40	58.30	56.40	57.70	57.40
		Average	87.67	84.07	82.20	80.35	76.62	76.23	76.12	74.33	72.90	73.37
		98 Percentile	96.10	92.30	87.31	84.93	84.37	83.40	94.82	92.01	87.48	84.82
		NAAQS Standard (24 hrs)	60	60	60	60	60	60	60	60	60	60
Sulphur Dioxide	µg/m ³	Maximum	18.20	16.90	16.40	18.20	18.80	17.40	18.50	19.30	16.30	16.40
		Minimum	12.40	10.40	10.20	11.20	9.20	10.40	8.20	10.30	13.50	13.40
		Average	14.62	13.37	14.33	14.27	13.70	14.43	13.72	14.77	15.00	15.18
		98 Percentile	18.06	16.73	16.34	18.01	18.54	17.30	18.48	19.09	16.23	16.39
		NAAQS Standard (24 hrs)	80	80	80	80	80	80	80	80	80	80
Nitrogen Dioxide	µg/m ³	Maximum	49.80	48.50	44.90	46.20	43.20	44.50	44.50	46.30	44.80	45.80
		Minimum	45.60	41.80	36.50	35.60	36.40	33.60	32.40	36.20	31.40	30.60
		Average	47.38	45.33	41.02	41.93	40.20	40.53	39.17	40.77	38.17	37.95
		98 Percentile	49.75	48.47	44.78	46.13	43.13	44.42	44.10	45.90	44.58	45.59
		NAAQS Standard (24 hrs)	80	80	80	80	80	80	80	80	80	80
Carbon Monoxide	mg/m ³	Maximum	1.08	0.96	0.96	0.91	0.87	0.85	1.20	1.40	0.96	0.93
		Minimum	0.73	0.69	0.82	0.80	0.78	0.74	0.74	0.71	0.70	0.68
		Average	0.93	0.87	0.89	0.84	0.82	0.79	0.84	0.87	0.80	0.80
		98 Percentile	1.07	0.96	0.96	0.91	0.87	0.85	1.16	1.35	0.95	0.92
		NAAQS Standard (08 hrs)	2	2	2	2	2	2	2	2	2	2
Ozone	µg/m ³	Maximum	27.80	29.30	31.40	33.60	26.20	27.30	32.60	34.30	32.60	32.10
		Minimum	21.40	21.10	21.20	21.30	21.90	23.10	21.20	21.40	22.40	23.60
		Average	23.18	23.33	23.97	24.73	24.42	24.72	26.22	26.53	27.18	27.57
		98 Percentile	27.38	28.71	30.62	32.72	26.14	27.15	32.17	33.82	32.38	32.03
		NAAQS Standard (08 hrs)	100	100	100	100	100	100	100	100	100	100
Hydrocarbon	ppm	Maximum	BLQ (LOQ-1.0)	BLQ (LOQ-1.0)	BLQ (LOQ-1.0)	BLQ (LOQ-1.0)	BLQ (LOQ-1.0)	BLQ (LOQ-1.0)	BLQ (LOQ-1.0)	BLQ (LOQ-1.0)	BLQ (LOQ-1.0)	BLQ (LOQ-1.0)

Parameter	Unit	Observed	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8	AAQ9	AAQ10
		Minimum	BLQ (LOQ- 1.0)	BLQ (LOQ- 1.0)	BLQ (LOQ- 1.0)	BLQ (LOQ- 1.0)	BLQ (LOQ- 1.0)	BLQ (LOQ- 1.0)	BLQ (LOQ- 1.0)	BLQ (LOQ- 1.0)	BLQ (LOQ- 1.0)	BLQ (LOQ- 1.0)
		Average	BLQ (LOQ- 1.0)	BLQ (LOQ- 1.0)	BLQ (LOQ- 1.0)	BLQ (LOQ- 1.0)	BLQ (LOQ- 1.0)	BLQ (LOQ- 1.0)	BLQ (LOQ- 1.0)	BLQ (LOQ- 1.0)	BLQ (LOQ- 1.0)	BLQ (LOQ- 1.0)

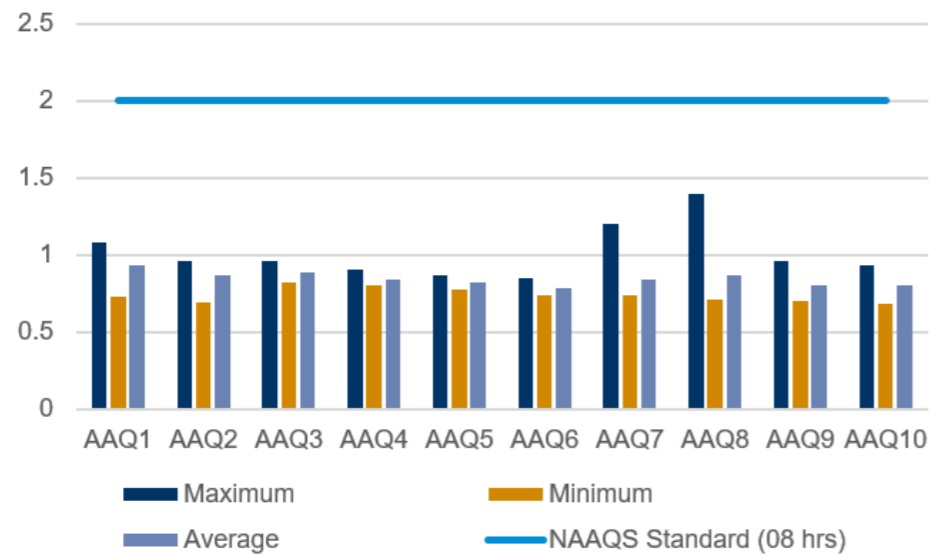
Figure 5.11 Graphical representation of air quality in the area



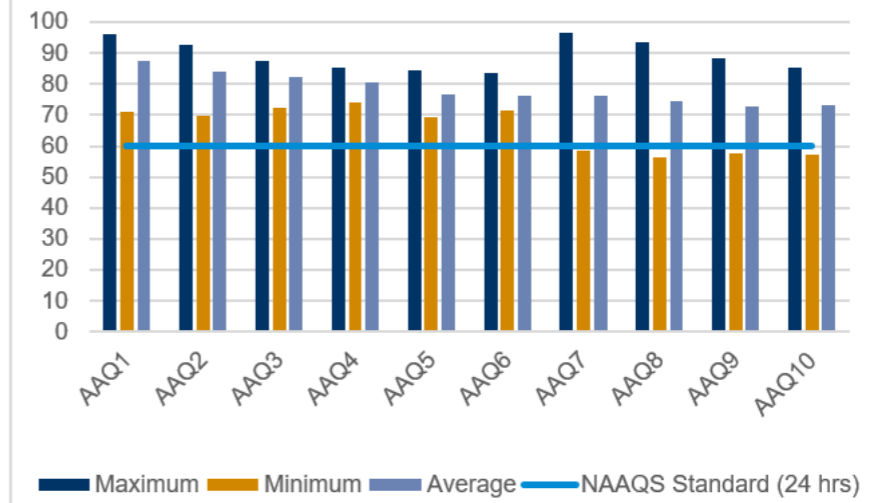
PM10 concentration in the area



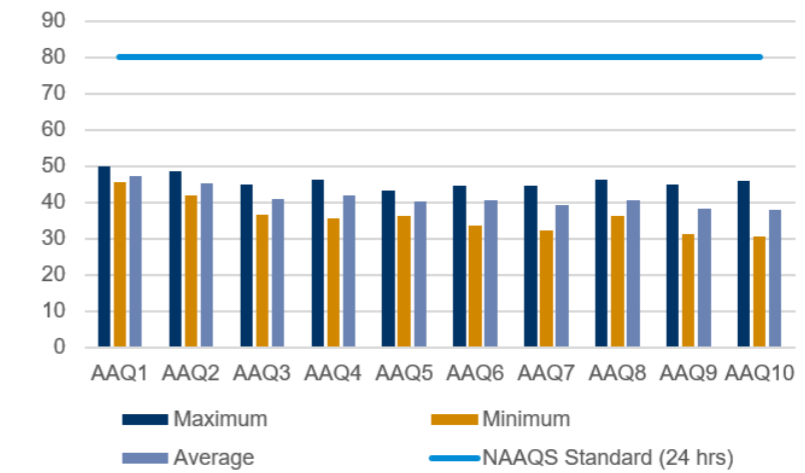
SO2 concentration in the area



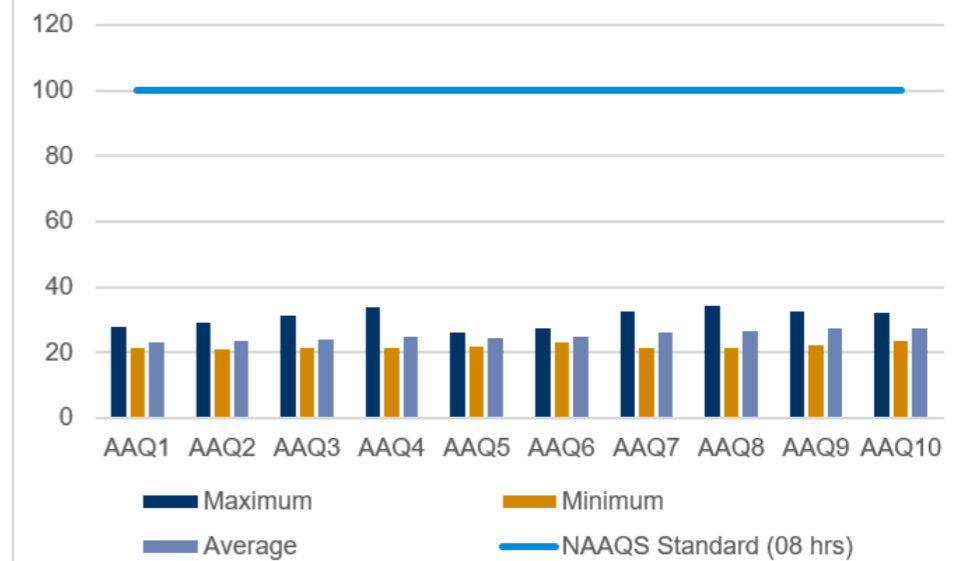
CO concentration in the area



PM2.5 concentration in the area



NO2 concentration in the area



O3 concentration in the area

All parameters except PM10 and PM 2.5 are within the permissible limits as shown above. The exceedance of particulate matter in the project area is largely attributed to the existing vehicular traffic and resuspension of dust. Unpaved shoulders and loose soil at few stretches along the road also contribute to dust emissions. Overall particulate levels in the NCR region has been recorded to be high during winter season due to low dispersion rates.

In Delhi NCR region, in addition to local emission and meteorological conditions, various factors such as long-range transport, and dust play an important role in the accumulation or dispersion of pollutants. As per IFC EHS Guidelines, an airshed should be considered as having poor air quality if nationally legislated air quality standards are exceeded significantly. Since the particulate matter emissions are persistently high in the project AOI, including Delhi NCR, the airshed in the project AOI is considered as degraded.

5.2.7 Noise Quality

Noise levels were recorded at twenty-two (22) locations once during the study period with the aid of a digital noise level meter. Noise levels were recorded for 24 hours and the noise quality has been reported as Leq day and Leq night for each of the locations. Daytime is considered from 0600 to 2200 hours and night time from 2200 to 0600 hours.

The RoW and areas along the existing road comprises of mixed land use with residential quarters as well as commercial activities. There are several unplanned markets and shops operating into late evening hours, which contribute to the high noise levels in the area. These shops are usually for fabrication works, car repair workshops, vendors and hawkers selling fruits, vegetables and other household items, restaurants and food joints, stationary, etc. Due to presence of these commercial activities, the customer footfall in these areas are high with several vehicles plying throughout the day thus generating high noise. Also there are random pick and drop points for passengers from local buses, autorickshaws and cabs which add to the high noise in the area, especially the initial 10km of the existing road. These drop points also cause congestions from time to time leading to fluctuation of noise. It is therefore understood that road traffic may not be the dominant noise contributor at some locations during the course of the day or night, and other noise sources maybe contributing to higher noise levels in that area. While for the greenfield Khurja realignment, there are no sensitive receptors identified as the realignment route passes through the agricultural lands. For details on sensitive receptors, the **Appendix C** is to be referred.

The details of noise monitoring locations are given in **Table 5.7**. A map highlighting the noise sampling locations within the Project Aol has been presented in **Figure 5.1413** and **Figure 5.1514**.

Table 5.7 Details of 24 Hour Ambient Noise Monitoring Location

Location Ref	Nearest Village/ location	Coordinates (decimal degrees)	Approximate distance from the median (m)	General activities in the area
NQ1	Mittal Vastra Bhandar Lak Kuan, GT Road Gaziabad	N 28°38'08.26", E 77°27'44.34"	18.57	Commercial area with unplanned market and shops, noise largely from movement of people and vehicles
NQ2	Near Shyam Residency, 4th Mile Stone GT Road Chhaparaula	N 28°37'36.43", E 77°28'25.65"	30.90	Commercial area close to the highway

Location Ref	Nearest Village/ location	Coordinates (decimal degrees)	Approximate distance from the median (m)	General activities in the area
NQ3	Market Complex adjacent to Dujana Gate, above Axis Bank ATM Accheja Village	N 28°36'05.48", E 77°30'15.90"	19.96	Commercial area, noise largely from movement of people and vehicles
NQ4	PS – Dhoom Manikpur adjacent to Prachin Shiv Mandir	N 28°34'34.83", E 77°31'44.96"	138.23	Open agricultural land close to residential area
NQ5	Pradhan Market near Divine Public School (LHS)	N 28°35'31.41", E 77°30'52.73"	26.31	Area with few shops and school nearby
NQ6	Veer Restaurant Vishveriya City & Khandera village (LHS)	N 28°31'22.83", E 77°33'34.72"	2184.65 (2.1 kms)	Area with open agricultural land and residential dwellings nearby
NQ7	Motel Manish & Restaurant Sanwali village (RHS)	N 28°28'01.18", E 77°40'20.02"	23.25	Commercial area close to the highway
NQ8	House in Lalpur village (RHS)	N 28°26'23.66", E 77°44'35.95"	24.0	Residential area adjacent to the highway
NQ9	Coco Splash Water Park Hardaspur, near Gulfar construction and labour camp, Aligarh (RHS)	N 27°53'42.83", E 77°00'43.81"	4506.09 (4.5 kms)	Commercial area with labour camp nearby and in proximity to construction works
NQ10	House just at U turn of Kumar Jewellers (RHS)	N 27°57'18.02", E 78°00'33.39"	26.31	Commercial area with market complex and shops close to the highway
NQ11	Near SBI Bank PallaSallu Branch (RHS)	N 27°58'49.7", E 77°59'33.71"	19.34	Commercial area with market complex and shops close to the highway
NQ12	Sarswati Sweets Centre, Muni village just opposite to LHS location (RHS)	N 28°06'43.03", E 77°55'59.43"	21.63	Commercial area with market complex and shops close to the highway.
NQ13	CSC Jan Sewa Kendra opposite PNB Muni village (RHS)	N 28°06'43.04", E 77°56'01.50"	29.31	Residential area close to the highway with some extent of commercial activities

Location Ref	Nearest Village/ location	Coordinates (decimal degrees)	Approximate distance from the median (m)	General activities in the area
NQ14	Near MaaSharda Medical store Masjid & Village (RHS)	N 28°10'17.40", E 77°54'00.35"	27.96	Residential area close to the highway with some extent of commercial activities. This is one of the locations closer to the Khurja realignment.
NQ15	Vijya Family Dhaba & Restaurant near Mirpur Public School (RHS)	N 28°12'03.22", E 77°53'10.87"	40.27	Commercial area surrounded by agricultural land, in proximity to the highway, also some educational institutes nearby.
NQ16	House in Dariyapur Village adjacent to Govt Primary School (LHS)	N 28°25'28.51", E 77°48'02.77"	21.00	Residential area adjacent to the highway
NQ17	PNC Infratech Ltd. Construction and Labour Camp (LHS)	N 28°17'15.88", E 77°51'32.16"	187.42	Construction and labour camp surrounded by agricultural land
NQ18	Panchshil Colony	N 28°37'59.6346", E 77°27'49.1646"	102.97	Residential colony with some extent of commercial activities
NQ19	Jain Vihar Colony	N 28°38'4.0956", E 77°27'54.162"	85.0	Residential colony with some extent of commercial activities close to the highway
NQ20	Near Luharli Toll Plaza	N 28°29'57.02", E 77°37'36.06"	38.27	Open area close to the toll plaza with few shops in the vicinity
NQ21	Saheed Bhagat Singh Family Dhaba Near Soma Toll Plaza	N 28°4'6.6606", E 77°56'21.138"	36.96	Commercial area near toll plaza, with other restaurants nearby
NQ22	Uchagaon	N 28°9'9.1614", E 77°55'5.6454"	956.66	Predominantly agricultural area with scattered residences away from the existing highway. This is one of the locations closer to the Khurja realignment (~700 m)

Source: ERM Monitoring conducted in December 2019 – January 2020

Appendix B provides the laboratory reports on noise levels recorded on hourly basis (1 hour Leq) at each monitoring location throughout the day. It was observed that there were significant fluctuations in hourly noise due to too many ad hoc activities in the area.

Table 5.8 Results on Ambient Noise Levels in the Study Area

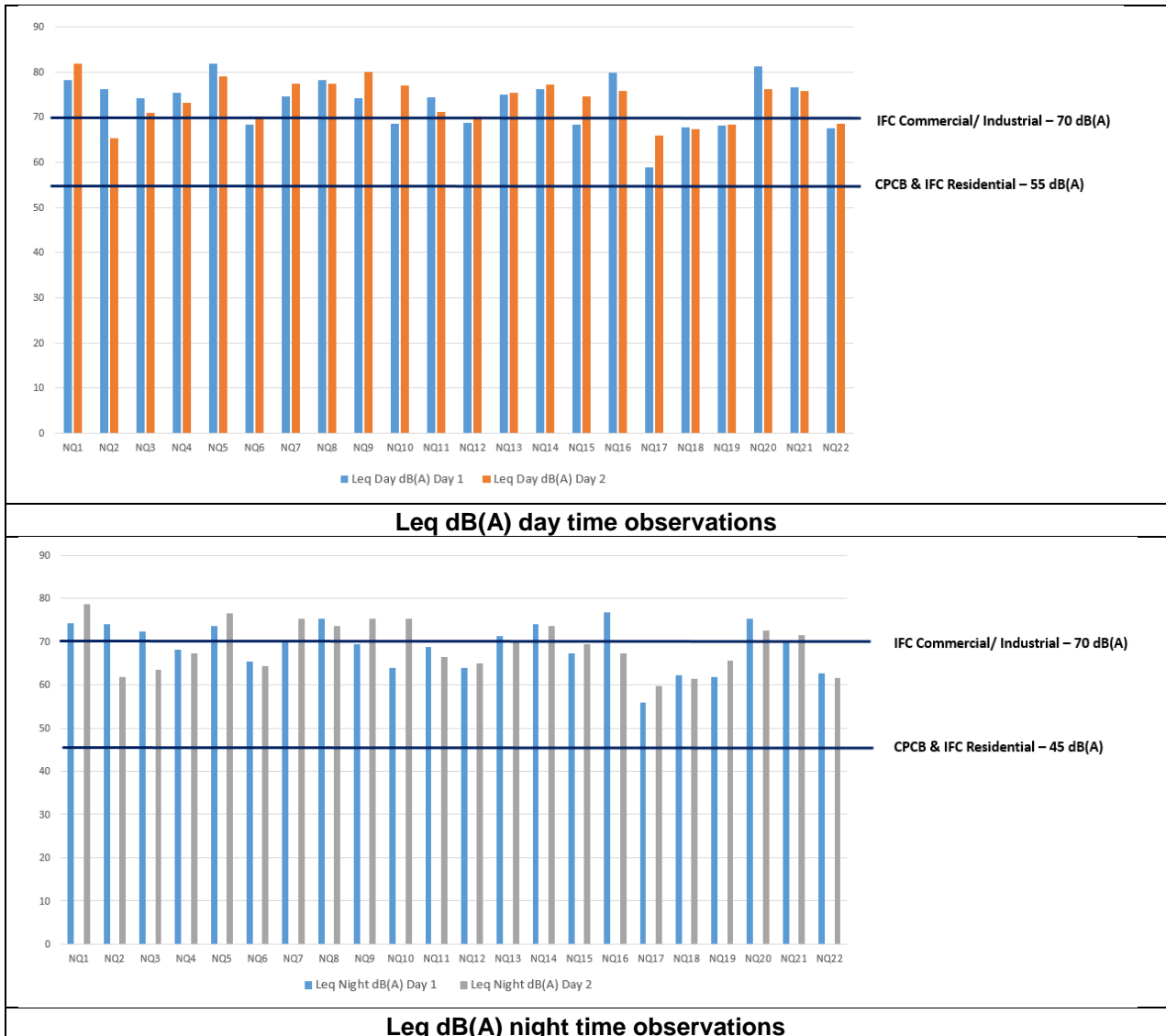
S. No.	Location	Recorded Levels					
		Observation 1 (Day 1)			Observation 2 (Day 2)		
		Leq Day dB(A)	Leq Night dB(A)	Min 1 hr Leq dB(A) Night	Leq Day dB(A)	Leq Night dB(A)	Min 1 hr Leq dB(A) Night
1.	NQ1	78.3	74.2	73.0	81.8	78.7	74.8
2.	NQ2	76.1	74.0	72.1	65.3	61.8	55.2
3.	NQ3	74.2	72.4	67.3	71.0	63.5	61.3
4.	NQ4	75.3	68.2	62.9	73.1	67.3	65.7
5.	NQ5	81.9	73.7	67.8	79.0	76.6	74.1
6.	NQ6	68.4	65.3	63.9	70.2	64.4	63.0
7.	NQ7	74.5	69.9	68.1	77.4	75.2	60.4
8.	NQ8	78.2	75.3	72.4	77.3	73.5	71.4
9.	NQ9	74.1	69.4	67.8	80.1	75.3	64.9
10.	NQ10	68.6	63.9	62.0	76.9	75.2	74.3
11.	NQ11	74.4	68.8	67.2	71.2	66.4	64.2
12.	NQ12	68.7	64.0	62.7	70.1	65.0	63.9
13.	NQ13	75.0	71.3	69.8	75.4	70.1	68.0
14.	NQ14	76.1	74.0	67.3	77.1	73.6	70.5
15.	NQ15	68.4	67.2	66.1	74.6	69.4	65.0
16.	NQ16	79.9	76.7	67.4	75.7	67.3	64.8
17.	NQ17	58.8	56.0	54.0	65.9	59.7	57.2
18.	NQ18	67.8	62.3	57.0	67.4	61.3	55.9
19.	NQ19	68.1	61.7	55.9	68.3	65.6	63.4
20.	NQ20	81.3	75.3	67.4	76.1	72.5	64.8
21.	NQ21	76.5	70.1	68.2	75.7	71.4	68.0
22.	NQ22	67.6	62.6	56.9	68.5	61.5	55.9

Note: Day time is considered from 6 am to 10 pm and night time is considered from 10 pm to 6am.

Source: ERM Monitoring conducted in December 2019 – January 2020

The results for the average Leq values are graphically represented in subsequent figures:

Figure 5.12 Graphical Representation of Noise Monitoring Results



At each location monitoring is conducted for 48 hours, presented as Observation 1 and 2 for 24 hours of a working day and other 24 hours of a nonworking day (considering Saturdays and Sundays as non - working days), respectively. Furthermore, Leq Day signifies the average over the entire daytime sampling period and Leq night demonstrate the average over the night time sampling period.

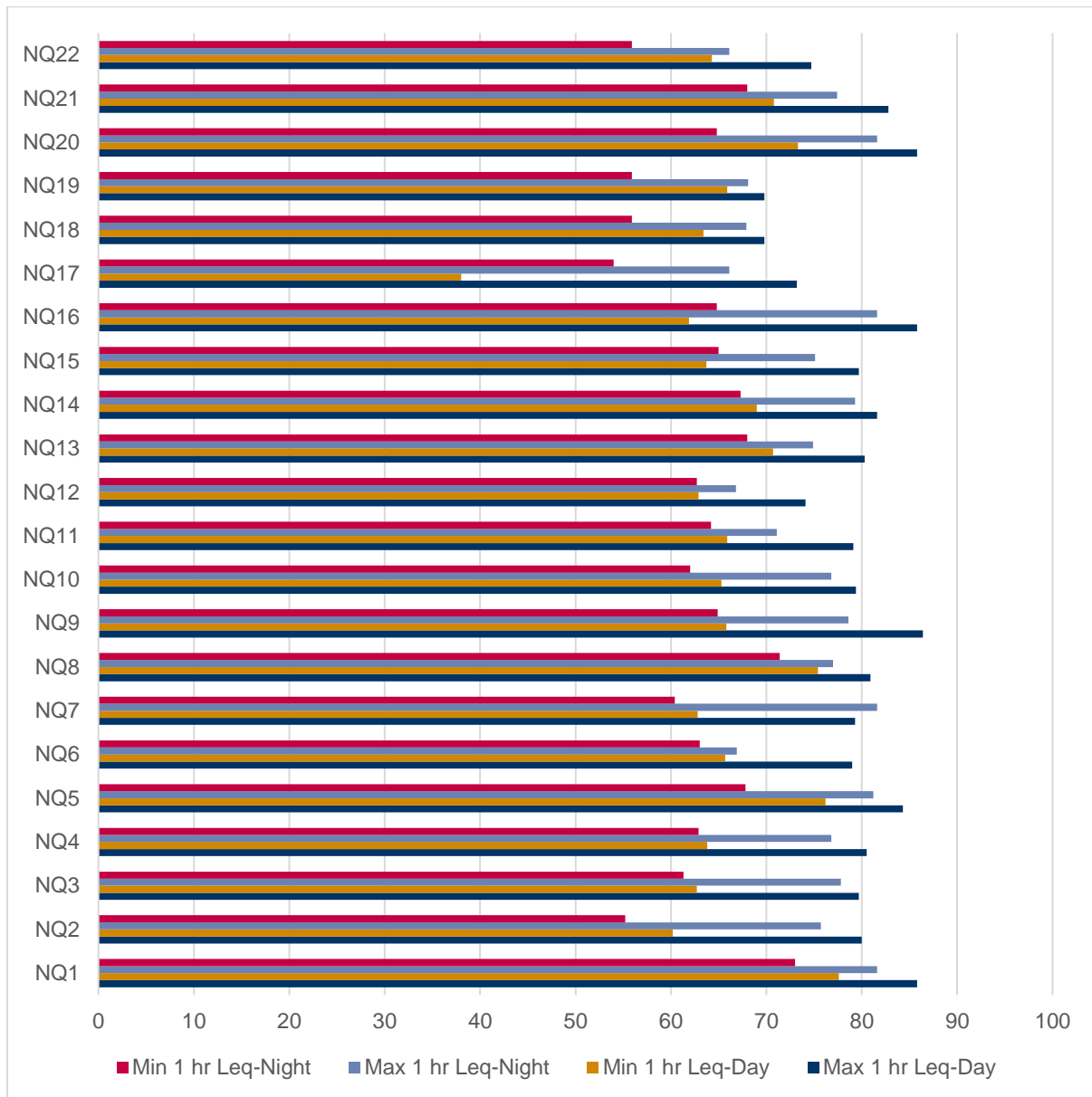
The CPCB Permissible levels of noise for residential area 55 Leq dB(A) for day time and 45 Leq dB(A) for night time. As per IFC guidelines, noise levels should not exceed 1-hr Leq 45/55 dBA night/day for residential/institutional/mixed and 1-hr Leq 70 dBA for night/day for commercial/industrial, or maximum increase in noise levels should not exceed 3 dBA over baseline. The equivalent ambient noise level for day and night time (Leq day) at all the monitoring locations were observed to be above prescribed CPCB limits and IFC guidelines for residential area. Noise standards for industrial / commercial areas are exceeded at few of the locations. The high noise levels in the study area can be attributed to incessant vehicular movement on expressway and presence of settlements in the surroundings. The major towns located along the expressway are bypassed.

As per the results of the monitored values on 1 hourly Leq, it was observed that the maximum hourly noise levels were not confined to any particular hour of the day for any of the locations. The max 1 hr Leq during daytime ranged from 69.8 dB(A) at NQ18 and NQ19 to 86.4 dB(A) at NQ1. The max 1 hr Leq during nighttime ranged from 81.6 dB(A) at NQ1, NQ7, NQ16 and NQ20 to 66.1 dB(A) at NQ17 and NQ22.

Table 5.9 Results on Max and Min 1-hourly Leq

S. No.	Location	Max 1 hr Leq-Day	Min 1 hr Leq-Day	Max 1 hr Leq-Night	Min 1 hr Leq-Night
1.	NQ1	85.8	77.6	81.6	73.0
2.	NQ2	80.0	60.2	75.7	55.2
3.	NQ3	79.7	62.7	77.8	61.3
4.	NQ4	80.5	63.8	76.8	62.9
5.	NQ5	84.3	76.2	81.2	67.8
6.	NQ6	79.0	65.7	66.9	63.0
7.	NQ7	79.3	62.8	81.6	60.4
8.	NQ8	80.9	75.4	77.0	71.4
9.	NQ9	86.4	65.8	78.6	64.9
10.	NQ10	79.4	65.3	76.8	62.0
11.	NQ11	79.1	65.9	71.1	64.2
12.	NQ12	74.1	62.9	66.8	62.7
13.	NQ13	80.3	70.7	74.9	68.0
14.	NQ14	81.6	69.0	79.3	67.3
15.	NQ15	79.7	63.7	75.1	65.0
16.	NQ16	85.8	61.9	81.6	64.8
17.	NQ17	73.2	38.0	66.1	54.0
18.	NQ18	69.8	63.4	67.9	55.9
19.	NQ19	69.8	65.9	68.1	55.9
20.	NQ20	85.8	73.3	81.6	64.8
21.	NQ21	82.8	70.8	77.4	68.0
22.	NQ22	74.7	64.3	66.1	55.9

Figure 5.13 Graphical Representation of Hourly Min and Max Noise Monitoring Results



5.2.8 Water Environment

5.2.8.1 Groundwater Quality Assessment

The groundwater quality assessment was done to understand the baseline groundwater quality of the study area. The ground water samples from borewells were collected from selected villages in in the study area and analysed for physicochemical and bacteriological parameters. The results were compared with IS: 10500, 2012 drinking water standards to identify and interpret any deviation in the statutory limits set for parameters under this standard. A map showing location of water sampling is presented in **Figure 5.1413** and **Figure 5.1514**. The details of water sampling locations are presented in **Table 5.10** and the results of groundwater quality assessment have been presented in **Table 5.11**.

Table 5.10 Groundwater quality monitoring locations

Location Code	Location name	Coordinates	Well Type	Approximate distance from median (m)	Selection Criteria
GW1	Mirpur village	N 28°12'26.6718", E 77°52'53.9904"	Hand pump	25.83	Proximity to the road was the primary criteria for selection of the locations for monitoring. Also wells which were used by community for domestic consumption were considered for sampling. Objective was to understand the existing ground water quality in the nearby habitation and assess any impact on ground water quality due to proposed project.
GW2	Muni Village Community Health Center	N 28°06'36.79", E 77°56'01.24"	Hand pump	39.5	
GW3	Galfar Construction Camp	N 27°53'43.8058", E 78°0'38.5164"	Borewell	4506.09 (4.5 kms)	
GW4	Lal Kuan Vaishnavi Complex	N 28°38'7.8", E 77°27'46.7994"	Hand pump	52.02	
GW5	Aman Dry Cleaners Near PS Dhoom	N 28°34'33.7686", E 77°31'57.3168"	Hand pump	95.06	
GW6	Jokhabad Village Opp. Sharma Hotel	N 28°28'29.1252", E 77°39'46.3284"	Hand pump	72.71	
GW7	Dariyapur village	N 28°25'27.2028", E 77°48'7.2072"	Hand pump	19.28	
GW8	Agwal village	N 28°17'28.8378", E 77°51'28.1982"	Hand pump	304.17	

Source: ERM Monitoring conducted in December 2019

The groundwater quality analysis of the samples in the study area is given below table. Detailed laboratory reports are attached as **Annexure B**.

Table 5.11 Groundwater Quality in the Study Area

S No	Parameter	Unit	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8	IS: 10500, 2012 Acceptable Limit	IS: 10500, 2012, Permissibl e Limit
A	<i>Physical Parameters</i>											
1.	Turbidity	N.T.U	0.3	0.3	0.2	0.4	0.5	0.3	0.2	0.2		5
2.	pH value	None	7.5	7.59	7.68	7.45	7.66	7.25	8.01	7.52	6.5-8.5	No relaxation
3.	Temperature	°C									1	5
B	<i>Chemical parameters</i>											
1.	Total Dissolved Solids (as TDS)	mg/l	812.2	692.2	702.4	1186.6	1993	1013.8	324.4	752	500	2000
2.	Calcium (as Ca)	mg/l	62.5	48.1	57.7	160.3	43.3	86.6	40.1	80.2	75	200
3.	Chloride as Cl	mg/l	92	38	42	149.9	239.9	175.9	4.0	86	30	100
4.	Fluoride (as F)	mg/l	0.6	0.5	0.5	0.5	0.8	0.4	1.1	0.7	1.0	1.5
5.	Free Residual Chlorine	mg/l	BDL (DL-0.1)	BDL (DL-0.1)	BDL (DL-0.1)	BDL (DL-0.1)	BDL (DL-0.1)	BDL (DL-0.1)	BDL (DL-0.1)	BDL (DL-0.1)	0.2	1
6.	Iron (as Fe)	mg/l	BLQ (LOQ-0.1)	BLQ (LOQ-0.1)	BLQ (LOQ-0.1)	BLQ (LOQ-0.1)	BLQ (LOQ-0.1)	BLQ (LOQ-0.1)	BLQ (LOQ-0.1)	BLQ (LOQ-0.1)	0.3	No relaxation
7.	Magnesium (as Mg)	mg/l	34	26.2	35	55.4	63.2	60.3	43.7	44.7	30	100

S No	Parameter	Unit	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8	IS: 10500, 2012 Acceptable Limit	IS: 10500, 2012, Permissible Limit
8.	Nitrate as NO ₃	mg/l	1.3	1.1	1.1	2.5	3.1	1.5	0.8	1.6	45	No Relaxation
9.	Sulphates (as SO ₄) ²⁻	mg/l	26.9	23.9	17.2	181	131.8	65.7	27.2	84.9	200	400
10.	Total Alkalinity as CaCO ₃	mg/l	500	476	516	348	784.0	528	260.0	324	-	600
11.	Total Hardness (as CaCO ₃)	mg/l	296	228	288	628	368.0	464	280	384	200	600
12.	Zinc as Zn	mg/l	BLQ (LOQ-0.2)	0.72	BLQ (LOQ-0.2)	0.43	BLQ (LOQ-0.2)	BLQ (LOQ-0.2)	0.34	0.3	15	-
C <i>Biological parameters</i>												
13.	Total Coliform	MPN / 100ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Shall not be detectable in any 100 ml sample	

Source: Primary Baseline Monitoring results by Avon Food Lab Private Limited. **Nomenclature:** BLQ (Below Limit of Quantification) and BDL (Below Detection Limit). **Colour coding:** Results highlighted in red are found to be above permissible limits and results highlighted in yellow are found to be above acceptable limits.

Interpretation of Results

As per the results presented in **Table 5.1110**, the following aspects are either above the permissible limit or the acceptable limits as per IS: 10500, 2012 drinking water standards:

Total Dissolved Solids (TDS): TDS was observed to be higher than acceptable limits at almost all locations except for GW 7. Since the groundwater sample was taken from an area characterised by agricultural fields and activities, mixing of soil contaminants (such as Iron) with groundwater through leaching and increase in evaporation due to irrigation activities can lead to high TDS;

Calcium: Calcium content was found to be above acceptable limits at GW-4, GW-6 and GW-8. Hardness in most groundwater is naturally occurring from weathering of calcium bearing minerals. As can be observed in the previous paragraph, TDS in the groundwater samples was observed to be high. Therefore, high amount of calcium is bound to occur in the groundwater.

Magnesium & Chlorides: The salts are observed to be above acceptable limits at almost all locations. As can be observed in the previously, TDS in the groundwater samples was observed to be high. Therefore, high amount of magnesium & chlorides is bound to occur in the groundwater. Furthermore, presence of underlying rocks (limestone and gypsum) leads to high concentration of magnesium in the groundwater as well once dissolved;

Total Hardness: Hardness of water is considered to be an important factor to determine the portability and its domestic usage particularly for washing. Total hardness of water is correlated to the presence of bivalent metallic ions viz. **calcium and magnesium**. Total hardness values in the groundwater samples were found to be exceeding permissible limits at both sampling locations. Therefore, the groundwater may not be potable and/or suitable for domestic usage.

5.2.9 Soil Environment

5.2.9.1 Soil characteristics

As per the Aquifer Mapping and Ground Water Management Plan for Parts of NCR of Uttar Pradesh and Soil Map of Uttar Pradesh published by National Bureau of soil Survey & Land by Central Ground Water Board, in major part of NCR, the soils occur on nearly level to level plains, are deep and well drained and have loamy surface. Generally, the soils are fine or coarse loamy, with both varieties occurring together and one or the other being predominant component at different places. A number of variants of above soil type also exist in the area due to slight departure from general characteristics.

5.2.9.2 Soil Quality Assessment

Soil characteristics within the study area, especially the physical quality and fertility of the soil have been characterized by analysing soil samples collected from eight (08) locations in December 2019. Soil sampling is undertaken along the road in areas where commercial activities were observed, parameters like TPH, BTEX would indicate any possibility of contamination. While other parameters are collected to establish baseline of road in case any claims are made later. Soil sampling locations are shown in **Table 5.12**. Soil analysis and results have been presented in **Table 5.1312**.

Table 5.12: Details of Soil Sampling Locations

Location Ref	Location	Coordinates	Approximate distance from the median (m)
SQ1	Near Pallu Sallu SBI Branch	N 27°58'49.91", E 77°59'33.69"	19.76

Location Ref	Location	Coordinates	Approximate distance from the median (m)
SQ2	Galfar Construction Camp	N 27°53'43.8058", E 78°0'38.5164"	4453.30 (4.5 kms)
SQ3	Near Chhapraula Police Chauki	N 28°37'0.6924", E 77°29'16.4292"	27.91
SQ4	Near Manikpur Police Chauki	N 28°34'38.2614", E 77°31'47.532"	14.22
SQ5	Before (500m) Peripheral Expressway	N 28°31'31.1838", E 77°35'24.828"	74.61
SQ6	Open land before Essar Petrol Pump	N 28°27'45.2196", E 77°41'6.7554"	14.52
SQ7	PNC Construction Office	N 28°17'15.51", E 77°51'30.29"	157.28
SQ8	Open agriculture land	N 28°15'10.08", E 77°52'48.76"	272.14

Source: ERM Monitoring conducted in December 2019

Table 5.13: Results of Soil Sampling in the Study Area

S. No	Parameter	Unit	SQ1	SQ2	SQ3	SQ4	SQ5	SQ6	SQ7	SQ8
A	Physical Parameter									
1	pH (10% Slurry)		7.73	7.92	8.49	7.78	8.14	7.8	7.54	7.58
2	Moisture	%	6.46	8.2	6.2	7.4	6.84	8.2	6.4	6.82
3	Bulk Density	Gm/cc	1.23	1.3	1.25	1.2	1.43	1.28	1.3	1.49
4	Porosity	%	32.4	30.8	30.8	36.5	34.2	34	38.4	29.6
5	Infiltration Capacity	Cm/hr	1.37	1.1	1.10	1.2	0.8	0.85	1.2	1.2
6	Water Holding Capacity	%	40.4	32.4	38.2	38	40.5	30.8	36.2	42.73
7	Electrical Conductivity	µ ³ /cm	204	450	162	272	180	288	326	264
8	Texture	-	Sandy Loam	Sandy Loam	Loam	Sandy Loam	Loam	Loam	Loam	Sandy Loam
9	Sand	%	67	61	51	65	30	39	71	35
10	Clay	%	11	14	34	12	25	17	9	20
11	Silt	%	22	25	15	23	45	44	20	45
B	Chemical Parameter									
1	Nitrogen as Nitrate	mg/kg	6.2	8.2	7.8	8.4	6.8	7	6.6	7.2
2	Phosphorus	mg/kg	4.8	4.2	3.6	2.6	2.8	3.2	3.8	3

S. No	Parameter	Unit	SQ1	SQ2	SQ3	SQ4	SQ5	SQ6	SQ7	SQ8
3	Sulphate	mg/kg	0.8	0.54	0.82	0.4	0.8	0.6	0.5	0.4
4	Potassium	mg/kg	2020.0 4	2150.82	2032.78	2193.0 5	1796.8 8	2207. 77	2098.4 3	3527.17
5	Calcium	mg/kg	1782.4 1	1115.98	1494.54	1612.8 3	1415.2 2	1440. 84	1348.2 9	1225.17
6	Sodium	mg/kg	421.58	480.08	330.29	344.11	329.28	346.5 4	334.72	350.21
7	TPH	mg/kg	BDL (DL- 0.1)	BDL (DL-0.1)	BDL (DL-0.1)	BDL (DL- 0.1)	BDL (DL- 0.1)	BDL (DL- 0.1)	BDL (DL- 0.1)	BDL (DL- 0.1)
8	PAH	mg/kg	BLQ (LOQ- 0.25)	BLQ (LOQ- 0.25)	BLQ (LOQ- 0.25)	BLQ (LOQ- 0.25)	BLQ (LOQ- 0.25)	BLQ (LOQ- -0.25)	BLQ (LOQ- 0.25)	BLQ (LOQ- 0.25)
9	Phenols	mg/kg	BDL (DL- 0.01)	BDL (DL- 0.01)	BDL (DL- 0.01)	BDL (DL- 0.01)	BDL (DL- 0.01)	BDL (DL- 0.01)	BDL (DL- 0.01)	BDL (DL- 0.01)
10	Benzene	mg/kg	BLQ (LOQ- 0.2)	BLQ (LOQ- 0.2)	BLQ (LOQ- 0.2)	BLQ (LOQ- 0.2)	BLQ (LOQ- 0.2)	BLQ (LOQ- -0.2)	BLQ (LOQ- 0.2)	BLQ (LOQ-0.2)
11	Toluene	mg/kg	BLQ (LOQ- 0.2)	BLQ (LOQ- 0.2)	BLQ (LOQ- 0.2)	BLQ (LOQ- 0.2)	BLQ (LOQ- 0.2)	BLQ (LOQ- -0.2)	BLQ (LOQ- 0.2)	BLQ (LOQ-0.2)
12	Ethyl benzene	mg/kg	BLQ (LOQ- 0.2)	BLQ (LOQ- 0.2)	BLQ (LOQ- 0.2)	BLQ (LOQ- 0.2)	BLQ (LOQ- 0.2)	BLQ (LOQ- -0.2)	BLQ (LOQ- 0.2)	BLQ (LOQ-0.2)
13	Xylene	mg/kg	BLQ (LOQ- 0.2)	BLQ (LOQ- 0.2)	BLQ (LOQ- 0.2)	BLQ (LOQ- 0.2)	BLQ (LOQ- 0.2)	BLQ (LOQ- -0.2)	BLQ (LOQ- 0.2)	BLQ (LOQ-0.2)
14	Naphthalene	mg/kg	BLQ (LOQ- 0.25)	BLQ (LOQ- 0.25)	BLQ (LOQ- 0.25)	BLQ (LOQ- 0.25)	BLQ (LOQ- 0.25)	BLQ (LOQ- -0.25)	BLQ (LOQ- 0.25)	BLQ (LOQ- 0.25)

Source: Avon Food Labs Private Limited

BLQ: Below Limit of Quantification

LOQ: Limit of Quantification

The above results have been compared with the standard soil classification as given in Table below.

Table 5.14: Standard Soil Classification

SN.	Soil Test Parameters	Classification
1	pH	<4.5 Extremely acidic 4.51-5.00 Very strongly acidic 5.00-5.50 slightly acidic 5.51-6.0 moderately acidic 6.01-6.50 slightly acidic

SN.	Soil Test Parameters	Classification
		6.51-7.30 Neutral 7.31-7.80 slightly alkaline 7.81-8.50 moderately alkaline 8.51-9.0 strongly alkaline 9.01 very strongly alkaline
2	Salinity Electrical Conductivity (mmhos/cm) (1 ppm = 640 mhos/cm)	Up to 1.00 Average 1.01-2.00 harmful to germination 2.01-3.00 harmful to crops (sensitive to salts)
3	Organic Carbon	Up to 0.2: very less 0.21-0.4: less 0.41-0.5 medium, 0.51-0.8: on an average sufficient 0.81-1.00: sufficient >1.0 more than sufficient
4	Nitrogen (kg/ha)	Up to 50 very less 51-100 less 101-150 good 151-300 Better >300 sufficient
5	Phosphorus (kg/ha)	Up to 15 very less 16-30 less 31-50 medium, 51-65 on an average sufficient 66-80 sufficient >80 more than sufficient
6	Potash (kg/ha)	0-120 very less 120-180 less 181-240 medium 241-300 average 301-360 better >360 more than sufficient

Source: Handbook of agriculture, Indian Council of Agricultural Research, New Delhi, India

Discussion of Results

- Texture:** The texture of soil samples analysed at eight locations were found to be either Sandy loam or loam. Such soils are normally made up of sand along with varying amounts of silt and clay and is considered good for gardening and agricultural purposes. Sand particles are often larger and more solid than other types of particles found in soil, and for this reason there is normally more room for water to move freely through it.
- pH:** Generally, soil pH in the range of 6.50-7.00 is considered to be best suited for growing most crops. The pH level in soil samples were observed to be in range of 7.54-8.49 indicating slightly alkaline to moderately alkaline nature of soil in the project study area as per standard soil classification;
- Electrical Conductivity:** EC is used to estimate the soluble salt concentration in soil, and is commonly used as a measure of salinity. The EC value of soil samples were found to be in range of 162 (SQ3) and 450 μ S/cm (SQ4). This indicates low concentration of soluble salts in the soil;

- **BTEX contamination:** Soil contamination with benzene, toluene, ethylbenzene and xylene isomers (BTEX) has raised increasing concern because of its high solubility in water and toxicity to biotic communities. In the project study area, the concentration of BTEX is found Below Limit of Quantification.

Figure 5.14 Map Showing Environmental Monitoring Locations

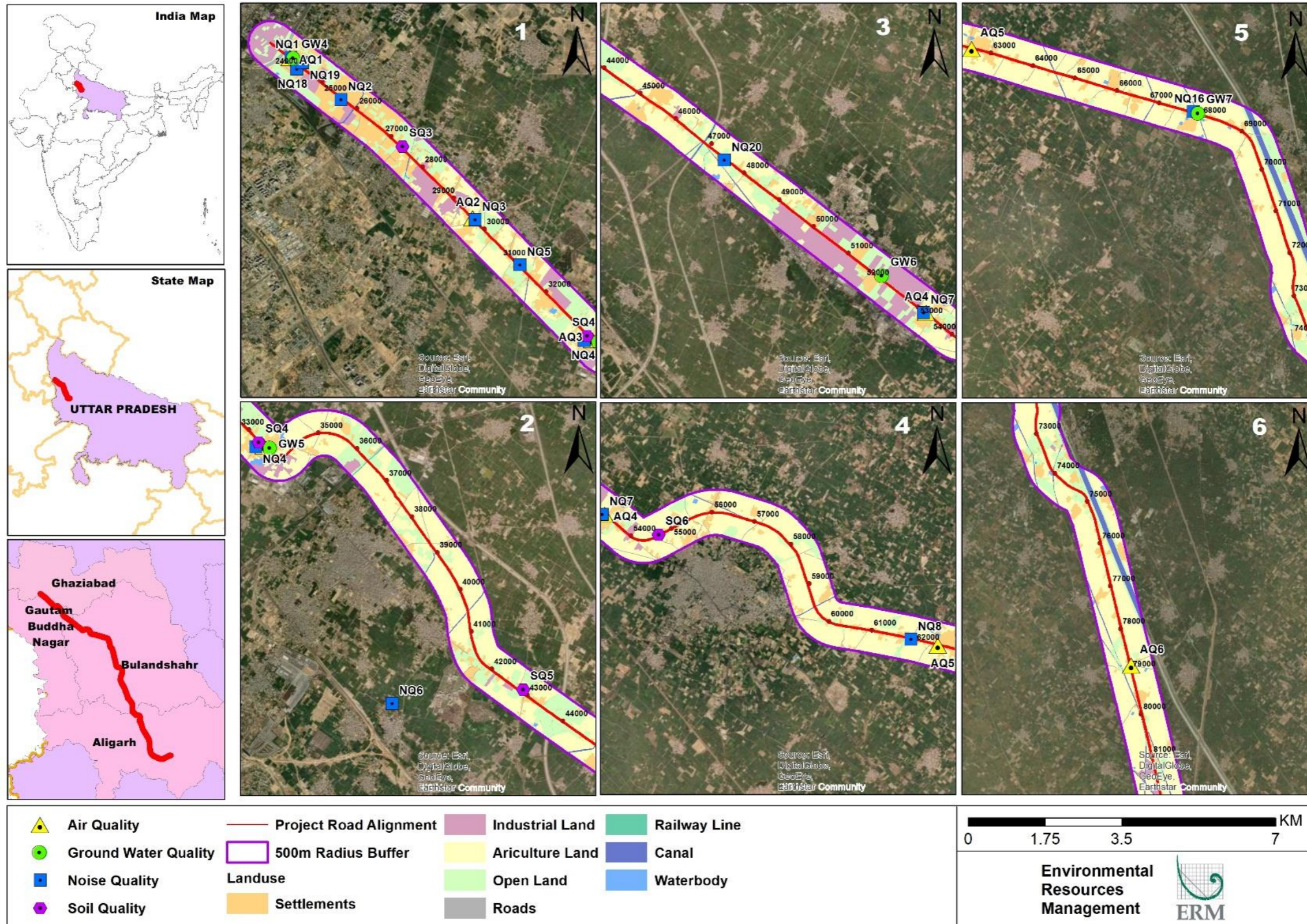
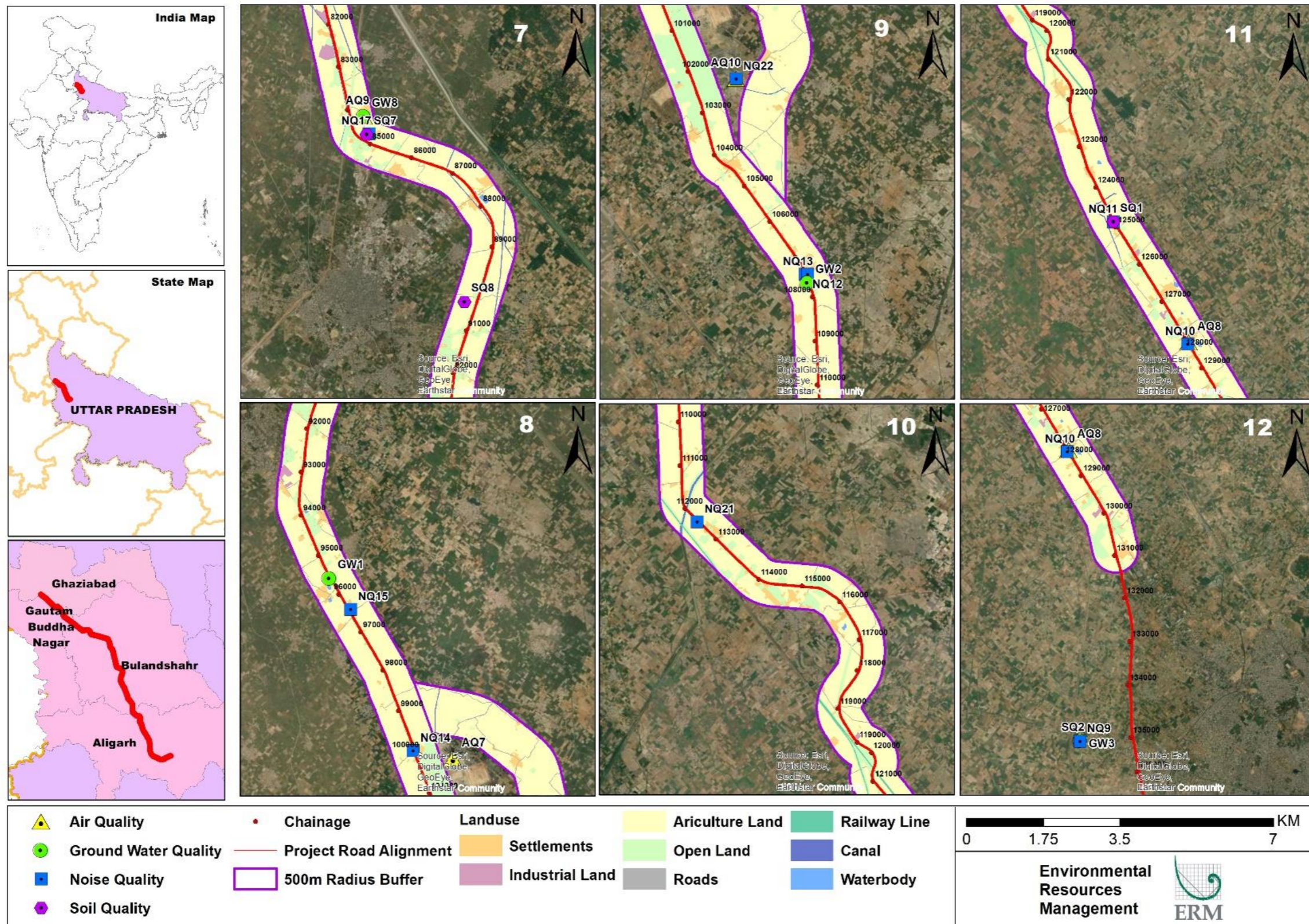


Figure 5.15 Map Showing Environmental Monitoring Locations



5.2.10 Natural Hazards

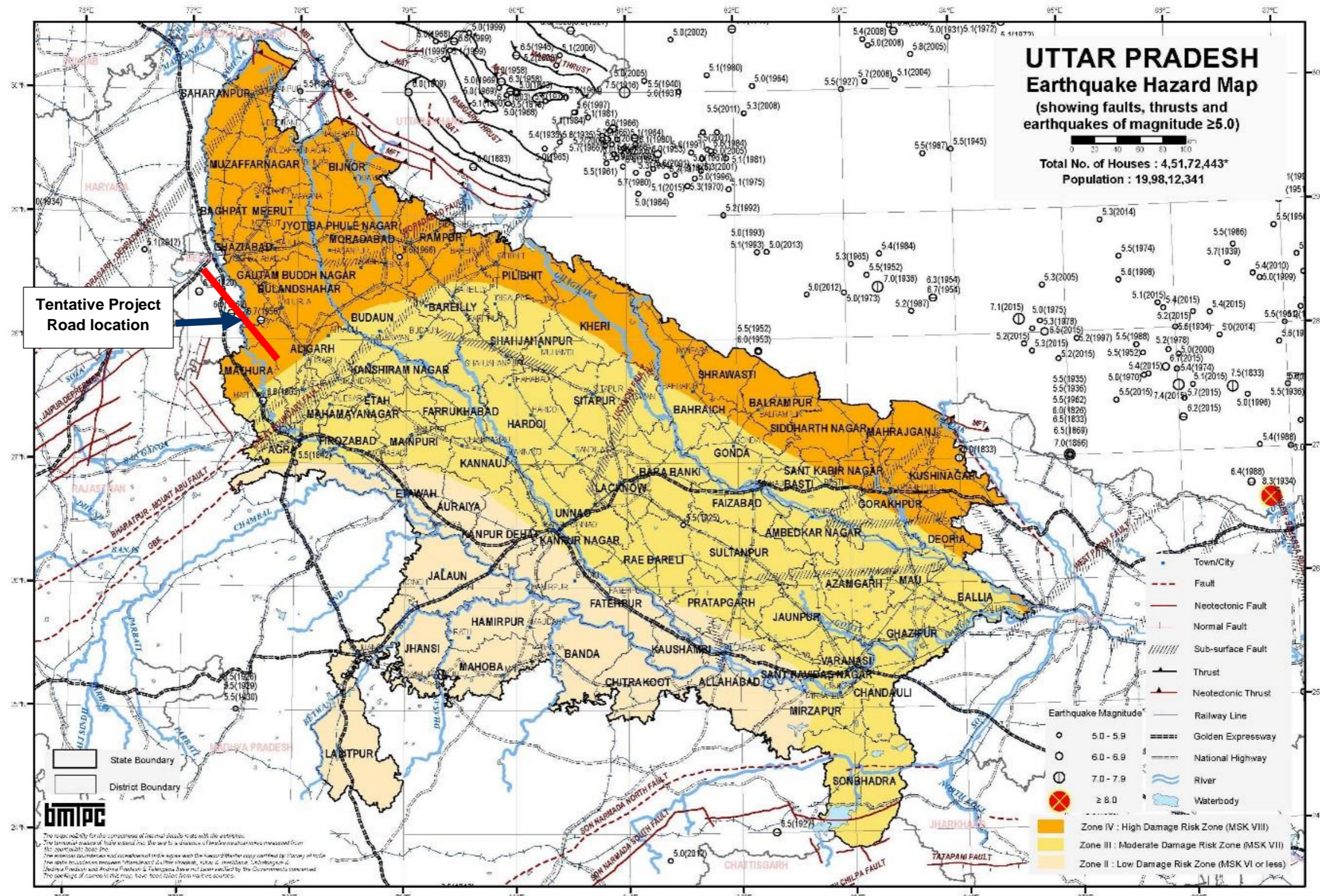
Building Materials & Technology Promotion Council (BMTPC), Government of India, have published hazard maps of Uttar Pradesh. As per these maps the study area falls under the respective hazard zones as given in **Table 5.1514**. Hazard zonation maps of the state for earthquake, wind/cyclone, and flood with marked indicative project road are presented in **Figure 5.1615**, **Figure 5.1716** and **Figure 5.1817**.

Table 5.15 Natural Hazard Details, Uttar Pradesh

Characteristics	Details
Earthquake	As per the data released by Building Materials & Technology Promotion Council (BMTPC) of Government of India and Disaster Management, the Project road is located in an area that is designated as Zone IV that corresponds to MSK VIII with Risk of Partial Collapse and Heavy Damage. However, there were no major earthquakes occurred in project area till date.
Wind/cyclone	As per the data released by Building Materials & Technology Promotion Council (BMTPC) of Government of India and Disaster Management, the Project site is located in a an area that experiences high wind velocities $V_b = 50$ m/s and the zone is classified as very high damage risk zone for cyclones.
Flood	As per the data released by Building Materials & Technology Promotion Council (BMTPC) of Government of India and Disaster Management, the Project site falls in an area which is likely prone to flooding incidents.

Source: Building Materials & Technology Promotion Council (BMTPC), Government of India.

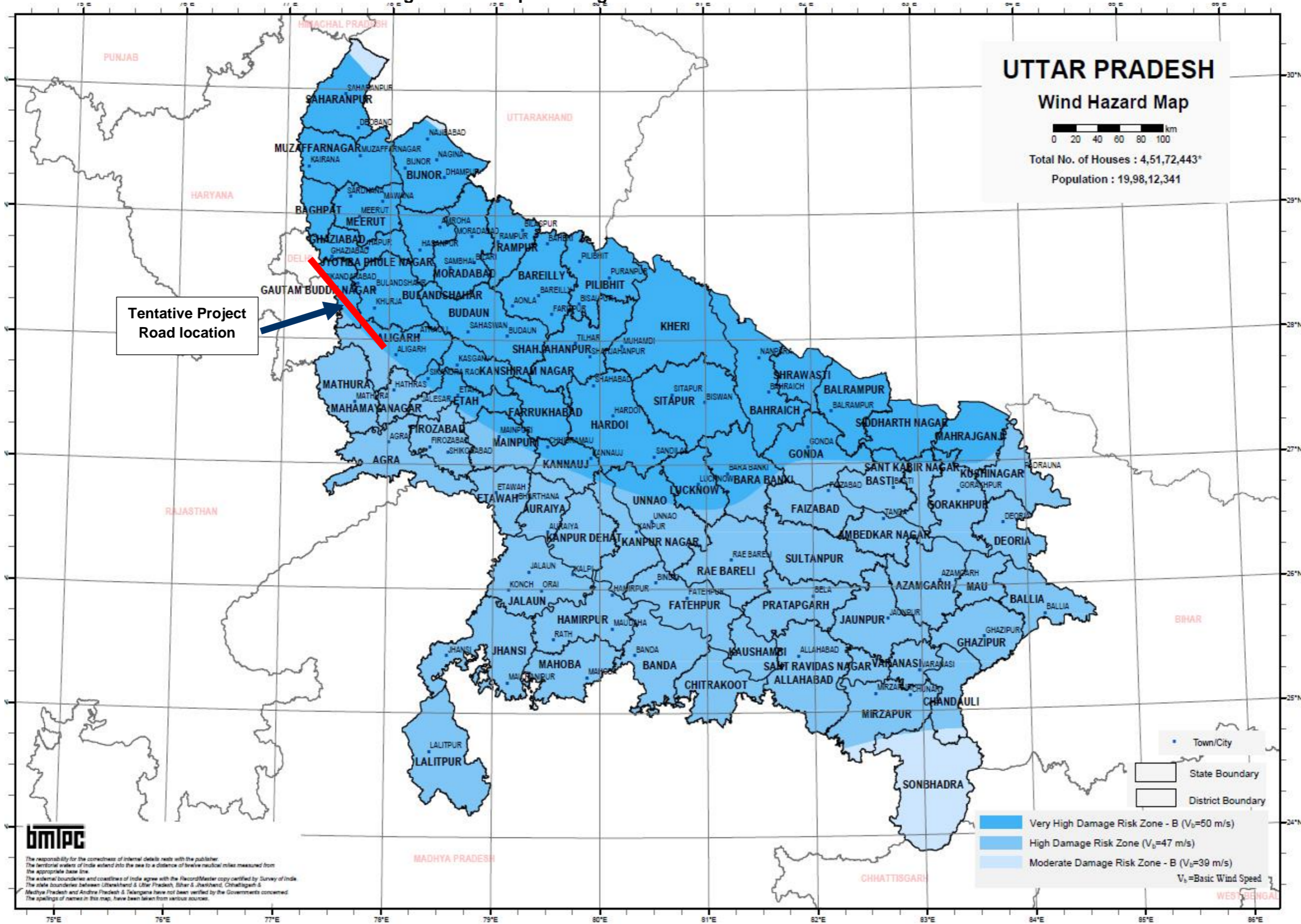
Figure 5.16 Map Showing Earthquake Zones in Uttar Pradesh



BMTPC : Vulnerability Atlas - 3rd Edition : Peer Group, MoHUA, GOI; Map is Based on digitised data of SOI; Seismic Zones of India Map IS: 1893 (Part I): 2002, BIS; Earthquake Epicentre from IMD; Seismotectonic Atlas of India and its Environs, GSI; Houses/Population as per Census 2011; *Houses including vacant & locked houses. Disclaimer: The maps are solely for thematic presentation.

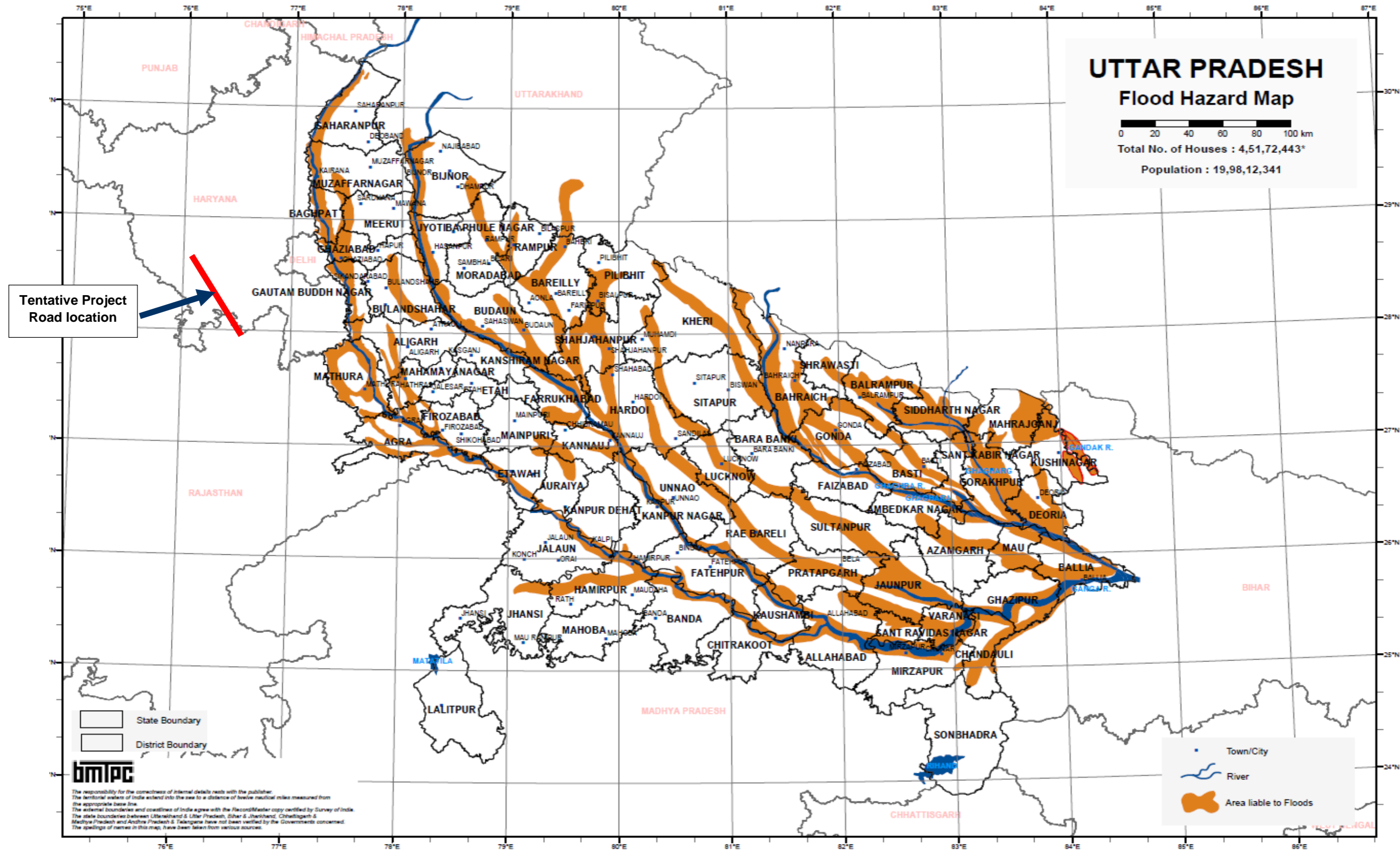
Source: Building Materials & Technology Promotion Council (BMTPC), Government of India.

Figure 5.17 Map Showing Wind Hazard Zones in Uttar Pradesh



Source: Building Materials & Technology Promotion Council (BMTPC), Government of India.

Figure 5.18 Map Showing Flood Hazard Zones in Uttar Pradesh



Source: Building Materials & Technology Promotion Council (BMTPC), Government of India

5.3 Ecological Baseline

An ecological survey was undertaken along the road stretch (from Ghaziabad to Aligarh), for the road expansion Project from 4th August 2021 to 6th August 2021 (03 days). The purpose of the survey was to establish an ecological baseline of the study area and to understand the impacts of the project on species and habitats in the surrounding areas and finally in the management strategy and mitigation.

5.3.1 Objectives of the Ecological Study

The ecological surveys were conducted with the following objectives:

5.3.1.1 Baseline assessment of Flora

- Identification of sensitive habitats (terrestrial as well as aquatic) and forest land falling within the determined study areas (Core + Buffer);
- Classification of flora for any endangered or protected or restricted range floral species prevailing in the study area based on field surveys; and
- Identification of areas protected under international conventions, national or local legislation and those recognized nationally and internationally for their ecological, landscape, cultural or other related value.

5.3.1.2 Baseline assessment of Fauna

- Identification of fauna (specifically birds, mammals and herpetofauna) based on direct sightings, calls, pugmarks, if any, droppings, nests, etc.
- Identification and classification of any species recognized as threatened (in accordance with International Union for the Conservation of Nature [IUCN] Red List Online Version 2021-2) and according to the schedules of the Wildlife (Protection) Act, 1972, restricted range and migratory/congregatory as defined in IFC PS 6 (2019)
- Identification of areas (terrestrial as well as aquatic) which are important or sensitive for ecological reasons including their breeding, nesting, foraging, resting, over wintering areas including wildlife migratory corridors/avian migratory routes.

5.3.2 Approach and Methodology

5.3.2.1 Determining Study Area

The study area for ecological assessment of the road project is as follows:

- Core area: ROW of the road.
- Buffer area: of 500 m radius from the ROW of the road.

The above core and buffer areas were established based on sensitivities identified during desktop review and experience gathered from multiple linear project ecological assessments carried out by ERM in the last few years.

5.3.2.2 Baseline Ecological Survey

A baseline survey was carried out to determine the existing ecological conditions and to facilitate an adequate assessment of the project's impacts upon ecology and development of appropriate mitigation measures. The baseline survey had two parts, (i) Secondary data collection and (ii) Primary data collection.

Secondary Data Collection

Secondary baseline data regarding Protected Areas, Key Biodiversity Areas and other Internationally Recognized Areas, threatened, range restricted and migratory and congregatory species etc.) and forest cover was collected from reliable sources like published documents, online bird databases such as eBird and Birdlife Data zone on IBAs of Birdlife International etc. Consultations were carried out with local people to understand flora & fauna of conservation significance in the study area, presence of any Schedule I species, migratory species or other species having conservation value and pressures on forest resource. Key consultations were made with the local communities on the presence of various avifaunal and mammalian species on the presence of Critically Endangered (CR), Endangered (EN) and Scheduled species (as per Indian Wild Life (Protection) Act, 1972) in and around the proposed project area.

Results of eBird Database

To understand the activity of the migratory birds in the region, data of migratory birds was extracted from the eBird Database²⁰. According to this secondary information, 77 migratory birds were reported from the region. A list of these migratory birds with their latest IUCN Red List (Online Version 2021-2) and Wildlife Protection Act Schedule status has been presented in **Table 5.1615**.

The database reported, three Endangered [Black-bellied Tern (*Sterna acuticauda*), Egyptian Vulture (*Neophron percnopterus*), Steppe Eagle (*Aquila nipalensis*)]; four were Vulnerable [Common Pochard (*Aythya farina*), Greater Spotted Eagle (*Clanga clanga*), Indian Spotted Eagle (*Clanga hastate*), & Sarus Crane (*Antigone antigone*)]; and twelve Near Threatened [Asian Woollyneck (*Ciconia episcopus*), Alexandrine Parakeet (*Palaeornis eupatria*), Black-headed Ibis (*Threskiornis melanocephalus*), Black-necked Stork (*Ephippiorhynchus asiaticus*), Black-tailed Godwit (*Limosa limosa*), Ferruginous Duck (*Aythya nyroca*), Laggar Falcon (*Falco jugger*), Northern Lapwing (*Vanellus vanellus*), Oriental Darter (*Anhinga melanogaster*), Painted Stork (*Mycteria leucocephala*), River Lapwing (*Vanellus duvaucelii*), & River Tern (*Sterna aurantia*)] species as per the latest IUCN Red List (Online Version 2021-2).

Eighteen (18) species [Black Eagle (*Ictinaetus malaiensis*), Black Kite (*Milvus migrans*), Black-winged Kite (*Elanus caeruleus*), Bonelli's Eagle (*Aquila fasciata*), Booted Eagle (*Hieraaetus pennatus*), Crested Serpent-Eagle (*Spilornis cheela*), Eurasian Sparrowhawk (*Accipiter nisus*), Eurasian Spoonbill (*Platalea leucorodia*), Greater Spotted Eagle (*Clanga clanga*), Indian Grey Hornbill (*Ocyroceros birostris*), Indian Peafowl (*Pavo cristatus*), Laggar Falcon (*Falco jugger*), Long-legged Buzzard (*Buteo rufinus*), Oriental Honey-buzzard (*Pernis ptilorhynchus*), Shikra (*Accipiter badius*), Steppe Eagle (*Aquila nipalensis*), Western Marsh-Harrier (*Circus aeruginosus*), & White-eyed Buzzard (*Butastur teesa*)] were listed as Schedule I; 189 species as Schedule IV; and 01 as Schedule V under Wildlife Protection Act, 1972 (15 species were not listed under any category of the Schedule species).

Table 5.16 Birds reported from the region

Sr. No.	Common Name	Scientific Name	Migratory Status	IUCN Red List Status (Online Version 2021-2)	Wildlife Protection Act Schedule
1	Alexandrine Parakeet	<i>Palaeornis eupatria</i>	R	Near Threatened	Schedule IV
2	African Comb Duck	<i>Sarkidiornis melanotos</i>	R	Least Concern	Schedule IV
3	Ashy Drongo	<i>Dicrurus leucophaeus</i>	R	Least Concern	Schedule IV

²⁰ eBird Database [<https://ebird.org/hotspot/L3810713>; <https://ebird.org/hotspot/L2712373>; <https://ebird.org/hotspot/L7189330>; <https://ebird.org/hotspot/L15592241>]

Sr. No.	Common Name	Scientific Name	Migratory Status	IUCN Red List Status (Online Version 2021-2)	Wildlife Protection Act Schedule
4	Ashy Prinia	<i>Prinia socialis</i>	R	Least Concern	Schedule IV
5	Ashy-crowned Sparrow-lark	<i>Eremopterix griseus</i>	R	Least Concern	Schedule IV
6	Asian Desert Warbler	<i>Sylvia nana</i>	M	Least Concern	Schedule IV
7	Asian Koel	<i>Eudynamys scolopaceus</i>	R	Least Concern	Schedule IV
8	Asian Openbill	<i>Anastomus oscitans</i>	R	Least Concern	Schedule IV
9	Asian Pied Starling	<i>Gracupica contra</i>	R	Least Concern	Schedule IV
10	Asian Plain Martin	<i>Riparia chinensis</i>	R	Least Concern	Not Listed
11	Asian Woollyneck	<i>Ciconia episcopus</i>	R	Near Threatened	Schedule IV
12	Bank Myna	<i>Acridotheres ginginianus</i>	R	Least Concern	Schedule IV
13	Bar-headed Goose	<i>Anser indicus</i>	M	Least Concern	Schedule IV
14	Barn Owl	<i>Tyto alba</i>	R	Least Concern	Schedule IV
15	Barn Swallow	<i>Hirundo rustica</i>	R	Least Concern	Not Listed
16	Barred Buttonquail	<i>Turnix suscitator</i>	R	Least Concern	Schedule IV
17	Baya Weaver	<i>Ploceus philippinus</i>	R	Least Concern	Schedule IV
18	Bay-backed Shrike	<i>Lanius vittatus</i>	R	Least Concern	Not Listed
19	Bengal Bushlark	<i>Mirafra assamica</i>	R	Least Concern	Schedule IV
20	Black Bittern	<i>Ixobrychus flavicollis</i>	M	Least Concern	Schedule IV
21	Black Drongo	<i>Dicrurus macrocercus</i>	R	Least Concern	Schedule IV
22	Black Eagle	<i>Ictinaetus malaiensis</i>	R	Least Concern	Schedule I
23	Black Francolin	<i>Francolinus francolinus</i>	R	Least Concern	Schedule IV
24	Black Kite	<i>Milvus migrans</i>	R	Least Concern	Schedule I
25	Black Redstart	<i>Phoenicurus ochruros</i>	M	Least Concern	Schedule IV
26	Black Stork	<i>Ciconia nigra</i>	M	Least Concern	Schedule IV
27	Black-bellied Tern	<i>Sterna acuticauda</i>	R	Endangered	Schedule IV
28	Black-breasted Weaver	<i>Ploceus benghalensis</i>	R	Least Concern	Schedule IV
29	Black-crowned Night Heron	<i>Nycticorax Nycticorax</i>	R	Least Concern	Schedule IV
30	Black-headed Gull	<i>Chroicocephalus ridibundus</i>	M	Least Concern	Schedule IV
31	Black-headed Ibis	<i>Threskiornis melanocephalus</i>	R	Near Threatened	Schedule IV
32	Black-hooded Oriole	<i>Oriolus xanthornus</i>	R	Least Concern	Schedule IV
33	Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	R	Near Threatened	Schedule IV
34	Black-rumped Flameback	<i>Dinopium benghalense</i>	R	Least Concern	Schedule IV
35	Black-tailed Godwit	<i>Limosa limosa</i>	M	Near Threatened	Schedule IV
36	Black-throated Thrush	<i>Turdus atrogularis</i>	M	Least Concern	Schedule IV
37	Black-winged Kite	<i>Elanus caeruleus</i>	R	Least Concern	Schedule I
38	Black-winged Stilt	<i>Himantopus himantopus</i>	R	Least Concern	Schedule IV

Sr. No.	Common Name	Scientific Name	Migratory Status	IUCN Red List Status (Online Version 2021-2)	Wildlife Protection Act Schedule
39	Blue-cheeked Bee-eater	<i>Merops persicus</i>	R	Least Concern	Not Listed
40	Blue-tailed Bee-eater	<i>Merops philippinus</i>	R	Least Concern	Schedule IV
41	Bluethroat	<i>Cyanecula svecica</i>	M	Least Concern	Schedule IV
42	Blyth's Reed Warbler	<i>Acrocephalus dumetorum</i>	M	Least Concern	Schedule IV
43	Bonelli's Eagle	<i>Aquila fasciata</i>	R	Least Concern	Schedule I
44	Booted Eagle	<i>Hieraetus pennatus</i>	M	Least Concern	Schedule I
45	Brahminy Starling	<i>Sturnia pagodarum</i>	R	Least Concern	Schedule IV
46	Bronze-winged Jacana	<i>Metopidius indicus</i>	R	Least Concern	Schedule IV
47	Brown Fish-Owl	<i>Ketupa zeylonensis</i>	R	Least Concern	Schedule IV
48	Brown Rock-Chat	<i>Oenanthe fusca</i>	R	Least Concern	Schedule IV
49	Brown Shrike	<i>Lanius cristatus</i>	M	Least Concern	Not Listed
50	Brown-headed Barbet	<i>Psilopogon zeylanicus</i>	R	Least Concern	Schedule IV
51	Brown-headed Gull	<i>Larus brunnicephalus</i>	M	Least Concern	Schedule IV
52	Cattle Egret	<i>Bubulcus ibis</i>	R	Least Concern	Schedule IV
53	Cinnamon Bittern	<i>Ixobrychus cinnamomeus</i>	R	Least Concern	Schedule IV
54	Clamorous Reed Warbler	<i>Acrocephalus stentoreus</i>	R	Least Concern	Schedule IV
55	Common Babbler	<i>Argya caudata</i>	R	Least Concern	Schedule IV
56	Common Chiffchaff	<i>Phylloscopus collybita</i>	M	Least Concern	Schedule IV
57	Common Coot	<i>Fulica atra</i>	R	Least Concern	Schedule IV
58	Common Greenshank	<i>Tringa nebularia</i>	M	Least Concern	Schedule IV
59	Common Hawk-cuckoo	<i>Hierococcyx varius</i>	R	Least Concern	Schedule IV
60	Common Hoopoe	<i>Upupa epops</i>	R	Least Concern	Not Listed
61	Common Kestrel	<i>Falco tinnunculus</i>	M	Least Concern	Schedule IV
62	Common Kingfisher	<i>Alcedo atthis</i>	R	Least Concern	Schedule IV
63	Common Moorhen	<i>Gallinula chloropus</i>	R	Least Concern	Schedule IV
64	Common Myna	<i>Acridotheres tristis</i>	R	Least Concern	Schedule IV
65	Common Pochard	<i>Aythya ferina</i>	M	Vulnerable	Schedule IV
66	Common Redshank	<i>Tringa totanus</i>	M	Least Concern	Schedule IV
67	Common Sandpiper	<i>Actitis hypoleucos</i>	M	Least Concern	Schedule IV
68	Common Snipe	<i>Gallinago gallinago</i>	M	Least Concern	Schedule IV
69	Common Starling	<i>Sturnus vulgaris</i>	M	Least Concern	Schedule IV
70	Common Tailorbird	<i>Orthotomus sutorius</i>	R	Least Concern	Schedule IV
71	Common Woodshrike	<i>Tephrodornis pondicerianus</i>	R	Least Concern	Schedule IV
72	Coppersmith Barbet	<i>Psilopogon haemacephalus</i>	R	Least Concern	Schedule IV

Sr. No.	Common Name	Scientific Name	Migratory Status	IUCN Red List Status (Online Version 2021-2)	Wildlife Protection Act Schedule
73	Cotton Pygmy-goose	<i>Nettapus coromandelianus</i>	M	Least Concern	Schedule IV
74	Crested Lark	<i>Galerida cristata</i>	R	Least Concern	Schedule IV
75	Crested Serpent-Eagle	<i>Spilornis cheela</i>	M	Least Concern	Schedule I
76	Desert Wheatear	<i>Oenanthe deserti</i>	M	Least Concern	Schedule IV
77	Dusky Crag-Martin	<i>Ptyonoprogne concolor</i>	R	Least Concern	Not Listed
78	Egyptian Vulture	<i>Neophron percnopterus</i>	R	Endangered	Schedule IV
79	Eurasian Collared-Dove	<i>Streptopelia decaocto</i>	R	Least Concern	Schedule IV
80	Eurasian Sparrowhawk	<i>Accipiter nisus</i>	M	Least Concern	Schedule I
81	Eurasian Spoonbill	<i>Platalea leucorodia</i>	R	Least Concern	Schedule I
82	European Roller	<i>Coracias garrulus</i>	M	Least Concern	Schedule IV
83	Ferruginous Duck	<i>Aythya nyroca</i>	M	Near Threatened	Schedule IV
84	Gadwall	<i>Mareca strepera</i>	M	Least Concern	Schedule IV
85	Garganey	<i>Spatula querquedula</i>	M	Least Concern	Schedule IV
86	Glossy Ibis	<i>Plegadis falceinellus</i>	M	Least Concern	Schedule IV
87	Great Cormorant	<i>Phalacrocorax carbo</i>	R	Least Concern	Schedule IV
88	Great Egret	<i>Ardea alba</i>	R	Least Concern	Schedule IV
89	Greater Coucal	<i>Centropus sinensis</i>	R	Least Concern	Schedule IV
90	Greater Flamingo	<i>Phoenicopterus roseus</i>	M	Least Concern	Schedule IV
91	Greater Painted-snipe	<i>Rostratula benghalensis</i>	R	Least Concern	Not Listed
92	Greater Spotted Eagle	<i>Clanga clanga</i>	M	Vulnerable	Schedule I
93	Green Bee-eater	<i>Merops orientalis</i>	R	Least Concern	Schedule IV
94	Green Sandpiper	<i>Tringa ochropus</i>	M	Least Concern	Schedule IV
95	Greenish Warbler	<i>Phylloscopus trochiloides</i>	M	Least Concern	Schedule IV
96	Grey Francolin	<i>Francolinus pondicerianus</i>	R	Least Concern	Schedule IV
97	Grey Heron	<i>Ardea cinerea</i>	R	Least Concern	Schedule IV
98	Grey Wagtail	<i>Motacilla cinerea</i>	M	Least Concern	Schedule IV
99	Greylag Goose	<i>Anser anser</i>	M	Least Concern	Schedule IV
100	House Crow	<i>Corvus splendens</i>	R	Least Concern	Schedule V
101	House Sparrow	<i>Passer domesticus</i>	R	Least Concern	Schedule IV
102	Indian Bushlark	<i>Mirafra erythroptera</i>	R	Least Concern	Schedule IV
103	Indian Cormorant	<i>Phalacrocorax fuscicollis</i>	R	Least Concern	Schedule IV
104	Indian Golden Oriole	<i>Oriolus kundoo</i>	R	Least Concern	Schedule IV
105	Indian Grey Hornbill	<i>Ocyrceros birostris</i>	R	Least Concern	Schedule I
106	Indian Paradise-flycatcher	<i>Terpsiphone paradisi</i>	R	Least Concern	Schedule IV
107	Indian Peafowl	<i>Pavo cristatus</i>	R	Least Concern	Schedule I
108	Indian Pond Heron	<i>Ardeola grayii</i>	R	Least Concern	Schedule IV
109	Indian Robin	<i>Saxicoloides fulicata</i>	R	Least Concern	Schedule IV

Sr. No.	Common Name	Scientific Name	Migratory Status	IUCN Red List Status (Online Version 2021-2)	Wildlife Protection Act Schedule
110	Indian Scops-owl	<i>Otus bakkamoena</i>	R	Least Concern	Schedule IV
111	Indian Silverbill	<i>Euodice malabarica</i>	R	Least Concern	Schedule IV
112	Indian Spot-billed Duck	<i>Anas poecilorhyncha</i>	R	Least Concern	Schedule IV
113	Indian Spotted Eagle	<i>Clanga hastata</i>	R	Vulnerable	Not Listed
114	Indian Thick-knee	<i>Burhinus indicus</i>	R	Least Concern	Not Listed
115	Indian White-eye	<i>Zosterops palpebrosus</i>	R	Least Concern	Schedule IV
116	Intermediate Egret	<i>Ardea intermedia</i>	R	Least Concern	Schedule IV
117	Isabelline Shrike	<i>Lanius isabellinus</i>	M	Least Concern	Not Listed
118	Isabelline Wheatear	<i>Oenanthe isabellina</i>	M	Least Concern	Schedule IV
119	Jungle Babbler	<i>Turdoides striatus</i>	R	Least Concern	Schedule IV
120	Kentish Plover	<i>Charadrius alexandrinus</i>	M	Least Concern	Schedule IV
121	Laggar Falcon	<i>Falco jugger</i>	R	Near Threatened	Schedule I
122	Large Grey Babbler	<i>Argya malcolmi</i>	R	Least Concern	Schedule IV
123	Large-billed Crow	<i>Corvus macrorhynchos</i>	R	Least Concern	Schedule IV
124	Laughing Dove	<i>Streptopelia senegalensis</i>	R	Least Concern	Schedule IV
125	Lesser Whistling-duck	<i>Dendrocygna javanica</i>	R	Least Concern	Schedule IV
126	Lesser Whitethroat	<i>Sylvia curruca</i>	M	Least Concern	Schedule IV
127	Little Cormorant	<i>Microcarbo niger</i>	R	Least Concern	Schedule IV
128	Little Egret	<i>Egretta garzetta</i>	R	Least Concern	Schedule IV
129	Little Grebe	<i>Tachybaptus ruficollis</i>	R	Least Concern	Schedule IV
130	Little Ringed Plover	<i>Charadrius dubius</i>	R	Least Concern	Schedule IV
131	Little Stint	<i>Calidris minuta</i>	R	Least Concern	Schedule IV
132	Little Swift	<i>Apus affinis</i>	R	Least Concern	Not Listed
133	Long-billed Pipit	<i>Anthus similis</i>	M	Least Concern	Schedule IV
134	Long-legged Buzzard	<i>Buteo rufinus</i>	M	Least Concern	Schedule I
135	Long-tailed Shrike	<i>Lanius schach</i>	R	Least Concern	Not Listed
136	Mallard	<i>Anas platyrhynchos</i>	M	Least Concern	Schedule IV
137	Marsh Sandpiper	<i>Tringa stagnatilis</i>	M	Least Concern	Schedule IV
138	Northern Lapwing	<i>Vanellus vanellus</i>	M	Near Threatened	Schedule IV
139	Northern Pintail	<i>Anas acuta</i>	M	Least Concern	Schedule IV
140	Northern Shoveler	<i>Spatula clypeata</i>	M	Least Concern	Schedule IV
141	Olive-backed Pipit	<i>Anthus hodgsoni</i>	M	Least Concern	Schedule IV
142	Oriental Darter	<i>Anhinga melanogaster</i>	R	Near Threatened	Schedule IV
143	Oriental Honey-buzzard	<i>Pernis ptilorhynchus</i>	R	Least Concern	Schedule I
144	Oriental Magpie-Robin	<i>Copsychus saularis</i>	R	Least Concern	Schedule IV
145	Oriental Skylark	<i>Alauda gulgula</i>	R	Least Concern	Schedule IV

Sr. No.	Common Name	Scientific Name	Migratory Status	IUCN Red List Status (Online Version 2021-2)	Wildlife Protection Act Schedule
146	Oriental Turtle-Dove	<i>Streptopelia orientalis</i>	R	Least Concern	Schedule IV
147	Paddyfield Pipit	<i>Anthus rufulus</i>	R	Least Concern	Schedule IV
148	Painted Stork	<i>Mycteria leucocephala</i>	R	Near Threatened	Schedule IV
149	Pallas's Gull	<i>Larus ichthyaetus</i>	M	Least Concern	Schedule IV
150	Peregrine Falcon	<i>Falco peregrinus</i>	M	Least Concern	Schedule IV
151	Pheasant-tailed Jacana	<i>Hydrophasianus chirurgus</i>	R	Least Concern	Schedule IV
152	Pied Avocet	<i>Recurvirostra avosetta</i>	M	Least Concern	Schedule IV
153	Pied Bushchat	<i>Saxicola caprata</i>	R	Least Concern	Schedule IV
154	Pied Kingfisher	<i>Ceryle rudis</i>	R	Least Concern	Schedule IV
155	Plain Prinia	<i>Prinia inornata</i>	R	Least Concern	Schedule IV
156	Plum-headed Parakeet	<i>Psittacula cyanocephala</i>	R	Least Concern	Schedule IV
157	Purple Heron	<i>Ardea purpurea</i>	R	Least Concern	Schedule IV
158	Purple Sunbird	<i>Nectarinia asiatica</i>	R	Least Concern	Schedule IV
159	Purple Swamphen	<i>Porphyrio porphyrio</i>	R	Least Concern	Schedule IV
160	Rain Quail	<i>Coturnix coromandelica</i>	R	Least Concern	Schedule IV
161	Red Avadavat	<i>Amandava amandava</i>	R	Least Concern	Schedule IV
162	Red Collared-Dove	<i>Streptopelia tranquebarica</i>	R	Least Concern	Schedule IV
163	Red-breasted Flycatcher	<i>Ficedula parva</i>	M	Least Concern	Schedule IV
164	Red-crested Pochard	<i>Netta rufina</i>	M	Least Concern	Schedule IV
165	Red-headed Bunting	<i>Emberiza bruniceps</i>	M	Least Concern	Schedule IV
166	Red-naped Ibis	<i>Pseudibis papillosa</i>	R	Least Concern	Schedule IV
167	Red-rumped Swallow	<i>Cecropis daurica</i>	R	Least Concern	Schedule IV
168	Red-throated Flycatcher	<i>Ficedula albicilla</i>	M	Least Concern	Schedule IV
169	Red-vented Bulbul	<i>Pycnonotus cafer</i>	R	Least Concern	Schedule IV
170	Red-wattled Lapwing	<i>Vanellus indicus</i>	R	Least Concern	Schedule IV
171	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	R	Least Concern	Schedule IV
172	River Lapwing	<i>Vanellus duvaucelii</i>	R	Near Threatened	Schedule IV
173	River Tern	<i>Sterna aurantia</i>	R	Near Threatened	Schedule IV
174	Rock Dove	<i>Columba livia</i>	R	Least Concern	Schedule IV
175	Rose-ringed Parakeet	<i>Psittacula krameri</i>	R	Least Concern	Schedule IV
176	Rosy Pipit	<i>Anthus roseatus</i>	M	Least Concern	Schedule IV
177	Rosy Starling	<i>Pastor roseus</i>	M	Least Concern	Schedule IV
178	Ruddy Shelduck	<i>Tadorna ferruginea</i>	M	Least Concern	Schedule IV
179	Ruff	<i>Calidris pugnax</i>	M	Least Concern	Schedule IV
180	Rufous Treepie	<i>Dendrocitta vagabunda</i>	R	Least Concern	Schedule IV

Sr. No.	Common Name	Scientific Name	Migratory Status	IUCN Red List Status (Online Version 2021-2)	Wildlife Protection Act Schedule
181	Sarus Crane	<i>Antigone antigone</i>	R	Vulnerable	Schedule IV
182	Scaly-breasted Munia	<i>Lonchura punctulata</i>	R	Least Concern	Schedule IV
183	Shikra	<i>Accipiter badius</i>	R	Least Concern	Schedule I
184	Short-eared Owl	<i>Asio flammeus</i>	M	Least Concern	Schedule IV
185	Siberian Stonechat	<i>Saxicola maurus</i>	M	Not Listed	Schedule IV
186	Small Minivet	<i>Pericrocotus cinnamomeus</i>	M	Least Concern	Schedule IV
187	Spotted Crake	<i>Porzana porzana</i>	M	Least Concern	Schedule IV
188	Spotted Dove	<i>Spilopelia chinensis</i>	R	Least Concern	Schedule IV
189	Spotted Owlet	<i>Athene brama</i>	R	Least Concern	Schedule IV
190	Spotted Redshank	<i>Tringa erythropus</i>	M	Least Concern	Schedule IV
191	Steppe Eagle	<i>Aquila nipalensis</i>	M	Endangered	Schedule I
192	Streaked Weaver	<i>Ploceus manyar</i>	R	Least Concern	Schedule IV
193	Streak-throated Swallow	<i>Petrochelidon fluvicola</i>	R	Least Concern	Schedule IV
194	Striated Babbler	<i>Argya earlei</i>	R	Least Concern	Schedule IV
195	Striated Grassbird	<i>Megalurus palustris</i>	R	Least Concern	Schedule IV
196	Sulphur-bellied Warbler	<i>Phylloscopus griseolus</i>	M	Least Concern	Not Listed
197	Tawny Pipit	<i>Anthus campestris</i>	M	Least Concern	Schedule IV
198	Temminck's Stint	<i>Calidris temminckii</i>	M	Least Concern	Schedule IV
199	Tree Pipit	<i>Anthus trivialis</i>	M	Least Concern	Schedule IV
200	Tricoloured Munia	<i>Lonchura malacca</i>	R	Least Concern	Schedule IV
201	Tufted Duck	<i>Aythya fuligula</i>	M	Least Concern	Schedule IV
202	Variable Wheatear	<i>Oenanthe picata</i>	M	Least Concern	Schedule IV
203	Watercock	<i>Gallicrex cinerea</i>	R	Least Concern	Schedule IV
204	Western Marsh-Harrier	<i>Circus aeruginosus</i>	M	Least Concern	Schedule I
205	Western Yellow Wagtail	<i>Motacilla flava</i>	M	Least Concern	Schedule IV
206	Whiskered Tern	<i>Chlidonias hybrida</i>	R	Least Concern	Schedule IV
207	White Wagtail	<i>Motacilla alba</i>	M	Least Concern	Schedule IV
208	White-breasted Kingfisher	<i>Halcyon smyrnensis</i>	R	Least Concern	Schedule IV
209	White-breasted Waterhen	<i>Amauornis phoenicurus</i>	R	Least Concern	Schedule IV
210	White-browed Fantail	<i>Rhipidura aureola</i>	R	Least Concern	Schedule IV
211	White-browed Wagtail	<i>Motacilla maderaspatensis</i>	R	Least Concern	Schedule IV
212	White-capped Bunting	<i>Emberiza stewarti</i>	M	Least Concern	Schedule IV
213	White-eared Bulbul	<i>Pycnonotus leucotis</i>	R	Least Concern	Schedule IV
214	White-eyed Buzzard	<i>Butastur teesa</i>	R	Least Concern	Schedule I
215	White-tailed Lapwing	<i>Vanellus leucurus</i>	M	Least Concern	Schedule IV

Sr. No.	Common Name	Scientific Name	Migratory Status	IUCN Red List Status (Online Version 2021-2)	Wildlife Protection Act Schedule
216	Wire-tailed Swallow	<i>Hirundo smithii</i>	R	Least Concern	Not Listed
217	Wood Sandpiper	<i>Tringa glareola</i>	M	Least Concern	Schedule IV
218	Yellow Bittern	<i>Ixobrychus sinensis</i>	R	Least Concern	Schedule IV
219	Yellow-bellied Prinia	<i>Prinia flaviventris</i>	R	Least Concern	Schedule IV
220	Yellow-eyed Babbler	<i>Chrysomma sinense</i>	R	Least Concern	Schedule IV
221	Yellow-footed Green-Pigeon	<i>Treron phoenicopterus</i>	R	Least Concern	Schedule IV
222	Yellow-wattled Lapwing	<i>Vanellus malabaricus</i>	R	Least Concern	Schedule IV
223	Zitting Cisticola	<i>Cisticola juncidis</i>	R	Least Concern	Schedule IV

Source: eBird Database²¹.

Vultures and Raptors

Similarly, to understand the activity of the vultures and raptors in the region, district level data of raptors was extracted from the eBird Database²². According to this secondary information, one vulture and 18 raptors were reported from the region. A list of these birds of prey, with their latest IUCN Red List (Online Version 2021-2) and Wildlife Protection Act, 1972 Schedule status has been presented in **Table 5.1716**.

Table 5.17 Vultures and Raptors reported from the region

Sr. No.	Common Name	Scientific Name	Migratory Status	IUCN Red List Status (Online Version 2021-2)	Wildlife Protection Act Schedule
Vultures					
1	Egyptian Vulture	<i>Neophron percnopterus</i>	R	Endangered	Schedule IV
Raptors					
1	Black Eagle	<i>Ictinaetus malaiensis</i>	R	Least Concern	Schedule I
2	Black Kite	<i>Milvus migrans</i>	R	Least Concern	Schedule I
3	Black-winged Kite	<i>Elanus caeruleus</i>	R	Least Concern	Schedule I
4	Bonelli's Eagle	<i>Aquila fasciata</i>	R	Least Concern	Schedule I
5	Booted Eagle	<i>Hieraaetus pennatus</i>	M	Least Concern	Schedule I
6	Common Kestrel	<i>Falco tinnunculus</i>	M	Least Concern	Schedule IV
7	Crested Serpent-Eagle	<i>Spilornis cheela</i>	M	Least Concern	Schedule I
8	Eurasian Sparrowhawk	<i>Accipiter nisus</i>	M	Least Concern	Schedule I
9	Greater Spotted Eagle	<i>Clanga clanga</i>	M	Vulnerable	Schedule I
10	Indian Spotted Eagle	<i>Clanga hastata</i>	R	Vulnerable	Not Listed
11	Laggar Falcon	<i>Falco jugger</i>	R	Near Threatened	Schedule I
12	Long-legged Buzzard	<i>Buteo rufinus</i>	M	Least Concern	Schedule I

²¹ eBird Database [<https://ebird.org/hotspot/L3810713>; <https://ebird.org/hotspot/L2712373>; <https://ebird.org/hotspot/L7189330>; <https://ebird.org/hotspot/L15592241>]

²² eBird Database [<https://ebird.org/hotspot/L3810713>; <https://ebird.org/hotspot/L2712373>; <https://ebird.org/hotspot/L7189330>; <https://ebird.org/hotspot/L15592241>]

Sr. No.	Common Name	Scientific Name	Migratory Status	IUCN Red List Status (Online Version 2021-2)	Wildlife Protection Act Schedule
13	Oriental Honey-buzzard	<i>Pernis ptilorhynchus</i>	R	Least Concern	Schedule I
14	Peregrine Falcon	<i>Falco peregrinus</i>	M	Least Concern	Schedule IV
15	Shikra	<i>Accipiter badius</i>	R	Least Concern	Schedule I
16	Steppe Eagle	<i>Aquila nipalensis</i>	M	Endangered	Schedule I
17	Western Marsh-Harrier	<i>Circus aeruginosus</i>	M	Least Concern	Schedule I
18	White-eyed Buzzard	<i>Butastur teesa</i>	R	Least Concern	Schedule I

Source: eBird Database²³.

Primary Survey

Habitat Survey

Different habitats (natural, modified and critical) available within the study area identified by the desktop review were verified through site visit. Data regarding the type and quality of habitat with reference to flora and fauna supported were collected.

Floral Survey

The floral diversity of the study area was recorded by visual observation during the site visit and identified using published manuals. The information (Scientific publications) dealing with the floristic diversity of the related area available in the public domain were also considered in the survey.

Faunal Survey

Faunal species from the study areas were recorded based on direct sightings, indirect evidence such as dung, droppings, scats, pugmarks, scratch signs, burrows, nests etc. Consultations with local communities were carried out by displaying pictorial representations of species anticipated in the area to confirm whether there have been any recent sightings. The pictorial representation of the species was typically obtained from the authentic sources^{24, 25}. The species occurring within the study area were surveyed using the below methods:

a. Amphibians

Amphibians are often restricted to natural and constructed ponds during the hottest parts of the day²⁶. All such water bodies, although limited in number in the Project area, were visited during the hottest parts of the day to determine the presence of amphibians along the shaded ledges of the water body.

²³ eBird Database [<https://ebird.org/hotspot/L3810713>; <https://ebird.org/hotspot/L2712373>; <https://ebird.org/hotspot/L7189330>; <https://ebird.org/hotspot/L15592241>]

²⁴ Grewal, B., Sen, S., Singh, S., Devasar, N. & Bhatia G. (2016) A pictorial Field Guide to Birds of India, Pakistan, Nepal, Bhutan, Sri Lanka and Bangladesh. Om Books International, Noida, Uttar Pradesh, India.

²⁵ Menon, V., (2014), Indian Mammals: A Field Guide. Hachette, India

²⁶ Knutson et. al. (2004). Agricultural ponds support amphibian populations. Ecological Applications. 14 (3): 669-684.

b. Reptiles

Reptile presence was determined using Intensive Time Constrained Search Methods^{27,28}. The method was adapted for the terrain by targeting rocks and logs located around water bodies or recently dried streams, hedges and along the trunks of higher vegetation.

c. Avifauna

An adapted avifaunal survey method for linear project assessments was utilized for the purpose of this study. The adapted survey method focuses on key habitat features to cover, preferred time of day to ensure maximum bird activity. Any avifaunal species that was identified by visually sighting or hearing of bird calls were recorded. The birds were surveyed around ponds during the coolest parts of the day (morning and evening); and along motorable roads during the hottest parts of the day. Binoculars and standard field guides^{29, 30} were used for avifaunal identification.

d. Mammals

Mammal surveys were conducted along motorable roads, near water bodies and agricultural lands. Individuals were identified through indirect methods such as pellets, tracks, paw marks and scat. Species were then identified using standard literature^{31, 32}.

5.3.3 Results of Baseline Survey

5.3.3.1 Habitat Surveys

As part of the site visit, a site reconnaissance of the study area was undertaken to determine the types of habitat that are found. The study area majorly comprises of agricultural lands, open lands, water bodies, plantation (*Eucalyptus* sp. & *Populus* sp.) and orchards (Mango). Photo-documentation of different habitats has been presented in **Figure 5.1918**. The distribution of key habitats found in the study area have been presented in subsequent figures.

²⁷ Welsh, H.H., jr. (1987). Monitoring herpetofauna in woodlands of north western California and south west Oregon: a comparative strategy. Pp. 203-213. In. Multiple – Use Management of California's hardwood resources. T.R. Plumb, N.H. Pillsbury (eds. Gen. Tech. Regional Environmental Planning. PSW – 100) US Department of Agriculture, Forest Service.

²⁸ Welsh, H.H. Jr. and Lind, A. (1991). The structure of the herpetofaunal assemblage in the Douglas-fir/hardwood forests of northwestern California and south western Oregon. Pp: 395-411. In: Wildlife and vegetation of unmanaged Douglas-fir forests. (Tech. Coords). L.F. Ruggiero, K.B. Aubry, A.B. Carey and M.H. Huff. Ge. Tech. Rep. PNW-GTR-285. Portland, OR: US. Department of Agriculture, Forest Service.

²⁹ Grewal, B., Sen, S., Singh, S., Devasar, N. & Bhatia G. (2016) A pictorial Field Guide to Birds of India, Pakistan, Nepal, Bhutan, Sri Lanka and Bangladesh. Om Books International, Noida, Uttar Pradesh, India.

³⁰ Grimmet, R. Inskipp, C. and Inskipp, T. (2013). Birds of the Indian Subcontinent - Second Edition. Published by Christopher Helm, 49-51 Bedford Square, London

³¹ Prater, S.H. 2005. The Book of Indian Animals. Bombay Natural History Society and Oxford University Press - 12th Edition. pp 316

³² Menon, V. 2003. A field guide to Indian Mammals. Dorling Kindersley (India) Ltd. New Delhi

Figure 5.19 Habitats within the Study Area



Plantation of *Eucalyptus tereticornis* Sm.



Plantation of *Populus deltoides* W.Bartram ex Marshall



Mango orchard

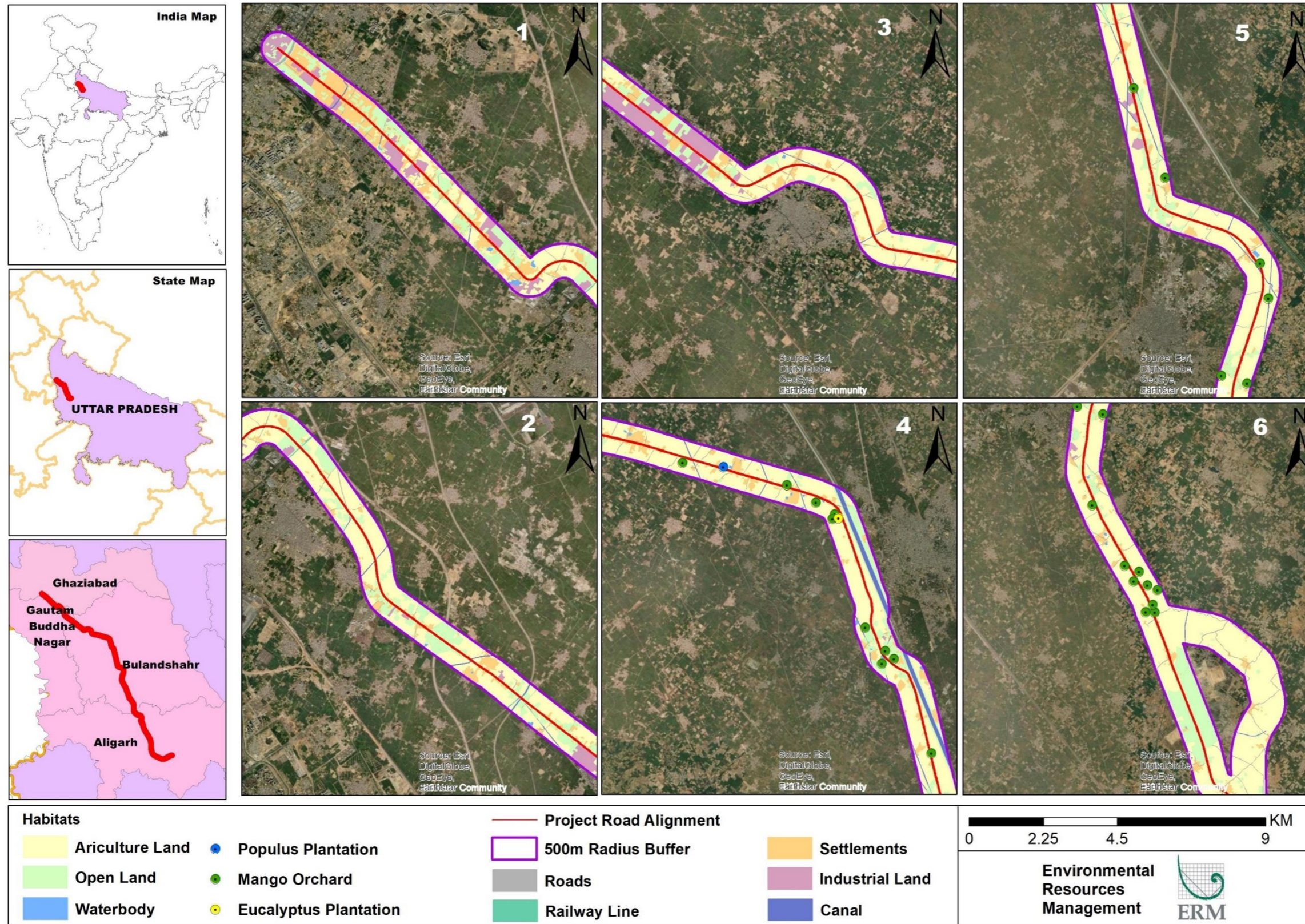


Water Body



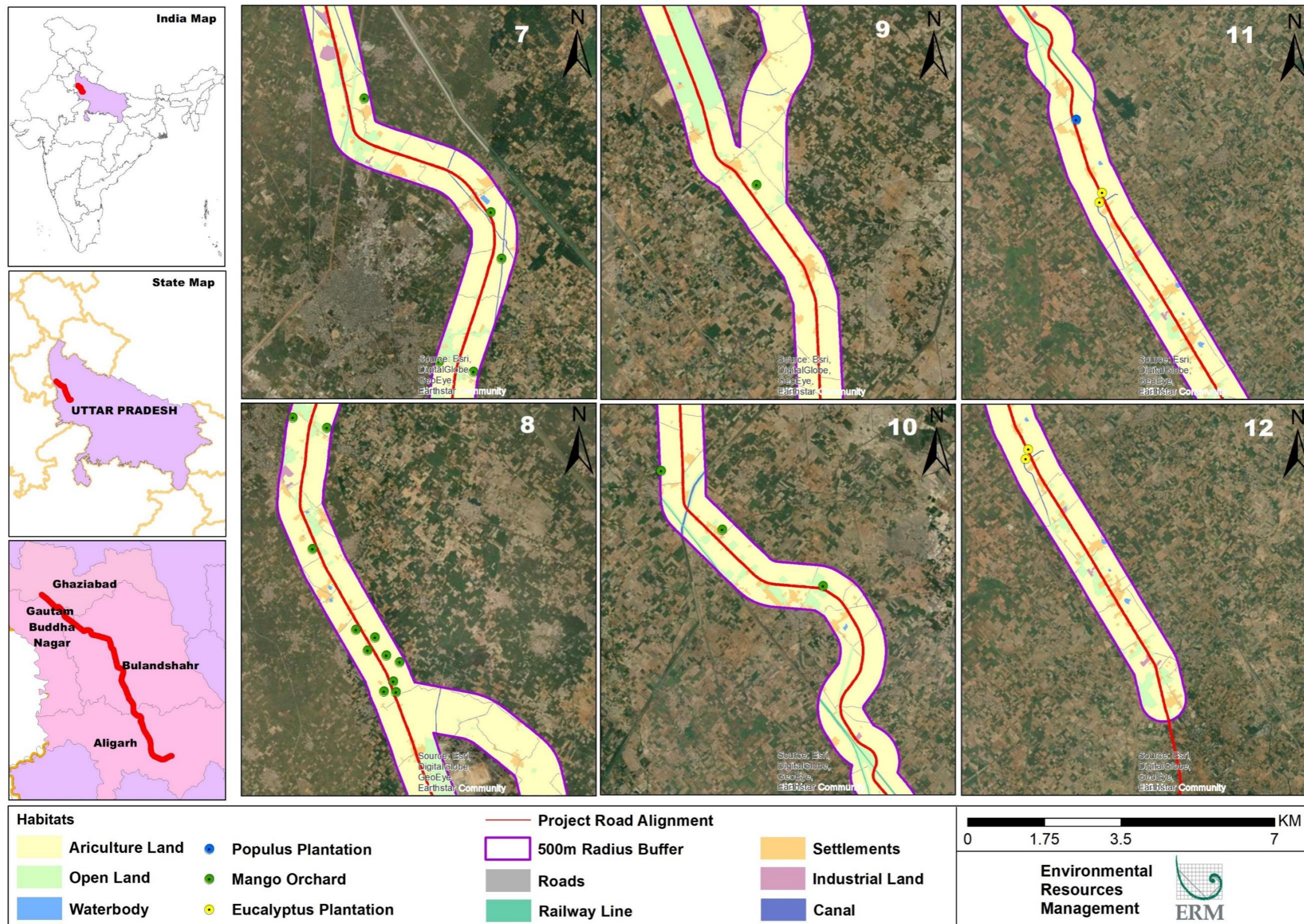
Agricultural land

Figure 5.20 Ecological habitat Map 1



Source: ERM India

Figure 5.21 Ecological habitat Map 2



Source: ERM India

5.3.3.2 Agricultural Profile

The agriculture in the area is dependent upon the rains, water canals and Tube wells. Sugarcane (*Saccharum officinarum* L.), Wheat (*Triticum aestivum* L.), Paddy (*Oryza sativa* L.), Mustard (*Brassica* spp.), Corn (*Zea mays* L.), Peanut (*Arachis hypogaea* L.) and Blackgram (*Vigna mungo* L.) are the major crops in the area.

5.3.3.3 Floral Assessment

The vegetation profile of the region has been presented in **Table 5.1817**.

Table 5.18 Vegetation profile of the region

Classification Scheme	Classification
Biogeographical Province of India ³³	7A: Gangetic Plain - Upper Gangetic Plain
Agro Ecological Sub Region (ICAR) ³⁴	Northern Plain, hot sub humid (dry) ecoregion
Agro-Climatic Region ³⁵	Upper Gangetic Plain (V)
Champion and Seth forest classification ³⁶	Northern Tropical Dry Deciduous forest (5B)

The floral assessment was undertaken in the available habitats in the study area. A list of flora found in the encountered habitat in the study area is given in **Table 5.1918**.

Sixty-three (63) floral species belonging to thirty-four (34) families were observed from the study area. Fabaceae was the most dominant family in the area with 12 species. None of the species identified in the study area are endangered.

³³ Wildlife Institute of India - ENVIS Centre

³⁴ http://iasri.res.in/agridata/12data%5Cchapter1%5Cdb2012tb1_3.pdf

³⁵ http://iasri.res.in/agridata/12data%5Cchapter1%5Cdb2012tb1_2.pdf

³⁶ Champion, H. G. and Seth, S. K. (1968). A Revised Survey of Forest Types of India, Govt. of India Press, New Delhi, p. 404.

Figure 5.22 Floral species within study area



Azadirachta indica A.Juss.



Dalbergia sissoo DC.



Cordia dichotoma G.Forst.



Aegle marmelos (L.) Corrêa



Butea monosperma (Lam.) Taub.



Tectona grandis L.f.



Toona ciliata M.Roem.



Melia azedarach L.



Acacia nilotica (L.) Delile



Acacia auriculiformis A.Cunn. ex Benth.



Leucaena leucocephala (Lam.) de Wit



Kigelia africana (Lam.) Benth.



Pterospermum acerifolium (L.) Willd.



Ficus virens Aiton





Syzygium cumini (L.) Skeels



Phoenix sylvestris (L.) Roxb.



Ricinus communis L.



Ficus palmata subsp. *virgata* Browicz



Tamarix indica Willd.



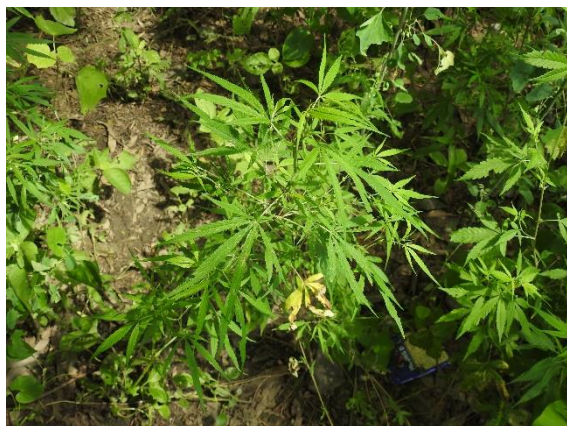
Lantana camara L.



Calotropis procera (Aiton) Dryand.



Datura metel L.



Cannabis sativa L.



Commelina benghalensis L.

Table 5.19 Flora observed in the study area

Sr. No.	Scientific Name	Family	Life form
1	<i>Acacia auriculiformis</i> A.Cunn. ex Benth.	Fabaceae	Tree
2	<i>Acacia nilotica</i> (L.) Delile	Fabaceae	Tree
3	<i>Achyranthes aspera</i> L.	Amaranthaceae	Herb
4	<i>Aegle marmelos</i> (L.) Corrêa	Rutaceae	Tree
5	<i>Ailanthus excelsa</i> Roxb.	Simaroubaceae	Tree
6	<i>Alstonia scholaris</i> (L.) R. Br.	Apocynaceae	Tree
7	<i>Artocarpus heterophyllus</i> Lam.	Moraceae	Tree
8	<i>Azadirachta indica</i> A.Juss.	Meliaceae	Tree
9	<i>Bauhinia purpurea</i> L.	Fabaceae	Tree
10	<i>Bombax ceiba</i> L.	Malvaceae	Tree
11	<i>Bougainvillea spectabilis</i> Willd.	Nyctaginaceae	Shrub
12	<i>Butea monosperma</i> (Lam.) Taub.	Fabaceae	Tree
13	<i>Calotropis procera</i> (Aiton) Dryand.	Apocynaceae	Shrub
14	<i>Cannabis sativa</i> L.	Cannabaceae	Herb
15	<i>Cassia fistula</i> L.	Fabaceae	Tree
16	<i>Casuarina equisetifolia</i> L.	Casuarinaceae	Tree
17	<i>Commelina benghalensis</i> L.	Commelinaceae	Herb
18	<i>Cordia dichotoma</i> G.Forst.	Boraginaceae	Tree
19	<i>Dalbergia sissoo</i> DC.	Fabaceae	Tree
20	<i>Datura metel</i> L.	Solanaceae	Herb
21	<i>Delonix regia</i> (Hook.) Raf.	Fabaceae	Tree
22	<i>Eichhornia crassipes</i> (Mart.) Solms	Pontederiaceae	Herb (Aquatic)
23	<i>Eucalyptus</i> sp.	Myrtaceae	Tree
24	<i>Eucalyptus tereticornis</i> Sm.	Myrtaceae	Tree
25	<i>Euphorbia hirta</i> L.	Euphorbiaceae	Herb
26	<i>Ficus benghalensis</i> L.	Moraceae	Tree
27	<i>Ficus palmata</i> subsp. <i>virgata</i> Browicz	Moraceae	Tree
28	<i>Ficus religiosa</i> L.	Moraceae	Tree
29	<i>Ficus rumphii</i> Blume	Moraceae	Tree
30	<i>Ficus virens</i> Aiton	Moraceae	Tree

Sr. No.	Scientific Name	Family	Life form
31	<i>Holoptelea integrifolia</i> Planch.	Ulmaceae	Tree
32	<i>Kigelia africana</i> (Lam.) Benth.	Bignoniaceae	Tree
33	<i>Lagerstroemia speciosa</i> (L.) Pers.	Lythraceae	Tree
34	<i>Lantana camara</i> L.	Verbenaceae	Shrub
35	<i>Leucaena leucocephala</i> (Lam.) de Wit	Fabaceae	Tree
36	<i>Mangifera indica</i> L.	Anacardiaceae	Tree
37	<i>Melia azedarach</i> L.	Meliaceae	Tree
38	<i>Moringa oleifera</i> Lam.	Moringaceae	Tree
39	<i>Morus indica</i> L.	Moraceae	Tree
40	<i>Neolamarckia cadamba</i> (Roxb.) Bosser	Rubiaceae	Tree
41	<i>Parkinsonia aculeata</i> L.	Fabaceae	Tree
42	<i>Parthenium hysterophorus</i> L.	Asteraceae	Herb
43	<i>Phoenix sylvestris</i> (L.) Roxb.	Arecaceae	Tree
44	<i>Phyllanthus emblica</i> L.	Phyllanthaceae	Tree
45	<i>Pithecellobium dulce</i> (Roxb.) Benth.	Fabaceae	Tree
46	<i>Polyalthia longifolia</i> Sonn.	Annonaceae	Tree
47	<i>Pongamia pinnata</i> (L.) Pierre	Fabaceae	Tree
48	<i>Populus deltoides</i> W.Bartram ex Marshall	Salicaceae	Tree
49	<i>Prosopis juliflora</i> (Sw.) DC.	Fabaceae	Tree
50	<i>Psidium guajava</i> L.	Myrtaceae	Tree
51	<i>Pterospermum acerifolium</i> (L.) Willd.	Malvaceae	Tree
52	<i>Ricinus communis</i> L.	Euphorbiaceae	Small Tree
53	<i>Salix tetrasperma</i> Roxb.	Salicaceae	Tree
54	<i>Solanum torvum</i> Sw.	Solanaceae	Shrub
55	<i>Syzygium cumini</i> (L.) Skeels	Myrtaceae	Tree
56	<i>Tamarix dioica</i> Roxb. ex Roth	Tamaricaceae	Tree
57	<i>Tamarix indica</i> Willd.	Tamaricaceae	Shrub
58	<i>Tectona grandis</i> L.f.	Lamiaceae	Tree
59	<i>Terminalia arjuna</i> (Roxb.) Wight & Arn.	Combretaceae	Tree
60	<i>Tinospora cordifolia</i> (Thunb.) Miers	Menispermaceae	Climber
61	<i>Toona ciliata</i> M.Roem.	Meliaceae	Tree
62	<i>Ziziphus jujuba</i> Mill.	Rhamnaceae	Tree
63	<i>Ziziphus mauritiana</i> Lamk.	Rhamnaceae	Tree

Source: ERM Primary Survey.

5.3.3.4 Faunal Assessment

The faunal assessment was carried out based on the aforementioned search techniques for each of the target class of fauna - herpetofauna (amphibians and reptiles), avifauna and mammals. The subsequent sections describe the fauna found on the site.

Herpetofauna

Twelve (12) species of herpetofauna were observed or reported from the study area, out of which only one, Indian Flapshell Turtle (*Lissemys punctata*) was listed as Schedule I species under Wildlife Protection Act, 1972; as well as Vulnerable category of the IUCN Red List (Online Version 2021-2).

The list of species with their latest IUCN Red List (Online Version 2021-2) and Wildlife Protection Act Schedule status are presented in **Table 5.2019**.

Table 5.20 Herpetofauna observed/reported in the study area

Sr. No.	Common Name	Scientific Name	IUCN Red List Status (Online Version 2021-2)	Wildlife Protection Act Schedule	Observed/ Reported
1	Asiatic Water Snake	<i>Fowlea piscator</i>	Not assessed	Schedule II	Reported
2	Banded Krait	<i>Bungarus fasciatus</i>	Least Concern	Not listed	Reported
3	Common Krait	<i>Bungarus caeruleus</i>	Not assessed	Schedule IV	Reported
4	Common Skittering Frog	<i>Euphlyctis cyanophlyctis</i>	Least Concern	Schedule IV	Observed
5	Indian Bullfrog	<i>Hoplobatrachus tigerinus</i>	Least Concern	Schedule IV	Observed
6	Indian Cobra	<i>Naja naja</i>	Least Concern	Schedule II	Reported
7	Indian Flapshell Turtle	<i>Lissemys punctata</i>	Vulnerable	Schedule I	Observed
8	Indian Pond Frog	<i>Rana hexadactyla</i>	Least Concern	Schedule III	Observed
9	Indian Rat Snake	<i>Ptyas mucosus</i>	Not assessed	Schedule II	Observed
10	Oriental Garden Lizard	<i>Calotes versicolor</i>	Not assessed	Not listed	Observed
11	Red Sand Boa	<i>Eryx johnii</i>	Not assessed	Schedule IV	Reported
12	Skink	<i>Mabuya</i> sp.	Not assessed	Not listed	Observed

Source: ERM Primary Survey; Consultation with the villagers.

Avifauna

A total of 48 species of birds were observed from the study area. Beside one Vulnerable [Sarus Crane (*Antigone antigone*)] and five Near Threatened species [Asian Woollyneck (*Ciconia episcopus*), Black-headed Ibis (*Threskiornis melanocephalus*), Oriental Darter (*Anhinga melanogaster*), Painted Stork (*Mycteria leucocephala*), & River Tern (*Sterna aurantia*)] all the other species have been classified as 'Least Concern' as per the latest IUCN Red List (Online Version 2021-2).

Four species [Black Kite (*Milvus migrans*), Black-winged Kite (*Elanus caeruleus*), Indian Peafowl (*Pavo cristatus*), & Shikra (*Accipiter badius*)] were are listed as Schedule I; 41 species as Schedule IV; and one as Schedule V under Wildlife Protection Act, 1972. The list of species with their latest IUCN Red List (Online Version 2021-2) and Wildlife Protection Act Schedule status has been presented in **Table 5.2120**. No migratory species was observed in the study area as the survey was conducted in the non-migratory season.

Figure 5.23 Some avifauna observed in the study area



Black Kite



Black-winged Kite



Saras Crane



Indian Peafowl



Red-naped Ibis



Black-headed Ibis



Asian Openbill



Purple Heron



Painted Stork



Asian Woollyneck



African Comb Duck



Indian Spot-billed Duck



Lesser Whistling-duck



Little Grebe



Common Moorhen

Purple Swamphen



Indian Cormorant



Oriental Darter



Bronze-winged Jacana



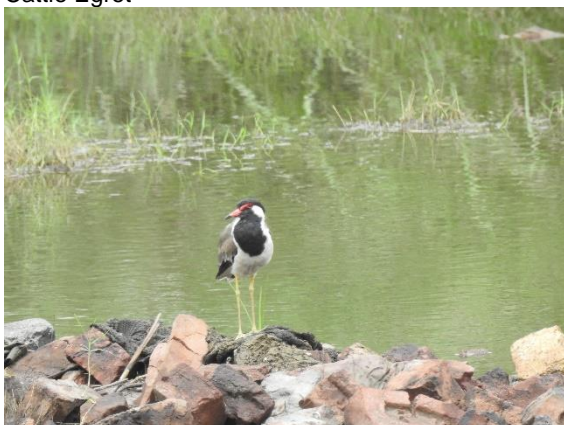
White-breasted Waterhen



Cattle Egret



Intermediate Egret



Red-wattled Lapwing



Black-winged Stilt



River Tern



Black Francolin



Lesser Coucal



Jacobin Cuckoo



Asian Koel



Wire-tailed Swallow



Laughing Dove



Eurasian Collared-Dove



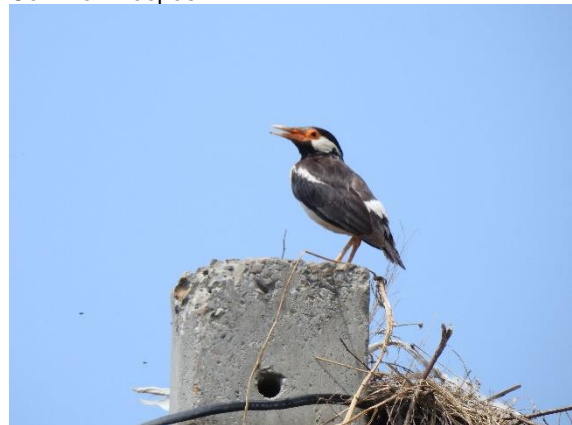
White-breasted Kingfisher



Common Hoopoe



Common Myna



Asian Pied Starling



Red-vented Bulbul



Baya Weaver



Scaly-breasted Munia



Indian Silverbill

Table 5.21 Avifauna observed from the study area

Sr. No.	Common Name	Scientific Name	Migratory Status	IUCN Red List Status (Online Version 2021-2)	Wildlife Protection Act Schedule
1	African Comb Duck	<i>Sarkidiornis melanotos</i>	R	Least Concern	Schedule IV
2	Asian Koel	<i>Eudynamys scolopaceus</i>	R	Least Concern	Schedule IV
3	Asian Openbill	<i>Anastomus oscitans</i>	R	Least Concern	Schedule IV
4	Asian Pied Starling	<i>Gracupica contra</i>	R	Least Concern	Schedule IV
5	Asian Woollyneck	<i>Ciconia episcopus</i>	R	Near Threatened	Schedule IV
6	Baya Weaver	<i>Ploceus philippinus</i>	R	Least Concern	Schedule IV
7	Black Drongo	<i>Dicrurus macrocercus</i>	R	Least Concern	Schedule IV
8	Black Francolin	<i>Francolinus francolinus</i>	R	Least Concern	Schedule IV
9	Black Kite	<i>Milvus migrans</i>	R	Least Concern	Schedule I
10	Black-headed Ibis	<i>Threskiornis melanocephalus</i>	R	Near Threatened	Schedule IV
11	Black-winged Kite	<i>Elanus caeruleus</i>	R	Least Concern	Schedule I
12	Black-winged Stilt	<i>Himantopus himantopus</i>	R	Least Concern	Schedule IV
13	Bronze-winged Jacana	<i>Metopidius indicus</i>	R	Least Concern	Schedule IV
14	Cattle Egret	<i>Bubulcus ibis</i>	R	Least Concern	Schedule IV
15	Common Hoopoe	<i>Upupa epops</i>	R	Least Concern	Not Listed
16	Common Moorhen	<i>Gallinula chloropus</i>	R	Least Concern	Schedule IV
17	Common Myna	<i>Acridotheres tristis</i>	R	Least Concern	Schedule IV
18	Eurasian Collared-Dove	<i>Streptopelia decaocto</i>	R	Least Concern	Schedule IV
19	Green Bee-eater	<i>Merops orientalis</i>	R	Least Concern	Schedule IV
20	House Crow	<i>Corvus splendens</i>	R	Least Concern	Schedule V
21	Indian Cormorant	<i>Phalacrocorax fuscicollis</i>	R	Least Concern	Schedule IV
22	Indian Peafowl	<i>Pavo cristatus</i>	R	Least Concern	Schedule I
23	Indian Pond Heron	<i>Ardeola grayii</i>	R	Least Concern	Schedule IV
24	Indian Silverbill	<i>Euodice malabarica</i>	R	Least Concern	Schedule IV
25	Indian Spot-billed Duck	<i>Anas poecilorhyncha</i>	R	Least Concern	Schedule IV
26	Intermediate Egret	<i>Ardea intermedia</i>	R	Least Concern	Schedule IV
27	Jacobin Cuckoo	<i>Clamator jacobinus</i>	R	Least Concern	Schedule IV
28	Large Grey Babbler	<i>Argya malcolmi</i>	R	Least Concern	Schedule IV
29	Laughing Dove	<i>Streptopelia senegalensis</i>	R	Least Concern	Schedule IV
30	Lesser Coucal	<i>Centropus bengalensis</i>	R	Least Concern	Schedule IV

Sr. No.	Common Name	Scientific Name	Migratory Status	IUCN Red List Status (Online Version 2021-2)	Wildlife Protection Act Schedule
31	Lesser Whistling-duck	<i>Dendrocygna javanica</i>	R	Least Concern	Schedule IV
32	Little Egret	<i>Egretta garzetta</i>	R	Least Concern	Schedule IV
33	Little Grebe	<i>Tachybaptus ruficollis</i>	R	Least Concern	Schedule IV
34	Oriental Darter	<i>Anhinga melanogaster</i>	R	Near Threatened	Schedule IV
35	Painted Stork	<i>Mycteria leucocephala</i>	R	Near Threatened	Schedule IV
36	Purple Heron	<i>Ardea purpurea</i>	R	Least Concern	Schedule IV
37	Purple Swamphen	<i>Porphyrio porphyrio</i>	R	Least Concern	Schedule IV
38	Red-naped Ibis	<i>Pseudibis papillosa</i>	R	Least Concern	Schedule IV
39	Red-vented Bulbul	<i>Pycnonotus cafer</i>	R	Least Concern	Schedule IV
40	Red-wattled Lapwing	<i>Vanellus indicus</i>	R	Least Concern	Schedule IV
41	River Tern	<i>Sterna aurantia</i>	R	Near Threatened	Schedule IV
42	Rock Dove	<i>Columba livia</i>	R	Least Concern	Schedule IV
43	Sarus Crane	<i>Antigone antigone</i>	R	Vulnerable	Schedule IV
44	Scaly-breasted Munia	<i>Lonchura punctulata</i>	R	Least Concern	Schedule IV
45	Shikra	<i>Accipiter badius</i>	R	Least Concern	Schedule I
46	White-breasted Kingfisher	<i>Halcyon smyrnensis</i>	R	Least Concern	Schedule IV
47	White-breasted Waterhen	<i>Amauornis phoenicurus</i>	R	Least Concern	Schedule IV
48	Wire-tailed Swallow	<i>Hirundo smithii</i>	R	Least Concern	Not Listed

Source: ERM Primary Survey.

Mammals

Eight (08) species of mammals were observed or reported from the study area, out of which none were listed as Schedule I species under Wildlife Protection Act, 1972 and none were listed under threatened category of the IUCN Red List (Online Version 2021-2). The list of species with their latest IUCN Red List (Online Version 2021-2) and Wildlife Protection Act Schedule status is presented in **Table 5.2221**.

Figure 5.24 Some mammals observed in the study area



Rhesus Monkey



Five-striped Palm Squirrel



Nilgai

Table 5.22 Mammals observed/reported from the study area

Sr. No.	Common Name	Scientific Name	IUCN Red List Status (Online Version 2021-1)	Wildlife Protection Act Schedule	Observed/ Reported
1	Bengal Fox	<i>Vulpes bengalensis</i>	Least Concern	Schedule II	Reported
2	Five-striped Palm Squirrel	<i>Funambulus pennanti</i>	Least Concern	Schedule IV	Observed
3	House Rat	<i>Rattus rattus</i>	Least Concern	Schedule V	Observed
4	House Shrew	<i>Suncus murinus</i>	Least Concern	Not listed	Observed
5	Indian Grey Mongoose	<i>Herpestes edwardsii</i>	Least Concern	Schedule II	Observed
6	Indian Hare	<i>Lepus nigricollis</i>	Least Concern	Schedule IV	Reported
7	Nilgai	<i>Boselaphus tragocamelus</i>	Least Concern	Schedule III	Observed
8	Rhesus Monkey	<i>Macaca mulatta</i>	Least Concern	Schedule II	Observed

Source: ERM Primary Survey; Consultation with the villagers.

5.3.3.5 Protected Areas & Key Biodiversity Areas (e.g. Important Bird Areas)

No protected areas fall close to the study area in 10 km radius. The nearest protected area, Asola Bhatti Wildlife Sanctuary, Delhi is about 25 km away from the road stretch in south-west-west

direction. Surajpur wetland is the nearest IBA, present about 5 km away in Gautam Budh Nagar (Noida) district.

Surajpur Wetland

Surajpur wetland is situated near Surajpur village in Dadri tehsil of Gautam Budh Nagar (Noida) District. The area is reserve forest and spreads over 308 ha. that includes 60 ha. of natural wetland. Surajpur wetland represents the mosaic of habitats supporting diverse flora and fauna. About 186 species of birds belonging to 44 families, 102 resident and 53 winter migrant, are reported from this wetland so far³⁷. Since the wetland is fast growing into an eco-tourism hub, substantial numbers of visitors (few are bird watchers) visit the area regularly.

Asola Bhatti Wildlife Sanctuary

Asola-Bhatti Wildlife Sanctuary covers 32.71 km² on the Southern Delhi Ridge of Aravalli hill range on Delhi-Haryana border. This protected area contains one of the last surviving remnants of Delhi Ridge hill range and its semi-arid forest habitat and dependent wildlife. The Sanctuary represents 17 species of mammals, around 201 species of resident and migratory birds, 12 species of reptiles, 5 species of amphibians, 63 species of butterflies and 05 species of dragonflies. Some important species found in the sanctuary area are Nilgai (*Boselaphus tragocamelus*), Jungle cat (*Felis chaus*), small Indian Civet (*Viverricula indica*), Mongoose (*Herpestes auropunctatus*), Jackal (*Canis aureus*), Indian porcupine (*Hystrix indica*), Cheetal (*Acinonyx jubatus*), etc. The sanctuary consists of a mixture of indigenous and exotic floral species and is known to harbour around 83 species of trees, 30 species of shrubs, 95 species of herbs, 18 species of grasses and around 4 species of sedges³⁸.

5.3.3.6 Migratory Route

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 congregate at key water bodies around India. Details on the Central Asian Flyway and migratory routes of the most common family of migratory species i.e. Anatidae (ducks, geese and swan) is shown in **Figure 5.2524**.

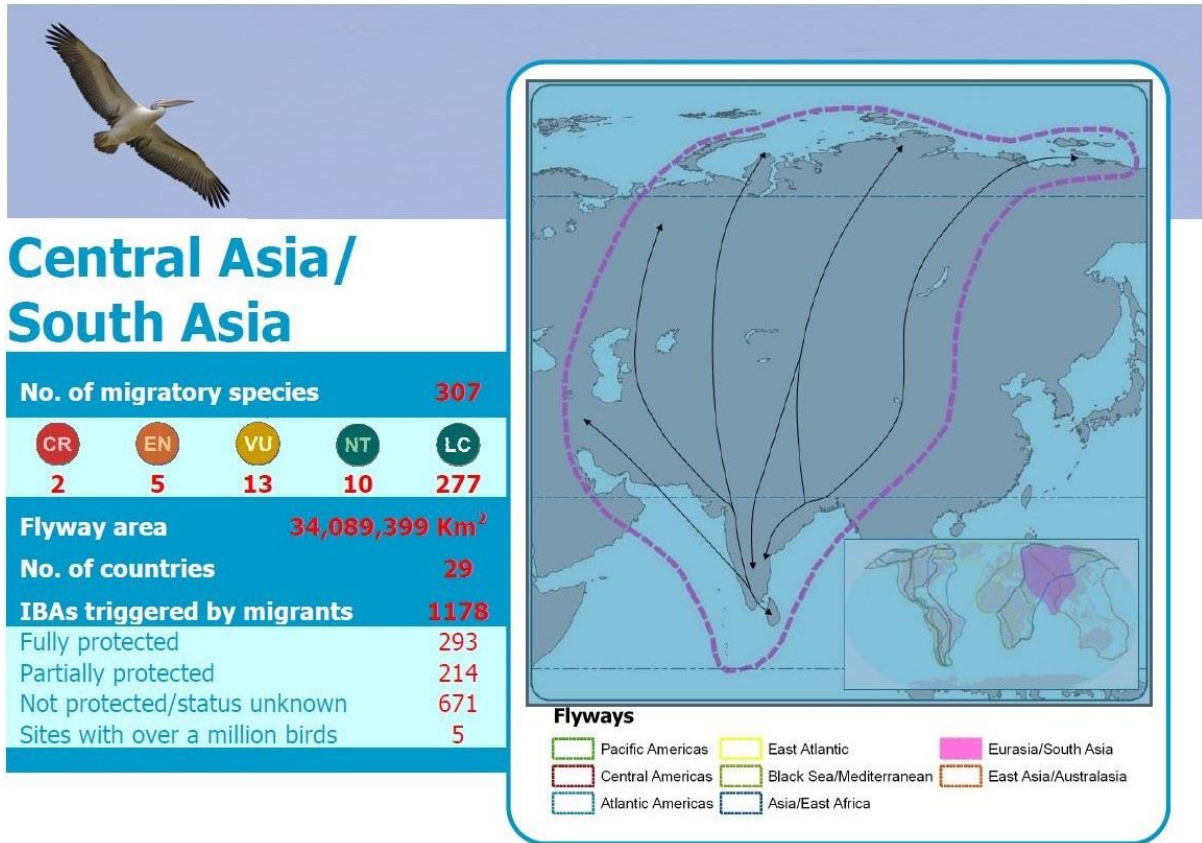
India lies along the Central Asian Flyway, a global migratory pathway that connects the Palearctic (Europe and Northern Asia) to the Indian subcontinent. The birds that utilize this flyway congregate at key water bodies around India. Details on the Central Asian Flyway and migratory routes of the most common family of migratory species is shown in **Figure 5.2524**. The available migratory routes passing through India is provided in **Figure 5.2625**, which indicates that the study site is present between the migratory routes of Common Crane, Demoiselle Crane, Northern Wheatear and Falcon.

The nearest IBA, (i.e. Surajpur Wetland) is about 5 km away from the study area that supports congregations of migratory bird species; three more IBAs, Dhanauri, Okhla and Sheikha Jheel are also present within the range of 20 km from the study area (**Figure 5.2726**). However, as there is no large water body in the 500 buffer of the study area, the migratory bird activity in the area may be considered minimal. Thus, Critical Habitat is unlikely to get triggered here.

³⁷ Rahmani, A.R., Islam, M.Z. and Kasambe, R.M. (2016) Important Bird and Biodiversity Areas in India: Priority Sites for Conservation (Revised and updated). Bombay Natural History Society, Indian Bird Conservation Network, Royal Society for the Protection of Birds and BirdLife International (U.K.). Pp. 1992 + xii

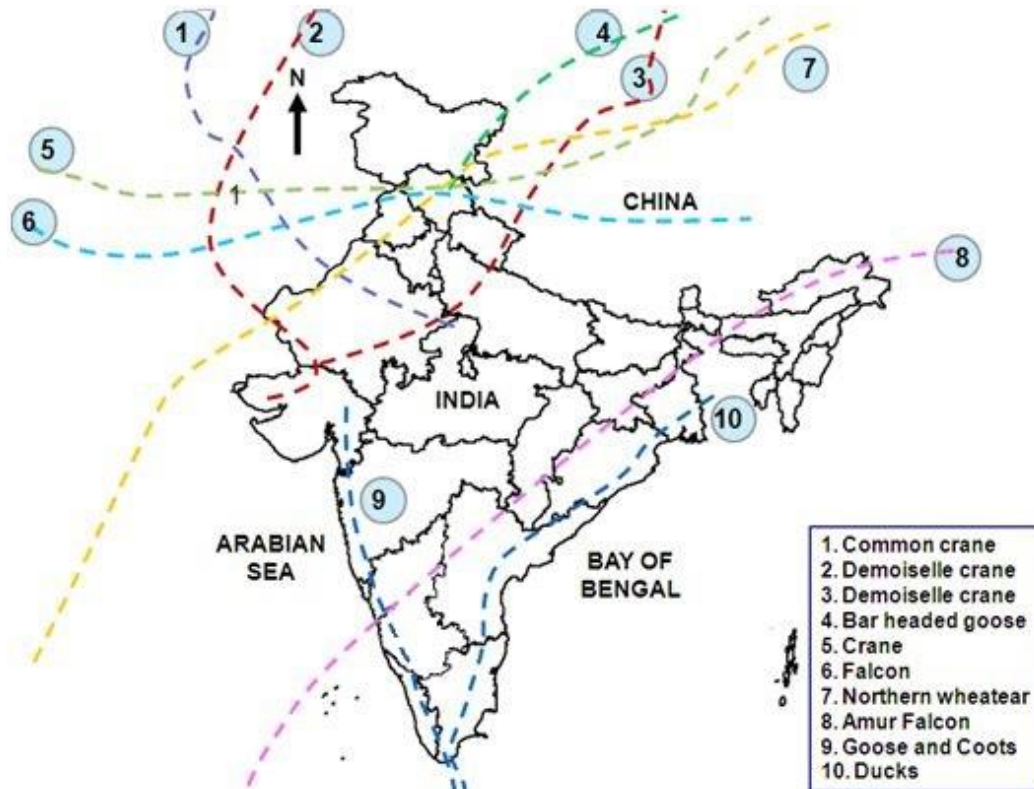
³⁸ <https://moef.gov.in/wp-content/uploads/2017/06/Asola%20Bhatti%20Wildlife%20Sanctuary%2C%20New%20Delhi%20Final.pdf>

Figure 5.25 Central Asian Flyway



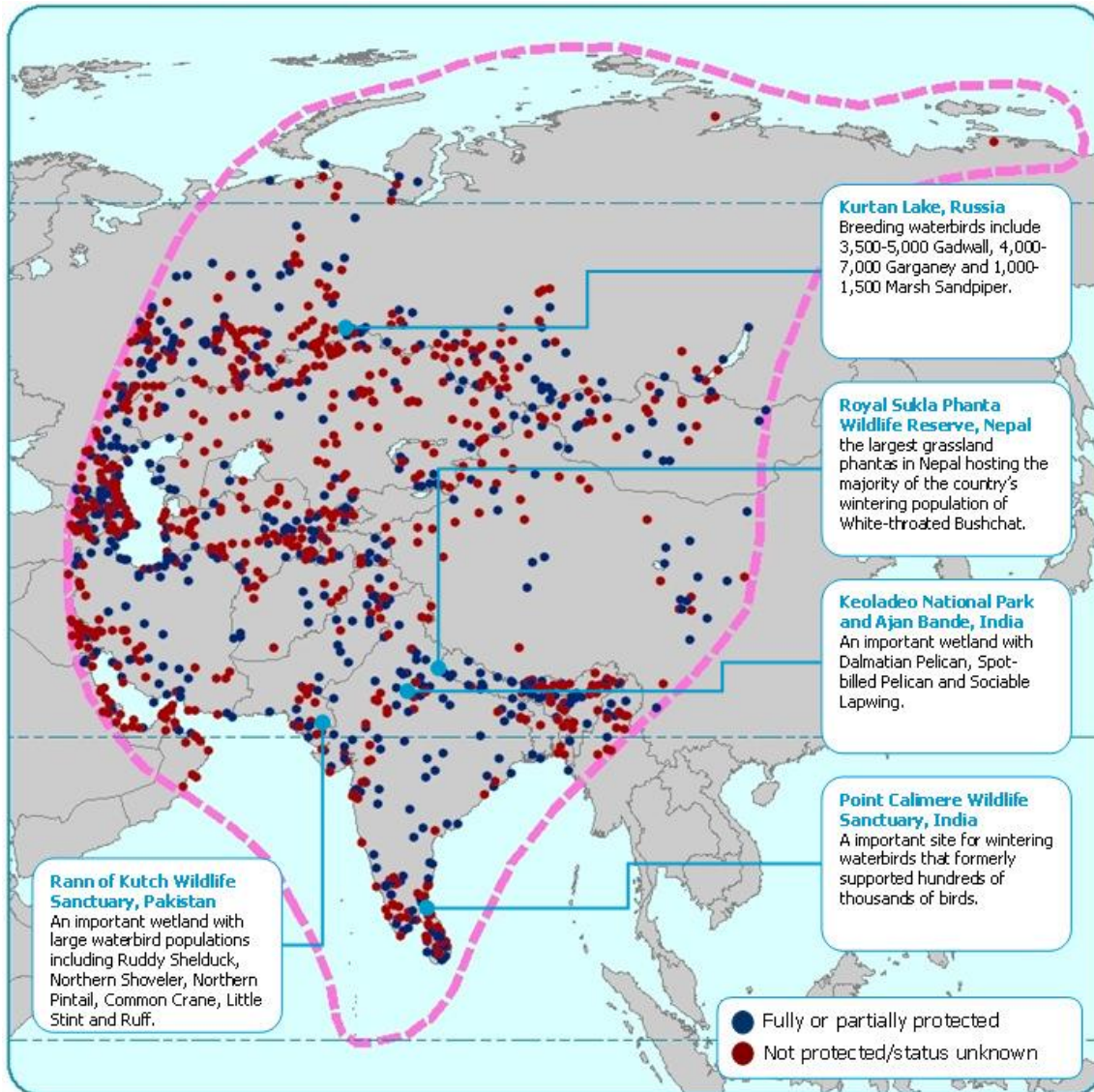
Source: Lama, D. 2017. Migratory Routes and Movement Ecology. In: Prins, H. & Namgail, T. (Eds.), Bird Migration Across the Himalayas: Wetland Functioning amidst Mountains and Glaciers. Cambridge University Press, Cambridge pp 13-142.

Figure 5.26 Migratory routes passing through India



Source: Ramachandra T.V., Durga Mabhab Mahapatra, M. Boominathan, K. Sankara Rao and Harish R. Bhat, 2011. Environmental Impact Assessment of the National Large Solar Telescope Project and its ecological impact in Merak area., CES Technical Report : 123, Energy & Wetlands Research Group, Centre for Ecological Sciences, Indian Institute of Science, Bangalore 560 012. (Available at: http://wgbis.ces.iisc.ernet.in/biodiversity/pubs/ces_tr/TR123/section6.htm)

Figure 5.27 Important Bird Areas (IBA) on the flyway



Source: Lama, D. 2017. Migratory Routes and Movement Ecology. In: Prins, H. & Namgail, T. (Eds.), Bird Migration Across the Himalayas: Wetland Functioning amidst Mountains and Glaciers. Cambridge University Press, Cambridge pp 13-142.

5.4 Socio Economic Setting

This section cover details pertaining to approach, methodology, baseline conditions and insights from community consultations and FGDs for the project road, including Khurja realignment.

5.4.1 Approach and Methodology

ERM has collected information on socio-economic parameters in the study area through secondary sources (primarily through compilation of socio-economic information of villages within 500 meters of each side of the road RoW), supplemented by consultations with stakeholders such as relevant government departments, project affected people, local communities, and community groups and organisations, as relevant. In addition to the household level socio-economic baseline survey, the key consultations undertaken as part of ESIA study are given below:

- Nearly 25 Focus Group Discussion and Village profiling with local community in the Project villages;
- Nearly 6 Focus Group Discussion with representatives/ staff in health institutions like CHC, PHC, Anganwaadi;
- Focus group consultations with selected land losers to cover locations, categories/ types of impacts relating to climate resilience (capacities); gender related aspects etc.;
- Consultations with local authorities (including NHAI, Land Acquisition Office etc.);
- Consultations with civil society organization operating in the area; and
- Consultations with truck drivers and *Dhaba* owners regarding HIV and practice of sex work in the study area;

The baseline chapter has been developed on the basis of secondary data and primary data collected through stakeholder consultations. Socio economic data for surveyed households will be included in the RAP-LEP Report, as this was being collated at the time of writing this report (Sept 2021).

5.4.2 Socio Economic Setting

The project is located across four districts in the state of Uttar Pradesh in India. The sections below provide an overview of these administrative units.

5.4.2.1 State Profile: Uttar Pradesh

Uttar Pradesh is a state in northern India. For administrative purposes the state of Uttar Pradesh is divided into 75 districts under 18 divisions. The current project is located in Ghaziabad, Gautam Buddha Nagar, Bulandshahr and Aligarh Districts. The table below provides a comparative overview of the key demographic indicators at the state and national level.

Table 5.23: Comparative Demographic Indicators: National and State Level

Indicators	India	Uttar Pradesh
Total Population	1,210,193,422	199,812,341
Decadal Population Growth Rate (2001-2011)	17.64%	20.23%
Percentage of Rural Population	68.84%	77.73 %
Percentage of Urban Population	31.16%	22.27 %
Population Density (persons per sq.km)	382	829

Source: 2011 Primary Census Abstract

The state comprises a population of 199,812,341 individuals, who pre-dominantly live in rural areas and make up 77.73% of the state's total population. The decadal population growth has reduced from

25.80% during the period 1991-2001 to 20.23 percent during 2001 to 2011. The sex ratio in the state is 912, which has increased from 898 in the past decade; however, it is still lower than the sex ratio of India, being 940 females per 1000 males. The population density of India is 382 persons/sq. km. while that of Uttar Pradesh is 829 persons/sq. km. The state is predominantly rural and has the fourth largest geographical area, of any state in the country.

5.4.2.2 District Profiles: Ghaziabad, Gautam Buddh Nagar, Bulandshahar & Aligarh

The Study Area is located across four districts namely, Ghaziabad, Gautam Buddh Nagar, Bulandshahar and Aligarh. Out of the four districts where study area is located, Ghaziabad is the most populated one, with 2.34% of the total State population, followed by Aligarh with 1.84%, Bulandshahar 1.75% and Gautam Buddh Nagar 0.82% respectively. Further details pertaining to sex ratio, literacy rate etc. are given in Table 5.2423 below.

Table 5.24: Demographic Profile of Districts vis-à-vis Uttar Pradesh

Attribute	Uttar Pradesh	Ghaziabad District	Gautam Buddh Nagar	Bulandshahar District	Aligarh District
Population	19,98,12,341	46,81,645	16,48,115	34,99,171	36,73,889
Population Density	829	3971	1286	776	1007
% of SC population	20.7	16.52	13.11	20.74	20.56
% of ST population	0.57	0.08	0.13	0.01	0.02
Sex Ratio	912	881	851	896	882
% total literacy rate	67.68%	78.07	80.12	68.88	67.52
% female literacy rate	57.18%	69.79	70.82	55.57	55.68
% rural population	77.73%	32.45	40.88	75.21	66.87

Source: 2011 Primary Census Abstract

5.4.2.3 Tehsil Profile: Ghaziabad, Dadri, Bulandshahar, Khurja, Sikandrabad, Atrauli, Gabhana & Koil

The Study Area villages are located in eight tehsils namely, Ghaziabad, Dadri, Bulandshahar, Khurja, Sikandrabad, Atrauli, Gabhana and Koil. The Table 5.2524 below gives a demographic description of all the eight tehsils which comprise of all the villages where the project is located. From the table it is evident that sex ratio in Dadri is lowest (874 females per 1000 males); while highest in Bulandshahar where it is 900 females per 1000 males.

Similarly, the total literacy rate is highest in Dadri followed by Ghaziabad tehsil. The female literacy rate is low in every tehsil compared to male literacy; however it is lowest in Atrauli tehsil with 38.48% female literacy rate. Further details are given in table below.

Table 5.25: Demographic Profile of Tehsils

Attribute	Ghaziabad	Dadri	Buland shahar	Debai	Khurja	Sikandra bad	Atrauli	Gabhana	Koil
Population	2705849	1110093	867941	433395	519063	385099	737767	308802	1810181
% of District Population	57.8	67.36	24.8	12.39	14.83	11.01	20.08	8.41	49.27
% SC population	13.52	10.26	16.28	17.35	27.36	21.17	18.01	22.76	19.62
% ST population	0.14	0.2	0	0	0.02	0	0.03	0.01	0.02

Attribute	Ghaziabad	Dadri	Buland shahar	Debai	Khurja	Sikandra bad	Atrauli	Gabhana	Koil
Sex Ratio	879	874	900	897	889	885	881	882	887
% Total literacy rate	80.94	82.94	70.14	64.97	68.96	71.35	60.42	71.37	68.24
% Female literacy rate	63.99	64.17	49.31	42.72	47.72	49.14	38.48	47.74	50.30

Source: District Census Handbook, Part A & PCA data

5.4.3 Project Area of Influence

The Area of Influence (AoI) considered for socio-economic impacts of this ESIA study includes an area within 500m on the either side of the centre line of the RoW, i.e. totalling to 1km of AoI, as most of the project interactions are likely to occur within this. ERM conducted household surveys and consultations in census villages located within this 1 km wide corridor.

The AoI covers a total of 160 villages, of which 136 villages fall under Core zone and remaining 24 villages fall in the remaining 1 km wide corridor. The AoI villages fall in eight sub-districts (or Tehsil) of Ghaziabad, Gautam Buddha Nagar, Bulandshahar and Aligarh Districts. The key terms used for sub-categorization of the Study Area are:

- Project AoI Project Villages/ Core zone villages – The land has been acquired from 130 villages, 03 Census towns (CT) and 03 Nagar Palika Parishads (NPP), a total of 136 settlements under eight Tehsils of Ghaziabad, Gautam Buddha Nagar, Bulandshahar and Aligarh Districts (*referring to the NH Notifications and land data shared with ERM*) for NH34 Project. This area will now be referred as Project villages and the details have been given below in *Table 5.2625*.
- Other villages & towns in the Area of influence - Other villages falling within the 1 km wide corridor that may be directly or indirectly affected by the project construction and /or operation. The table below indicates that there are 23 villages and one Census town (CT) falling within Area of influence.

Table 5.26: Project Area of Influence: Rural and Urban settlements)

SI No.	AoI: Project settlements/ Core zone settlements			SI No.	Area of Influence (other settlements)
1	Shahpur Bamhaita	69	Mandawarah	1	Semla
2	Hayatpur Bajhera	70	Bhatpura	2	Bulak Garhi
3	Sikandarpur Bhukarawale	71	Sikandrabad Rural	3	Shyampur
4	Khera Khus Khabar	72	Gendpurshaikhpur	4	Khempur
5	Daurau Chandpur	73	Pilakhanwali	5	Baghrai
6	Panihavar	74	Barkherah	6	Dhakpura
7	Nagala Nattha	75	Bilsuri	7	Baragaon
8	Rampur	76	Chandaru	8	Nagilia Udhaybhan
9	Pairai	77	Odara Urf Nawada	9	Khuriyavali
10	Chaumuhan	78	Adaoli	10	Kishanpur
11	Barothchajmal	79	Kamalpur	11	Kanwara
12	Barauli	80	Akbapur	12	Khaguwa Was
13	Ishanpur	81	Valipura	13	Srodhan
14	Pahavati	82	Machkauli	14	Sunahra
15	Madhaura	83	Jalkhera	15	Fatehpur Buzurg
16	Somna	84	Khetalpur Bhansauli	16	Basendua
17	Gabhana (CT)	85	Dhamrawali	17	Mohammadabad
18	Kanhoi	86	Maman Kalan	18	Bahalimpura (CT)
19	Ogarnagala Rajoo	87	Kaulsena	19	Luharli 139 Basantpur Bangar
20	Chuharpur	88	Hazipur Bhatola	20	Saithali

SI No.	Aol: Project settlements/ Core zone settlements		SI No.	Area of Influence (other settlements)	
21	Pala Sallu	89	Asadullapur	21	Khatana Dhirkhera
22	Kaurah Rustampur	90	Chandpur	22	Phoolpur
23	Bhartri	91	Tilbegumpur	23	Anandpur
24	Bhankri Khas	92	Sanwali	24	Khandera Girirajpur
25	Mahrawal	93	Junedpur		
26	Lekhrajpur	94	Lalpur		
27	Bhikampur	95	Dariapur		
28	Jatanpur Chikawati	96	Dostpur		
29	Tajpur Rasoolpur	97	Gangarua		
30	Hardaspur	98	Maman Khurd		
31	Bajidpur	99	Raja Rampur		
32	Alahadadpur Nivry	100	Khalsia Choharpur		
33	Ibrahimpur	101	Bartauli		
34	Shahpur Kutub	102	Dharpa Choharpur		
35	Chamraula	103	Kirra		
36	Talaspur Khurd	104	Agwal		
37	Daulatabad	105	Chandpur Khurd		
38	Kasba Kol	106	Lalpur Chitola		
39	Hajipur Chauhatta	107	Talibpur		
40	Rustampur Sakatkhan	108	Jhamka		
41	Pariyavali	109	Bajidpur NADA		
42	Nagla Pankhani	110	Rohinda		
43	Bhadesi Mafi	111	Rukanpur		
44	Rahamatpur Garmai	112	Arnia Khurd		
45	Alinagar	113	Muni		
46	Sidhauli	114	Keoli Khurd		
47	Nijampur Borna	115	Khurja (NPP)		
48	Boner	116	Sikandrabad (NPP)		
49	Bulandshahar Dehat	117	Talabpur Urf Hathipur		
50	Achaja Khurd	118	Bisnoli		
51	Chiti	119	Ibadullapur Urf Badalpur		
52	Munda Khera	120	Sadhopur		
53	Bauroli	121	Nagla Chamroo		
54	Mirpur	122	Chithara		
55	Wazidpur	123	Mahiuddinpur Urf Garakhpur		
56	Nagla Shekhu	124	Nagla Nainsukh		
57	Raniyavali	125	Shahpur Khurd		
58	Ahmadpur Halpura	126	Ranoli Latifpur		
59	Hazratpur Puthari	127	Bisahda		
60	Dashahara Kherli	128	Bairangpur Urf Nai Basti		
61	Mohammadpur Mazara Barhagaon	129	Beel Akbarpur		
62	Rasoolpur	130	Dhoom Manikpur		
63	Jahanpur	131	Badhpura		
64	Naiphal Urf Uchangaon	132	Nagla Kirani		
65	Ghatal	133	Kot		
66	Nekrampur Urf Visanpur	134	Dadri (NPP)		
67	Gopalpur	135	Chipyana Buzurg (CT)		
68	Hirdeypur	136	Chhapraula (CT)		

Source: ESDD Report and ERM India Pvt. Ltd

Note: The land has been acquired from 130 villages, 03 Census towns (CT) and 03 Nagar Palika Parishads (NPP), a total of 136 settlements under Core zone. The table also indicates that there are 23 villages and one Census town (CT) falling within Area of influence

5.4.4 Demographic profile of Aol

The project footprint falls in 136 settlements, out of which there are 130 villages, 03 Census towns (CT) and 03 Nagar Palika Parishads (NPP) known as “Project Villages/ Core zone Villages” while the other villages of the Aol falling within the 1km wide corridor has total 24 settlements out of which there are 23 villages and one Census town (CT), as shown above in **Table 5.2726**. The Project Villages comprise 116285 households with a population of 678676 individuals. The average size of the households is 6 in the Aol. Chandpur Khurd village has the highest sex ratio amongst the Project villages followed by Mahiuddinpur Urf Garakhpur. The other villages in the Aol have a sex ratio of 889 females per 1000 males, which is lower than the state figure (912).

Table 5.27: Demographic Profile of Project Aol

Settlement Name	No of HHS	Population	Sex Ratio	%SC	%ST	Lit%	Fem Lit%
Shahpur Bamhaita	NA	NA	NA	NA	NA	NA	NA
Hayatpur Bajhera	169	985	880	23.05	0.00	74.08	60.85
Sikandarpur Bhukarawale	232	1460	853	4.86	0.00	69.78	55.64
Khera Khus Khabar	125	796	937	32.29	0.00	71.67	60.06
Daurau Chandpur	579	3427	924	34.26	0.00	71.26	57.63
Panihavar	227	1372	844	28.72	0.00	78.41	67.03
Nagala Nattha	193	1056	814	70.08	0.00	70.65	53.35
Rampur	598	3311	877	12.32	0.00	79.07	65.94
Pairai	333	2037	877	8.00	0.00	79.50	70.45
Chaumuhan	358	2015	888	0.00	0.00	76.70	60.44
Barothchajmal	191	1146	888	24.96	0.00	72.26	57.76
Barauli	304	1639	897	13.36	0.00	76.43	60.12
Ishanpur	282	1655	907	21.81	0.00	63.81	52.83
Pahavati	325	1811	835	40.36	0.00	70.24	54.49
Madhaura	837	4864	890	31.37	0.00	75.73	63.79
Somna	348	2005	818	25.24	0.00	79.78	66.31
Gabhana (CT)	993	5886	901	31.86	0.10	71.72	60.36
Kanhoi	143	926	890	5.83	0.00	78.88	65.15
Ogarnagala Rajoo	466	2907	909	19.75	0.00	72.44	57.38
Chuharpur	207	1256	953	24.44	0.00	76.75	63.83
Pala Sallu	303	1824	993	17.65	0.00	74.36	60.90
Kaurah Rustampur	417	2683	939	9.21	0.00	77.77	67.64
Bhartri	259	1517	889	30.39	0.00	83.92	73.91
Bhankri Khas	333	1905	879	12.02	0.00	80.92	69.01
Mahrawal	801	4714	903	16.59	0.00	69.31	54.65
Lekhrajpur	270	1524	830	15.55	0.00	81.87	69.31
Bhikampur	355	2041	878	16.22	0.00	64.79	52.20
Jatanpur Chikawati	249	1468	914	14.99	0.00	78.42	63.44
Tajpur Rasoolpur	536	3305	952	5.14	0.00	66.73	53.87
Hardaspur	261	1687	887	33.85	0.00	71.52	57.05
Bajidpur	224	1654	854	10.40	0.00	75.04	60.50
Alahadpur Nivry	1532	9473	901	3.25	0.00	53.13	39.86
Ibrahimpur	288	1659	929	42.86	0.00	64.11	50.15
Shahpur Kutub	310	1665	881	99.88	0.00	75.38	60.00
Chamraula	100	542	895	99.82	0.00	68.85	59.13
Talaspur Khurd	497	3280	914	13.17	0.00	55.16	45.06
Daulatabad	129	803	804	2.86	0.00	67.71	51.84
Kasba Kol	1775	10057	834	19.11	0.00	72.67	61.77
Hajipur Chauhatta	180	1047	921	3.63	0.00	72.58	61.74
Rustampur Sakatkhan	431	2304	882	63.98	0.00	63.04	50.38
Pariyavali	574	3229	853	38.49	0.00	72.92	61.00

Settlement Name	No of HHs	Population	Sex Ratio	%SC	%ST	Lit%	Fem Lit%
Nagla Pankhani	159	829	802	54.76	0.00	77.55	64.69
Bhadesi Mafi	542	3163	891	73.73	0.00	69.40	57.70
Rahamatpur Garmai	114	682	863	41.06	0.00	80.40	69.60
Alinagar	214	1278	905	85.13	0.00	62.31	49.20
Sidhauli	1024	5641	840	19.27	0.05	75.48	66.04
Nijampur Borna	391	2451	675	34.11	0.00	86.76	77.73
Boner	300	1611	943	29.05	0.00	74.50	60.19
Bulandshahar Dehat	942	5463	898	7.32	0.00	71.07	58.82
Achaja Khurd	232	1155	848	58.87	0.00	69.95	50.23
Chiti	162	1144	885	22.73	0.00	78.59	63.80
Munda Khera	1100	6765	913	33.14	0.00	64.50	50.00
Baurola	1610	8664	864	14.19	0.00	55.99	44.19
Mirpur	521	3011	898	27.07	0.00	55.02	41.49
Wazidpur	539	3175	932	19.65	0.00	53.41	41.75
Nagla Shekhu	549	3160	881	30.38	0.00	78.49	64.66
Raniyavali	235	1359	893	34.73	0.00	77.20	61.52
Ahmadpur Halpura	103	569	830	42.18	0.00	76.54	58.93
Hazratpur Puthari	230	1336	825	39.67	0.00	67.03	51.65
Dashahara Kherli	344	2004	859	19.31	0.00	82.49	73.60
Mohammadpur Mazara Barhagaon	151	995	928	2.61	0.00	76.69	65.00
Rasoolpur	170	826	908	74.21	0.00	71.39	49.69
Jahanpur	179	1108	917	7.31	0.00	76.73	66.59
Naiphal Urf Uchangaon	304	1876	899	42.00	0.00	73.56	62.21
Ghatal	263	1527	902	32.55	0.00	65.56	51.75
Nekrampur Urf Visanpur	77	536	868	33.77	0.00	67.88	51.72
Gopalpur	245	1074	681	14.71	0.00	73.40	56.36
Hirdeypur	218	1383	900	11.14	0.00	73.56	60.00
Mandawarah	592	3382	871	77.74	0.00	72.38	57.83
Bhatpura	318	1828	862	56.07	0.00	75.05	60.55
Sikandrabad Rural	4144	22794	891	22.30	0.00	73.07	62.59
Gendpurshaikhpur	208	1269	821	9.69	0.00	81.29	66.80
Pilakhanwali	583	3557	929	20.72	0.00	75.49	60.37
Barkherah	451	2608	863	23.43	0.00	82.44	69.41
Bilsuri	801	4436	866	27.07	0.00	78.56	63.85
Chandaru	945	6804	662	27.15	0.00	71.24	55.67
Odara Urf Nawada	239	1499	914	23.62	0.00	79.68	67.90
Adaoli	199	1164	940	19.50	0.00	63.67	49.22
Kamalpur	524	3385	915	18.02	0.15	72.05	62.70
Akbapur	932	6681	905	22.63	0.00	61.72	51.01
Valipura	213	1240	934	27.82	0.00	76.74	63.51
Machkauli	335	1824	888	27.36	0.00	70.20	59.13
Jalkhera	587	3284	886	55.48	0.00	82.98	72.41
Khetalpur Bhansauli	519	3313	863	26.08	0.00	69.95	53.35
Dhamrawali	510	2970	925	42.32	0.00	71.43	57.07
Maman Kalan	623	4096	884	1.27	0.00	57.33	41.42
Kaulsena	387	2458	901	14.56	0.00	61.08	47.61
Hazipur Bhatola	688	4588	922	10.53	0.00	32.99	19.11
Asadullapur	0	0	0	0	0	0	0
Chandpur	4	21	909	0.00	0.00	87.50	71.43
Tilbegumpur	1756	10790	864	9.74	0.00	66.17	53.99
Sanwali	496	2608	838	2.26	0.00	81.02	66.17
Junedpur	290	1857	846	44.10	0.00	74.89	57.69

Settlement Name	No of HHs	Population	Sex Ratio	%SC	%ST	Lit%	Fem Lit%
Lalpur	114	705	870	2.27	0.00	73.94	54.11
Dariapur	732	4814	878	16.76	0.00	70.52	59.47
Dostpur	216	1257	862	25.30	0.00	77.37	62.55
Gangarua	529	3209	908	16.42	0.00	66.50	52.95
Maman Khurd	247	1515	882	23.10	0.00	77.25	60.91
Raja Rampur	218	1318	843	1.82	0.00	59.82	44.62
Khalsia Choharpur	274	1655	881	2.42	0.00	70.00	55.78
Bartauli	381	2301	877	16.56	0.00	61.07	51.06
Dharpa Choharpur	409	2388	864	45.02	0.00	71.77	57.98
Kirra	529	2943	865	65.92	0.00	63.80	49.03
Agwal	301	2064	929	30.09	0.00	55.66	44.44
Chandpur Khurd	13	105	1100	0.00	0.00	88.17	85.11
Lalpur Chitola	202	1273	801	0.00	0.00	81.92	76.36
Talibpur	150	919	927	97.28	0.00	65.49	53.05
Jhamka	437	2584	924	16.45	0.00	62.76	48.96
Bajidpur	304	1682	848	86.03	0.00	65.98	49.92
Rohinda	580	3655	899	17.81	0.00	51.42	39.05
Rukanpur	292	1716	863	43.65	0.00	77.81	63.45
Arnia Khurd	353	1973	818	30.56	0.00	72.05	59.24
Muni	690	4065	899	26.84	0.00	70.23	56.73
Keoli Khurd	509	3353	896	29.53	0.00	64.03	50.11
Khurja (NPP)	19641	111062	902	13.44	0.04	65.61	58.53
Sikandrabad (NPP)	13231	81028	922	11.43	0.00	65.71	57.49
Talabpur Urf Hathipur	113	664	809	0.00	0.00	82.25	68.42
Bisnoli	572	3419	844	17.99	0.00	81.43	70.66
Ibadullapur Urf Badalpur	600	3716	955	12.08	0.00	81.45	71.91
Sadhapur	638	3729	894	5.63	0.00	82.27	69.36
Nagla Chamroo	294	1735	840	20.58	0.00	74.81	56.76
Chithara	1168	7656	868	21.92	0.00	78.12	65.66
Mahiuddinpur Urf Garakhpur	1	2	1000	0.00	0.00	50.00	0.00
Nagla Nainsukh	256	1544	867	13.80	0.00	75.13	60.99
Shahpur Khurd	222	1281	903	28.65	0.00	75.05	58.68
Ranoli Latifpur	447	2878	870	10.70	0.00	77.78	65.51
Bisahda	1167	6669	844	11.55	0.00	77.22	65.99
Bairangpur Urf Nai Basti	424	3071	888	18.07	0.00	79.93	67.17
Beel Akbarpur	355	2194	957	30.77	0.00	78.72	65.55
Dhoom Manikpur	1803	10388	880	20.84	0.87	79.73	69.43
Badhpura	635	3979	864	9.45	0.00	76.45	64.79
Nagla Kirani	3	4	0	0.00	0.00	50.00	0.00
Kot	672	4244	885	8.29	0.00	79.42	68.35
Dadri (NPP)	16215	91189	866	11.61	0.12	74.37	65.57
Chipyana Buzurg (CT)	3364	17400	866	13.53	0.01	85.12	77.45
Chhapraula (CT)	2988	15154	845	5.31	0.00	83.65	74.86
Aol Core zone villages	116285	678676	884	18.19	0.04	70.71	60.08
Other Aol villages	8591	51899	889	25.31	0.00	73.68	60.22
Total Aol villages	124876	730575	885	18.70	0.03	70.83	60.09

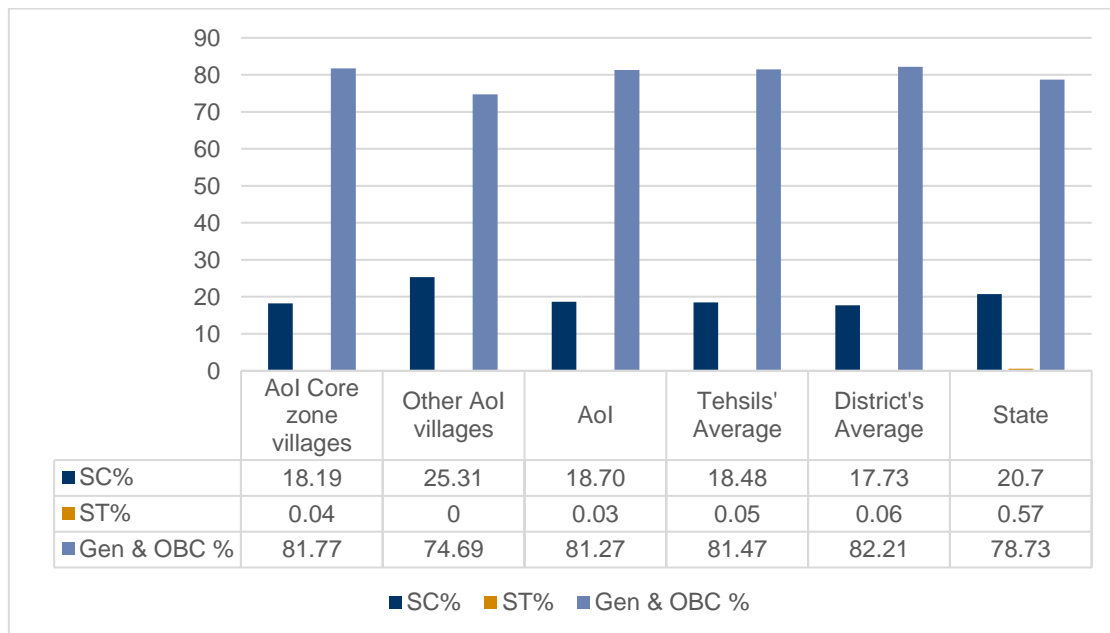
Source: Census of India, 2011

Note: The land has been acquired from 130 villages, 03 Census towns (CT) and 03 Nagar Palika Parishads (NPP), a total of 136 settlements under Core zone. The table also indicates that there are 23 villages and one Census town (CT) falling within Area of influence

5.4.5 Social Stratification

The population in the Aol falls under both rural and urban categories. The villages and towns comprise of majorly Rajputs, Brahmins, Muslims, Gurjars (OBC) and SC (Scheduled Caste)³⁹ social groups. No ST (Scheduled Tribe) population has been identified during household survey; however, the review of census data, 2011 indicated a presence of very small ST community in the Study Area. Majority of the populations in the Study Area, tehsils, districts and state belong to general and Other Backward Caste (OBC) community.

Figure 5.28 Proportion of SC/ST Population in the Aol villages' vis-à-vis Tehsil/ District



Source: Census of India, 2011

5.4.5.1 Schedule Caste population

During household survey and focus group discussions with local community and elected representatives of affected villages it was understood that the major sub castes of SC population inhabiting the area are Jatav, Dhimar, Suryvanshi and Dhoni etc. Further during one of the FGDs, in Khetalpur, community informed that the present elected village representative is from SC community due to the reservation for SC community. Earlier the elected representative/ Sarpanch was from general category, who did not used to bother about meetings with local community and their equal participation in decision making.

5.4.5.2 Schedule Tribe population

The Figure 5.2827 above indicates that the ST population is only 0.57% in the state of Uttar Pradesh; and similarly minimal at the district and tehsil level, i.e. 0.06% and 0.05% average ST population at district and tehsil level respectively.

³⁹ The **Scheduled Castes (SCs)** and **Scheduled Tribes (STs)** are officially designated groups of people in India. In modern literature, the Scheduled Castes are sometimes referred to as **Dalit**, meaning "broken/scattered", having been popularised by B. R. Ambedkar (1891–1956). The Scheduled Castes and Scheduled Tribes comprise about 16.6% and 8.6%, respectively, of India's population (according to the 2011 census). The Constitution (Scheduled Castes) Order, 1950 lists 1,108 castes across 28 states in its First Schedule, and the Constitution (Scheduled Tribes) Order, 1950 lists 744 tribes across 22 states in its First Schedule. Since the independence of India, the Scheduled Castes and Scheduled Tribes were given Reservation status, guaranteeing political representation. The Constitution lays down the general principles of positive discrimination for SCs and STs.

Further as per the review of the 2011 Census data, of the Aol villages it was understood that the presence of ST community in core zone villages is negligible (i.e. 0.04%) and there is no ST community in the other Aol villages. During household survey and focus group discussions with local community and Sarpanch's of affected villages, it was confirmed that there is no significant ST community clusters in the area/ villages. The 2011 Census data shows that there is 0.10% ST population in Gabhana (CT), 0.05% in Sidhauri, 0.15% in Kamalpur, 0.05% in Khurja (NPP), 0.87% in Dhoom manikpur, 0.12% in Dadri (NPP) and 0.01% in Chipyana Buzurg (NPP).

Box 5.1 Migrant Gadiya Lohar Community in Ghaziabad

Gadiya Lohar Community

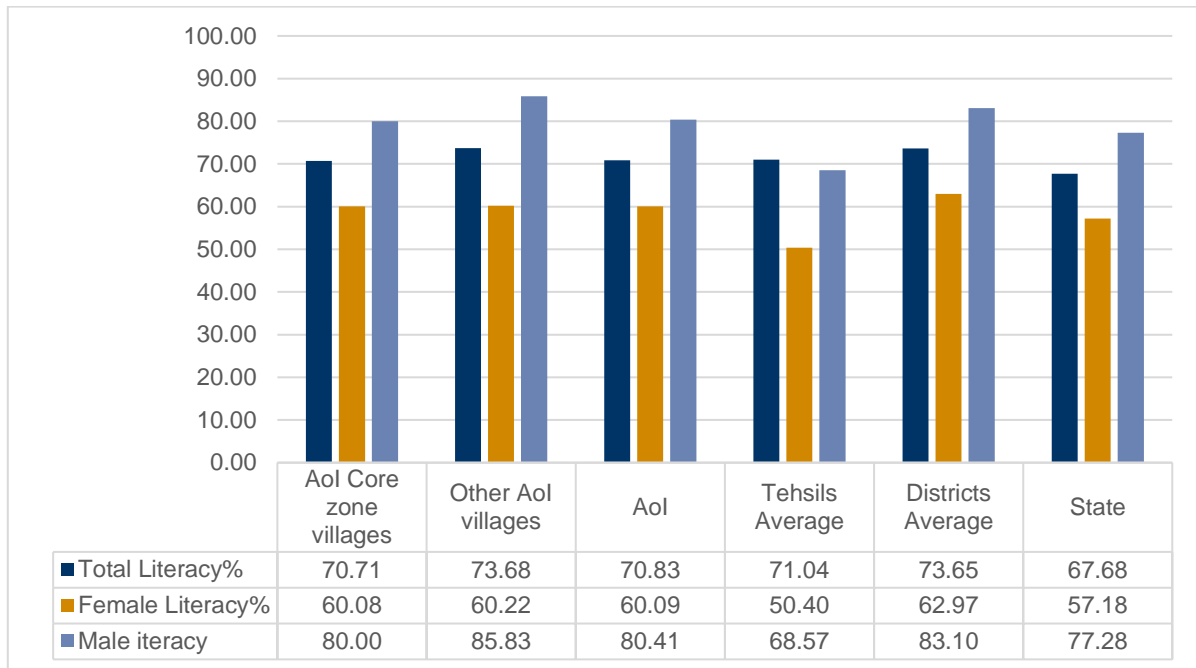
Lohar Community members are living in three clusters along the initial stretch of NH 91 (New NH No. 34) for up to 15 years as reported by them during survey. The *Lohar* Community are known to be a nomadic community originally belonging to Chittorgarh, Rajasthan. The Lohar community prefer typically locate themselves in clusters along the road where they can easily attract customers and have good market for the iron products they manufacture. Thus, roads with significant moving population provides locational advantage for them. Many Lohar community clusters are also located across different pockets in Ghaziabad along the road. As per the official list of the Government UP this community is not categorized under SC, ST or OBC therefore they are assumed to be falling under General Category in UP. This community is listed as OBC for the state of Rajasthan, which is also where they trace their origins to.

It was also noted in the consultation with Lohar Community that their relatives were allotted 50 square yards of land per family in Sardhana - Meerut by UP State Government as a result of their physical displacement from Kankerkhara in Meerut due to land acquisition for a development project. However Lohar community identified in the survey didn't mention having their houses in Sardhana.

5.4.6 Literacy & Education

The total literacy rate in the Core Zone villages is the lowest as compared to the other Aol villages, overall Aol, Tehsil and district figures. However, the literacy rate in core zone villages is higher than that of the state. Further, the female literacy rate is at par with that of the state, district and overall Aol.

Figure 5.29 Comparative overview of the Literacy Rate across Study Area, District and State



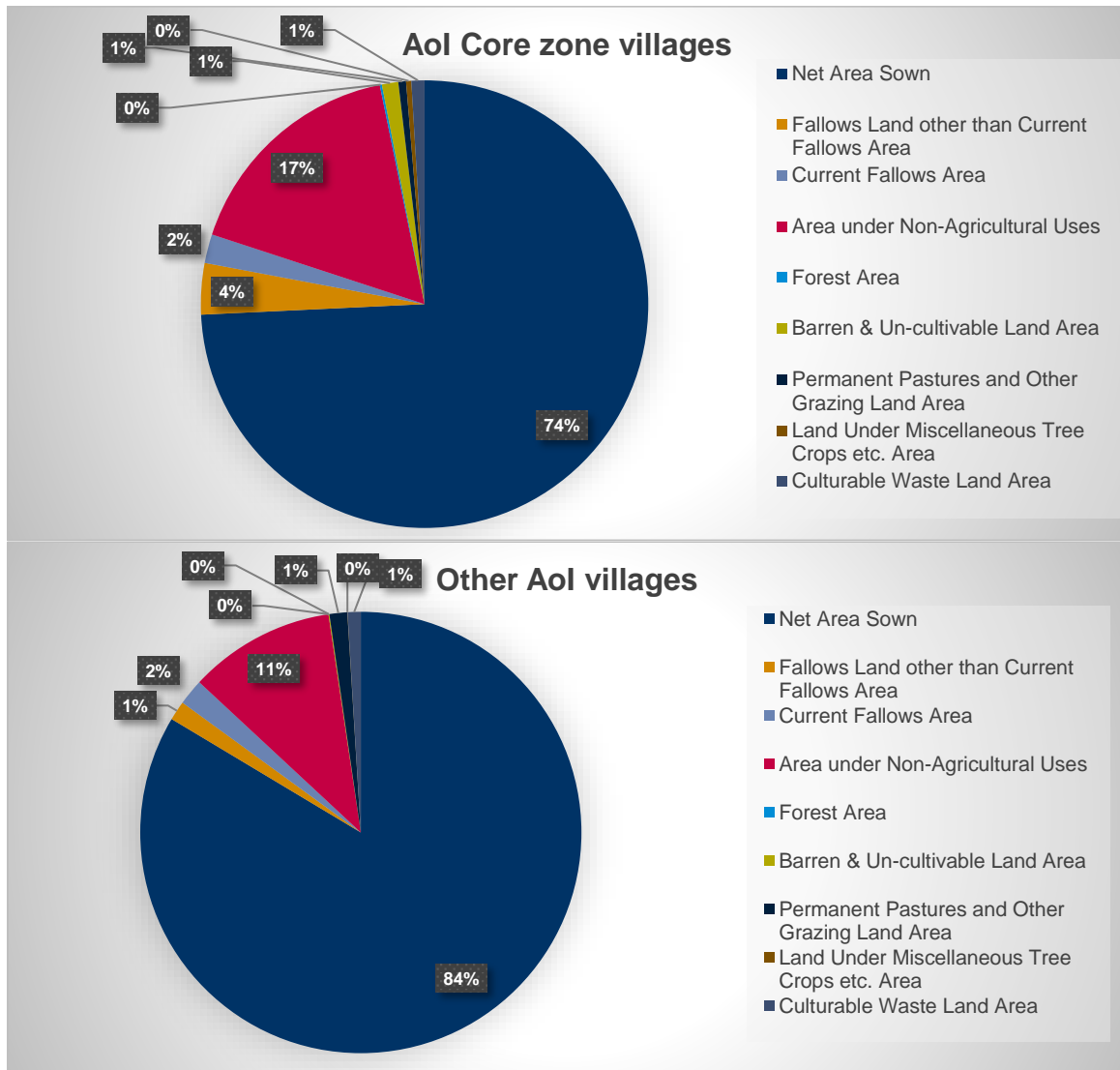
Source: Census of India, 2011

There is a changing scenario in terms of educational attainment for girl children, such that reportedly all girls in the Project Villages attend schools. During consultation in Project villages, it was understood that mostly girls complete their education till middle school as there is government middle school in 92 villages out of total 135 project villages, in remaining 43 villages there is reportedly a private school or government middle school in the nearby villages.

5.4.7 Land ownership & use

This section presents an overview of the ownership and use of land in the project area, based on the Census 2011. The Aol is largely rural and has an agrarian economy and hence the dependence on land as a resource is high. The table for land use/ utilization reiterates the dependence of people on agriculture, making it one of the primary sources of their livelihood. Given below is the proportion of land used in the area.

Figure 5.30 Proportion of Land Use in Study Area including villages, CTs and NPPs



Source: Census of India, 2011

5.4.7.1 Land category breakup

Table 5.28: Land Use Break Up in the Study Area (in hectares)

Aol Settlement Name	Total Area	Net Area Sown	Net Area Sown %	Forest Area	Area under Non-Agricultural Uses	Barren & Un-cultivable Land Area	Permanent Pastures and Other Grazing Land Area	Land Under Miscellaneous Tree Crops etc. Area	Culturable Waste Land Area	Fallows Land other than Current Fallows Area	Current Fallows Area
Shahpur Bamhaita	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hayatpur Bajhera	144.3	129.61	89.82	0	8.58	0	0.77	0	2.36	0	2.98
Sikandarapur Bhukarawale	105.27	62.15	59.04	0	0.42	19.04	0	0	0	19.3	4.34
Khera Khus Khabar	144.21	94.66	65.64	0	1.01	9.54	4.45	0	24.8	6.91	2.84
Daurau Chandpur	436.93	385.64	88.26	0	40.34	0	4.83	0	2.24	1.84	2.04
Panihavar	271.02	240.31	88.67	0	19.08	0	0	0	9.34	0.1	2.19
Nagala Nattha	97.07	78.26	80.62	0	12.14	0	0	0	0.95	4.87	0.85
Rampur	140.9	98.01	69.56	0	0	0	0	0	1.04	37.46	4.39
Pairai	385.5	342.87	88.94	0	12.5	5.6	0	13.6	2.18	2.5	6.25
Chaumuhan	162.12	139.83	86.25	0	20.23	0	2.06	0	0	0	0
Barothchajmal	372.98	333.77	89.49	0	20.68	0	4.94	1	3.85	5.57	3.17
Barauli	248.78	211.79	85.13	0	35.25	0	0	0	0	0	1.74
Ishanpur	150.38	132.2	87.91	0	9.55	0	2.05	2.29	0.09	1.05	3.26
Pahavati	316.29	277.87	87.85	0	29.76	0	0	0	1	3.69	3.97
Madhaura	732.07	613.39	83.79	0	90.23	0	4.96	0	7.21	0	16.29
Somna	325.3	228.81	70.34	0	73.4	0	0.33	0	12.86	0	9.9
Gabhana (CT)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Kanhoi	252.59	217.27	86.02	0	28.97	0	0	0	2.3	0	4.05
Ogarnagala Rajoo	530.43	428.8	80.84	0	66.13	0	2.54	0	18.47	0.83	13.67
Chuharpur	181.75	155.45	85.53	0	16.3	0	0	10	0	0	0
Pala Sallu	401.04	320.5	79.92	42.12	35.02	0	0	1.2	0	2.2	0
Kaurah Rustampur	457.08	395.44	86.51	0	43.42	0	0	0	2.36	1.42	13.44
Bhartri	230.36	185.08	80.34	0	28.48	0	4.65	0	3.75	8.4	0
Bhankri Khas	371.79	305.7	82.22	0	48.7	0	0.81	0	1.45	7.59	7.54
Mahrawal	509.1	390.13	76.63	0	70.29	0	0.98	1.19	9.2	25.8	11.5
Lekhrajpur	161.82	135.54	83.76	0	20.54	0	3.94	0.29	1.5	0	0

Aol Settlement Name	Total Area	Net Area Sown	Net Area Sown %	Forest Area	Area under Non-Agricultural Uses	Barren & Un-cultivable Land Area	Permanent Pastures and Other Grazing Land Area	Land Under Miscellaneous Tree Crops etc. Area	Culturable Waste Land Area	Fallows Land other than Current Fallows Area	Current Fallows Area
Bhikampur	97.75	77.61	79.40	0	18.43	0	1.7	0	0	0	0
Jatanpur Chikawati	178.36	165.54	92.81	0	12.81	0	0	0	0	0	0
Tajpur Rasoolpur	185.55	154.68	83.36	0	27.68	0	1.96	0	0	0	1.22
Hardaspur	147.65	110.7	74.97	0	16.57	0	0	0	1.78	7.12	11.48
Bajidpur	304.63	276.87	90.89	0	26.77	0	0	0	0.66	0.08	0.24
Alahadadpur Nivry	150.25	61.28	40.79	0	61.46	1.42	0	0	0	0	26.09
Ibrahimpur	119.95	108.09	90.11	0	9.26	0	1.6	0	0.03	0.1	0
Shahpur Kutub	74.27	58.97	79.40	0	9.1	4.28	0	0	0	0	1.82
Chamraula	40.54	29.56	72.92	0.21	5.39	0	1.56	0	0.07	1.01	2.73
Talaspur Khurd	174.86	132.48	75.76	0	34.77	2.4	0	0	0	0	5.22
Daulatabad	50.05	44.16	88.23	0	5.21	0	0	0	0	0.28	0.4
Kasba Kol	493.72	82.71	16.75	0	260.33	0	0	0	0	149.62	1.06
Hajipur Chauhatta	149.21	133.88	89.73	0	12.62	0	0	0	0.09	0.98	1.64
Rustampur Sakatkhan	120.89	87.06	72.02	0	20.03	0	0	0	2	5.12	6.68
Pariyavali	261.02	182.46	69.90	0	41.82	0	0	4.5	0.64	16.85	14.75
Nagla Pankhani	60.43	48.37	80.04	0	7.15	0	0.06	0.31	0	2.54	2
Bhadesi Mafi	226.08	145.16	64.21	0	36.41	0	0.24	0.6	0.05	9.44	34.18
Rahamatpur Garmai	80.83	69.08	85.46	0	9.42	0	0	1.24	0	0.46	0.64
Alinagar	42.3	32.4	76.60	0	7.48	0	0	0	0	2.42	0
Sidhauili	320.48	198.6	61.97	0	99.39	0	0	0	2.96	17.3	2.22
Nijampur Borna	271.39	152.38	56.15	0	76.94	0	0	0	0.2	27.53	14.34
Boner	180.99	130.81	72.27	0	18.24	0	0	0	8.91	13.11	9.92
Bulandshahar Dehat	710.06	467.76	65.88	0	235.72	0	0	0	6.11	0	0.47
Achaja Khurd	134.68	95.619	71.00	0	35.793	0	0	0	0.069	3.198	0
Chiti	244.915	177.459	72.46	0	45.78	0	0	20	0.15	1.291	0.232
Munda Khera	252.79	168.81	66.78	0	81.06	0	0	0	0.22	0.93	1.76
Bauroli	319.65	241.22	75.46	0	70.85	0	0	0	0.3	4.17	3.11
Mirpur	252.2	212.81	84.38	0	30.04	0	0	0	1.05	0	8.31
Wazidpur	183.08	143.85	78.57	0	0	32.21	0	0	0.26	4.74	2.02

Aol Settlement Name	Total Area	Net Area Sown	Net Area Sown %	Forest Area	Area under Non-Agricultural Uses	Barren & Un-cultivable Land Area	Permanent Pastures and Other Grazing Land Area	Land Under Miscellaneous Tree Crops etc. Area	Culturable Waste Land Area	Fallow Land other than Current Fallows Area	Current Fallows Area
Nagla Shekhu	401.97	349.43	86.93	0	41.04	0	0	0	4.55	0	6.95
Raniyavali	250.5	219.55	87.64	0	29.67	0	0	0	0.23	0.64	0.41
Ahmadpur Halpura	115.02	101.71	88.43	0	11.26	0	0.35	0	0.22	1.43	0.05
Hazratpur Puthari	231.75	208.95	90.16	0	16.13	0	0	0	3.45	0.78	2.43
Dashahara Kherli	489.56	452.4	92.41	0	37.16	0	0	0	0	0	0
Mohammadpur Mazara Barhagaon	192.54	149.07	77.42	0	13.51	0	0	10.08	16.73	0.81	2.35
Rasoolpur	151.8	135.25	89.10	0	11.4	0	0	0	1.83	0	3.32
Jahanpur	216.74	107.45	49.58	0	16.17	0	0	0	2.91	90.21	0
Naiphal Urf Uchangaon	337	312.8	92.82	0	17.33	0	0	0	2.77	4.1	0
Ghatal	227.88	208.74	91.60	0	13.818	0	0	0	3.65	0	1.67
Nekrampur Urf Visanpur	122.58	96.05	78.36	0	16.7	0	0.67	0.68	0	5.31	3.17
Gopalpur	96.97	3.45	3.56	0	93.49	0	0	0	0.03	0	0
Hirdeypur	123.58	87.2	70.56	0	21.75	0	0	3	1.15	4.19	6.29
Mandawarah	172.87	148.77	86.06	0	16.07	0	0	0	0	5.77	2.76
Bhatpura	156.42	109.2	69.81	0	16.92	0	18.43	0	2.77	2.73	6.37
Sikandrabad Rural	2175.65	1661.68	76.38	0	200.91	0	74.24	0	28.88	173.37	36.57
Gendpurshaikhpur	224.04	177.01	79.01	0	30.52	0	10.92	0	1.64	1.39	2.55
Pilakhanwali	341.1	295.83	86.73	0	38.3	0	0	0	6.81	0.16	0
Barkherah	326.66	275.64	84.38	0	46.14	0	0	0	0.27	2.99	1.62
Bilsuri	195.65	136.91	69.98	0	48.36	0	2.84	0	7.46	0.08	0
Chandaru	291.42	183.38	62.93	0	86.07	0	0	1.44	1.13	9.4	10
Odara Urf Nawada	151.59	104.36	68.84	0	41.99	0	0	0	0.5	0	5.19
Adaoli	65.56	56.68	86.46	0	0	8.88	0	0	0	0	0
Kamalpur	192.07	164.99	85.90	0	26.34	0	0	0	0.74	0	0
Akbapur	405.43	200	49.33	0	205.1	0	0	0	0.3	0	0
Valipura	104.66	104.66	100.00	0	0	0	0	0	0	0	0
Machkauli	50.17	19.6	39.07	0	29.88	0	0	0	0.685	0	0
Jalkhera	320.44	269.99	84.26	0	45.09	0	0.26	0	2.28	2.82	0

Aol Settlement Name	Total Area	Net Area Sown	Net Area Sown %	Forest Area	Area under Non-Agricultural Uses	Barren & Un-cultivable Land Area	Permanent Pastures and Other Grazing Land Area	Land Under Miscellaneous Tree Crops etc. Area	Culturable Waste Land Area	Fallow Land other than Current Fallows Area	Current Fallows Area
Khetalpur Bhansauli	226.43	186.6	82.41	0	33.9	0	0	0	3.84	0	2.09
Dhamrawali	278.27	245.31	88.16	0	31.33	0	0	0	0.69	0	0.94
Maman Kalan	159.8	134.06	83.89	0	24.32	0	0	0	0.21	0	0.22
Kaulsena	185.84	153.69	82.70	0	29.49	0	0.78	0	1.74	0	0.14
Hazipur Bhatola	247.68	215.086	86.84	0	23.223	0	0	0	3.396	5.809	0.166
Asadullapur	50.54	42.35	83.80	0	8.16	0	0	0	0.03	0	0
Chandpur	282.12	114.24	40.49	0	164.52	0	0	0	3.36	0	0
Tilbegumpur	576.1	280.38	48.67	0	277.97	0	0	0	2.64	11.91	3.2
Sanwali	304.17	94.91	31.20	0	174.2	0	2.83	0	0.04	24.17	8.03
Junedpur	240.99	167.21	69.38	0	69.8	0	0	0	1.65	2.33	0
Lalpur	126.57	88.03	69.55	0	29.47	0	3.35	0	0.56	5.16	0
Dariapur	252.58	210.89	83.49	0	34.14	0	0	6.25	0.2	0	1.1
Dostpur	153.29	74.45	48.57	0	51.76	25.25	0.46	0	0.57	0	0.8
Gangarua	349.39	286.47	81.99	0	56.23	0	0	0	0.59	5.03	1.07
Maman Khurd	165.72	141.2	85.20	0	23.53	0	0	0	0.29	0	0.7
Raja Rampur	122.62	109.91	89.63	0	0	12.71	0	0	0	0	0
Khalsia Choharpur	166.03	118.037	71.09	0	46.29	0	0	0	0.84	0	0.86
Bartauli	292.12	247.285	84.65	0	33.47	0	0	0	0.666	5.28	5.417
Dharpa Choharpur	324.61	242.754	74.78	0	73.18	0	0	0	0.97	6.932	0.777
Kirra	438.09	363.28	82.92	0	45.06	0	0	0	12.11	12.06	4.98
Agwal	209.63	164.86	78.64	0	36.49	0	0	0	0.23	6.56	1.49
Chandpur Khurd	86.67	76.36	88.10	0	9.34	0	0	0	0.1	0.26	0.12
Lalpur Chitola	86.99	65.73	75.56	0	19	0	0	0	0	0.06	2.2
Talibpur	107.78	90.15	83.64	0	16.97	0	0	0	0.1	0	0.56
Jhamka	387.56	349.49	90.18	0	29.22	0	0	0	0.32	2.835	5.7
Bajidpur	175.8	159.56	90.76	0	14.38	0	0	0.09	0.09	0.17	1.51
Rohinda	441.88	377.169	85.36	0	47.71	0	0	6.03	0	7.525	3.442
Rukanpur	366.02	356.02	97.27	10	0	0	0	0	0	0	0
Arnia Khurd	400.27	316	78.95	1.438	27.888	0	0	0.7	21.58	19.16	13.5

Aol Settlement Name	Total Area	Net Area Sown	Net Area Sown %	Forest Area	Area under Non-Agricultural Uses	Barren & Un-cultivable Land Area	Permanent Pastures and Other Grazing Land Area	Land Under Miscellaneous Tree Crops etc. Area	Culturable Waste Land Area	Fallows Land other than Current Fallows Area	Current Fallows Area
Muni	403.64	348.34	86.30	0	47.73	0	0	0.12	0.94	6.51	0
Keoli Khurd	511.26	451.24	88.26	0	36.35	0	0	0	6.09	3.87	13.71
Khurja (NPP)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sikandrabad (NPP)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Talabpur Urf Hathipur	88.01	80.54	91.51	0	7.09	0	0	0	0.01	0	0.37
Bisnoli	170.58	129.08	75.67	0	15.65	0	0	0	0	0	25.85
Ibadullapur Urf Badalpur	313.61	0	0.00	0	313.61	0	0	0	0	0	0
Sadhapur	180.66	0	0.00	0	180.66	0	0	0	0	0	0
Nagla Chamroo	230.28	172.87	75.07	0	31.58	11.665	7.81	0	7.36	0	0
Chithara	770.78	423.45	54.94	0	237.37	0	0	0	0	4.41	105.55
Mahiuddinpur Urf Garakhpur	127.49	110.18	86.42	0	0	10.36	0.42	0	0	7.48	0.15
Nagla Nainsukh	221.2	204.8	92.59	0	0.46	0	9.69	0	1.06	0	5.19
Shahpur Khurd	202	176.53	87.39	0	0.18	14.81	0.28	0	0	8.18	2.02
Ranoli Latifpur	353.85	264.63	74.79	0	0.5	55.62	0.42	0	0	33.65	0.03
Bisahda	714.01	463.45	64.91	0	222.91	0	0	0	24.38	0	3.27
Bairangpur Urf Nai Basti	333.01	211.28	63.45	0	31.591	3.13	0	0.6	0.101	0.7	85.61
Beel Akbarpur	362.19	229.66	63.41	0	34.27	0	0	0	13.1	23.16	62
Dhoom Manikpur	1127	609.98	54.12	0	2.12	192.85	1.38	0	0	315.95	4.71
Badhpura	219.08	108.86	49.69	0	35.73	0	0	44.76	0	29.73	0
Nagla Kirani	107.68	92.32	85.74	0	0	7.16	0.16	3	0	4.62	0.42
Kot	526.58	395.53	75.11	0	57.84	0	15.16	0	0.32	49.58	8.15
Dadri (NPP)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chipyana Buzurg (CT)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chhapraula (CT)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aol Core zone villages	35257.745	26178.429	74.25	53.768	5905.343	416.925	194.88	132.97	333.657	1307.09	734.684
Other Aol villages	6158.156	5147.656	83.59	0	660.846	4.02	80.34	1.06	59.128	87.568	117.537
Aol villages	41415.901	31326.085	75.64	53.768	6566.189	420.945	275.22	134.03	392.785	1394.658	852.221

Source: Census of India, 2011

Note.: The land breakup data of rural & urban areas, i.e. Shahpur Bamhaita, Gabhana (CT), Khurja (CT), Sikandrabad (CT), Dadri (CT), Chipyana Buzurg (CT) and Chhapraula (CT) falling under Core zone and Bahalimpura (CT) under Aol were not detailed out in census data. Hence those details have not been given in table above.*

The Table 5.2827 given above states that approximately 74.25% is net sown area, out of which 1.24% is unirrigated land and 98.76% is irrigated by some sources, i.e. wells, canals, bore-wells etc 1.18% of the total land area in the Project villages is categorised barren and uncultivable land, indicating predominance of agricultural use, and higher productivity, given that the major part of cultivated land is also irrigated and not just dependent on rainfall. The agricultural productivity of the region (Western UP) is also comparatively high, making this a region of high value, multi-cropped agriculture. The Project villages have only 0.15% area as forest land, 16.75% area under non-agricultural use and 0.95% as culturable waste land. Additionally, 0.38% is land comprising of miscellaneous tree crops, and 0.55% are permanent pastures and other grazing land. Current fallows area and fallow lands other than current fallows comprise of only 2.08 % and 3.71% respectively.

This data is a decade old and during consultations with local communities in the project villages it is understood that with the availability of reliable electricity in recent years, more people have invested in installing bore wells and have brought more land into agricultural use- privately owned land. No details pertaining to usage of government land could be ascertained during household survey and consultations.

In the settlements falling within 500 meter of Aol, 83.59 % of the land is categorised as net sown area out of which almost all (99.9%) is land area irrigated by several sources, i.e. canals, bore-wells etc; only Semla village was identified to have 0.18% of unirrigated land in Aol villages. A very small proportion, 0.07 % of total land area is barren and uncultivable land, 10.73 % is under non-agricultural uses, 0.96 % is culturable wasteland, 0.02 % is land comprising of miscellaneous tree crops, and 1.30 % comprise of permanent pastures and other grazing land. Current fallows area and fallow lands other than current fallows comprise of 1.91 % and 1.42 % respectively in the Aol. There is no forest land area in the Project Aol.

5.4.7.2 Land & Asset Ownership & Occupation (Squatting/ Encroachment)

During FGDs and consultations with local communities in Project villages in the Aol it was understood that majority of the households in rural settlements own private land varying on an average between 1- 2.5 acres (i.e. 0.4- 1 hectares)/ household (as understood during focus group discussion and information shared during consultations). The land ownerships however varies across social groups/ communities, i.e. SC; There were very few households surveyed, who did not possess any land, either for agricultural purposes or for commercial purposes.

Further, during FGDs and consultations with local communities, it was understood that the land ownership also varies in project villages, depending on the caste and community in the villages. In village Shahpur Bamhaita under Ghaziabad District it was understood that the private landholding used to be very high among Yadav community nearly a decade ago, however a majority of people have sold their land to commercial developers in the area or have been acquired under NH34 or Meerut Expressway and the remaining 10% (broad estimate, based on recall) possess an average of 0.5 to 2.5 hectares of land, for each household. The status of land holding remains very similar in the villages of Gautam Buddha Nagar in the initial 10 km of the road.

Moving towards the Bulandshahar and Aligarh districts it was understood that majority of the land holding remains with general category community, i.e. Brahmin and Rajputs and Gujjars from OBC community. The average land holding across villages is understood to be between 1-2 hectares while around 5-10% of the population possess a maximum land holding of 4-5 hectares or more.

The land falling within the existing RoW is government land and is under the NHAI; however, several instances of encroachment and squatting were identified within the RoW. In majority of the cases land within existing RoW had been encroached for extensions to residential and commercial private

structures. In other instances the land within RoW was used for temporary/ make-shift/ movable commercial structures.

5.4.8 Occupation and Livelihood

The Project Aol is categorized by nearly 31.51% working population, where majority of the working population comes under “Main Workers”, i.e. being employed for more than 6 months in a year. The Project Villages have nearly 81.07% Main workers of the total working population. The table below depicts that women workers form a smaller proportion in the overall working population both as a main worker (6.54%) and marginal worker (4.64%) in the project villages. During FGDs with women groups, it was informed that women are majorly engaged in unpaid household work and taking care of their family. Their engagement in paid work is influenced by their caste, poverty and economic status where women from BPL families, SC and other backward castes are engaged in paid work due to financial needs. However, many women are now choosing to go out to work in nearby factories and even migrating to highly urbanised areas such as Delhi, Bangalore, Mumbai etc. The scenario remains almost similar in the other Aol villages for proportion of females as Main and Marginal workers, where total male marginal workers and female marginal workers are 7.30 % and 5.34 % respectively.

The proportion of Non-working population out of the total study area population, comprising of children, the older folks, handicapped as well as unemployed youth, in the Study Area is much higher than the total working population, indicating a higher dependency. Negative effects on livelihoods and the means of livelihoods (agricultural land, assets such as shops, etc.) of the working population is therefore likely to have greater significance the higher dependency ratio.

Table 5.29: Working Population in the Project Aol

Village Name	WPR	Main work%	Main male%	Main female%	Marginal work%	Marginal male%	Marginal female%	Non Worker %
Hayatpur Bajhera	35.63	72.65	45.99	3.04	27.35	1.72	18.87	64.37
Sikandarpur Bhukarawale	25.96	63.59	27.79	3.27	36.41	15.36	2.53	74.04
Khera Khus Khabar	26.88	40.65	20.44	0.78	59.35	30.41	0.52	73.12
Daurau Chandpur	38.26	63.54	39.64	7.72	36.46	14.04	13.85	61.74
Panihavar	28.57	63.78	32.39	1.43	36.22	15.59	4.14	71.43
Nagala Nattha	43.75	55.63	32.13	14.77	44.37	21.13	17.30	56.25
Rampur	29.42	85.63	43.37	4.46	14.37	5.56	2.71	70.58
Pairai	45.90	64.39	37.70	20.27	35.61	18.71	13.66	54.10
Chaumuhan	28.39	99.13	48.08	5.70	0.87	0.37	0.11	71.61
Barothchajmal	28.88	97.58	50.74	2.78	2.42	0.99	0.37	71.12
Barauli	30.75	53.17	27.43	4.00	46.83	23.84	3.87	69.25
Ishanpur	29.06	83.99	42.97	3.94	16.01	4.95	4.32	70.94
Pahavati	39.32	75.84	49.54	6.19	24.16	4.26	15.78	60.68
Madhula	35.30	68.08	41.96	3.89	31.92	9.01	13.80	64.70
Somna	36.11	81.77	41.80	14.52	18.23	9.70	2.77	63.89
Gabhana (CT)	33.37	77.49	43.60	6.16	22.51	5.68	9.53	66.63
Kanhoi	41.25	99.48	48.57	32.57	0.52	0.20	0.23	58.75
Ogarnagala Rajoo	30.24	69.40	35.78	4.70	30.60	14.71	3.25	69.76
Chuharpur	39.33	58.50	38.41	6.85	41.50	16.80	15.82	60.67
Pala Sallu	26.75	99.18	47.54	5.39	0.82	0.33	0.11	73.25
Kaurah Rustampur	28.33	86.18	43.79	3.77	13.82	6.14	1.54	71.67
Bhartri	42.98	54.91	41.97	2.94	45.09	15.57	23.67	57.02
Bhankri Khas	39.37	66.80	45.27	4.71	33.20	7.69	19.19	60.63
Mahrawal	31.61	64.56	33.43	5.99	35.44	13.32	8.85	68.39
Lekhrajpur	46.85	85.85	50.78	27.50	14.15	5.04	8.54	53.15

Village Name	WPR	Main work%	Main male%	Main female%	Marginal work%	Marginal male%	Marginal female%	Non Worker %
Bhikampur	35.96	58.86	35.33	5.03	41.14	16.19	13.21	64.04
Jatanpur Chikawati	33.58	67.75	37.55	6.56	32.25	11.60	9.99	66.42
Tajpur Rasoolpur	33.25	87.63	46.13	11.29	12.37	2.54	5.77	66.75
Hardaspur	26.67	100.00	48.43	2.14	0.00	0.00	0.00	73.33
Bajidpur	36.70	66.72	42.94	2.89	33.28	3.81	22.05	63.30
Alahadadpur Nivry	30.57	59.53	31.48	3.45	40.47	14.71	9.78	69.43
Ibrahimpur	24.71	86.83	37.21	4.51	13.17	5.47	0.88	75.29
Shahpur Kutub	28.29	83.86	39.32	6.03	16.14	6.55	2.31	71.71
Chamraula	38.93	46.45	29.02	5.86	53.55	25.17	16.02	61.07
Talaspur Khurd	25.46	78.68	35.36	3.26	21.32	7.93	2.68	74.54
Daulatabad	27.77	66.82	31.91	1.96	33.18	15.96	0.84	72.23
Kasba Kol	28.06	87.70	38.62	7.81	12.30	4.30	2.43	71.94
Hajipur Chauhatta	35.63	82.84	50.46	6.77	17.16	1.28	11.35	64.37
Rustampur Sakatkhan	31.64	66.80	33.66	6.94	33.20	14.13	6.39	68.36
Pariyavali	30.57	56.13	29.15	3.10	43.87	20.14	5.52	69.43
Nagla Pankhani	52.11	73.84	50.65	23.31	26.16	7.83	20.87	47.89
Bhadesi Mafi	30.22	87.97	44.11	6.91	12.03	5.56	1.48	69.78
Rahamatpur Garmai	24.49	53.89	22.40	2.53	46.11	20.22	0.95	75.51
Alinagar	27.07	91.33	43.37	4.12	8.67	3.13	1.48	72.93
Sidhauli	29.57	73.32	35.84	4.82	26.68	11.81	3.22	70.43
Nijampur Borna	39.41	91.30	56.94	4.96	8.70	4.17	2.33	60.59
Boner	29.42	89.03	47.53	3.58	10.97	4.46	1.92	70.58
Bulandshahar Dehat	29.38	89.91	43.40	7.50	10.09	4.41	1.35	70.62
Achaja Khurd	46.84	71.72	48.16	16.42	28.28	5.12	22.83	53.16
Chiti	30.51	93.41	49.09	5.21	6.59	2.14	1.86	69.49
Munda Khera	33.64	89.63	47.12	11.58	10.37	4.41	2.48	66.36
Bauroli	31.86	81.45	42.25	7.07	18.55	7.01	4.63	68.14
Mirpur	29.96	86.25	41.55	8.35	13.75	4.29	3.93	70.04
Wazidpur	27.81	66.36	31.83	4.11	33.64	12.66	5.81	72.19
Nagla Shekhu	38.96	67.99	41.37	9.59	32.01	8.51	16.96	61.04
Raniyavali	32.97	43.08	23.82	3.43	56.92	22.01	15.13	67.03
Ahmadpur Halpura	26.36	90.67	41.16	3.10	9.33	2.89	1.94	73.64
Hazratpur Puthari	37.43	77.40	42.49	12.58	22.60	8.88	7.95	62.57
Dashahara Kherli	32.88	91.65	44.43	13.50	8.35	2.23	3.35	67.12
Mohammadpur Mazara Barhagaon	50.35	45.51	38.37	6.26	54.49	20.54	34.86	49.65
Rasoolpur	28.21	98.28	45.50	8.14	1.72	0.92	0.00	71.79
Jahanpur	34.21	89.18	49.65	9.62	10.82	3.98	3.40	65.79
Naiphal Urf Uchangaon	31.08	57.12	29.76	4.39	42.88	22.77	2.82	68.92
Ghatal	41.32	75.59	40.72	20.72	24.41	10.21	9.94	58.68
Nekrampur Urf Visanpur	26.31	82.98	40.07	0.80	17.02	8.01	0.40	73.69
Gopalpur	34.26	95.38	50.86	5.98	4.62	2.50	0.23	65.74
Hirdeypur	31.60	77.57	43.68	3.21	22.43	5.91	8.40	68.40
Mandawarah	36.28	56.32	29.92	9.53	43.68	17.20	14.29	63.72
Bhatpura	29.21	63.86	30.24	5.20	36.14	13.95	6.62	70.79
Sikandrabad Rural	30.50	84.74	41.62	8.15	15.26	5.47	3.74	69.50
Gendpurshaikhpur	27.11	89.83	40.17	5.07	10.17	3.87	1.40	72.89
Pilakhanwali	27.61	79.43	39.53	2.98	20.57	4.88	6.54	72.39
Barkherah	30.10	84.59	41.93	6.37	15.41	5.07	4.14	69.90
Bilsuri	30.00	86.33	44.09	4.91	13.67	3.83	4.42	70.00
Chandaru	33.86	72.74	36.02	7.42	27.26	9.13	9.38	66.14

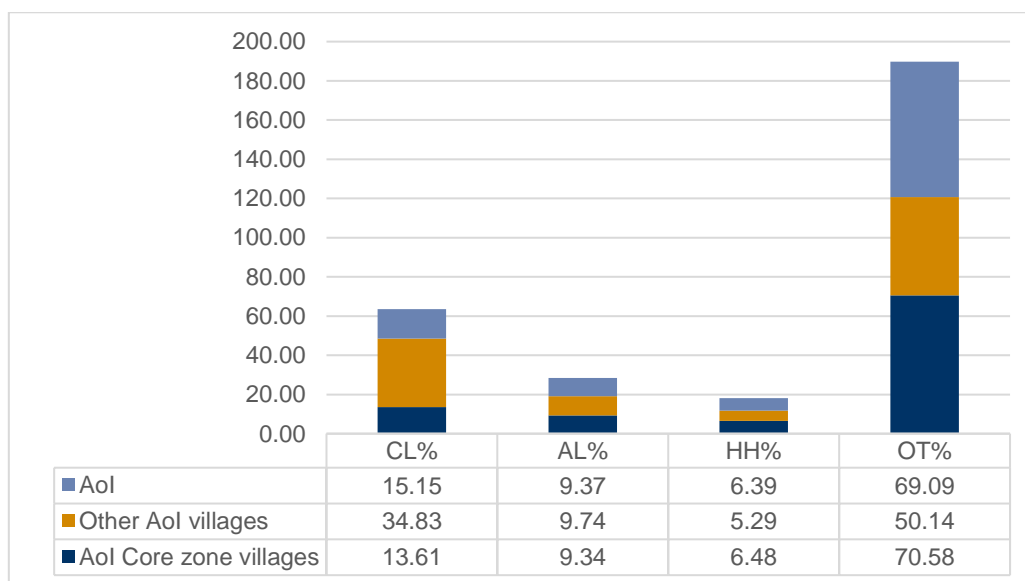
Village Name	WPR	Main work%	Main male%	Main female%	Marginal work%	Marginal male%	Marginal female%	Non Worker %
Odara Urf Nawada	50.57	53.56	41.38	11.45	46.44	20.43	26.82	49.43
Adaoli	22.77	64.15	27.50	0.89	35.85	14.83	1.06	77.23
Kamalpur	35.51	64.39	39.54	4.64	35.61	14.42	10.70	64.49
Akbapur	31.34	57.55	28.65	6.30	42.45	20.81	5.01	68.66
Valipura	29.60	74.93	39.00	4.17	25.07	10.30	4.34	70.40
Machkauli	29.88	69.91	35.20	4.78	30.09	14.60	2.68	70.12
Jalkhera	31.33	80.86	44.17	4.08	19.14	6.38	5.57	68.67
Khetalpur Bhansauli	30.88	74.00	34.31	9.58	26.00	12.20	3.19	69.12
Dhamrawali	35.62	79.87	45.95	9.53	20.13	6.48	7.92	64.38
Maman Kalan	36.13	71.42	35.23	15.14	28.58	11.59	8.90	63.87
Kaulsena	30.15	72.20	35.19	6.87	27.80	11.21	5.24	69.85
Hazipur Bhatola	43.88	58.17	28.95	21.81	41.83	21.49	14.95	56.12
Asadullapur	NA	NA	NA	NA	NA	NA	NA	NA
Chandpur	38.10	87.50	63.64	0.00	12.50	9.09	0.00	61.90
Tilbegumpur	26.25	88.74	40.55	3.32	11.26	3.68	2.12	73.75
Sanwali	53.41	47.38	42.92	4.29	52.62	19.03	38.94	46.59
Junedpur	32.85	98.36	44.33	18.10	1.64	0.60	0.47	67.15
Lalpur	24.68	96.55	43.50	1.22	3.45	1.59	0.00	75.32
Dariapur	31.28	88.51	43.68	9.47	11.49	4.41	2.67	68.72
Dostpur	29.91	64.36	35.11	0.86	35.64	15.85	4.64	70.09
Gangarua	34.93	76.63	42.98	8.91	23.37	4.76	11.92	65.07
Maman Khurd	29.83	76.55	39.50	3.94	23.45	11.55	1.83	70.17
Raja Rampur	26.78	93.48	44.48	1.99	6.52	3.08	0.17	73.22
Khalsia Choharpur	29.37	90.12	45.23	5.16	9.88	5.00	0.52	70.63
Bartauli	24.82	88.09	38.83	2.51	11.91	4.57	1.12	75.18
Dharpa Choharpur	29.02	96.54	46.45	6.68	3.46	1.17	0.81	70.98
Kirra	39.38	79.38	46.45	13.70	20.62	6.34	10.18	60.62
Agwal	27.18	79.68	39.35	2.62	20.32	8.97	1.81	72.82
Chandpur Khurd	29.52	100.00	58.00	3.64	0.00	0.00	0.00	70.48
Lalpur Chitola	30.48	99.23	52.76	2.12	0.77	0.00	0.53	69.52
Talibpur	31.45	95.16	48.43	9.95	4.84	1.26	1.81	68.55
Jhamka	33.51	68.94	32.61	12.81	31.06	16.16	4.19	66.49
Bajidpur	29.37	79.96	41.43	2.33	20.04	7.03	4.53	70.63
Rohinda	35.51	69.72	37.97	10.06	30.28	12.52	8.79	64.49
Rukanpur	30.94	65.73	34.85	3.52	34.27	7.82	13.84	69.06
Arnia Khurd	27.88	93.09	42.86	5.29	6.91	2.12	1.69	72.12
Muni	32.08	66.79	34.14	7.28	33.21	9.53	11.90	67.92
Keoli Khurd	30.69	92.13	46.66	7.76	7.87	3.34	1.39	69.31
Khurja (NPP)	29.74	88.87	45.15	5.69	11.13	4.04	2.50	70.26
Sikandrabad (NPP)	29.75	88.75	45.04	6.19	11.25	4.25	2.37	70.25
Talabpur Urf Hathipur	31.33	70.67	37.33	3.37	29.33	10.63	7.41	68.67
Bisnoli	27.90	64.26	29.50	4.22	35.74	15.16	3.83	72.10
Ibadullapur Urf Badalpur	23.79	81.11	34.88	2.98	18.89	7.10	1.76	76.21
Sadhapur	29.95	86.66	42.10	7.90	13.34	4.22	3.75	70.05
Nagla Chamroo	36.60	97.95	48.99	20.20	2.05	0.74	0.76	63.40
Chithara	25.09	75.90	32.63	3.40	24.10	9.32	2.28	74.91
Mahiuddinpur Urf Garakhpur	50.00	100.00	100.00	0.00	0.00	0.00	0.00	50.00
Nagla Nainsukh	31.41	66.19	33.01	6.69	33.81	16.32	4.04	68.59
Shahpur Khurd	31.38	67.91	34.47	6.74	32.09	10.40	9.70	68.62
Ranoli Latifpur	35.34	85.05	44.31	13.67	14.95	3.25	7.62	64.66

Village Name	WPR	Main work%	Main male%	Main female%	Marginal work%	Marginal male%	Marginal female%	Non Worker %
Bisahda	36.45	64.17	35.31	9.27	35.83	12.94	13.20	63.55
Bairangpur Urf Nai Basti	26.21	97.76	43.45	5.54	2.24	0.86	0.28	73.79
Beel Akbarpur	26.03	91.24	41.57	5.13	8.76	3.03	1.49	73.97
Dhoom Manikpur	25.78	74.94	33.68	3.00	25.06	10.17	2.24	74.22
Badhpura	27.24	81.00	36.02	5.91	19.00	7.31	2.71	72.76
Nagla Kirani	100.00	0.00	0.00	NA	100.00	100.00	NA	0.00
Kot	34.10	79.68	44.47	7.63	20.32	4.13	10.09	65.90
Dadri (NPP)	29.66	84.08	41.91	5.36	15.92	5.85	3.43	70.34
Chipyana Buzurg (CT)	32.54	85.99	43.54	10.02	14.01	6.53	2.28	67.46
Chhapraula (CT)	31.76	81.26	42.32	6.27	18.74	7.15	4.54	68.24
Aol Core zone villages	30.94	81.07	41.48	6.54	18.93	6.93	4.64	69.06
Other Aol villages	39.01	66.10	38.85	11.11	33.90	12.11	14.47	60.99
Aol villages	31.51	79.76	41.29	6.87	20.24	7.30	5.34	68.49

Source: Census of India, 2011

The average work participation rate of population from urban settlements, i.e. CTs and NPPs, is 31.14% which is very similar to the WPR 31.75% of Core villages. Out of the Main Working Population, majority of the population are engaged in “Other works” like construction workers, in shops or any commercial set up, self-business, helper in shops, worker in hotels/ Dhabas etc. in their villages or nearby urban areas which is mostly located along NH34. The proportion of cultivators is very low in project villages, even lower than the cultivators in Study area. This is likely to be a result of their proximity to a national highway of significance, as ‘other works’ may be more remunerative as compared to agriculture, which is the overall mainstay of the larger region, combined with the context of several people whose land would have been acquired for the highway, roads, and other industrial development along the corridor, leaving them with smaller holdings that would be less remunerative. The proportion of Household workers is also very minimal, less than 6.5 percent at all three levels, i.e. Project villages, Aol and Study area villages, as depicted in Figure 5.3130.

Figure 5.31 Distribution of Main Working Population in the Project Aol



Source: Census of India, 2011

5.4.8.1 Farm based Livelihoods

As depicted in the Figure 5.3130 above, the proportion of workers dependent on farm based livelihood, i.e. as cultivators and agricultural labourers in the entire Study is low ~25% compared to a large population dependent on “Other works” which involves non-farm based livelihoods. The reason behind low engagement in farm based livelihoods is due to low land holding among people, as discussed above, combined with spreading urbanization of the area and dependence on other sources of income/ livelihoods such as petty businesses of grocery shops, working in garages, hotels and other services.

The Project AoI includes parts of Ghaziabad, Aligarh and passes through Bulandshahar. Non- Farm Based Livelihoods

The Figure 5.3130 depicts that the non-farm based livelihood categorized as Others in the graph in the Study Area is highest around 69.09%. It is the main source of income at the household level in Project villages. The non-farm based livelihoods in the project villages mainly comprise of daily wage construction labours, workers in shop, own business like hotels/ dhabas etc. along NH. The people work in the nearby villages, or at tehsils and city level. Some households also informed that their family members have migrated// migrate to the nearby cities and states.

During consultation at village level people informed that youth from their villages migrate to nearby cities such as Delhi, Aligarh and states such as Maharashtra, Tamil Nadu etc. for services and work; However, the proportion of migrants is very small as informed during FGDs by local communities. These emigrants from the Project AoI villages work in factories, petrol pumps or as construction labour, earning a daily wage of INR 500-800, depending on skill and nature of engagement.

Further during FGDs it was stated that several migrant workers returned to their villages from various cities where they were employed, on account of the COVID 19 related lockdown and significant reduction of manufacturing and construction work. These workers have started their own small/ petty business here, few of such households were identified during household survey in Khurja where the family had returned from Tamil Nadu post COVID due to retrenchment in their company.

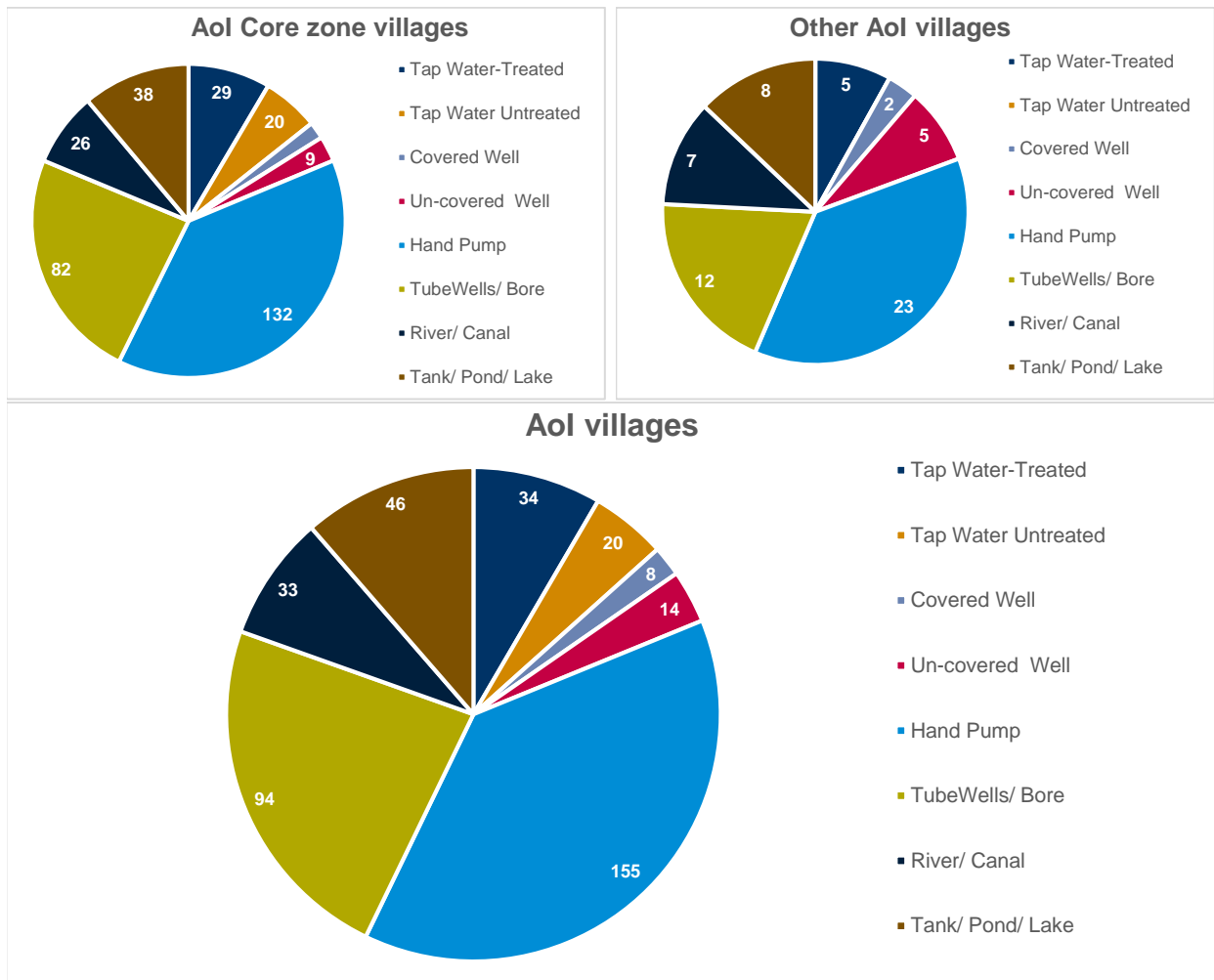
5.4.9 Physical infrastructure

5.4.9.1 Water sources

The source of water for both drinking and agricultural purposes have been given below in Figure 5.3231. The data below shows that the major source of water in Project villages is hand pumps and tube wells. The census data shows that canal/ river water is available in 26 core zone villages.

The census data, 2011 below shows that there is treated tap water connection in only 29 project villages, of which 6 are in urban settlements like Gabhana (NPP), Khurja (NPP), Sikandrabad (NPP), Dadri (NPP), and the census towns of Chipiyana Buzurg (CT) and Chhapraula (CT).

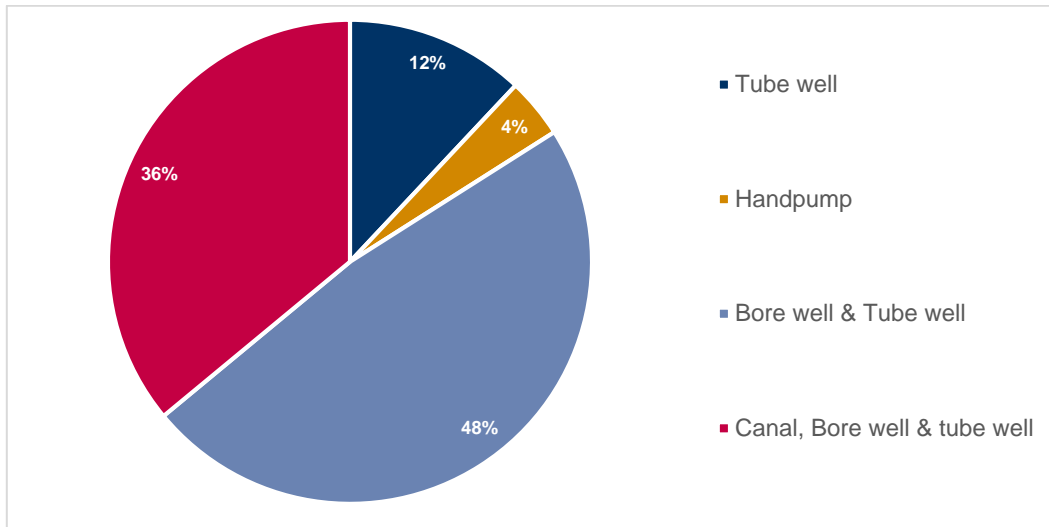
Figure 5.32 Water sources in project affected villages & study area



Source: Census of India, 2011

The data given above is however decade old, the baseline situation is likely to have improved as during consultation in project villages it was identified that out of 25 Gram Panchayats and villages where FGDs and village profiling was carried out, 84% villages have bore wells and tube wells for irrigation purposes and 36% villages have access to canals for irrigation, remaining 12% and 4% villages have access to only tube wells and hand pumps at their village level. The analysis clearly indicates that the overall access to water sources such as, canal, bore well etc. has improved over a decade and none of the villages are water deficit.

Figure 5.33 Details of water sources informed during village profiling



Source: Data collected by ERM during FGDs and village profiling, August, 2021

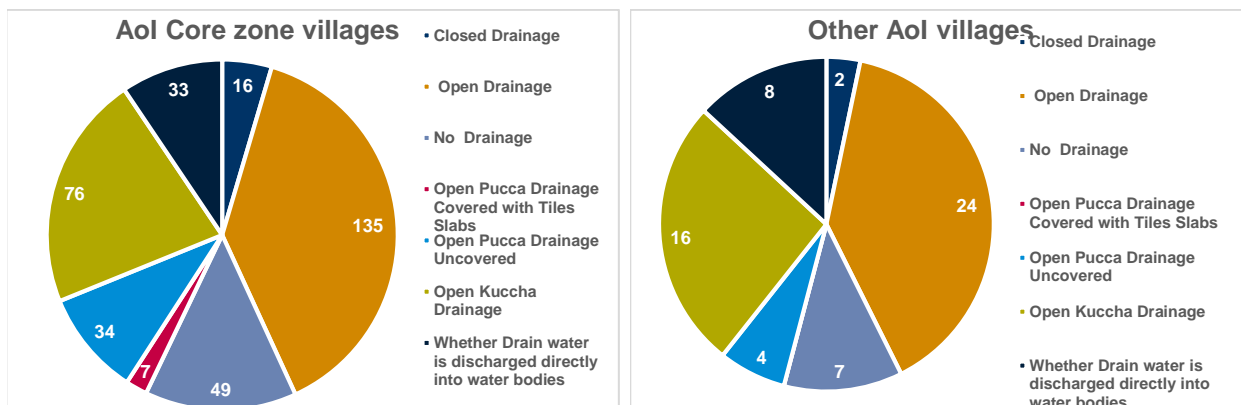
5.4.9.2 Drainage

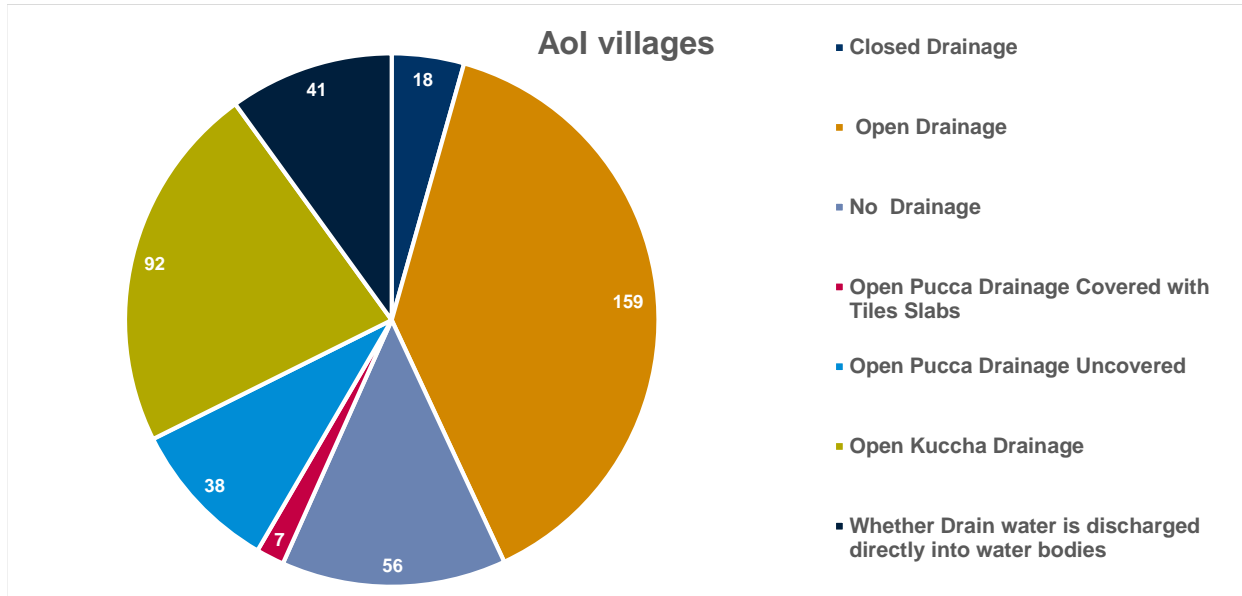
As per the definition given in Census, 2011, Drainage is a system of disposal of waste water and other liquid wastes from the house. It may be understood that waste water may consist of kitchen waste water, bath and wash water. However, it does not include the wastes from the latrines. If the Census house has water outlet connected to some form of drainage system to carry away the waste water generated by the household living in it, it is ascertained that the household is connected to closed drainage or open drainage. The waste water outlet may be a closed drainage or an open drainage.

The Figure 5.34, below gives a description of drainage system in the AOI. From the given figure it can be seen that the status of closed drainages in the AOI is very poor, only 16 out of 136 project villages were identified to have closed drainage facility in the village, while there are open drainages and open kuccha drainages in 135 and 76 villages respectively under Project villages.

The lack of proper drainage system in Project villages/urban settlements have led to a situation where drain water is discharged directly into water bodies in rural areas or to sewage treatment plants in urban/ city areas, where available. The table below states that drain water is discharged directly into water bodies in 33 of the Project settlements out of which 31 are project villages and two are project census towns and in Aol it is in 8 villages. There are total three census towns and three NPPs in the entire zone; out of which there are closed drainages in all the CTs and NPPs.

Figure 5.34 Drainage system in Project impacted villages & AOI





Source: Census of India, 2011

5.4.9.3 Toilets & Sanitation

The census data of 2011 states that 21 project villages are covered under “Swachh Bharat Mission”; and 10 project villages have community toilet complexes built by Govt. The given census data is decade old and the current situation has remarkably changed. The review of District level details⁴⁰ of “Swachh Bharat Mission”, Uttar Pradesh clearly indicates that the project Districts namely, Ghaziabad, Gautam Buddha Nagar, Bulandshahar & Aligarh have 100% SBM coverage and the districts have been declared open defecation free in FY 2019-2020;.

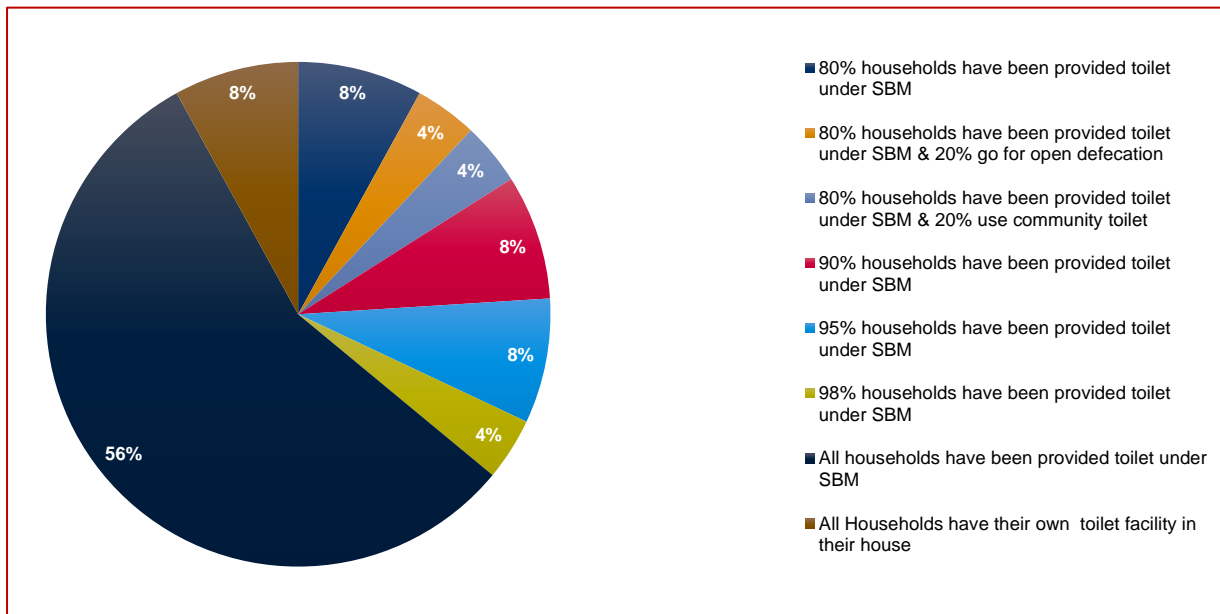
Status of toilets as per FGDs

During household surveys and focus group discussions it was informed that there are pucca toilets in nearly every household also the situation has improved a lot after inception of government schemes like “Swachh Bharat Mission”. Especially in the project affected area, which are located in the vicinity of NH, it was observed that there are septic toilets in nearly every household and toilets are used by residents. Local communities in the project affected villages informed that they have stopped going for open defecation, the reason being the construction of pucca toilets in their home and their residence being close to NH; however, the practice of open defecation still persists in the settlements which are away from main carriageway of NH.

Given below is the status of toilets and “Swachh Bharat Mission” in Gram Panchayats/ villages where ERM conducted focus group discussion and carried out consultations with local community for village profiling.

⁴⁰ <http://sbm.gov.in/sbmreport/State.aspx>

Figure 5.35 Status of SBM in Gram Panchayats/ villages where ERM conducted FGDs



Source: Data collected by ERM during FGDs and village profiling, August, 2021

The graph above indicates that 56% villages conducted for FGDs have provided toilet under “Swacch Bharat Mission” in each household, 8% villages had built toilets on their own at each household level. The data also indicates that 4% villages have households where 20% of the total village population still go for open defecation. Further details are given above in **Figure 5.3534**.

5.4.10 Social infrastructure

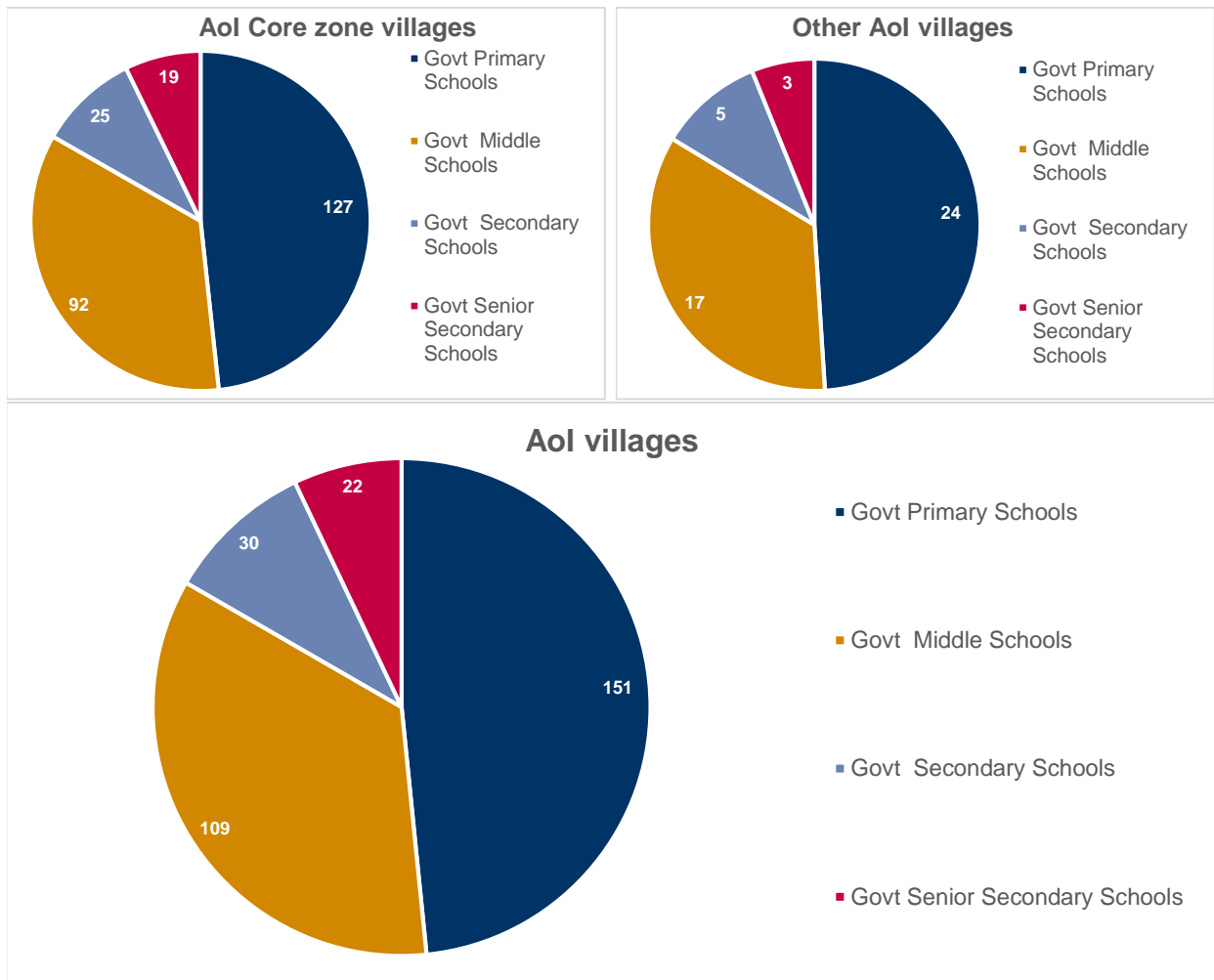
5.4.10.1 Education Infrastructure

According to Census of India, Primary Schools provide education from class 1st to 5th, Middle Schools cater to children studying from classes 6th to 8th, Secondary school provides education to students of classes 9th and 10th and similarly, senior secondary school teaches children studying in classes 11th and 12th. One interesting fact here is that, a composite school with classes 1st to 12th, will be treated as four separate units and will be counted separately as a Primary, Middle, Secondary and Senior Secondary school.

The Project Aol villages have government primary schools and government middle schools in 127 and 92 villages respectively out of total 136 villages. The project villages have a dearth of government secondary schools and government senior secondary schools, there are only 25 government secondary schools and 19 government senior secondary schools out of total 136 project affected villages. This being the major reason behind high dropout rates among girls after middle schooling, there are fewer secondary and senior secondary schools in Project villages and parents do not prefer their female child to travel from one village to another for education due to safety reasons.

Apart from government schools in Project villages there are also primary private schools in 54 villages, private middle schools in 35 villages and private secondary schools in 16 villages. During consultation in Beel Akbarpur village it was informed that during construction of eastern and western peripheral road one of the village primary school was totally impacted. The school is currently surrounded with eastern & western peripheral roads/ flyovers and toll plazas. Village community suggested the school is not accessible currently by children of their village and it should be shifted/ relocated near their village. They also added that financially strong families prefer sending their children to private schools; while majority of the families in villages send their children to government schools only.

Figure 5.36 Availability of schools in the AOI

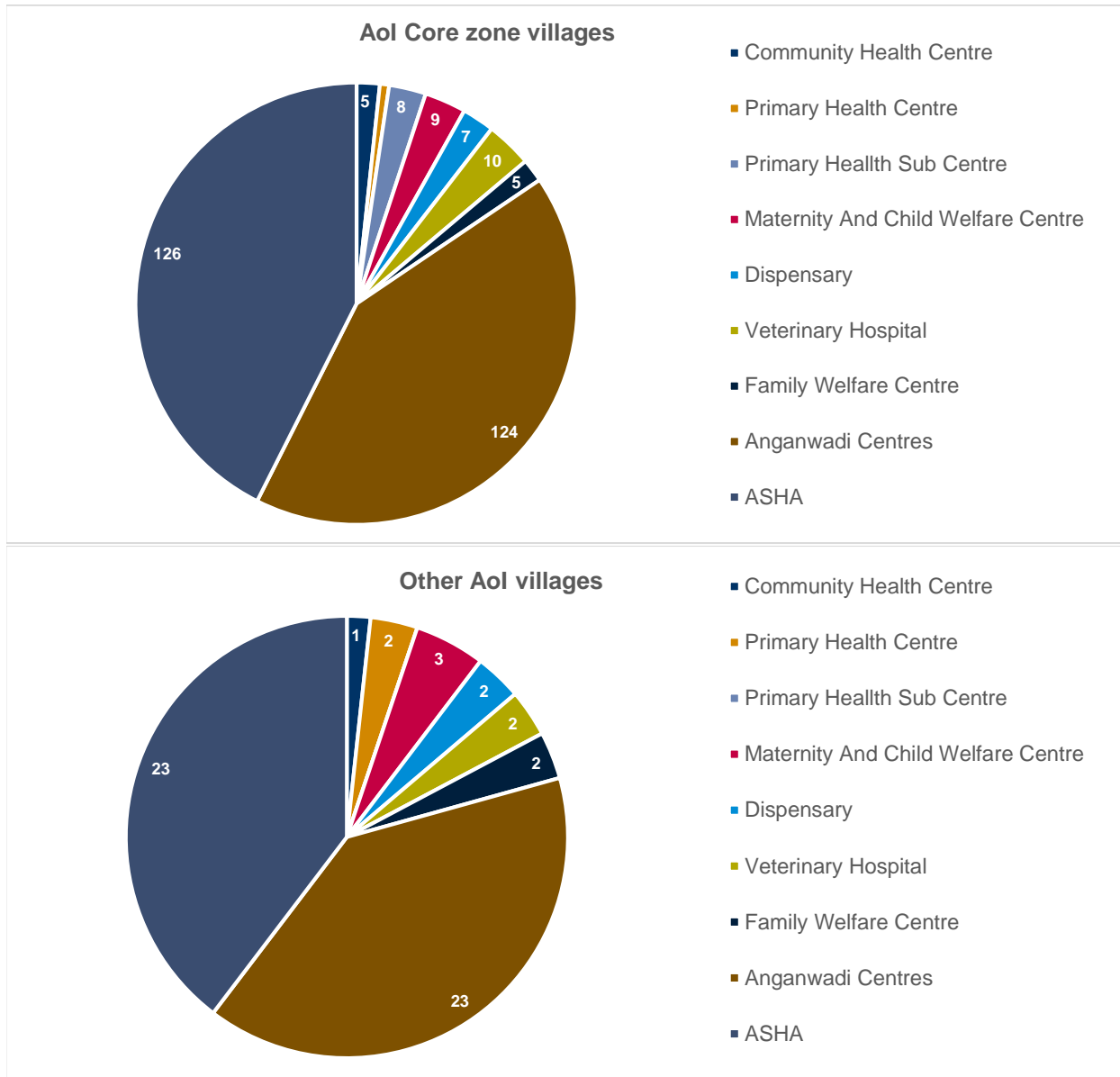


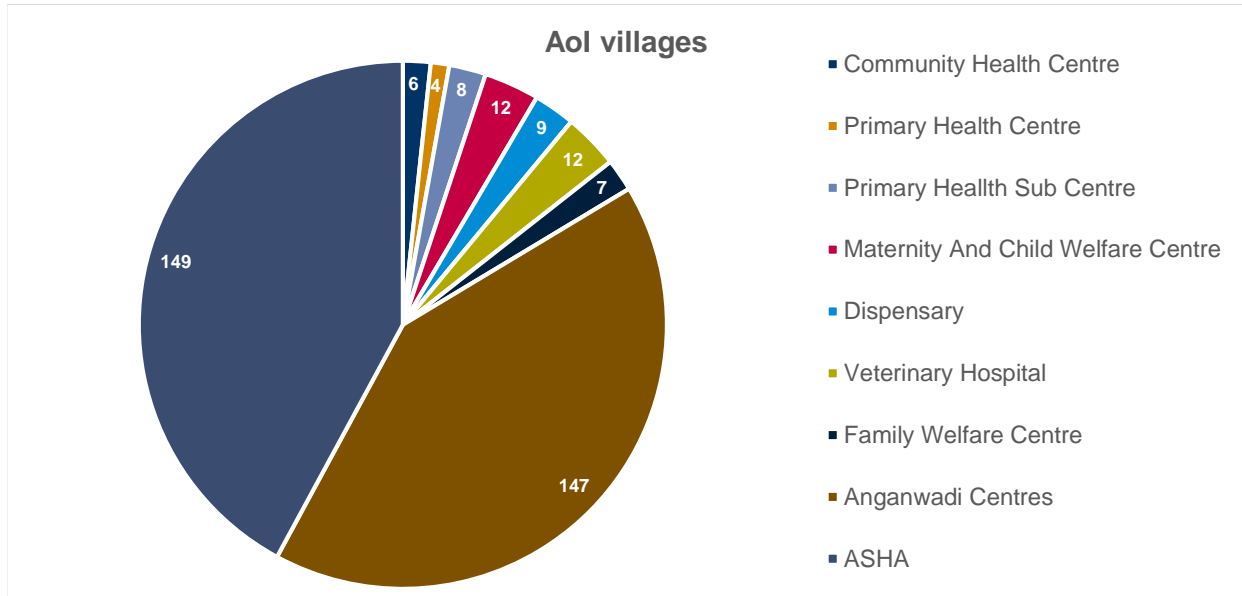
Source: Census of India, 2011

5.4.10.2 Health facilities and health seeking behaviour

The health facilities in the Study Area follow a three-tier health infrastructure system, as applied to the other parts of the Uttar Pradesh state. The health facilities available at the village level comprise of Primary Health Sub Centres and Public Health Centres (PHC). While the sub centres cater to a population of 5,000 individuals, the PHCs are for a population of 10,000-30,000 individuals. While the PHCs are mostly for OPD (Out Patient Department) and basic IPD (Indoor Patient Department) cases, sub centres usually have a delivery room and two resident nurses (one male and one female). Each PHC has 5-6 sub centres under them. In turn, a cluster of 6-10 PHCs come under a CHC (Community Health Centre), which caters to a population exceeding 1 lakh, and also provides emergency services. The CHCs in turn report to the public hospitals at the district level.

Figure 5.37 Availability of health facilities in the AOI





Source: Census of India, 2011

From the figure above it can be understood that there are five community health centres in the Project area out of which two are in NPPs, one in CT and remaining at the village level; there is one one in Aol at census town level. Further at the core zone level there are two primary health centres one each at Khurja (NPP) and Gabhana (CT); there are total seven dispensaries in Core zone out of which three each are at CT and NPP level, remaining two are at village level. Also, there are other health facilities in the study area, the details of which are given above in Figure 5.3736.

5.4.10.3 Accidents and Road safety

As per the review of Setu's ESDD report, 2019 shared with ERM it was identified that average monthly fatalities (from July, 2015 to August, 2018) was 2.21. The representation of NH34 accident/incident data has been given below. One of the reasons being the unauthorized cuts and crossings on the main carriageway and absence of over-bridges. Further details of road accidents happened on NH34 are given below in Table 5.3029.

Table 5.30: Accident Incident data

Year	Fatal	Grievous	Minor	Non Injured	No. of animals killed, if any
July- December, 2015	27	253	217	0	3
2016	30	246	289	0	0
2017	24	222	161	58	0
January – August, 2018	3	122	142	13	0
Total	84	843	809	71	3
Monthly Avg.	2.21	22.18	21.29	1.87	0.08

Source: Setu's ESDD Report shared with ERM

Note: No accidents data after August, 2018 has been received for review

During consultation with local communities and Sarpanch's at village level it was understood that safety from road accidents have been a major concern for them. Local community shared multiple incidences of road accidents, hit and run incidents with ERM team.

During one of the consultations with health departments/ Anganwaadis that was held in Kot village it was informed by Anganwaadi helper that there have been a remarkable reduction in number of

children coming to centre for mid-day meals in last three years; as there had been an instance of fatal road accident three years ago with an Angaanwadi child.

Local community during consultations also expressed their apprehension of increase in road accidents due to no over-bridges for road crossing and increase in moving traffic.

It was also reported by women in Bhakri Khans, Bidha Nagar, Gabhana, Daryapur that as their villages are adjacent to the highway and are densely populated, they have faced safety issues such as offensive/abusive remarks from speeding truck drivers crossing the road, crossing the road after dark due to lack of street lights and, high rate of accidents due to lack of traffic management. Some of these villages are also identified as black spots⁴¹, as per the excel data provided by Cube Highways in July 2021.

Table 5.31: Data on Causes of Accidents along the Project Road

Year	Total Accidents	Drunk Driving	Over speed	Vehicle out of control	Vehicle defect	Wrong side driving	Fault of driver/ cyclist/	Unknown	Other
2015	180	11%	39%	28%	4%	0%	18%	0%	0%
2016	344	10%	34%	27%	8%	0%	21%	0%	0%
2017	265	9%	42%	28%	1%	0%	20%	0%	0%
2018	196	10%	46%	27%	0%	0%	17%	0%	0%
Total	985	10%	39%	27%	4%	0%	19%	0%	0%

Source: Preliminary Safety Audit Report, July 2021 prepared by V R TECHNICHE Consultants Pvt. Ltd

The data above states that most of the accidental cases take place due to over-speeding by people/ drivers. The accidents resulting due to over-speeding are 39% of the total accidents taken place between 2015-2018; followed by 27% accidents taking place due to vehicle being out of driver's control.

5.4.11 Gender Assessment

As per census of India, 2011, the sex ratio at birth (912 girls to 1,000 boys) in Uttar Pradesh has increased just by one percentage point in the past years and it continues to be far lower than the national average of 943 (2011-13).

Further, the overall literacy rate for those ages seven and above has improved over the past decade in Uttar Pradesh but continues to be far below the national average of 74% (Census of India, 2011). The difference between the 67% literacy rate of men and the 57% rate of women in the state is high, when compared to the national average which for men is 82% and for women 65%.

The state has low sex ratio, as female foetuses are most likely to be targeted for the illegal practise of sex selective abortions⁴², Females have low literacy rates, lowest mean age of females at marriage, high maternal mortality rate, have the longest reproductive spans, and the most crimes committed against them⁴³ and are least likely to be employed in the workforce⁴⁴.

The situation in most of the project villages is either similar to the state or worse than the state. As discussed in **Section 5.4.4**, the overall sex ratio in project village (884 females per 1000 males) is

⁴¹ Ministry of Road Transport and Highways define the accident blackspot on National Highways as - "Road Accident Black spot is a stretch of National Highway of about 500m in length in which either 5 road accidents (in all three years put together involving fatalities/grievous injuries) took place during the last 3 calendar years or 10 fatalities (in all three years put together) took place during the last 3 calendar years".

⁴² [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(20\)30677-2/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30677-2/fulltext). Accessed on 22.09.2021

⁴³ <https://ncrb.gov.in/StatPublications/CII/CII2014/Table%205.2.pdf> Accessed on 22.09.2021

⁴⁴ http://mospi.nic.in/sites/default/files/publication_reports/Quarterly_Bulletin_PLFS_October_December_2020L2.pdf Accessed on 22.09.2021

much lower than the state of Uttar Pradesh. The reason behind lower sex ratio is not very different from those stated above.

However, as per the consultation in certain project villages including Beel akbarpur, Chapraulla and Badalpur (in Gautam Budh Nagar), Bilsuri, Khalsiya Chuharpur, Luharli, Bhaiqli, Daryapur and Bhakri Khans (Bulandshahar and Aligarh), women reported that they have witnessed change in past 10 years, and have seen fewer cases of sex selective abortions, and overall a decreasing trend in discrimination between sons and daughters.

As observed and reported by women in the project villages, education and awareness has lead to changes in social attitudes towards girl children. Another reason reported was that women/girls are perceived to be better at providing “emotional support” to parents, and are better “care givers” during old-age, in addition to support in both domestic and economic work. These reasons varied amongst different castes, religions and class in all the villages.

5.4.11.1 Gender and Literacy

As discussed in **section 5.4.4 and 5.4.6**, the overall literacy rate of the Project villages is 70.71 %, whereas the female literacy rate is approximately 60.08 %. As per the last census data (2011), this figure shows that the literacy rate is better than that of the state.

As per consultation with staff of government primary secondary and senior secondary school, in project villages such as Bilsuri, Bhakri Khans, Badalpur and Bhaiqli village, they have witnessed lower school dropouts and higher female enrolment in the past one decade due to better access to school in terms of distance, improvement in education policy⁴⁵ and free education for students, better student-teacher ratio, sanitation facility etc.. Reportedly, the dropout rate for females was lower than males at the primary and secondary level in these villages. It was reported by women that school education is now extremely important for their children, that even if middle school is more than 5-10 kms, they are willing to send their girls. However, the same does not apply to girls pursuing higher studies after school, especially for women from Yadav, Rajputs and Gujjar communities.

However, it was observed in various villages, and clearly reported in Beel Akbarpur and Badalpur village (Gautam Budh Nagar) that the caste plays a major factor that deters school education for children coming from marginalised communities. Reportedly, more than 50 per cent of children from SC community drop out of school in these villages. The primary school teachers in these villages reported that female enrolment ratio for children of the scheduled caste category has always tended to be low. The scenario was similar across all the villages, even though the above mentioned villages fall under peri-urban category, where there is visible transition from rural to urban land uses located between the outer limits of urban and regional centres and the rural environment.

Even though many villages reported better female enrolment ratio and lower drop outs, many children have again started to miss their education during the pandemic, because they do not have access to online educational resources, particularly for children from BPL families, and SC community such as Jatav, Balmik, Dhimar, Suryvanshi and Dhoni. In addition, it was also reported that there is lack of transparency in providing the mid-day meal, and children do not receive food at home. Therefore, they have started to support their parents financially by taking up casual work as child labour, to manage their meals.

Further, women in Beelakbarpur (Gautam Budh Nagar district) , Khalsiya Chuharpur (Bulandshahar district), Ishanpur and Gangarua (Aligarh district) villages reported as the pandemic has increased poverty, reversed migration and job losses, they are witnessing that girls are dropping out of school.

⁴⁵ Right to education was legislated in India in 2009.

Due to this, they are either pushed towards paid and unpaid child labour or becoming victims of child marriage.

5.4.11.2 Gender and workforce

As discussed in **section 5.4.8**, as per Census of India, 2011 the Project villages have approximately 31.51% of working population, where majority of the working population comes under “Main Workers”, i.e. being employed for more than 6 months in a year. The women workers form a smaller proportion in the overall working population both as a main worker (6.54%) and marginal worker (4.64%) in the project villages.

As per the consultation with women in Project villages, it was observed and reported that even though the overall education status has improved in the Project villages, this has not lead to increase in women’s participation in workforce. It was indicated that majority of women are engaged in unpaid work such as household chores, care giving etc. Where women are engaged in paid work it is mostly working in farm based activities, factories, construction work, extremely limited service sector jobs or self employment (salons, petty shops etc.) either within the village or nearby urban areas. This is due to either distance of workplace from their home, availability of round the clock transportation, and above all patriarchal norms of the family. In one village, Badalpur it was reported that there are no Angawadis in the village to take care of young children. Therefore, some women have to take care of their children all day, and are unable to join the workforce.

It was reported that in the past decade, their engagement in farming or farm based wage work has also reduced significantly. This is mainly due to reduction in landholding or loss of land due to government led land acquisitions. The acquisition of all agriculture land by greater NOIDA authority, rice mills and real estate developers in Gautam Budh Nagar district has lead to less than 10 percent women working in their own farms and completely engaged in household work. In other districts, this trend was more apparent in villages adjacent to the main highway such as Daryapur, Accheja, Palla Sallu, Bhakri Khans across the Project road. Further, women of Schedule Caste category other backward castes and BPL families (overlapping categories), who used to work as agricultural labourers have now either become unemployed or have started working as construction labourers.

Agriculture-based wage work still remain the main source of livelihood for women in these villages, as men are preferred over women in construction work. In non-farm based activities, they receive wages between INR 350-400 per day, in comparison to men who receive INR 500-800 per day. In agriculture, they receive wages between INR 250-300 per day and men receive INR 400-450 per day.

Overall, engagement in work is strongly influenced by caste and economic status in most of the villages such as Badalpur, Achheja, Bilsuri, Bhakri Khans where women from Yadav, Gujjar and Rajput families, even if they complete their education, have restriction in working in any factory, service sector or even government jobs.

However, it was reported by young women that this trend is gradually changing and women have now started taking up jobs. It was also reported in Badalpur and Chappraula village of Gautam Budh Nagar district, that majority of women from higher income group families have started to migrate to Delhi, NOIDA or Ghaziabad for higher studies, better economic opportunities. However, this trend was mainly reported in these two villages due to their proximity to Delhi and other satellite towns, and being per-urban settlements.

Majority of women who have completed their graduation or higher studies, remain unemployed due to family norms/restrictions on migrating to nearby cities. Therefore, lack of employment remains a major challenge.

Further, there are no active NGOs in any of the Project villages and majority of women were willing to work, if there are skill development activities and home-based employment is provided. Some also indicated that they will be willing to take up full time jobs, construction work and other employment opportunity, if available.

5.4.11.1 Access to Resources, Ownership and Political representation

As discussed in **section 5.4.7**, private land ownership varied on an average between 1- 2.5 acres (i.e. 0.4- 1 hectares)/ household across the Project villages. This variation depended on caste and community segregation. As per FGD with community at large, it was understood that landholding has either reduced significantly or households have become landless either due to government led acquisition or they have willingly sold land to private developers as land values increased resulting from urbanisation and/or proximity to a major National Highway. This trend was more apparent in Gautam Budh Nagar, that is urbanising more rapidly due to its proximity to the NCR and the development of several industrial and logistics sector projects.

Most land or asset ownership noted in Project villages is in the name of male members of the household. The legal provisions for inheritance of land in any case continue to discriminate against women despite the nationwide extension of Hindu Succession Amendment Act (HSA 2005) main provisions.

The situation in Project villages is not very different and women do not possess land ownership titles. This, in addition to predominant patriarchal societal norms also influence decision making powers of women. Although, majority of women in Project village reported that all the household decisions are taken based on mutual agreement between men and women. Majority of women, also say, they cannot take an independent decision to spend their own income without consulting the male head of the family. The same does not hold true for male household members.

Similarly, women's participation in village level Gram Sabhas or discussion related to village issues remain extremely low, as reported. Majority of women in Badalpur, Bhakri Khans, Accheja, Bidha Nagar, Khalsiya Chuharpur indicated that they are not aware of any monthly Gram Sabha that take place. In one village, Badalpur, where a woman has been elected as a Sarpanch recently, indicated that she participates in Gram Sabha meetings, and discusses, issues raised by other ward members such as budget allocation, development work in the village etc. However, majority of the decisions and discussions are done by her husband who acts as de-facto, un-elected Sarpanch.

This situation underscores the need for greater outreach to women and women's groups to communicate project-related messages and information, to ensure they are not left out of the process and programmes. Greater focus and efforts would also be required to ensure their participation in the mitigations, entitlements and livelihoods programmes of the Project.

6. ANALYSIS OF ALTERNATIVES

The chapter analyses feasible alternatives to the proposed project with respect to site, technology, design etc. The proposed project is a part of master transportation plan of the government and the widening of the expressway to cater accessibility and increase in traffic volume is part of that master plan. Therefore in this section, a comparative analysis of alternatives will help to determine the best method of achieving project objectives while minimising adverse environmental and socioeconomic impacts. Various alternatives selected for analysis usually includes the 'no project' or 'no action' alternative. The chapter discusses how environmental and socioeconomic parameters were assigned due importance and were carefully considered in the analysis of alternatives.

6.1 No project scenario

The existing connectivity is along the proposed road, which is currently a four lane highway with varying pavement width. High current traffic volumes with higher estimated future traffic volumes, along with the aim of improving the efficiency of freight movement, will require the capacity of the present highway to be increased. The additional lanes will be essential to better handle the high volume of traffic and freight movement forecast for this region.

There are dense settlements/habitations along the existing highway which contribute to slower, inefficient traffic flow and further vehicular-pedestrian conflicts creates higher probability for accident occurrence. These conflicts lead to reduced efficiency of the existing infrastructure. This is further compounded by the intensity of land use, in terms of unregulated development along the highway, particularly in the initial 10km.

If the proposed expansion is not implemented, there is likelihood that the existing poor condition of the corridor deteriorates further. The population growth, increase in traffic volumes and the economic development along the corridor would continue to occur and will worsen the already critical situation. In the absence of the proposed development, the existing unsafe conditions and the adverse environmental consequences and increased community risk in terms of the environmental quality along the existing roads would continue to worsen. In the absence of the proposed expansion, the connectivity to interior districts of Uttar Pradesh with Delhi NCR will be impacted potentially resulting in decrease in economic benefits. Increased air pollution and noise levels due to bad road conditions, slow moving traffic and congestion, will gradually increase.

Therefore, continuing with a 'no project scenario', will result in aggravation of the existing issues and potential adverse impacts. Potential benefits of the proposed road widening are understood to be substantial and far reaching both in terms of the geographical spread and environment and socioeconomic benefits. However, there will be impacts related to loss of structures- constructed and used by the community along the stretch of the road, within the RoW, for commerce and to a limited number, as residences. This would also require long term planning for the operational phase to ensure prevention of unplanned growth in the form of new encroachments coming up along the new road, in future. While implementation of the project scenario, i.e. widening of four lanes to six lanes, will have other positive impacts in the long run on social, environmental, economic and financial issues. The scenario has been assessed to be economically viable and will improve the existing conditions of the project area. It would thereby, contribute to the developmental goals envisaged by NHAI, MoRTH Gol, and enhance the growth potential of the area.

6.2 Alternatives to Project Alignment

Although the project alternatives in terms of location (alignment) options are limited as the project objective is to improve an existing, and in-use road: Ghaziabad Aligarh road section of NH-3434, now names NH 34. Four existing bypasses will also be widened from four lanes to six lanes.

The length of route i.e. at Khurja, requires change of alignment from the existing carriageway alignment due to the upcoming KSTPP, in order to avoid impact on the public due to traffic

congestion; air pollution; noise levels and accidents and for facilitating traffic movement. However, impacts from the proposed realignment would not be severe in magnitude, as stated by NHAI PIU officers during consultations. No documents on impacts optimisation or assessment of alternatives were available for ERM to review, to confirm this. There are no other major realignments/bypasses proposed as part of the expansion that require alternative alignments.

6.2.1 Impact Optimization (avoidance of displacement)

In order to avoid displacement of people due to expansion/ widening of existing corridor, two alternatives were analysed for enumerating structures falling within the RoW. Out of the two alignment options, i.e. toe line (narrower corridor) and drainage line wider corridor), the one with a narrower width and fewer displacement impacts has been considered, as the lines were based on preliminary design and the Cube Highways technical team assured that expansion will be completed within the provided toe line. Following table shows a comparison of the potential displacement impacts in a sample/selected section of the road which is most densely populated based on which the impact optimization was undertaken. This also prevented further physical displacement.

Settlement and Chainage	Length of selected/sample stretch (m)	Cumulative Count of structures falling within	
		Option 1 (Toe line)	Option 2 (Drainage line)
Bhankari Khas village (km 128+000)	400m	27 assets/structures	30 assets/structures
Pala Sallu Village (km123+500 to km123+750)	250m	20 assets/structures	46 assets/structures

Each affected asset/structure roughly translates into 2 to 4 households being affected, either in the form of economic displacement impacts or both physical and economic displacement impacts. By making the corridor narrower, the required land is reduced and the need to clear encroaching/squatter structures also reduces.

It is also important to note that as part of the earlier land acquisition process, NHAI had initially notified 448.17 ha of land for the expansion works as per 3A Notification. However as per the 3G Notification, 408.09 ha of land has been acquired for the Project as some land could not be acquired, thus demonstrating that some level of optimisation has also been achieved previously. Section 2.7.1.1 compares the land totals from preliminary identification up to acquisition and the requirement has been decreased by approx. 9%.

Therefore, that Project has been proposed alongwith mitigation measures to minimise the impact due to project implementation on the environmental and social features. Since no documents were available to review to assess the comparison of alternative alignments or optimisation, the above is stated based on site observations and consultations with NHAI PIU officers. This alternative is most suitable, as per NHAI, where the option of 'project with alternatives' is limited.

6.3 Alternative Technologies

Following sustainable construction methods will be utilised in order to minimize environmental footprint by using recycled products and reducing need for fresh materials:

- a) Cold-in-Place Recycling (CIPR) is a type of in-situ recycling technique which involves specialized plants, where the existing pavement surface is milled to a depth, processed, mixed with asphalt emulsion (or foamed asphalt) and placed and compacted in a single pass. Even though CIPR is one of the commonly used methods for full-depth reclamation of asphalt

pavements world-wide, it is not so common in India. This is one of the most optimal and sustainable technologies to carry out full depth reclamation.

- b) Hot-in-Plant Recycling (HIPR) is a type of recycling technique where the bituminous mix is produced at plant with milled materials. It is a combination of Reclaimed Asphalt Pavement (RAP) and virgin materials (i.e. virgin aggregates and virgin binder). HIPR ensures recycle of a large quantum of milled pavement material resulting in the reduction of fresh materials for overlay. HIR uses up to 35 percent less energy than conventional paving methods; requires up to 50 percent less asphalt cement than conventional equivalent methods, thus emits fewer greenhouse gases. This method, therefore, is an environmentally friendly method of road maintenance reduces cost and is sustainable.

6.4 Conclusion

The proposed widening project of the existing carriageway thus involves up-gradation works and no new alignment is being proposed except for 9 km of realignments at Khurja for improving the access issues due to upcoming KSTPP and avoid vehicular accidents along the road stretch. The scope for project alternatives as a whole is thus very much limited.

7. STAKEHOLDER ENGAGEMENT IDENTIFICATION, INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

7.1 Stakeholder identification & Mapping

A stakeholder is defined as “any identifiable group or individual who can affect the achievement of an organization’s objectives or who is affected by the achievement of an organization’s objectives”. Stakeholders thus vary in terms of degree of interest, influence and control they have over the project. While those stakeholders who have a direct impact on or are directly impacted by the project are known as **Primary Stakeholders**, those who have an indirect impact or are indirectly impacted are known as **Secondary Stakeholders**.

During the ESIA process, a stakeholder identification and prioritization was conducted for identifying the key stakeholders of the project, while keeping in mind the nature of the project and its setting. Furthermore, consultations were conducted with these identified stakeholders through a participatory approach. The Table 7.1 below presents the key stakeholders of the project.

Table 7.1 Stakeholder group categorization

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
Project affected persons, households, and the community in the Project Aol	<ul style="list-style-type: none"> ■ Encroachers/squatters/occupiers*; ■ Tenants/ shareholders; ■ People who consider themselves “Titleholders”; ■ Workers engaged in affected commercial structures; ■ Skilled and unskilled labours to be engaged for the construction phase of the Project; ■ Owners of land required for temporary occupation or use ■ Local community from the Project villages in the Project Aol. ■ Road users, Truck drivers etc ■ Local businesses along the highway dependent on the road users 	<ul style="list-style-type: none"> ■ Vulnerable Social Groups (i.e. women headed households, handicapped individuals, households comprising only the elderly (65 yrs and older) and households of SC & ST community) from Project affected villages and villages within the Project Area of Influence;
Institutional Stakeholders	<ul style="list-style-type: none"> ■ Gram Panchayats (GPs) ■ Tehsil Officials; ■ Community Health Centre, Primary Health Centres and Anganwaadi officials; ■ Ghaziabad Aligarh Expressway Private Ltd.; ■ Cube Highways; ■ Developers & Contractors, EPC contractor; ■ Asset Valuation Agencies of all three districts (horticulture, public work, agriculture etc.), ■ IFC as investor 	<ul style="list-style-type: none"> ■ Civic Bodies/ NGOs; ■ Local Political Parties/ groups; ■ Local Media Reporters
Government Bodies/Regulatory Authorities	<p>Government Agencies (Local Government Authorities of 4 districts (Ghaziabad, Gautam Buddha Nagar, Bulandshahr and Aligarh and all the revenue divisions):</p> <ul style="list-style-type: none"> ■ District level Land Revenue Departments of all three districts; ■ Revenue Division Offices; ■ CALA; ■ NHAI; ■ Regulatory Authorities <ul style="list-style-type: none"> - Central Pollution Control Board (CPCB) 	

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
	<ul style="list-style-type: none"> - UP Pollution Control Board (UPPCB); - Ministry of Environment Forest and Climate Change (MoEFCC); - Local Fire Authority; - Ministry of Road Transport and Highways - State Transport Authority; - District Collector and Revenue Department; - Department of Telegraph – Communication, Govt. of Uttar Pradesh; 	

7.2 Stakeholder Consultations undertaken in the process of ESIA study

ERM had consultations with variety of stakeholder in the process of carrying out social survey for the ESIA, RAP-LEP study which includes focused group discussions with 25 villages; consultations with women groups at select villages; consultations with health institutions like CHC, PHC, Aganwadi staff; consultation with truck drivers, Consultation with NHA officials etc.

Key points raised by locals during consultation with villagers pertaining to present operation of project road were as follows;

- The issue of water logging specially in initial 10 km stretch is a concerns of the locals, as there is no drainage system developed by NHA.
- The existing highway has a higher frequency of road accidents, in a month approximately 15-20 accidents occur.
- There is a heavy traffic on the road, particularly during the monsoon season which cause long hours of traffic jam specially in initial 10 km stretch. Air pollution increases due to a heavy traffic jam.
- Due to non-availability of service lane in certain locations, the drainage made alongside the road is encroached by the villagers.
- Length of the Cut in the median at U-tern should be large and space of divider should be at least 8 feet to prevent accident risk It was reported by the locals that the breadth of divider is narrow.
- There should be functional street light on road;
- It is recommended by the locals that existing flyover should be removed and elevated flyover should be constructed to avoid frequent accidents
- There are no signage marks for pedestrian road crossing near cut of the road.
- Gopalpur Jhokhabad panchayat is located in the industrial area. The road is used by the Industrial workers for crossing the road during morning and evening. During the consultation, it was suggested that the foot over bridge should be constructed for the workers in order to cross the road.
- Locals recommended that there should be a bus stand at key locations in order to avoid the crowd on the road.
- The road is not maintained and neither it is in a good condition. There should be a provision for registration of complains on road maintenance.

- Locals suggested that there should be a GRM facility, where they can raise their concerns.
- There should be foot over bridge or underpass for crossing the road;
- Loharli village is situated at the Toll plaza, to avoid paying tolls the locals or even truck drivers in some cases use village road, which results in to heavy traffic jam situation in village road
- There should be provision provided by NHAI for Immediate action if accidents happened on the road.

Key points raised by locals during consultation with villagers pertaining to the land acquisition and compensation issues of project road were as follows;

- During the RAP-LEP survey and consultation, it was reported by various impacted households that they have not received compensation either for their land by NHAI for the six laning of the road. The issues were raised mainly in villages like Gautam Buddh Nagar district including Chipyana Bujurg, Chapraula, Achcheja, Ibadullapur urf Badalpur, Sadopur and Dhoom Manikpur and 1 village in Ghaziabad district is Shahpur Bamhaita, Daryapur and Bilsuri in Bulandeshahar and Palla Sallu and BAKhri Khans in Aligarh district;
- It was reported that they still consider them as titleholder unless the compensation is provided;
- Out of the total households surveyed many received some sort of legal notice from NHAI regarding the encroached structure, the same was reported by Gram Panchayat member. However, none of them had the copy of the legal notices with them.

Details regarding consultation with different group is provided in chapter 7 of RAP-LEP report.

7.3 Stakeholder Categorization

The significance of a stakeholder group is categorized considering the magnitude of impact (type, extent, duration, scale and frequency) or degree of influence (power and proximity) of stakeholder group and urgency/ likelihood of the impact associated with the particular stakeholder group in the project context.

The magnitude of stakeholder impact/influence is assessed taking the power/responsibility and proximity of the stakeholder group and the group is consequently categorized as negligible, small, medium or large. The urgency or likelihood of the impact on/influence by the stakeholder is assessed on a scale of low, medium and high. The overall significance of the stakeholder group is assessed as per the matrix provided in *Table 7.2* below.

Table 7.2 Stakeholder Significance and Engagement Requirement

Magnitude	Significance	Likelihood of Influence on/ by Stakeholder		
		Low	Medium	High
Magnitude of Influence/ Impact	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Urgent
	Large	Moderate	Urgent	Urgent

The influence and priority have both been primarily rated as:

- High Influence:** This implies a high degree of influence of the stakeholder on the project in terms of participation and decision making or high priority to engage with the stakeholder;

- Medium Influence: Which implies a moderate level of influence and participation of the stakeholder in the project as well as a priority level to engage the stakeholder which is neither highly critical nor are insignificant in terms of influence; and
- Low Influence: This implies a low degree of influence of the stakeholder on the project in terms of participation and decision-making or low priority to engage that stakeholder.

The intermediary categories of low to medium or medium to high primarily imply that their influence and importance could vary in that particular range subject to context specific conditions or also based on the responses of the project towards the community

The coverage of stakeholders as stated above includes any person, group, institution or organization that is likely to be impacted (directly or indirectly) or may have interest/ influence over project. Keeping this wide scope of inclusion in stakeholder category and the long life of project, it is difficult to identify all potential stakeholders and gauge their level of influence over project at the outset of the project. Therefore, the project proponent is advised to consider this stakeholder mapping as a live document, which should be revised in a timely manner so as to make it comprehensive for any given period of time.

Table 7.3 Stakeholder Analysis

Relevant Stakeholders	Profile/ Status	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
Primary Stakeholder					
Encroachers /squatters/ occupiers	<ul style="list-style-type: none"> The stakeholders whose structures were identified to fall within RoW acquired for six lining work and this includes total of 897 households connected with 603 identified structures. The structures whether of temporary or permanent nature, will be cleared during construction stage. The stakeholders comprise of structures such as shops, residential structures, mobile hawkers, temporary shed etc. 	<ul style="list-style-type: none"> The dependence by stakeholders on affected structure for residential and commercial purposes were identified during household and Asset survey; The impact/ structural damage to commercial structures such as, shops, garage, welding shop, or any structure used for renting purposes etc. will affect the livelihood and disrupt the current living standard of the affected household. 	<ul style="list-style-type: none"> The influence of this stakeholder group on the Project is moderate considering they do not have legal rights on the identified structure; however there is major dependence of encroachers/ squatters/ occupiers on structures within RoW as they use it for commercial activity, residential purposes etc. Also they have spent lot of time, money and effort in making the structure worth living/ usage. 	<ul style="list-style-type: none"> The key concern of this stakeholder group is of losing the structure which they have been using as residence or for commercial purposes; Loss of a source of livelihood; This group reports that they have spent lot of time, money and effort in making the structure worth living/ usage The major concern of the encroacher/ squatter/ occupier from the Project is to get compensation as per the market rate and get timely payment of their compensation amount; Adequate compensation for affected structure; To get employment opportunities that the Project will generate, both in construction & operational stage. Minimal disturbance to their existing economic activity; This Stakeholder group expected income generating activities or employment as construction labourers, masons, drivers, etc. during the construction phase of the Project; 	Medium

Relevant Stakeholders	Profile/ Status	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
Encroachers /squatters/ occupiers who will be physically displaced	<ul style="list-style-type: none"> 30 households connected with 28 structures were identified as the PAH who will be physically displaced from their current location because of land clearing work during construction phase of the project. these 30 households include 28 from Lohar community and 2 from other community and all of them are located in initial 10 km area of the project highway. 	<ul style="list-style-type: none"> 27 structures owned by 28 Lohar community households were identified under 'Residential-cum-commercial' category. These households are located here for long period, for more than 10 -15 years. Remaining 1 structure owned by 2 other community HHs was identified as residential located in Dhummanikpur village. This structure was already acquired and compensated as per NH Act 1956 and it was partly demolished as well by the concessionaire. 	<ul style="list-style-type: none"> This stakeholder group is quite aware with the fact that they will have to vacate the area as and when road expansion works, start and they do not have any legal right to claim any sort of benefits from the project concessionaire. Considering this fact, influence of this stakeholder group over project is moderate. 	<ul style="list-style-type: none"> Loss of housing and livelihoods Lohar community members have expectation from project in terms of alternate land or house from project, before dismantling their house for road expansion work. Other two households also have expectation from project in terms of advance intimation before dismantling their house and some financial help in order to buy alternate land for their residence in the same village. Their relatives lives in the same village. 	Medium
People who consider themselves "Titleholders" (identified households in	<ul style="list-style-type: none"> People occupying/using structures within the RoW who consider themselves "Titleholders" as their compensation is pending or they have refused to accept it/ other 	<ul style="list-style-type: none"> The dependence by stakeholders on affected structure for residential and commercial 	<ul style="list-style-type: none"> The stakeholder groups' influence on the Project pertains to the smooth functioning of the Project and the timely completion of the Project activities; 	<ul style="list-style-type: none"> The major concern of the affected asset/landowners from the Project is to get compensation as per the market rate and get timely payment of their compensation amount that 	Medium

Relevant Stakeholders	Profile/ Status	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
Bankari Khas, Palla Sallu and Vidha Nagar/Rustampur”);	<p>outstanding conflict issues... Respondent for about 25% of 603 surveyed structures claimed as titleholder for the surveyed structures.</p> <ul style="list-style-type: none"> During Household & Asset survey by ERM, it was identified that such issues have been identified in villages like Bilsuri in Bulandshahr, Dhummanikpur, GB Nagar These identified PAH were not categorised as Encroachers/Squatters during survey. 	<p>purposes were identified during household and Asset survey;</p> <ul style="list-style-type: none"> The impact/ structural damage to commercial structures such as, shops, garage, welding shop, or any structure used for renting purposes etc. will affect the livelihood and affect the current living standard of the affected household. 	<ul style="list-style-type: none"> 	<p>was due from the last round of land acquisition;</p> <ul style="list-style-type: none"> Adequate compensation for the affected structure; To get employment opportunities that the Project will generate, both in construction & operational stage. Minimal disturbance to the community with regards to access issues, pollution, health and safety risks and influx of migrant workers This Stakeholder group may expect income generating activities or employment as construction labourers, masons, drivers, etc. during the construction phase of the Project; 	
Workers engaged in affected commercial structures;	<ul style="list-style-type: none"> This stakeholder group comprises of those households, whose family member depend on the Project affected structure for their livelihood. During household and asset survey 	<ul style="list-style-type: none"> The dependence of stakeholders during household and asset survey was identified; The impact on structure will lead to disruption in commercial activities and loss of livelihood, thus leading to change in living standards of workers dependent on it. 	<ul style="list-style-type: none"> The stakeholder groups' influence on the Project pertains to the smooth functioning and their contribution for the Project in terms of positive feedback and support; Also this group could be used as a resource during construction phase of the Project 	<p>The key concern of the workers were that they may lose their livelihood opportunity</p> <p>Identified workers expected Project to provide them livelihood opportunities;</p>	Medium

Relevant Stakeholders	Profile/ Status	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
Resident community living in settlements along the highways and also users	<ul style="list-style-type: none"> The stakeholder group comprises of those resident community, who are living in settlements along the highway and also users. These resident community is depend on the Project affected structure for their livelihood. 	<ul style="list-style-type: none"> The impact on structure (shops) will lead to disruption in commercial activities and loss of livelihood, thus leading to change in living standards. 	<ul style="list-style-type: none"> The stakeholder groups' influence on the Project pertains to the smooth functioning of the Project and the timely completion of the Project activities 	<p>The key concern of this stakeholder group is of losing the structure which they have been using as commercial purposes and is allied adjacent to the resident of community will affect their source of income.</p> <p>Adequate compensation for the affected structure, since they depend on the assets (shops) for a source of income.</p>	High
Users: Truck drivers	<ul style="list-style-type: none"> This stakeholder groups includes truck drivers and co-workers travelling with them and passing through Project road and staying the various Dhabas situated along the highway for taking rest. Major locations (Dhabas) along the Project corridor used by truck drivers for their stay are in the areas of Bhakri Khas (near Aligarh) and in initial 10 km stretch of the Project corridor. 	<ul style="list-style-type: none"> Maintenance of road quality has direct bearing on trucks movement on the highway. This helps in reducing accident risks and damages to the vehicles. 	<ul style="list-style-type: none"> Movement of truckers on highway is reportedly largest contributor on revenue generation for the Project; Movement of tuckers especially around locations of their stay along the highway, also poses potential HIV/AIDS risks on locals on account of unprotected sexual practices. NACO (National ADIS Control Organisation) identifies long distance travelling truck drivers as significant contributor to spread of HIA/AIDS and therefore NACO have come up with several targeted interventions for truckers to prevent and control HIV/AIDS spread⁴⁶. Consultation with truckers indicates they have not come 	<p>Good quality road and regular maintenance are the key expectation of truckers from the Project.</p>	Medium

⁴⁶ <http://naco.gov.in/sites/default/files/26%2C%20Targeted%20Interventions%20for%20Truckers%20-%20Operational%20Guidelines.pdf>

Relevant Stakeholders	Profile/ Status	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
			across any HIV/AIDS awareness program along the project corridor. Some truck drivers reported experiencing such awareness program I other parts of the country.		
Commercial enterprises dependent on road users	<ul style="list-style-type: none"> Commercial enterprises rely on road users, and the extension of Project roads from four to six lanes will benefit enterprises. Therefore, the proposed road Project will lead to a positive impact. 	<ul style="list-style-type: none"> The impact of project on this stakeholder is positive, as extension of road will increase the commuters on Project road and create more profit for enterprises. 	<ul style="list-style-type: none"> The stakeholder groups' influence on the Project pertains to the smooth functioning of the Project and the timely completion of the Project activities 	During the FGD consultation, the commercial enterprises have expressed their expectation from the Project:- <ul style="list-style-type: none"> The facility of drainage to be provided on the road because during the monsoon season the issue of water logging is a major concerns The Project road is in bad condition; it requires quarterly maintenance, as the road is degrading. 	Medium
Vulnerable households like women headed households, BPL and Landless households from SC community,	<ul style="list-style-type: none"> This group includes women headed households and households with old age persons (above 60) only in the famiy, amongst the total surveyed households and about 77 such housheolds were identified in the survey. All of this vulnerable group are classified under economically displaced category. 	<ul style="list-style-type: none"> Project's influence over this category of stakeholders is assessed to be low; 	<ul style="list-style-type: none"> This stakeholder group may not be able to voice their concern/issue as loudly as other affected groups and therefore their influence over project activities is assessed to be low; In view of their vulnerability, this stakeholder group should be specifically consulted and hadholding spport should be extended during implementation phase of RAP-LEP program to be able to serve them in better way. 	<ul style="list-style-type: none"> Priority in pension scheme of RAP-LEP program of the project for this stakeholder group; Minimal disturbance to their existing structures and in case the structures are affected then they expect to get compensated as per the existing market rate. 	low

Relevant Stakeholders	Profile/ Status	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
Developers & Contractors, EPC contractor, Ghaziabad Aligarh Expressway Private Ltd. & Cube Highways;	<ul style="list-style-type: none"> This stakeholder group comprises of current O&M contractor of NH34, Ghaziabad Aligarh Expressway Private Ltd. (GAEPL), Cube Highways (CH), Developers and contractors engaged by O&M contractor currently and any EPC contractors to be engaged six laning work. This stakeholder group also include EPC contractor engaged by NHAI for Khurja realignment area. However, project concessionaire GAEPL does not have any control over this EPC contractor. Any concerns/grievances related to EPC contractor can be routed through NHAI. 	<ul style="list-style-type: none"> The Project provides this group contractor-ship opportunities and steady flow of income; Being a huge NHAI/ Govt. road Project in the state, the Project will give an opportunity to developers and local contractors to be engaged for a longer period of time and grow. 	<p>This stakeholder group is critical for the smooth functioning and timely implementation of the Project;</p> <ul style="list-style-type: none"> This group may also play an important role in the formation of public opinion towards the Project 	<p>Continued economic opportunities and work generation;</p> <p>Clarity in terms of scope of work, expectations, key performance indicators, responsibilities and timelines for the Project;</p> <p>Timely and adequate disclosure of information to allow the Project activities to be carried out;</p> <p>Fair business opportunities and contract closure;</p> <ul style="list-style-type: none"> Undertake Project activities in keeping with the contractual agreements and applicable regulations in place. 	High
Gram Panchayats (GPs)	<ul style="list-style-type: none"> This stakeholder group is comprised of Sarpanch, ward member and Gram Sewak of Panchayats of 	<ul style="list-style-type: none"> The influence of Project on this stakeholder group is minimal due to limited control that the Project can exert on the functioning of this group. 	<ul style="list-style-type: none"> This group has the ability to influence the perception of the community in regards to the Project and its activities; Also granting No dues/claim/objection shall be taken prior to construction phase for using any area as labour camps or storage (if required) from respective Gram Panchayat as an internal process; In addition any future CSR activities planned to be carried out at the ground level would first have to be 	<ul style="list-style-type: none"> Involvement of this group in decision making process for the Project, especially related to the land acquisition and compensation process; Involvement in the formulation and implementation of the community development activities for the Project; Adequate communication of Project information, in terms of timelines of key activities and their potential impacts. 	Low

Relevant Stakeholders	Profile/ Status	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
			permitted by local Panchayat and would be smoothly executed if they get Panchayat's support.		
Regulatory Authorities	<p>This stakeholder group comprises of central, state and district level regulatory authorities. The regulatory authorities identified during ESIA stage for the Project are the Government Agencies (Local Government Authorities of 4 districts (Gautam Buddha Nagar, Bulandshahr and Aligarh and all the revenue divisions):</p> <ul style="list-style-type: none"> ■ District level Land Revenue Departments of all three districts; ■ Competent Authority for Land Acquisition; ■ National Highway Authority of India; ■ Central Pollution Control Board (CPCB) ■ UP Pollution Control Board (UPPCB); ■ Ministry of Environment Forest and Climate Change (MoEFCC); ■ Local Fire Authority; ■ Ministry of Road Transport and Highways ■ State Transport Authority; ■ District Collector and Revenue Department; ■ Department of Telegraph, Communication, Govt. of Uttar Pradesh 	<ul style="list-style-type: none"> ■ The key expectations of the regulatory authorities is ensuring that the Project proponent meets all the statutory compliances and that the Project operations are undertaken as per the conditions put forth by the authorities and after having obtained all the necessary permits; 	The Project has ensured compliance with the relevant guidelines and policy recommendations as per the NHAI;	<p>Project's compliance to the regulatory requirements;</p> <p>Timely disclosure of information and provisioning of updated through the life of the Project</p> <p>This stakeholder group is also critical for various permits/clearances required, prior to construction work.</p>	High

Relevant Stakeholders	Profile/ Status	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	These authorities influence the Project in terms of establishing policy, granting permits and approvals for the Project, monitoring and enforcing compliance with the applicable rules and regulations.				
Secondary Stakeholders					
Local Political Groups	This stakeholder group is comprised of the political parties and local politicians active in the region; This group is active in the area and may play an important role in the polarisation of public opinion towards the Project.	The Project will have minimal or no influence on this stakeholder group	This stakeholder group is expected to play a critical role in the development of the public opinion towards the Project.	The main expectation and concern of the stakeholder group from the Project includes the Project's role in the development of the area in keeping with the broader agenda of the Projects and keeping the constituents and loyalists of the parties at the forefront.	Medium
Civil Society/Local NGOs	This stakeholder group comprises of NGOs and Civil Society Organizations of a national, state and local level who may be active in the area. The two NGOs identified in the region during FGDs and household survey by ERM are state level NGOs, involved in skill development, education and conservation/ recharging of water bodies. The two NGOs identified in the region include the following: Shiv Nadar Foundation: An NGO working in Bilsuri village of the Project area. The NGO provides computer classes, smart classes/ education to 120 upper primary students of Govt. school in the village; Sleep well Foundation: This foundation works on skill development of youths in	<ul style="list-style-type: none"> The level of influence of Project on this stakeholder group is limited as it does not affect the functioning of this group. 	<ul style="list-style-type: none"> The stakeholder group may play an important role in the development of public opinion for the Project; This stakeholder group may also be involved in the implementation of the community and livelihoods development plans 	<ul style="list-style-type: none"> The main expectations and concerns of the stakeholder group from the Project is likely to include the development of the Project, in keeping with the applicable regulations and with minimal impacts on the local population, while contributing towards the overall development of the area The interest of this stakeholder group primarily pertains to the roles of the Project in implementing community development activities in the area; Involvement in the formulation and implementation of the 	Medium

Relevant Stakeholders	Profile/ Status	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	Mirpur village. This organization recently also recharged a pond/ water body in the area.			community development activities for the Project; and <ul style="list-style-type: none"> ■ Timely disclosure of information pertaining to the Project. 	

8. IMPACT ASSESSMENT AND MITIGATION MEASURES

8.1 Introduction

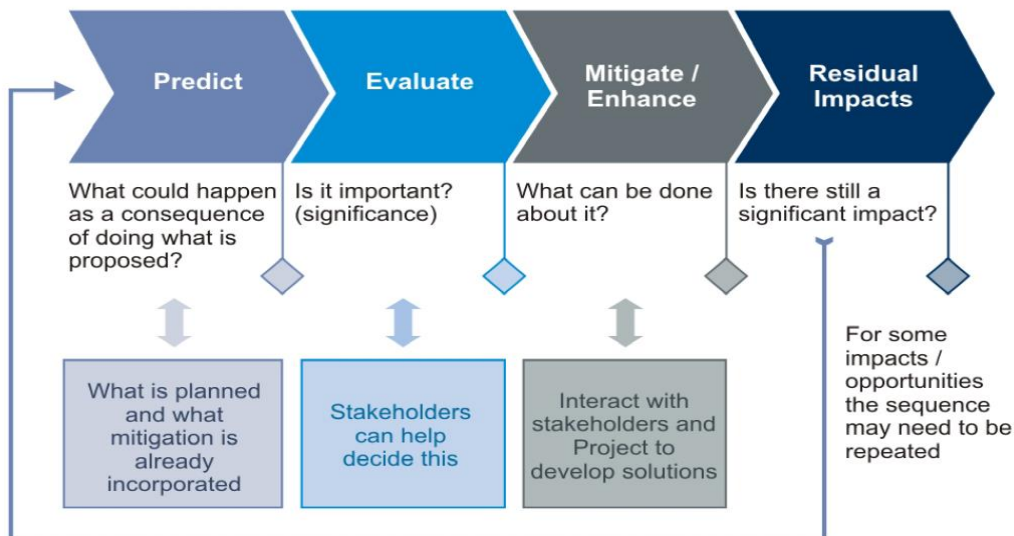
This section assesses the manner in which the proposed road project will interact with elements of the physical, ecological or social environment to produce impacts to resources/ receptors. It has been organized as per the various phases of the project life cycle as follows to understand the risks and impacts associated with each phase.

8.2 Impact Assessment and Methodology

Impact identification and assessment starts with scoping and continues through the remainder of the Impact Assessment (IA) Process. The principal IA steps are summarized in **Figure 8.1** and comprises of

- **Impact prediction:** to determine what could potentially happen to resources/receptors as a consequence of the Projects and its associated activities.
- **Impact evaluation:** to evaluate the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value and/or importance of the affected resource/receptor.
- **Mitigation and enhancement:** to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts.
- **Residual impact evaluation:** to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures.

Figure 8.1 Impact Assessment Process



8.2.1 Prediction of Impacts

Prediction of impacts was carried out with an objective to determine what is likely to happen to the environment as a consequence of the Project and its associated activities. From the potentially significant interactions identified in scoping, the impacts to the various resources/receptors were elaborated and evaluated.

8.2.2 Evaluation of Impacts

Each impact was described in terms of its various relevant characteristics (e.g., type, scale, duration, frequency, extent). The terminology used to describe impact characteristics is shown in **Table 8.1**.

Table 8.1 Impact Characteristic Terminology

Characteristic	Definition	Designation
Type	A descriptor indicating the relationship of the impact to the Project road (in terms of cause and effect)	Direct Indirect Induced
Extent	The “reach” of the impact (e.g., confined to a small area around the Project Footprint, Projected for several kilometres, etc.)	Local National Global
Duration	The time period over which a resource/ receptor is affected.	Temporary Short-term Long-term Permanent
Scale	The size of the impact (e.g., the size of the area damaged or impacted, the fraction of a resource that is lost or affected, etc.)	[no fixed designations; intended to be a numerical value or a qualitative description of “intensity”]
Frequency	A measure of the constancy or periodicity of the impact.	[no fixed designations; intended to be a numerical value or a qualitative description]

The definitions for the type designations are given in **Table 8.2**. Definitions for the other designations are resource/receptor-specific.

Table 8.2 Impact Type Definitions

Type	Definition
Direct	Impacts that result from a direct interaction between the Project road and a resource/ receptor
Indirect	Impacts that follow on from the direct interactions between the Project road and its environment as a result of subsequent interactions within the environment
Induced	Impacts that result from other activities (which are not part of the Project) that happen as a consequence of the Project.

The above characteristics and definitions apply to planned and unplanned events. An additional characteristic that pertains only to unplanned events is likelihood. The likelihood of an unplanned event occurring was designated using a qualitative scale, as described in **Table 8.3**.

Table 8.3 Definitions of Likelihood Designations

Likelihood	Definition
Unlikely	The event is unlikely but may occur at some time during normal operating conditions (probability less than 20%)
Possible	The event is likely to occur at some time during normal operating conditions (probability greater than 20% and less than 50%)
Likely	The event will occur during normal operating conditions (probability greater than 50%)

Once an impact’s characteristics were defined, each impact was assigned a ‘magnitude’. Magnitude is typically a function of a combination (depending on the resource/receptor in question) of the following impact characteristics:

- Extent
- Duration
- Scale
- Frequency

In case of unplanned events only, magnitude incorporates the ‘likelihood’ factor discussed above.

Magnitude essentially describes the intensity of the change that was predicted to occur in the resource/receptor as a result of the impact. As discussed above, the magnitude designations themselves are universally consistent, but the descriptions for these designations vary on a resource/receptor-by-resource/receptor basis. The universal magnitude designations are:

- Positive
- Negligible
- Small
- Medium
- Large

In the case of a positive impact, no magnitude designation (aside from ‘positive’) was assigned. It was considered sufficient for the purpose of the IA to indicate that the Project (widening of expressway) was expected to result in a positive impact, without characterising the exact degree of positive change likely to occur.

In the case of impacts resulting from unplanned events, the same resource/ receptor-specific approach to concluding a magnitude designation was followed, but the ‘likelihood’ factor was considered, together with the other impact characteristics, when assigning a magnitude designation.

In addition to characterising the magnitude of impact, the other principal impact evaluation step was definition of the sensitivity/ vulnerability/ importance of the impacted resource/receptor. There are a range of factors that was taken into account when defining the sensitivity/ vulnerability/ importance of the resource/receptor, which may be physical, biological, cultural or human. Other factors were also considered when characterising sensitivity/ vulnerability/importance, such as legal protection, government policy, stakeholder views and economic value. The sensitivity/ vulnerability/importance designations used herein for all resources/receptors are:

- Low
- Medium
- High

Once magnitude of impact and sensitivity/ vulnerability/ importance of resource/ receptor have been characterised, the significance was assigned for each impact. Impact significance is designated using the matrix shown in Figure 8.2.

Figure 8.2 Impact Significance

		Sensitivity/Vulnerability/importance of Resource/Receptor		
		Low	Medium	High
Magnitude of Impact	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

The matrix applies universally to all resources/receptors, and all impacts to these resources/receptors, as the resource/receptor-specific considerations are factored into the assignment of magnitude and sensitivity/ vulnerability/ importance designations that enter into the matrix. **Box 8.1** provides a context of what the various impact significance ratings imply.

Box 8.1 Context of Impact Significance

An impact of **negligible** significance is one where a resource/ receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.

An impact of **minor** significance is one where a resource/ receptor will experience a noticeable effect, but the impact magnitude is sufficiently small and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards/ guidelines.

An impact of **moderate** significance has an impact magnitude that is within applicable standards/guidelines, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.

An impact of **major** significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of IA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.

It is important to note that impact prediction and evaluation takes into account any embedded controls (i.e., physical or procedural controls that are already planned as part of the Project design, regardless of the results of the IA Process).

Activity-Impact Interaction Matrix for Planning, Construction and Operation & Maintenance phases has been further used to assess the impact significance at activity levels on environmental, ecological and social resources.

8.2.3 Identification of Mitigation and Enhancement Measures

Once the significance of an impact has been characterised, the next step was to evaluate what mitigation and enhancement measures are warranted. For the purposes of this IA, ERM adopted the following Mitigation Hierarchy:

- **Avoid at Source, Reduce at Source:** avoiding or reducing at source through the design of the Project.
- **Abate on Site:** add something to the design to abate the impact.
- **Abate at Receptor:** if an impact cannot be abated on-site then control measures can be implemented off-site.
- **Repair or Remedy:** some impacts involve unavoidable damage to a resource (e.g. agricultural land and forestry due to creating access, work camps or materials storage areas) and these impacts can be addressed through repair, restoration or reinstatement measures.
- **Compensate in Kind, Compensate Through Other Means:** where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (e.g., planting to replace damaged vegetation, financial compensation for damaged crops or providing community facilities for loss of fisheries, access, recreation and amenity space).

The priority in mitigation was to first apply mitigation measures to the source of the impact (i.e., to avoid or reduce the magnitude of the impact from the associated Project activity), and then to address the resultant effect to the resource/receptor via abatement or compensatory measures or offsets (i.e., to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

8.2.4 Residual Impact Evaluation

Once mitigation and enhancement measures are declared, the next step in the ESIA Process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the implementation of the proposed mitigation and enhancement measures.

8.2.5 Management and Monitoring

The final stage in the IA Process was the definition of the basic management and monitoring measures that are needed to identify whether: a) impacts or their associated Project components remain in conformance with applicable standards/ guidelines; and b) mitigation measures are effectively addressing impacts and compensatory measures and offsets are reducing effects to the extent predicted. This is covered in **Section 9** under Environmental and Social Management Plan (ESMP).

8.3 Environmental Impact Assessment Criteria

For the purpose of this assessment the following sections define the criteria against which the impacts associated with the proposed project of widening of 126.3 km Ghaziabad Aligarh road section from 4 lane to 6 lane, along with Khurja Realignment have been assessed. Interactions that are likely to lead to significant impacts, as identified during the scoping exercise and baseline conditions are presented in the table below.

Table 8.4 Interactions identified that are likely to result in significant environmental impacts

Resource/Receptor	Potentially Significant Impacts
Construction within existing ROW (i.e., widening/ six laning)	
Land Use	<ul style="list-style-type: none"> ■ Temporary changes in land use due to temporary site office, labour camps and material storage.
Topography and drainage	<ul style="list-style-type: none"> ■ Alteration of micro drainage channels due to site preparation and alteration activities and widening of existing road.
Soil Environment	<ul style="list-style-type: none"> ■ Sedimentation into nearby water bodies due to soil erosion and run-off; ■ Storage and handling of hazardous materials (e.g., fuel and lubricant) and waste generated from operation of construction equipment and machinery and their maintenance may lead to soil contamination due to leaks/ spillage; and ■ Impact on soil and land environment due to improper management of domestic solid waste generated from labour camps.
Ambient Air Quality	<ul style="list-style-type: none"> ■ Fugitive dust emissions due to movement of machinery and vehicles; ■ Fugitive dust emission from construction activities ■ Fugitive emission due to operation of batching plant, mixers; and

Resource/Receptor	Potentially Significant Impacts
	<ul style="list-style-type: none"> ■ Air emissions due to operations of DG sets.
Water Environment	<ul style="list-style-type: none"> ■ Usage of ground water for construction; ■ Surface and ground water contamination due to improper disposal of sewage at site from labour camps; and ■ Surface and ground water contamination due to spillage of oil and hazardous waste.
Ambient Noise Quality	<ul style="list-style-type: none"> ■ Noise generation due to movement of vehicles and machinery; ■ Noise generation due to operation of batching plant, mixers; and ■ Noise generation due to operation of DG set.
Health and Safety (Occupational and Community)	<ul style="list-style-type: none"> ■ Occupational health hazards due to dust and noise pollution; ■ Occupational safety risks during construction activities due to movement of vehicles; ■ Safety risk due to improper handling of construction machinery
Construction of Khurja realignment	
Land Use	<ul style="list-style-type: none"> ■ Change in land use is anticipated for the Khurja realignment construction. ■ Temporary changes in land use due to temporary site office, labour camps and material storage.
Topography and drainage	<ul style="list-style-type: none"> ■ Alteration of topography and micro drainage channels due to site preparation and alteration activities, widening of existing road
Soil Environment	<ul style="list-style-type: none"> ■ Decrease of soil quality due to loss of vegetation cover in open areas; ■ Soil erosion during monsoon season and windy periods; ■ Sedimentation into nearby water bodies due to soil erosion and run-off; ■ Storage and handling of hazardous materials (e.g., fuel and lubricant) and waste generated from operation of construction equipment and machinery and their maintenance may lead to soil contamination due to leaks/ spillage; and ■ Impact on soil and land environment due to improper management of domestic solid waste generated from labour camps.
Ambient Air Quality	<ul style="list-style-type: none"> ■ Fugitive dust emissions due to movement of machinery and vehicles; ■ Fugitive dust emission from construction activities ■ Fugitive emission due to operation of batching plant, mixers; and ■ Air emissions due to operations of DG sets and other machinery.
Water Environment	<ul style="list-style-type: none"> ■ Usage of water resources for construction; ■ Surface and ground water contamination due to improper disposal of sewage from labour camps; and ■ Surface and ground water contamination due to spillage of oil and hazardous waste from construction camps.

Resource/Receptor	Potentially Significant Impacts
Ambient Noise Quality	<ul style="list-style-type: none"> ■ Noise generation due to movement of vehicles and machineries; ■ Noise generation due to operation of batching plant, mixers; and ■ Noise generation due to operation of DG set.
Health and Safety (Occupational and Community)	<ul style="list-style-type: none"> ■ Occupational health hazards due to dust and noise pollution; ■ Occupational safety risks during construction activities due to movement of vehicles; ■ Safety risk due to wrong handling of construction machinery.
Operations and Maintenance Phase	
Ambient Air Quality	<ul style="list-style-type: none"> ■ Air emissions due to vehicular movement during operational six laned road
Water Environment	<ul style="list-style-type: none"> ■ Surface and ground water contamination due to accidental spillages during road operations and maintenance ■ Improper disposal of hazardous waste during maintenance activities
Ambient Noise Quality	<ul style="list-style-type: none"> ■ Noise due to increased traffic during operations
Health and Safety (Occupational and Community)	<ul style="list-style-type: none"> ■ Occupational health hazards due to dust and noise pollution; ■ Community safety risks due to accidents during road operations

8.3.1 Assessment Criteria for Change in Land Use

For the purpose of assessment of impacts on land use of the area, following project activities, leading to an alteration in land use of the area during construction phase, were considered:

- Site preparation and removal of vegetation and grass cover
- Levelling of ground;
- Concrete filling, road building; and
- Road roller movement and levelling of road.

For the assessment of land use, the sensitivity and magnitude criteria outline in **Table 8.5** and **Table 8.6** have been used respectively.

Table 8.5 Sensitivity Assessment Criteria for Land Use

Land Use Sensitivity	Criteria
Low	<ul style="list-style-type: none"> ■ Land not of relevant use by community ■ Negligible visual change.
Medium	<ul style="list-style-type: none"> ■ Land of local use by communities e.g. grazing, agriculture, but no major dependence ■ Visual Change but common feature
High	<ul style="list-style-type: none"> ■ Land of regional importance. Change would impact Land use classification of the area. ■ Land use of major dependence of local people for agriculture, livestock grazing, settlement etc. ■ Visual Change aesthetically affecting locals.

Table 8.6 Criteria for Impact Magnitude for Assessment of Impact to Land Use

Magnitude	Criteria
Negligible	An imperceptible, barely or rarely perceptible change in land use characteristics. The change may be short term.
Small	Subtle changes in land use character over a wide area of a more noticeable change either over a restricted area or infrequently perceived. The change may be short term to long term and is reversible.
Medium	A noticeable change in land use character, frequently perceived or continuous and over a wide area; or a clearly evident change over a restricted area that may be infrequently perceived. The change may be medium to long term and may not be reversible.
Large	A clearly evident, frequently perceived and continuous change in land use characteristics affecting an extensive area. The change may be long term and would not be reversible.

8.3.2 Assessment Criteria for Impact on Topography and Drainage

For the purpose of assessment of impacts on topography and drainage of the area, sensitivity and magnitude criteria have been outlined in **Table 8.7** and **Table 8.8** respectively.

Table 8.7 Sensitivity Assessment Criteria for Topography

Topography and Drainage Sensitivity	Criteria
Low	Flat topography
Medium	Undulating topography
High	Hilly area

Table 8.8 Criteria for Impact Magnitude for Assessment of Impacts on Topography and Drainage

Magnitude	Criteria
Negligible	An imperceptible, barely or rarely perceptible change in topographical characteristics. The change may be short term.
Small	A subtle change in topography character over a wide area of a more noticeable change either over a restricted area or infrequently perceived. The change may be short term to long term and is reversible.
Medium	A noticeable change in topographic character, frequently perceived or continuous and over a wide area; or a clearly evident change over a restricted area that may be infrequently perceived. The change may be medium to long term and may not be reversible.
Large	A clearly evident, frequently perceived and continuous change in topographic characteristics affecting an extensive area. The change may be long term and would not be reversible.

8.3.3 Assessment Criteria for Impact on Soil Environment

8.3.3.1 Project Phases and Associated Activities

For impact assessment, the following phases of the project cycles were considered for potential impacts on the soil environment. The phase wise project activities that may impact the environment are described below.

Construction Phase

- Site preparation and removal of vegetation and grass cover
- Levelling of ground;
- Concrete filling, road building;
- Road roller movement and levelling of road;
- Storage of oil and lubricants onsite;
- Storage of construction materials; and
- Disposal of different type of waste generated from the labour camps, temporary site office.

Operation and Maintenance Phase

- Operation of expressway;
- Disposal of municipal solid waste on road side; and
- Road maintenance.

For the assessment of soil quality, the sensitivity and magnitude criteria is as outlines in **Table 8.9** and **Table 8.10** respectively.

Table 8.9 Sensitivity Assessment Criteria for Soil Quality (compaction, erosion and contamination)

Sensitivity Criteria	Contributing Criteria	
	Environment	Social
Soil Quality related criteria as compaction, erosion and contamination and Land use change	The extent to which the soil and its quality plays an ecosystem role in terms of supporting biodiversity. This includes its role as in supporting a lifecycle stage	The extent to which the soil and its quality provides a use (agricultural use) to the local communities and businesses, or is important in terms of national resource protection objectives, targets and legislation
Low	The soil quality does not support diverse habitat or populations and/or supports habitat or population of low quality	The soil quality has little or no role in provisioning of services as agricultural uses for the local community.
Medium	The soil quality supports diverse habitat or population of flora and fauna and supports habitats commonly available in the study area	The soil has local importance in terms of provisioning services as agricultural services but there is ample capacity and / or adequate opportunity for alternative sources of comparable quality i.e. ready availability across the study area.
High	The soil quality supports economically important or biologically unique species or provides essential habitat for such species.	The soil is wholly relied upon locally, with no suitable technically or economically feasible alternatives, or is important at a regional level for provisioning services.

Table 8.10 Criteria for Impact Magnitude for Assessment of Impact to Soil

Magnitude Criteria	Negligible	Small	Medium	Large
Soil compaction and erosion	■ Qualitative-No perceptible or readily	■ Perceptible change from baseline	■ Clearly evident (e.g. perceptible and	■ Major (e.g. order of magnitude)

Magnitude Criteria	Negligible	Small	Medium	Large
	measurable change from baseline conditions <ul style="list-style-type: none"> ■ Scale- Localized area as Particular activity areas ■ Time-Short duration (few days) or one time as temporary 	conditions but likely to easily revert back to earlier stage with mitigation <ul style="list-style-type: none"> ■ Scale- - Project site, activity areas and immediate vicinity not impacting any sensitive receptor ■ Short term- Only during particular activities or phase of the project lifecycle as civil works or construction phase (few months) 	readily measurable) change from baseline conditions and/or likely take time to revert back to earlier stage with mitigation <ul style="list-style-type: none"> ■ Scale- Project site, activity areas and immediate vicinity impacting sensitive receptor/s ■ Long term- Spread across several phases of the project lifecycle (few years) 	change in comparison to baseline conditions and/or likely difficult or may not to revert back to earlier stage with mitigation <ul style="list-style-type: none"> ■ Scale- Regional or international; ■ Permanent change
Soil contamination	Well within standards	Well within standards	Exceeds Target Value but well within Interventional Value	Exceeds Interventional Value and needs intervention.

8.3.4 Assessment Criteria for Impact on Water Environment

The impacts of project on the water environment are assessed due to consumption of water during project activities and contamination of water from accidental spillage of fuel, oils, domestic and hazardous waste during construction activities close to water bodies.

For the assessment of water quality, the sensitivity criteria and magnitude criteria are outlined in **Table 8.11** and **Table 8.12** respectively have been used.

Table 8.11 Sensitivity Assessment Criteria for Water Resources (Surface water and Ground water)

Sensitivity Criteria	Contributing Criteria	
	Environment	Social
Water Resources - Surface water and	The extent to which the water resource plays an ecosystem or	The extent to which the water resource provides or could provide a use (drinking

Sensitivity Criteria	Contributing Criteria	
	Environment	Social
ground water (quality/quantity related criteria)	amenity role in terms of supporting biodiversity either directly or indirectly, particularly with respect to dependent ecosystems.	water, agricultural uses, washing and other domestic or industrial, use as waterways) to the local communities and businesses, or is important in terms of national resource protection objectives, targets and legislation
Low	The water resource does not support diverse aquatic habitat or populations, or supports aquatic habitat or population that is of low quality.	The water resource has little or no role in terms of provisioning services as agricultural water source, other domestic uses as washing, bathing, industrial use and waterways for the local community. The groundwater resource may be used in the future to meet demands
Medium	The water resource supports diverse populations of flora and / or fauna but available in the surface water bodies in the region.	The surface water resources have local importance in terms of provisioning services but there is ample capacity and / or adequate opportunity for alternative sources of comparable quality. The surface water may be used in the future to meet demands.
High	The water resource supports economically important or biologically unique aquatic species or provides essential habitat for such species.	The surface water resources are wholly relied upon locally, with no suitable technically or economically feasible alternatives, it is important at a regional or transboundary watershed level for provisioning services. The groundwater resource is wholly relied upon locally, with no suitable technically or economically feasible alternatives. The development stage of groundwater is critical or over exploited.

Table 8.12 Criteria for Impact Magnitude for Assessment of Impact to Surface and Groundwater Resources

Magnitude Criteria	Negligible	Small	Medium	Large
General Criteria	No perceptible or readily measurable change from baseline conditions.	Perceptible change from baseline conditions but likely to be within applicable norms and standards for mode of use.	Clearly evident (e.g. perceptible and readily measurable) change from baseline conditions and / or likely to approach and even occasionally exceed applicable norms and standards for mode of use.	Major changes in comparison to baseline conditions and / or likely to regularly or continually exceed applicable norms and standards for mode of use.
Water	There is likely to be negligible or no consumption of surface water by the Project at any time	The Project will consume surface water, but the amounts abstracted are likely to be relatively small in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation)	The Project will consume surface water, and the amounts abstracted are likely to be significant in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation)	The Project will consume surface water, and the amounts abstracted are likely to be very significant in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation)
	There is likely to be negligible or no abstraction, use of or discharge to the groundwater by the Project at any time.	The Project will consume groundwater or deliver discharge to groundwater, but the amounts abstracted / discharged are likely to be relatively small in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation).	The Project will consume groundwater or discharge to groundwater, and the amounts abstracted / discharged are likely to be significant in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation).	The Project will consume groundwater or discharge to groundwater, and the amounts abstracted / discharged are likely to be very significant in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation).

8.3.5 Assessment Criteria for Impact on Air Quality

The assessment with respect to air quality of the study area has been done for the following project activities:

- Fugitive emissions from site clearing, levelling and preparation, construction material handling etc.;
- Fugitive emission from traffic movement;
- Exhaust emission from operation of machineries like batching plant, mixing plant; and
- Point source emission from diesel generator.

The sensitivity criteria and impact magnitude criteria has been provided in **Table 8.13** and **Table 8.14** respectively.

Table 8.13 Sensitivity criteria for air quality

Sensitivity Criteria	Contributing Criteria	
	Human Receptors	Ecological Receptors
Low	Locations where human exposure is transient. ¹¹	No
Medium	Few Receptors (settlements) within 500 m of the project site	Nationally designated sites.
High	Densely populated receptors(settlements) within 500 m of project site	Internationally designated sites.

Table 8.14 Criteria for Impact Magnitude for Assessment of Impact to Air Quality

Magnitude Criteria	Negligible	Small	Medium	Large
Air Quality	Soil type with large grain size (e.g. sand); and/or No emissions/dust generation due to Project across all phases	Soil type with large grain size (e.g. sand); and/or Limited emissions/dust generations for short duration	Moderately dusty soil type (e.g. silt); and/or Dust generation and emissions from Projects for long duration	Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size); and Significant process emissions from Project for the entire Project cycle.

8.3.6 Assessment Criteria for Impact on Ambient Noise

The assessment with respect to ambient noise quality of the study area has been done for the following project activities:

- Construction activities including site preparation, clearing and levelling, construction material handling etc.;
- Transportation of construction materials, machinery and personnel;
- Operation of DG sets, batching plant, mixing plant and other machineries; and
- Increase in traffic movement.

The ambient noise levels have been assessed with respect to Noise Pollution (Regulation and Control) Rules, 2000 and WHO Guidelines as shown in **Table 8.15** and **Table 8.16** respectively.

¹¹ As per the NAAQS and World Bank/IFC guidelines, there are no standards that apply to short –term exposure, e.g., one or two hours, but there is still a risk of health impacts, albeit less certain.

Table 8.15 Ambient noise quality standards

Area Code	Category of Area	Limits in dB(A) L_{eq} *	
		Day Time	Night Time
(A)	Industrial Area	75	70
(B)	Commercial Area	65	55
(C)	Residential Area	55	45
(D)	Silence Zone	50	40

Note:

1. Day time shall mean from 6.00 a.m. and 10.00 p.m.
2. Night time shall mean from 10.00 p.m. and 6.00 a.m.
3. Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority.
4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

* dB(A) L_{eq} denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing. A "decibel" is a unit in which noise is measured. "A", in dB (A) L_{eq} , denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear. L_{eq} : It is energy mean of the noise level over a specified period.

Table 8.16 Noise emission criteria

Location	Noise Level Limit (dB(A))	
	Daytime (0700 – 2200 hrs)	Night-time (2200 – 0700 hrs)
Industrial; commercial	70	70
Residential; institutional; educational	55	45

Source: Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, World Health Organisation (WHO), 1999.

The above standards have been utilized to create a sensitivity criteria for ambient noise and criteria for impact magnitude for assessment of impact to ambient noise.

Table 8.17 Sensitivity criteria for Ambient Noise

Sensitivity Criteria	Contributing Criteria	
	Human Receptors	Ecological Receptors
Low	Industrial Use	Locally designated sites; and/or areas of specific ecological interest, not subject to statutory protection (for example, as defined by the project ecology team).
Medium	Residential and Recreational place	Nationally designated sites.
High	Educational/ Religious/ Medical Facilities	Internationally designated sites.

Table 8.18 Criteria for impact magnitude for assessment of impact to ambient noise

Magnitude Criteria	Negligible	Small	Medium	Large

Noise Quality	Predicted noise levels are at or less than 3 dB (A) above the relevant limits / thresholds. Short term exposure (Few hours in a day and not continuous)	Predicted noise levels are 3 to less than 5 dB (A) above the relevant limits / thresholds.	Predicted noise levels are between 5 and 10 dB (A) above the relevant limits / thresholds. Medium Term Exposure (1 to 6 months)	Predicted noise levels are more than 10 dB (A) above the relevant limits / thresholds. Long term exposure (> 6 months)
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8.4 Environmental Impact Assessment and Mitigation Measures

8.4.1 Construction Phase

8.4.1.1 Change in land use

Impact Magnitude

Based on review of the land use in the Project Aol, it was observed that majority of land use is agricultural land that covers 81.56 sq.km. area (64.28%) of total 126.89 sq.km. area. It is followed by open land with 20.07 sq.km. area (15.82%) and settlements land (9.82%). The land use pattern of the Project Aol has been shown in map (refer **Figure 5.1**). For borrow areas, wasteland 500m away from road and 800m away from settlements will be used which will later be restored using waste soil from the construction phase. Further details are given in **Appendix K**. Therefore, no significant change in land use is anticipated for the six laning, although there will be change in land use for the Khurja realignment.

There is no major dependency for grazing on land required for the project. Since, majority of the land is agricultural and open land, the receptor sensitivity is assessed as **medium**.

Further, since the proposed project activity is of widening of existing expressway and does not involve fresh land acquisition, the impact magnitude of change in land use due to project development has been classified as **low**.

Embedded built in controls

The impacts during the construction activity are envisaged to be of a short duration as the construction phase will be about 1 to 1.5 years but in different patches. Additionally, the EPC contractors will be instructed to avoid any unnecessary disturbance to nearby surrounding features or land parcels. Further, construction activities will be restricted to the footprint area of the Project components and remaining area to be kept undisturbed to the extent possible.

Post completion of the construction work, the areas utilised for labour camps, temporary site office and storage of construction material and equipment are expected to be restored to their near original state.

Significance of impact

The overall impact significance has been assessed to be **minor**.

Additional mitigation measures

The following mitigation measures should be implemented to minimize potential impacts on land use during the construction phase:

- Construction activity should be restricted to designated area;

- Waste should not be allowed to litter in and around the Project area;
- On completion of the construction activities, land used for temporary facilities (labour camps, temporary site office and storage of construction material and equipment) will be restored to the extent possible and handed; and
- The land use around the permanent project facilities will not be disturbed.
- It is to be noted that construction in the realignment area will be undertaken by NHA therefore Cube will be required to provide inputs to NHA on adequacy of mitigation measure being implemented by the sub-contractors

Residual impact significance

The residual impact significance will remain **minor** as changes in land use will be for long term (widening of existing expressway).

Impact	Change in land use			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	Transboundary	
Impact Scale	Limited to Project footprint			
Impact Magnitude	Positive	Negligible	Small	Medium
Resource /Receptor Sensitivity	Low	Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impact is assessed as Minor			
Residual Magnitude	Positive	Negligible	Small	Medium
Residual Impact Significance	Negligible	Minor	Moderate	Major
	Significance of residual impact is assessed as Minor			

8.4.1.2 Impact on Topography and Drainage

Impacts

The Project area exhibits flat topography with gradual decrease in elevation along the project road. There are no major water bodies that pass through the Project road. Since the proposed project road is an existing expressway now widened from 4 lane to 6 lane lying mostly on a flat terrain the receptor sensitivity has been assessed to be **low**.

The topography may be altered slightly due to the widening of expressway, from site preparation, land clearing and levelling and road construction work. Since these changes are envisaged to be small and restricted to the immediate vicinity of the existing road, the impact magnitude has therefore been assessed as **small** considering the footprint of the Project.

Construction phase will involve storage of construction material and excavated soil in open which maybe prone to run-off during rains. There are stretches along the road where the existing drains are choked or no drains were constructed due to disagreement between village panchayat and NHA. Surface runoffs from construction areas will further aggravate the situation.

Embedded built in controls

- The EPC contractor at site will be instructed to avoid any unnecessary changes in the topography. The storm water drainage system of the road will be build based on natural topography of the area and will use existing micro drainage channels patterns.

- Drainage plan was developed during 4 lane design considering 20/50 years storm events. The six laning is just a retrofitting of 4lane project and no major changes are made to existing project.

Significance of impact

The impact significance is therefore envisaged to be **minor to moderate**.

Additional mitigation measures

- Surface clearing and levelling operations should be undertaken with minimal disturbance to the existing contour thereby maintaining the general slope of the site;
- Adequate plan for storage of construction material and loose earth shall be made prior to commencement of each sub section of work, such plan would include plan will include a sedimentation tank before disposal into existing storm water drains of the road;
- Where storm water drains are dismantled for expansion or donot exist run off shall be diverted to soak pits of appropriate size.
- Disruption/alteration of micro-watershed drainage pattern should be minimized to the extent possible
- In addition to treatment of existing culverts and bridges, new cross drainage structures shall be proposed to take care of the increased run off and maintain the existing drainage of the project Aol.
- It is to be noted that construction in the realignment area will be undertaken by NHA1 therefore Cube will be required to provide inputs to NHA1 on adequacy of mitigation measure being implemented by the sub-contractors

Residual impact significance

The residual impact significance will be reduced to **negligible** after implementing above mentioned mitigation measures.

Impact	Change in topography and drainage					
Impact Nature	Negative		Positive		Neutral	
Impact Type	Direct		Indirect		Induced	
Impact Duration	Temporary	Short-term		Long-term		Permanent
Impact Extent	Local		Regional		Transboundary	
Impact Scale	Limited to project site					
Impact Magnitude	Positive	Negligible	Small	Medium	Large	
Resource /Receptor Sensitivity	Low		Medium		High	
Impact Significance	Negligible		Minor	Moderate		Major
	Significance of impact is considered Minor .					
Residual Magnitude	Positive	Negligible	Small	Medium	Large	
Residual Impact Significance	Negligible		Minor	Moderate		Major
	Residual of impact is considered Negligible					

8.4.1.3 Impact due to soil compaction and erosion

Context

During construction, soil compaction and erosion may occur from traffic movement on the unpaved areas due to traffic diversion and other construction activities near construction laydown areas.

Impact Magnitude

During the construction phase, the top soil will be susceptible to soil erosion to some extent due to site clearance activities. The region is characterised by sandy loam and loamy soil which is loose in nature, and thus soil erosion can occur easily in the Project area. Although the scale of site clearance will be small considering it is widening of existing expressway, but because of its continuous nature for a stretch of 126.3 kms, the removal of stabilised top soil would result in loosening of soil and increase in soil erosion.

As for soil compaction, the site preparation, road building and levelling work will lead to soil compaction, the impacts arising from soil compaction will be moderate. Therefore, the overall resource/receptor sensitivity is assessed as **medium** and the impact magnitude is assessed to be **small to medium**.

Embedded built in controls

Construction materials and machinery will be stored in designated areas;

Topography shall be restored to the extent possible and plantation will be done in ROW to the extent possible.

Significance of impact

Based on the above, after incorporating the embedded control the impact significance is envisaged to be **minor** and is likely to impact the project footprint area during the construction phase.

Additional mitigation measures

- Top soil that has been stripped should be stored for landscaping of the site;
- Soil to be ploughed in compacted area after completion of the construction work;
- Plantation will be done in ROW to the extent possible using fast growing local vegetation;
- As a best practice, site clearance, vegetation removal and road construction will not be carried out during the monsoon season to minimize erosion and run-off.
- It is to be noted that construction in the realignment area will be undertaken by NHA1 therefore Cube will be required provide inputs to NHA1 on adequacy of mitigation measure being implemented by the sub-contractors

Residual impact significance

The significance of residual impacts will be **negligible** taking into account the recommended mitigation measures.

Impact	Soil Erosion and Compaction				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	Transboundary		
Impact Scale	Limited to Project area				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is assessed as minor				
Residual Magnitude	Positive	Negligible	Small	Medium	Large
	Negligible	Minor	Moderate	Major	

Residual Impact
Significance

Significance of impact is assessed as **negligible**

8.4.1.4 Impact on land and soil due to improper waste disposal

Impact Magnitude

General construction waste generated onsite will comprise of surplus or off-specification materials such as concrete, bitumen, fuels, oils etc. Municipal domestic wastes consisting of food waste, plastic, glass, aluminium cans and waste paper will also be generated by the construction workforce at labour camps and temporary site office area, which shall be constructed for them. A small proportion of the waste generated during construction phase will be hazardous and may include lubricants, hydraulic fluids, waste fuel, grease and waste oil containing rags. If improperly managed, solid and hazardous waste could create negative impacts on land. Additionally, soil contamination during the construction phase may result from leaks and spills of oil, lubricants, or fuel from heavy equipment, improper handling of chemical/fuel storage and wastewater from labour camps and temporary site offices. Such spills could have a long-term impact on soil quality. Therefore, the receptor sensitivity and impact magnitude are assessed as **medium**

Embedded/in-built controls

- The construction contractors will have control over the amount and types of waste (hazardous and non- hazardous) produced at the site;
- Workers will be strictly instructed against random disposal of any waste generated from the construction activity;
- Construction contractor will ensure that no unauthorized dumping of used oil and other hazardous wastes is undertaken at the site.
- Hazardous waste will be disposed through authorised vendor only.

Significance of Impact

Based on the above the impact after incorporating the embedded control the impact significance is envisaged to be **moderate**.

Additional Mitigation Measures

- Municipal domestic waste generated at site to be segregated onsite and ensure proper collection and handover to local municipal body/ local authority for further disposal;
- Ensure hazardous waste containers are properly labelled and should not be stored for more than 90 days at the construction site. If required to be stored on-site it should be provided with impervious surface, shed and secondary containment system;
- The construction contractor should ensure daily collection and periodic (weekly) disposal of construction waste generated debris, concrete, cement wastes as per the Construction and Demolition Waste Management rules 2016;
- Use of spill control kits to contain and clean minor spills and leaks.
- Unloading and loading protocols should be prepared for diesel, lubricants, oils, hydraulics and any other liquid construction material and workers trained to prevent/contain spills and leaks.
- It is to be noted that construction in the realignment area will be undertaken by NHAI therefore Cube will be required to provide inputs to NHAI on adequacy of mitigation measure being implemented by the sub-contractors

After implementation of mitigation measures, significance of impacts is envisaged to reduce to **minor**.

Residual Impact Significance

Impact	On land due to improper waste disposal			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	Transboundary	
Impact Scale	Limited to Project area			
Likelihood	Likely			
Impact Magnitude	Positive	Negligible	Small	Medium
Resource /Receptor Sensitivity	Low	Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impact is assessed to be moderate			
Residual Magnitude	Positive	Negligible	Small	Medium
Residual Impact Significance	Negligible	Minor	Moderate	Major
	Significance of residual impact is assessed to be minor			

8.4.1.5 Impact on Water Availability

Impact Magnitude

Water is a prime requirement for the execution of civil works. As reported about 10 KLD water will be required during construction phase, this includes water for civil works and dust suppression. As of now, the source of water could be ground/surface, depending upon availability and feasibility. Therefore, the receptor sensitivity is assessed to be **medium**. However, since the construction phase of the Project will last for a period of 15-18 months distributed across the entire stretch, therefore, magnitude of impact is assessed as **small**.

Embedded built in controls

Construction labour deputed onsite to be sensitised about water conservation and encouraged for optimal use of water

Significance of Impact

The significance of impact is assessed to be **minor**.

Additional Mitigation Measures

- Regular inspection for identification of water leakages and preventing wastage of water from water supply tankers is necessary for efficient utilisation of water;
- Blending of low quality water with fresh water for construction uses to ensure efficient use of natural resource; and
- Recycling/reusing to the extent possible;
- Cube may raise any issues on water management at Khurja realignment with NHA and seek implementation of similar measures.

Residual Impact Significance

The significance of impact is envisaged to be remain **minor** after implementation of mitigation measures.

Impact	Water availability during construction phase				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local	Regional		Transboundary	
Impact Scale	Limited to Project area				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor	Moderate		Major
	Significance of impact is assessed as minor				
Residual Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate		Major
	Significance of residual impact is assessed as minor				

8.4.1.6 Impact on Water Quality

Impact Magnitude

The project area does not have significant presence of surface water bodies that are likely to be impacted due to the construction activities. There are seasonal small ponds which are scattered across the AOI, however reportedly they are not used for consumption by community. There is an irrigation canal that cross the highway, which is regulated by the state irrigation department and water is released into it seasonally. Groundwater sources are present in the form of handpumps and tubewells which are used by community for domestic consumption.

There is a potential for contamination of surface and groundwater resources resulting from improper management of sewage at project site office or other accidental spills/leaks at the storage areas. The construction activities may also cause alteration in the physico-chemical properties of water in the nearby surface waterbodies.e.g. increased turbidity, less dissolve oxygen, because of sedimentation which can affect aquatic biodiversity. Water that comes into contact with cement, uncured concrete, concrete dust etc. used during construction quickly produces a strong alkaline solution that can affect the quality of surface water bodies.

The soil type of the area is sandy loam to loam soil. This type of soil usually has high filtration rate (measured in the range of 20-30 mm per hour) into the subsoil and subsequently the ground water. Therefore, the receptor sensitivity is assessed to be **medium**.

Furthermore, accidental spillage of chemical and fuel may contaminate the ground water and small water bodies in the vicinity of sections under construction. In such scenario, the spillage of chemicals and fuel can cause measurable changes in the water quality during construction activities (i.e. 6-8months). The magnitude of impact on water quality is thus assessed to be **medium**.

Embedded/in-built controls

- Provision of septic tank and soak pits onsite for treatment and disposal of sewage, thereby minimizing the impacts of wastewater discharge. Planning of toilets, soak pits and septic tanks, waste collection areas will be away from natural drainage channels;
- Provision for impervious storage area, especially for fuel & lubricant, hazardous waste, etc. will be made onsite.

Significance of Impact

The overall significance of impact is assessed to be **moderate**.

Additional Mitigation Measures

- Hire/engage licensed contractors for management and disposal of waste and sludge;
- Labourers should be given training towards proactive use of designated areas/bins for waste disposal and encouraged for use of toilets. Open defecation and random disposal of sewage should be strictly restricted; and
- Spill/ leakage clearance plan to be adopted for immediate cleaning of spills and leakages.
- It is to be noted that construction in the realignment area will be undertaken by NHA1 therefore Cube will be required to provide inputs to NHA1 on adequacy of mitigation measure being implemented by the sub-contractors.
- Measures will be implemented to protect aquatic life and control sediment loads including use of settling ponds, establishment of maintenance of vegetative buffers, etc.

Residual Impact Significance

The significance of impact is envisaged to be **minor** on implementation of mitigation measures.

Impact	Water quality during construction phase				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	Transboundary		
Impact Scale	Limited to WTG footprint, construction areas & associated facilities				
Frequency	Construction phase				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is assessed to be moderate				
Residual Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of residual impact is assessed to be minor				

8.4.1.7 Impact on Ambient Air Quality

Impacts

Air quality will largely get impacted from the following sources during the construction phase:

- Fugitive emissions from site clearing (demolition of impacted structures), levelling and preparation, construction material handling etc.;
- Vehicular emissions due to traffic diversions through unpaved areas and fugitive emissions due to increase in idling time of vehicles;
- Exhaust emission from operation of machineries like batching plant, mixing plant and movement of construction vehicles/ trucks; and
- Emissions from emergency power diesel generator required during construction activity.

Based on ambient air quality monitoring conducted within Project Aol, all the parameters were found to be within permissible limits, except particulate matter (**Section 5.2.6**). The exceedance of PM10 in the project area is largely attributed to the existing vehicular traffic and resuspension of dust. Unpaved shoulders and loose soil at few stretches along the road also contribute to dust emissions. Overall particulate levels in the NCR region has been recorded to be high during winter season due to low dispersion rates.

The Project is spread across a larger area (project Aol being ~126 sq.km as per land use assessment) and the air quality impacts would be confined to 500 m of the construction activity area, material storage area, village/ towns located along the corridor. There will be long term impact on the ambient air quality of the area because of the nature of the project involving regular vehicular movement and increase in traffic volume after widening on expressway. Villages along the state highways and village roads in the Project Aol will be impacted due to increased emissions. Therefore, the receptor sensitivity is assessed as **high**.

Since the construction related activities will last for a limited duration (i.e. 15 18 months) and distributed over the entire stretch, the impact magnitude is assessed to be **small**.

Embedded built in controls

- Preventive measures such regular water sprinkling should be done to mitigate fugitive dust emission during construction phase;
- Emissions from the batching plant, mixing plant stationary machines will be controlled by ensuring that the engines are always properly tuned and maintained.
- Consent for Establishment (CFE) and Consent for Operation (CFO) shall be obtained for construction establishments such as hot mix plants, batching plants and stone crushers from the SPCB.
- Project will ensure compliance with regulatory requirement on adequate stack heights and emission monitoring will be done regularly to comply with permit requirements.

Significance of impact

The impact on air quality will be local and long-term, will happen during all phases namely construction, operation and demolition of impacted structures within ROW. Therefore, the overall impacts are envisaged to be **moderate**.

Additional mitigation measures

- Emissions from the emergency D.G. set and other stationary machines will be controlled by ensuring that the engines are always properly tuned and maintained.
- Idling of vehicles and equipment must be prevented.
- Vehicles/ trucks deployed for borrow material, sand and aggregate haulage shall be covered with tarpaulins to be spillage proof.
- Location of all construction establishments such as hot mix plants, crusher plants, construction camps and offices etc shall be located at least 1 km away from the human habitations and preferably on the downwind direction;
- Low sulphur diesel shall be used in the Diesel Generator sets and DGs to be fitted with stack of required height.
- To ensure the efficacy of the mitigation measures suggested, all operational areas (work sites, haul roads, hot mix plants, quarries, borrow sites and disposal sites) under the road construction works are to be regularly monitored for air quality parameters so that suitable mitigation measures can be taken up if any of the parameters exceed the prescribed limit.

- Traffic diversions shall be planned on existing lanes of the carriageway to the extent possible. In areas, where unpaved surfaces are required for diversion, proper mitigation measures such as dust suppression, tyre wetting, etc. shall be put in place.
- Tyre washing shall be undertaken for all vehicles/ trucks moving out of the construction areas and unpaved areas.
- Cube may raise any issues on dust suppression at Khurja realignment with NHAI and seek implementation of similar measures.
- A comprehensive PM management plan for the construction period shall be developed. This plan would include identification of sources of PM (e.g., earthworks, vehicle raised PM, wind raised PM, haulage and handling), control measures, monitoring mechanisms and integration with grievance mechanism.

Residual impact significance

The residual impact due to the Project on air quality is envisaged to be **minor**.

Impact	Air Quality during construction phase				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		Transboundary	
Impact Scale	Limited to Project area and immediate vicinity				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is assessed to be Moderate				
Residual Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of residual impact is assessed to be Minor				

8.4.1.8 Impact on Ambient Noise

Impacts

Pre construction stage activities such as establishment of labour camps, stockyards will generate a little noise in addition to baseline noise levels. There will be increased noise levels due to diversion of traffic and movement of heavy equipment on unpaved roads for a short duration during the pre-construction stage.

The project road passes through semi-urban areas with rural settings at few stretches, and therefore is required to comply with to CPCB standards set for residential areas (Day time $L_{eq} = 55$ and Night time $L_{eq} = 45$). As per IFC guidelines, noise levels should not exceed 1-hr $L_{eq} 45/55$ dBA night/day for residential/institutional/mixed and 1-hr $L_{eq} 70$ dBA for night/day for commercial/industrial, or maximum increase in noise levels should not exceed 3 dBA over baseline.

The list of project activities that might result in noise impacts is given below:

- Noise from heavy vehicular traffic movement;
- Noise from increased workforce and construction/demolition;
- Noise from cranes, drillers, bulldozers, excavators, etc.; and

■ Noise from D.G. sets.

Construction work is expected to last for approximately 15-18 months and construction activities will be restricted to daytime. Noise generation from select construction equipment and machinery utilized in the construction of the project are presented in **Table 8.19**. Specific information about types, quantities, and operating schedules of the construction equipment is not currently available and therefore, assumptions have made regarding the type, number and Sound Power Levels (SPLs) of construction equipment, based on similar projects and publicly available data. It has been assumed that only one of each type of equipment will be on-site during any day or night period.

Table 8.19 Assumed construction equipment sound pressure level inventory

Construction Equipment	Average Noise Level at 50 feet (dB A)
Bulldozer	82
Backhoe	78
Loaders	79
Vibratory roller	102
Fuel truck	85
Cranes	81
Dump truck	76
Grader	85
Compressors	78
Generators	85
Rock drill	81
Grader	85
Concrete mixer truck	79
Concrete pump truck	81
Scraper	85

Source: The SPLs of the construction equipment have been taken from FHWA noise specification 721.560¹ and ERM's internal database

Settlements located within 500 m of the expressway will most likely be affected by increasing noise levels because of proximity to the project site. The receptor sensitivity is therefore considered as **medium**.

Impact magnitude is considered to be **small** considering the construction period of the project to last for approximately 15 - 18 months.

Embedded built in controls

Normal working hours of the contractor to be defined (preferable 8 am to 6pm). If work needs to be undertaken outside these hours, it should be limited to activities which do not generate noise. In case utility shifting is carried out during night time, adequate information shall be shared with community in advance. All high noise activities such as excavation, drilling, etc. shall be restricted to day time.

¹ Construction Noise Handbook. FHWA-HEP-06-15; DOTVNTSC-FHWA-06-02; NTIS No. PB2006-109102. Final Report August 2006 (updated5/20/2010). <http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook

Significance of impact

The overall impact significance is assessed to be **minor**.

Additional mitigation measures

- Only well-maintained equipment should be operated on-site;
- Equipping construction equipment engines with adequate mufflers, silencers, and engine enclosures would reduce their noise by 5 to 10 dB (A).
- If it is noticed that any particular equipment is generating too much noise then lubricating moving parts, tightening loose parts and replacing worn out components should be carried out to bring down the noise and placing such machinery far away from the households as possible;
- Limit the number of heavy vehicles required for the Project to only those that are necessary
- Machinery and construction equipment that may be in intermittent use should be shut down or throttled down during non-work periods; and
- Minimal use of vehicle horns and heavy engine breaking in the area needs to be encouraged.
- Cube may raise any issues on noise management at Khurja realignment with NHAI and seek implementation of similar measures.
- A detailed Noise Management Plan shall be developed that sets out standards and procedures for managing noise during construction including check for maximum sound level of equipment, identification of sensitive noise receptors (e.g., schools) and control measures to address excessive noise, use of enclosures and shielding to control noise, interface with grievance mechanism, etc.

Residual impact significance

After implementation of mitigation measures, the significance of residual impacts will be **minor**.

Impact	Noise generation during construction phase			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	Transboundary	
Impact Scale	Limited to Project footprint area and surrounding communities			
Impact Magnitude	Positive	Negligible	Small	Medium
Resource /Receptor Sensitivity	Low	Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impact is assessed to be moderate			
Residual Magnitude	Positive	Negligible	Small	Medium
Residual Impact Significance	Negligible	Minor	Moderate	Major
	Significance of residual impact is assessed to be minor			

8.4.2 Operation Phase

8.4.2.1 Impact on Soil environment due to improper waste disposal

The operational phase of the project will have limited impacts on soil in the form of waste generation and soil contamination due to accidental spillages/ leakages.

Impact Magnitude

During operation phase, the waste generated from Project road will include littering of domestic solid waste, vegetation removed from median and ROW maintenance, dust and waste generated from ROW maintenance and chemicals or hazardous wastes from accidental spillage or overturning of vehicles/trucks carrying such material. Since, the quantity of waste generated will be much lesser than the quantity generated during the construction stage and will be taken care of by maintenance, the receptor sensitivity is assessed as **low** and impact magnitude is **small**.

Embedded built in controls

The solid waste generated will have to be swept, collected and disposed regularly through approved vendors in accordance with Solid Waste Management Rules, 2016, as amended. The hazardous wastes during operation phase will comprise of grease, lubricants emulsions and oil fromom DG sets. All hazardous waste generated will be stored onsite at separate designated covered area provided with impervious flooring and will be sent for disposal to nearest CHWTSDF¹/sell off to authorised vendor. For accidental spillages, spill control kits shall be used to contain and clean up and guidelines and procedures shall be prepared and followed for immediate clean-up actions following any spillages.

Further details with respect to emergency response in case of major accidents, vehicles overturns etc. resulting in spillages, clean up mechanisms and other roles/ responsibilities have been presented in the **Appendix J – Emergency Response Plan**.

Significance of impact

Based on the above, after incorporating the embedded control the impact significance is envisaged to be **negligible**.

Additional mitigation measures

As the embedded controls are sufficient to address the impact no mitigation measures are deemed necessary.

Impact	On land due to improper waste disposal				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local		Regional		Transboundary
Impact Scale	Limited to Project road and ROW				
Frequency	O&M phase				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is assessed to be negligible				

¹ Common Hazardous Waste Treatment, Storage and Disposal Facility

8.4.2.2 Impact on Water Availability

Impact Magnitude

It is envisaged that about 4-5 KLD of water will be required to meet the drinking water requirements of the Toll Plaza while another 3-4 KLD will be required for other domestic use. Furthermore, 0.1 KLD of water is envisaged to be required to meet domestic water requirements. The water for drinking and domestic purposes is expected to be sourced via tankers from nearby villages or existing borewells in the Project area, while bottled water may be used for drinking purpose.

Operation of Toll Plaza is a continuous activity having daily consumption of water, however the requirement will be **small** and will be met through existing sources. The resource sensitivity is assessed as **medium**.

The overall impact magnitude is assessed as **minor**.

Embedded built in controls

Authorised water tankers will be utilised to fulfil supply requirements for all purposes, including site office.

Significance of impact

The overall significance of impacts on water availability due to operational activities is envisaged to be **moderate** because the Project operational phase will last for at least 25 years.

Additional mitigation measures

Optimising water usage for road operations and toll plaza by application of water conservation measures such as low pressure taps, low flush urinals etc.

Recycling/reusing to the extent possible; and

Regular inspection for identification of water leakages and preventing wastage of water from water supply tankers is necessary for efficient utilisation of water.

Residual impact significance

Upon application of additional mitigation measures, the significance of the residual impact is envisaged to be **negligible**.

Impact	Water availability during operational phase				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local		Regional		Transboundary
Impact Scale	Limited to Administrative building and Toll plaza areas				
Frequency	O&M Phase				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor	Moderate	Major	
Residual Magnitude	Impact significance is assessed to be minor				
	Positive	Negligible	Small	Medium	Large
	Negligible		Minor	Moderate	Major

**Residual Impact
 Significance**

Residual impact significance is assessed to be **negligible**

8.4.2.3 Impact on water quality

Impact Magnitude

During operation phase, domestic wastewater generation is expected from toilets and washrooms. The sewage generated from Administrative building at Toll Plazas is envisaged to be disposed via septic tanks. The storm water collected on Project road will be drained through existing storm water drains and water drainage channels provided along the project road.

Embedded built in controls

The drainage and sewerage system will be provided for the collection and treatment of wastewater along the road alignment and at the Toll plaza areas;

Wastewater discharge on open land will not be practiced.

Significance of impact

The project road traverses several water canals and there are more than 40 small surface water bodies that are present in Project Aol. The receptor/resource sensitivity is assessed as **medium**. The overall significance of impacts on water quality due to operational activities is envisaged to be **minor**.

Additional mitigation measures

During operation stage, regular cleaning of choked / blocked or damaged drainage provision are necessary to avoid operational impact.

Monitoring of water quality to comply with Water (Prevention and Control of Pollution) Act will have better control over the quality maintenance.

Residual impact significance

The significance of the residual impacts is envisaged to be **negligible**.

Impact	Water quality during operational phase				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		Transboundary	
Impact Scale	Limited to Administrative building and Toll plaza areas, and water bodies in the Aol				
Frequency	O&M phase				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor	Moderate	Major	
	Impact significance is assessed to be minor				
Residual Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible		Minor	Moderate	Major

8.4.2.4 Impact on air quality

Impacts

- Air quality will largely get impacted from the following sources during the operation phase:
- Fugitive emissions from road clearing and maintenance etc.;
- Vehicular emissions due to traffic movement on project roads
- Exhaust emission from operation of DG sets used at backup at Toll Plaza;; and
- Emissions from power diesel generator required during O&M activity

Vehicular pollution experienced by receptors along any stretch of the road is a factor of traffic volume and passing time taken for passing that stretch. Congested stretch of road will have more stoppages leading to additional consumption of fuel which will be directly proportional to the emission, while broader roads will have shorter passing time hence limits the sensitivity to the receptor.

The ambient air quality monitored along the existing road includes the emission from the existing traffic volume. All parameters except particulate matter is observed to be well within the limits.

The 6-laning of road will decrease congestion in the busy stretches which will in the short term result in decrease of pollutant concentration as the passing time of vehicles will decrease. It is understood that the six laning is planned to accommodate smooth traffic movement till year 2035, while current projections and trends of e-vehicle suggest that about 15-20% of vehicle will be electric by 2025 and this will increase further by 2035. Therefore, it is estimated that in the long term with the advent of more e-vehicles the emission levels will decrease.

The particulate levels in Delhi-NCR region is usually high throughout the year due to various reasons, one of the key factor is re-suspension of dust in the air due to vehicle movement, which will increase due to increase in traffic volumes.

Road dust is a mixture of particles deposited on the surface of paved roads, and susceptible to be reentrained into the atmosphere due to the vehicle-generated turbulence or wind. For unpaved roads, road dust is the road material itself.

Road dust emissions to air are known to increase considerably concentrations of atmospheric particulate (PM) pollutants in urban and industrial environments, causing exceedances of the air quality standards, and related health effects also due to the high content of heavy metals and organic compounds originated from the wear of brakes/tires and motor exhausts and embedded in the road dust reservoir.

Since the operation phase will last for at least 25 years, the magnitude of impact due to higher particulates is assessed to be **medium**.

Embedded built in controls

- Preventive measures such as plantation in RoW with dust arresting foliage and trees
- Ensuring regular road sweeping, dust collection
- Ensure proper maintenance of road for smooth operation of traffic
- Regular water sprinkling should be done to mitigate fugitive dust emission during summer season;

Significance of impact

The impact on air quality will be local and long-term, therefore, the overall impacts are envisaged to be **moderate**.

Additional mitigation measures

- Extensive measures for road sweeping and dust removal shall be put in place, including engagement of Vacuum Sweepers
- Water sprays can be used with vacuum sweepers to reduce the resuspension of dust.
- Early morning road washing can also be explored due high pollution days

Residual impact significance

The residual impact due to the Project on air quality is envisaged to be **minor to moderate**

Impact	Air Quality during operation phase				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local	Regional		Transboundary	
Impact Scale	Limited to Project road and nearby villages and towns				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor	Moderate		Major
	Significance of impact is assessed to be moderate				
Residual Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate		Major
	Significance of residual impact is assessed to be minor to moderate				

8.4.2.5 Impact due to Noise

Context

During operations, there will be noise from increased vehicular movement on the highway. There could be noise from usage of poorly maintained vehicles and old vehicles, though considered to be negligible. The impact is more significant at the sensitive receptors like residences, schools, colleges and hospitals present along the project road for widening.

ERM conducted a Noise Quality Modelling study for expansion of Ghaziabad – Aligarh Road from existing 4 to 6 lanes from Chainage 23.600 to 129.600 km, leaving the structures along the alignment that are already provided with 6 lanes. For the noise quality study, the Project Road was divided into following four sections based on traffic projections along:

- a) NH-34 from Chainage 23.600 to 27.000 km (Lalkuan Section) with predominant commercial land use on either side;
- b) NH-34 from Chainage 27.000 to 33.600 km (Mankipur Section) with predominant commercial land use on either side;
- c) NH-91 from Chainage 33.600 to 98.400 km (TP-1 Section) with predominant rural mixed land use on either side;
- d) NH-91 from Chainage 98.400 to 129.000 km (TP-2 Section) with predominant rural mixed land use on either side.

Apart from the above sections on existing highway, noise levels were also predicted for operations of the proposed greenfield re-alignment (Khurja bypass).

Sensitive receptors encountered either side of the above mentioned four sections of the Project Road under expansion were identified. All the identified sensitive receptors fall under the Silence Zone (as defined in the Indian Air Quality Standards with respect to Noise, which extends up to 100 m from their location).

Noise measurements were conducted within the area of influence of projected traffic induced noise spread along the Project Road at 15 locations during 30 October to 16 November 2019 using four Envirotech make (SLM 100) instruments. SLM 100 is a microprocessor based, Integrated Sound Level meter designed to meet the requirements of IS: 15575 (Pt 1) 2005. Each instrument was set at (A) weighting scale corresponding to human audible frequency range of 20 to 20,000 hertz with average noise measured at one minute interval for 24 hours both on working and non-working days. Each instrument continuously displays sound pressure levels (SPL), equivalent sound level, max and min SPL integrated over the duration of its operation. For each of the 15 noise measurement locations, baseline in terms of equivalent noise levels Leq day (0600 to 2200 hours) in dB(A) and Leq night (2200 to 0600 hours) in dB(A) were measured 24 hourly during working and non-working days. Leq day and Leq night baseline values were established by logarithmical averages of measured noise values. It was observed that none of the 15 locations complied with the corresponding Indian ambient air standards and IFC noise standards with respect to noise for the related land use as the prevailing receptors are located close by the Project Road and there prevails situation of traffic congestions at number of stretches along the Project Road.

The guidance adopted to assess impact magnitude of change in noise levels included the following:

- a) Change in baseline up to 3 dB(A) will have negligible impact as this change is generally not noticeable by human receptors.
- b) Change in baseline from 3 to 5 dB(A) is considered to have small impact magnitude,
- c) Change in baseline from 5 to 10 dB(A) as medium impact magnitude; and
- d) Change in baseline to more than 10 dB(A) is considered to have significant large impact magnitude.

Increment of baseline noise level to 3 dB(A) or more is considered as a measure to assess impact significance with respect to change in baseline of the year 2020 due to increase of the Projected traffic and related speeds in the years 2025, 2030, 2035 and 2040.

For the noise quality modelling, Cube Highways provided projected traffic and average speeds of the vehicles were used as input for scenarios for years 2020, 2025, 2030, 2035 and 2040 without and with mitigations in place for the above mentioned four sections of the Project Road.

Projected traffic induced noise levels in terms of equivalent noise levels Leq day dB(A) and Leq night dB(A) were ascertained at receivers located 25 m, 30 m, 40m, 50m, 70 m and 80 m from the centreline of the section of the Project Road.

For each of the noise quality monitoring stations (NQ-1 to NQ-15), background noise levels (Leq day and Leq night) for the year 2020 were determined by logarithmically subtracting corresponding projected traffic induced noise levels (for the traffic of year 2020) from the measured noise levels. Resultant noise levels were determined by logarithmical addition of projected traffic induced noise levels and calculated background noise levels for each of the 15 noise measuring locations. Changes in baseline of the year 2020 for the projected years 2025, 2030, 2035 and 2040 were assessed by ascertaining arithmetical difference between the resultant noise levels and the measured noise levels.

Based on noise quality modelling, the following has been assessed:

- i) For the Lalkuan Section, between Chainage 23.000 and 27.000 km covering NQ-01 and NQ-02 monitoring stations, it is inferred that the Project Road expansion will result in negligible change in baseline noise levels for the projected years 2025 onwards as the changes in the baseline resulted in increase of less than 3 dB(A).

- ii) For the Manikpur Section between Chainage 27.000 and 33.600 km covering NQ-03, NQ-04 & NQ-05 monitoring stations, it is inferred that the Project Road expansion will result in negligible change in baseline noise levels of projected years 2025 onwards as the changes in the baseline resulted in increase of less than 3 dB(A).
- iii) For the TP-1 Section between Chainage 34.400 and 98.400 km covering NQ-06 to NQ-10 monitoring stations, it is inferred that the Project Road expansion will result in negligible change in baseline noise levels for the projected years 2025 onwards as the changes in the baseline resulted in increase of less than 3 dB(A).
- iv) For TP-2 Section between Chainage 98.400 to 129.000 km covering NO-11 to NQ-15 monitoring stations, it is inferred that the Project Road expansion will result in negligible change in baseline noise levels of projected years 2025 onwards as the changes in the baseline resulted in increase of less than 3 dB(A).

For Khurja bypass, the nearest receptor observed along the Khurja realignment is at 200 m, the baseline monitoring was conducted at the nearest location NQ22, which depicts the background noise as it was a greenfield location. The traffic volume for the stretch remains similar to the stretch at the beginning of the realignment. The observations at 200m based on the extrapolation of resultant observed at 25m, suggest that the incremental change in noise will be less than 0.3 dB (A).

Details of the noise assessment study undertaken for the Project is provided in **Appendix C**. For the four sections of the Project Road where noise baseline monitoring was undertaken at 15 locations, it is inferred that the Project Road expansion will result in negligible change in baseline noise levels of projected years 2025 onwards as the change in baseline will be less than 3 dB(A).

Impact Magnitude

Since the proposed project is expansion of existing 4 lane Ghaziabad Aligarh Expressway, increase in traffic volume is anticipated but since the Project road is already in operation, the resultant increase in ambient noise levels will not be significant. Therefore, the impact magnitude has been assessed as small. Details of the noise assessment study undertaken for the Project is provided in **Appendix C**.

Significance of impact

Since all major towns falling in the project are bypassed, impact significance of noise during the operational phase of the Project has been assessed as **minor**.

Mitigation measures

The following mitigation measures should be implemented to minimize noise potential during operational phase:

- Planting one or more rows of avenue vegetation along the project road and stationary noise sources reduce noise;
- Traffic management measures such as prohibition on use of horns and speed restrictions at noise sensitive areas like schools, and major hospitals to reduce roadway noise levels. This will be implemented through signages (no horn zones), community awareness sessions etc.;
- Annual monitoring of ambient noise levels (during day and night time) at identified residential receptors for determination of actual impact from traffic;
- Noise barriers shall be considered where there are sensitive receptors within 10-15m from the road, design of such barriers shall take into consideration access and convenience issues of the community;
- Cube should encourage use of e-vehicles as part of their E&S awareness activity. E-vehicles have low noise from operation.

Residual impact significance

After implementation of mitigation measures, residual impacts will be **negligible**.

Impact	Noise during operational phase				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local		Regional		Transboundary
Impact Scale	Within 100 meters of project road				
Frequency	Operation Phase				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is assessed to be minor				
Residual Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible		Minor	Moderate	Major
	Significance of residual impact is assessed to be negligible				

8.5 Ecological Impacts

8.5.1 Construction Phase

Ecological Impacts due to Vegetation Clearance

Context and Analysis

The road stretch is majorly passing across the agricultural lands. Water bodies, plantations (*Eucalyptus* sp. & *Populus* sp.) and Mango orchards are also present within the proximity of the road. Road side plantation is also present throughout the length (excluding human settlements). *Azadirachta indica* A.Juss., *Dalbergia sissoo* DC., *Toona ciliata* M.Roem., *Melia azedarach* L., *Acacia nilotica* (L.) Delile, *Kigelia africana* (Lam.) Benth., *Ficus virens* Aiton, *Pongamia pinnata* (L.) Pierre, *Ficus religiosa* L., *Leucaena leucocephala* (Lam.) de Wit, *Alstonia scholaris* (L.) R. Br., & *Neolamarckia cadamba* (Roxb.) Bosser are the common trees used for the road side plantation. Thus, the vegetation clearance on the one or both side of the road will be required for the proposed expansion project, which may cause habitat loss/modification for faunal species.

Embedded/ In-built Controls

The impacts during the construction activity will be short term and the construction of the Project will be executed in a phased manner. Clearance of vegetation shall be limited to a narrow area.

Receptor Sensitivity

The ecological baseline section reveals that the tree species located at or within the immediate vicinity of the project area are *Azadirachta indica* A.Juss., *Dalbergia sissoo* DC., *Toona ciliata* M.Roem., *Melia azedarach* L., *Acacia nilotica* (L.) Delile, *Kigelia africana* (Lam.) Benth., *Ficus virens* Aiton, *Pongamia pinnata* (L.) Pierre, *Ficus religiosa* L., *Leucaena leucocephala* (Lam.) de Wit, *Alstonia scholaris* (L.) R. Br., & *Neolamarckia cadamba* (Roxb.) Bosser, etc. Construction activities for road expansion could lead to the clearance of tree, shrub and herb species. This vegetation clearance along with the increased noise level (because of the movement and activity of heavy vehicles, etc.)

and anthropogenic activities will lead to habitat disturbance for reptiles such as Oriental Garden Lizard (*Calotes versicolor*) - LC; amphibians such as Indian Flapshell Turtle (*Lissemys punctata*) - VU; birds like Ashy-crowned Sparrow-lark (*Eremopterix griseus*), Asian Koel (*Eudynamys scolopaceus*), Baya Weaver (*Ploceus philippinus*), Common Babbler (*Argya caudata*), Common Hoopoe (*Upupa epops*), Green Bee-eater (*Merops orientalis*), Indian Robin (*Saxicoloides fulicatus*), Indian Silverbill (*Euodice malabarica*), Purple Sunbird (*Nectarinia asiatica*), Red-vented Bulbul (*Pycnonotus cafer*), etc.; and mammals such as Indian Grey Mongoose (*Herpestes edwardsi*), Indian Hare (*Lepus nigricollis*), Bengal Fox (*Vulpes bengalensis*), Nilgai (*Boselaphus tragocamelus*), etc.

Although, the study area has three Endangered species, Black-bellied Tern (*Sterna acuticauda*), Egyptian Vulture (*Neophron percnopterus*), Steppe Eagle (*Aquila nipalensis*); five Vulnerable species, Common Pochard (*Aythya farina*), Greater Spotted Eagle (*Clanga clanga*), Indian Spotted Eagle (*Clanga hastate*), Sarus Crane (*Antigone antigone*), & Indian Flapshell Turtle (*Lissemys punctata*); and twelve Near Threatened species (Table 5.1615 and Table 5.2120), as per IUCN Red List (Online Version 2021-2). One amphibian species, Indian Flapshell Turtle (*Lissemys punctata*); and eighteen bird species (Table 5.1615 and Table 5.2120) are also protected under Schedule I as per the Indian Wildlife Protection Act, 1972. Beside, Indian Flapshell Turtle (*Lissemys punctata*), none of the above mentioned species is going to be significantly impacted by construction activities due to their preferable habitat. The construction activities may cause alteration in the physico-chemical properties of water in the nearby waterbodies and ultimately result into habitat loss for aquatic, amphibious as well as other water loving fauna.

The sensitivity of the site has however been deemed **Medium** for Habitat and **Medium** for Species as the construction activities will not significantly impact the Critically Endangered (CR) or Endangered (EN) species, but are likely to impact some of the Vulnerable (VU), Near Threatened (NT) and Schedule I species through increased noise level, altered air and water quality, movement of heavy vehicles, etc. Magnitude of Impact

Anthropogenic movement will create an increased stress on faunal species. Mammals, birds, reptiles and amphibians in the study area. Mammal species are also susceptible to higher noise levels from anthropogenic movement and construction due to their better auditory perception. Noises can affect mating and breeding behaviour in all species that utilize sound to communicate with one another and find suitable mates.

As the construction activities may affect part of the habitat but does not threaten the long-term viability/ function of the habitat, so overall Impact Magnitude is expected to be **Medium** for Habitat.

Impacts from construction activity may cause a change in the population of the above-mentioned species so magnitude of impact is also expected to be **Medium** for Species.

Magnitude of Impact

The road stretch is passing through the agriculture lands. Clearance of vegetation will be restricted to a narrow area on both the sides of road, which will be minimal and such changes will be permanent. Moreover, there is substantial habitat for these species in the region and any impact due to the project activity is unlikely to cause loss of habitat viability and function in the region, so overall Impact Magnitude is expected to be **Small** for Habitat.

For species also, loss of vegetation not going to cause a significant change in the population of the above-mentioned species so magnitude of impact is also expected to be **Small** for Species.

Significance of Impacts

Significance of Impact on Habitat is expected to be **Minor** as Habitat sensitivity is **Medium** and magnitude of impact is **Small**.

Significance of impact on species is also **Minor** as species sensitivity is **Medium** and magnitude of impact on species is **Small**.

Mitigation Measures

The following mitigation measures will further reduce the impact significance on the habitat and species:

- Vegetation disturbance, clearance and construction activities should be restricted to the required areas;
- The road side towards the water bodies should be avoided to extent possible during the planning and construction;
- Topsoil that is disturbed should be stored separately for later restoration of the habitat;
- Unnecessary disturbance of neighbouring vegetation due to off-road vehicular movement, fuel wood procurement, needless expansion of labour camp (if any) and destruction of floral resources should be prohibited;
- Measures will be implemented to protect aquatic life and control sediment loads of water bodies including use of settling ponds, establishment of maintenance of vegetative buffers, etc.
- Strict prohibition on use of fuel wood and shrubs from nearby areas as kitchen fuel; and
- Simultaneous revegetation using native species on road sides as well as possible outskirts of Project activity area should be practiced.

Residual Impacts

The removal of vegetation can have a direct and indirect impact on the local ecology. Here in this road expansion project the vegetation removal is going to happen in limited area (in the modified habitats). The significance of the residual impacts will remain **Minor** for habitats and species after employing the mitigation measures.

Impact	Clearance of vegetation - Construction Phase				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term		Long-term	Permanent
Impact Extent	Local		Regional		International
Impact Scale	Limited to construction area and immediate surroundings				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity (Habitat)	Low		Medium		High
Resource Sensitivity (Species)	Low		Medium		High
Impact Significance	Negligible		Minor		Moderate
	Significance of impact is considered Minor for habitat and also Minor for species.				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Not significant		Minor		Moderate
	Significance of impact is considered Minor for habitats and species.				

Ecological impacts due to other Construction Activities

Context and Analysis

Construction of storeyard, labour camp (if any), and construction of road increases the anthropogenic movement (men and material transport), noise and chance of sedimentation /contamination of water resources due to excavation and filling activities in the study area. These activities are assessed with respect to disturbance of habitats and species. Excavation for the construction activities will have a direct impact on burrowing fauna and an indirect impact on flora/fauna through the changing of soil properties.

Anthropogenic movement will result in an increased stress on fauna in the area that will have to remain alert for an extended period of time and may prevent proper breeding, nesting, mating, socializing and foraging. Noise from anthropogenic movement (men and material transport) along with the construction activities may further disturb fauna in the nearby areas.

Embedded / In-built Controls

The labour force and the supervisory staff will be provided in-house and external trainings for the situations dealing with wildlife encounters and dos and don'ts while dealing with these situations. Selection of labour camps, mixing plants and equipment laydown areas will be located away from the areas from where the sedimentation/contamination of water resources can happen.

Receptor Sensitivity

The ecological baseline section reveals that the tree species located at or within the immediate vicinity of the project area are *Azadirachta indica* A.Juss., *Dalbergia sissoo* DC., *Toona ciliata* M.Roem., *Melia azedarach* L., *Acacia nilotica* (L.) Delile, *Kigelia africana* (Lam.) Benth., *Ficus virens* Aiton, *Pongamia pinnata* (L.) Pierre, *Ficus religiosa* L., *Leucaena leucocephala* (Lam.) de Wit, *Alstonia scholaris* (L.) R. Br., & *Neolamarckia cadamba* (Roxb.) Bosser, etc. Construction activities for road expansion could lead to the clearance of tree, shrub and herb species. This vegetation clearance along with the increased noise level (because of the movement and activity of heavy vehicles, etc.) and anthropogenic activities will lead to habitat disturbance for reptiles such as Oriental Garden Lizard (*Calotes versicolor*) - LC; amphibians such as Indian Flapshell Turtle (*Lissemys punctata*) - VU; birds like Ashy-crowned Sparrow-lark (*Eremopterix griseus*), Asian Koel (*Eudynamis scolopaceus*), Baya Weaver (*Ploceus philippinus*), Common Babbler (*Argya caudata*), Common Hoopoe (*Upupa epops*), Green Bee-eater (*Merops orientalis*), Indian Robin (*Saxicoloides fulicatus*), Indian Silverbill (*Euodice malabarica*), Purple Sunbird (*Nectarinia asiatica*), Red-vented Bulbul (*Pycnonotus cafer*), etc.; and mammals such as Indian Grey Mongoose (*Herpestes edwardsi*), Indian Hare (*Lepus nigricollis*), Bengal Fox (*Vulpes bengalensis*), Nilgai (*Boselaphus tragocamelus*), etc.

Although, the study area has three Endangered species, Black-bellied Tern (*Sterna acuticauda*), Egyptian Vulture (*Neophron percnopterus*), Steppe Eagle (*Aquila nipalensis*); five Vulnerable species, Common Pochard (*Aythya farina*), Greater Spotted Eagle (*Clanga clanga*), Indian Spotted Eagle (*Clanga hastate*), Sarus Crane (*Antigone antigone*), & Indian Flapshell Turtle (*Lissemys punctata*); and twelve Near Threatened species, Asian Woollyneck (*Ciconia episcopus*), Alexandrine Parakeet (*Palaeornis eupatria*), Black-headed Ibis (*Threskiornis melanocephalus*), Black-necked Stork (*Ephippiorhynchus asiaticus*), Black-tailed Godwit (*Limosa limosa*), Ferruginous Duck (*Aythya nyroca*), Laggar Falcon (*Falco jugger*), Northern Lapwing (*Vanellus vanellus*), Oriental Darter (*Anhinga melanogaster*), Painted Stork (*Mycteria leucocephala*), River Lapwing (*Vanellus duvaucelii*), & River Tern (*Sterna aurantia*), as per IUCN Red List (Online Version 2021-2). Beside, Indian Flapshell Turtle (*Lissemys punctata*), none of the above mentioned species is going to be significantly impacted by construction activities due to their preferable habitat. The construction activities may cause alteration in the physico-chemical properties of water in the nearby waterbodies and ultimately result into habitat loss for aquatic, amphibious as well as water loving fauna.

One amphibian species, Indian Flapshell Turtle (*Lissemys punctata*); and eighteen bird species, Black Eagle (*Ictinaetus malaiensis*), Black Kite (*Milvus migrans*), Black-winged Kite (*Elanus caeruleus*), Bonelli's Eagle (*Aquila fasciata*), Booted Eagle (*Hieraaetus pennatus*), Crested Serpent-Eagle (*Spilornis cheela*), Eurasian Sparrowhawk (*Accipiter nisus*), Eurasian Spoonbill (*Platalea leucorodia*), Greater Spotted Eagle (*Clanga clanga*), Indian Grey Hornbill (*Ocyrceros birostris*), Indian Peafowl (*Pavo cristatus*), Laggar Falcon (*Falco jugger*), Long-legged Buzzard (*Buteo rufinus*), Oriental Honey-buzzard (*Pernis ptilorhynchus*), Shikra (*Accipiter badius*), Steppe Eagle (*Aquila nipalensis*), Western Marsh-Harrier (*Circus aeruginosus*), & White-eyed Buzzard (*Butastur teesa*) are also protected under Schedule I as per the Indian Wildlife Protection Act, 1972.

The sensitivity of the site has however been deemed **Medium** for Habitat and **Medium** for Species as the construction activities will not significantly impact the Critically Endangered (CR) or Endangered (EN) species, but are likely to impact some of the Vulnerable (VU), Near Threatened (NT) and Schedule I species.

Magnitude of Impact

Anthropogenic movement will create an increased stress on faunal species. Mammals, birds, reptiles and amphibians in the study area. Mammal species are also susceptible to higher noise levels from anthropogenic movement and construction due to their better auditory perception. Noises can affect mating and breeding behaviour in all species that utilize sound to communicate with one another and find suitable mates.

As the construction activities may affect part of the habitat but does not threaten the long-term viability/ function of the habitat, so overall Impact Magnitude is expected to be **Medium** for Habitat.

Impacts from construction activity may cause a change in the population of the above-mentioned species so magnitude of impact is also expected to be **Medium** for Species.

Significance of Impacts

Significance of impact on habitat is expected to be **Moderate** as habitat sensitivity is **Medium** and magnitude of impact is **Medium**.

Significance of impact on species is also **Moderate** as species sensitivity is **Medium** and magnitude of impact on species is **Medium**.

Mitigation Measures

The following mitigation measures could potentially reduce the impact significance on the habitat and species:

- Construction and transportation activities should be avoided at night (6:00 pm to 6:00 am) and should particularly avoid high faunal activity areas like locations near forest or water bodies during dawn (6:00 am to 7:30 am) and dusk (5:00 pm to 6:30 pm);
- Areas with pre-existing burrows or ground roosting sites of birds should be avoided when possible;
- Temporary barriers should be installed on excavated areas;
- Hazardous materials should not be stored near water bodies, and drainage channels;
- Efforts should be made to minimize construction noise and the use of noise barriers should be considered (if feasible) for high noise levels;
- Waste materials should be cleared in a timely manner and the use of artificial lights should be minimized to not attract wildlife;
- Good housekeeping should be followed for construction activities, waste packaging material should be properly disposed;
- Proper sanitation facilities should be provided at the labour camps;
- Labour movement should be restricted between construction camps and project sites; and

- General awareness regarding fauna should be enhanced through trainings, posters, etc. among the staff and labourers.

Residual Impacts

The implementation of suggested mitigation measures can reduce the impacts of construction activities but there will still be some impacts due to noise and anthropogenic movement. The residual impacts for species will be **Minor**. As while impacts of construction activity will be reduced there will still continue to be some disturbance to fauna and flora.

Impact	Ecological impacts due to construction activities				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local		Regional		International
Impact Scale	Largely restricted to construction area and immediate surroundings				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity (Habitat)	Low		Medium		High
Resource Sensitivity (Species)	Low		Medium		High
Impact Significance	Not significant	Minor	Moderate	Major	
	Significance of impact is considered Moderate for habitats and species.				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Not significant	Minor	Moderate	Major	
	Significance of impact is considered Minor for habitats and species.				

8.5.2 Operation Phase

Ecological Impacts due increased width of road and vehicular movement

Context and Analysis

During the ecological survey, several species of birds were found to soar crossing the road at several places, specifically near the settlements around the garbage dumping grounds to feed. Similarly, some mammals were also found to cross the road at several places (from agricultural land to agricultural land, agricultural land to settlement, and settlement to settlement). The proposed expansion of road and increased vehicular movement on the road may lead the risk of road hits, road kills and collision of birds (specifically raptors / vulture) with moving vehicles. Carcasses along with roadside may also attract scavenger fauna (birds of prey) and other small mammals, which would also pose threat in terms of road kills and accidents.

Embedded/ In-built Controls

Not provided.

Receptor Sensitivity

Many avifaunal species observed / reported during the ecological survey were soaring / flying across the road. The species included, two Endangered (as per IUCN Red List Online Version 2021-2) - [Egyptian Vulture (*Neophron percnopterus*), & Steppe Eagle (*Aquila nipalensis*)]; three Vulnerable (as per IUCN Red List Online Version 2021-2) - [Greater Spotted Eagle (*Clanga clanga*), Indian Spotted Eagle (*Clanga hastate*), & Sarus Crane (*Antigone antigone*)]; seven Near Threatened (as per IUCN Red List Online Version 2021-2) - [Asian Woollyneck (*Ciconia episcopus*), Alexandrine Parakeet (*Palaeornis eupatria*), Black-headed Ibis (*Threskiornis melanocephalus*), Black-necked Stork (*Ephippiorhynchus asiaticus*), Laggar Falcon (*Falco jugger*), Oriental Darter (*Anhinga melanogaster*), & Painted Stork (*Mycteria leucocephala*)]; as well as eighteen Schedule I species (as per the Indian Wildlife Protection Act, 1972) - [Black Eagle (*Ictinaetus malaiensis*), Black Kite (*Milvus migrans*), Black-winged Kite (*Elanus caeruleus*), Bonelli's Eagle (*Aquila fasciata*), Booted Eagle (*Hieraaetus pennatus*), Crested Serpent-Eagle (*Spilornis cheela*), Eurasian Sparrowhawk (*Accipiter nisus*), Eurasian Spoonbill (*Platalea leucorodia*), Greater Spotted Eagle (*Clanga clanga*), Indian Grey Hornbill (*Ocyrceros birostris*), Indian Peafowl (*Pavo cristatus*), Laggar Falcon (*Falco jugger*), Long-legged Buzzard (*Buteo rufinus*), Oriental Honey-buzzard (*Pernis ptilorhynchus*), Shikra (*Accipiter badius*), Steppe Eagle (*Aquila nipalensis*), Western Marsh-Harrier (*Circus aeruginosus*), & White-eyed Buzzard (*Butastur teesa*)].

Few mammals also observed / reported during the ecological survey were crossing the road. The species included, Bengal Fox (*Vulpes bengalensis*), Indian Grey Mongoose (*Herpestes edwardsii*), Nilgai (*Boselaphus tragocamelus*), & Rhesus Monkey (*Macaca mulatta*).

Due to the likelihood that threatened (as per IUCN Red List Online Version 2021-2) and Schedule I species (protected under the Indian Wildlife Protection Act, 1972); will soar across the road and cross the road, thus the sensitivity has been deemed to have **High** for the species.

Magnitude of Impact

Mortality from road kills and vehicular collision are likely to cause some changes in the population viability of the species. Particularly for Endangered raptor and vulture species that have low population sizes. Due to the good (~126.6 km) length of the road, the magnitude of impact is expected to be **Medium** for Species.

Significance of Impacts

Significance of Impact on species is expected to be **Major** as species sensitivity is **High** and magnitude of impact is **Medium**.

Mitigation Measures

The following mitigation measures will further reduce the impact significance on the species:

- Roadside barricades should be used to reduce the incidence of road hits and road kills;
- Regular clearing of road side garbage dumping grounds to reduce the source of attraction for raptors, vultures and other birds;
- A carcass management plan should also be followed to reduce the collision risk of Vultures and/or Raptors with vehicles; and
- Speed limit sign boards should be installed at appropriate places after consultation with the forest department; and
- O&M team should maintain a road hits / kills and vehicular collision register to record any faunal carcasses. The register should include a date, type of specie (to the extent identifiable), and geographic location. If possible, the register should be backed-up with photo-documentation of any identified carcasses or remains. If the number of carcasses are significant, then Client should

commissioning an ecologist to suggest more stringent mitigation measures at the sensitive Project components.

Residual Impacts

The proper and successful implementation of all the suggested mitigation measures can reduce the significance of impacts to **Moderate**. This significance has been retained as the mitigation measures are likely to reduce mortality to some extent, but complete cessation of mortality cannot be expected.

Impact	Road hits / kills and Vehicular Collision				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local		Regional		International
Impact Scale	Limited to electrical components of transmission lines and transmission poles.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity (Species)	Low		Medium		High
Impact Significance	Negligible		Minor	Moderate	Major
	Significance of impact is Major for species.				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible		Minor	Moderate	Major
	Significance of impact is considered Moderate .				

8.6 Socio Economic Impact Assessment and Mitigation Measures

8.6.1 Context for identification of Social Impacts

The social and socio-economic impacts envisaged to occur within the Project Area of Influence (as described in **Section 5.1.2**) on account of the Project related activities are assessed based on the following understanding:

- The project is being developed (six-laning works) within the existing RoW, with no new land acquisition;
- Even within the RoW, the assessment of encroachments/squatters (assets) to be removed considers the toe line extents on either side of the centre line of the road provided by CH (this is still being finalised), which falls within the RoW and is a narrower corridor of impact. The decision has been taken to not remove all encroachments in the area beyond the toe-line, that is within the RoW, to avoid wider displacement impacts, at this time.
- While there are ongoing court cases connected with the earlier land acquisition undertaken by NHAI (year 2009 to Year 2013), these have been noted under legacy issues in the project description (Section 2). These have been recorded as legacy issues where they are reported but are not included in the scope of work of the RAP-LEP. CH has clarified that the land parcels associated with the pending cases do not lie within the current area required for the six-laning works, covered in this ESIA.

The assessed impacts are described for three Project road stretches within the overall length of road as they present differently in terms of both context and the type of Project activities envisaged in each stretch:

- Initial 10 km (Chainage km 23.600 to Chainage km 33.600): All construction activities being planned will be within the currently available width (within the RoW) ranging between 33.200m and 35.000m, for this stretch with the objective of minimising impact over densely populated commercial and residential structures in this stretch. This stretch also requires significant amount of utility re-routing works prior to road widening, which may have additional impacts on the receptors;
- Rest of the Project Road (Chainage km 33.600 to Chainage km 149.600): 116.6 km in length. This stretch also includes a 7 km stretch near Khurja Power plant area that will not be 6 laned, but will be used as a 4-lane section, until the Khurja Realignment (chainage km 98.400 to chainage km 107.685) of 9.285 km length (described below) is completed. This section of the road 7.1 km between chainage 98.400 to 105.500, after the realignment is active, will be included under the land area for the Super Thermal Power Plant in Khurja. Major construction works will happen along other stretches of this 109km length of road where six-laning will be undertaken which shall include restructuring of major & minor junctions, reconstruction of bus bays/bus stops/bus shed, truck lay byes etc..
- Khurja Re-alignment: this stretch is currently being developed by NHAI under a separate contract and will be handed over to the project road concessionaire/GAEPL after completion of construction works. Land acquisition and compensation disbursement is currently underway for this stretch. Once complete and handed over, it will form part of the NH 34 project road.

8.6.2 Potential Socio-Economic Impacts by Project Phase and Type

The potential social and socioeconomic impacts from the proposed project have been described under three Project Phases:

- Planning Phase or Pre-Construction Phase Impacts

- Construction Phase Impacts
- Operations Phase Impacts

As this is a highway that has been in continuous use in the past it is likely to continue to be in use long after the project period and therefore, a decommissioning phase is not considered for this type of infrastructure.

8.6.2.1 Planning Phase or Pre-Construction Phase Impacts

Project Planning Phase Impacts or Pre-construction phase impacts usually result from Project related land-procurement and change in ownership and/or use. In the case of this project, even as no new land acquisition is being undertaken, there has been encroachment or squatting for economic or residential purposes, within the NH RoW that will need to be removed. This is likely to result in economic displacement to a lesser or greater extent for the affected households (897 households), and also physical (and economic) displacement of 29 households residing in 28 structures, in the initial Project road stretch. Host community impacts where resettlement sites will be identified will be covered in the RAP-LEP.

Even within the assessed number of affected assets (encroachment or squatting) on government land, the impact numbers for both owners and users are described in this section.

Since land for the Khurja Realignment has already been acquired and the process of compensation is being completed⁵⁰, the impacts assessed for this section of the road will be discussed in the construction and operations Phases only. However, the gap in compensation and economic resettlement (there is no physical displacement) will be assessed and included in the Resettlement Action Plan and Livelihoods Enhancement Plan being prepared as a Management Plan, for this Project.

8.6.2.2 Construction Phase Impacts

Construction phase impacts, are likely to result from Project related construction activities all along the road and may be experienced more severely at locations where there is a greater density of population and existing traffic. In addition to negative impacts, there is also the likelihood of a temporary boost in local employment as the project will try and use locally sourced labour in both skilled and unskilled categories.

Impacts are also likely to result from temporary requirement of land for the project, and nearby settlements, along access roads to such camps/areas, etc. Temporary Land Requirement (Labour camps, laydown areas, storage areas, hot-mix plant locations, borrow areas, etc), if not managed well, may result in adverse impacts for the nearby communities, and also on access roads used by project vehicles and workers.

8.6.2.3 Operations Phase Impacts

Operation phase of the project is expected to increase traffic both in terms of volume and speeds (in particular sections), and therefore may create several adverse impacts for local community in the AOI, if not managed well. Increased traffic is likely to increased risks of accident, dust pollution and noise for settlements along the highway. Densely populated settlements along both sides of the road such as village Daryapur, palla sallu, Bhakri Khas etc. will be relatively more exposed to such increased risks. Frequency of pedestrian crossings including children and livestock for such settlements on either side of the road is greater, leading to increased risk in these densely populated settlements.

⁵⁰ Status at the time of writing this report (30 Sept 2021)

Increased traffic volume especially movement of trucks may also have impact on the safety of local women, specifically around the truck parking lots/restaurants used by truckers.

8.6.3 Impact Identification and Mitigation

For the assessment of social impacts, the sensitivity and magnitude criteria outlined in **Table 8.20**, **Table 8.21** and **Table 8.22** respectively have been used.

Table 8.20 Significance criteria for impacts

Receptor Sensitivity	Impact Magnitude			
	Negligible	Small	Medium	Large
Low	Negligible	Negligible	Minor	Moderate
Medium	Negligible	Minor	Moderate	Major
High	Negligible	Moderate	Major	Critical

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

Table 8.21 Impact Magnitude for Local Communities

	Extent / Duration / Scale / Frequency
Large	Change dominates over baseline conditions. Affects the majority of the area or population in the area of influence and/or persists over many years. The impact may be experienced over a regional or national area.
Medium	Clearly evident difference from baseline conditions. Tendency is that impact affects a substantial area or number of people and/or is of medium duration. Frequency may be occasional and impact may potentially be regional in scale.
Small	Perceptible difference from baseline conditions. Tendency is that impact is local, rare and affects a small proportion of receptors and is of a short duration.
Negligible	Change remains within the range commonly experienced within the household or community.

Table 8.22 Receptor Sensitivity for Local Communities

Category	Definition
High	Profound or multiple levels of vulnerability that undermine the ability to adapt to changes brought by the project.
Medium	Some but few areas of vulnerability; but still retaining an ability to at least in part adapt to change brought by the project.
Low	Minimal vulnerability; consequently with a high ability to adapt to changes brought by the project and opportunities associated with it.

8.6.4 Potential impacts from Project Activities on Stakeholder Categories

The impact on structures falling within the project corridor will not only affect the current residential and commercial structure but will also hamper the livelihood and economy of families associated with those structures.

The table below describes the potential impacts that are likely to result from Project activities in various stages of the project, comprising of Planning, Construction and Operation stage on various

socioeconomic and community aspects, including from the land requirements of the project (land use change) to impact over existing structures.

Table 8.23 Summary of Potential impacts from project activities

Impact Categories	Impacts	Impacted Stakeholders	Mitigation measure
Planning Phase Impacts			
<p>Impact of clearing land area required for six laning between Chainage km 23.6 to Chainage Km 130.0 (up to Toe-line within ROW)</p> <p>For an effective impact length of 83.450 km</p>	<ul style="list-style-type: none"> ■ A total of 603 structures were identified that will be either partially or fully located within toe-line (<i>i.e. clear land requirement within the RoW area defined by CH Technical Team</i>) and surveyed along project corridor between chainage km 23.6 to chainage km 130.0 (excluding Khurja realignment area). This includes 290 structures in initial 10 km till chainage km 33.6. ■ Total 897 households connected with/dependant on 603 structures were surveyed which includes 485 HHs in initial 10 km and remaining 412 HHs between chainage km 33.6 to chainage km 130.0; ■ Total 29 HHs identified for physical and economic, displacement. This includes 27 HHs from Lohar Community and 2 HHs from other community; all are within the initial 10 km stretch. ■ Impact on vulnerable groups: Out of all the project affected surveyed households, vulnerable groups such as women headed households, scheduled caste community are understood to be impacted the most during Planning phase of the project, on account of loss of livelihoods linked to the surveyed residential/commercial structures coming under impact area in ROW; 	<ul style="list-style-type: none"> ■ Owners of the surveyed structure-encroachers/squatters on government land; ■ Tenants/users of the affected assets structure; ■ Dependants on surveyed commercial structures such as workers engaged in commercial structure ■ Structure owners who still consider themselves as titleholders for the following reasons; <ul style="list-style-type: none"> – Ownership claim over Patta land/Abaadi land abutting ROW area (encroachers); – Pending litigation over inadequate or no compensation (legacy issue) ■ All surveyed structure owner/users/dependents households are technically classified either as encroachers or squatters as affected structures are located within the toe-line corridor of the ROW, which is government land. 	<ul style="list-style-type: none"> ■ Identification of all encroachers and squatters located in impact area within ROW through a census survey; ■ Measurement of all fixed assets identified in impact area through Asset survey; ■ Provision for compensation for the fixed assets identified and surveyed in impact area (Toe-line) within ROW; ■ Compensation to be determined based on full replacement cost principle as per IFC PS-5; ■ Adequate provision for resettlement of the households that will be physically displaced as per entitlement matrix of the Resettlement Action Plan (RAP), aligned with IFC PS5; ■ Provision for loss of livelihood opportunities for the affected households as per entitlement matrix of RAP-LEP) ■ The RAP-LEP report developed for the project will ensure that the vulnerable communities are duly supported and considered as part of livelihood schemes; ■ Ensure that the grievance management mechanism established is accessible to vulnerable groups;

Impact Categories	Impacts	Impacted Stakeholders	Mitigation measure
Construction Phase Impacts			
<p>Temporary occupation of land for construction phase activities:</p> <ul style="list-style-type: none"> Construction camps area that will also include storage and laydown area, Workers/Labour Camps, Parking areas for heavy vehicles in the same construction camp premise 	<ul style="list-style-type: none"> Project will require to set up construction camps and have identified five tentative locations for this purpose, with one camp at every 25 km. required land area for each construction plants will be taken on lease from private land owners. Labour camps, storage area etc. will also be accommodated in the same premises. Each location is expected to cover about 2 ha and will be operational for the duration of the construction phase 1.5 years COVID 19 related infection risks may persist and may be enhanced for workers, and may need to be especially managed both, within labour camps and in the interactions of workers and the local community 	<ul style="list-style-type: none"> Since these locations will be taken on rent from a willing land owner and there will be some flexibility in terms of location, owners of the land required for temporary occupation are not likely to be adversely affected if all safeguards are followed Users of land, if any, may be temporarily affected Neighbouring local community located near these sites, or along access roads used by project staff and workers to the sites, may face several adverse impacts if these are not well managed/mitigated. 	<ul style="list-style-type: none"> Adequate lease/ rents to the land owners; Restoration of land to its original state, or better, at the time of handing it back to the owners; Ensure access for neighbouring community area Either ensure there are no users of the land at the time of the rental agreement, or, document users and provide adequate Compensation for the loss of livelihoods to the users of the land required for temporary use as this will temporarily economically displace them; Application of all precautions to implement and follow the COVID-19 related safeguards, as relevant and as prescribed by the government, at that time⁵¹; Timely dissemination of project related information with all relevant stakeholders, in order to serve advance notice and reduce the extent of losses/ impacts; Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance.
Community Health and Safety issues	<ul style="list-style-type: none"> The movement of material and machinery from the four construction plants/camps to the construction sites along the project corridor, would pose health and safety risks to the community around as the vehicular movement will increase in the area and may result in collision and accident risks, and create additional vehicular and dust 	<ul style="list-style-type: none"> Local Community; Livestock Owners; Workers engaged during construction phase 	<p>Stakeholder engagement through the project cycle and an effective Grievance Redressal Mechanism to avoid, mitigate and manage conflicts and disagreements.</p> <p>While these are recommended for the construction activities currently underway for</p>

⁵¹ A specific set of measures or a protocol will need to be developed, based on the situation and medical advice that is current at that time, since this is a rapidly changing and developing subject

Impact Categories	Impacts	Impacted Stakeholders	Mitigation measure
	<p>pollution, affecting people, animals and potentially affecting crops in the vicinity of the corridor of movement;</p> <ul style="list-style-type: none"> ■ Labour influx in the area due to construction phase may lead to community health and safety related impacts or risks which may include <ul style="list-style-type: none"> - Potential spread of communicable diseases (infectious and vector-borne), if external labour will be sourced from outside the area, - The issue of COVID-19 related infections may remain a relevant concern and may need to be especially managed both, within labour camps and in the interactions of workers and the local community ■ Conflicts with local community resulting from disagreements over other issues and local impacts 		<p>the Khurja Realignment as well, it is understood that NHAI is overseeing that component, being delivered through a separate contract and Cube Highways has no official role there. However, it is suggested that NHAI be requested to consider applying these measures at the Khurja Realignment site as well.</p> <p>As part of the stakeholder engagement and information disclosure process,</p> <ul style="list-style-type: none"> ■ The community will be provided with an understanding of the activities to be undertaken and the precautions taken for safety; ■ The project will also propagate health and safety awareness amongst the community; ■ Special measures will be followed for managing COVID 19 risks and response, with adequate awareness and information dissemination ■ The traffic movement for the project in the area will be regulated to ensure road and pedestrian (including livestock) safety; ■ EPC contractor shall maintain safe distance of the proposed construction camps from schools, hospitals, etc. in order to avoid interactions with community hotspots and hence risks of accidents; ■ The Contractor shall be informed of the EHSS practices that are expected from its workers during the construction phase engagement. Obligations like preparation of Traffic Management Plan, Local

Impact Categories	Impacts	Impacted Stakeholders	Mitigation measure
			<p>Procurement Plan, EHSS Plan, etc. shall be communicated to them at the time of selection and appropriate clauses should be included at the time of contract finalization;</p> <ul style="list-style-type: none"> ■ The contractor shall be required to adhere to IFC's accommodation guidelines, for the labour camps in terms of provisions, sanitation facilities, etc. thus limiting the probability of diseases and infections in the local community on account of improper management of waste; ■ The movement of workers from the project site and labour camps should be regulated and similarly the project boundary and labour accommodation to check for unauthorized visitors/ outsiders entering the site in order to avoid any possible tensions between the migrant workforce and host community; ■ Concessionaire shall put in place a grievance redressal mechanism to allow for the workers and community members to report any concern or grievance related to project activities.
<p>Impacts from shifting of utilities and drainage in the initial stretch</p>	<ul style="list-style-type: none"> ■ Disruption in electricity supply and telecommunication may be expected due to shifting/re-routing of utilities in the impact area; ■ Existing drainage may be disrupted with widening related construction works till the time it is repaired/reconstructed as part of six laning works; 	<ul style="list-style-type: none"> ■ residential and/or commercial structures user along the road will be immediate affected entities due to adverse impact on drainage; 	<ul style="list-style-type: none"> ■ Alternate utilities (like electric poles, transformer, communication line etc.) will be installed and will be made functional prior to clearing the existing utilities in impact area, thus minimising the duration of adverse impact on users;

Impact Categories	Impacts	Impacted Stakeholders	Mitigation measure
		<ul style="list-style-type: none"> ■ Population in AOI to be affected by utilities re-routing work, if not well coordinated and managed. 	<ul style="list-style-type: none"> ■ Coordination between utilities re-routing teams will be ensured to minimise the duration of disruption and avoid multiple rounds of disruptions
<p>Employment and entrepreneurship opportunities during construction phase</p>	<ul style="list-style-type: none"> ■ The construction phase will provide a boost to the local employment as a higher number is expected to be engaged as construction labour during construction phase; ■ Approximately 2000 unskilled and 100 -150 skilled workers are expected to be involved daily, during peak construction phase of the project and major chunk of these workers will be engaged at the four construction camps across the project corridor; ■ Development of smaller vendors in the area through petty contractors, small shops near construction camps etc. providing essential goods and services during the construction phase; ■ There will be an impact on the local food market due to increased demand for agricultural products and food items, specially around the construction camps. 	<ul style="list-style-type: none"> ■ Members of local community that can be engaged as labours for the construction phase; ■ Local vendors for petty contract opportunities like hiring of vehicles, tractors etc. 	<p>Enhancement measures</p> <ul style="list-style-type: none"> ■ The sourcing of local labour wherever possible should be made obligatory through setting of targets to the sub-contractors engaged at various construction sites across the project corridor, subject to availability of local manpower; ■ Preference should be given to affected households and vulnerable population in the Project Villages, to the extent practicable, and based on agreed targets; ■ Employment of members of SC community and Women Headed households should be encouraged by Concessionaire through documented agreement with contractors/ sub-contractors and may be set at a minimum of 20 percent of total workers or person-days of employment; ■ Engagement of local vendors, to the extent possible, for the goods and services required for the project during construction phase; ■ The project proponent will establish a mechanism to audit subcontractors and suppliers with respect to compliance of utilizing local labour and resources;

Impact Categories	Impacts	Impacted Stakeholders	Mitigation measure
			<ul style="list-style-type: none"> ■ Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance with respect to information sharing related to jobs and access to jobs.
Operation Phase Impacts -Applicable for the whole Project Road including Khurja Realignment which will have become part of NH34 in this Phase, after handover.			
Community health and safety	<p>Operation phase of the project is expected to increase traffic both in terms of volume and speeds, and therefore may create several adverse impact on local community in AOI.</p> <p>Increased traffic is likely to increased risks of accident, dust pollution and noise for settlement along the highway.</p> <p>Increased traffic volume especially movement of truckers is also likely to have impact over safety of local women, specifically around the parking lots/restaurants used by truckers.</p>	<ul style="list-style-type: none"> ■ Local residents specifically in densely affected settlements along highway in AOI ■ Pedestrians nearby public institutions like schools, hospitals along the highway; ■ Livestock crossing road 	<ul style="list-style-type: none"> ■ Some traffic engineering measures will be implemented by project to ensure safer use of the highway, improving the current conditions. ■ The traffic – animal conflicts during the operation stage shall be resolved by implementing speed calming mitigation measures such as road humps, rumble strips, speed limits, sign boards etc. ■ In coordination with communities, signs, signals, markings, speed limits, warnings of sharp turns, including signs to alert drivers of road sections that are known for animal crossing should be maintained. Awareness shall be created among the communities on emergency preparedness in addressing emergency situations like vehicular accidents, pedestrian accident, etc. ■ it is suggested to provide mitigation measures for the identified sensitive receptors to minimise noise impact; ■ To further minimize horizontal spread of traffic-induced noise, it is suggested the divider of all sections of the Project Road be provided with ~1 m thick hedge bushes of 1.5 m height as the natural noise

Impact Categories	Impacts	Impacted Stakeholders	Mitigation measure
			barriers. Also in the right of way, where land is available in sections of the Project Road, avenue plantations be carried out to provide natural noise barriers.

8.6.5 Planning Phase Impacts

8.6.5.1 Impact of clearing land area required for six laning between Chainage km 23.600 to Chainage km 129.600

Context and Receptors

As discussed under project description section (chapter-2) of this report, the project works do not require any fresh land acquisition. All construction activities pertaining to six laning are planned to be undertaken within the existing ROW. Khurja realignment area which is currently being developed as a six lane highway by NHAI is in the final stages of compensation transfer and the road will be handed over to O&M Concessionaire (i.e. GAEPL) after completion of six laning works.

Land acquisition as per NH Act 1956 for existing ROW for 4/6 laning between chainage 23.300 to 129.600 were largely completed in 2013. Though there have been several cases filed by land owners that are mostly related to inadequate valuation compensation for acquired land and assets, title dispute, claim over Abadi/patta land etc. Details on land acquisition process, status, land dispute and legal cases etc are provided in Section 2.5 of this report.

To minimise displacement impact, CH has adopted the approach of clearing the land area which is absolutely critical and required for six laning, its supporting facilities and for necessary construction activities within the ROW. Based on this approach, CH Technical team provided the assessment corridor for Chainage km 33.6 to Chainage km 130 indicating that impact area will be considered only up to toe-line which also formed the basis for conducting Asset & Socio-Economic survey. Similarly, CH technical team provided updated drawing for Chainage km 23.6 to Chainage km 33.6 (initial 10 km stretch) for carrying out asset and socio-economic survey. Total coverage of affected structures and surveyed households as per the Asset and Socio-Economic survey is summarised below. All affected structures/assets have been included in the asset survey. However, at some locations, the household survey could not be done as either there was no one available during the survey duration, or the occupants refused to participate in the survey (one asset). Of the 603 assets, six (6) were unoccupied or abandoned, implying that there were no households associated with these structures.

Table 8.24 District wise summary of affected structures and dependant households

District	Affected Assets surveyed (number)	Dependant surveyed households Number
Ghaziabad	40	67
Gautambudh Nagar	274	443
Bulandshahr	162	223
Aligarh	127	164
Total	603	897

Source: Asset and Socio-Economic Survey by ERM (14th June to 9th Sept 2021)

As indicated above, total 603 structures were identified and surveyed within impact area in project road ROW.

Key findings of the survey were;

- A total of 603 assets are being impacted, out of which, 389 are commercial structures, 98 are ancillary residential structures⁵² and 1 residential structure, 87 are mixed use structures (this includes structures which have commercial entities such as shops, tea stalls etc. being attached to the residents). Another 25 are institutional assets (including school buildings, factories, temples, small shrines etc.) and 3 other structures (standalone fodder stores, and 1 toilet not attached to any commercial/residential asset).
- Out of these 603 assets surveyed and being impacted, 34.66 % (or 209) are being fully impacted, 28.02 % (or 169) are being partially impacted, 33.33 % (or 201) have minor impacts and 4 % (or 24) have negligible impacts.
- Out of 209 fully impacted structures, 80 % (or 169) are commercial structures, 12.96 % (27) are mixed (residential and commercial structures), 6 % (11) are institutional and religious structure and 0.48 % are residential structure, another 0.48% are others. No ancillary residential structure is being fully impacted
- Key receptors because of clearing land in toe-line area will be owners/users of the structures and other dependent households such as workers employed in affected shops;
- Affected structures also includes cases where compensation for assets located in the ROW for six laning as per NHA 1956 is still pending owing to several litigations and other legal matters in court. Cases for due compensation for the assets located on Patta/Abadi land, are the prominent one and these are clustered in three villages (i.e. Palla Sallu, Bhakri Khas and Vidha Nagar/Rustampur) in Aligarh District;
- Out of all the project affected surveyed households, vulnerable groups such as women headed households, scheduled caste community are understood to be impacted the most during Planning phase of the project, on account of loss of livelihoods opportunities linked to the surveyed structures coming under impact area in ROW;

Physical Displacement

Total 28 residential and residential-cum-commercial structures were identified as fully affected structures located within impact area along the project corridor. Total 29 households were found residing in these fully affected structures with no alternate house available for them and therefore these households are considered as the case of physical displacement.

Table 8.25 Details of Physical Displacement

Location	Number of structures	Number of households	Remarks
Ch km 23.580 to 23.747	11	12	Lohar community
Ch km 25.988 to 26.060	5	5	Lohar community
Ch km 26.890 to 26.955	11	10	Lohar community
Ch km 33.468	1	2	OBC community
Total	28	29	

⁵² These are being identified as ancillary residential structures as these assets have impact only on the courtyard, standalone kitchens which is set up in the courtyard and not attached to the main building, cattle sheds, stand alone front rooms, boundary wall, staircases, extended area of the courtyard. All these are being impacted either partially, or have minor or negligible impacts and will not lead to physical displacement.

Source: Census survey by ERM Sep 2021

All these 28 structures are located in initial 10 km stretch of the project road. Out of these 27 structures are owned by Lohar community and these community members reported living here for 5 to 15 years. Remaining 1 structure is owned by residents of Dhummanikpur village which is already acquired earlier and partially dismantled as well by land acquisition for six laning. Pictures of few Lohar community structures and remaining one structures is provided below.

Few structures of Lohar Community



Structure in Dhummanikpur village



Khurja Realignment Area

For Khurja realignment section, only socio-economic survey was conducted based on list of titleholders published in gazette as per section 3D of NHA 1956. Total **708** HHs were identified and surveyed as dependant households for the land and assets being acquired for Khurja realignment area. These surveyed households are located across nine villages.

Asset survey for Khurja realignment area were not conducted as land acquisition process as per NHA 1956 is currently underway and It was reported that assets within the ROW are being compensated by Competent Authority for Land Acquisition (CALA) as per compensation determination criteria under the First Schedule of the Right to Fair Compensation Transparency and Resettlement & Rehabilitation (RFCTLARR) Act, 2013. No Physical Displacement is envisaged in this sections as the acquired land did not contain any residences.

Embedded/In built control

- Compensation due for assets located on Patta/Government land are likely to be settled based on provision of ex-gratia amount for private structures on government land as per NHAI policy Guideline issued in 2017. This number and list will be confirmed by the RAP Implementation consultant before RAP-LEP implementation to avoid double compensating the affected assets;

Impact significance

The impact of removal of the assets within the land area required for six laning will be permanent and affect more than 800 households, physically displacing 29 households along the project corridor in four districts. Therefore, impact significance for this activity is evaluated to be **Moderate, for the overall Project though the concentration of impacts in the initial road stretch make the impact significance Major for that road stretch.**

Additional Mitigation Measures

- Survey of the encroachers, squatters and other dependent households and their structures located in impact area required for six laning through a census survey;
- Provision for compensation at full replacement cost as per IFC PS-5 standards for the immovable assets identified and surveyed in impact area for six laning;
- Provision for resettlement of the households that will be physically displaced as per entitlement matrix of the Resettlement Action Plan (RAP);
- Provision for loss of livelihood opportunities for the surveyed households as per entitlement matrix of Livelihood Enhancement Plan (LEP)
- The RAP-LEP report developed for the project will ensure that the vulnerable communities are duly covered under compensation matrix and livelihood schemes as per IFC PS-5 requirements;
- Ensure that the grievance management mechanism established is accessible to all affected households, specifically to the vulnerable groups;

Residual Impacts

Impact	Impact of clearing land area required for six laning between Chainage km 23.600 to Chainage km 129.600				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Frequency	Project villages across four districts in the state of Uttar Pradesh				
Frequency	Planning Phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Vulnerability of social Receptors	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
Impact Significance	Significance of impact is considered Moderate for the project, including Khurja Realignment but-Major in the Initial stretch.				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor for the full stretch	Moderate	Major	

8.6.6 Construction Phase Impacts

8.6.6.1 Temporary land requirement during construction phase

Context and Receptors

Project will require to set up construction camps and have identified five tentative locations for this purpose, with one camp at every 25 kms. Construction camp sites will include labour camps, storage area for construction materials, parking lot for construction machines and vehicles, hot mix plants etc.

Each camp is estimated to accommodate approximately 100 workers. The exact locations of the campsites are not finalised yet.

Site selection criteria for construction camps will include factors like;

- Site location should be closer or preferably adjacent to NH-91 to minimise risk to surrounding local community;
- Private land area will be preferred that will be taken on lease for the construction phase duration

Key receptors will be surrounding community members and owners/user of the land parcels identified for construction camps.

COVID 19 related infection risks may also persist and may be enhanced for workers, and may need to be especially managed both, within labour camps and in the interactions of workers and the local community

Embedded/In built control

Site selection criteria for construction camps will help in minimising impact over neighbouring community to come extent.

Impact significance

The significance of this impact is evaluated to be **Minor** based on the nature, duration and extent of the activity.

Additional Mitigation Measures

- Adequate lease/ rents to be paid the land owners;
- Restoration of land to its original state, or better, at the time of handing it back to the owners;
- Compensation for the loss of livelihoods to the users of the land required for temporary use as this will temporarily economically displace them;
- Application of all precautions to implement and follow the COVID-19 related safeguards, as relevant and as prescribed by the government, at that time⁵³;
- Timely dissemination of project related information with all relevant stakeholders, in order to serve advance notice and reduce the extent of losses/ impacts;
- Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance.

Residual Impacts

Impact	Temporary land requirement during construction phase				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Frequency	Construction Phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large

⁵³ A specific set of measures or a protocol will need to be developed, based on the situation and medical advice that is current at that time, since this is a rapidly changing and developing subject

Vulnerability of social Receptors	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor . If mitigation measures are not applied at the Khurja Realignment, by NHA, the impacts will not be reduced to Negligible, as indicated below for the Project Road				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	

8.6.6.2 Impact on Occupational Health and Safety

Impacts

Occupational health and safety needs to be monitored for several activities anticipated for the Project. While these are also applicable to Khurja Realignment where construction works are underway, it is understood that Cube Highways does not have a role there yet. However, these may also be recommended to NHA for their consideration:

- Working with batching plant, mixing plant, grinder and other construction equipment;
- Operation of rotating machinery like road roller and other mechanical equipment;
- Working with machines generating noise;
- Unhygienic conditions at site and labour camps including contaminated drinking water for workers.

The Project site also needs to implement proper measures for fire safety, rotating machinery, hot works and any emergencies.

Note: The occupational health and safety concerns mentioned above would be consistent across the Project life cycle and therefore the impacts would be similar in nature

Embedded built in controls

- All construction activities (to the extent possible) should be carried out during daytime hours and vigilance should be maintained for any potential accidents;
- Personal Protective Equipment (PPEs) including safety shoes, helmet, goggles, ear muffs and face masks;
- The nearest hospital, ambulance, fire station and police station should be identified in the implemented emergency management plan.

Significance of impact

The impact significance on occupational health and safety is assessed as **minor**.

Additional mitigation measures

- All workers (regular and contracted) should be provided with training on Health and Safety policies in place with appropriate refresher courses throughout the life cycle of the Project;
- Appropriate safety harnesses and lowering/raising tools should be used for hot works;
- Safe drinking water supply should be provided for the workers;
- An up-to-date first aid box should be provided at all construction sites and a trained person should be appointed to manage it;
- All equipment (rotating/grinding) should be turned off and checked when not in use; and

- A safety or emergency management plan should be in place to account for natural disasters, accidents and any emergency situations. The nearest hospital, ambulance, fire station and police station should be identified in the implemented emergency management plan.

Residual impact significance

Upon implementation of additional mitigation measures, the residual impact significance is envisaged to be **minor** to **negligible**.

Impact	Occupational Health & Safety during construction phase				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local		Regional		Transboundary
Impact Scale	Limited to Project footprint area and surrounding communities				
Frequency	Construction phase				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible		Minor		Major
	Significance of impact is assessed to be minor				
Residual Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible		Minor		Major
	Significance of residual impact is assessed to be negligible to minor				

8.6.6.3 Community Health & Safety Impacts

Context and Receptors

Adjacent community in AOI along project corridor may experience health and safety associated impacts on account of the following factors;

- Movement of material and machinery from the construction camps to the construction sites along the project corridor may lead to accident risks affecting local population and cattle around.
- The traffic diversions on unpaved roads and increased vehicular movement will also increase the dust generation in the surrounding areas affecting local population and standing crops in close vicinity. There will be noise and vibration related impacts from construction vehicle transit resulting in disturbance to residents in the vicinity of construction areas/ sections.
- Other health and safety issues from road project are pedestrian safety, women's safety, traffic safety, and emergency preparedness.
- Labour influx in construction camps may enhance potential risk of communicable diseases (infectious and vector-borne), community conflicts and the safety of women and girls from the proximate settlements, especially if external labour will be sourced from outside the region;
- The issue of COVID-19 related infections may remain a relevant concern and may need to be especially managed both, within labour camps and in the interactions of workers and the local community;

- Conflicts with local community resulting from disagreements over other issues and local impacts.
- Shifting of utilities and tree felling activities will result in disturbance to the local community in immediate vicinity of the Project road. Utility shifting activities will pose safety hazards to the residing communities due to excavation, shifting of power lines, etc. and may result in access restrictions.

Key receptors would be surrounding community in AOI, especially in close vicinity of construction camps and existing users of the Project Road. Cattle roaming around construction area would also be prone to accident risk.

A similar set of impacts is envisaged for the Khurja Realignment where construction activities are currently underway, under the oversight of NHAI, through their construction contractors.

Impact significance

The significance of this impact is evaluated to be **Moderate** based on the nature, duration and extent of the activity.

Additional Mitigation Measures

The following risk mitigation measures are suggested to minimize the potential risks/hazards to community. While these are recommended for the construction activities currently underway for the Khurja Realignment as well, it is understood that NHAI is overseeing that component which is being delivered through a separate contract and Cube Highways has no official role there. However, it is suggested that NHAI be requested to consider applying these measures to the Khurja Realignment as well:

- As part of the stakeholder engagement and information disclosure process, the community will be provided with an understanding of the activities to be undertaken and the precautions taken for safety, including women's safety;
- The project will also propagate health and safety awareness amongst the community;
- Special measures will be followed for managing COVID 19 risks and response, with adequate awareness and information dissemination
- EPC contractor shall maintain safe distance of the proposed construction camps from schools, hospitals, etc. in order to avoid interactions with community hotspots and hence risks of accidents;
- The Contractor shall be informed about EHSS practices that are expected from its workers during the construction phase engagement with special focus on women's safety. Obligations such as preparation of Traffic Management Plan, Local Procurement Plan, EHSS Plan, etc. shall be communicated to them at the time of selection and appropriate clauses should be included at the time of contract finalization;
- EPC Contractor shall at all times carry out construction work on the road in manner creating least interference to the free flow of traffic. Contractor shall provide and maintain, during execution of the work, a passage for traffic either along a part of the existing carriageway under improvement or along a temporary diversion constructed close to the road sections under construction;
- EPC Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, marking, flags, lights and flagmen for the formation and protection of traffic approaching or passing through the section of the road under construction.

- Upon completion of the works for which the temporary traffic arrangements or diversions have been made, the EPC Contractor shall remove all temporary installations and signs and reinstate all affected roads and other structures or installations to the conditions that existed before the work started.
- The contractor will ensure availability of safe corridors and crossings of pedestrian / bicyclists where paving activities are located in inhabited areas, based on needs of the local community. The contractor will also install barriers, traffic calming devices, signs, signals and markings to avoid pedestrian from crossing hazardous sections. Traffic wardens may be used at times of heavier pedestrian traffic (school starting and giving over times) to assist with safe road crossing
- Emergency preparedness shall be discussed with the traversed communities and coordination to be maintained with the contractor, local police, and community in addressing emergency situations like vehicular accidents, pedestrian accident, or release of oil and chemical spills.
- The contractor shall be required to adhere to IFC's accommodation guidelines, for the labour camps in terms of provisions, sanitation facilities, etc. thus limiting the probability of diseases and infections in the local community on account of improper management of waste;
- The movement of workers from the project site and labour camps should be regulated and similarly the project boundary and labour accommodation to check for unauthorized visitors/ outsiders entering the site in order to avoid any possible tensions between the migrant workforce and host community;
- Concessionaire shall put in place a grievance redressal mechanism to allow for the workers and community members to report any concern or grievance related to project activities. Safety violations, gender based violence or other sexual harassment and unsafe incidents.

Residual Impacts

Impact	Community health and safety impact				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Frequency	Surrounding community around construction camps in AOI and current users of the Project Road				
Frequency	Construction Phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Vulnerability of social Receptors	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
Impact Significance	Significance of impact is considered Moderate				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	

8.6.6.4 Impact on account of utilities re-routing and drainage shifting in the initial stretch

Context and receptor

Initial 10 km stretch of the road includes significantly higher number of utilities (electricity poles, transformers, telecommunication lines, drains etc.) being co-located with the pedestrian paths and shop frontages in the impact area. The utilities will need to be shifted prior to the start of widening work. Drainage existing along the impact area (i.e. toel line) may be altered and will be redesigned as six laning construction plan. Thus these proposed activities will impact the local community in AOI, specifically those with shop fronts along the highway, pedestrian movement along the stretch, those using access roads going into residential areas located behind. These impacts are likely to occur as a result of utilities -related works and would be for the duration that the utilities re-routing and reconstruction of drainage works is completed.

Embedded/ In-Built Control

- Alternate utilities (such as electric poles, transformer, communication line etc.) will be installed and will be made functional prior to clearing utilities in the impact area, thus avoiding or minimising disruption period for the users of these utilities.
- CH will also undertake to ensure coordination of schedules of works across utilities such that the period of disruption is minimal.

Significance of Impact

The significance of this impact is evaluated to be **Moderate** based on the nature, duration and extent of the activity.

Additional Mitigation Measures

EPC Contractor will be taking additional coordination and suitable site specific mitigation measures to ensure minimising disruption period because of utilities re-routing. These additional measure will be;

- Avoid crowded time period for re-routing work, for mobilisation of heavy vehicles and machinery to construction locations;
- Avoid closure of shops, regular access to residences. Shops and houses will continue to have regular access during all hours of the day as construction activities requiring access control will be undertaken during the night, with prior intimation to the residents/shopkeepers, and access will be disturbed only for a few hours;
- Traffic re-routing will follow a plan to not block access;
- Advance intimation in surrounding community on potential disruption hours because of utilities shifting; and
- Make people aware of the grievance redressal mechanism to allow for community members to report any concern or grievance related to project activities, safety violations, and unsafe incidents.

Residual Impact Significance

Impact	Impact of utilities re-routing and drainage shifting in initial stretch			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent

Impact Extent	Local	Regional		International	
	local community along highway in AOI				
Frequency	Construction Phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Vulnerability of social Receptors	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Moderate .				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	

Residual impact significance post implementation of recommended mitigation measures is assessed as **Minor**.

8.6.6.5 Impact on Employment and Entrepreneurship Opportunities

Context and Receptors

The social baseline conditions in the AOI suggest that major working population the Project villages are engaged in "Other work" i.e. services, business etc.; the population of cultivators and agricultural labourers are limited only to 24.52% of the entire workers in the core AOI settlements.

The construction phase will provide a boost to the local employment, as temporary and permanent employment opportunities/ jobs are expected to be created in the period, which will lead to hiring people from local and distant areas based on the skill set required. Project will require approximately 2000 unskilled and semiskilled labour per day, and approximately 100 to 150 skilled labour per day for the duration of the construction phase. A higher number of unskilled labourers is required to be engaged for construction activities, which may be sourced locally. Additionally, there would be some skilled labour required that may be available locally now (due to Covid 19 related reverse migration) or would need to be brought in from other states (if not present in local area) that would also lead to spike in economic activity in the area, during construction phase. This would lead to better business opportunities for smaller vendors in the area owning petty shops, petty contractor firms, etc. for providing essential goods and services to the project.

Additionally, there would be increased demand for agricultural products, animal based food products, etc., that may require enhanced production of associated items and opportunities for traders.

In principle, such an assessment would also apply to Khurja though the specifics are not known as the construction is being overseen by NHAI and the construction is being done by a separate contractor.

Impact Significance

Impact	Increase in Employment and Entrepreneurship Opportunities				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to project AoI				

Impact	<i>Increase in Employment and Entrepreneurship Opportunities</i>				
Frequency	Construction Phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered to be Moderate				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	No Residual Impacts envisaged				

The significance of this impact is understood to be **Positive**.

Enhancement Measures

- The sourcing of local labour wherever possible should be encouraged for the EPC contractors and sub-contractors and in all major procurement activities, with tracking;
- Preference should be given to the project affected households and vulnerable population in the Project area, to the extent practicable;
- Employment of members of SC-STs and Women Headed households should be considered on priority by the EPC contractors and their sub-contractors, and tracked;
- Engagement of local vendors, to the extent possible, for the goods and services required for the project during construction phase should be encouraged and tracked;
- The project proponent will establish a mechanism to audit subcontractors and suppliers with respect to utilizing local labour and resources and require tracking across the Construction Phase;
- Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance with respect to information sharing related to jobs and opportunities for vendor-ship.

Cube Highways may consider engaging with NHA to apply the above to the Khurja Realignment as this is being delivered by a separate contractor and the stretch is not handed over to GAEPL yet.

8.6.6.6 Impact on Vulnerable Groups

Context and Receptors

Vulnerability in the society is defined based on the economic status of the households, and the difference in access to social, economic and political power between men and women. Thus vulnerable group for this project will specifically include women headed households, elderly persons (above 60 years of age) and households with limited landholdings and resources are relatively vulnerable to changes in the immediate surroundings, affecting their livelihoods. Individuals with disabilities will also be included as vulnerable, for special consideration for RAP-LEP implementation

As discussed in **Section 5.4.5**, the project villages are characterised by a SC population of 18.7 percent and a very small ST⁵⁴ population of 0.03 percent limited to only five villages which includes Gabhana (CT), Sidhauri, Kamalpur, Dadri (NPP) and Chipiyana Buzurg (CT), mostly urban settlements. SC population inhabiting the area are Jatav, Dhimar, Suryvanshi and Dhoni etc. While there is no overt caste based distinction reported in terms of habitation patterns, practices, etc., the SC and ST households are generally reported to have smaller land holding than the general population. SC population are present in almost all villages in AOI. More details in terms of percentage of vulnerable households out of the total surveyed households in impact area in project corridor will be provided in RAP-LEP report. Prima facie SC households in three villages Palla Sallu, Bhakri Khas and Vidha Nagar/Rustampur are most affected amongst the affected SC population in total surveyed households.

Women headed households, households with all elderly members, and individuals with disabilities are also assessed to be in the vulnerable category and are likely to be disproportionately impacted. Though their overall numbers are small (survey data is currently being compiled) these individuals and groups will need special assistance and consideration in the mitigation measures, especially pertaining to displacement impacts, accessing livelihoods related enhancements (should they so choose) and other support; for stakeholder engagement and accessing the GRM.

Embedded/In Built Control

- In the process of analysing households survey conducted for designing RAP-LEP program, vulnerable groups will also be identified and appropriate livelihood measures and other support will be prepared for them.
- As part of other community development activities for the local villages, the Concessionaire will identify specific programmes for SC/ST groups and vulnerable groups.

Impact Significance

Based on the profile of the stakeholder group, the impact significance is assessed to be **Moderate**.

Additional Mitigation Measures

In addition to the embedded measures, the following additional mitigation measures are identified and may be considered for application at the Khurja Realignment by NHAI, through their contractors :

- As part of the stakeholder engagement, ensure adequate representation of the vulnerable groups, and specific engagement activities are undertaken with these groups;
- Ensure that the grievance management mechanism established is accessible to these groups.

Residual Impact Significance

The significance of impact will be reduced to **minor** after implementation of mitigation measures suggested.

Impact	Indigenous Communities/Vulnerable Groups			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	

⁵⁴ ST community is considered akin to Indigenous population in India generally; however there are a number of ST groups present in India, some of whom have merged with the mainstream population in terms of habitation and occupational patterns, language, etc., while certain groups continue to follow distinguished cultural practices.

Impact	Indigenous Communities/Vulnerable Groups				
Impact Scale	The SC/ST Community and other vulnerable groups may be negatively impacted by the project, in case the economic or developmental opportunities generated by the project are not equally accessible to them in comparison to other social groups.				
Frequency	Planning Construction, operations Phase				
Likelihood	Possible				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/Receptor Sensitivity	Low		Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered to be Moderate				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of Residual Impacts is Minor . This would apply to the Khurja Realignment after implementing mitigation measures proposed.				

8.6.6.7 Impact on Women

Context and Receptors

Census profile of the villages in AOI indicate that socio-economic status of women is lagging behind in comparison to their male counterpart on various indicators. Literacy rate of female population is just 60% as against 81% literacy rate of male population in AOI villages. Further ratio of women working population is quite low. Only 6.54% and 4.64% women were recorded as main worker and marginal worker out of the total working population. Section 5.1.11 provides more detail on assessment of various socio-economic indicators of male and female groups.

Status of impact on women headed households and other women groups amongst surveyed households will be covered in detail in RAP-LEP report. Based on consultations with stakeholders especially with women's groups, it is understood that female group may be relatively more vulnerable in view of lower socioeconomic indicators, little decision-making power in the households especially relating to financial matters of land and assets. Lack of decision making power could make women vulnerable to loss of income (resulting out of capture or misuse of compensation by other members of their household).

Women and girls are disproportionately at risk in terms of safety especially in settlements that are on either side of the road (requiring road-crossing to access facilities) near the parking lots and clusters of small shops and restaurant for truck drivers and other moving traffic in the road. Arrival of migrant workers in project corridor may pose additional safety risk for local population.

Gender based violence though not expressed in much detail during the consultations does pose risks (through induced impacts) given the context of overall factors such as women's exclusion of key decision making in the family, lower educational attainment, rising cases of child marriages and girls dropping out of school, and lower female worker participation rates. Instances of harassment of women when they are crossing the highway, or walking along it were brought up in several discussions.

Embedded/In Built Control

- The migrant workforce engaged during construction phase shall be provided training on the Do's and Don'ts during their stay in the construction camps, which shall include limited engagement with local community, not causing disturbances to the community, etc.

Impact Significance

Based on the above the impact after implementing the embedded controls is assessed to be **Moderate**.

Additional Mitigation Measures

In addition to the embedded measures, the following additional mitigation measures are identified. It is important for Cube Highways to engage with NHAI to ensure that these measures are also implemented by the construction contractor working on the Khurja Realignment to avoid/mitigate impacts on women. While Cube Highways does not have any formal role there yet, it may be useful for their team to engage with the local community to cover the measures stated below:

- A Gender Action Plan is prepared for the Project where women focussed engagement is detailed in and provided as Appendix F of this report.
- As part of the further Community Development Activities for the villages in AOI, the concessionaire will identify specific programmes for women groups, women's safety and measures for supporting Women Headed households.
- Provision of Grievance Redressal Mechanism to all the stakeholders in order to raise and register their grievances, with additional support for women to access the system.

Residual Impact Significance

The significance of impact will be reduced to **Minor** after implementation of mitigation measures suggested in construction phase.

Impact	Women Groups				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	The women in the Project villages are understood to be impacted during Planning, construction and operations phases				
Frequency	Planning Construction, operations Phases				
Likelihood	Possible				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered to be Moderate				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of Residual Impacts is Minor				

8.6.7 Operation Phase Impacts

The operations phase considers the Project Road including the Khurja Realignment section, which would have become part of NH 34 by this phase after hand over to GAEPL/CH. As would be the case with the construction phase impacts, GAEPL/CH will have the authority and responsibility to manage/mitigate impacts along the full road stretch in the Project.

8.6.7.1 Impact on local community health and safety

Context and receptor

Operational stage of the Project is likely to have impact associated with community health and safety issues because of the following factors;

- Operational phase is expected to add more traffic volume that may increase chances of accidents, especially at densely populated clusters along the Highway and settlements that are on both sides of the road in AOI;
- Increased traffic movement is also likely to add accident risk for pedestrians especially for local residents accessing facilities such as schools, hospitals located in the Project AOI;
- Vehicle-animal (livestock) conflict may also increase along the road stretches passing through rural areas;
- Increased incidence of communicable disease from the influx of migrant staff and workers staying near toll plazas as well as increased risk of HIV/AIDS spread over local community may be expected, specifically around the Dhabas (restaurants) used by truckers for their stay along the highway
- Some of the above risks may be disproportionately experienced by women and these have been discussed in greater detail in the GAP, at Appendix F.

The Project Aol will also experience increased noise levels during operation phase. A noise quality assessment was undertaken for the expansion of Ghaziabad – Aligarh Road from existing 4 to 6 lanes from Chainage 23.600 to 129.600 km, leaving the structures along the alignment that are already provided with 6 lanes (**Appendix C**). Noise measurements were conducted within the Aol noise induced traffic along the Project Road at 15 locations during 30 October to 16 November 2019 both on working and non-working days in a week at each of the identified location. In all 15 monitoring locations were selected for noise measurements. Changes in the noise levels have been inferred when predicted Leq day and Leq night values for the years 2025, 2030, 2035 and 2040 were compared with baseline established for the year 2020 at each of the 15 locations.

Noise level assessment was undertaken for four (4) sections of the highway:

- a) NH-34 from **Chainage 23.600 to 27.000 km** referred to as the **Lalkuan Section** with predominant commercial landuse on either side of the alignment.
- b) NH-34 from **Chainage 27.000 to 33.600 km** referred to as the **Mankipur Section** with predominant commercial landuse on either side of the alignment.
- c) NH-91 from **Chainage 33.600 to 98.400 km** referred to as the **TP-1** (Toll Plaza-1 at Chainage 47.500 km) **Section** with predominant rural mixed landuse on either side of the alignment.
- d) NH-91 from **Chainage 98.400 to 129.600 km** referred to as the **TP-2 Section** (Toll Plaza-2 at Chainage 113.300 km) with predominant rural mixed landuse on either side of the alignment.

For the four sections of the Project Road covering NQ-01 to NQ-15 monitoring stations, it is inferred that the Project Road expansion will result in negligible change in baseline noise levels of projected years 2025 onwards as the change in baseline will be less than 3 dB(A).

Embedded/ In-Built Control

- Some traffic engineering measures will be implemented by project to ensure safer use of the highway, improving the current conditions, with the aim of streamlining traffic flow, reducing

accident risk and managing pedestrian traffic more safely, however, specific measures were not available for review at the time of preparing this document.

Significance of Impact

Based on the above the impact after implementing the embedded controls is assessed to be **Moderate**.

Additional Mitigation Measures

In addition to the embedded measures, the following additional mitigation measures are identified:

- The traffic – animal (livestock) conflicts during the operation stage shall be resolved by implementing speed calming mitigation measures in line with applicable IRC codes and NHA1 guidelines.
- In coordination with communities, signs, signals, markings, speed limits, warnings of sharp turns, including signs to alert drivers of road sections that are known for animal crossing should be maintained. Awareness shall be created among the communities on emergency preparedness in addressing emergency situations like vehicular accidents, pedestrian accident, etc.
- To further minimize horizontal spread of traffic induced noise, it is suggested the divider of all sections of the Project Road be provided with ~1 m thick hedge bushes of 1.5 m height as the natural noise barriers. Also in the right of way, where land is available in sections of the Project Road, avenue plantations be carried out to provide natural noise barriers.

Residual Impact Significance

The significance of impact will be reduced to **Minor** after implementation of recommended mitigation measures.

Impact	Operation Phase impact on local community health & Safety				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Scale of impact will be limited to AOI of the project corridor in four districts of Uttar Pradesh.				
Frequency	Operation Phase				
Likelihood	Possible				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered to be Moderate				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of Residual Impacts is Minor				

8.6.8 Cumulative Impacts

8.6.8.1 Construction Phase

- Cumulative dust emissions from road construction, proposed thermal power plant construction and other smaller development activities in local stretches. The particulate levels observed are already exceeding the NAAQS, however the construction of a large thermal power plant at Khurja will coincide with the construction work relating to the road in the particular stretch. The construction impact from Khurja Plant will be contained within 1-2 km radius of the plant, while for other developments which are currently observed to be smaller in scale, the impact will be local. It is to be noted that the National Green Tribunal has put forth stringent norms for construction in NCR region, hence all construction activities (major one like KTPP) will have to put in adequate measures to mitigate dust generation.
- Influx of migrant workers: Multiple construction work sites in a concentrated area will attract labour force from adjoining and far off places, this can put pressure on local resources, water supply, transportation, rented accommodation and crowded local roads/markets etc. This can result in social conflicts, cultural conflicts and petty crimes. Also presence of many immigrant workers can expose local community to transmissible diseases.

It is understood that both the KTPP and road project (Khurja Realignment) will have their own labour camps, while Cube Highways can manage its sub contractors and labour camps directly for the 6 laning, it will need to raise the requirement with NHAI for the Khurja realignment stretch. The labour camp for KTPP is expected to be within the site boundary of the Thermal Power Plant hence interaction with the community would be limited.

- Community Health & Safety: Movement of construction machinery of multiple sub-contractors in a smaller area with limited coordination can lead to unwanted disruption in traffic movement, accidents and conflict with the community. Incidents of break down, damage to local vehicles or injury to cattle livestock etc. that may be passed off as stray incident may become magnified when cumulative complaints are reported. Local disruptions and discomfort to community can lead to protest and violent incidents.

8.6.8.2 Mitigation measure

As mitigating Cumulative impacts are beyond the control of project proponent, the mitigation measure are limited to raising the key issue with relevant stakeholders at available platforms:

- Cube Highways to engage and communicate with NHAI, KTPP authorities and local authorities regarding the mitigation measure being implemented by them and need for similar measure form other stakeholders for control of dust from construction;
- Work towards awareness of community towards need for dust suppression at available platform so that they can seek such arrangements from other stakeholders also
- Hire local workers to the extent possible and manage the labour camp effectively with adequate training on dealing with community, communicate with other stakeholder to implement similar measure and coordinate project schedule to the extent possible to minimize larger periods of construction in same villages.
- Manage the movement of construction machinery with help from local authority, such that all stakeholder have define schedule and durations. Impart training to drivers for movement in local roads and communicate such needs to other stakeholders through appropriate authorities. In case of Khurja alignment Cube can directly monitor the sub contractors through NHAI.

8.6.8.3 Operation Phase

- Unplanned development around the road: Advent of road (specially the realignment) and other developments will attract more commercial development along the road, in semi urban areas it will be largely unplanned leading to decline in standard of living with poor sanitation, congestion in local roads as well as disruption to any planned growth. This may also lead to change in land use from agricultural to commercial /residential affecting a change in livelihood of the local community.
- Ambient Air Quality: The existing particulate levels in the area are high, increase in traffic will enhance dust levels due to resuspension of dust, and this will be further enhance by presence of a thermal power plant. The cumulative impact can be significant if not adequately mitigated.

8.6.8.4 Mitigation measure

As mitigating Cumulative impacts are beyond the control of any single project proponent, the mitigation measures are limited to raising the key issue with relevant regulatory stakeholders at available platforms:

- Village panchayats and urban local bodies may be included in the exercise to periodically monitor unplanned development e.g., resource capture- water sources, land through encroachment, etc., and propose for planned developments in consultation with appropriate authorities. Planned development will limit stress on any existing resources.
- Cube Highways may raise the issue of unplanned development with appropriate authorities to enhance awareness about potential issues to environment and society.
- It is expected that all major projects like KTHP will need to abide by the existing Air Quality standards; however, there are various agencies looking at reducing air pollution in NCR region, any recommendations made by them in near future will be applicable to such projects also.
- Role of Cube Highways may be limited to managing its own emissions as well as raising such issues at appropriate platforms.

9. ENVIRONMENT AND SOCIAL MANAGEMENT PLAN

This *section* presents the Environmental and Social Management Plan (ESMP) for the project road. The purpose of this ESMP is to specify the standards and controls required to manage and monitor environmental and social impacts during different phase of Project life cycle, i.e. pre-construction, construction and operation phases. To achieve this, the ESMP identifies potential adverse impacts from the planned activities and outlines mitigation measures required to reduce the likely negative effects on the physical, natural and social environment. This is in accordance with IFC Performance Standards 1 which emphasizes the importance of managing social and environmental performance through the lifecycle of the Project.

9.1 Project Organizational Structure – Cube Highways

To ensure the efficacy of environmental and social management plan, certain institutional mechanisms with well-defined roles and responsibilities is essential for effective implementation of identified mitigation measures both during construction and operation phases. The project organisational chart is presented in **Section 2.6**.

At corporate level, various teams of Cube Highways will be involved in the project planning and development activities, as well as for provided support during O&M phase of the project. During construction, Project Head, Monitoring team, F&A team, Legal team, Secretarial team, Public Relations Officer (PRO), E&S team and Traffic Safety team will be supporting various project activities. Similarly, during O&M phase, all departments from Cube Highways will be having roles (with representatives from each department) in ensuring smooth operations of the project road.

During construction phase of the Project, the activities will be led by a Project Manager, who will be supported by Deputy Project Managers (2) and an entire set of Project Management Consultant (PMC) team. An EPC contractor will be engaged on turnkey basis for construction phase. The EPC contractor will have employee looking after E&S aspects. During O&M phase, the operations will be led by the SPV Head with E&S team and support teams.

9.1.1 EHS Management

Cube Highways will have the decisive responsibility of implementing the provisions of the ESMP at GAEPL. This role will include the ongoing management of environmental and social impacts, monitoring of contractor performance as well as developing mechanisms for dealing with environmental and social problems.

Cube Highways will also ensure that the activities of its contractors are conducted in accordance with good practice measures, implementation of which will be required through contractual documentation.

Cube Highways will majorly play a role of supervisor to oversee the project performance pertaining to environment, health, safety and social issues. It already has a dedicated EHS department at the corporate level. An outline for responsibilities of the EHS department is given below:

Role of Environment and Social Department (E&S Department)

The E&S department of Cube Highways shall be responsible for monitoring the implementation of the various actions which are to be executed by the agencies specified in the ESMP. During construction phase, the E&S Department of Cube Highways will oversee the E&S issues of the project activities, along with SPV level E&S team, whereas the responsibility lies with the E&S person of the EPC contractor hired for the project activities who will report back to Cube's department. During operation phase, the responsibility will lie with the E&S department of Cube Highways. In general, the EHS department shall perform the following activities:

- Preparation of required documents on environmental and social management;

- Ensuring availability of resources and appropriate institutional arrangements for implementation of ESMP;
- Implementation of the health and safety measures;
- Collection of the statistics of health of workers;
- Providing support during routine medical check-ups of workers;
- Awareness and implementing safety programmes;
- Providing job specific induction training;
- Compliance of regulatory requirements;
- Carrying out environmental audits;
- Identify unsafe acts and conditions and suggest remedies;
- Develop safety culture and comply with company's EHS policy and standard requirements;
- Encourage and enforce the use of PPE's;
- Educate all employees for the use of PPE's and safe practices;
- Direct, coordinate and orient the safety activities;
- Promulgate the spread of policy, objectives, rules and/or regulations;
- Perform a thorough investigation of all accidents and review the recommendations to avoid any repetition;
- Monitoring the progress of implementation of ESMP; and
- Reviewing and updating the ESMP as and when required for its effective implementation.

9.2 Inspection, Monitoring and Audit

Inspection and monitoring of the environmental impacts of the Project activities will increase the effectiveness of ESMP. Through the process of inspection and auditing, Cube Highways will ensure that the conditions stipulated in various permits are complied. Regular site inspections will be done by EPC contractor (during construction phase) while monitoring and audits will be conducted by trained team of Cube Highways E&S department subject to be reviewed and conducted by external agencies/experts. The entire process of inspections and audits should be documented. The inspection and audit findings are to be implemented by the site in-charge in their respective areas.

9.3 Reporting and Documentation

Cube Highways will develop and implement a programme of regular reporting through the stages of the project lifecycle. The personnel who are delegated EHS roles shall be required to fully comply with the monitoring programme in terms of timely submissions of reports as per acceptable level of detail. Reporting will be done in form of environmental check list, incident record register, training records, and environmental and social performance reports (weekly, monthly, quarterly, half yearly, yearly etc.). Also, Cube Highways will develop site specific ESMS for the Project and thereafter conduct annual ESMS audits through third party for ensuring implementation.

9.3.1 External Reporting and Communication

Cube Highways's Construction Project Manager, in coordination with E&S team, is responsible for ensuring that communication with regulatory agencies and stakeholders are maintained as per the requirement. All complaints and enquiries are to be appropriately dealt with and records should be maintained in a Complaint/Enquiry Register by the delegated staff of E&S.

Cube Highways will also need to establish a Community Disclosure and Grievance Redressal system that will be part of Stakeholder Engagement Plan and will be applicable to the construction and O&M phases. The primary objective of the Grievance Redressal system shall be to provide an accessible mechanism to the stakeholders of the project and resolve any social and environmental related grievances. For this purpose, a Grievance Redressal Cell (GRC) shall be established, to resolve non-judicial disputes arising out of various matters related to the implementation of the ESMP, as well as other aspects of the project, as deemed fit to be raised before the GRC.

The Grievance Redressal Mechanism that needs to be implemented has been presented as **Appendix E**.

9.3.2 Internal Reporting and Communication

Internally, the personnel delegated EHS roles will share inspection and audit findings with their suggested measures regularly to the senior management for their consideration. The same are also to be communicated within the staff working on the project. To maintain an open communication between the staff and management on EHS and social issues the followings will be used:

- Team Briefings,
- On-site work group meetings;
- Work Specific Instructions.

9.3.3 Documentation

Documentation is an important step in the implementation of the ESMP, Cube Highways will establish a documentation and record keeping system in keeping with their ESMS, to ensure recording and updating of documents as discussed in the ESMP. Responsibilities have to 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:

- Master Environment Management System document;
- 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.

9.3.4 ESMP Review and Amendments

The ESMP acts as an environment and social management tool which needs to be periodically reviewed to address changes in the organization, process or regulatory requirements.

Following a review, Project in charge in coordination with EHS delegated personnel will be responsible for making the amendments in the ESMP and seeking approval from the Regional and Corporate heads. The amended ESMP will be communicated to all the staff on the project.

9.4 Training Programme and Capacity Building

Training is needed for effective implementation of ESMP. The training programme will ensure that all concerned members of the team understand the following aspects:

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

E&S head of Cube Highways will ensure that Environmental health and safety induction training and job specific trainings are identified and given to the concerned personnel for construction activities and operation of the proposed road project.

Also 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. This will help in minimising adverse environmental impacts, compliance with the applicable regulations and standards, and achieving performance beyond compliance. The same level of awareness and commitment will be imparted to the contractors and sub-contractors prior to the commencement of the project.

9.5 Environmental and Social Management Plan

This section outlines the potential adverse impacts, mitigation measures, monitoring and management responsibilities during construction and operation phases of the Project.

The purpose of ESMP is to:

- Provide an institutional mechanism with well-defined roles and responsibilities for ensuring that measures identified in ESIA designated to mitigation potentially adverse impacts are implemented;
- List all suggested mitigation measures and control technologies, safeguards identified through the ESIA process;
- Provide Project monitoring program for effective implementation of the mitigation measures and ascertain efficacy of the environmental management and risk control systems in place; and
- Assist in ensuring compliance with all relevant legislations at local, state and national level for the Project.

The various detailed management plans developed are as below:

- Appendix D - Stakeholder Engagement Plan
- Appendix E - Grievance Redressal Mechanism
- Appendix F - Gender Action Plan
- Appendix G - Traffic Safety Management Plan
- Appendix H – Roadside Drain Management Plan
- Appendix I – Occupational health and safety plan
- Appendix J – Emergency Response Plan
- Appendix K - Specific Plan For Closure/ Redevelopment Of Borrow Areas Used For The Project Road

- Appendix L – Greenbelt Development Plan
- Appendix M – Waste Management Plan

Table 9.1 Environmental and Social Management Plan

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
Land Use									
<ul style="list-style-type: none"> Site preparation and removal of vegetation and grass cover Levelling of ground; Concrete filling, road building; Soil extraction from borrow area and Road roller movement and levelling of road. 	Permanent and temporary changes in land use	Construction	<ul style="list-style-type: none"> On completion of construction activities, land used for temporary facilities such as labour camps, site office, storage should be restored to the extent possible Vegetation clearance, levelling and construction activity should be restricted to designated area. The land use in and around permanent project facilities should not be disturbed. Water should not be allowed to stagnate in and around the Project road Waste should not be allowed to litter in an around the Project road Borrow areas to be restored with waste soil generated in construction phase <p>Refer Annexure K - Specific Plan For Closure/ Redevelopment Of Borrow Areas Used For The Project Road</p>	<p>EPC Contractor /O&M Team</p> <p>NHAI will manage the Khurja realignment, however Cube Highways will raise relevant issues with NHAI</p>	Site inspection	<p>Upon completion of task</p> <p>Monthly Monitoring</p>	EHSS Manager and EPC EHS Team	E&S Department, Cube Highways	Reports from different contractors to the site HSE In-charge of Cube Highways
Topography and Drainage									
<ul style="list-style-type: none"> Site preparation and vegetation clearance, Ground levelling 	Changes in Topography and Drainage	Construction	<ul style="list-style-type: none"> Disruption/alteration of micro-watershed drainage pattern should be minimized to the extent possible. Storm water drains should be built along the Project road and sloped to / connected to natural slope/contour in the area to ensure passage for rainwater to the micro-drainage channels. <p>Refer Annexure H - Roadside Drain Management Plan</p>	<p>EPC Contractor /O&M Team</p> <p>NHAI will manage the Khurja realignment, however Cube Highways will raise relevant issues with NHAI</p>	Site inspection	Six monthly Monitoring	EHSS Manager and EPC EHS Team	E&S Department, Cube Highways	Reports from different contractors to the site HSE In-charge of Cube Highways
Soil									

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
<ul style="list-style-type: none"> ■ Site preparation and removal of vegetation and grass cover ■ Levelling of ground; ■ Concrete filling, road building; ■ Road roller movement and levelling of road; ■ Storage of oil and lubricants onsite; ■ Storage of construction materials ■ Disposal of different type of waste generated from the labour camps, temporary site office 	Soil contamination Soil compaction and erosion,	Construction	<ul style="list-style-type: none"> ■ Vegetation clearance and preparation work will not be carried out during the monsoon season to minimize erosion and run-off. ■ Stripping of topsoil shall not be conducted earlier than required; (vegetation cover will be maintained for as long as possible) in order to prevent the erosion (wind and water) of soil ■ Top soil that has been stripped should be stored for landscaping of the site; ■ Chemicals, fuels stored on site should be stored as per HW Rules. ■ Road side plantation and RoW plantation using fast growing local vegetation <p>Refer to Annexure M - Waste Management Plan</p>	EPC Contractor /O&M Team NHAH will manage the Khurja realignment, however Cube Highways will raise relevant issues with NHAH	Site inspection	Monthly Monitoring	EHSS Manager and EPC EHS Team	E&S Department, Cube Highways	Reports from different contractors to the site HSE In-charge of Cube Highways
Air Quality									
<ul style="list-style-type: none"> ■ Fugitive emissions from site clearing, levelling and preparation, construction material handling etc.; ■ Fugitive emission from traffic movement; ■ Exhaust emission from operation of machineries like batching plant, mixing plant; ■ Vehicular emissions due to traffic movement 	Fugitive and point source emission	Construction,	<ul style="list-style-type: none"> ■ Regular water sprinkling should be done to mitigate fugitive dust emission during construction phase ■ DG sets should be placed within enclosures and have an adequate stack height; ■ Emissions from the batching plant, mixing plant stationary machines will be controlled by ensuring that the engines are always properly tuned and maintained ■ Low sulphur fuels to be used in machinery ■ Prevent idling of vehicles and equipment 	EPC Contractor /O&M Team NHAH will manage the Khurja realignment, however Cube Highways will raise relevant issues with NHAH	Site inspection	Monthly Monitoring	EHSS Manager and EPC EHS Team	E&S Department, Cube Highways	Reports from different contractors to the site HSE In-charge of Cube Highways

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
<ul style="list-style-type: none"> on site and on access roads; and ■ Emissions from power diesel generator required during construction activity 									
<ul style="list-style-type: none"> ■ Fugitive emissions from road clearing and maintenance etc.; ■ Vehicular emissions due to traffic movement on project roads ■ Exhaust emission from operation of DG sets used at backup at Toll Plaza;; and ■ Emissions from power diesel generator required during O&M activity 	Air Quality	Operations	<ul style="list-style-type: none"> ■ Robust measures for road sweeping and dust removal shall be put in place, including engagement of Vacuum Sweepers ■ Water sprays can be used with vacuum sweepers to reduce the resuspension of dust. ■ Early morning road washing can also be explored due high pollution days 	O&M Team	Site inspection		EHSS Manager of O&M team	E&S Department, Cube Highways	Reports to the site HSE In-charge of Cube Highways
Water Environment									
Water required for construction phase and operation phase of the project is met from the groundwater or from private vendors via	Depletion of water resource	Construction,	<ul style="list-style-type: none"> ■ Permission will be obtained from Central Groundwater Authority for abstraction of ground water; ■ Permission to use water from surface resources or to use tanker water 	EPC Contractor /O&M Team	Permission letter	-	EHSS Manager and EPC EHS Team	E&S Department, Cube Highways	Reports from different contractors to the site HSE In-charge of Cube Highways
				EPC Contractor /O&M Team	Water consumption log book	Monthly Monitoring	EHSS Manager and EPC EHS Team		

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
tanker or surface water resources. Impact is anticipated from consumption of water during project activities and contamination of water from accidental spillage of fuel, oils, domestic and hazardous waste.			Maintain logbook for water consumption; <ul style="list-style-type: none"> Prepare and implement water conservation scheme e.g., rainwater harvesting Labour deputed onsite to be sensitised about water conservation and encouraged for optimal use of water No construction activities should be undertaken during monsoon season. Storm water drains should be built along the Project road and sloped to / connected to natural slope/contour in the area to ensure drainage of rainwater 	EPC Contractor /O&M Team	Site inspection	Six monthly Monitoring	EHSS Manager and EPC EHS Team		
			Regular inspection for identification of broken and blocked drains along the project road Refer Annexure H – Raodside Drain Management Plan	EPC Contractor /O&M Team	Site inspection	Monthly Monitoring			
<ul style="list-style-type: none"> Spillage of fuels, chemicals on project road; and Improper waste disposal in labour camps 	Water Contamination	Construction, Operation	<ul style="list-style-type: none"> Prevent & mitigate spill of fuel during construction phase Spill/ leakage clearance plan to be adopted for immediate cleaning of spills and leakages during operation phase Labourers should be given training towards proactive use of designated areas/bins for waste disposal and encouraged for use of toilets. Open defecation and random disposal of sewage should be strictly restricted Regularly monitoring the ground water quality by engaging a NABL accredited laboratory to be undertaken. 	EPC Contractor /O&M Team	Site inspection	Once in three months	EHSS Manager and EPC EHS Team	E&S Department, Cube Highways	Reports from different contractors to the site HSE In-charge of Cube Highways

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
<ul style="list-style-type: none"> Run off from the road surfaces Road cleaning and washing 	Water Contamination	Operation	<ul style="list-style-type: none"> During operation stage, regular cleaning of choked / blocked or damaged drainage provision are necessary to avoid operational impact. Any major spills etc. shall be immediately addressed to <p>Refer to Roadside Drain Management Plan</p>	O&M Team	Site inspection	Monthly monitoring of drains.	EHSS Manager of O&M team	E&S Department, Cube Highways	Reports to the site HSE In-charge of Cube Highways
Noise quality									
<ul style="list-style-type: none"> Construction activities including from site preparation including clearing and levelling, construction material handling etc.; Transportation of construction materials, machinery and personnel; Operation of DG sets, batching plant, mixing plant and other machineries; 	Increase in noise level	Construction	<ul style="list-style-type: none"> Normal working hours of the contractor to be defined (preferable 8 am to 6pm). If work needs to be undertaken outside these hours, it should be limited to activities which do not generate noise; Only well-maintained equipment should be operated on-site. DG sets used should have adequate enclosures for noise control The labourers should be provided with adequate PPE's like ear muffs, ear plugs when working in batching plant or mixing plant Machinery and construction equipment that may be in intermittent use should be shut down or throttled down during non-work periods. 	EPC Contractor /O&M Team	Site inspection	Monthly Monitoring	EHSS Manager and EPC EHS Team	E&S Department, Cube Highways	Reports from different contractors to the site HSE In-charge of Cube Highways
<ul style="list-style-type: none"> Increase in traffic movement; and Demolition activities during decommissioning phase. 	Increase in noise level	Operation	<ul style="list-style-type: none"> Planting one or more rows of avenue vegetation along the project road and stationary noise sources reduce noise Traffic management measures such as prohibition on use of horns and speed restrictions at noise sensitive areas like schools, and major hospitals to reduce roadway noise levels Annual monitoring of ambient noise levels (during day and night time) at identified residential receptors for 	O&M Team	Site inspection	Annual review of noise barriers and monitoring of Noise in areas of concern	EHSS Manager of O&M team	E&S Department, Cube Highways	Reports to the site HSE In-charge of Cube Highways

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			<p>determination of actual impact from traffic;</p> <ul style="list-style-type: none"> Noise barriers shall be considered where there are sensitive receptors within 10-15m from the road, design of such barriers shall take into consideration access and convenience issues of the community. 						
Occupational Health and Safety									
<ul style="list-style-type: none"> Working at machines and hot work; Working with live electrical components; and Operation of road rollers, mixers, cranes and other mechanical construction equipment 	Injury, near-misses and fatalities for labour contracted on site.	Construction, Operation	<ul style="list-style-type: none"> All workers (regular and contracted) should be provided with training on Health and Safety policies in place with appropriate refresher courses throughout the life cycle of the Project Obtain and check safety method statements from contractors. Electrical and maintenance work should not be carried out during poor weather and during lightning strikes. Permitting system should be implemented to ensure that cranes and lifting equipment is operated by trained and authorized persons only. Appropriate PPEs should be provided for batching plant and mixing plant noise. An up-to-date first aid box should be provided at all construction sites and a trained person should be appointed to manage it. A safety or emergency management plan should be in place to account for natural disasters, accidents and any emergency situations. The nearest hospital, ambulance, fire station and police station should be identified in the implemented. emergency management plan. <p>Refer to Annexure I – Occupational health and safety plan and Annexure J – Emergency Response Plan</p>	EPC Contractor /O&M Team	<ul style="list-style-type: none"> Training report Site inspection Permitting document Site specific Emergency Management Plan 	Monthly Monitoring	EHSS Manager and EPC EHS Team	E&S Department, Cube Highways	Reports from different contractors to the site HSE In-charge of Cube Highways

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
Ecology									
Vegetation Clearance	Habitat loss/modification for faunal species	Construction	<ul style="list-style-type: none"> Vegetation disturbance, clearance and construction activities should be restricted to the required areas; Topsoil that is disturbed should be stored separately for later restoration of the habitat; Unnecessary disturbance of neighbouring vegetation due to off-road vehicular movement, fuel wood procurement, needless expansion of labour camp (if any) and destruction of floral resources should be prohibited; Strict prohibition on use of fuel wood and shrubs from nearby areas as kitchen fuel; and Simultaneous revegetation using native species on the road side as well as possible outskirts of Project activity area should be practiced. <p>Refer to Annexure L – Greenbelt Development Plan</p>	EPC Contractor	Regular Site inspection	Monthly Monitoring	EHSS Manager and EPC EHS Team	E&S Department, Cube Highways	Reports from different contractors to the site HSE In-charge of Cube Highways
Construction of store-yard, labour camp, and construction of road	<ul style="list-style-type: none"> Increases the anthropogenic movement (men and material transport), noise and chance of sedimentation /contamination of water resources due to excavation and filling activities Increased stress on fauna in the area 	Construction	<ul style="list-style-type: none"> Construction and transportation activities should be avoided at night (6:00 pm to 6:00 am) and should particularly avoid high faunal activity areas like locations near forest or water bodies during dawn (6:00 am to 7:30 am) and dusk (5:00 pm to 6:30 pm); Areas with pre-existing burrows or ground roosting sites of birds should be avoided when possible; Temporary barriers should be installed on excavated areas; Hazardous materials should not be stored near water bodies, and drainage channels; Efforts should be made to minimize construction noise and the use of noise barriers should be considered (if feasible) for high noise levels; 	EPC Contractor	Regular Site inspection	Monthly Monitoring	EHSS Manager and EPC EHS Team	E&S Department, Cube Highways	Reports from different contractors to the site HSE In-charge of Cube Highways

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			<ul style="list-style-type: none"> ■ Waste materials should be cleared in a timely manner and the use of artificial lights should be minimized to not attract wildlife; ■ Good housekeeping should be followed for construction activities, waste packaging material should be properly disposed; ■ Proper sanitation facilities should be provided at the labour camps; ■ Labour movement should be restricted between construction camps and project sites; and ■ General awareness regarding fauna should be enhanced through trainings, posters, etc. among the staff and labourers. 						
Operation of Widened road	Increased vehicular movement on the road may lead to the increase risks of road hits, road kills and collision of birds (specifically raptors / vulture) with moving vehicles	Operation	<ul style="list-style-type: none"> ■ Roadside barricades should be used to reduce the incidence of road hits and road kills; ■ Regular clearing of road side garbage dumping grounds to reduce the source of attraction for raptors, vultures and other birds; ■ A carcass management plan should also be followed to reduce the potential of collision risk of Vultures and/or Raptors with vehicles; and ■ Speed limit sign boards should be installed at appropriate places after consultation with the forest department; and ■ O&M team should maintain a road hits / kills and vehicular collision register to record any faunal carcasses. The register should include a date, type of specie (to the extent identifiable), and geographic location. If possible, the register should be backed-up with photo-documentation of any identified carcasses or remains. If the number of carcasses are significant, then Client should commission an ecologist to 	O&M Team	Site inspection	<p>Weekly Monitoring of carcass, road hits and road kills</p> <p>Continuous monitoring of dumping grounds, barricades etc.</p>	EHSS Manager of O&M team	E&S Department, Cube Highways	Reports to the site HSE In-charge of Cube Highways

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			suggest more stringent mitigation measures at the sensitive Project components.						
Community Health and Safety									
<ul style="list-style-type: none"> ■ Movement of material and machinery from the construction camps to the construction sites. The traffic diversions on unpaved roads and increased vehicular movement ■ Labour influx in construction camps interactions of workers and the local community ■ Shifting of utilities and tree felling activities; 	<ul style="list-style-type: none"> ■ Accident risks affecting local population and cattle around. ■ Increase the dust generation in the surrounding areas affecting local population and standing crops in close vicinity. ■ Noise and vibration related impacts from construction vehicle transit ■ Pedestrian safety, women's safety, traffic safety, and emergency preparedness. ■ Potential risk of communicable diseases (infectious and vector-borne) and Conflicts with local community ■ COVID-19 related infections ■ Safety hazards to the residing communities due to excavation, shifting of power lines, etc. and may result in access restrictions. 	Construction	<ul style="list-style-type: none"> ■ Make community aware of safety issues as part of the stakeholder engagement and information disclosure process. ■ Special measures will be followed for managing COVID 19 risks and response, with adequate awareness and information dissemination. ■ Maintain safe distance of the proposed construction camps from schools, hospitals, etc. in order to avoid interactions with community hotspots and hence risks of accidents. ■ Ensure implementation of EHSS practices that are expected from its workers during the construction phase engagement. ■ EPC Contractor shall at all times carry out construction work on the road in manner creating least interference to the free flow of traffic. Contractor shall provide and maintain, during execution of the work, a passage for traffic either along a part of the existing carriageway under improvement or along a temporary diversion constructed close to the road sections under construction; ■ EPC Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, marking, flags, lights and flagmen for the formation and protection of traffic approaching or passing through the section of the road under construction. ■ Upon completion of the works for which the temporary traffic 	<ul style="list-style-type: none"> ■ EPC contractor ■ Project team 	<ul style="list-style-type: none"> ■ Regular site inspection ■ Review of grievances and actions taken ■ Accident and incident records 	<ul style="list-style-type: none"> ■ Weekly inspections at site level ■ Monthly audits by corporate E&S team 	EHSS Manager, EPC contractor EHS team and Project team	CH corporate E&S Department	Monthly progress report by EPC team

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			<p>arrangements or diversions have been made, the EPC Contractor shall remove all temporary installations and signs and reinstate all affected roads and other structures or installations to the conditions that existed before the work started.</p> <ul style="list-style-type: none"> ■ The contractor will ensure availability of safe corridors and crossings of pedestrian / bicyclists where paving activities are located in inhabited areas, based on needs of the local community. The contractor will also install barriers, traffic calming devices, signs, signals and markings to avoid pedestrian from crossing hazardous sections. ■ Emergency preparedness shall be discussed with the traversed communities and coordination to be maintained with the contractor, local police, and community in addressing emergency situations like vehicular accidents, pedestrian accident, or release of oil and chemical spills. ■ The contractor shall be required to adhere to IFC's accommodation guidelines, for the labour camps in terms of provisions, sanitation facilities, etc. thus limiting the probability of diseases and infections in the local community on account of improper management of waste; ■ The movement of workers from the project site and labour camps should be regulated and similarly the project boundary and labour accommodation to check for unauthorized visitors/ outsiders entering the site in order to avoid any possible tensions between the migrant workforce and host community; ■ Preparation and implementation of Traffic Management Plan, Local Procurement Plan, EHSS Plan, etc. 						

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			<p>shall be communicated to EPC contractor at the time of selection and appropriate clauses should be included at the time of contract finalization;</p> <ul style="list-style-type: none"> A grievance redressal mechanism shall be put in place to allow for the workers and community members to report any concern or grievance related to project activities. <p>Refer to following annexures - Annexure D - Stakeholder Engagement Plan, Annexure E - Grievance Redressal Mechanism, Annexure G - Traffic Safety Management Plan and Annexure J – Emergency Response Plan</p>						
Increased traffic volume due to widening Road operations	<ul style="list-style-type: none"> Increase chances of accidents, especially at densely populated clusters along the Highway and settlements that are on both sides of the road in AOI; Accident risk for pedestrians especially for local residents accessing facilities such as schools, hospitals located in the Project AOI; Vehicle-animal (livestock) conflict along the road stretches passing through rural areas; Increased incidence of communicable disease from the influx of migrant staff and workers Increased noise levels 	Operation	<ul style="list-style-type: none"> The traffic – animal (livestock) conflicts during the operation stage shall be resolved by implementing speed calming mitigation measures in line with applicable IRC codes and NHAJ guidelines. In coordination with communities, signs, signals, markings, speed limits, warnings of sharp turns, including signs to alert drivers of road sections that are known for animal crossing should be maintained. Awareness shall be created among the communities on emergency preparedness in addressing emergency situations like vehicular accidents, pedestrian accident, etc. When compared with the projected traffic induced daytime noise levels, there is likelihood of increase of noise levels to 3 dB(A) and above including at the sensitive receptors due to increase in traffic volume and related vehicular speed starting from the year 2035 onwards, Considering special treatment required to avoid disturbance due to noise to the 	O&M team	<ul style="list-style-type: none"> Regular site inspection Actions taken against grievances reported by community 	<ul style="list-style-type: none"> Monthly inspections at site level Quarterly audits by corporate E&S team 	EHSS Manager and O&M team	CH corporate E&S Department	Monthly progress report by O&M team

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			<p>sensitive receptors falling under the definition of the Indian Standard on Silence Zone, it is suggested to provide mitigation measures for the identified sensitive receptors.</p> <ul style="list-style-type: none"> To further minimize horizontal spread of traffic induced noise, it is suggested the divider of all sections of the Project Road be provided with ~1 m thick hedge bushes of 1.5 m height as the natural noise barriers. Also in the right of way, where land is available in sections of the Project Road, avenue plantations be carried out to provide natural noise barriers. <p>Refer to Appendix G – Traffic Safety Management Plan</p>						

Social Impacts									
Impact of clearing land area required for six laning between Chainage km 23.6 to Chainage km 130.0 (up to Toe-line within ROW)	<ul style="list-style-type: none"> 603 structures were identified within the area (i.e. toe line) required for six laning that needs to be partially or fully dismantled; Total 897 households (HHs) identified and surveyed as owner/user or dependant on structures identified in impact area either for residential or commercial use or for both; 29 HHs identified as both, physically and also economically displaced which includes 27 HHs from Lohar Community located in 3 different clusters and 2 HHs from SC community. All are located in initial 10 km stretch of the Project road. 	Planning Phase	<ul style="list-style-type: none"> Compensation at full replacement cost for affected assets; Prepare and implement RAP-LEP <p>Refer to Annexure D – Stakeholder Engagement Plan</p>	<ul style="list-style-type: none"> Cube Highway RAP-LEP Implementing agency (to be hired by CH) 	<ul style="list-style-type: none"> Evidence of compensation disbursement for affected assets Third party monitoring reports of RAP-LEP program RAP-LEP completion audit 	<ul style="list-style-type: none"> Compensation disbursement for affected assets prior to clearing land area for construction activities; Quarterly third party monitoring of RAP-LEP program during implementation period; 	<ul style="list-style-type: none"> CH for compensation disbursement for affected assets; Third party agency for RAP-LEP implementation 	CH corporate E&S Department	<ul style="list-style-type: none"> Monthly progress report on compensation disbursement; Third party quarterly monitoring report submission to CH corporate E&S head Monthly progress report on RAP-LEP implementation by implementing Agency to CH corporate E&S head

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
	<ul style="list-style-type: none"> Remaining 867 HHs were identified as economically displaced only to a smaller or greater extent; 								
<p>Gap closure between NHA led Land acquisition compensation and IFC PS5 for displacement impact for Khurja realignment area. Although this is not currently part of the project, it will be handed over to GAEPL after construction and will be part of the NH 34 (old number NH91). It is therefore being treated as associated infrastructure</p>	<ul style="list-style-type: none"> Land acquisition and compensation disbursement process is currently underway as per NHA 1956 for the realignment area. NHA will hand over this stretch to project concessionaire after completing 4-laning construction work. However, Cube Highway is considering dependant households for this area for LEP program, to close the gap between NHA's compensation and IFC PS5 for resettlement and rehabilitation (livelihoods restoration/enhancement). List of affected households based on 3D notification list was prepared and residential dependant households were identified and surveyed. Total 708 HHs from 9 villages were identified and surveyed as dependant households for eligibility for the LEP program. 	<p>Planning phase after agreement with NHA is completed.</p>	<ul style="list-style-type: none"> Final list of HHs to be prepared post verification of identified HHs based on 3G list of affected HHs by the LEP implementation agency; Provisional integration of identified 708 HHs in RAP-LEP. However, implementation of the program will be initiated post verification of HHs list based on 3G data as well as agreement with NHA for the realignment area. 	<ul style="list-style-type: none"> Cube Highway RAP-LEP Implementing agency (to be hired by CH) 	<ul style="list-style-type: none"> Verified list of HHs based on 3G data Third party monitoring reports of RAP-LEP program RAP-LEP completion audit 	<p>Quarterly third-party monitoring of RAP-LEP program during implementation period;</p>	<p>Third party agency for RAP-LEP implementation</p>	<p>CH corporate E&S Department</p>	<ul style="list-style-type: none"> Third party quarterly monitoring report submission to CH corporate E&S head Monthly progress report on RAP-LEP implementation by implementing Agency to CH corporate E&S Head
<p>Temporary land requirement for Construction Camps which will include labour camp, storage area, parking area for heavy vehicles etc.</p>	<ul style="list-style-type: none"> Impact on land owners whose land will be identified, based on mutual agreement on rent/lease, for setting up construction camps by EPC contractor during construction phase; 	<p>Construction Phase</p>	<ul style="list-style-type: none"> Sign lease/rent deed for identified land for construction camp based on mutual consent of land owners and EPC contractor; Land restoration before handing it back to land owner after construction phase is over; Disclosure of GRM process with neighbouring community 	<ul style="list-style-type: none"> EPC contractor Social and Community Manager appointed for at site level for GRM implementation 	<ul style="list-style-type: none"> Lease deed for construction camps; Monitoring Checklist to check labour working conditions inside construction 	<p>Bi-weekly monitoring of construction camps by Social & Community Manager engaged at site;</p>	<p>EHSS Manager</p>	<p>CH corporate E&S Department</p>	<p>Monthly progress report submission by site level EHS team to CH corporate E&S head</p>

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
	<ul style="list-style-type: none"> Impact on surrounding community 				<ul style="list-style-type: none"> camp including labour colony maintenance Evidence of GRM disclosure and Grievance records 				
Utilities re-routing and drainage shifting in initial 10 km stretch*	Local community in AOI, specifically those with shop fronts along the highway will be impacted	Construction Phase	<ul style="list-style-type: none"> Minimal disruption period by way of installing alternate utilities prior to clearing utilities in impact area; Avoid peak traffic hours and crowded period; Advance intimation before to community before clearings and shifting utilities Disclosure of GRM process to report pertinent grievances <p>Refer to Appendix H – Roadside drain Management Plan</p>	<ul style="list-style-type: none"> Respective Site in-charge Social and Community Manager 	<ul style="list-style-type: none"> Share plan of action with dates for utilities shifting with social and community Manager Evidence of advance intimation to nearby community; Evidence of GRM disclosure and Grievance records 	Bi weekly monitoring by Social & Community Manager during utilities shifting period	<ul style="list-style-type: none"> EHSS Manager 	CH corporate E&S Department	Monthly progress report submission by site level EHS team to CH corporate E&S head
Impact on vulnerable group	Disproportionate impact on vulnerable groups may be expected because of different project activities during planning and construction phase of the Project.	Planning Phase & Construction Phase	<ul style="list-style-type: none"> Identify vulnerable groups among the households surveyed; Consider vulnerable groups in designing community development activities; Ensure access to GRM process for vulnerable groups <p>Refer to Appendix G – Grievance Redressal Mechanism</p>	<ul style="list-style-type: none"> CH E&S Department Social and Community Manager 	<ul style="list-style-type: none"> Specific measures for Vulnerable groups in RAP-LEP program; Specific measures for vulnerable groups in Community Development program; Evidence of GRM disclosure to vulnerable group 	Monthly monitoring	EHSS Manager	CH corporate E&S Department	Monthly progress report submission by Social and Community Manager to CH corporate E&S head

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
Impact on women group	Women and girls in the settlements along the Highway may experience different or more significant impacts, including the risk of gender based violence, potentially, additional risk on account of presence of migrant workers in their area	Planning, Construction and operation phase	<ul style="list-style-type: none"> Gender Action Plan (GAP) to be prepared and implemented; Access to GRM system for women group <p>Refer to Appendix F - Gender Action Plan</p>	<ul style="list-style-type: none"> Corporate E&S Department Social and Community Manager 	<ul style="list-style-type: none"> GAP report implementation progress report Evidence of GRM disclosure to women group 	Monthly monitoring by Social and Community Manager	EHSS Manager	CH corporate E&S Department	Monthly progress report submission by Social and Community Manager to CH corporate E&S head
Impact due to labour influx and labour accommodations	If migrant labour are hired, there is a high likelihood of regular interaction between the local community and migrant labourers. If not monitored; these interactions may create interpersonal and communal conflicts due to differences in cultures, beliefs, social practices, food habits etc. moreover, these interactions can also lead to spread of transferable diseases.	Construction phase	<ul style="list-style-type: none"> Adequately monitor the contractor's compliance to the applicable rules and regulations; To the extent possible, locate the labour camp(s) within the project footprint area identified; Development of the labour camp in keeping with the IFC Worker's Accommodation Guideline; Provide adequate sanitation and waste management facilities including, such as safe drinking water, proper waste collection and disposal system, etc.; Undertake health awareness among the local community, Provide the local community an understanding of the project activities and the possible health and safety risks associated with the same as part of the engagement process; Implement on-site vector control measures; Access to the local community to the grievance redressal mechanism for the project; Implement Projects policy of non-discrimination and prevent unequal distribution of project benefit. 	<ul style="list-style-type: none"> EPC contractor Project team Social and Community Manager appointed for at site level for GRM implementation 	<ul style="list-style-type: none"> Regular site/labour camp inspection Review of grievances and actions taken 	<ul style="list-style-type: none"> Weekly inspections at site level Monthly audits by corporate E&S team 	EHSS Manager, EPC contractor EHS team and Project team	CH corporate E&S Department	Monthly progress report by EPC team
Cumulative Impacts	Cumulative dust emissions from road construction, proposed thermal power plant	Construction Phase	<ul style="list-style-type: none"> Cube Highways to engage and communicate with NHA, KSTPP authorities and local authorities regarding the mitigation measure 	<ul style="list-style-type: none"> Cube Highways Project team 	<ul style="list-style-type: none"> Records and documentation for all meetings conducted with 	<ul style="list-style-type: none"> Six monthly audits by corporate E&S team to follow 	Stakeholder representatives	CH corporate E&S Department	<ul style="list-style-type: none"> Records and documentation for all meetings conducted with

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
	<p>construction and other smaller development activities</p> <p>Influx of migrant workers</p> <p>Community Health & Safety</p>		<p>being implemented by them and need for similar measure form other stakeholders for control of dust from construction;</p> <ul style="list-style-type: none"> ■ Work towards awareness of community towards need for dust suppression at available platform so that they can seek such arrangements from other stakeholders also ■ Hire local workers to the extent possible and manage the labour camp effectively with adequate training on dealing with community, communicate with other stakeholder to implement similar measure and coordinate project schedule to the extent possible to minimize larger periods of construction in same villages. ■ Manage the movement of construction machinery with help from local authority, such that all stakeholders have define schedule and durations. Impart training to drivers for movement in local roads and communicate such needs to other stakeholders through appropriate authorities. 	<ul style="list-style-type: none"> ■ E&S team 	<p>NHAI, KSTPP and other authorities</p> <ul style="list-style-type: none"> ■ Records of all training sessions for community and workers 	<p>up on actions discussed with external stakeholders</p>			<p>NHAI, KSTPP and other authorities</p> <ul style="list-style-type: none"> ■ Records of all training sessions for community and workers
	<p>Unplanned development around the road</p> <p>Impacts on Ambient Air Quality</p>	Operation Phase	<ul style="list-style-type: none"> ■ Village panchayats and urban local bodies may be included in the excerice to periodically monitor unplanned development e.g., resource capture- water sources, land through encroachment, etc., and propose for planned developments in consultation with appropriate authoriries. Planned development will limit stress on any existing resources. ■ Cube Highways may raise the issue of unplanned development with appropriate authorities to enhance awareness about potential issues to environmnrnt and society. ■ It is expected that all major projects like KTPP will need to abide by the 	<ul style="list-style-type: none"> ■ Cube Highways O&M team ■ E&S team 	<ul style="list-style-type: none"> ■ Records and documentation for all meetings conducted with NHAI, KSTPP and other authorities ■ Records of all training sessions for community and workers 	<ul style="list-style-type: none"> ■ Six monthly audits by corporate E&S team to follow up on any actions discussed with external stakeholders 	Stakeholder representatives	CH corporate E&S Department	<ul style="list-style-type: none"> ■ Records and documentation for all meetings conducted with NHAI, KSTPP and other authorities ■ Records of all training sessions for community and workers

Project Activities	Impact/ Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			<p>existing Air Quality standards; however, there are various agencies looking at reducing air pollution in NCR region, any recommendations made by them in near future will be applicable to such projects also.</p> <ul style="list-style-type: none"> ■ Role of Cube Highways may be limited to managing its own emissions as well as raising such issues at appropriate platforms. 						

9.6 Environmental Monitoring and Evaluation Program

The monitoring programme will be required to ensure effectiveness of implementation of suggested mitigation measures. The environmental monitoring will help in assessing the changes in environmental conditions by monitoring the effective implementation of mitigation measures, and measuring deteriorations in environmental quality for further preventive actions.

The monitoring plan has the following objectives:

- To ensure effective implementation of ESMP
- To comply with all applicable environmental, safety, labour and local legislation
- To ensure that public opinions and obligations are taken in to account
- To modify the mitigation measures or implementing additional measures, if required
- To evaluate the effectiveness of environmental management programme, regular monitoring of the important environmental parameters will be taken up.

The schedule, duration and parameters to be monitored are shown in Table below. The monitoring will be carried out by Project team through the approved laboratory and will be supervised by the Cube Highways E&S team. The monitoring results shall be comparable with the baseline values and against national environmental standards as well as IFC / WB EHS Guidelines.

Table 9.2 Environmental Monitoring Plan

Attribute	Parameter	Frequency	Duration	Location	Type of sampling
Ambient Air	PM2.5, PM10, NOx, SO2 and CO	Six monthly during construction Annual during operation stage.	<ul style="list-style-type: none"> ■ Entire construction phase ■ Upto 2 years of operations of 6-lane 	Construction Sites and major establishments along the alignment including base line monitored stations	High volume sampler to be located in the down wind direction atleast 50m from the road. Use method specified by CPCB for 24 hr sampling
Water	Physical, chemical and biological parameters as per Table 5.9 of this report.	Six monthly during construction Annual during operation stage	<ul style="list-style-type: none"> ■ Entire construction phase ■ Upto 2 years of operations of 6-lane 	GW samples from borewells; Surface water from the water courses along the road project.	Grab sample collected from source and analyze as per standard methods for examination and compared against

Attribute	Parameter	Frequency	Duration	Location	Type of sampling
					drinking water (IS: 10500-1991)
Noise	Leq day and Leq night as per noise standards	Quarterly during construction Six monthly during operation stage	<ul style="list-style-type: none"> ■ Entire construction phase ■ Upto 2 years of operations of 6-lane 	Near the construction camps, working zones, sensitive receptors at major human settlements along the road; baseline locations to be considered	For 24 hours as Leq day and Leq night for each of the locations
Soil	Physical and chemical parameters as per Table 5.11 of this report.	Six monthly during construction Annual during operation stage	<ul style="list-style-type: none"> ■ Entire construction phase ■ Upto 2 years of operations of 6-lane 	Construction camp sites, Batching plants and baseline locations	Sample of soil collected and analyzed using absorption spectrometer

Apart from the above environmental monitoring plan, Project will need to monitor other environmental and social components of particular significance at critical locations as suggested below as performance indicators.

Table 9.3 Performance Indicators

Indicator	Description	Phase	Responsibility
Road side and other Plantation areas	<ul style="list-style-type: none"> ■ No. of trees planted (Total) ■ No. of Trees planted along Road sides ■ No. of Trees planted at other locations (such as camps, borrow areas, debris disposal sites) 	O&M	O&M team
Tree cutting	<ul style="list-style-type: none"> ■ No. of Trees to be cut ■ No. of Trees cut ■ % Progress on the tree removal 	Pre - Construction	Project team
Borrow areas	<ul style="list-style-type: none"> ■ No. of Borrow Areas identified and verified 	Pre - Construction and O&M	EPC Contractor

Indicator	Description	Phase	Responsibility
	<ul style="list-style-type: none"> ■ No. of borrow areas for which redevelopment/ closure plans have been prepared ■ No. of borrow areas restored and rehabilitated ■ No. of borrow areas handed over 		
Storage of excavated materials	<ul style="list-style-type: none"> ■ No. of locations identified for temporary storage of the excavated materials to be used in embankment and sub grade 	Pre-construction and construction	Contractor
Silting of surface water bodies	<ul style="list-style-type: none"> ■ Before the onset of monsoon all the debris/excavated materials shall be cleaned from the work sites and disposed of at the pre – identified approved locations 	Construction	Contractor supervised by CH E&S team
Trainings Imparted	<ul style="list-style-type: none"> ■ No. of Training sessions organized for <ul style="list-style-type: none"> - Department staff - Contractors - Combined ■ No. of people trained <ul style="list-style-type: none"> - Department staff - Contractors 	Construction and Operational Phase	CH Project team and CH E&S team
Drainage	<ul style="list-style-type: none"> ■ Total Length of drainage system installed ■ No. of Locations 	Construction	Contractor
Safety provisions for existing road users	<ul style="list-style-type: none"> ■ Signages (by type and No.) ■ Guard Rails ■ Barricades 	Construction	Contractor
Other Public in the vicinity of project road.	<ul style="list-style-type: none"> ■ No. of awareness sessions for educating the public about road safety and other environmental aspects (such as waste dumping, pollution and health impacts etc.) 	Pre-construction and construction	Project team and Contractor

10. IMPACT SUMMARY AND CONCLUSION

This environmental and social impact assessment has been conducted to evaluate the impacts associated with the widening of 126.300 km long road from Ghaziabad to Aligarh from 4 lane to 6 lane along with realignment of 9.285 km bypass road at Khurja for upcoming Khurja Super Thermal Power Plant. The impact assessment has been conducted in compliance with the administrative framework identified herein, including relevant national legislative requirements and international guidelines/conventions.

10.1 Impacts Requiring Detailed Assessment

Following a scoping exercise, this ESIA was focused on interactions between the Project activities and various resources/receptors that could result in significant impacts. The table below presents the outcomes of the comprehensive assessment of identified impacts as a result of the various phases of the Project.

Table 10.1 Impact Assessment Summary

Impact Description	Impact Nature	Significance of Impact	
		Without Mitigation	With Mitigation
Construction Phase			
Change in Land Use	Negative	Minor	Minor
Drainage and Topography	Negative	Minor	Negligible
Land and Soil due to improper waste disposal	Negative	Moderate	Minor
Water Availability	Negative	Minor	Minor
Water Quality	Negative	Moderate	Minor
Air Quality	Negative	Moderate	Minor
Ambient Noise	Negative	Moderate	Minor
Ecological impacts due to Vegetation Clearance	Negative	Minor for habitat and also Minor for species.	Negligible
Ecological impacts due to other construction activities	Negative	Moderate	Minor
Occupational Health and Safety	Negative	Minor	Minor to Negligible
Community Health and Safety	Negative	Moderate	Minor
Clearing land area required for six laning between Chainage km 23.600 to Chainage km 130.000	Negative	Moderate for the project but-Major in the Initial stretch.	Minor
Temporary land requirement	Negative	Minor	Negligible
Utilities re-routing and drainage shifting in initial stretch	Negative	Moderate	Minor
Employment and Entrepreneurship Opportunities	Positive	Moderate	--
Vulnerable Groups	Negative	Moderate	Minor
Women	Negative	Moderate	Minor
Operation and Maintenance Phase			
Soil environment	Negative	Negligible	--
Water availability	Negative	Minor	Negligible
Water quality	Negative	Minor	Negligible
Ambient Air	Negative	Moderate	Minor to moderate
Ambient Noise	Negative	Moderate	Minor
Local community health and safety	Negative	Moderate	Minor

Impact Description	Impact Nature	Significance of Impact	
		Without Mitigation	With Mitigation
Ecological impacts due to Road hits / kills and Vehicular Collision	Negative	Major	Minor

10.2 Conclusion

The proposed project is an infrastructure project proposing to widen and strengthen the existing expressway between Ghaziabad and Aligarh in 126 km section from 4 lane to 6 lane and developing realignment of 9.285 kms for upcoming Khurja Super Thermal Power plant by replacing an existing highway length of approx. 7 kms. Since there is no additional land acquisition for the widening, requirement of Environmental Clearance of expansion activity from MoEF&CC will not be applicable.

This ESIA report attempts to identify significant potential environmental impacts associated with the construction and operational phases of the proposed road Project. Apart from positive impacts road projects could also generate some adverse direct and indirect environmental impacts. Direct environmental impacts are usually due to construction activities, while indirect environmental impacts are usually related to the operation of improved roads.

Major construction works for expressway widening, removal of vegetation in RoW, setting up of labour camps, realignment in 9.285 km section, etc. are likely to have environmental impacts on baseline parameters, such as on land use (conversion from agricultural to industrial land), ambient air quality and noise quality, especially during the construction phase. However, the environmental impacts are assessed to be reversible and mitigable through implementation of the proposed mitigation measures.

The social impacts from the Project are assessed to be beneficial in terms of local employment and overall local area development. However, even though there is no fresh land acquisition, the project road widening will lead to impact on 603 assets and 897 dependent households for the main alignment and 708 households for the Khurja realignment, therefore it will lead to involuntary displacement. The Project will also lead to physical displacement of 29 households, residing in 28 structures that are located within the toe line (main alignment). In case they are physically displaced, it will impact their place of residence, along with this, it may also lead to economic displacement, as their access to nearby market will be impacted. The applicable RAP-LEP will be prepared to mitigate the impacts of displacement. Additionally, the Khurja Realignment that did involve land acquisition for the new road and was handed by NHAI, since it is an associated facility, will also be assessed for alignment with IFC PS5, using samples of the compensation provided. Gaps found will be addressed through the application of the RAP-LEP provisions for the Khurja Realignment.

The Environmental and Social Management Plan (ESMP) describes mitigation measures for impacts specific to Project activities and also discuss implementation mechanism. To conclude, the implementation of ESMP will help Cube Highways/GAEPL in complying with its internal requirements as well as national/state regulatory framework in addition to meeting IFC, ADB, AIIB and CDC requirements.

APPENDIX A PROVIDED AS SEPARATE FILE

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