



Green National Highways Corridor Project

Two Lane Upgradation with Paved Shoulders
of Bowadra to Vizianagram Section of NH
516 E in Andhra Pradesh

Environmental Impact Assessment & Environmental Management Plan

November, 2019

**Ministry of Road Transport and Highways
Government of India**

List of Acronyms

ADT	Average Daily Traffic
AADT	Annual Average Daily Traffic
AH	Asian Highway
AMSL	Above Mean Sea Level
APR&BD	AP Roads and Building Department
APPCB	Andhra Pradesh Pollution Control Board
ASI	Archaeological Survey of India
BDL	Below Detection Limit
BOQ	Bill of Quantities
CCE	Chief Controller of Explosives
CD	Cross Drainage
CFE	Consent for Establish
CFO	Consent for Operate
CE	Chief Engineer
CGWA	Central Ground Water Authority
CoI	Corridor of Impact
CPCB	Central Pollution Control Board
CO	Carbon Monoxide
DEIAA	District Level Environmental Impact Assessment Authority
DFO	Divisional Forest Officer
DPR	Detailed Project Report
EC	Environmental Clearance
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EMF	Environment Management Framework
EMP	Environment Management Plan
ESO	Environment & Safety Officer
ESR	Environmental Screening Report
FRO	Forest Range Officer
GHG	Green House Gas
GNHCP	Green National Highways Corridor Project
GoI	Government of India
IRC	Indian Roads Congress
IS	Indian Standards
LCV	Light Commercial Vehicle
LHS	Left Hand Side
Km	Kilometer
MoEFCC	Ministry of Environment, Forest and Climate Change, Govt. of India
MoRTH	Ministry of Road Transport and Highways, Govt. of India
NBWL	National Board for Wildlife
NAAQS	National Ambient Air Quality Standards
NGHM	National Green Highways Mission
NGO	Non-Governmental Organization

NH	National Highways
NHDP	National Highways Development Program
NOC	No Objection Certificate
NO ₂	Nitrogen Dioxide
NRSC	National Remote Sensing Centre
OD	Origin and Destination
OP	Operational Policies
PCU	Passenger Car Units
PIU	Project Implementation Unit
POL	Petroleum, Oil and Lubricants
PMC	Project Management Cell
PROW	Proposed Right of Way
PUP	Pedestrian Under Pass
PWD	Public Works Department
RCC	Reinforced Cement Concrete
RET	Rare, Threaten and Endangered
RHS	Right Hand Side
RoW	Right of Way
ROB	Rail Over Bridge
SEAC	State Expert Appraisal Committee
SEIAA	State Level Environmental Impact Assessment Authority
SEI	Significant Environmental Issues
SO ₂	Sulphur Dioxide
SIA	Social Impact Assessment
SOI	Survey of India
SH	State Highway
TCS	Typical Cross Section
ToR	Terms of Reference
VEC	Valued Ecosystem Components
PUP	Vehicular Under Pass
WB	The World Bank
WMM	Wet Mix Macadam

CHAPTER 1

INTRODUCTION

1.1 Background

The AP Roads and Building Department (APR&BD), National Highway (NH) Division, under Ministry of Road Transport & Highways (MoRT&H) intends to develop and maintain National Highway 516 E connecting to Bowdara - Vizianagram Road Section from Km 62/000 of SH-39 to Km 1/600 (KM 544/300 of NH-26) near collector office junction at Vizianagram) of state of Andhra Pradesh. Total length of the existing project road is 32.248 km.

APR&BD through their letter Lr. No/600/New NH/Pckg-6/EE (NH&CRF) DEE-6/AEE-3/2015-16 dated 30.06.2016 instructed the consultants to commence the assignment, and the project activities thereafter. The Contract agreement for the assignment was signed on 28th July, 2016.

1.1.1 Green National Highways Corridor Project (GNHCP)

Two upgradation with Paved Shoulders of Bowdara - Vizianagram Road Section of NH 516E is proposed by constructed under Green National Highways Corridor Project (GNHCP) through its support to the Govt. of India's Bharatmala Pariyojana and financed by the World Bank. It will promote the vision of enhancing effectiveness of the transport network of India with cost and natural resources efficiency and safe high capacity highways. The GNHCP operation is aligned with the Government of India's objective of eliminating poverty and ensuring access to minimum standard of basic needs for all citizens through investing in growth enablers transport & connectivity Infrastructure. The basic proposition of the GNHCP includes strengthening of road pavement in addition to widening to two-lane/two-lane with paved shoulder standards and promoting/ demonstrating green and resilient approaches while doing so. The list of roads (sub-projects) identified for inclusion in this project are given below:

Sr. No.	State	Highway	Section	Length (in kms)
1.	Andhra Pradesh	NH-516E	Bowada to Vizianagram	26.94
2.	Andhra Pradesh	NH-516E	Paderu to Araku	49.37
3.	Himachal Pradesh	NH-707	Poanta Sahib to Gumma	94.99
4.	Himachal Pradesh	NH-707	Gumma to Fediz	9.80
5.	Rajasthan	NH-158	Ras-Beawar-Mandal	116.75

1.1.2 Project Highway : Bowdara - Vizianagaram Road Section of NH 516E

The project highway starts from Bowdara (18°11'51.83"N Latitude, 83° 7'21.78"E Longitude) and ends at Vizianagaram (18°11'51.83"N Latitude, 83°7'21.78"E Longitude) on SH-26. The existing length of project highway is 32.248 km. The project stretch traverses through plain terrain and have mostly poor geometry except few locations where curve improvement may not be required. The project road is located in Vizianagaram and Visakhapatnam districts of Andhra Pradesh. The project road connects the important towns / villages like Bowdara, Tatipudi, Gantiyada and Vizianagaram.

The project road is about 26.929 km design length *i.e.* from Km 62/000 of SH-39 to Km 1/600 (Km 544/300 of NH-26, near collector office junction Vizianagaram) in the state of Andhra Pradesh. The improvement of the project road would include upgradation of existing road to two-lanes with paved shoulder configuration, removal of geometric deficiencies, rehabilitation and construction of bridges, culverts, providing traffic safety measures, etc.

The index map of the project road has been shown in the **Figure 1.1**. The alignment marked on the Survey of India (SOI) Toposheet is presented in the **Figure 1.2**.

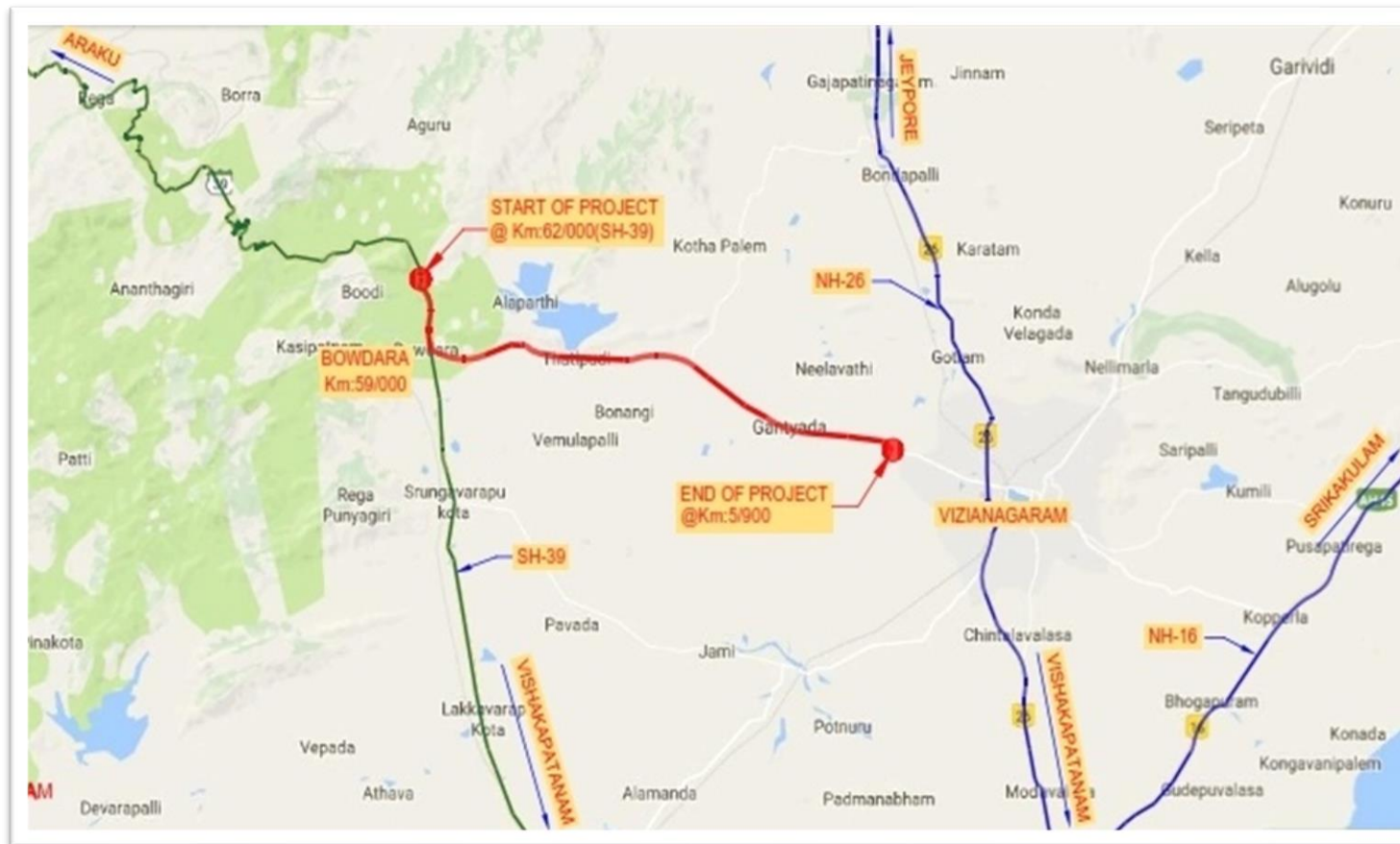


Figure 1.1: Project Road Index Map

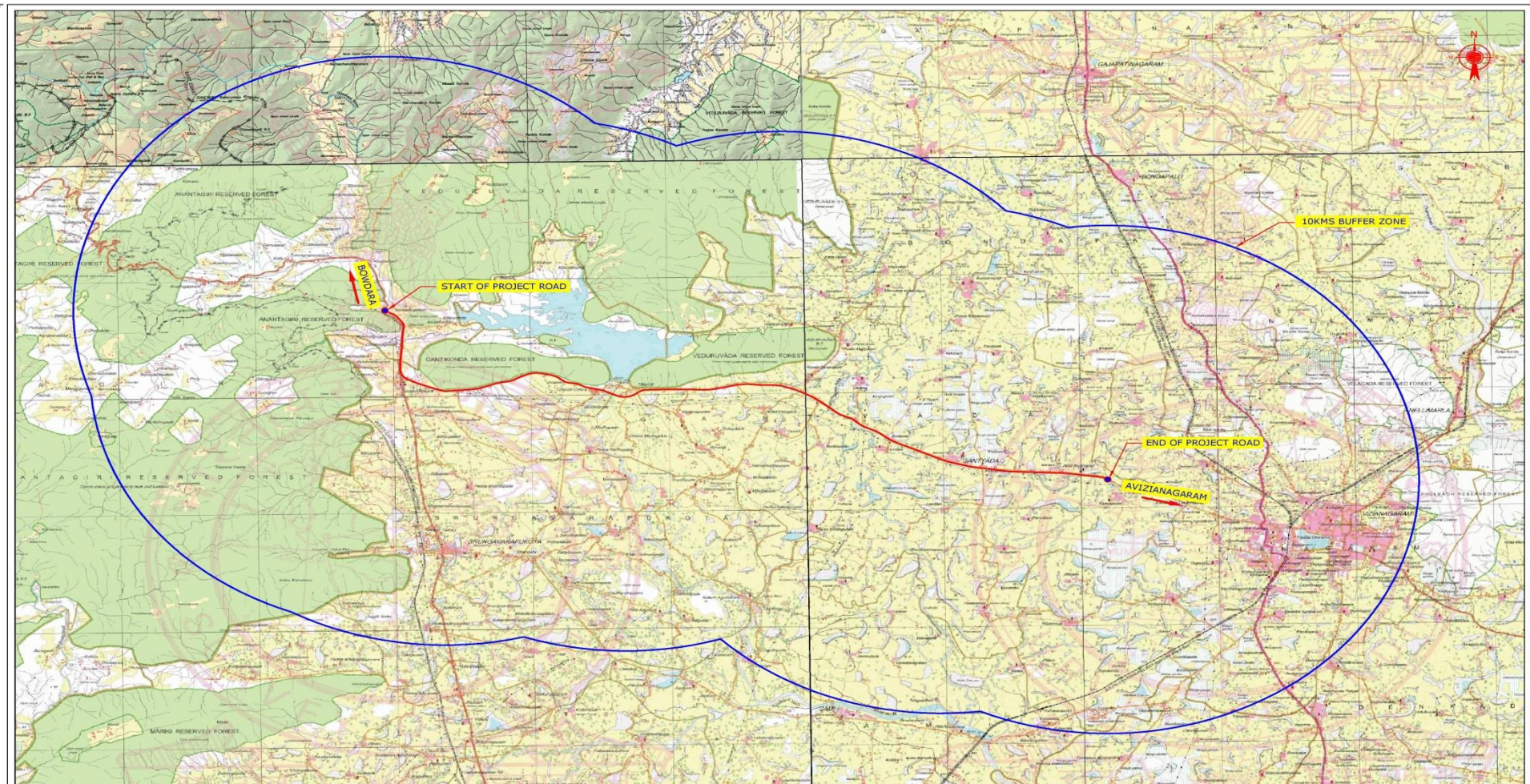


Figure 1.2: Toposheet Map Showing the Project Road

1.2 OBJECTIVES OF THE PROJECT

The main objectives are to upgradation of existing road to two-lanes with paved shoulder configuration; and alleviate the current unsafe and congested conditions of the project road connecting the villages and towns, with one another and to the National Highway network for the benefit of the road users at large. A modest design speed for the safe and efficient movement of people and goods is seen as the objective and the design of consultants reflect this.

The project road is aimed to provide congestion free, safe and smooth road to the population residing along project road and other users travelling through the project road. The other objective of widening and strengthening of the project road is (with required cost effectiveness, coupled with environmental management standard) for achieving sustainable development of the region, state and ultimately to the country.

1.3 EXISTING CONDITION OF THE PROJECT ROAD

The project road section from Bowdara to Vizianagaram passes through rural and semi urban sections. The total proposed length of project road is 26.9 km. Major settlements along the project road are Bowdara, Tatipudi and Vizianagaram. The 60 % of the existing road is in poor to fair condition. 83 % project road is two lane while 17 % road is intermediate lane.



1.4 MAJOR VILLAGE/TOWN ON PROJECT ROAD

The villages and settlements are on either side of the project road. The details of settlements along the project road are presented in **Table 1.1**.

Table 1.1: Details of Settlements along the Project Road in Bowdara to Vizianagaram

S.No.	Name of village/Town/Habitation	District
1	Bowdara (Km 3+000)	Vizianagaram
2	Tatipudi (Km 10+200)	
3	Gantiyada (Km 22+000)	
4	Ramavaram (Km 26+929)	

1.5 NEED OF THE PROJECT ROAD

- a) The proposed project road between Bowdara and Vizianagaram will facilitate the transportation of agriculture produce from the surrounding areas in Visakhapatnam and Vizianagaram districts to their market places in Andhra Pradesh and Orissa by enabling movement of heavy vehicles in all weather conditions.
- b) Improvement of the road geometrics will also attract more traffic to the region which in turn helps in the upliftment of the living standards of the people, and also help in reduction of accidents.
- c) To meet the demand of safe travel and accident free travel, upgradation of the present project road is very much needed.
- d) Development of this road will enhance the tourism spots like Araku, Lambasinghi etc.,

The necessity of the project road is summarised below:

- Connects Bharatmala Corridors viz, NH-16 (AH45) at Rajahmundry and NH-26 at Vizianagaram improving the lower weaker sections of the region.
- Boosts Tourism in hill stations Araku, Lambasinghi and Borra Caves, Boating in Tatipudi Reservoir
- Creates more health facilities, educational opportunities especially for women.
- Improves Road Safety
- Enhances mobility to remote places.
- Facilitates overall economic development of the region.

1.6 BENEFITS OF THE PROJECT

The implementation of the project road will have the following direct benefits:

- a) The project road widening will help in economic growth in the project road and surroundings.
- b) The road widening will help in regional development of Andhra Pradesh and population residing along the project road.
- c) Improved quality of life is expected for the population in the project influence area. The project road widening will provide economic boost to the local population through facilitation of easy transportation of materials to the commercial centres.
- d) Employment & business opportunities will be available to the locals during construction phase.

The proposed project road is based on its importance of strengthening the road linkage between Bowdara and Vizianagaram, and will, along with improved connectivity for the Koyyuru- Chintapalli-Lambasingi-Paderu and Paderu-Araku road sections also on NH-516E, facilitate the transportation of agriculture produce from the surrounding areas in Visakhapatnam and Vizianagaram districts to their market places in Andhra Pradesh and Orissa by enabling movement of heavy vehicles in all weather conditions.

The project road passes through habitations like Bowdara, Thatipudi, and Gantayada and also provides connectivity to around five villages on the right hand side and five villages on the left hand side.

Tourism is already a major contributor to Andhra Pradesh's economy, with a contribution of around 13%. The project road (along with the Koyyuru-Paderu and Paderu-Araku road sections of NH-516E, also to be upgraded under the GNHCP project) would improve connectivity for tourists visiting various famous tourist destinations in Andhra Pradesh, such as Lambasingi (a small village in the Eastern Ghats of Chintapalli division in Andhra Pradesh at an altitude of 1,000 m above sea level with a deciduous forest cover consisting of several coffee, pine, and eucalyptus plantations, and known for its diversity of bird life), Araku Valley (located in the Eastern Ghats about 114 kilometres from Visakhapatnam, close to the Odisha state border, and famous for its coffee plantations which are largely in the tribal areas), Borra caves (located in the Ananthagiri hills of the Araku Valley caves, these are considered the deepest caves in the country, at an elevation of about 705 m). Better connectivity would enable work force participation and tourism related activities in the region.

Other Various Positive Impacts and Benefits

Other various positive impacts and benefits expected from the proposed project are furnished below.

- Improvement of project road would increase new economic and employment opportunities by catering good connection to new markets, production centre. As a result villagers would be able to transport their produce faster and get more profit margins instead of depending solely on local 'haats' and middlemen.
- With the project, good connectivity would attract industrialists; businessmen to set up agro-based industries and new business centre like minerals, fruits, vegetables. It will create opportunity in the uplift of poor farmers.
- Improved connectivity will attract tourists as project road is only mode of transportation to religious places.
- Improve the condition of existing traffic flow by removing all bottlenecks at various locations.
- With road improvement, it will reduce the cost of transportation and fuel consumption.
- Increase the carrying capacity of the existing traffic volume and enable it to cater to the future traffic.
- Improve the condition of existing traffic flow by removing all bottlenecks at various locations.
- Essential and emergency services like schools, health centre, public distribution system etc can be availed faster.

1.7 NEED OF ENVIRONMENTAL IMPACT ASSESSMENT STUDY (EIA)

The objective of the Environmental Assessment is the characterisation of the existing status of the environment, to identify the probable adverse and positive impacts on the environment and community due to the proposed project and to delineate various measures to mitigate the adverse impacts and to enhance positive environmental impacts.

The Environmental Assessment provides tool for decision-making as well as it helps in ensuring the sustainable development with mitigating adverse environmental impacts by providing site specific Environmental Management Plan (EMP). In order to achieve these objectives, detailed surveys and monitoring have been carried out along the proposed project road to identify Valued Ecosystem Components (VEC) and project specific significant environmental issues (SEI).

1.8 SCOPE OF ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

The scope of EIA is to meet the Environmental Framework requirements and environmental assessment guidelines of the World Bank.

- Collecting primary and secondary environmental baseline data within the project boundary and surrounding areas;
- Assessing potential adverse environmental impacts that might arise during design, construction and operation phases with respect to design proposal of the project and using the environmental baseline study;
- Suggesting appropriate mitigation measures to effectively manage potential adverse environmental impacts; and
- Analyse the alternatives in terms of alternatives of upgradation of the alignment, technology, design and operation, including the "without and with project" situation. A detailed analysis for each of the alternatives, was carried out to analyse the feasibility in terms of capital and recurrent costs; their suitability under local conditions and quantify the environmental impacts to the extent possible, and attach economic values where feasible and explain the rationale behind the preferred/chosen option
- Consultation with the Public/key Stakeholders and incorporate their concerns into the project design;
- Developing an Environmental Management Plan (EMP) including environmental monitoring plan to implement suggested mitigation measures and management plans to minimise adverse impacts through effective management systems including formulation of monitoring and reporting requirements;

1.9 APPROACH AND METHODOLOGY OF EIA STUDIES

The methodology for the EIA study employs a traditional approach of identifying the environmental sensitivities along the project corridor and analysing the environmental issues identified. The EIA process simultaneously informs the design of the project road about these issues so that necessary modification can be carried to minimise these environmental concerns. Thereafter the impact assessment that is carried out would identify the impacts which are still likely and also identify mitigation measures which need to be adopted during the construction and operation of the National highway.

1.9.1 ENVIRONMENTAL SCREENING AND SCOPING

Environmental screening exercise of the project road was undertaken to facilitate inputs on environmental considerations; apart from social, economic and traffic & transport considerations. Further, this report will also provide scoping inputs in determining the major environmental issues and defines the scope of work for conducting environmental assessment. As per the recommendation of the Environmental Screening report, detailed Environmental Assessment will be taken up as a next step of the consultants in the assignment. The scoping exercise defines geographical boundaries for the project road for impact assessment as well as defining the project influence area to assess the impacts due to project interventions during construction and operation phases.

The environmental screening typically identifies the natural habitats (e.g. national parks, wildlife sanctuaries, sacred groves, protected areas, forests, water bodies etc.), major rivers and waterways, notified cultural heritage sites and any other potentially sensitive areas. The information available from secondary sources along with the inputs from the site visits and consultation with local people are used to identify these issues and sensitive receptors which might be located along the project corridor.

1.9.2 DELINEATION OF THE PROJECT IMPACT ZONE

For carrying out further environmental studies and subsequently the assessment, it was required to delineate the Corridor of Impacts (COI) and project influence zone. Depending on the severity of impact the project influence zone has been classified as:

1.9.3 CORRIDOR OF IMPACT (COI) AND PROJECT INFLUENCE ZONE

The area of the proposed Right of Way (ROW) has been considered as the Corridor of Impact. The proposed RoW is 30m at re-alignments and bypasses. The project influence zone has been considered as 10 km either side of the project road.

1.9.4 COLLECTION OF PRIMARY AND SECONDARY ENVIRONMENTAL DATA

Primary and secondary data were collected through field monitoring and various verifiable sources for different environmental components e.g. ambient air, soil, water, noise, climate, physiography, ecology, etc.

1.9.5 COLLECTION OF PRIMARY BASELINE INFORMATION

For gathering the baseline environmental condition along the project corridor baselines studies were conducted. These baseline studies carried out included:

- Baseline environmental surveys for assessing the ambient air, ground and surface water, soil and noise levels;

- Enumeration of trees to identify the location, number, types spread, girth etc. Local name, value of the trees within the proposed RoW;
- Ecological surveys to identify the habitats and the flora and fauna;
- Structure enumeration to identify the one likely to be impacted;
- Socio-economic surveys to identify the condition of the impacted persons.

In addition to the above survey interactions were carried out with the populations along the project corridor to gather local level information on the following:

- Local practices and traditions with respect to conservation and use of natural resources;
- Farming practices and Cropping pattern;
- Perception of the people about the project
- Traffic surveys were used to estimate the present and future traffic
- Preliminary engineering surveys to identify the topographical features

This information was used to develop the baseline environmental condition in the project area and identify the environmental sensitivities which might still get affected by the proposed alignment.

The sources from which baseline information gathered, are presented in **Table 1.2** below

Table 1.2: Secondary Data Collected for EIA Studies

Environmental and Social Aspect	Parameters of Concern	Source of Information
Climatic Condition in the Project Influence Area	Temperature and Rain Fall	IMD (Indian Metrological Department)
Soil & Geology	Soil type and its stability, Fertility of the Soil potentiality for soil erosion	Geological Survey of India, State Mining Department
Slopes	Direction of slope, Percentage of slope	Contour Survey, Satellite image and Survey of India topographic sheets
Drainage/ Flooding	Existing drainage map and flooding level including its extent of water spread. Identification of drainage channel and its catchments area around the Project stretch	Satellite Imagery/ Toposheet /Hydrology study/State Water Resource Department.
Water Bodies and Water Quality	Identification of water bodies/canal/drainage channels where the run	Toposheets/field study. Hydrological data from the CGWA Reports

Environmental and Social Aspect	Parameters of Concern	Source of Information
	off surface water will flow/due to erosion and also due to spillage oil and other hazardous materials. Status of surface water and ground water quality	
Air Quality	Air quality status of the project area.	Monitoring of the ambient air quality carried out by the Savant Enviro Tech Pvt. Ltd an NABL Accredited Laboratory.
Ambient Noise levels	Existing noise level in the project area	Monitoring of the ambient noise level carried out by the Savant Enviro Tech Pvt. Ltd an NABL Accredited Laboratory.
Forest Within Proposed ROW Legal Status – Protected Areas, Endangered Plant and Animal, Ecological Sensitive Area, Migratory Corridor/ route,	Status of the forests, Conservation of forest area, & endangered plant and animal and any other species	Department of Forest, Govt. of Andhra Pradesh, DFOs, Discussion with local community and local FRO
Trees and Vegetation Cover	Identification of existing tree species and the project influence area	Forest Department and Field Survey.
Settlements within the PROW	Settlements & its population along the corridor. Its location & numbers	Population/ District Census report 2011. Topographic survey data.
Cultural / Heritage and Ancient Structures.	Conservation areas if any Protected structures, monuments and heritage structures.	Archaeological Survey of India, State Archaeological Department

1.9.6 CONSULTATION WITH KEY STACK HOLDERS

During the EIA process, a preliminary identification of key stakeholders was carried out. An inventory of actual / potential stakeholders, including local groups and individuals, local institutions which may be directly or indirectly affected by the project or with interest in the development activities in the region was made at a preliminary stage. This inventory was arrived through discussions with local APR&BD official and also in consultation with members of the local community.

Consultation with the community is a continual process that was carried out during the EIA study and would also be continued during the construction and operation phases of the project. The consultations with community and local institution like panchayat also helped in developing preliminary understanding of the requirement of people in the area and identification of the enhancement proposals.

1.9.7 IMPACTS IDENTIFICATION AND EVALUATION

The principal impact assessment (IA) steps comprise of the following:

- Impact prediction: to determine what could potentially happen to resources/ receptors as a consequence of the project 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.

1.9.8 ENVIRONMENTAL MANAGEMENT AND MONITORING

The final stage in the EIA Process is preparation of the management and monitoring measures that are needed to ensure:

- a) Environmental impacts and their associated Project components remain in conformance with applicable regulations and standards; and
- b) Mitigation measures are effectively implemented within permissible level..

An Environmental Management Plan, which is compilation of control and mitigation measures to be implemented with respect to environmental performance for the project road. The Environmental Management Plan includes mitigation measures, budgetary estimates, performance indicators, reporting and monitoring activities.

1.10 LIMITATIONS OF EIA STUDY

The EIA report is based on the preliminary designs which were prepared for the road. The final design would be developed by the Contractor before the initiation of construction. Even though no major changes are expected in the design the EIA report needs to be verified against the final engineering design. Further, the report has been developed on certain information available at this point of time, scientific principles and professional judgement to certain facts with resultant subjective

interpretation. Professional judgement expressed herein is based on the available data and information.

1.11 STRUCTURE OF THE EIA REPORT

The EIA report for the project road has been prepared complying country regulations and The World Bank Guidelines for Environmental Assessment. The EIA report has been structured in the following Chapters:

Chapter 1 as Introduction describes background, brief description of project road, needs and benefits of the project road, scope of environmental assessment, needs of EIA study, approach and methodology adopted and structure for EIA report.

Chapter 2 as Project Description describes existing road conditions and facilities, traffic projections, right of way, proposed bypass and realignment, proposed roadway improvements, bridge and cross drainage structures, junctions improvement, underpass, community facilities, construction materials requirement and sources, way side amenities, road safety improvement proposal, etc.

Chapter 3 as Policy, Legal and Administrative Framework presents the legal and administrative framework of World Bank, Government of India and Government of Andhra Pradesh. This section underlines various clearances, permissions, consents involved for the project road at the State level and at the Central level.

Chapter 4 as Baseline Environmental Conditions presents the existing environmental conditions along the corridor, which were ascertained by conducting a field survey along with collection of secondary information pertaining to the corridor. Primary data for various environmental parameters was generated using suitable monitoring devices. The methodology was strictly adhered to the stipulated guidelines by MOEF&CC and CPCB.

Chapter 5 as Anticipated Environmental Impacts describe identification and evaluation of anticipated environmental impacts caused on various environmental and social parameters by the various activities proposed for the upgradation of the project road.

Chapter 6 as Analysis of Alternatives presents analysis of alternatives carried out during EIA studies considering with and without project, alternatives for bypasses and realignments, pavement technologies, construction materials, etc.

Chapter 7 as Green Initiatives Chapter describes green highway, green initiatives, GHG emissions reductions and climate resilient initiatives adopted in the project and estimated GHG emissions reduction.

Chapter 8 as Consultations with Key Stakeholders provide details of consultation carried out in order to know the feedbacks of local population and the project affected people (PAP). Key stakeholder Consultation meetings were held with

the stake holders to record their views on the environmental issues pertaining to the road and the suggested remedies to be adopted for the proposed project road.

Chapter 9 as Environmental Management Plan describes mitigation measures to avoid or minimization of anticipated environmental impacts during design, preconstruction, construction and de-mobilization phases. Environmental Management Plan that include institutional aspects of the project implementation and cost estimates for implementation of EMP.

Annexure referred in the EIA report have been enclosed at the end of EIA report as Annexure.

CHAPTER 2

PROJECT DESCRIPTION

2.1 Project Profile

The project road starts from Bowdara (18°11'51.83"N Latitude, 83° 7'21.78"E Longitude) and ends at Vizianagaram (18°11'51.83"N Latitude, 83°7'21.78"E Longitude) on SH-26. Approximate length of the project road is 26.929 Km traversing Bowdara, Tatipudi, Gantyada and Vizianagaram. The project road is located in Vizianagaram and Visakhapatnam districts of Andhra Pradesh State. The key map of the project road is shown in **Figure 2.1**.

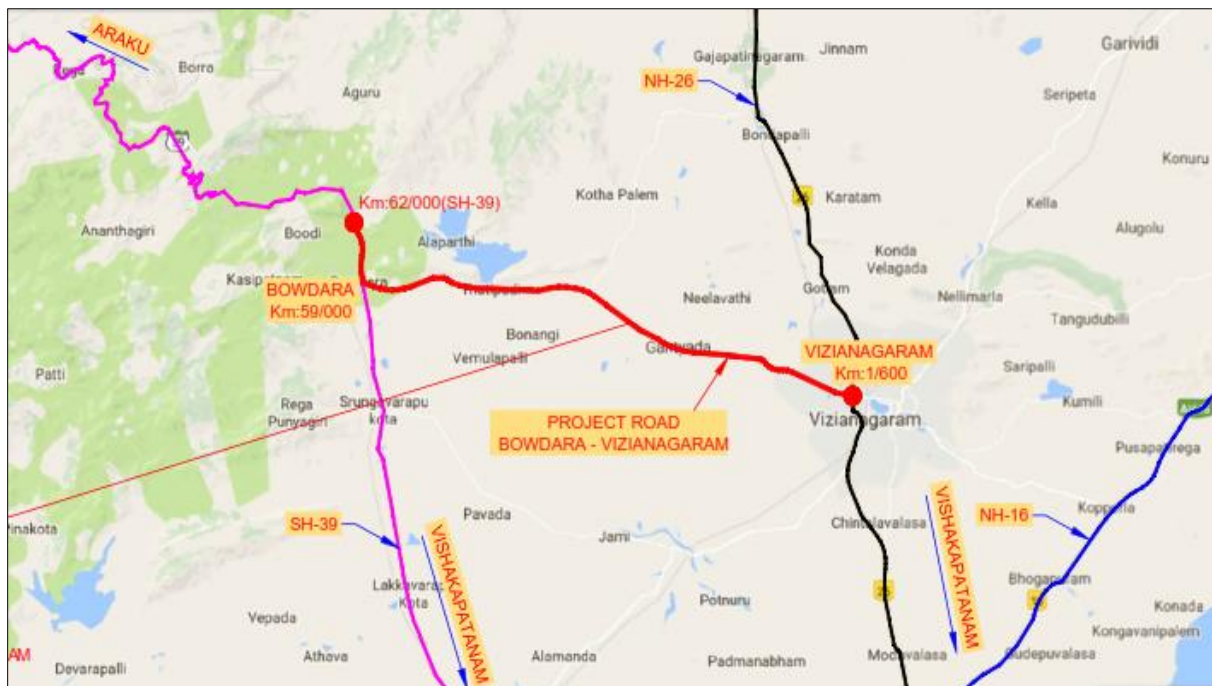


Figure 2.1 Key Map of the Project Road

The project road connecting to Bowdara - Vizianagaram Road Section (is about 26.9 km length i.e. from km 62/000 of SH-39 to km 1/600 (KM 544/300 of NH-26, near collector office junction Vizianagaram) of state of Andhra Pradesh. The project road passes through important towns/villages like Bowdara, Tatipudi, Gantyada and Vizianagaram. The project stretch traverses through plain terrain and have mostly poor geometry. The district wise length of the project is given in **Table 2.1**.

Table 2.1: District wise project Road Alignment

Road section	From (km)	To (km)	Length(km)	District
NH-516 E	0	2+100	2.1	Visakhapatnam
	2+100	26+900	24.8	Vizianagaram

Source: Design report

2.2 Project Alignment

The description of existing road alignment is described below:-

- The entire project road traverses through plain terrain. The carriageway, in general, is of two lanes with average lane width of 7.10 m.
- Width of the earthen shoulder varies in between 0.4 m to 0.75 m in general.
- The horizontal geometry along the existing road found to be very poor with multiple sharpe curves and substandard curves at many isolated locations.
- The vertical profile of the existing road is fair except at few isolated locations with substandard sight distances.
- 2 realignments are proposed at Bowdara Junction and Tadipudi Village.

2.3 Existing Road Features and Constraints

The major constraints or challenges of utilizing the current facility on the road are as listed below:

- a) Dense Built-up and Settlements
- b) Limited Right of Way
- c) Poor Condition of the existing pavement
- d) Poor Condition of existing cross drainage structures
- e) Safety of Road Users
- f) Poor Geometry

The immediate outcome of the project road is to provide accessibility to social services and markets, increased fuel efficiency, reduced travel time, reduction in accidents, reduction in vehicle emissions and increase employment opportunities apart from agriculture, both through improved access to economic centres and increased industrial and tourism activities in the project area.

2.3.1 Dense Built Up Areas & Settlements

The project road traverses through 18 nos. of major built-up / settlements. The presence of these settlements obstructs the flow of traffic due to reduction in speed. The traffic flowing through these sections also creates potential road safety hazard to pedestrians. The major settlements along the road are listed in **Table 2.2**.

Table 2.2: List of Major Built-Up / Settlements along Project Road

S.No	Village Name	From	To	length	District
1	Venkayyapalem	0	850	850	Visakhapatnam
2	Chilakalagedda	850	2100	1250	
3	Tennuboddavara	2100	3600	1500	Vizianagaram
4	Kiltampalam	3600	5800	2200	
5	Chinakhandepalli	5800	6100	300	
6	Chidipalem	6100	6500	400	
7	Bheemavaram	6500	7400	900	
8	Mushidipalli	7400	9800	2400	
9	Tatipudi	9800	10800	1000	
10	Madanapuram	10800	13300	2500	
11	Kottavelagada	13300	15600	2300	
12	Kondatamara Palli	15600	17750	2150	
13	Buradapadu	17750	17900	150	
14	Korilam	17900	19750	1850	
15	Gantyada	19750	22720	2970	
16	Kotarubilli	22720	24450	1730	
17	Narava	24450	26100	1650	
18	Ramavaram	26100	26900	800	

There is total 4.450 K of built up length, which is congested and obstructing traffic due to pedestrian movement and become accident prone.

2.3.2 Right of Way

The existing RoW varies from 17 to 28m. Additional ROW will be required for curve improvements and realignments. RoW of 30m is proposed throughout the road and major realignments respectively. The proposed right of way is given in **Table 2.3**.

Table 2.3: Proposed ROW for the Project Road

S.No	Proposed Chainage		Length (m)	PROW
	From	To		
1	0+000	2+700	2700	30
2	2+700	3+150	450	30
3	3+150	9+680	6530	30
4	9+680	11+150	1470	30
5	11+150	16+700	5550	30
6	16+700	17+300	600	*
7	17+300	20+500	3200	30
8	20+500	20+800	300	40
9	20+800	21+400	600	30
10	21+400	23+400	2000	*
11	23+400	24+900	1500	30
12	24+900	26+000	1100	*
13	26+000	26+937	937	30
14	26+937	32+248	5311	
17	Total Length (m)		32248	

2.3.3 Deficient Cross Drainage Structures and Improvements

There is no river crossed the alignment. The project road is having one major bridge, 4 minor bridges, 18 slab culverts and 71 pipe culverts.

The existing bridge has 7.4m deck width comprising of 7.0m wide carriageway and the bridge super structure is of RCC T- Girder and slab and Substructure is of RCC wall type abutments and trussel type piers.

Most the minor bridges in the project road are Arch type constructed with bricks, and are in poor structural condition *i.e.* disintegration of bricks, visible cracks and poor plastering.

There are 89 existing culverts in total with 71 and 18 slab/arch culverts along the project stretch. The width of the existing culverts ranges from 6.6m to maximum of 15.5m. All the existing culverts which are in fair condition are proposed for widening without opening in the median portion.

In general widening is proposed to match with the cross section of approach at the culvert locations. The all slab culverts are proposed for widening as they are hydraulically adequate and structurally fair in condition in with course rubble masonry substructure and foundation is proposed for reconstruction with box culvert of

equivalent or higher vent area. The summary of existing bridge and other structures are given in **Table 2.4.**

Table 2.4: Summary of Existing Bridges and Other Structures

Description	Numbers
Number of Major Bridge	1
Number of Minor Bridges	4
Number of Slab/Arch Culverts	18
Number of Culverts	71
Number of Viaducts	0
ROBs	0
Number of VUP/PUP/Overpass	0
Number of Causeways	0
Total No. of other Structures	93

2.3.4 Safety of the Users

With improvement of existing intermediate/two lane to two lane with paved shoulder standards, safety of the commuters will be increased as this will improve the visibility and additional carriageway space. Road users will also be facilitated with different project amenities, slope protection measures, road markings and sign etc., which will improve the safety of commuters along the project road.

The project road traverses through built-up / settlements. The presences of these settlements obstruct the flow of traffic due to reduction in speed. The traffic flowing through these sections also creates potential hazard to pedestrians. Hence, 2 realignments are proposed in order to provide a safe and congestion free passage to road users.

2.3.5 Network Connectivity and Alternate Route Study

The survey data was analyzed to assess the lead distribution for goods vehicles. The distribution observed for different vehicle types is grouped into various ranges and lead distribution data are presented in Table 2.5 for survey Location.

Table 2.5: Trip Length Distribution of Goods Vehicles at Km 8+100 on Vizianagaram-Bowdara Road

Lead Distribution of Goods Vehicles-2017- Trip length %					
Trip Length(Km)	LCV	2 Axle	3 Axle	4-6 Axle	MAV
0-20	61.8	43.7	58.8	60	0
21-50	32.7	40.8	23.5	0	0

Lead Distribution of Goods Vehicles-2017- Trip length %					
Trip Length(Km)	LCV	2 Axle	3 Axle	4-6 Axle	MAV
51-100	3.6	8.5	11.8	0	0
101-250	1.8	2.8	5.9	0	0
251-500	0	2.8	0	0	0
501-750	0	1.4	0	20	0
751-1000	0	0	0	0	0
1001-1500	0	0	0	0	0
1501-3000	0	0	0	20	0
>3000	0	0	0	0	0
Total	100	100	100	100	0

The average Lead for freight vehicles is given in **Table 2.6**.

Table 2.6: Average Lead by Vehicle Types

Vehicle Type	Type of Vehicle	ATL (kms)
1	LCV	23.45
2	2-Axle Truck	47.42
3	3-Axle Truck	35.71
5	4 -6 Axle	461.6
6	7++ Axle	0

2.3.6 Average Occupancy and Average Trip Length of Passenger Vehicles

The average occupancy and average lead at different locations for passenger vehicles are presented in **Table 2.7**.

Table 2.7: Average Lead & Occupancy for Passenger Vehicles

Average Lead & Occupancy		
Vehicle Type	Average Lead (in Kms)	Average Occupancy
Car/Taxi/Jeep	31.37	3
Shared taxi	12	15
Min bus	0	0
Govt. Bus	27.72	32
Pvt Bus	30.38	20

2.3.7 Trip Purpose

The trip purpose distribution of the passenger vehicles is given in

Table **2.8.**

Table 2.8 : Distribution of Trip Purpose

S. No.	Trip Purpose	Vehicle Type				
		Car/Taxi/Jeep	Shared taxi	Min bus	Govt. Bus	Pvt. Bus
1	Work/Office	19.75	100	0	100	0
2	Business	33.61	0	0	0	100
3	Education	2.94	0	0	0	0
4	Social	0.84	0	0	0	0
5	Shopping	1.26	0	0	0	0
6	Religious/Tourism	19.75	0	0	0	0
7	Health	21.85	0	0	0	0
	Total	100	100	0	100	100

The purpose wise percentage distribution of Cars shows that significant proportion of trips is business related, work and religious related.

2.3.8 Commodity Analysis

Mode-wise distribution of various commodities is presented in the Table

Table 2.9: Vehicle wise Commodity Distribution (%) at Km 8/100 on Vizianagaram-Bowdara Road

Commodities Carried by Different Categories of Vehicles-2017-Count						
S.No	Commodity code	LCV	2 Axle	3 Axle	4-6 Axle	MAV
1	Empty	47%	42%	47%	40%	0%
2	Agricultural Products	5%	13%	53%	20%	0%
3	Forest Products	0%	0%	0%	0%	0%
4	Fuel and Oil	4%	3%	0%	20%	0%
5	Construction Material	4%	24%	0%	0%	0%
6	Minerals and gases	4%	0%	0%	0%	0%
7	Chemical and Fertilizer	0%	0%	0%	0%	0%
8	Machinery	0%	4%	0%	0%	0%

Commodities Carried by Different Categories of Vehicles-2017-Count						
S.No	Commodity code	LCV	2 Axle	3 Axle	4-6 Axle	MAV
9	Other Manufacturing Goods (Electronic Product, cloths, Iron & Steel Product, Leather product etc)	4%	6%	0%	20%	0%
10	Others (Vegetables, animal & their product, leather, wooden furniture, mixed goods, household goods etc.)	33%	8%	0%	0%	0%
Total		100	100	100	100	100

Major commodities that are transported on Vizianagaram-Bowdara road are Agricultural products, Manufacturing goods and other goods such as Vegetables, Household goods, etc. as observed from OD survey conducted near to Narava.

2.4 Traffic Study

The traffic was counted at 5 locations, along the project road section at chainages 12/700 Km, 8/100 Km, 1/600Km, 16/900 Km and 30/918 Km in April 2017. The vehicle wise the annual average daily traffic (AADT) along the project road section is presented in **Table 2.10**.

Table 2.10: Vehicle Wise ADT and AADT for Bowdara-Vizianagaram Road

Vehicle Type/Location	Km 12+700	
	ADT	AADT
Car/ Jeep/Van	474	469
Taxi	4	4
Two wheeler	3871	3833
3wh(pass)	1553	1537
Minibus	10	10
School Bus	18	19
Bus (Govt.)	131	137
Bus (Pvt)	9	9
Light Motor Vehicle	299	311
LCV	62	64
2-Axle	94	98
3-Axle	41	42

Vehicle Type/Location	Km 12+700	
	ADT	AADT
4-Axle and 6 Axle	15	15
7 Axle Above	1	1
Tractor	10	11
Tractor with Trailer	69	72
Cycle	129	129
Cycle Rickshaw	10	10
Animal cart	8	8
Others	5	5
Toll exempted Car/Jeep	1	1
Toll exempted Bus	1	1
Toll exempted LCV	0	0
Toll exempted Truck	0	0
Total Passenger Vehicles	6071	6018
Total Freight Vehicles	591	615
Total Fast Moving Vehicles	6662	6633
Total Slow Moving Vehicles	152	152
Total Vehicles	6814	6785
Total PCU	5806	5834

2.4.1 Estimated Traffic

The projected traffic on the project road is presented in **Table 2.11**.

Table 2.11: Estimated and Recommended Traffic Growth Rates

Year	PCU
2017	5834
2018	6165
2019	6517
2020	6889
2021	7283
2022	7712
2023	8166
2024	8649
2025	9161
2026	9705

Year	PCU
2027	10176
2028	10671
2029	11191
2030	11736

Threshold for 4-lane for rolling terrain is 10000 PCUs which is reaching after 8 years Project is proposed to be improved with 2-lane with paved shoulders.

2.5 Design Speed

The design standards for the project road have been set from IRC SP 73-2015 "Manual of Specifications and Standards for Two-Laning with Paved shoulders" and IRC SP 84-2014 "Manual of Specifications and Standards for Four-Laning of Highways through public private partnership.

The project road is proposed for improvement two lanes with paved shoulders with design speed of 80-100 kmph in throughout the stretch.

2.6 Widening Proposal with Typical Cross Sections

In view of traffic requirements, widening scheme with various typical cross sections (TCS) have been developed to meet the need of the project road. Details of proposed and widening and upgradation scheme with cross sectional elements for particular typical cross sections and location-wise application of TCS are given in **Table 2.12**. Corresponding typical cross sections are shown in **Figure 2.2 to Figure 2.6**.

Table 2.12: Typical Cross Sections Schedule

S.No	Proposed Chainage		Length (m)	TCS Type	PROW	Remarks
	From	To				
1	0+000	2+700	2700	TCS-1	30	Rural section
2	2+700	3+150	450	TCS-2	30	Realignment/Curve Improvement (Bowdara Junction)- to avoid impact

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S.No	Proposed Chainage		Length (m)	TCS Type	PROW	Remarks
	From	To				
						on settlements and not to reduce design speed
3	3+150	9+680	6530	TCS-1	30	Rural section
4	9+680	11+150	1470	TCS-2	30	Major Bridge/Tatipudi village Realigned - To avoid sharpe curve at approaches, improve geometry, design speed and reduce impact on settlments
5	11+150	16+700	5550	TCS-1	30	Rural section
6	16+700	17+300	600	TCS-3	*	Thamarapalli village
7	17+300	20+500	3200	TCS-1	30	Rural section
8	20+500	20+800	300	TCS-4	40	Toll Plaza @ 20+650
9	20+800	21+400	600	TCS-1	30	Rural section
10	21+400	23+400	2000	TCS-3	*	Gantyada village
11	23+400	24+900	1500	TCS-1	30	Rural section
12	24+900	26+000	1100	TCS-3	*	Narva village/Rural section
13	26+000	26+937	937	TCS-1	30	Rural section
	Total length (m)		26937			
Note:* As per existing Right of way						

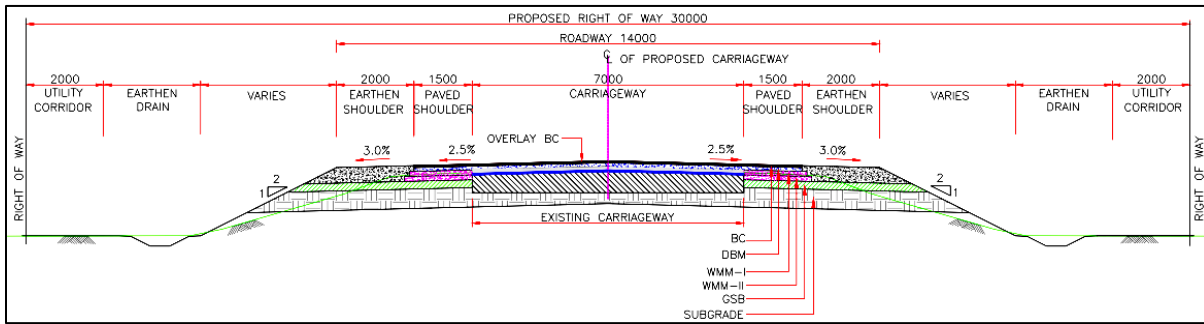


Figure 2-2: TCS-1 _2-LANE WITH PAVED SHOULDER IN RURAL SECTION (Overlay with Widening)

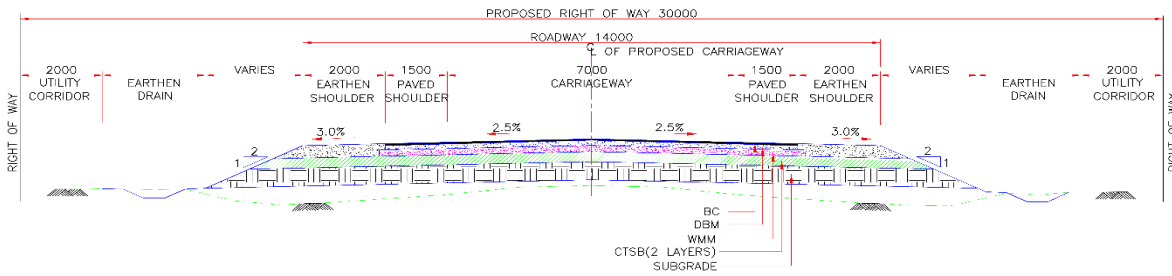


Figure 2-3: TCS-2 _2-LANE WITH PAVED SHOULDER IN RURAL SECTION (Realignments and Curve Improvement)

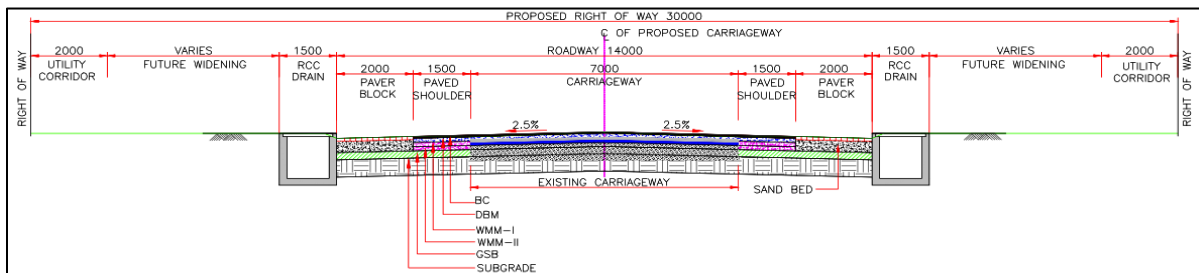


Figure 2-4: TCS-3 _2-LANE WITH PAVED SHOULDER IN BUILTUP SECTION (Concentric -overlay with widening)

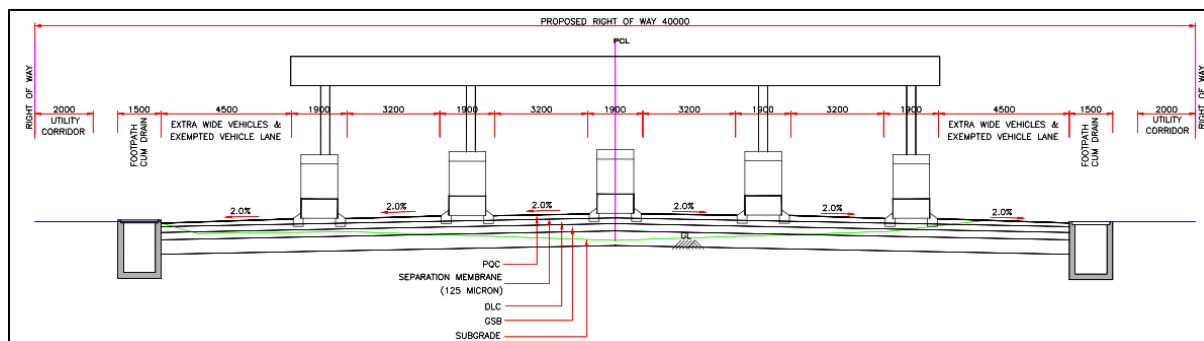


Figure 2-5: TCS-4 _2+1 LANES ON EACH SIDE TOLL PLAZA SECTION (Concentric –overlay with widening)

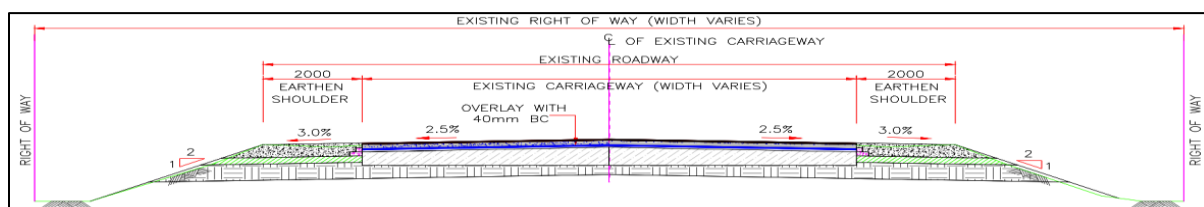


Figure 2-6: TCS-5 _2-LANE WITH PAVED SHOULDER IN ONETIME IMPROVEMENT SECTION (Concentric –overlay with widening)

2.7 Existing and Proposed Pavement

The experienced professionals have undertaken this investigation to collect the detailed visual information of the pavement and its associates. The observations are recorded at an interval of 100m along the project corridor, and the required information as per IRC: SP: 19-2001 was collected. Detailed pavement condition survey data at every 100m interval is presented in **Table 2.13**.

Table 2.13: Summary of Pavement Condition of the Project Road

S. No.	Existing Chainage (km)			Rutting (mm)	Distresses (% Area)				Other Distresses	Overall Condition
	From	To	Length		Cracking	Potholes	Patching	Ravelling		
1	62/400	59/400	3	5	4	2	-	3	Bleeding at few isolated locations	FAIR
2	30/900	27/200	3.7	5.0	9	4	-	3.0	Bleeding	FAIR

S. No.	Existing Chainage (km)			Rutting (mm)	Distresses (% Area)				Other Distresses	Overall Condition
	From	To	Length		Cracking	Potholes	Patching	Ravelling		
3	27/200	25/000	2.2	8.0	2	-	-	-	-	FAIR
4	25/000	9/100	15.9	6.0	4	-	-	8.0	Bleeding	FAIR
5	9/100	2/700	6.4	5.0	5	4	3.000	6.0	Paved Shoulder Under Construction	FAIR
6	2/700	1/600	1.1	2.0	5	3.0	-	4.0	-	FAIR

2.8 Bypasses and Realignments

There is no bypass proposed in the project road. Two realignments have been proposed in the project road at Bowdara Junction and Thatipudi. Details of realignments proposed, are given in **Table 2.14**.

Table 2.14: Realignment Locations

S. No.	Road Name	Proposed Chainage		Length (Mts)	Remarks
		From	To		
1	Bowdara Junction	2+700	3+150	450	Re-alignment
2	Thatipudi	9+680	11+150	1470	Re-alignment
Total Length (m)				1920	

Source: Design Report

2.9 Proposed Structures

The project road is having one major bridge, 4 minor bridges, 18 Box/slab culverts and 71 pipe culverts. one new major bridge is proposed on project road. Out of four minor bridges two are proposed for repair and widening, while reconstruction and new construction of one minor bridge each. The summary of proposed structures on the project road is presented in **Table 2.15**.

Table 2.15: List of Structures

S. No.	Type of proposed structure	Retained with Repair	Repair & Widening	Reconstruction	New Structures	Total Structures
1	Major Bridge	0	0	0	1	1
2	Minor Bridge	0	2	1	1	4
3	Pipe Culvert	0	47	38	1	86
4	Box/Slab Culvert	0	17	1	1	19
5	ROB	0	0	0	0	0
6	VUP	0	0	0	0	0
7	VUP Grade-II	0	0	0	0	0
8	Pedestrian Subway	0	0	0	0	0

2.9.1 Major and Minor Bridge

All existing minor bridges are having RCC solid slab type superstructure, stone masonry wall type substructure and with open foundation.. Details of major and minor bridges are given in Table 2.16 and Table 2.17, respectively.

Table 2.16: Major Bridges Details

S. No	Existing Chainage	Design Chainage	Type of bridge	Details of existing bridge					Improvement Proposal								Remarks
				Type of superstructure	Type of foundation	Span configuration	Total length in (m)	Deck width (m)	Improvement Proposal	Type of superstructure proposed	Type of foundation proposed	Span configuration	Total length of new Bridge (m)	Deck width of New Bridge (m)	Bridge Configuration		
1	22+612	9+883	Major Bridge	RCC T-Girder and slab	-	5x19 + 5 + 4x13.5	154	7.4	New construction	RCC I-Girder	Pile foundation	7x20	140	16	2 lane with footpath	Realignment	

Table Error! No text of specified style in document.-17: Minor Bridges To Be Repaired and Widened

S.No	Existing Chainage as per survey (Km)	Design Chainage as per survey (Km)	Type	Super Structure Type	Sub Structure Type	No of Spans	Clear Span (m)	Total deck width	Improvement proposals / Proposed structural configuration	Type of Structure	No of Spans	Clear Span (m)	Total length of Bridge (m)	Proposed width of structure (m)	Bridge Configuration	Remarks
1	6+212	26+511	MNBR	Solid Slab		2	3.3	12	Widening	MNBR	2	3.3	6.6	16	2 lane + PS	-
2	8+212	24+526	MNBR	Solid Slab		1	6.2	12	Widening	MNBR	1	6.2	6.2	16	2 lane + PS	-
3	15+162	17+570	MNBR	Brick Arch	Stone Masonry	3	8.2	24.6	Reconstruction	MNBR	4	7.5	30	16	2 lane + PS	Raft foundation with soil replacement 0.9m
4	22+462	10+092	MNBR	Brick Arch	Stone Masonry	1	6.1	6.1	New Construction	MNBR	1	8	8	16	2 lane + PS	Raft foundation with soil replacement level of 65.318

2.9.2 Vehicular Under Pass (VUP)

There is no vehicular under proposed in the project road.

2.10 Major and Minor Junction Improvement

On the basis of intersection traffic, neighboring landuse, physical constraints, Consultants have proposed appropriate control for major intersections along project road. The improvements, in form of grade separation, signalisation and priority control are analysed based on the Indian Road Congress guidelines.

Details of major junctions improvement proposed on the project road are given in **Table 2.18**.

Table 2.18: Major Junctions on the Project Road

Major Junctions						
Sl.No.	Name of Intersection	Existing Chainage (km)	Design Chainage (km)	Connecting To	Type of Junction	Remarks
1	Bowdara bypass	-	2+700	NH	3 Legged	Near Bowdara Junction

There are 23 minor junctions proposed in the alignment which will be improved as per IRC guidelines as per details given in **Table 2.19**.

Table 2.19: Minor Junctions Improvement Proposal

S. NO	Existing Chainage	Proposed Chainage	Road Leading To LHS	Road Leading To RHS	Cross Road	Type of Junction	Type of Surface	Direction	Remark
1	-	0+850	Village	-	VR	3 Legged / 'T'	Mud road	LHS	
2	30/020	3+820	Village	-	VR	3 Legged / 'T'	Mud road	LHS	
3	29/020	4+820	-	Village	VR	3 Legged / 'T'	Mud road	RHS	
4	28/350	5+500	-	Village	VR	3 Legged / 'T'	Mud road	RHS	
5	27/650	6+200	-	Village	VR	3 Legged / 'T'	Mud road	RHS	

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S. N O	Existing Chainage	Proposed Chainage	Road Leading To LHS	Road Leading To RHS	Cross Road	Type of Junction	Type of Surface	Direction	Remark
6	25/700	8+150	-	Village	VR	3 Legged / 'T'	Mud road	RHS	
7	25/100	8+780	Thatipudi	-	VR	3 Legged / 'Y'	Mud road	LHS	
8		9+580		Village					
9		9+700	Thatipudi			Start Of Realignment			
10		10+900	Thatipudi			End Of Realignment			Replace of 11+100
11	21350	12+550	-	Madanapuram	VR	3 Legged / 'Y'	Mud road	RHS	
12	19/320	14+550	Village	-	VR	3 Legged / 'T'	Mud road	LHS	
13	17/500	16+400	Padmaji Palam	-	VR	3 Legged / 'Y'	BT	LHS	
14		17+000	-	Vasadi	VR	3 Legged / 'Y'	BT	RHS	
15	15/200	18+700	Ginjera	-	VR	3 Legged / 'Y'	BT	LHS	
16	14/580	19+300	Field	Korlam Village	VR	4 Legged / '+'	Mud road	Both sides	
17	14/080	19+800	-	Korlam	VR	3 Legged / 'T'	BT	RHS	
18	14/050	19+820	Gantyarda Bypass	-	VR	3 Legged / 'T'	BT	LHS	
19	9/850	24+000	Kottarupalli	Field	VR	4 Legged / '+'	Mud road	Both sides	
20		25+400	Jaggampuram		VR	3 Legged / 'Y'	BT	LHS	
21	7/750	26+100	A.M.G Bethsaida	Field	VR	4 Legged / '+'	Mud road	Both sides	
22		27+500	Ramavararam	-	VR	3 Legged / 'T'	BT	RHS	
23		30+700	To Ayyanapetta	-	VR	3 Legged / 'T'	BT	RHS	

2.11 Toll Plaza

In the project road, 2+1 lanes toll plaza has been proposed on either sides. The details of the Toll Plaza are given **Table 2.20**.

Table 2.20: Details of the Toll Plaza Proposed Along the Project Road

S.No	Proposed Chainage		Length (m)	Remarks
	From	To		
1	20+500	20+800	300	Toll Plaza @ Km 20+650

2.12 Bus Bays and Truck Lay-byes

Bus Shelters and bus bays are proposed at the 6 locations as given in **Table 2.21**.

Table 2.21: Locations of Proposed Bus Bay and Bus Shelter

Sl. No	Existing Chainage (km)		Proposed Chainage (km)		Direction	Remarks
	From	To	From	To		
1	59/800	59/570	2+250	2+480	LHS	Bowdara
2	30/500	30/270	3+350	3+580	RHS	
3	24/650	24/420	9+350	9+580	LHS	Tatipudi
4	22/650	22/420	11+350	11+580	RHS	
5	12/850	12/620	21+150	21+380	LHS	Gantyada
6	10/250	10/020	23+750	23+980	RHS	

There is no truck lay bye proposed in the project road.

2.13 Drainage

The IRC: SP 42 will generally be followed for design of highway drainage. The planning of highway and drainage is intricately linked with the terrain, alignment of the highway and the proposed cross drainage works. The planning and designing of adequate drainage system is a primary requirement for maintaining a structural soundness and functional efficiency of a road. Pavement structure including sub-grade must be protected from any ingress of water; otherwise over a period of time it may weaken the sub-grade by saturating it and cause distress in the pavement structure. Hence disposal of water from the pavement and sub-grade is a basic consideration in road design. Over and above quick drainage takes away the water from pavement surface and reduces chances of skidding of vehicles. In order to guard

the pavement from the poorly drained conditions, planning, designing, construction and maintenance of longitudinal drains on either side of the roads is very much essential. The surface water from the pavement and shoulders will be made to flow into the drains by providing suitable cross Slopes / Camber.

Earthen drains are provided through-out the project corridor to ensure efficient drainage from carriageway to drain. All drains are connected to cross drainage structure. Median drains are provided with rain water harvesting structure. Proper drainage arrangements are provided for grade separated structures. If requires, CD work is also provided for loops and ramps.

a) Surface Drains

Surface drainage is proposed for the road stretch in the built-up sections to carry the surface water in to the percolation pits / rainwater harvesting pits provided. The details of surface drain are shown in Table 2.22.

Table Error! No text of specified style in document.-22: Locations of Lined Drainage

S. No.	Design Chainage		Length(meter)	Remarks
	From	To		
1	16+700	17+300	600 X 2	Both sides
2	21+400	23+400	2000 X 2	Both sides
3	24+900	26+000	1100 X 2	Both sides
		Total	7400	Both sides

Proper drainage arrangement of earthen drain length of 46400m and RCC drain length of 7400m (both sides) at built up locations are proposed

2.14 Rain Water Harvesting Units

In the project road, 108 nos. of rain water harvesting units has been proposed.

2.15 Wire Roped Crash Barriers

At high embankment locations Wire roped crash barriers are proposed with a length of 1750m.

2.16 Energy dissipation units

155 nos. of Energy dissipation units has been proposed at high embankment locations

2.17 Road Safety

2.17.1 Road Accident Data

The accident data collected in 2018 for the project road is given in Table 2.23:

Table 2.23: Accidents Data for the Project Road for 2018

Police Station	Year	Nature of Accidents		ASI
		Fatal	Non-Fatal	
Gantyada	2012	2	12	60
	2013	3	14	74
	2014	3	16	82
	2015	0	18	72
	2016	1	15	66
Vizianagaram	2012	0	7	28
	2013	0	12	48
	2014	2	1	16
	2015	1	5	26
	2016	1	8	38

It is observed that Ramavaram, Narava and Gantyada are found to be most accident prone areas on Bowdara -Vizianagaram road. All the accident black spots have been reviewed and appropriate measures are proposed. The proposed upgradation of the project road will be help in avoiding accident and enhance road safety.

2.17.2 Remedies and Improvements for Black Spot Removal

Majority of the accidents have occurred near the intersections and curved sections. Therefore, all the intersections have been designed according to the standards specified in the MORTH Type Design for Intersections on National Highways.

2.17.3 Road User Safety Solutions

a) Highway Design: Geometry of the road have been designed as per the applicable Design speed and relevant codes and standards. The deficient curves (horizontal and vertical) along the existing geometry will be improved. Super elevation as per the curve radius will be provided in order to avoid overturning of vehicles due to speed. Adequate sight distances will be provided in order to avoid blind spots both horizontally and vertically.

Substandard horizontal and vertical geometry is improved at chainages Km 2/700 to Km 3/280 and Km 9/680 to Km 11/150 etc. to improve the sight distance and to maintain the design speed.

b) Road Signs: As per the applicability and requirement, road signs will be place all along the road in order to guide the road user to traverse safely. A combination of road signs like Mandatory – Regulatory signs, Cautionary-Warning signs and Informatory signs will be installed. Variable Message signs will also be placed at identified locations in order to inform road user about various details like climatic conditions ahead, diversions, accident zones, speed reduction zones etc.

c) Mast Lights and Traffic Lights / Signals: Traffic signals will be generally installed at intersections to control the movement of vehicles. All traffic must move in conformity with the traffic lights or signals. Traffic Signals, Pedestrian Signals and Lane Marking signals,

Two high mast lights at Toll plaza locations, 264 nos of single arm lights are proposed at built up and Junctions locations.

d) Pavement Markings: Pavement markings will be provided to delineate the centre of road, identify travel lane, define road edge. Pavement markings also provide information about special lane use. Markings can also be in the form of patterns, arrows, or other devices set into or attached to the carriageway or kerbs or to objects within or adjacent to the carriageway, for control, warning, guidance or information of road users.

2.17.4 Pedestrian Safety

1) Pedestrian Signals

Pedestrian Signals will be installed at the urban locations where pedestrian movement is heavy.

At crossings with medium pedestrian crossings a push button traffic light can be installed. Pedestrians can push the button and wait for the light to turn green and then move on and cross cautiously.

2) Guard Rails and Lighting

Pedestrian Guard Rails will be installed at the following locations.

a) Hazardous locations on Straight Sections: In particularly busy reaches where the road is congested and vehicles move at a fast pace, guard rails should be provided on both sides of the carriageway so as to channelize the pedestrian on to the planned crossing locations.

b) At Junctions/Intersections: Railing barriers will be provided to prevent people from crossing the junctions diagonally at signalised intersections. The barrier must open only at planned crossing facility (at zebra crossing). At Signalised junctions' sufficient length of guard rail will be provided to guide the pedestrian to the neared planned pedestrian crossing.

c) School Colleges: Guard rails will be provided near schools in order to prevent children to run straight into the road.

d) Bus Stops, Railway Stations, Temple etc: Guard rails will be provided alongside walks with suitable access at bus stops, railway stations and other areas of heavy pedestrian activity such as cinema houses, stadiums etc.

e) Overpass, Subway etc.: Guard-rails is to be provided at Overpasses and subways in order to compel the pedestrians to use the facilities provided for them.

3) Pedestrian Crossings

a) Zebra Crossings: Zebra crossings will be provided along with stop lines as per IRC 35 for safe crossing of pedestrians.

b) Hump Subways: Hump subways are provided by providing the subway partially under ground and partially over the ground in order to reduce the walking length.

c) Full Subways: Full subways are provided by providing the subway fully under the ground.

d) Foot Over bridge: FoB will be provided where there are space constraints and heavy pedestrian movement.

4) Footpath

Footpath with Kerb and pedestrian guard rail will be proposed continuously throughout the urban and built-up sections in order to provide a safe passage for pedestrians to walk along the traffic.

2.17.5 Road Safety Schedule and Traffic Calming Measures

Detailed road safety schedule and traffic calming measures are provided in the form of detailed design report. The schedule contains the provision and locations of road markings and road Signs for all the major junctions, minor junctions, schools, temples, Govt. Offices, other community buildings etc.

2.18 Construction Materials

In this project, the cutting /excavated materials are proposed to be reused in construction of pavement, structure and slope protection work. The existing bituminous surface will be scrapped and reused after proper treatment in new construction of pavement. The excess lime quantity present in the vicinity of project road is proposed to be used in stabilization of sub-base layer.

Construction materials quantities required for the project is given below.

Earthen Soil : 4,92,422 Cum

Granular sub base: 93,828 Cum

Bituminous BC layer: 13,399 Cum

DBM: 10,172 Cum

Concrete: 16,581 Cum

Excavated Material from Roads Section: 2,36,061 Cum

2.19 Construction Schedule

The project will be completed in 18 months time from the date of start the construction.

CHAPTER 3

POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

This section presents the national and state level environmental legislations and regulations; and World Bank Policies relevant to the “Improvement and upgradation of Bowadra-Vizianagaram Road Section of NH 516 E in the State of Andhra Pradesh”. The various environmental regulations applicable and regulatory consents and clearances required for the proposed up-gradation project are also been incorporated in this section.

3.1 Legal Framework

The Government of India has laid out various policy guidelines, acts and regulations pertaining to environment. The Environment (Protection) Act, 1986 provides umbrella legislation for the protection of environment. As per this Act, the responsibility to administer, the legislation has been jointly entrusted to the Ministry of Environment, Forests and Climate Change (MoEF&CC) at National level, whereas Andhra Pradesh Pollution Control Board (APPCB) at State level in the present context to “Improvement and upgradation of Bowadra-Vizianagaram Road Section of NH 516 E in the State of Andhra Pradesh”.

3.2 Applicable National and State Regulations

The key environmental and other regulations relevant to Improvement and upgradation of Bowdara-Vizianagaram Road Section in the State of Andhra Pradesh is presented in **Table 3.1**.

Table 3.1: Environmental Regulations Relevant to the Project Road

S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required, if any	Authority
1	Environment (Protection) Act- 1986	To protect and improve overall environment	Yes	It is umbrella legislation. Various notifications, rules and schedules are promulgated under this act.	--	MoEF&CC, APPCB
2	Environmental Impact Assessment Notification, 2006 &	Prior environmental clearance for designated activities for category A and	Yes	The project road is not covered under the preview of EIA Notification 2006 and	No	SEIAA/ DEIAA

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S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required, if any	Authority
	subsequent activities	B projects under the Environmental Impact Assessment Notification, 2006 & subsequent activities		subsequent amendment. However, for opening of new borrow areas and stone quarry, prior environmental clearance will be required from SEIAA/DEIAA.	Prior Environmental Clearance for opening borrow areas and stone quarry	
3	Notification for use of Fly ash, 3 rd November, 2009 and its amendment on 25 th January 2016	"No agency, person or organization shall, within a radius of 300 Kilometres of a thermal power plant undertake construction or approve design for construction of roads or flyover embankments with top soils; the guidelines or specifications issued by the Indian Road Congress (IRC) as contained in IRC specification No. SP: 58 of 2001 as amended from time to time regarding use of fly ash	Yes	Simahadry Thermal power plant near Vishakhapatnam is nearest to the project highway & is located at a distance of about 130 km from project Highway. Flyash can provide technically viable, environmentally sound & cost effective alternative to natural borrow soil.	Essential Use of Fly ash in the Road	MORTH
4	Forest Conservation Act, 1980	To check deforestation by restricting conversion of forested areas into non-forested areas	No	The project area does not pass through any forest area.	Prior Forest Clearance for diversion of forest land for non forest activities	Dept. of Forest, Govt. of Andhra Pradesh

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S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required, if any	Authority
5	The Wildlife Protection Act, 1972	To protect wildlife, if occurred along the project	No	This act is applicable for wildlife protection in the Wildlife Sanctuary, National Park, wildlife corridors, etc.	As there is no Wildlife Sanctuary, National Park, wildlife corridors, etc. within 10 km from the project road, hence no clearance is required.	NBWL, MOEF&CC
6	Air (Prevention and Control of Pollution) Act, 1981	To control air pollution & controlling emission of air pollutants as per the prescribed standards.	Yes	This act is applicable for construction phase to control stack/fugitive emissions and to manage ambient air quality at project site and ancillary activities like crusher plant, hot mix plant, concrete batch mix plant, WMM Plants, DG Set etc, for the road The NAAQ standards (CPCB) for Ambient Air Quality have been promulgated by the MoEF&CC for various land uses.	Consent For Establish (CFE) and Consent For Operate (CFO) for hot mix plant, batching plant and WMM Plants, DG sets, etc.	APPCB
7	Water Prevention and Control of Pollution) Act 1974	To control water pollution by controlling discharge of liquid pollutants as per the prescribed standards	Yes	This act is applicable for construction phase of the road to manage to liquid effluent discharges from worker camp, concrete batch mix plant, etc.	Consent for Establish (CFE) and Consent for Operate (CFO) for plants and workers camps, etc.	APPCB
8	Noise Pollution (Regulation and Control) Rule 2000	The standards for noise for day and night have been promulgated by the	Yes	This act will be applicable for all construction equipment/ plant and machinery including vehicles	None	APPCB

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S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required, if any	Authority
		MoEF&CC for various land uses.		deployed for construction of the proposed road to regulate ambient noise levels This act will be applicable to regulate noise nuisance during construction phase		
9	Hazardous and Other Wastes (Management, & Trans-boundary Movement) Rules, 2016 and amended thereof	Protection to the general public against improper handling and disposal of hazardous wastes	Yes	The rules will be applicable to used oil generated from construction equipment/ machinery during construction works. The rule includes storage, handling, transportation procedures and requirements for safe disposal of hazardous wastes	Hazardous Waste Authorization with CFE and CFO	APPCB
10	Construction and Demolition Waste Management Rules, 2016	Safe disposal and management of construction and demolition wastes	Yes	This rule shall be applicable to generation of wastes resulting from demolition of bridge and culvert structures and scarifying of surface of existing road and from road construction activities.	Construction and Demolition Waste Management Plan should be prepared , prior to commencement of works	Local Municipal Corporation
11	Solid Waste Management Rules 2016	Collection and disposal of municipal solid waste	Yes	This rule is applicable to all forms/types of solid waste generated at construction activities, camp site, plant sites, etc..	Solid Waste Management Plan should be prepared , prior to commencement of works	Local Municipal Corporation

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S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required, if any	Authority
12	Guidelines to Regulate and Control Ground Water Extraction in India (With effect from 01.06.2019)	Regulate and control ground water extraction for various purpose.	Yes	NOC is required for infrastructure, mining projects, others requiring water withdrawal	NOC from CGWA	CGWA
13	Mines and Minerals (Development and Regulation) Amendment Act, 2015	This act has been notified for safe and sound mining activity.	Yes	The construction of project road will require aggregate through mining from riverbeds and quarries	Permit and mining lease for stone quarry	Department of mining, State Government
14	Minor Mineral and concession Rules, 2015	For opening new borrow / quarry	Yes	Regulate use of minor minerals like stone, soil, river sand etc.	Permit and mining lease for stone quarry	District Collector
15	Ancient Monuments and Archaeological Sites and Remains Act, 1958	Protection of Archaeological Monuments and Remains	Yes	No notified Archaeological Monuments is located within 300m of the project highway. However for chance finds the said act will be applicable.	Permission from ASI	Archaeological Survey of India
16	Explosive Act 1984	An Act to regulate the manufacture, possession, use, sale, [transport, import and export] of Explosives	Yes	If contractor open stone quarry and use explosive for quarrying	License for storage and handling of explosive.	Chief Controller of Explosives
17	The Building and Other Construction Workers (regulation of employment and conditions of service) Act, 1996	To regulate the employment and conditions of construction workers and to provide for their safety, health and welfare measure and for other matter incidental thereto	Yes	To ensure safety and welfare measures for workers employed at construction sites. Compliance to provisions of health and safety measures for the construction workers in	None. Safety and welfare measures for work force employed at construction sites are to be regulated in conformity with this act.	State Labour Department

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S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required, if any	Authority
				conformity with BOCW rule concerning safety and health in construction. These regulations to be complied with during the construction of proposed road works.		
18	Bonded Labour System (Abolition) Act, 1976 along with Rules, 1976	An Act to provide for the abolition of bonded labour system with a view to preventing the economic and physical exploitation of the weaker sections of the people and for matters connected therewith or incidental thereto	Yes	Contractors shall employ numbers of Labours during Construction Phase. Contractor will ensure that there is no Bonded Labour by him or sub contractors.	Labour License	State Labour Department
19	Contract Labour (Regulation and Abolition) Act 1970 along with rules, 1971	The Object of the Contract Labour Regulation and Abolition) Act, 1970 is to prevent exploitation of contract labour and also to introduce better conditions of work	Yes	Contractors shall employ numbers of work-force during Construction Phase. The Act applies to the Principal Employer of an Establishment and the Contractor where in 20 or more workmen are employed or were employed even for one day during preceding 12 months as Contract Labour.	Labour License	State Labour Department

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S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required, if any	Authority
20	Employees Provident Funds and Miscellaneous Provisions Acts 1952 along with EPF Scheme Rules and Forms	It is a beneficent piece of social welfare legislation aimed at promoting and securing the well-being of the employees	Yes	Contractors shall be employing Workman more than 20 persons during Construction Phase	Compliance of regulations	State Labour Department
21	Employees State Insurance Act 1948 along with Rules and Regulations	Protect the interest of workers in contingencies such as sickness, maternity, temporary or permanent physical disablement, death due to employment injury resulting in loss of wages or earning capacity. the Act also guarantees reasonably good medical care to workers and their immediate dependents.	Yes	Contractor shall be applying large number of labours during construction which will include both Men and Women	Insurance	State Labour Department
22	Equal Remuneration Act, 1976 along with allied Rules	An Act to provide for the payment of equal remuneration to men and women workers and for the prevention of discrimination, on the ground of sex, against women in the matter of employment	Yes	Contractor shall be applying large number of labours during construction which will include both Men and Women.	Compliance of regulations	State Labour Department

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S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required, if any	Authority
		and for matters, connected therewith or incidental thereto.				
23	Inter State Migrant Workmen (Regulation of Employment and Conditions Service Act, 1979	Act of the Parliament of India enacted to regulate the condition of service of inter- state labourers in Indian labour law. The Act's purpose is to protect workers whose services are requisitioned outside their native states in India. Whenever an employer faces shortage of skills among the locally available workers, the act creates provision to employ better skilled workers available outside the state	Yes	Contractor Shall be employing large number of workers during Construction from other States also.	Compliance of regulations	State Labour Department
24	Minimum Wages Act 1948 along with Central Rules 1950	To ensure that workman gets at least minimum wages as fixed by Govt. Minimum wages sets the lowest limit below which wages cannot be allowed to sink.	Yes	Contractor Shall be employing large number of workers during Construction	Compliance of regulations	State Labour Department
25	Persons with Disabilities	It gives effect to the	Yes	Contractor Shall be employing		State Labour Department

S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required, if any	Authority
	(Equal Opportunities, Protection of Rights and Full Participations) Act , 1995 along with Rules,1996 and National Trust for Welfare of Persons with Disabilities Act,1999 with rules 2000.	proclamation on the full participation and equality of the persons with disabilities in the Asian & Pacific Region and provides for their education, employment, creation of barrier free environment, social security, etc.		large number of workers during Construction.	Compliance of regulations	
26	Central Motor Vehicle Act 2019	The Act provides in detail the legislative provisions regarding licensing of drivers/ conductors, registration of motor vehicles, control of motor vehicles through permits, special provisions relating to state transport undertakings, traffic regulation, insurance, liability, offences and penalties.	Yes	These rules will be applicable to road users		Motor Vehicle Department

3.2.1 Other Applicable National Laws and Regulations

Other key laws, including amendments thereof, pertaining to environment, health and safety aspects that are applicable to proposed interventions under GNHCP include:

- a) Easement Act, 1882, as amended

- b) Wetland (Conservation and Management) Rules 2017
- c) Public Liability Insurance Act, 1991, as amended
- d) The Public Liability Insurance Rules, 1991, as amended
- e) Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996
- f) Plastic Waste Management Rules, 2016, as amended
- g) Batteries (Management and Handling) Rules, 2001, as amended
- h) Petroleum Rules, 2002, as amended
- i) Gas Cylinder Rules, 2004, as amended
- j) The Insecticides Act, 1968 and Insecticides Rules, 1971 and as amended

Environmental issues during road construction stage generally involve equity, safety and public health issues. The following laws will also apply to GNHCP:

- i) Workmen's Compensation Act 1923: The Act provides for compensation in case of injury by accident arising out of and during employment.
- ii) Payment of Wages Act, 1936: It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers.
- iii) Child Labour (Prohibition and Regulation) Act, 1986: The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of child labour is prohibited in Building and Construction Industry.

3.3 Key Statutory Clearances/Permissions Requirements – Construction Stage

During the construction stage, some of the key statutory requirements that need to be obtained by the Contractor as part of mobilization (pre-construction) have been listed in **Table 3.2**.

Table 3.2: Key Statutory Clearances to be Obtained by the Contractor

Sr. No.	Clearance/ Consents Requirement	Statute under which clearance/permission is required	Statutory Authority
1.	Borrow Area for Sand and Earth	EIA Notification, 2006 and subsequent amendments there after	DEIAA/SEIAA
2.	Stone Quarry	EIA Notification, 2006 + Mines and Minerals (Development and Regulation) Amendment Act, 2015	DEIAA/SEIAA + Department of Mines
3.	Hot mix plant, Crusher and Batch Mix Plant	Air (Prevention and Control of Pollution) Act, 1981	AP Pollution Control Board

Sr. No.	Clearance/ Consents Requirement	Statute under which clearance/permission is required	Statutory Authority
4.	Storage, Handling and Transport of Hazardous Wastes	Hazardous and Other Waste (Management and Transboundary Movement) Rules 2016	AP Pollution Control Board
5.	Storage and Handling Fuel/Oil (such as Diesel)	Manufacture, Storage and Import of Hazardous Chemicals (Amendment) Rules, 2000	Chief Controller of Explosives
6.	Location, emissions, sewage/waste water discharge from plants, labour camps and construction camp sites	Water (Prevention and Control of Pollution) Act, 1974 + Air (Prevention and Control of Pollution) Act, 1981	AP Pollution Control Board
7.	Permission for Withdrawal of Groundwater for Construction	Guidelines to Regulate and Control Ground Water Extraction in India, 2019	Central Ground Water Board
8.	Disposal of Bituminous Wastes	Construction and Demolition (C&D) Waste Management Rules, 2016	Local Civic Body
9.	Traffic Management and Regulation during construction and maintenance	National Road Safety Policy + Guidelines of Indian Roads Congress	Traffic Police Department and District Administration
10.	Construction over Waterways/Canals	Guidelines to Regulate and Control Road Construction over Waterways, as applicable at the State Level	Irrigation Department + Inland Waterways Association

3.4 World Bank Safeguard Policies Applicable to Project Road

The safeguard policies of the World Bank relevant to the Improvement and upgradation of Bowadra-Vizianagaram road in the State of Andhra Pradesh are given in **Table 3.3**.

Table 3.3: Relevant and Applicability of WB Safeguard Policies for Upgradation of Bowdara-Vizianagaram in the State of Andhra Pradesh

S. No	World Bank Safeguard Policy	Key Features	Policy Applicability to Sub Project	Policy Triggered Or Not
1.	OP/BP 4.01 Environmental Assessment	Overall governing policy intended to ensure Bank-financed projects are environmentally sound and sustainable	All potential impacts due to the improvement and upgradation project road are to be assessed and necessary mitigation measures are to be incorporated accordingly.	Triggered
2.	OP/BP 4.36 Forests	Policy is intended to support sustainable and conservation-oriented forest management, harness potential of forests to reduce poverty in a sustainable manner, integrate forests into sustainable economic development, and protect vital local and global environmental services and values of forests.	The proposed improvement and upgradation of the project road does not pass through forest area.	Not Triggered
3.	OP/BP 4.11 Physical Cultural Resources	Policy is intended to ensure that projects identify and inventory cultural resources that are potentially affected by the project. Projects should include mitigation measures, when there are adverse impacts on physical cultural resources.	Construction of road will be on existing road corridor and will avoid cultural property resources (CPR) and therefore does NOT warrant shifting or affect CPRs. However, there may be direct or indirect impact on nearby cultural properties along the road.	Triggered
4.	OP/BP 4.11 Involuntary Resettlement	Involuntary Resettlement Policy addresses direct economic and social impacts from project activities that may cause involuntary taking of land resulting in: (i) relocation or loss of shelter, (ii) loss of assets or access to assets, and/or (iii) loss of income sources or livelihoods	The proposed improvement and upgradation of the project road require land acquisition and Involuntary Resettlement.	Triggered
5.	Natural Habitats OP 4.04	This policy supports the protection, maintenance and rehabilitation of natural	If project is likely to be in proximity to sensitive natural habitats with wildlife	Not Triggered

S. No	World Bank Safeguard Policy	Key Features	Policy Applicability to Sub Project	Policy Triggered Or Not
		habitats. The Bank doesn't finance projects that involve the conversion of designated critical Natural Habitats.	crossing or movement. However, the project road are not located within protected domains.	
6.	Access to Information	<p>The policy governs the public accessibility of information in the Bank's possession. The Bank allows access to any information in its possession that is not on a list of exceptions. Documents such as EMF, all EIAs and EMPs will be disclosed both by the Borrower and the Bank.</p> <p>The policy requires the Borrower to consult Project Affected People and local NGOs through various phases of the project cycle. It requires that groups being consulted be provided on-time, comprehensible and easily accessible information.</p>	For the sub- project road, consultations with key stakeholder have been carried out during the planning and design stages, to determine the baseline conditions and issues; locally viable mitigation measures for addressing environmental impacts; consensus on engineering designs especially where realignments are concerned and to provide for community and stakeholder involvement in designing sub-project propositions.	Triggered

3.5 Indian Road Congress (IRC) Code of Practices applicable for the Project Road

Key Indian Road Congress (IRC) Code of Practices applicable for the project road with respect to environment are given in **Table 3.4**:

Table 3.4: Indian Road Congress Code of Practices for Project Road

S.No.	IRC Code Theme	Year	Purpose
1.	Recommendations for Road Construction in Areas Affected by Water Logging, Flooding and/or Salts Infestation	IRC:34-2011	Construction in water logged areas

S.No.	IRC Code Theme	Year	Purpose
2.	Recommended Practice for Construction of Earth Embankments and Sub-Grade for Road Works (First Revision)	IRC:36-2010	Issues relating to Borrow pits
3.	Guidelines for Pedestrian Facilities	IRC: 103 -1988	Safety of pedestrians
4.	Recommended Practice for Recycling of Bituminous Pavements	IRC:120-2015	For recycling of bituminous pavements
5.	Guidelines for Use of Construction and Demolition Waste in Road Sector	IRC:121-2017	Use of Construction and Demolition Waste in Road Sector
6.	Guidelines on Landscaping and Tree Plantation	IRC:SP:21-2009	Landscaping and Tree Plantation along of the road
7.	Guidelines on Road Drainage	IRC: SP: 42-1994	Drainage
8.	Highway Safety Code	IRC: SP: 44-1994	Highways safety
9.	Guidelines for Traffic Management in Work Zones	IRC:SP-55-2014	Worksite Safety Management
10.	Guidelines for Use of Flyash in Road Embankments	IRC:SP:58-2001	Use of Flyash in Road Embankments
11.	Guidelines for Use of Geotextiles in Road Pavements and Associated Works	IRC:SP:59-2002	Use of Geotextiles in Road Pavements and Associated Works
12.	Guidelines for Soil and Granular Material Stabilization Using Cement Lime and Fly Ash	IRC:SP-89-2010	Soil and Granular Material Stabilization Using Cement Lime and Fly Ash
13.	Guidelines on Requirements for Environmental Clearance for Road Projects	IRC:SP-93-2017	Requirements for Environmental Clearance for Road Projects
14.	Guidelines for the use of Waste Plastic in Hot Bituminous Mixes (Dry Process) in Wearing Courses	IRC:SP-98-2013	Use of waste plastic in hot bituminous mixes (dry process) in wearing courses
15.	Use of Cold Mix Technology in Construction and Maintenance of Roads Using Bitumen Emulsion	IRC:SP-100-2014	Use of Cold Mix Technology in Construction and Maintenance of Roads Using Bitumen Emulsion
16.	Interim Guidelines for Warm Mix Asphalt	IRC:SP-101-2014	Warm Mix Asphalt
17.	Guidelines on Preparation and Implementation of Environment Management Plan	IRC:SP-108-2015	Preparation and Implementation of Environment Management Plan

3.6 Environmental Standards and IS Codes

Environmental standards applicable to the Improvement and upgradation of Bowdara-Vizianagram in the State of Andhra Pradesh are as given below:

- National Ambient Air Quality Standards, 2009

- Measurement of Air Pollution - IS: 5182-1977
- Ambient Noise Standards
- Measurement of Noise from Moving Road Vehicles - IS: 3028-1980
- Measurement of Noise from Stationery Road Vehicles - IS: 10399-1982
- Measurement of Noise Pollution from Machines - IS: 4758-1968
- Stack Emissions of CPCB for Hot Mix Plants
- Discharge Standards of CPCB for Disposal of Treated Sewage
- Drinking Water Quality Standards - IS:10500:2012
- CPCB Standards for Surface Water Use

3.7 Applicable MoRTH and IRC Specifications

All road works in India are to be in accordance with the MoRTH specifications for Road and Bridge works and guidelines of Indian Roads Congress (IRC). The MoRTH specifications have special provisions towards protection of environment under Clause 501, Annexure A and the contractor is to satisfy the provisions. Apart from the Annexure A to clause 501, there are provisions for control of erosion, drainage, dust suppression, borrow area and haul road management under relevant sections. A few other key applicable clauses include:

Section 111	Precautions for safeguarding the environment
Clause 201.2	Preservation of Property/Amenities during clearing and grubbing
Clause 301.3.2	Stripping and storing of topsoil for reuse during excavation for roadway and drains
Clause 302.4	Restriction on timings for blasting operations
Clause 304.3.6	Public safety near towns/villages where excavation is carried out
Clause 305.2.2.2	Location of borrowing and relevant regulations
Clause 305.3.3	Stripping and storing of topsoil at borrow locations
Section 306	Soil erosion and sedimentation control
Clause 407.4.2	Provisions for turfing on median and islands
Section 517	Recycling of bituminous pavement and excavated material
Clause 701.2.1	Use of geo-textiles for control of soil erosion
Section 810	Use of Metal beam crash barriers for safety, relevant regulations and specifications
Clause 2501	Precautions during river training works

CHAPTER 4

BASELINE ENVIRONMENTAL CONDITIONS

4.1 GENERAL

The project road, two lane upgradation with paved shoulders of Bowadra to Vizianagram Section of NH 516 E is situated in Vizianagaram and Visakhapatnam districts of Andhra Pradesh. The baseline environmental conditions along the project road are discussed in the following sub sections:

The collection of baseline information on physical, biological and socio-economic aspects of the project area is the most important reference for carrying out environmental impact assessment studies. The description of environmental settings includes the characteristic of area in which the activity of project road would occur and cover area likely to be impacted by anticipated environmental impacts. For environmental assessment along the project road, information and data have been obtained by intensive site visits, primary data collection by monitoring and analysis, secondary data from published sources, and various government agencies. Important ecosystem components have been systematically analyzed in this environmental assessment report.

The primary data for ambient air quality, ambient noise level, water quality (ground and surface) and soil quality were collected through environment monitoring undertaken by Savant Envirotech Pvt. Ltd an NABL Accredited Laboratory.

In order to understand and collect the baseline environmental conditions in the study area, relevant primary and secondary data were collected through sampling, monitoring, actual field visits and published secondary sources. The methodologies adopted are classified below:

- The preparation of questionnaire for environmental surveys.
- Field observations of these questionnaires.
- Sampling, monitoring and analysis of environmental components like ambient air, ground and surface water, soil and the noise level.
- Collection of secondary data for various environmental components from various departments.
- Compilation, analysis and presentation in the report.

Baseline data was collected during March to May months of 2018.

4.2 Study Area

The proposed Right of Way (RoW) of the project road has been considered as Corridor of Impact (CoI) for baseline environmental study, while 10 km area on either side (aerial distance) from the project road have been considered as project influence area (PIA) for collection of primary and secondary data. The primary environmental monitoring and field survey were carried out along the project road.

4.3 PHYSICAL ENVIRONMENT

The physical environmental profile along the project road has been discussed in the following subsections:

4.3.1 Topography and Physiography

The project road entirely traverses within Gantyada and Srungavarapukota tehsils of Vizianagram district and Anantagiri tehsil of Visakhapatnam district. Topography along the project road is mostly plain. There is flowing river crossed by the project road. Digital elevation model of the project area is shown in **Figure 4.1**.

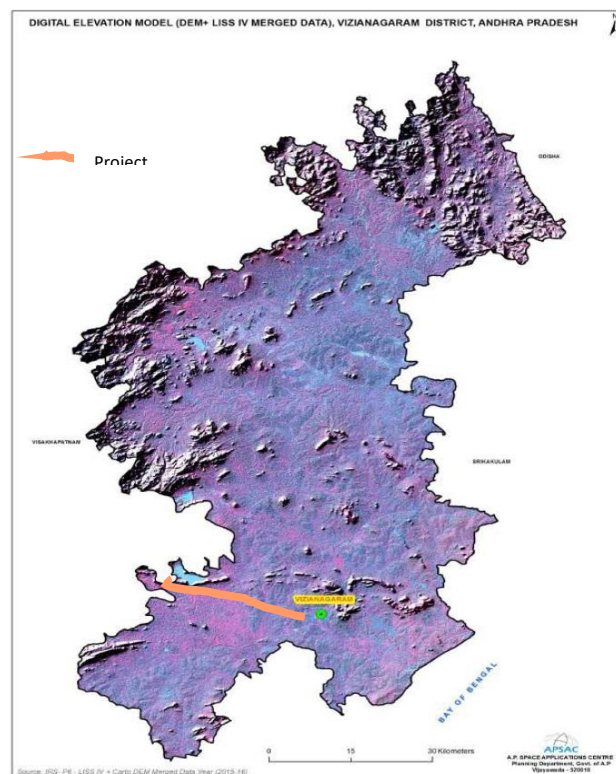


Figure 4.1: Digital Elevation Model Map

Source : AP Space Application Center, Vijaywada

4.3.2 GEOLOGY

Geologically, the area constitutes a part of Eastern Ghats Mobile Belt of Archaean age. It includes rocks of Khondalite Group, Charnockite Group and Migmatite complex. Sediments of Upper Gondwana, Cainozoic laterite and Quaternary deposits overlies the Archaeans. The project road is within denudation terraces as shown in **Figure 4.2**.

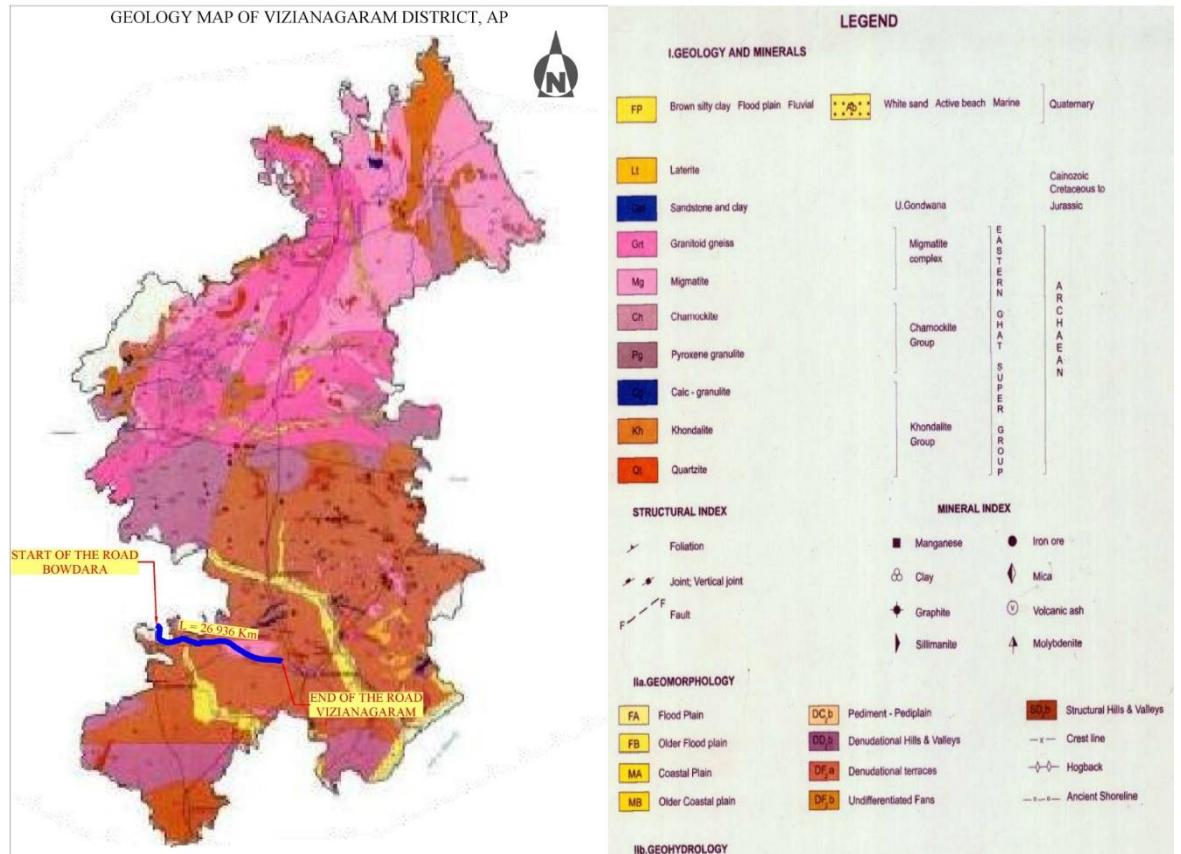


Figure 4.2: Geological Map of the Area

Source : AP Space Application Center, Vijaywada

4.3.3 GEOMORPHOLOGY

As per geomorphology of the district map, the project road is under Fluvial landform. Geomorphological map of the area is given in **Figure 4.3**.

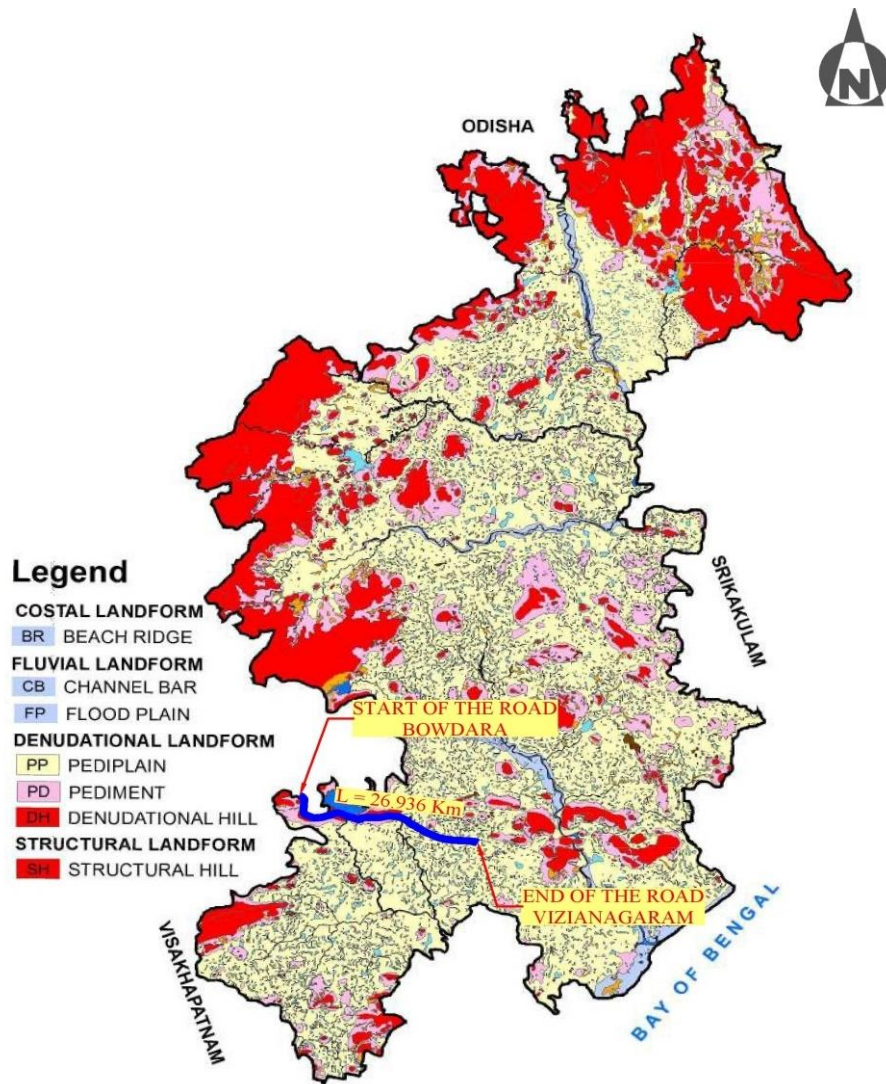


Figure 4.3: Geomorphological Map of the Area

4.3.4 SOIL

Soil Type in the Area

Soil found in the area around project road are red soils, sandy loams and sandy clay and they constitute 96% of the total area. The soil in the along the road are predominantly loamy with medium fertility. There are mostly red loamy soil, as far as dry lands are concerned and clay loamy in case of wet lands. The soil at some places are as thick as 4 metres. It is likely that the thick soil cover might represent alluvium along the valleys. Soil along the project area is fertile and used for paddy cultivation. Soil map of the area is presented in **Figure 4.4**.

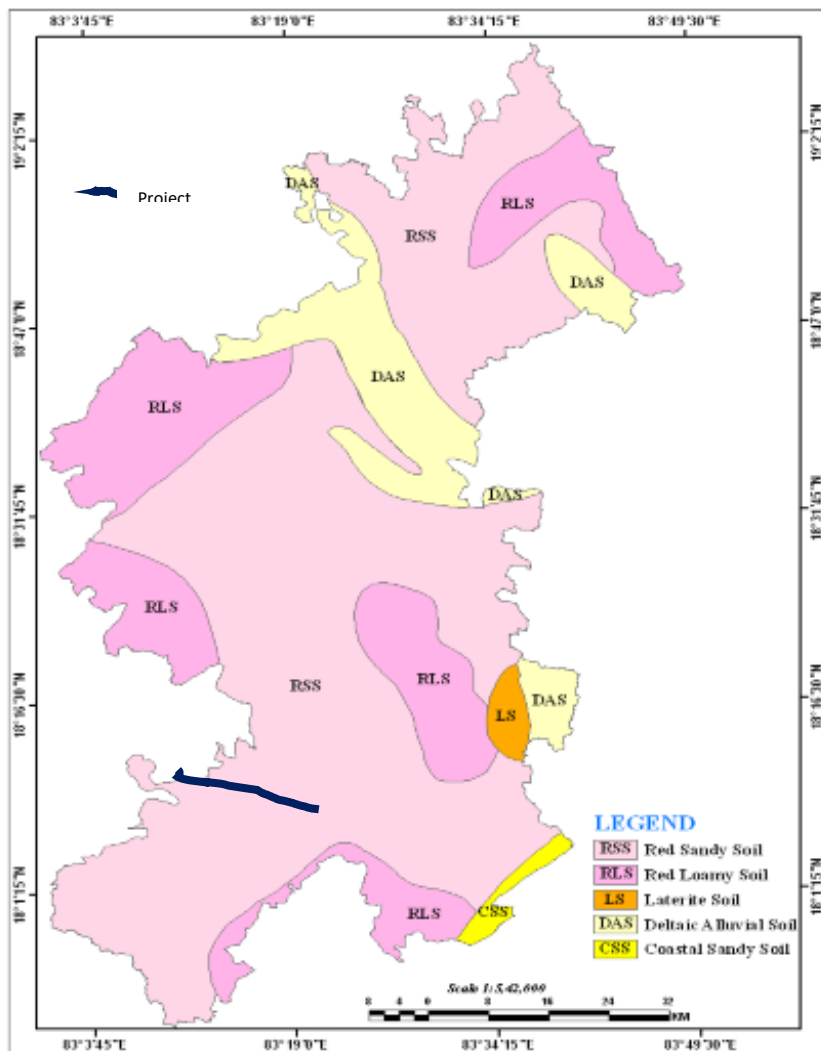


Figure 4.4: Soil Type in the Area

Soil Characteristics of the Area

The soil characteristics include both physical, chemical and nutrients parameters of soils. M/s. Savanth Envirotech (P) Limited field team carried out soil survey to assess the soil characteristics of the study area.

For studying the soil characteristics of the area along the project road, two samples were collected to assess the baseline soil conditions along the project road. Soil Sampling locations details are given in **Table 4.1**.

Table 4.1: Soil Sampling Location Details

S.No	Location code	Location Name	Chainage	Latitude	Longitude
1.	S1	Near Bowdara	2+100	N 18 ⁰ 10'52.53"	E 83 ⁰ 07'37.62"
2.	S3	Near Vizianagaram	26+700	N 18 ⁰ 08'10.55"	E 83 ⁰ 20'21.27"

Soil sampling locations are shown in **Figure 4.5**.

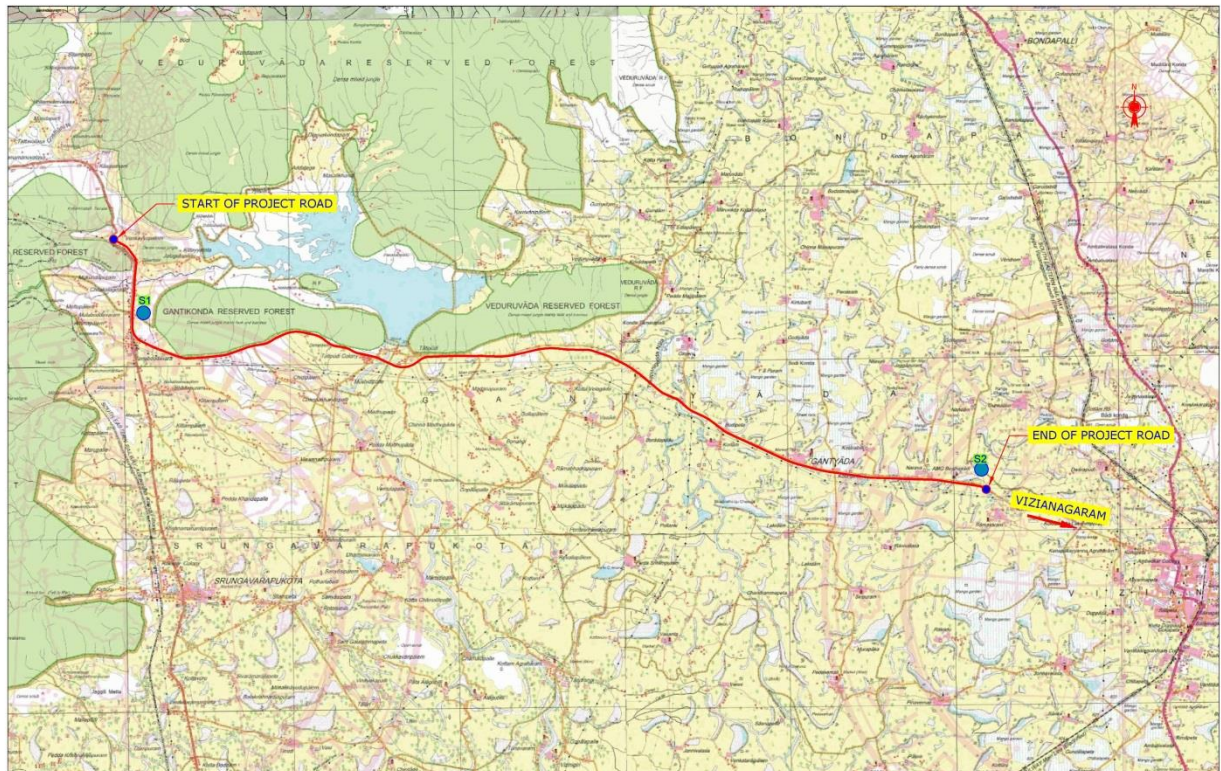


Figure 4.5 Soil Sampling Locations

The physical, chemical, nutrient characteristics of soil samples were determined. The samples were collected by ramming a core-cutter into the soil up to a depth of 15 cm. Soil characteristics along the project road are presented in **Table 4.2**.

Moisture: Moisture content of soil of the area ranges from 5.04 to 6.22 %.

Total Organic Carbon: the total organic carbon of soil the area ranges from 0.82 to 0.83 %

Bulk Density: Bulk density of soil samples of the area ranges from 1.18 to 1.19 g/cc. Generally soil with low bulk density have favourable physical condition whereas those with high bulk densities exhibit poor physical conditions.

pH: The pH of soil of the area ranges from 7.02 to 8.05. The soil are therefore, neutral to alkaline in nature.

Electrical Conductivity: The Electrical conductivity of soil of the study area ranges from 248 to 320 umho/cm.

Calcium: Calcium content in soil sample ranges from 262 to 295.0 mg/kg.

Magnesium: Magnesium content in soil sample ranges from 195.5 to 210.0 mg/kg.

Texture: Soil of the area are Silt Loam to sandy loam in texture.

Sulphates content in soil sample ranges from 4.36 to 4.54 mg/kg.

Table 4.2: Soil Analysis Results

S.No	Parameters	Units	S1	S2
1	pH	--	7.02	8.05
2	Electrical Conductivity	µ mhos	320.0	248.0
3	Bulk Density	g/cc	1.18	1.19
4	Moisture Content	%	5.04	6.22
5	Nitrates as N	mg/kg	1.69	1.55
6	Phosphorous as P	mg/kg	12.8	1.26
7	Potassium as K	mg/kg	15.22	16.54
8	Sodium as Na	mg/kg	13.42	12.51
9	Calcium as Ca	mg/ kg	295.0	262.1
10	Magnesium as Mg	mg/ kg	210.0	195.5
11	Total Organic Carbon	%	0.83	0.82
12	Type of Soil	--	Silt Loam	Sandy Clay
13	a) Sand (%)	--	29	45

	b) Silt (%)	--	49	25
	c) Clay (%)	--	22	30
14	Sulphates as SO ₄	mg/ kg	4.54	4.36

4.3.5 HYDROGEOLOGY

Vizianagram District has consolidated formations which include crystallines (Khondalites, Charnockites and granitic gneisses) and meta sediments (Dolomites, shales, phyllites and quartzites) of Archaean and Pre-cambrian periods respectively.

The present project road from km 62/000 of SH-39 to km 1/600 (KM 544/300 of NH-26, Tatitupudi reservoir at 400m distance from north direction at 9+700 chainage, Gummala cheruvu is at 500m distance from north direction at chainage 21+800, Tamaraplli pond is at 300m distance from NW direction at chaingae 16+500 and pond at 15+900, there are no rivers along the road. There is no flowing river crossed by the project road. The drainage map of the area is shown in **Figure 4.6**.

Ground water occurs in all most all geological formations and its potential depends upon the nature of geological formations, geographical setup, incidence of rainfall, recharge and other hydrogeological characters of the aquifer. In consolidated formations ground water occurs under unconfined to semi-confined conditions. Ground water is developed in these formations by dug wells, dug cum bore wells and bore wells tapping weathered and fractured zones. Ground water prospects map for the area is shown in **Figure 4.7**.

The yields of ground water aquifers are in the range of 20 to 70 m³/day. The occurrence of fractures in the crystalline formations is limited down to 30 to 40 m bgl and occasionally extends down to 70 - 100 m bgl. The bore wells constructed in the crystalline formations generally tap the weathered and fractured zones. The yields of the bore wells generally range between 80 to 400 m³/day.

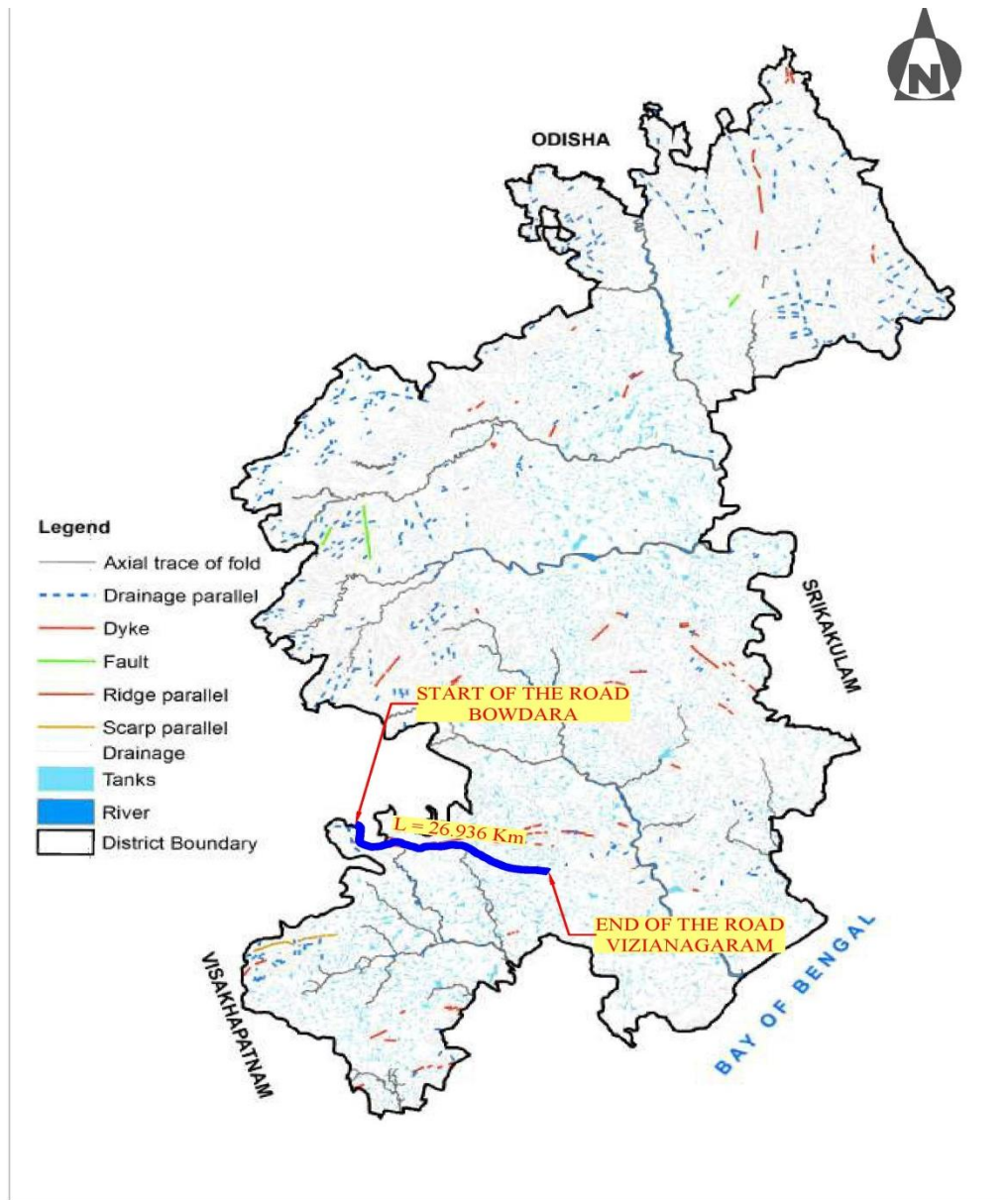


Figure 4.6: Drainage Map of the Area

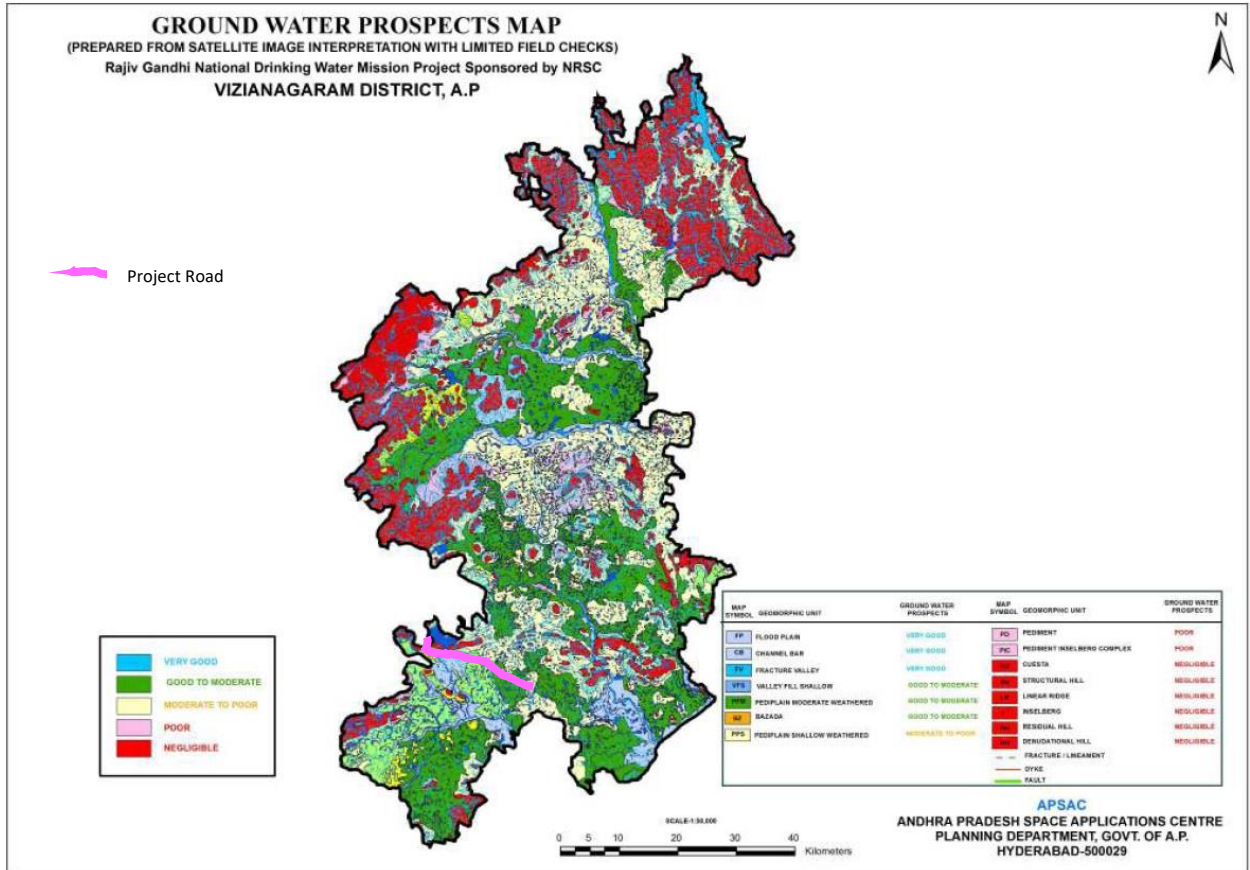


Figure 4.7 Ground Water Prospect Map of the Area

4.3.6 WATER QUALITY

To determine the ground and surface water quality in the study area, three ground water and two surface samples were collected during the study period. Ground and surface water sampling location details are given in **Table 4.3**.

Table 4.3: Ground and Surface Water Sampling Location Details

S.No	Location code	Location Name	Chainage	Latitude	Longitude
Ground Water Sampling Locations*					
1.	GW1	Bowdara	2+900	18 ⁰ 10'26.81"	83 ⁰ 07' 36.38"

S.No	Location code	Location Name	Chainage	Latitude	Longitude
2.	GW2	Gantyada	21+500	18° 08'38.44"	83° 17' 27.39"
3.	GW3	Vizianagaram	25+900	18° 08'14.31"	83° 19' 54.87"
Surface Water Sampling Locations					
1.	SW1	Tatipudi Reservoir\$	9+700	18° 10'22.35"	83° 24' 30.17"
2.	SW2	Vizianagaram Lake#		18° 06'46.91"	83° 24'04.44"

Note: * Bore well sample representing Residential area, \$: Reservoir sample collected Downstream, #: Vizianagaram Pedda Cheruvu sample collected

Ground and surface water sampling locations are shown in **Figure 4.8.**

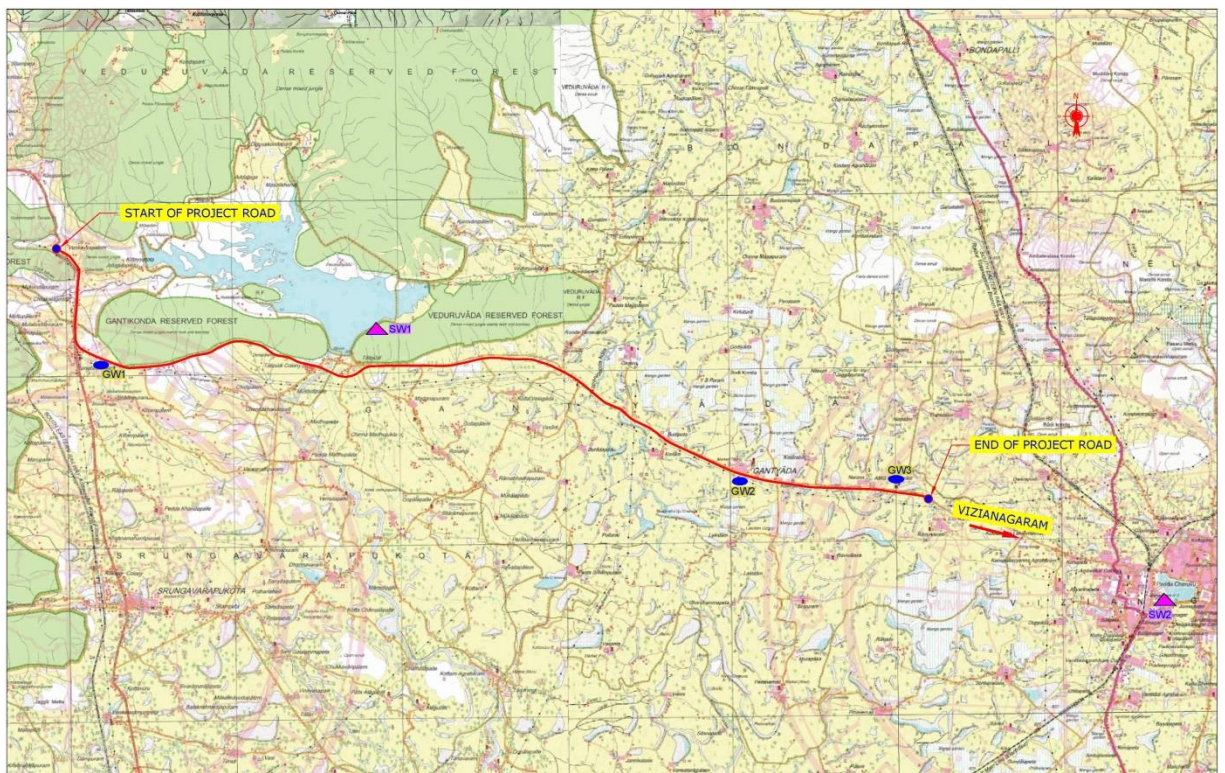


Figure 4.8: Ground and Surface Water Sampling Locations

These samples were taken as grab samples and were analyzed for various parameters compared with the standards for drinking water as per IS: 10500.

Samples were collected in polyethylene carboys for chemical analysis. Samples collected for metal content were acidified with 1 ml of HNO₃. Selected physico-chemical characteristics have been analyzed for projecting the existing water quality status in the study area. Parameters like temperature, Dissolved Oxygen (DO), and pH were analyzed at the time of sample collection.

The samples were collected and analyzed as per the procedures specified in "Standard Methods for the Examination of Water and Wastewater" published by American Public Health Association (APHA).

Ground Water Quality

Ground water quality analysis results are given in **Table 4.4**. From the tabulated data the following inferences are made:

pH:-The pH value of all ground water samples ranges from 6.07 to 7.23 and meets the acceptable drinking water standards.

Colour: The colour of ground water samples was found <1 hazen unit and meets the acceptable limit of drinking water standards.

Odour:-The odour in ground water samples was agreeable and meets the acceptable limit for drinking water standards.

Total Dissolved Solids (TDS): TDS in ground water samples range from 98.2 to 1017.0 mg/l and meet desirable limit of 2000 mg/l in all the ground water sampling locations.

Total Alkalinity: Total alkalinity in ground water samples ranges from 55 mg/l to 320 mg/l and meets permissible limit of 600 mg/l in all the ground water sampling locations in the absence of alternate source of water.

Total Hardness: Total hardness of ground water samples ranges between 90 mg/l to 415 mg/l and meets permissible limit (600 mg/l) in the absence of alternate source of water.

Calcium: Calcium content in ground water samples ranges from 16.03 mg/l to 152.2 mg/l and and meets permissible limit (200 mg/l) in the absence of alternate source of water.

Magnesium: Magnesium content in ground water samples ranges from 8.5 mg/l to 46.12 mg/l and meets permissible limit (100 mg/l) in the absence of alternate source of water.

Sulphate: Sulphate content in ground water samples ranges from 28.4 to 62.1 mg/l and meets the acceptable limit of 200 mg/l at all the ground water sampling locations.

Iron: Iron content in all ground water sample ranges from 0.10 to 0.18 mg/l and meets acceptable limit of 0.3 mg/l at all the ground water sampling locations.

Chloride: Chloride content in ground water samples range from 68.4 mg/l to 190 mg/l and meets acceptable limit of 250 mg/l at all the ground water sampling locations.

Other Parameters : Other analysed parameters given in the table were found within acceptable limit / below detection limit (BDL) for ground water samples. Overall drinking water quality of ground water samples was found fit for drinking.

Table 4.4: Ground Water Analysis Results

S. No	Parameter	Method	Unit	GW1	GW2	GW3	IS 10500-2012 Limits	
							Acceptable	Permissible
1	pH	APHA 22nd Edition	--	7.23	6.07	6.22	6.5-8.5	No
2	Colour	APHA 22nd Edition	Hazan	< 1.0	< 1.0	< 1.0	5.0	15.0
3	Total Dissolved Solids	APHA 22nd Edition 2540 C	mg/l	1017.0	544.2	98.2	200.0	2000.0
4	Total Alkalinity (as CaCO ₃)	APHA 22nd Edition 2320 B	mg/l	320.0	170.0	55.0	200.0	600.0
5	Total Hardness (as CaCO ₃)	APHA 22nd Edition 2340 C	mg/l	415	255	90.0	200.0	600.0
6	Calcium (as Ca)	APHA 22nd Edition 3500 Ca B	mg/l	152.2	26.05	16.03	75.0	200.0
7	Magnesium (as Mg)	APHA 22nd Edition 3500-Mg B	mg/l	8.5	46.12	12.15	30.0	100.0
8	Sulphate (as SO ₄)	APHA 22nd Edition 4500 SO ₄ E	mg/l	88.0	62.1	28.4	200.0	400.0
9	Chloride (as Cl)	APHA 22nd Edition 4500 Cl- B	mg/l	190	102.7	68.4	250.0	1000.0
10	Lead as Pb	APHA 22nd Edition 3111B	mg/l	< 0.01	< 0.01	< 0.01	0.01	No Relaxation
11	Cadmium as Cd	APHA 22nd Edition 3111B	mg/l	< 0.01	< 0.01	< 0.001	0.003	No Relaxation
12	Total Chromium as Cr	APHA 22nd Edition 3111B	mg/l	< 0.05	< 0.05	< 0.05	0.05	No Relaxation
13	Copper as Cu	APHA 22nd Edition 3111B	mg/l	< 0.01	< 0.01	< 0.01	0.05	1.5
14	Zinc as Zn	APHA 22nd Edition 3111B	mg/l	< 0.5	< 0.5	< 0.5	5.0	15.0
15	Nickel as Ni	APHA 22nd Edition 3111B	mg/l	< 0.01	< 0.01	< 0.01	0.02	No Relaxation
16	Fluorides as F	APHA 22nd Edition 4500 F- D	mg/l	<0.5	<0.5	<0.5	1.0	1.5

17	Aluminium as Al	APHA 22nd Edition 3500 Al B	mg/l	< 0.03	< 0.03	< 0.03	0.03	0.2
18	Boron as B	APHA 22nd Edition 4500 B B	mg/l	< 0.2	< 0.2	< 0.2	0.2	1.0
19	Manganese as Mn	APHA 22nd Edition 3111B	mg/l	<0.02	<0.02	<0.02	0.1	0.3
20	Iron as Fe	APHA 22nd Edition 3500 Fe B	mg/l	0.11	0.18	0.10	0.3	No Relaxation
21	Nitrate Nitrogen	APHA 22nd Edition 4500 NO3 B	mg/l	8.2	9.4	8.5	45.0	No Relaxation
22	Sodium as Na	APHA 22nd Edition 3500 Na B	mg/l	100.2	85.0	48.6	--	--
23	Potassium as K	APHA 22nd Edition 3500 K B	mg/l	24.2	4.5	2.4	--	--
24	Odour	APHA 22nd Edition 2150 B	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
25	Electrical Conductivity	APHA 22nd Edition 2510 B	µMho/cm	1429.0	620.0	150.4	--	--
26	Phosphorus as P	APHA 22nd Edition 4500 P C	mg/l	0.22	0.54	0.41	--	--

Surface Water Quality

Surface water quality analysis results are given in **Table 4.5**. From the tabulated data it is observed that surface water quality is reasonable and meet acceptable limit of IS 10500:2012, except biological contamination in the surface water.

Table 4.5: Surface Water Analysis Results

Ground Water Monitoring			Unit	SW1	SW2
S. No.	Parameter	Method		Result	Result
1	pH	APHA 22nd Edition 4500 H+ B	--	7.85	8.78
2	Color	APHA 22nd Edition 2120	CU	< 1.0	< 1.0
3	Turbidity	APHA 22nd Edition 2130	NTU	01	01
3	Total Dissolved Solids	APHA 22nd Edition 2540 C	mg/l	112.0	108
4	Total Alkalinity (as CaCO3)	APHA 22nd Edition 2320 B	mg/l	55.0	115.0
5	Total Hardness (as CaCO3)	APHA 22nd Edition 2340 C	mg/l	70	95
6	Calcium (as Ca)	APHA 22nd Edition 3500 Ca B	mg/l	14.02	28.05
7	Magnesium (as Mg)	APHA 22nd Edition 3500-Mg B	mg/l	2.15	8.5
8	Sulphate (as SO4)	APHA 22nd Edition 4500 SO4 E	mg/l	41.03	0.41

Ground Water Monitoring			Unit	SW1	SW2
S. No.	Parameter	Method		Result	Result
9	Chloride (as Cl)	APHA 22nd Edition 4500 Cl- B	mg/l	88.05	9.78
10	Lead as Pb	APHA 22nd Edition 3111B	mg/l	< 0.01	< 0.01
11	Cadmium as Cd	APHA 22nd Edition 3111B	mg/l	< 0.001	< 0.001
12	Total Chromium as Cr	APHA 22nd Edition 3111B	mg/l	< 0.05	< 0.05
13	Copper as Cu	APHA 22nd Edition 3111B	mg/l	< 0.01	< 0.01
14	Zinc as Zn	APHA 22nd Edition 3111B	mg/l	< 0.5	< 0.5
15	Nickel as Ni	APHA 22nd Edition 3111B	mg/l	< 0.01	< 0.01
16	Fluorides as F	APHA 22nd Edition 4500 F- D	mg/l	<0.5	<0.5
17	Aluminum as Al	APHA 22nd Edition 3500 Al B	mg/l	< 0.03	< 0.03
18	Boran as B	APHA 22nd Edition 4500 B B	mg/l	< 1.0	< 1.0
19	Manganese as Mn	APHA 22nd Edition 3111B	mg/l	<0.02	<0.02
20	Iron as Fe	APHA 22nd Edition 3500 Fe B	mg/l	0.21	0.13
21	Nitrate Nitrogen	APHA 22nd Edition 4500 NO3 B	mg/l	15.6	4.5
22	Chemical Oxygen Demand	APHA 22nd Edition 5200 B	mg/l	24	16.0
23	BOD	IS3025(Part-44)2009	mg/l	8.2	18.4
24	Sodium as Na	APHA 22nd Edition 3500 Na B	mg/l	65.6	5.2
25	Potassium as K	APHA 22nd Edition 3500 K B	mg/l	2.10	0.88
26	Total Suspended solids	APHA 22nd Edition 2540D	mg/l	10.5	10.4
27	Dissolved Oxygen	APHA 22nd Edition 4500 O C	mg/l	5.3	5.4
28	Oil& Grease	APHA 22nd Edition 5520 OB	mg/l	<1.0	<1.0
28	Electrical Conductivity	APHA 22nd Edition 2510 B	µMho/cm	236	821
29	Phosphorus as P	APHA 22nd Edition 4500 P C	mg/l	0.11	0.12
31	Total Coliforms	IS1622	MPN/100ml	54	56
32	E-Coli	IS1622	MPN/100ml	05	07

4.3.7 CLIMATE AND METEOROLOGY

The climate of the area is characterized as high humidity almost throughout the year with extreme summer and adequate seasonal rainfall. The summer is normally from the month of March to June. The rainy season is followed in the form of South-West monsoon till the middle of October. Retreating monsoon is followed till November. During the period from December to February the district experiences good weather with cool temperatures.

The annual average rainfall of the district is 1081 mm, of which 922 mm falls as South West (June-September) and 159 mm as North East (October-December) monsoon. The actual rainfall in the district was 1069.0 mm in the year of 2015-16. The mean minimum and maximum temperature recorded in the district are 19.4° C in December and 37.5° C in May, respectively.

Site Specific climate data form the study period of March to May 2018, the temperature varying from 22.1°C to 37.4°C, wind speed is 00 to 10 m/sec and the annual rainfall of the area is 1011mm. Annual rainfall map of the area is given in **Figure 4.9.**

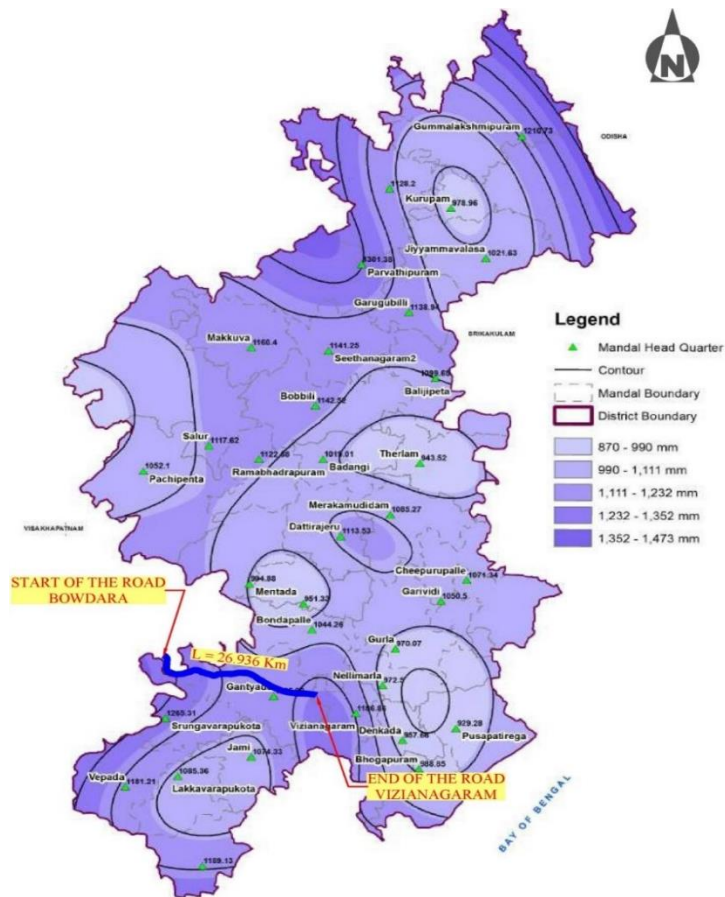


Figure 4.9 Rainfall Map of the Area

Micro Meteorology : Micro meteorological studies were conducted during the study period. Methodology plays a vital role in effecting the dispersion of pollutants, once discharged into the atmosphere, their transport, dispersion and diffusion into the environment. The meteorological data is very useful for interpretation of the baseline information and for model study of air quality impacts also. Since meteorological data show wide fluctuations with time, meaningful interpretation can only be drawn from long term and reliable data. Such source of data is the India Meteorological Department (IMD) that maintains a network of meteorological stations at several important locations.

The station was installed in such a way that there are no obstructions facilitating free flow of wind. Wind speed, wind direction, humidity and temperature are recorded on hourly basis in the study period.

- Calm period is observed to be 12.37 % during the time of monitoring.
- The predominant wind is west direction.

The windrose diagram for the study area for March to May 2018 at Bowdara is given in **Figure 4.10**.

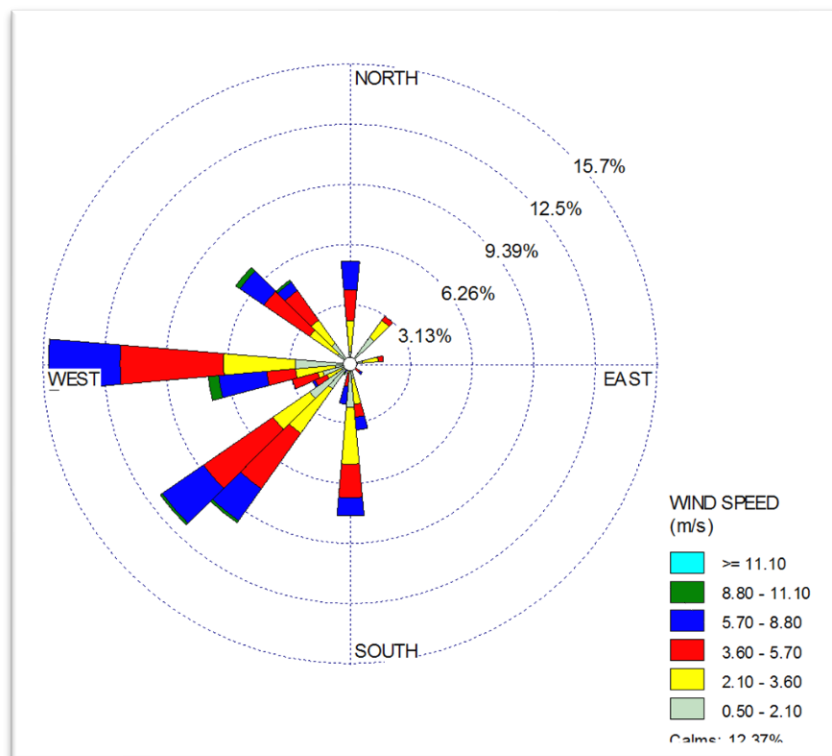


Figure 4.10: Windrose-Diagram for March to May 2018 at Bowdara

4.3.8 Ambient Air Quality

Air pollution means the presence in the outdoor atmosphere of one or more contaminants or combinations thereof in such quantities and of such duration as are or may tend to be injurious to human, plant or animal life or property. Air pollutants include particulate matter and gaseous pollutants. With project road activities a range of pollutants may be released into the atmosphere that will be dispersed and may have adverse impact on neighbourhood air environment. Thus, collection of base line data of ambient air quality occupies important role for the environmental impact assessment study. The ambient air quality status along the project road forms basis for prediction of the impacts due to the project activities.

Description of Sampling Locations

The location of ambient air quality stations is contingent on the meteorological status of the area. Hence, the micro meteorological data was collected before initiating the ambient air quality monitoring. There ambient air quality monitoring locations namely, Bowdara Junction, Gantyada and Vizianagram were selected along the project road. **Table 4.6** presents the ambient air quality monitoring locations with chainage of locations on the project road. Ambient air quality monitoring locations are shown in the **Figure 4.11**.



Figure 4.11: Ambient Air Quality Monitoring Locations

Table 4.6: Details of Ambient Air Quality Monitoring Locations

S.No	Location code	Location Name	Chainage	Latitude	Longitude
1.	AAQ1	Bowdara Junction	3+100	18° 10'26.97"	83° 07' 38.29"
2.	AAQ2	Gantiyada	21+900	18° 08'31.39"	83° 17' 40.25"
3.	AAQ3	Vizianagaram	26+929	18° 08'13.78"	83° 19' 56.61"

The results of ambient air quality monitoring carried out along the project road are presented in **Table 4.7**. National ambient air quality standards for industrial, residential, rural & other areas are met for all monitored parameters at all three ambient air quality monitoring locations.

Table 0.7 : Ambient Air Quality Status Along the Project Road

Location	Average Concentration ($\mu\text{g}/\text{m}^3$)							
	PM ₁₀		PM _{2.5}		SO ₂		NO ₂	
	Min	Max	Min	Max	Min	Max	Min	Max
Bowdara Junction	60.5	63.9	20.6	24.8	20.9	23.5	27.6	31.8
Gantiyada	65.54	69.65	20.56	25.78	13.63	20.80	17.25	29.60
Vizianagaram	65.22	70.63	23.14	31.54	13.56	16.44	18.32	20.65

4.3.9 Noise Measurements

A preliminary reconnaissance survey was undertaken to identify the major noise generating sources along the project road. The noise measurements at three locations was carried out. Lutron Make Noise Level Meter instrument was used to ascertain noise status at monitoring sites along the project road. **Table 4.8** presents the ambient noise monitoring locations with chainage of locations on the project road.

Table 4.8: Details of Ambient Noise Monitoring Locations

S. No	Location Code	Location	Chainage	Latitude	Longitude
1.	N1	Bowdara Junction	3+100	N 18° 10'24.33"	E 83° 07'38.33"
2.	N2	Gantiyada	21+900	N 18° 08'29.28"	E 83° 17'47.85"
3.	N3	Vizianagaram (End chainage)	26+900	N 18° 08'06.55"	E 83° 20'27.04"

Day and night-time Leq were calculated from hourly Leq values and given in **Table 4.9**. Day and night-time Leq were compared with the stipulated noise standards. Day time Leq levels at Bowdara Junction and Vizianagaram are exceeded from stipulated standards due to unnecessary vehicles horn, traffic congestion and various advertisers through amplifier. Night time Leq levels at all three locations are within the stipulated limit.

Table 0.9 : Day and Night Leq along the Project Road

Location	Distance / Direction	Leq Day dB(A)	Leq Night dB(A)
Bowdara Junction	150 mts /South	66	36
Gantiyada	120 mts /West	65	40
Vizianagaram(End chainage)	150 mts /South	76	52
Noise standards for Commercial Areas		65	55

4.3.10 Land Use / Land Cover Classification of the Study area

Using the standard land use classification system developed by National Remote Sensing Centre (NRSC), about Seven classes of level I, land use / land cover classes were identified and mapped using satellite data along the project corridor. Further, the imagery is interpreted and ground checked for corrections.

The land use / land cover of Bowdara to Vizianagaram road based on satellite imagery is given in **Figure 4.12**. Forest land occupy around 29.77%, agriculture crop land occupy 29.49%, agriculture plantation land occupies 26.59%, fallow land occupy around 5.6%, built-up land occupies about 3.9 %, water bodies occupy around 3.47%, Baren around 1.51% of the total study area (10 km either side of the project road).

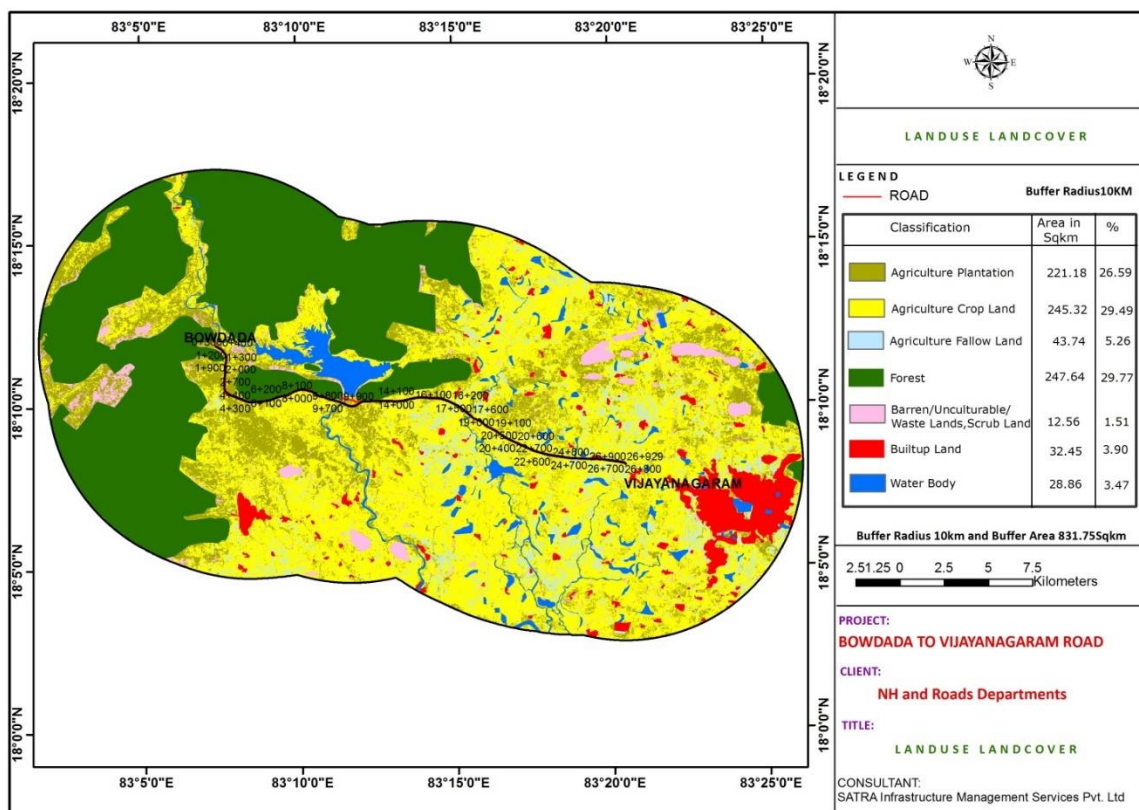


Figure 4.12: Land Use & Land Cover Map of Study Area

4.3.11 HAZARD AND VULNERABILITY PROFILE

The hazard and vulnerability profile of the project region which includes wind hazards, earth quake hazards, flood hazards are summarized below:

WIND HAZARD

As per wind hazard map of Andhra Pradesh, the project road traverses in high damage risk zone for 80% of length and remaining 20% length in moderate zone. The wind hazard map showing the project road is shown in Error! Reference source not found..

FLOOD HAZARD

Flood hazard map of the area is shown in **Figure 4.14**. The project road is not located in flood hazard area.

EARTHQUAKE ZONES

In general, India is divided into 4 seismic zones (II, III, IV, V); Zone –II being the least active seismic zone, whereas Zone-V is the highest seismic zone. The earthquake hazard map along the project road is shown in Error! Reference source

not found. The project road falls under Zone – II, which is at low risk, however warrants earthquake resistant designs for structures.

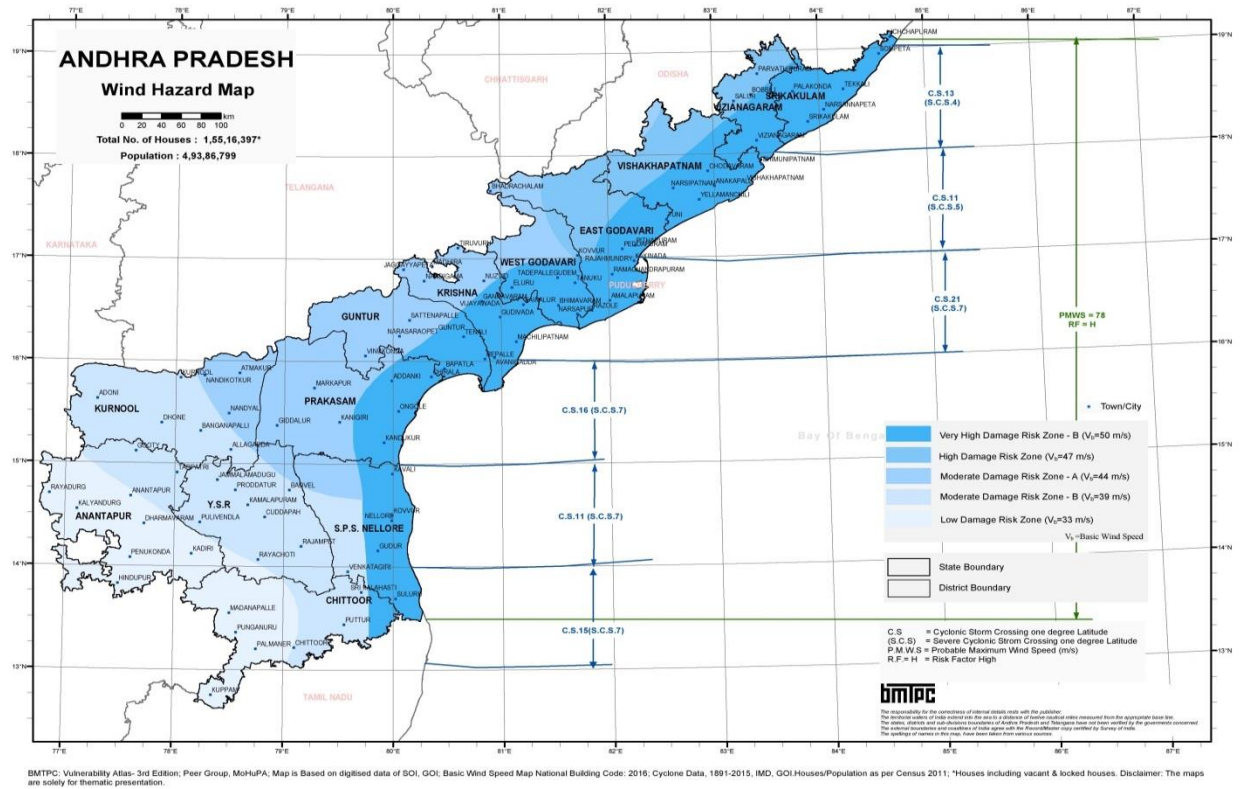


Figure 4.3.11.13: Wind Hazard Map of the Area

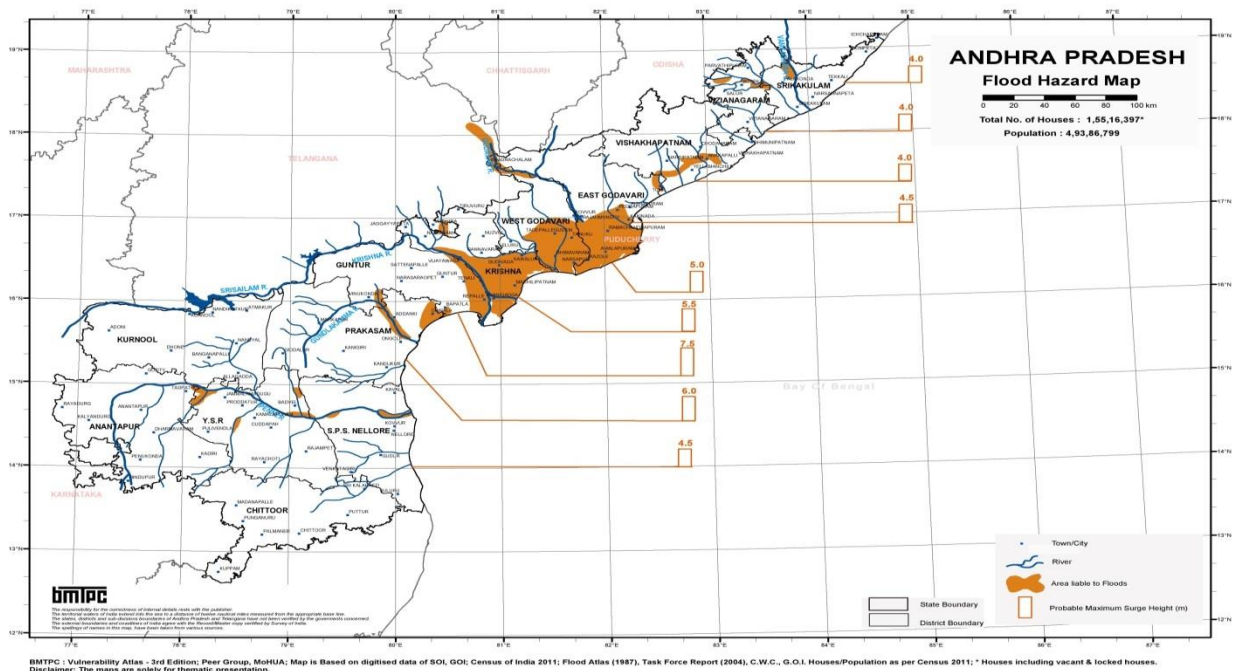


Figure 4.3.11.14: Flood Hazard Map of the Area

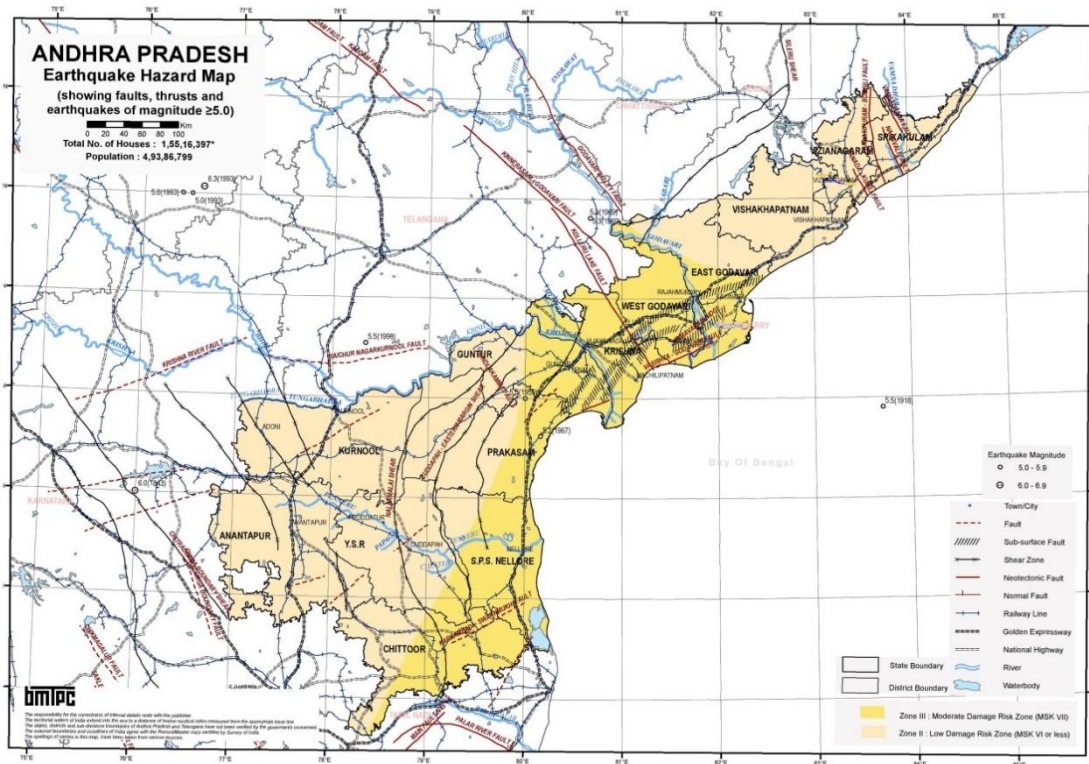


Figure 4.3.11.15: Earthquake Zone Map of the Area

VULNERABILITY STATUS OF PROJECT

The Overall vulnerability of the project road can be stated as moderate. List of various hazards and Vulnerability status along the project road are given in **Table 4.10** and **Error! Reference source not found..**

Table 4.3.11-1: Over all Vulnerability of Project road

S.No	Name of Road	Districts	Hazards		
			Earthquake	Flood	Vulnerability
1	Bowdara-Vizianagaram	Vizianagaram and Vishakhapatnam	Zone-II	-	Moderate

4.4 BIOLOGICAL ENVIRONMENT

4.4.1 FLORA

The project road has a variety of trees. Trees like palm, coconut, mango, teak, subabul, badam, banian, and tamarind are found along the project road. Details of trees are given in **Table 4.11**. During the baseline assessment, enumeration of

trees with in a 15m corridor on each side of the road was conducted and numbers of trees were found to be 3596 (LHS-1490 and RHS- 2106).

Table 0.11: List of Trees, Shrubs and Herbs along the Project road

Tree Name	Left	Right	Total
Adivi Marri	1	--	1
Badam	1	11	12
Badisa	21	24	45
Banian	21	29	50
Banian + Palm	11	11	22
Bellam	4	5	9
Boddu	--	1	1
Buridi	--	5	5
Buraga	3	--	3
Cashew	27	--	27
Coconut	31	50	81
Cotton	1	--	1
Dannu	1	--	1
Dirisena	2	5	7
Drum Struvk	1	--	1
Jaru Mamidi	3	--	3
Gandra	--	13	13
Jeed Mamidi	1	--	1
Kaju	--	2	2
Kanuga	182	134	316
Kanugu	--	27	27
Kankudu	4	--	4
Mango	56	48	104
Malam	--	1	1
Mulam	--	1	1
Neem	15	21	36
Neredu	11	9	20
Palm	883	1547	2430
Ragi	2	--	2
Seema Chinta	1	--	1
Subabul	66	61	127
Tamarind	13	28	41
Teak wood	112	65	177
Thurai	15	--	15

Tree Name	Left	Right	Total
Velaga	1	--	1
Ashok	--	6	6
Total Trees	1490	2106	3596

The trees species observed in the study area are given in **Table 4.12**.

Table 4.12: Trees Species Observed in the Study Area

S.No	Botanical Name	Vernacular Name	Family	Status
1	<i>Acacia auriculiformis Benth.</i>	Australia thumma	Leguminosae	Common
2	<i>Acacia leucophloea (Roxb.)</i>	Tella thumma	Leguminosae	Dominant
3	<i>Acacia nilotica (L.) Delile</i>	Nalla thumma	Leguminosae	Dominant
4	<i>Aegle marmelos (L.) Corrêa</i>		Rutaceae	Rare
5	<i>Ailanthus excelsa Roxb</i>	Pedda manu	Simaroubaceae	Dominant
6	<i>Alangium salviifolium (L.f.) Wangerin</i>	Vuduga chettu	Cornaceae	Sparse
7	<i>Albizia amara (Roxb.) B.Boivin</i>	Konda sigara	Leguminosae	Sparse
8	<i>Albizia lebbeck (L.) Benth.</i>		Leguminosae	Common
9	<i>Alstonia scholaris R.BR</i>	Edakula pala	Apocynaceae	Dominant
10	<i>Annona squamosa L.</i>	Seethapalam	Annonaceae	Common
11*	<i>Anthocephalus cadamba (Roxb.) Miq.</i>	Kadambe	Rubiaceae	Common
12	<i>Azadirachta indica A.Juss.</i>	Vepa	Meliaceae	Dominant
13	<i>Balanitesa egyptiaca (L.) Delile</i>	Gara	Zygophyllaceae	Common
14	<i>Bauhinia purpurea L.</i>	Bodhanta	Leguminosae	Dominant
15	<i>Borassus flabellifer L.</i>	Thadi chettu	Arecaceae	Dominant
16	<i>Butea monosperma (Lam.) Taub.</i>	Modhuga	Leguminosae	Sparse
17	<i>Carica papaya L.</i>	Bopaya chettu	Caricaceae	Common
18	<i>Cassia fistula L.</i>	Rela	Leguminosae	Sparse
19	<i>Cassia siamea Lam.</i>	Seema thangedu	Leguminosae	Common
20	<i>Ceiba pentandra (L.) Gaertn</i>	Tella buruga	Malvaceae	Sparse
21	<i>Chukrasia tabularis</i>	Konda vepa	Meliaceae	Common
22	<i>Citrus limon (L.) Burm. f.</i>	Nimma	Rutaceae	Sparse
23	<i>Cocos nucifera L.</i>	Kobbari	Arecaceae	Dominant
24*	<i>Dalbergia latifolia Roxb</i>	Jiteegi	Leguminosae	Sparse
25	<i>Dalbergia sissoo DC.</i>	Sisu	Leguminosae	Dominant
26	<i>Decalepis hamiltonii</i>	Maredu kommulu	Periplocaceae	Sparse
27	<i>Delonix regia (Hook.) Raf.</i>	Chittikesaram	Leguminosae	Dominant
28	<i>Dendrocalamus strictus</i>	Sanna vedru	Graminae	Dominant
29	<i>Diospyros melanoxylon, Roxb.</i>		Ebenaceae	Sparse
30	<i>Dolichandron eatrovirens (Roth) K.Schum.</i>		Bignoniaceae	Sparse

S.No	Botanical Name	Vernacular Name	Family	Status
31	<i>Eucalyptus globulus</i> Labill.	Neelagiri thylam	Myrtaceae	Common
32	<i>Ficus benghalensis</i> L.	Marri	Moraceae	Common
33	<i>Ficus hispida</i> L.f.	Medipandu, Bem medu akulu	Moraceae	Dominant
34	<i>Ficus microcape</i>		Moraceae	Sparse
35	<i>Ficus racemosa</i>	Medi	Moraceae	Common
36	<i>Ficus religiosa</i> L.	Ravi	Moraceae	Sparse
37	<i>Gmelina asiatica</i> L.		Lamiaceae	Rare
38	<i>Holoptelea integrifolia</i> Planch.	Nemali nara	Ulmaceae	Rare
39	<i>Lannea coromandelica</i> (Houtt.) Merr.	Gumpena	Anacardiaceae	Rare
40	<i>Leucaena leucocephala</i> (Lam.) de Wit	Jabarichettu	Leguminosae	Dominant
41*	<i>Limonia acidissima</i> L.	Velaga	Rutaceae	Common
42	<i>Madhuca indica</i> , Gmel.		Sapotaceae	Common
43	<i>Mangifera indica</i> L.	Mamidi	Anacardiaceae	Common
44	<i>Morinda tinctoria</i> Roxb.	Maddichettu	Rubiaceae	Sparse

4.4.2 FAUNA

Throughout the study area, there are no direct evidence of wild animal species observed. From the secondary source and local people in villages, it is also revealed that presence of common snakes exists here. Common bird species such as Paddy egrets, Green bee eaters, Indian rollers, Parakeets, common babblers, Weaver birds, Mynas, Black drangos, Crows, Sparrows are sighted here.

From the baseline survey, it was noted that none of the terrestrial species are under Rare, Endangered and Threatened (RET) species, and not listed in the Schedule I of the Indian Wildlife (Protection) Act, 1972 as amended in 1991. Details of faunal species found in the area are given in **Table 4.13**.

Table 4.13: Faunal Species found In the Study Area

Scientific Name	Common Name
<i>Bendicota bengalensis</i>	Indian mole rat
<i>Bendicota indica</i>	Bandicoot rat
<i>Mus booduga</i>	Little Indian Field mouse
<i>Mus musculus</i>	House Mouse
<i>Rattus rattus</i>	House rat
<i>Suncus murinus</i>	Grey musk shrew
<i>Funambulus palmarum</i>	Three striped palm squirrel

Scientific Name	Common Name
<i>Herpestes edwardsii</i>	Grey Mongoose

4.4.3 WILDLIFE PROTECTED AREAS

Wildlife Protected Area Map for Andhra Pradesh is given in **Figure 4.16**. There are no National Park, Wildlife Sanctuary, Biosphere Reserve and any other notified sensitive area within the 15 Km radius from the project road.

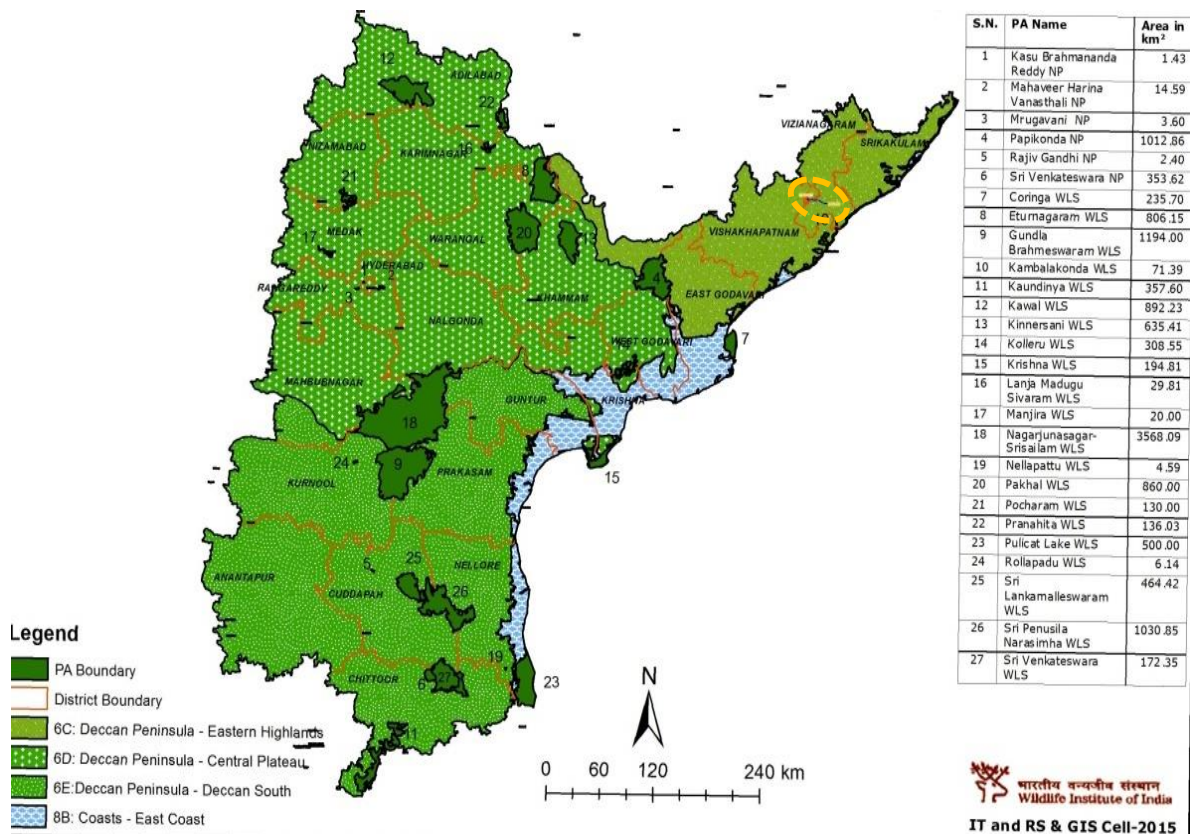


Figure 4.16: Wildlife Protected Area Map for Andhra Pradesh

4.5 SOCIO-ECONOMIC ENVIRONMENT

With the geographical area of 1,62,760 sq km Andhra Pradesh ranks as the 8th largest state in the country. Situated in a tropical region, the state has the 2nd longest coastline in the country with a length of 974 km. Andhra Pradesh is the tenth largest state in the Country, in terms of population. As per 2011 Census, the State accounts for 4.10% of the total population of the country.

The decadal growth of population rose from 18.88 % during 1961-71 to 21.13 % during 1981-91. Subsequently a significant decline was observed in the rate of growth of population and decline is even more prominent at 9.21 % during 2001-11, lower than the all-India's growth rate of 17.72 %.

The density of population for Andhra Pradesh is 304 persons per square kilometer, as against 368 persons per square kilometer at all India level in 2011. The sex ratio in the state was up from 983 in 2001 to 997 in 2011 and is higher than all India figures of 943 in 2011. The literacy rate of the State is 67.35 % in 2011 as against 62.07 % in 2001. The literacy rate of the State is lower than the all India literacy rate at 72.98% %. Literacy in Andhra Pradesh increased over 37 percentage points from 29.94 % in 1981 to 67.35 % in 2011. Female literacy rate has gone up from 52.72 % in 2001 to 59.96 % in 2011. Urbanization has been regarded as an important component for growth realization. The percentage of urban population to the total population in the State is 29.47 % in 2011 as compared to 24.13 % in 2001.

4.5.1 Demographic Features of the Project District – Vizianagaram

Vizianagaram district stands 21st position in terms of area with 6,539 sq. km, and ranks 23rd in terms of population with 23,44,474 persons in the State. Vizianagaram district stands 22nd position in terms of urban area with 140.06 sq. km, and ranks 22nd in terms of urban population with 4,90,911 persons in the State while it stands 21st in terms of rural area with 6,398.94 sq. km and ranks 21st in terms of rural population with 18,53,563 persons in the State.

Geographical area and population of the project district are given in **Table 4.14**.

Table 4.14: Geographical Area and Population of Project District

Sl. No.	District	Area in sq. km.	Population	No. of HHs
1	Visakhapatnam	11161	4290589	1097042
2	Vizianagaram	6539	2344474	587149
Andhra Pradesh State		1,62,760	84580777	21022588

Source: Final Population Tables, Census of India, 2011.

Literacy

The literacy rate of Vizianagaram district as per 2011 census is around 52.82 %. It is observed that the literacy rate of male in both rural and urban areas are higher as compared to female literacy rate in the district. A variation across the rural and urban areas and the gender gap in literacy for the project district is presented in the following **Table 4.15**.

Table 4.15: Gender wise Literacy Rate in Vizianagarm District of Andhra Pradesh

Literacy Rate %	Total	Rural	Urban
Persons	52.82	48.11	70.59
Males	57.13	58.68	53.15
Females	42.87	41.32	46.85
Gender gap in literacy	14.26	17.36	6.30
Source: Primary Census Abstract, Census of India, 2011			

Work Participation

The occupational classification as per 2011 Census shows that the percent total workers in Vizianagaram district account for 49.39 % of total population of the district. The proportion of main workers to total population in Vizianagaram district is around 40.66 %. Out of the total main workers, male main workers accounted for 51.87 % and female main workers are around 29.65 %. Of the remaining total population, around 8.73 % are marginal workers. It can be seen from the below table that, in the project district that nearly 50 % of the total population are non-workers. The details across gender are presented in the following **Table 4.16**.

Table 4.16: Percentage of Workers and Non-Workers in Vizianagaram District of Andhra Pradesh (w.r.t. Total Population)

Description	Total	Male	Female
Work Participation Rate (%)	49.39	58.48	40.46
Proportion of Main Workers (%)	40.66	51.87	29.65
Proportion of Marginal Workers (%)	8.73	6.61	10.82
Proportion of Non Workers (%)	50.61	41.52	59.54

Description	Total	Male	Female
Source: Primary Census Abstract, Census of India, 2011			

Occupation Profile

The occupation classification in Vizianagaram district shows that, out of the total main workers, cultivators comprising (20.67 %), Agricultural Labourers (43.99 %), Household Industries workers (2.30 %) and other workers (33.04 %). Occupation profile of Vizianagaram District is given in **Table 4.17**.

Table 4.17: Occupation profile of Vizianagaram District of Andhra Pradesh (w.r.t. Total Main Workers)

Occupation	Total	Male	Female
Cultivators (%)	20.67	20.84	20.37
Agricultural labourers (%)	43.99	35.32	58.89
Household Industries (%)	2.30	2.29	2.33
Other workers (%)	33.04	41.55	18.41
Source: Primary Census Abstract, Census of India, 2011			

4.5.2 Demographic Features of the Project District – Visakhapatnam

Demographic profile has an important bearing on the development process. According to the 2011 census, the total population of Visakhapatnam district is around 42.90 lakhs.

The proportion of urban population is 47.45% in Visakhapatnam district. The number of households in Visakhapatnam district is 1097042 of which around 52.82 % are in rural area and the remaining 47.18 % are in urban areas.

The average household size is 3.91 in Visakhapatnam district. The sex ratio is 1006 in total. The proportion of SC population is around 7.68 %. The ST population in Visakhapatnam district is around 14.42 %. The basic demographic details are presented in below **Table 4.18**.

Table 4.18: Demographic profile of Visakhapatnam District

Description	Total	Rural	Urban
No. of Households	1097042	579417	517625
Population	Persons	4290589	2035922
	Males	2138910	1025676
	Females	2151679	1010246
Sex ratio (Females per 1000 Males)	1006	1025	985

Description	Total	Rural	Urban
Proportion of SC Population (%)	7.68	6.74	8.72
Proportion of ST Population (%)	14.42	25.72	1.89

Source: Primary Census Abstract, Census of India, 2011

Literacy

The literacy rate of Visakhapatnam district as per 2011 census is around 59.86 %. It is observed that the literacy rate of male in both rural and urban areas are higher as compared to female literacy rate in the district. A variation across the rural and urban areas and the gender gap in literacy for the project district is presented in the **Table 4.19**.

Table 4.19: Gender Wise Literacy Rate in Visakhapatnam District

Literacy Rate %	Total	Rural	Urban
Persons	59.86	47.55	73.48
Males	66.52	55.55	78.43
Females	53.23	39.75	68.46
Gender gap in literacy	13.29	15.80	9.98

Source: Primary Census Abstract, Census of India, 2011

Work Participation

The occupational classification as per 2011 Census shows that the percent total workers in Visakhapatnam district account for 44.05 % of total population of the district. The proportion of main workers to total population in Visakhapatnam district is around 34.52 %. Out of the total main workers, male main workers accounted for 49.08 % and female main workers are around 20.05 %. Of the remaining total population, around 9.53 % are marginal workers. It can be seen from the below table that, in the project district that nearly 55.95 % of the total population are non-workers. The details across gender are presented in the following **Table 4.20**.

Table 4.20: Percentage of Workers and Non-Workers in Visakhapatnam District of Andhra Pradesh (w.r.t. Total Population)

Description	Total	Male	Female
Work Participation Rate (%)	44.05	57.93	30.25
Proportion of Main Workers (%)	34.52	49.08	20.05
Proportion of Marginal Workers (%)	9.53	8.85	10.20

Description	Total	Male	Female
Proportion of Non Workers (%)	55.95	42.07	69.75
Source: Primary Census Abstract, Census of India, 2011			

Occupation Profile

The occupation classification in Visakhapatnam district shows that, out of the total main workers, cultivators comprising (19.23 %), Agricultural Labourers (25.42 %), Household Industries workers (2.55 %) and other workers (52.80 %). Occupation profile of Visakhapatnam District is given in **Table 4.21**.

Table 4.21: Occupation Profile of Visakhapatnam District of Andhra Pradesh (w.r.t. Total Main Workers)

Occupation	Total	Male	Female
Cultivators (%)	19.23	17.33	23.84
Agricultural Labourers (%)	25.42	20.11	38.36
Household Industries (%)	2.55	2.28	3.20
Other Workers (%)	52.80	60.28	34.60
Source: Primary Census Abstract, Census of India, 2011			

4.5.3 Demographic Profile of Settlement Along The Project Road

Demographic profile of settlement along the project road are given in **Table 4.22** as per census records 2011.

Table 4.22: Demographic Profile of Settlements Along the Project Road

Name	No_HH	TOT_P	TOT_M	TOT_F	P_SC	M_SC	F_SC	P_ST	M_ST	F_ST
Tennuboddavara	622	2257	1099	1158	152	77	75	899	420	479
Kiltampalem	518	2239	1162	1077	160	87	73	682	343	339
Chinakhandepalle	68	201	107	94	0	0	0	19	9	10
Mushidipalle	212	1365	378	987	240	75	165	448	207	241
Chinakhandepalle	68	201	107	94	0	0	0	19	9	10
Mushidipalle	212	1365	378	987	240	75	165	448	207	241
Tatchidi (Tuttidi)	39	187	100	87	0	0	0	187	100	87
Kondataduru	99	362	190	172	0	0	0	343	185	158

4.6 TOURISM

As per tourist map of Andhra Pradesh, Borra caves and Araku valley are the tourist spots near to Bowdara (start point of project road). The Tourist map of Andhra Pradesh is shown in **Figure 4.17**.



Figure 4.17: Tourist Map for Andhra Pradesh State

4.7 INDUSTRIES

There are no specific industries along the project road.

4.8 ARCHAEOLOGICAL AND HISTORICAL MONUMENTS

The project road doesn't have any notified/protected archaeological or historical monument.

CHAPTER 5

ANTICIPATED ENVIRONMENTAL IMPACTS

5.1. Environmental Impacts & Issues

This section presents identification and evaluate of anticipated impacts during pre-construction, construction and operation phases of the two lane upgradation with paved shoulders of Bowadra to Vizianagram Section of NH 516 E in Andhra Pradesh. The planning of the proposed project intervention points towards the impacts in the pre-construction, the construction stages and the operation stages. The subsequent sections deal with the prediction of impacts due to the project on the physical, biological and socio & cultural environment **Tables 5.1** and **5.2** below presents the general environmental impacts expected due to the proposed up-gradation of the project road. Environmental impacts have been assessed based on the information collected from the project activities as per DPR, screening & scoping of environmental attributes, and baseline data collected during the EIA study. The quantum of anticipated impacts on physical, biological and socio-economic environment has been discussed in details in subsequent paragraphs.

5.2 Impacts on Topography, Physiography and Geology

Construction Phase

The two lane upgradation with paved shoulders of Bowadra to Vizianagram Section of NH 516 E is traversing mostly through plain territory. Therefore, no significant cutting and filling activity will be involved in existing alignment of the project road.

The proposed up-gradation of the project road will be confined along the existing alignment except two realignments in the length of 1920 m. The design has not suggested any substantial change in the height of the embankments of the existing alignment. However, for construction of two realignments at Bowdara Junction (Km 2.700 to Km 3.150) and Thatipudi (Km 9+680 to Km 11+150), earth filling will be required for embankment for new road construction. The overall topography of the area is not going to alter due to minor changes in geometry & profile and two realignments construction.

Table 5.1 : Anticipated Impacts on Physical & Biological Environment

Project Activity	Planning and Design Phase	Pre-construction Phase		Construction Phase					Road Operation
		Removal of Old Structures	Removal of trees and vegetation	Earth works including and borrow area	Laying of pavement	Vehicle & Equipment operation & maintenance	Asphalt & crusher plants	Sanitation & Waste (labour campus)	Vehicle operation
Air		Dust generation during dismantling	Reduced buffering of air pollution, Hotter, drier microclimate along the road	Dust generation	Asphalt odour and emissions	Dust, Pollution	Soot, Odour, gaseous Dust, Pollution	Odour / Smoke from Cooking of food	dust, vehicular emissions
Land	Impact on productive land if land acquisition required	Generation of debris	Erosion and loss of top soil	Erosion and loss of top soil	Land contamination due to improper disposal of bitumen waste/ solid wastes	Contamination by fuel and lubricants and compaction	Contamination and compaction of soil at camp & Plants	Contamination from Wastes and sewage	--
Water	Impact on Water Sources	Siltation due to loose earth	Siltation due to loose earth	Alteration of drainage, Break in continuity of ditches Siltation,	Reduction of ground water recharge area	Contamination by fuel and lubricants	Contamination by asphalt leakage or fuel	Contamination from wastes and untreated	Spill Contamination by fuel, lubricants and washing of vehicles

Project Activity	Planning and Design Phase	Pre-construction Phase		Construction Phase					Road Operation
				Stagnant water pools in quarries and borrow area.				sewage disposal	
Noise		Noise Pollution	High Noise due to machinery	Noise Pollution	Noise pollution	Noise pollution	Noise Pollution	--	Noise from traffic movement
Flora	Tree cutting		Loss of Biomass and vegetation cover due to Removal of vegetation	Lowered productivity loss of ground for vegetation	--		Lower productivity Use as fuel wood	Felling trees for fuel	Compensatory plantation and road side plantation

Table 5.2: Anticipated Impact on Social and Cultural Environment

Project Activity	Planning and Design Phase	Pre Construction Phase			Construction Phase					Operation		
		Land acquisition	Removal of Structures	Removal of trees & vegetation	Earth works including quarrying	Laying of Pavement	Vehicle & machine operation & maintenance	Asphalt and crusher plants	Labour Camps	Vehicle operation	Indirect Induced development	
Env. Component Affected	Design decisions & Implementation policies											-
Agricultural land	-	Change in land prices	Change in land economic value	Loss of standing crops	Loss of productive land	-	-	Dust on agricultural land reduce n productivity	-	-	-	Conversion of Agricultural Land
Buildings and built structures in ROW	-	-	Loss of structures, Debris generation, Noise and Air pollution	-	Dust Deposition on structures	-	Noise, vibration may cause damage to structures near to road	Dust accumulation on building and structure	-	Vibration and noise		Change in building use and characteristics
People and Community	Impact on near by community structure,	-	Impact on people and loss of livelihood	Loss of shade & community tree.	Health hazard to people	Odour and dust	Noise and Air pollution and discomfort	Air and noise pollution and discomfort	Community clashes with migrant labour	Risk of accident due to increase in speed on smooth carriageway		Induced pollution and increase in accident rate

Project Activity	Planning and Design Phase	Pre Construction Phase			Construction Phase					Operation	
										Direct	Indirect Induced development
Cultural Assets	-	Impact on access to cultural structure	Displacement loss of structure from RoW	--	--	-	--	Dust accumulation	-	Damage from vibration & air pollution	-
Utilities and Amenities	-	-	Interruption in supply	-	-	-	Damage to utility and amenities	Dust accumulation on water bodies	Pressure on existing amenities		-
Labour's Health & Safety	-	-	-	-	Stagnation of water and disease	Asphalt odour and dust	Accident and injuries to labour/public	Impact on health due to inhale of dust	Health hazard from raw sewage disposal/wastes	Road safety issues	-

During construction of the project, following environmental impacts are anticipated on topography and physiography:

- minor changes are anticipated in existing profile of the land due to borrow pits and construction of re-alignments and improvement of sharp curb.
- disturbance on geological setting due to quarrying.
- uncontrolled digging of borrow pits resulting in water accumulation & breeding of vector disease.
- construction of embankments for realignments,
- debris disposal,
- construction of diversions roads for construction of bridge and culverts.

Physiographic impacts could be due to the construction of the embankments of two realignments at Bowdara Junction (Km 2.700 to Km 3.150) and Thatipudi (Km 9+680 to Km 11+150) and improvement of sharp curbs. The height and width of the embankment will be altered, when the road is widened and rehabilitated as per the new design for the project road.

In most of the stretch along the project road, project will stick to the existing ROW without any noticeable changes.

Borrow earth will be required in the project road for filling and will be obtained from several borrow areas to be opened in the nearby areas or from the existing approved borrowing areas. Except the construction of embankments, there would not be any other impacts to geomorphology of the area during construction stage.

Most of the excavated materials from existing roads will be left reused as construction materials. If not used, contractor may dispose of this in the nearby areas causing untidiness near disposal areas. Therefore, this is seen as a potential impact. It may increase soil erosion and could generate considerable impacts on natural drainage courses, and siltation to runoff during rains.

Likely impact on the geological resources will occur from the extraction of construction materials like borrow of earth, granular sub-base and aggregates for base courses, culverts and bridges.

Operational Phase

Upgradation and widening of the project road will not cause any topographic, physiographic and geological changes during operational stage.

5.3 Impact on Seismological Characteristics

The project road is located in seismic zone II as per BIS classification with low seismic risk. All cross-drainage structures and bridges on the project roads need to consider the seismic coefficients with regards to the seismic energy propagation along the fragile geological/lithological strata.

The construction and operation phase of the project road are not expected to add the seismicity issues due to the project road.

5.4 Impact on Soil

Construction Phase

Soil Erosion: Erosion of top-soil can be considered a moderate, direct and long-term negative impact resulting from the construction of existing road and two realignments at Bowadara Junction (Km 2.700 to Km 3.150) and Thatipudi (Km 9+680 to Km 11+150). The potential for soil erosion is pervasive during the construction stage, especially in realignment and earth work on the existing alignment. Starting with clearing and grubbing, vegetation will be stripped away, exposing raw soil. Earth works and embankment will also prone to erosion during rains.

Road Slopes and Spoils: Erosion problems may occur on newly constructed slopes and earth fills in realignments depending on soil type, angle of slope, height of slope and climatic factors like wind (direction, speed and frequency) and rain (intensity and duration). Soil erosion will add siltation to the runoff during the monsoon season.

Construction of New Bridges and Culverts: Along the project road reconstruction/widening of bridges and culverts is planned. Major bridge will be constructed at existing chainage Km 22.612 (Design Chainage Km 9.883) and minor bridge will be constructed at design chainage Km 26+511, Km 24+526,

Km 17+570 and Km 10+092, while 71 pipe culverts and 18 box culverts are proposed to be constructed in the proposed project. Construction of bridges involves excavation of natural water channels bed and banks for the construction of the foundation and piers. If the residual spoil is not properly disposed of, increased sedimentation in downstream of the bridge may take place during the monsoon. Also, the bridge-end fills require armouring to ensure minimum gullying and slumping.

During the construction period, some amount of drainage alteration and downstream erosion/siltation is anticipated. Some of these alterations may be because of construction of temporary traffic detours/diversion. Except for these temporary works, in almost all cases there should be an improvement in the drainage characteristics of the surrounding area due to improved design and added culvert/ditch capacity. Changes in the drainage pattern due to the raising of the road profile has not been discussed in specific cases, as the likely impact will not adverse and does not warrant mitigation as the road design itself takes care of cross drainage.

Quarries and Borrow Areas: The excavation of quarries and borrow pits used for obtaining aggregate materials and soil for road construction can cause direct, and indirect long-term major adverse impacts on the environment. While loss of productive soil is the most direct negative impact from borrow areas, other significant indirect negative impacts can also occur. Since most of the construction materials would be available from existing quarries nearby, relatively few new borrow areas may be required. One of the long-term residual adverse impacts of borrow pits not reclaimed, is the spread of mosquitos. Mosquitoes breeding and multiplying in stagnant water that collects in these pits can affect human health in villages in close vicinity.

Generation of Debris: The major source of debris generation is dismantling of existing cross drainage structures, scarifying of bitumen from carriageway and removal of existing road for upgradation.

Contamination of Soil: In this project, contamination of the soil may take place, from the following activities at the construction zones, construction labor camps, construction plant sites and other auxiliary facilities required for the construction. Details of the activities from which the contamination can occur are presented below:

- Scarified bitumen wastes,
- Debris generation due to dismantling of structures,
- Runoff from muck disposal area,
- Maintenance of the machinery and operation of the diesel generator sets on site,
- Oil spill from the operation of the construction machineries, maintenance and diesel storage and diesel generator sets,
- Spillage bitumen from operation of hot mix plant,
- Wastes from the residential facilities for the labour and officers at camp site, and
- Storage and stock yards of bitumen

Operation Phase

No significant impact is anticipated on soil along the road during operational phase.

5.3. Water Environment

5.3.1 Water Resource - Impacts

A. Surface Water -Impacts

The project roads are crossing natural streams at design chainage Km 9.883, Km 26+511, Km 24+526, Km 17+570 and Km 10+092, which remain dry in non-rainy days. There is no perennial river crossed by the project roads. No potential impact is anticipated on surface water bodies during the pre-construction phase.

Construction Phase

Estimated water requirement will be 30 to 40 kl per day per kilometre. Depending on the source of water there could be minor depletion of water sources due to the construction water requirements.

Operation Phase

During operation phase, no impact is anticipated on surface water resources.

B. Ground Water - Impacts

Construction Phase

Along the project road, ground water resources are available and ground water will be exploited through mostly from tube wells, where surface water sources are not available. Therefore, the eventual impact of the proposed upgradation of the project road will be negated to a considerable extent.

Operation Phase

During the operation phase, ground water resource will not be affected significantly. Therefore, no significant impact is anticipated during operation phase. However, rainwater harvesting will be provided along the project road in unpopulated areas.

5.3.2 Water Quality - Impacts

A. Impact on Surface Water Quality

Degradation of surface water quality due to sediment transport with runoff through erosion of soil and earth may occur from activities like removal of trees, clearing and grubbing, removal of grass cover, excavation, stock piling of materials as part of the pre-construction and construction activities. The soil type present along the project corridor consists of the loamy/silty soil, which are prone to erosion. The impacts due to increased sediment laden run-off will make the water more turbid. This is a significant negative impact on the water bodies/flowing streams. Heavier sediment may smother the algae growing in the lower strata and could completely alter the nature of the watercourse. Excessive sediment loads may also mean disruption to areas of fish breeding/aquatic life.

Contamination of Surface Water - The degradation of the surface to a much less extent ground water quality can occur from pavement construction works, bridge construction works at design chainage Km 9.883, Km 26+511, Km 24+526, Km 17+570 and Km 10+092, construction plants, machinery and accommodations of workers. The sources of water pollution from the construction activities are as follows:

- Water flow from scarified bitumen materials,
- Rain-water flow from muck disposal area,
- From the foundation works of the bridges and culverts such as piling and excavation for open/well foundations,
- Oil spills from the maintenance of the machinery and operation of the diesel generator sets on site,
- Oil spill from diesel storage and parking places,
- Operation of the emulsion sprayer and laying of hot mix,
- Discharge of sewage and waste from labour and plants,
- Storage and stock yards of bitumen and emulsion.

Degradation of water quality is also possible due to accidental discharges into water-courses from drainage of workers camps and from spillages from vehicle parking and/or fuel and lubricant storage areas.

Operation Phase

During normal operation phase, no impact is anticipated on the surface water quality.

B. Impact on Groundwater Quality

No impact is anticipated on ground water during pre-construction phase.

Construction Phase

- During construction phase, ground water quality can be affected due to following reason:
- Spillage of diesel, lube oil and used oil could lead to ground water pollution in long term and can affect ground water quality.
- Leached water from scarified bituminous waste materials entering into ground.
- Disposal of solid wastes, used POL wastes, oil contained cotton wastes in non-environmentally sound manner and leaching to ground water.

Operational Stage

During the normal operation phase, no impact is anticipated on the ground water quality of the area.

C. Floods Related Impacts

Pre construction phase impacts

The natural drainage channels are located at design chainage Km 9.883, Km 26+511, Km 24+526, Km 17+570, Km 10+092, and at 88 culvert locations. Pre-construction activities such as tree removal and clearing and grubbing will not lead to any flood related impacts.

Construction Phase

During construction phase, the project activities are unlikely to create localized flood related issues. Nevertheless, various construction activities could temporarily worsen the flooding problem due to improper drainage conditions on account of the contractor's poor engineering practices and negligence. If the high intensity rainfall continues for many days a number of sections along the project road could develop flooding situation.

Operation Phase

During operation phase, flood related impacts would not be appeared as culverts and cross drainage structures will be reconstructed/ constructed and widened to maintain proper drainage. Therefore, no flood related impact is anticipated during operation phase.

5.4 Impact on Air Environment

Construction Phase

During construction phase, there will be two main sources of air emissions *i.e.* mobile sources and fixed sources. Mobile sources are mostly vehicles involve in construction activities while emissions from fixed sources include diesel generator set, construction equipment and excavation/grading activities those produce dust and gaseous emissions.

Certain amount of dust and gaseous emissions will be generated during the construction phase from excavation machines and road construction machines. Pollutants of primary concern include Particulate Matter (PM_{2.5}) and Particulate

Matter (PM₁₀). However, suspended dust particles may be coarse and will be settled within a short distance from construction area. Therefore, anticipated impact on ambient air quality will be temporary and restricted within the closed vicinity of the construction activities along the project road only.

Considerable amount of emissions of carbon monoxide (CO), unburned hydrocarbon, sulfur di-oxide, particulate matters, nitrogen di-oxide (NO₂), etc, will be generated from the hot mix plant and may cause air pollution problem in nearby areas.

Summarily, generation of dust is likely due to:

- Site clearance and use of construction vehicles and machinery, etc.
- Transport of raw materials, borrow and quarry materials to construction sites,
- Earthworks,
- Stone crushing operations at the crushers,
- Handling and storage of aggregates at the asphalt plants,
- Concrete batching plants, and
- Asphalt mixing plants due to mixing of aggregates with bitumen.

Generation of dust is a critical issue and is likely to have adverse impact on health of workers and vegetation in surrounding areas. Generation of exhaust gases is likely due to movement of heavy machinery for clearance of the RoW for construction. High concentration of HC and NO_x are likely from hot mix plant operations. Toxic gases are released through the heating process during bitumen production. Although the impact will be much localized, it can be dispersed downwind depending on the wind speeds.

Air Pollution Modelling for Construction Phase

During the construction phase, the activities related to earthwork/rock excavation, borrow area operations, transport of material, storage and handling of construction materials, quarrying and/or stone crushing operations, movement of construction vehicles on unpaved roads, Hot-mix plant, handling of cement in batching plants, among others would contribute to the increased dust levels in terms of PM₁₀, PM_{2.5}, and other air pollutants like SO₂, and NO_x, and carbon monoxide levels.

The maximum concentration of PM₁₀ predicted is 4.75 µg/m³. PM₁₀ values are varying between 0.05 to 4.75 µg/m³ in the surrounding areas of the road project stretch. When compared with the National Ambient Air Quality Standard (NAAQS) of 100 µg/m³ for 24 hourly PM₁₀ concentration, predicted values are well below the prescribed standard limit on the road project stretch.

The maximum concentration of PM_{2.5} predicted is 7.47 µg/m³. PM_{2.5} values are varying between 0.1 to 7.47 µg/m³ in the surrounding areas of the road project stretch. When compared with the National Ambient Air Quality Standard (NAAQS) of 60 µg/m³ for 24 hourly PM_{2.5} concentration, predicted values are well below the prescribed standard limit on the road project stretch.

The predicted 1st high 8 Hour values of CO are varying from place to place in Bowdara –Vijayanagaram road. The maximum concentration of CO predicted is 901 µg/m³ (0.901 mg/m³). CO values are varying between 9 µg/m³ to 901 µg/m³ (0.009 mg/m³ to 0.901 mg/m³) in the surrounding areas of proposed road stretch. When compared with the National Ambient Air Quality Standard (NAAQS) of 4 mg/m³ (4000 µg/m³) for 8 hourly CO concentration, predicted values are well below the prescribed standard limit on the road project stretch.

The predicted concentrations of PM₁₀, PM_{2.5} and CO are found to be well below the NAAQ standards at all the places. It is already suggested in EMP to go for avenue plantation on either side of the proposed project road and median plantation. This will further reduce the concentration of PM & CO.

In the existing scenario, due to lesser width and higher roughness, the average vehicle speed is low, which results in more exhaust gas emissions. In the post-project scenario, improved road conditions and congestion free traffic movement will reduce emissions.

Furthermore, lower growth of traffic and better road conditions with improved average speed, which constitutes about 95% of the total project road length, will not have any significant increase in concentration of PM and CO even after 20 years of operation, subject to regular maintenance of the road condition and maintaining the average speed of traffic.

However, in Bowdara –Vijayanagaram road, the emissions will increase significantly due to increase in traffic density.

The Isopleths of PM₁₀, PM_{2.5} and CO concentration along the project stretch are given below in **Figures 5.1, 5.2** and **5.3**.

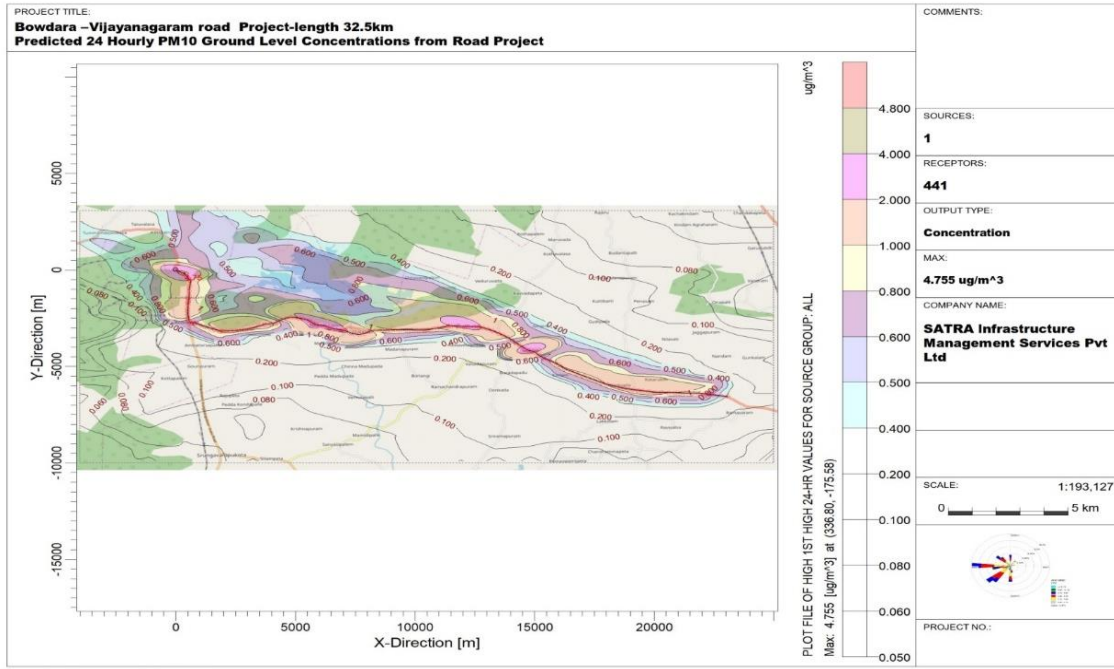


Figure 5.1: Isopleths Showing 24 Hourly GLC's for PM₁₀

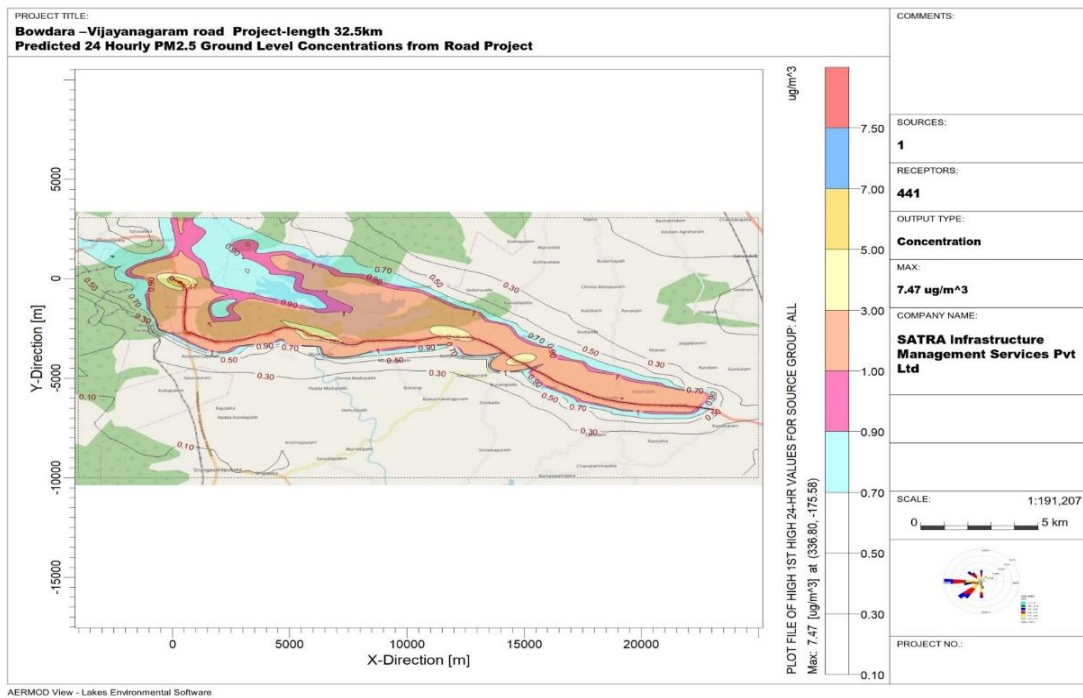


Figure 5.2: Isopleths Showing 24 Hourly GLC's for PM_{2.5}

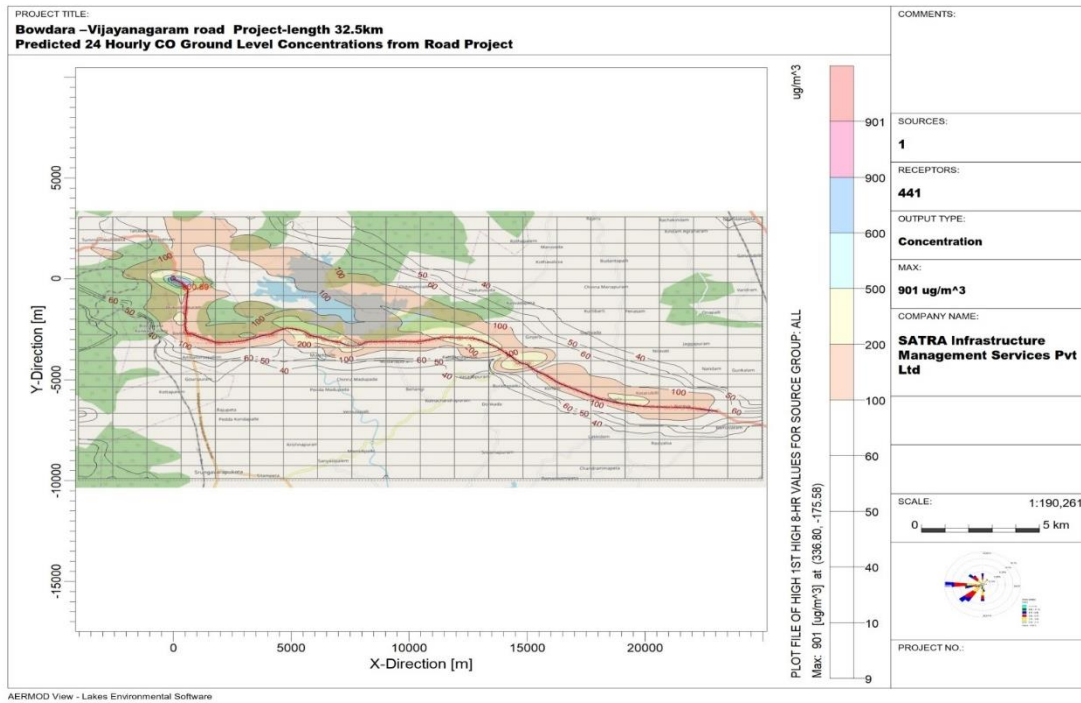


Figure 5.3: Isopleths Showing 24 Hourly GLC's for CO

Operational Phase

During operational phase, the congestion will be relieved to an optimum level on the project road. Widening and improvement along the project road could result in improved surface condition and traffic capacity. During the operation phase, vehicular emission will be emitted from vehicular movement on the roads.

5.5 Impact on Noise Environment

Construction Phase

Highway traffic noise, is a complex phenomenon because its intensity and characteristics vary with time depending upon the frequency as well as type of vehicles on the road. The impacts of noise due to the project roads will be of temporary significance locally in the construction phase. Table below present the source of noise pollution and the impact categorization.

Sn.	Phase	Source of Noise pollution	Impact categorization
1.	Pre-construction	<ul style="list-style-type: none"> • Man, material & machinery movements • establishment of labor camps, onsite offices, stock yards and construction plants 	<ul style="list-style-type: none"> • all activities will last for a short duration and also shall be localized in nature
2.	Construction Phase	<ul style="list-style-type: none"> • Plant Site <ul style="list-style-type: none"> - stone crushing, asphalt production plant and batching plants, diesel generators etc • Work zones <ul style="list-style-type: none"> - Community residing near to the work zones 	<ul style="list-style-type: none"> • Plant Site: Impact will be significant within 250m. • Work zones: Such impacts again will be of temporary nature as the construction site will go on changing with the progress of the works.

Construction - Related Noise

With regards to noise related impacts, construction phase is a difficult stage. During this period noise impacts will be high due to operation of construction machineries and the conflict with the regular traffic requiring more honking of vehicle horns and more stop and go (acceleration and deceleration process).

All temporary noise related impacts in the immediate vicinity of the project roads will occur during the construction activities. This will be occurred along the construction zones as well as construction camps, hot mix plants, WMM plants, crusher and quarry sites (if required).

Typical noise levels associated with highway construction is given in **Table 5.3**. The magnitude of impact will depend upon the specific types of equipment to be used, the construction methods employed and the scheduling of the work.

Table 5.3 : Typical Noise Levels Associated with Road Construction

Sn.	Activity Noise Levels	(d(B)A)
1.	Grading & Clearing	84
2.	Excavation	89
3.	Foundations	88
4.	Finishing of Road	84

Project Road Noise modelling

Dhwani-pro noise model is developed to undertake construction, industrial and traffic noise propagation studies for noise assessment. The model is used to predict the impact of noise on receptors from the noise generation source. It is also used to predict impact due to group noise sources in the industrial complex (multiple sound sources) and traffic.

A noise propagation modeling study has been conducted to find out the impact from the noise generated because of the estimated total traffic flow as well as the significance of these impacts. The noise modeling has been done taking into account the design speed at various stretches and the stretches with restricted speeds have also been considered.

Noise modeling for the project road is given in **Table 5.4**.

Table 5.4: Noise level predictions for the locations

S.No	Name of Locations	Noise Level dB(A)
1	Bowdera	55
2	Gantiyada	50
3	Vizayanagaram	60

The predicted noise levels during both day and night time are below the stipulated limits at road project stretch for all the land uses *i.e.*, commercial, residential/rural and sensitive.

The contour map showing noise levels due to traffic at the project stretch has been shown in **Figure 5.4**.

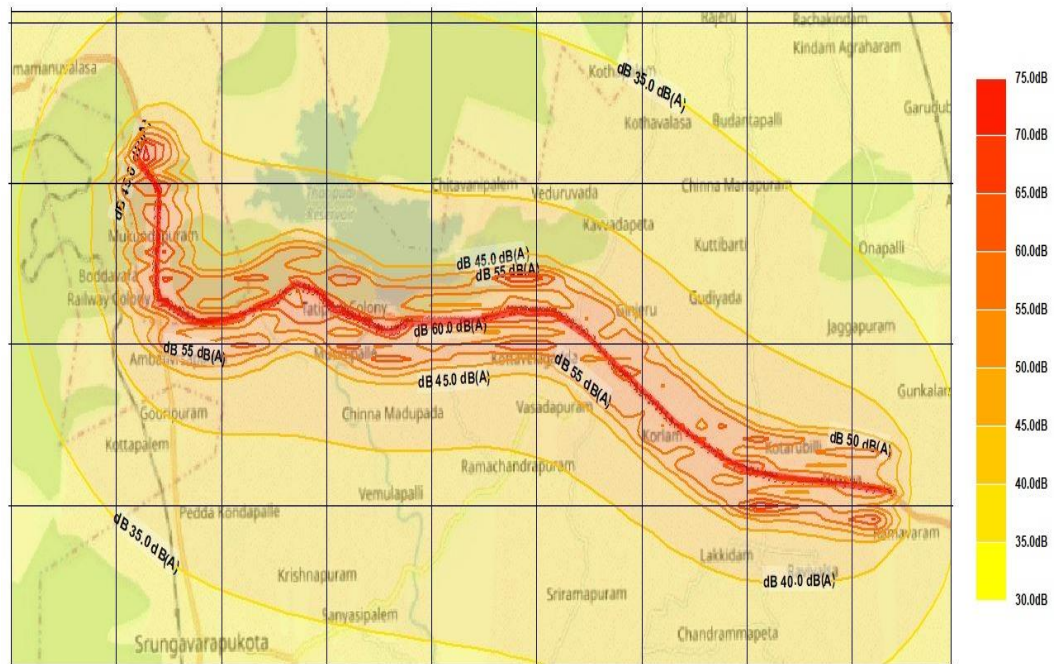


Figure 5.4: Contour Map Showing Noise Levels Due to Traffic at the Project Stretch

Operational Noise

During operation phase, noise levels will be reduced due to smooth flow of traffic on reconstructed/upgraded road. However, traffic will be increased on the road in due course of time and subsequently noise levels are expected to increase.

5.6 Impact on Biological Environment

5.6.1 Anticipated Impacts

The proposed up-gradation of the project road doesn't involve forest areas. Hence, anticipated impact on Forest area is not envisaged. Existing road side vegetation and trees were recorded during the field survey. Crops fields and open land are observed on both sides of the project road. Some of the indigenous of trees are likely to be cut down due to the upgradation.

Depending on the final design for upgradation/widening of road, the tree cutting and resultant pressure on flora and fauna (mainly avifauna) could be the potential impact during preconstruction/construction.

The major impact in this project on flora involves the removal of trees to permit construction and to provide clear zone for safety of the road users. **Table 5.5** below presents the major adverse impacts on the flora & fauna and the indicators chosen to assess the impacts for this study.

Table 5.5: Impacts Due To Construction and Indicators

Impacts Due To Construction	Indicators
Tree felling	No. of trees to be felled
Vegetation	Area of vegetation loss

Forest Area

There is no forest along the project road. Therefore, impact related to forest will not be appeared in the project.

Wildlife

There is no wildlife sanctuary, national park or bioreserve along the project roads. Therefore, no impact is anticipated on wildlife due to up-gradation of the project road.

Tree Cutting

Approximately 3596 trees are likely to felled for upgradation of the project. Trees growing within the proposed toe line (bottom of formation) will need to be removed for upgradation of the project road. Roadside trees with strong and rigid stems can pose safety hazards. Some trees obstruct clear sight distances. Others have a propensity to overturn when old and are potential safety hazards depending upon age and decay condition. All such trees that are safety hazards need to be cleared. All efforts will be made to minimizing cutting of trees.

There will be a significant, direct impact due to cutting of the roadside trees, it includes:

- The loss of shade.
- Loss of tree products.
- Loss of birds nesting place.
- Removal of roadside trees will also reduce comfort levels for slow moving traffic and pedestrians.
- The removal of trees would lead to erosion and contributes to the loss of the micro-ecosystems developed on the roadside.
- Besides these trees act as noise barrier, dust absorption, pollutant sequester, etc.

Removal of Vegetation

Clearing and grubbing is the foremost requirement to start the construction activities of the project roads. The impact due to removal of vegetation includes:

- Dust generation during windy atmosphere.
- Loss of productive top soil.

- Soil erosion during rainy season, may lead to water contamination.

Measures have been taken in reducing and curtailing the clearing and grubbing of excess land.

Impact of Dust on the Vegetation Growth

During the construction activities, dust will be emitted and deposited on the leaves of vegetation/crops along the project roads. Dust deposition on the leaves will affect the photosynthesis process and subsequently hamper the growth of the plants.

5.7 Impact on Socio-Economic Environment

Construction and operation phases of the project road will have some beneficial impact on social environment. Some increase in income of local people is expected as some local unskilled, semiskilled and skilled persons will gain direct or indirect employment during construction phase. Since the immigration of work force during construction phase is likely to be very small, the social impacts on literacy, health care, transport facilities and cultural aspect are expected to be insignificant.

The impacts of the construction of the project road on the socio-economic environment are systematically discussed under the following categories:

- Influx of construction workers,
- Economic impacts,
- Relocation of community structures within the proposed ROW.

Influx of Construction Workers

Although the construction contractors are likely to use un-skilled labour drawn from local communities, use of specialized road construction equipment will require trained personnel not likely to be found locally. Sudden and relatively short-lived influxes of construction workers to communities along the project will have the potential to 'skew' certain demographic variables and the traditional social coherence.

It is anticipated that the construction labour inputs for the construction of the project road will be in the order of about 100 to 150 persons per day. However, this number will fluctuate and the number in any particular activities will be lower.

Economic Impacts

The relatively short-lived economic impacts of the construction phase are likely to be experienced in local communities for the duration of construction, as workers will make everyday purchases from local traders. This is likely to give a short-lived stimulus to these traders that will disappear as soon as the construction is complete. Wider, flow-on economic impacts will be experienced in other sectors of economy as a result of purchase of construction materials and the payment of wages and salaries.

Impact on Religious Structures and Cultural Properties

Few religious structures are located along the project road. Some of these religious structures may be partially or fully affected during up-gradation of the project road. Shifting of religious structures is sensitive issue, therefore, local community and followers of religious structures should be taken in to confident.

Common Property Resources

Along the project road, few community structures are located, which are used by local communities. The partial or total impact on these common property resources is anticipated due to up-gradation of the project road. These should be properly relocated and rehabiliatee before start the construction or proper access to such common properties should be provided.

Adverse socio-economic impacts include all disruptions on the social and economic interactions of communities due to the road project. This involves effect on both the adjacent communities (mostly direct) as well as the nearby communities (mostly indirect).

5.8 Impacts Relating To Human Health & Safety

Poor sanitation arrangement and improper methods used for collection and disposal of solid wastes and effluent, accommodation without ventilation, unhygienic food, electrical safety, risk from mosquito and reptile etc at the construction workers camp will impact human health and safety.

5.9 Road Safety Aspects

Increase of incidence of accidents is anticipated due to disruptions of traffics movements on the in construction work zones on the project road.

5.10 Safety and Health Related Issues

Safety and health related issues for the project road are given below:

- Occupational health and safety risks to workers due to inadequate housekeeping and unsafe work practices at work sites.
- Health problems to workers due to inadequate sanitation and unhealthy environment at labour camps/plant sites.

Chapter 6

ANALYSIS OF ALTERNATIVES

6.1 INTRODUCTION

This chapter discusses the analysis of alternatives that have been considered for the two lane upgradation with paved shoulders of Bowadra to Vizianagram Section of NH 516 E in Andhra Pradesh . It also includes a discussions on the “With” and “Without” project scenario. The minimization of environmental impacts by considering design alternatives determines the extent of mainstreaming of the environmental components. An evaluation of the various alignment options has been done for arriving at the most promising alignment of the project road.

6.2 WITH AND WITHOUT PROJECT ALTERNATIVES

6.2.1 Without Project Scenario

The road has many alongside settlements and the traffic flow is seriously impacted by severe conflicts between the local and the through traffic on the road. This is further compounded by the various land use conflicts, in terms of uncontrolled development along the road and the encroachments onto the ROW.

The population growth, increase in traffic volumes and the economic development along the project road would continue to occur and will worsen the already critical situation on the road. The existing unsafe conditions and the adverse environmental consequences in terms of the environmental quality along the road would continue to worsen in the absence of the proposed improvements. Moreover, if it is decided not to proceed with the project, then the associated reduced socioeconomic development of this remote, relatively poorly connected area cannot be justified. Therefore, the no-action alternative is neither a reasonable nor a prudent course of action for the project road, as it would amount to failure to initiate any further improvements and impede economic development.

6.2.2 With Project Scenario

The ‘with project scenario’ is found to have a positive impact in the long run on social, environmental, economic and financial issues. This scenario includes the upgradation/widening to two lane upgradation with paved shoulders of the existing stretch as envisaged in the project objectives.

The scenario is economically viable and will improve the existing conditions. It, would thereby, contribute to the development goals envisaged by the Government of Andhra Pradesh and enhance the growth potential of the area.

To avoid the large-scale acquisition of land and properties, the project envisages the possible two laning of the road within the existing ROW to the possible extent,

In spite of the various development benefits likely to accrue due to the project, as is the case of every road development project; the project would be accompanied by certain impacts on the physical, biological and social environmental components.

The potential impacts on the various environmental components can be avoided through good environmental practices and implementation of mitigation measures. Wherever avoidance of negative impact has not been possible, appropriate mitigation and enhancement actions will be worked out to effectively offset the environmental impacts inflicted due to the project. A Comparative assessment of the "with and without" project scenarios along with anticipated benefits with project scenario are presented in **Table 6.1**.

Table 0.1: "With and Without" Project Scenarios - A Comparative Assessment

Component	"With" Project Scenario	'Without" Project Scenario
Highway Geometrics	2-lane with Paved Shoulders is being developed with geometric improvements	Existing intermediate/two lane carriageway with poor
Design Speed	40/80 kmph for 2 lane with Paved Shoulders	20-40 kmph in entire project section.
Congestion in Settlements	Free flow of traffic due to widened carriageway and	Congestion in urban/rural areas due to mixing of local, pedestrian and through
Felling of road side trees	Felling of trees located near the road edge as these trees shall become a road hazard. Triple the number of new young and healthy trees to be planted in compensation.	No felling of trees. The trees close to carriageway may become a safety hazard to the road users.
Pedestrian safety	Realignment of congested stretch for the safety of pedestrian. Along the settlement stretches with significant pedestrian traffic, provision of pedestrian (zebra) crossings and footpath has been kept in urban sections.	Pedestrian safety an issue of major concern especially along the settlements and congested sections.
Road Safety Measures	Provision of proper road markings, zebra crossings, crash barriers and improvement of geometry to enhance road safety	Accident incidents shall rise with an increased traffic volume.

Component	"With" Project Scenario	'Without" Project Scenario
Environmental Quality	Development of road and realignment in urban settlements will improve environmental quality due to lowered pollution levels and relieving of congestion of traffic. Besides tree plantation shall not only provide aesthetics but also improve the quality of air.	Poor due to congestion and high emission levels because of slow movement of traffic. A further deterioration is expected due to increase in traffic volumes and further congestion.
Drainage	Will be improved due to reconstruction/additional new construction of culverts /	These issues remain unaddressed without the proposed project.
Road Side Amenities	Appropriate road side amenities to be provided at various locations along the project road.	Continue to remain inadequate.
Better Transportation Facilities	Reduction in time and fuel consumption for easy and fast movement through the major towns and villages. Better Access	Increased vehicle operating costs due to reduced speeds
Environmental Enhancement	Enhancement of water bodies, community and cultural properties and also water front in	No enhancement proposal for without project scenario.
Development	Higher potential for development due to improvement in access and consequent increase in	Development activities will be greatly hampered by the gross inadequacy
Economic Development	There will be increased access to markets/educational/health facilities. Local people will be employed during construction of	The economy will remain static.
Financial and Economic Analysis	Project financially viable as per the HDM model. The cost of operation and maintenance, Vehicle Operating Cost (VOC) and	The cost of maintenance while catering to the projected higher traffic, accident cost, Vehicle
Loss of vegetative cover	Vegetative cover will be removed within corridor of Impact. Compensatory plantation will	No such impact in without project scenario.
Access to basic facilities such as Markets,	Easy access to basic facilities due to fine road	Difficulty in accessing the basic facilities due to heavy traffic and congestion under

By looking at the above table, "with" project scenario, with its minor adverse impacts is more acceptable than the "without" project scenario which would mean an aggravation of the existing problems. The potential benefits of the proposed road improvements are substantial and far-reaching both in terms of the geographical spread and time. Hence, it is clear that the implementation of the

project will have definite advantage to area in development of its economy and progress for its people.

6.3 ENVIRONMENTAL CONSIDERATIONS

The various avoidance measures for minimizing the extent of environmental impacts and avoiding of sensitive environmental features have been worked out. The **Table 6.2** provides the measures that have been adopted for offsetting the anticipated environmental impacts. A description of the measures has been presented in the **Table 6.2**.

Table 0-2: Alternative considerations for Minimisation of Environmental Impacts

Environmental and social considerations	Provisions considered in project road design
Maintaining Design Speed for through traffic on the road	Improved geometrics
Improvement of Road Safety	Intersection improvements; geometric improvements at curves, road safety signage etc.,
Adequate drainage	Provisions of longitudinal drains and CD Structures
Reduction of Air and Noise Pollution	Intersection improvements; site specific attenuation measures; tree plantations, Implementation of EMP
Avoidance of contamination due to Siltation / spillage	Silt Fencing, Oil Interceptor
Minimisation of Tree Loss	Maximum effort shall be given to avoid avoidable tree felling
Minimisation of Direct Impact on Sensitive Receptors, cultural and religious properties	Trees plantation and appropriate /site specific EMP
Minimisation of Property Acquisition	Realignments; Concentric widening to minimize social impacts and SIA & RAP
Displacement of Commercial Properties	Concentric widening to minimize social impacts and SIA & RAP
Minimisation of Loss of Utility Lines	Centre line alterations to minimize shifting requirements
Erosion control and Stabilisation of Slope	Turfing / Pitching Plantation measures

6.4 Analysis of Alternatives Alignment

After having examined the feasibility of the road-improvement in the existing alignment, it is concluded that some of the project segment (mainly thickly built-up stretches) may have technical, social and environmental constraints during construction because these critical stretches are experiencing congestion, encroachment of RoW and poor geometry. Therefore, it is pertinent to develop alternative alignment to these critical stretches. These alternatives have been analyzed keeping in view social, environmental and technical parameters and thus the best alternative has been finalized.

Criteria for Fixing Realignment

Obligatory sensitive reasons through which realignment options should not pass, are detailed in sections below.

Habitations: Proposed alignment has been fixed in such a way that it traverses at a minimum distance of 200-300m from built up areas and avoiding important buildings and structures. However, realignment options have been adopted to minimise the impact on settlement due to project.

Wildlife Sanctuaries, National Parks, Reserve Forest and other Eco Sensitive zones: No ecologically protected area (Wildlife Sanctuaries, National Parks, etc.) are located within 15 Km distance from the project road.

Water Bodies: The alignment has been fixed taking due consideration & importance of retaining the existing water bodies, ponds, tanks etc. as far as feasible.

Important Structures: The components which increases the project cost are the presence of the major bridges and other structures. In order to reduce the project cost, number of structures and their respective lengths were given due consideration while finalising the option.

Moreover, the alternative options have been worked out keeping the following in mind:

- The project should be constructable and easy to maintain; the project should reduce the vehicle operation cost with respect to the existing option already available
- It should be safe at all stages i.e. during design, construction and operation stages. Safety audits at each stage should confirm the same.
- The initial cost of project (capital expenditure), maintenance cost, and operating cost should be optimum, to enable comparison of economics pertaining to life cycle cost versus other re-alignment options.

- The alignment should be finalised giving due consideration to siting/location of major structures including Major / Minor Bridges.
- Alignment should follow the unused / barren land to the extent possible to reduce the cost of land acquisition and carbon foot print.

Justification for Selection

The major difficulties in following the existing alignment option completely, is the magnitude of land acquisition & social disruption and unsafe traffic condition. Therefore, realignment have been suggested in the built-up stretches. The project, therefore, involves mostly concentric widening of the existing alignment to fully utilise the available RoW. The project road shall be flexible pavement throughout the stretch.

Alignment Modifications

The selection of the alignment along various sections has been worked out based on continuous interaction between the highway and environmental teams. However, existing alignment has been followed almost throughout the stretch except few curve improvement, Realignment locations. Various alignment alternative for realignments have been analysed.

Curve Improvement Locations

Various locations have been identified along the project corridor, where the poor geometrics warrant a deviation from the existing alignment. Most of these locations are situated in curves both horizontal and vertical. Deviation from the existing alignment was followed at the following locations.

Care though has been taken to minimise the impact on sensitive, cultural and community features like water bodies, schools, hospitals etc.

Alternative Analysis of Bypasses

Realignment have been proposed to avoid various built-up areas along the project highway, where geometric improvements are not possible as per design standards. Realignments are inevitable at two places to improve the geometrics and mitigating the risks of social impacts. Alternatives alignments for the realignments have been analysed using google maps, field visits, topo survey maps and through consultations.

CHAPTER 7

GREEN INITIATIVES

This chapter describes green highway, green initiatives, GHG emissions reductions and climate resilient initiatives adopted in the project and estimated GHG emissions reduction.

7.1 CARBON FOOT PRINT

Carbon footprint is a commonly used term to describe the total amount of Carbon Dioxide (CO₂) and other greenhouse gas (GHG) emissions for which an individual or organization is responsible.

It is usually defined as the total amount of CO₂ and other GHGs emitted over the full life cycle of a product or service. It measures the total GHG emissions caused directly by a person, organization, event or product.

Carbon sources or carbon emission sources are formed in the pavement structure within the boundary of the pavement system, including a series of intermediate products and the unit process of collection. Bitumen pavement construction was divided into two parts, namely, Bitumen mixture production and Bitumen mixture construction. Bitumen mixture production includes aggregate stacking, aggregate supply, bitumen heating, aggregate heating, and mixture mixing. The construction of Bitumen mixture was divided into Bitumen mixture transportation, Bitumen mixture paving, and compaction of Bitumen mixture.

In concrete pavements the stages of carbon emission includes the Cement and steel production, concrete manufactures and concrete pavement construction. The boundary of carbon emission comprises four stages: material manufacture, transportation, construction, and disposal.

The challenge of global climate change has motivated transportation agencies involved in the construction and maintenance of transportation infrastructure to investigate strategies that reduce the life cycle greenhouse gas (GHG) emissions associated with the construction and rehabilitation of highway infrastructure.

Environmental consciousness is on the rise and many transportation officials are striving to make their practices and policies greener or more sustainable.

To analyze carbon footprint, one must look at the greenhouse gas (GHG) emissions associated with the construction and maintenance of a road. Greenhouse gases include carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄) etc.

7.1.1 CO₂ Equivalent (CO₂e)

It is used as a metric measure used to compare the emissions from various GHGs based upon their global warming potential (GWP).

CO₂ is taken as a reference for calculation of overall emissions because almost all of the materials contain the basic element as carbon, which on oxidation produces CO₂; and it is also the most prevalent GHG present in the atmosphere.

Although CO₂ and CO₂e are interrelated, they are distinct measures for calculating the global emissions. The carbon dioxide equivalent for a gas is derived by multiplying the Tonnes of the gas by the associated GWP [4]: kgCO₂e = (Amount of a gas in kg) * (GWP of the gas) In line with the definition given above, the carbon footprint of the road sector can be defined as the total amount of CO₂ and other GHGs (direct and indirect) emitted over the full life cycle of a road.

7.1.2 CALCULATIONS

Greenhouse gas emissions are typically measured in terms of carbon dioxide equivalents (CO₂).

Over the last several years, calculations of carbon footprints have gained more importance due to the fact that the environmental norms and conditions specify a particular amount of CO₂ emissions for various activities.

The total GHG emissions caused directly and indirectly by an individual, organization or product is expressed as a CO₂e.

$$CE (S) = CE (S1) + CE (S2) + CE (S3)$$

Where, CE (S1): Carbon emissions at the material manufacture stage; CE (S2): Carbon emissions at the material transportation stage; CE (S3): Carbon emissions at the construction stage.

Carbon foot print data for road works is given in **Table 7.1**.

Table Error! No text of specified style in document..1: Carbon foot print data

Carbon Foot print					
S.No	Component	Value	Unit	Project Value	Total GHG in kg/Co2
At Materials Manufacturing Stage					
1	Aggregates	0.0028	kg/co2/kg	160608	450
2	Bitumen	0.43	kg/co2/kg	2699	1150
3	Cement	0.82	kg/co2/kg	135	111

Carbon Foot print					
S.No	Component	Value	Unit	Project Value	Total GHG in kg/Co2
4	Steel	4.67	kg/co2/kg	99700	465599
At Materials Manufacturing Stage					467
At Transportation Stage					
5	Truck Transport (14 T capacity)	1.10	kg/co2/(Ve h*km)	215	237
At Construction Stage					
6	Clearance for road Construction	6.56	kg/co2/Ha	0	0
8	Excavation for Excavator	0.539	kg/co2/m3	80800	43551
9	Rolling of layers	0.102	kg/co2/m2	7000000	714000
10	Prime Coat	0.0205	kg/co2/m2	350000	7175
11	Tack Coat	0.0205	kg/co2/m2	340000	6970
12	Paving of asphalt layers for one layer	0.0965	kg/co2/m2	333333	32167
At Transportation Stage					803863
Traffic					
13	LMV (Goods)	0.914	kg/co2/km	35	32
14	LMV (Passengers)	0.46	kg/co2/km	35	16
Total GHG emissions					2075787

Carbon foot print data at materials construction stage and construction stage for road works is given in **Figure 7.1** and **7.2**, respectively.

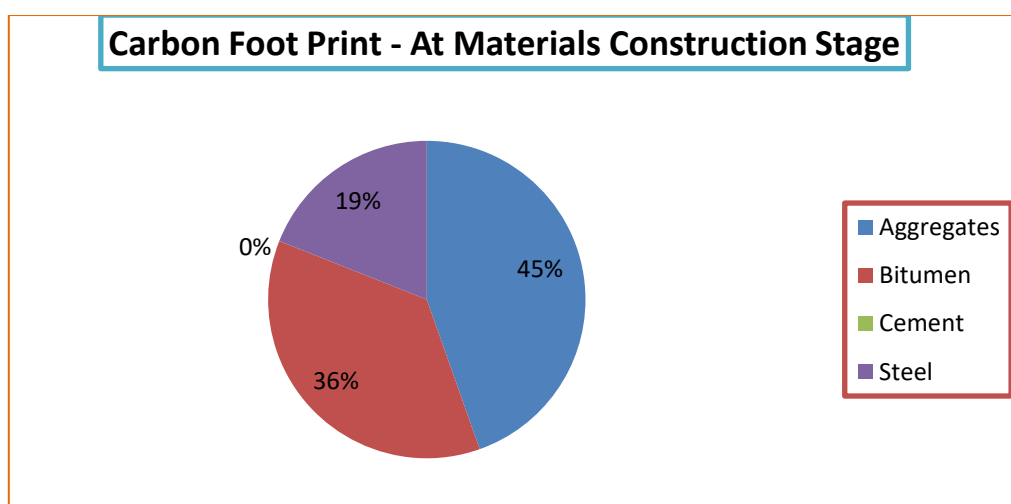


Figure Error! No text of specified style in document..1: Carbon Foot Print at Materials Construction Stage

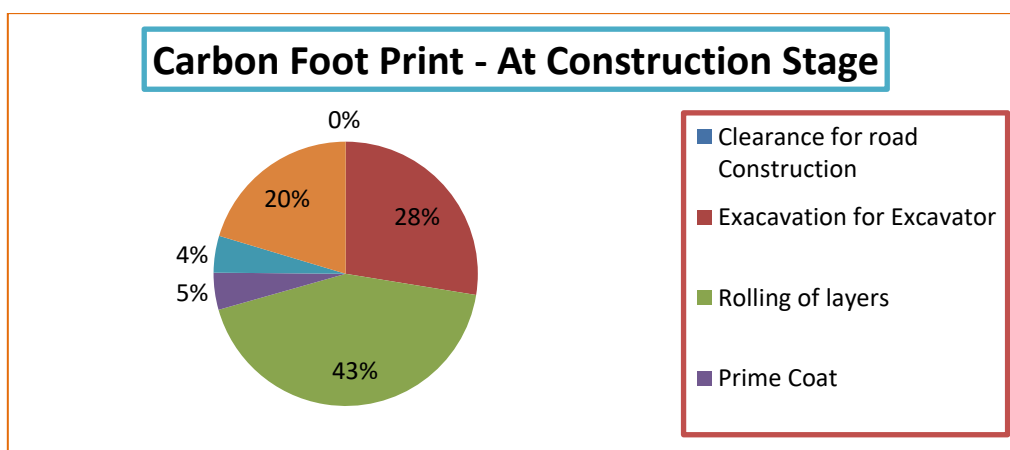


Figure Error! No text of specified style in document..2: Carbon Foot print at Construction Stage

7.2 WATER DEMAND OF THE PROJECT

The details of water requirement for construction stage are provided in the **Table 7.2**. Water Foot print for construction phase is given in **Figure 7.3**.

Table 7.2: Details of Water Requirement for Construction stage

Project Details			Water requirement, KLD for Construction stage				
S.No	Name of the road project	Proposed Length (in Km)	Dust suppression /Allied activity of Construction (Wetmix etc.,)	Domestic Purpose (KLD)	Trees to be planted	Green Belt/ Plantation (KLD)	Total in KLD
1	Bowdara to Vizianagar am	27	2	172	3454	2749	2923

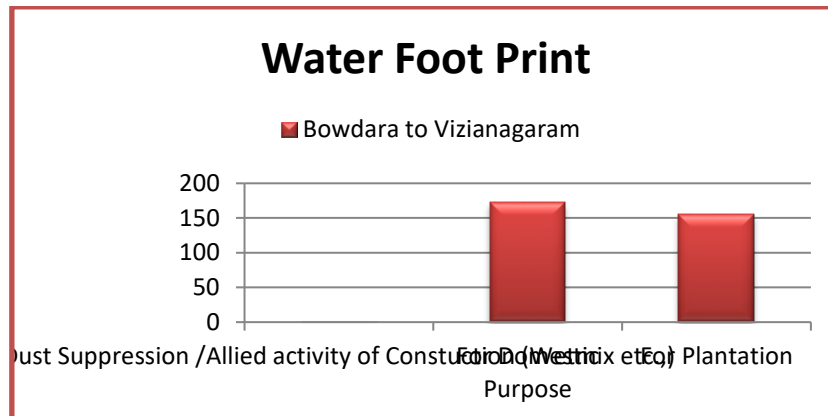


Figure Error! No text of specified style in document..3: Water Foot print (at construction Phase)

7.3 UTILIZATION OF COCO FIBRE IN ROAD CONSTRUCTION

Coconut shell is one of the waste material. It is a solid waste in form of shell with approximately 3.18 million tonnes produced annually.

Coconut shell (CS) and coconut fiber (CF) as shown in **Figure 7.4** are known as new waste materials that used in highway industry. This is because coconut shell has good weather resistant thus it is suitable to use as construction materials. Besides, it has no economic value and its dispose process is costly and will cause environmental problem.



Figure Error! No text of specified style in document..4: Coconut shell (left) and coconut fiber (right)

The chemical compositions of Coconut shell contains is 33.61% cellulose, 36.51% lignin, 29.27% pentosanes and 0.61% ash. Coconut shell has low ash content but high volatile matter, While coconut fiber has the lowest cellulose content, but with twice amount of lignin (41-45%) compared to jute and sisal which makes it has

greater resistance and hardness. coconut fiber will act as stabilizing additives when added into the asphalt mix around 180°C.

Coconut fiber generates many advantages when react with asphalt mixture as it can reduce bleeding of the binder and advancing the macrotexture of the coating. Besides, it can help to reform the mechanical characteristics and improve surface drainage pavement of tyres.

Coconut Fiber enables the use of discontinuous of grain size, which can increase the content of binder, hence the aggregates will coat with thicker film. This can reduce the oxidation of asphalt mixtures, moisture penetration and separation.

On the other hand, all asphalt applications has one problem, it will become brittle at low temperatures and soft at high temperatures. Coconut fiber can increase the range of temperature of porous asphalt thus help to resist degradation. This function can reduce the drying and cracking that occur in conventional asphalt pavement when faces various climate. At high mixing and compaction temperatures, coconut fiber also helps in reduce the flow of asphalt hence it can help to prevent bleeding and make sure the air void content is not clogged by asphalt binder.

Coconut fiber has outstanding moisture absorption because the irregular of crack in the cross section surface provides unique structure. The unique structure also results in better air permeability and moisture conductivity. In addition, the unique structure of the Coconut fiber will improve the moisture susceptibility, viscoelasticity and rutting resistance as well as ameliorate low temperature anti-cracking properties, durability, material toughness, fatigue life and lowering reflective cracking of asphalt concrete mixtures and pavements.

Detailed investigated should be done on the Coconut shell and Coconut fiber like reinforcing mechanisms as well as optimum fiber and shell content. The various properties of Coconut shell and Coconut fiber like fiber and shell content, fiber length, shell's size, shell's shape and orientation of fibers should be focus in the asphalt pavement in the future research. In addition, field performance of shell and fiber modified asphalt pavement should be determine the boundary effects on the test results. New research field can be conducting such as investigate modeling of mechanical properties of Coconut shell and Coconut fiber modified asphalt pavement by using composite science principles.

7.4 GABION WALLS FOR SLOPE PROTECTION

Gabion baskets were used for slope protection work. It is easily and quickly assembled and provided the advantage of being sustainable, resilient and flexible in nature. Typical gabion walls for slope protection is given in Figure 7.5.



Figure Error! No text of specified style in document..5: Gabion Walls for Slope Protection

Gabion retaining wall is flexible, free draining, permeable, environmentally friendly, quick and easy to assemble and cost-effective.

CHAPTER 8

CONSULTATION WITH KEY STAKEHOLDERS

8.1 GENERAL

Stakeholder's consultations and participation have been viewed as a continuous two way process, involving, promoting of public understanding of the processes and mechanisms through which developmental problems and needs are investigated and solved. The stakeholder consultation, as an integral part of environmental impact process throughout the project preparation stage not only minimizes the risks and unwanted political propaganda against the project but also abridges the gap between the community and the project formulators, which leads to timely completion of the project and making the project people friendly.

8.2 DEFINITION OF STAKEHOLDER

Stakeholder consultation involves the interaction of various stakeholders and the project proponent. It is highly desirable for all key stakeholders to arrive at a consensus on sensitive features, impacts and remedial actions. Stakeholder identification was done by examining the potential impacts of the project in terms of:

- Who may be affected directly (project affected people);
- Which agencies might have responsibility for the impact management;
- Which other organizations might have an interest in monitoring proponent activities or have local knowledge to contribute; and
- Which private/ non-government sector entities might face financial and social hardships if the predicted impacts occur?

8.3 TYPES/CATEGORIES OF STAKEHOLDERS CONSULTED

For the project road, following major groups of stakeholders have been identified for consultations:

- Primary Stakeholder as local people that include project affected people, local residents, shopkeepers, farmers, etc.
- Institutional stakeholders such as concerned govt. agencies, etc.

8.3.1 Primary Stakeholder

The enactment of the participation and consultations with the primary stakeholders was done at local or village level in areas where problems were noted.

During survey, one to one meetings are generally held with informed people. Informed people are those sections of the village community whose general awareness is very high. Such category of people include but not limited to, school teachers, retired senior level government officials such as military officials, post masters, forest officers, etc. In other words, informed people are those members of the local communities who in their past had a thorough experience and has geographic, political and general knowledge about the area and requirements of the communities.

These consultations sometimes focus on one or more specific issues for example road safety in a given section of the project road. Wherever possible such type of consultations is generally held with informed people.

Focus group meetings are usually conducted with a sample section of the community usually with a good representation from the affected communities. Such meetings usually provided substantial information about the community concerns.

During consultation, efforts were made for one to one meeting, however, local people did not attend the meetings due to hesitation. After that strategy were changed and stakeholder consultation were carried out in the form of focused group discussions with project affected people, shopkeeper, farmers, etc, along the project road,

8.3.2 Institutional Stake Holders

The general cooperation was received from the Govt. Department. This section has been provided to encourage the dialogue between the different departments.

8.4 DETAILS OF CONSULTATION CARRIED OUT

Stakeholder consultation was carried out with the objective of finding out the views and opinions of the stakeholders, mainly the community in and around, on issues relating to the project, its operations and also on peripheral development.

Through public participation, stakeholder's key social issues were identified and strategy was formulated. It included socio analysis and design of social strategy, institutional analysis and specifically addressed the issue of how poor and

vulnerable groups may benefit from the project. The consultation process established during preparation stage of the project used different types of consultation such as in-depth interviews with key informants, focus group discussions, and meetings. The consultation program included the following:

- Heads of households likely to be impacted;
- Household members including women;
- Villagers in the Project Influence area;
- Village panchayats; and
- Government Agencies and Departments.

The main objectives of the consultation program were to minimize the negative impact of the project corridors and to make people aware of the road rehabilitation project. During the process efforts were made to ascertain the views and preferences of the people. The aims of community consultation were:

- To understand views of the people affected w.r.t to the impacts of the road
- To identify and assess all major economic and sociological characteristics of the village to enable effective planning and implementation and;
- To resolve the issues relating to the impacts on community property.

8.4.1 Local Level Consultation

Local level consultations were carried out in affected villages and the comments received from participants have been incorporated in the document. Efforts were made to select both small and big habitations along the project road in order to get representation of all the segments of affected population. Prior intimation of at least 15 days before the planned consultation meeting was given to Village office /Sarpanch /Villagers, so that the villagers were aware of date and location of meeting before hand for active participation.

The objectives of local level consultations were to inform the population about the project, solicit their opinion on the proposed development and understand their requirement with respect to a transportation corridor. The apprehensions about the project both during the construction and operation phases were also considered and incorporated their views into the policy making and design.

During the census and socio economic survey, Village level consultations were held in four villages, where impacts were significant, and DPs from all villages along the subproject road were intimated about the proposed consultation meetings. All relevant aspects of subproject design, details of land required and impact to private property were discussed with the affected communities. The summary of the outcome of the consultations conducted in the project area is

presented in the **Table 8.1**. Photographs of consultation along the project road are given below:



Section of the Participants during the Consultations at **Thatipudi Village**



Section of the Participants during the Consultations at **Narva village**



Section of the Participants during the Consultations at **Bowdara Village**



Section of the Participants during the Consultations at **Ayannapeta village**

8.5 OUTCOME OF CONSULTATIONS

Most of the people were aware about the subproject and the 2-lanning with paved shoulder of the road but were not aware about specific details of the PRow, shift in centreline and the method of valuation for and building, payment of compensation and other rehabilitation and resettlement measures. The salient points of outcome of public consultations are summarised in the following **Table 8.1**.

Table 8.1: Summary of Consultation Outcome

Concerns and Issues	Mitigation measures proposed / Reason for not being able to address the concern
Meeting in Villages on 20.03.2018 to 21.03.2018 - Participants 15-30 in the Each Village	
A number of houses will be dismantled due to construction of the road.	Proper resettlement site will be developed.
Fare compensation on the basis of impact assessment of houses (on market rate). Facilities of issue of free House site Pattas and Construction of Houses for the affected houses to be given.	Will be provided. SIA and RAP is being prepared.
Impact on irrigation system and units such as hand pump, bore - well, well and water pathway.	As far as possible, these will be avoided, else these will be replaced.
Fare compensation for land (on market rate) and residue all and to the affected household	Will be provided as per the provisions of the New Act and Rules of the State. SIA and RAP is being prepared.
Impact on shop and commercial structure in government land	Will be provided assistance to restore income levels. SIA and RAP is being prepared.
Risk of accident of children and animal due to widening of the road.	Warning sign boards in built up sections, school zones and pedestrian crossing places will be provided. Road safety awareness will be undertaken.
Pollution and health related problems at the time of construction work.	Necessary mitigation measures proposed in the EMP.
Impact on rural water and drain system due to construction work.	Will not affect, civil work will be started only after utility shifting and restoring.

Concerns and Issues	Mitigation measures proposed / Reason for not being able to address the concern
Impact on religious structures and compensation	Impact will be assessed, structures valued and compensation will be provided at replacement cost for rebuilding at a suitable place.
Provision of under passes at junctions, school zones and zebra crossing.	No underpass proposed, but Zebra crossing will be provided at junctions, school zones, markets and settlements.
Provision for irrigation water flow from one side to the other.	Any such existing facilities will be maintained. Pipe culverts will be provided at required places.
Participation of local leaders or public representative in compensation.	The compensation will be determined as per the new LA Act and the Joint Collector will be the competent authority. SIA and RAP is being prepared.
Payment of compensation amount before starting the construction work.	Yes, all compensation will be paid before civil work commences.
Creation of employment for local people during the construction of the road	Provision has been made in the contract to engage local labourers
Many trees will be lost	Compensatory afforestation has been proposed. Plantation will be carried out along the project road.
Timeline of the civil work starting and ending	All details will be shared before implementation

List of participants with signature sheets are given in Annexure at the end of EIA Report.

8.5.1 Issues Discussed in the Public Consultations

Issues discussed in the public consultations are listed below:

1. Brief introduction of the project, importance, implementation and funding agency.
2. Loss of structure like Residential, Commercial, Residential & Commercial, PRs and others.

3. Loss of Agriculture Lands.
4. Compensation of for the affecting structures and lands.
5. Affecting of CPRs.
6. Resettlements and Rehabilitation sites.
7. Road safety and health (HIV/AIDS).
8. Water bodies affecting.
9. Gender issues.
- 10.Vulnerable persons.
- 11.Other issues.

8.6 INFORMATION DISCLOSURE

To keep more transparency in planning and for further active involvement of affected persons (Aps) and other key stakeholders the project information including EIA report will be disclosed on the Website of MORTH.

CHAPTER 9

ENVIRONMENTAL MANAGEMENT PLAN

9.1 Introduction

Environmental Management Plan has been prepared which mainly centered on the understanding of the interactions between the environmental setting and the project activities and the assessment of the anticipated impacts. Mitigation measures for anticipated environmental impacts have been elaborated as specific actions which would have to be implemented during the project implementation. The EMP would help the contractors/PIU to implement the project in an environmentally sustainable manner and where contractors, understand the potential environmental impacts arising from the project road and take appropriate actions/mitigation measures to properly mitigate/manage such environmental impacts. EMP can thus be considered to be an overview document for contractors that will guide environment management of all anticipated impacts in proposed two lane upgradation with paved shoulders of Bowadra to Vizianagram Section of NH 516 E. This EMP may also be considered as flexible and will be further developed by the Contractor in the Contractor's Environment Management Plan.

9.2 Outline of EMP and its Implementation Strategy

The EMP is a guiding tool which discusses the potential environmental impacts and specific mitigation/management measures for the proposed two lane upgradation with paved shoulders of Bowadra to Vizianagram Section of NH 516 E. It refers to the responsibilities ensuring commitment for implementation and means of verifying/supervision whether the same has been implemented properly. The timing and frequency of monitoring along with the supervision responsibility and reporting requirements are also provided in the Environmental Management Plan. As a part of the EMP, the contractors will commit to identification of the environmental and social impacts at the project road. In case of any future changes in the project road design, the EMP will need to be updated to reflect the new scope of the activities. such revisions will be finalized in consultation with the World Bank.

The PIU will be responsible to ensure implementation of EMP by the contractors with the overall accountability resting with the GNHCP-PMU. Whereas, the PIU/ Independent Engineer will ensure periodic quality audit/ guidance to the PIU and by imparting regular training, monitoring and ensuring that all EMP provisions and requirements are translated into 'contract documents and that these requirements are implemented to their full intent and extent.

Overall responsibility will be of Contractor for effective implementation of EMP and adherence to all the mitigation measures as outlined in this EMP associated with their respective activities. The Contractor will be required to comply with the provisions of the EMP.

9.3 Environmental Management Plan

The Environmental Management Plan (EMP) will guide the environmentally-sound construction of the project road and ensure efficient lines of communication/co-ordination between the PIU, Contractor, GNHCP-PMU. The EMP has been prepared for three stages of project road construction activities as: (i) Pre-construction Stage; (ii) Construction Stage; and (iii) Demobilization Stage. EMP for above project road have been prepared and presented in **Table 9.1**. Various guidelines, checklists and reporting formats for implementation of EMP are given as Annexures at the end of EIA Report.

The purpose of the EMP is to ensure that the activities are undertaken in a responsible non-detrimental manner with the objectives of: (i) provide a pro-active, feasible and practical working tool to enable the measurement and monitoring of environmental performance on site; (ii) guide and control the implementation of findings and recommendations of the environmental assessment conducted for the subproject; (iii) detail specific actions deemed necessary to assist in mitigating the environmental impacts of the project road; and (iv) ensure that safety recommendations are complied with.

Budgetary provisions for implementation of EMP shall be integrated with the bid/construction contract in the form of technical specifications and environmental performance requirements. The costs to be incurred on implementation of EMP shall be incidental to the civil works and therefore, no separate environment budget/cost will be provided to the contractor for implementation of EMP. The contractor will ensure effective implementation of EMP during pre-construction, construction and demobilization stages. EMP for operation stage will be implemented by PIU/PMU.

The Contractor is deemed not to have complied with the EMP if; i), within the boundaries of the project site/ ancillary sites, site extensions and haul/ access roads, (ii) there is evidence of contravention of clauses, (iii) if environmental damage ensues due to negligence, (iv) the contractor fails to comply with corrective action measures or other instructions issued by the PIU) / GNHCP-PMU within a specified timeframe and (v) the Contractor fails to respond adequately to complaints from the public.

Table 9.1: Environmental Mitigation Measures and Management Plan

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
A.	Pre-Construction Stage			
	Pre-construction Activities By the PIU			
A.1	Tree Cutting Permission	<ul style="list-style-type: none"> Approximately 3596 trees are likely to be felled for upgradation of the project. All efforts will be made to minimise cutting of trees. Prior permission will be obtained for cutting trees. 	PIU	PMU
A.2	Preservation of Trees	<ul style="list-style-type: none"> All efforts will be made to preserve trees including evaluation of minor design adjustments/alternatives (as applicable) to save trees. In the event of design changes, additional assessments including the possibility to save trees shall be made. Stacking, transport and storage of the wood will be done as per the relevant norms Systematic corridor level documentation for the trees cut and those saved will be maintained by the PIU. 	PIU	PMU
A.3	Utility Shifting	Prior permission will be taken from line department offices of Electricity (PDD), Telecommunications (for OFC underground cables etc), water Pipeline (PHE) etc. Utility shifting required to be undertaken by PIU.	PIU	PMU
	Orientation of Implementing Agencies	The PIU shall organize orientation sessions for contractor. This shall include on-site training (general as well as specific to the context of this project road. In training session PIU officers, project staff, contractors, consultants etc will be involved.	PIU	PMU
	Pre-construction Activities By the Contractor			
A.4	Appointment and Mobilization of Environment & Safety Officer	<ul style="list-style-type: none"> The contractor will appoint qualified and experienced Environment & Safety Officer (ESO), who will dedicatedly work and ensure implementation of EMP including Occupational, Health and Safety measures. Contractor to inform the PIU for the appointment and mobilization each ESO 	Contractor	Independent Engineer /PIU
A-5	Regulatory Approvals	<ul style="list-style-type: none"> Prior permission will be obtained from concerned Department for any works related to culverts, embankment construction, protective works etc. along or near natural streams. Labour license from Department of Labour. If contractors open new stone quarry or borrow areas, prior Environmental Clearance will be obtained from SEIAA/DEIAA. For setting-up of Stone Crusher Plant, HMM Plants, Batching Plant, D.G Sets- Consent to Establish and Consent to Operate will be 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		obtained from Andhra Pradesh Pollution Control Board (APPCB) or if contractor intend to procure construction materials from local authorized third party agencies then contractor will collect and submit necessary clearance/approval from authorized third party agencies.		
A-6	Common Property Resources (CPR's)	<ul style="list-style-type: none"> All common property resources shall be relocated and restored before the commencement of the road improvement activities. Before commencement of works, a joint field Monitoring will be conducted by the Contractor and PIU to map out the alignments, to check if any CPR is being impacted due to construction works. While relocating these utilities and facilities all concerned agencies including PIU shall take necessary precautions and shall provide barricades/delineation of such sites to prevent accidental fall of pedestrian and other road users into pits, drains both during demolition and construction/ relocation of sum facilities. 	Contractor	Independent Engineer /PIU
A.7	Procurement of Machinery, Crushers, Batching Plants etc	<ul style="list-style-type: none"> Specifications of Machinery, crushers, and batching plants shall comply with the requirements of the relevant environmental legislations. Crusher, Batching plants and hot mix plant shall be located 250m away from settlements/ commercial establishments, preferably in the downwind direction. No plants should be set-up within 250m from the residential/ settlement locations. The Contractor shall submit a detailed layout plan for such sites and seek prior approval of PIU before entering into formal agreement with a land owner for setting-up such sites. Actions by PIU/PMU against any non-compliance shall be borne by the Contractor at his own cost. Arrangements to minimize dust pollution through provision of water spray shall have to be provided at such sites. 	Contractor	Independent Engineer /PIU
A.8	Construction Camp Locations - Selection, Design & Lay-out	<ul style="list-style-type: none"> If contractor decides to establish labour camp, siting of the camp will be as per the guidelines given in Annexures- and layout of camp will be approved by PIU. Labour camp will not be established within 250 m from the nearest settlement to avoid conflicts and stress with the local community. 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
A.9	Arrangements for Temporary Land for Camp	The Contractor will obtain consent from land owners in writing for temporary use of land for labour camp, etc..	Contractor	Independent Engineer /PIU
A.10	Construction Vehicles, Equipment and Machinery	<ul style="list-style-type: none"> All vehicles and equipment to be procured for the proposed up-gradation works of project road will conform to the relevant Bureau of Indian Standard (BIS) norms. The discharge standards promulgated under the Environment Protection Act, 1986 and Motor Vehicles Act, 2019 will be strictly adhered to. The silent/quiet equipment like DG set as per regulations will be used at the construction site or labour camp. The contractor will maintain records of Pollution Under Control (PUC) certificates for all vehicles used during the contract period, which will be produced to PIU for Monitoring and whenever required. 	Contractor	Independent Engineer /PIU
A.11	Arrangement for Construction Water	<ul style="list-style-type: none"> The contractor shall source construction water preferentially from surface water bodies in the project area. Boring of any tube wells shall be drilled only after obtaining necessary permission from Central Ground Water Authority. To avoid disruption/disturbance to other water users, the contractor shall extract water from fixed locations. The contractor shall consult the local people before finalization the locations. Contractor can extract ground water only in case surface water sources are not available and that too only after proper permission from Central Ground Water Authority. 	Contractor	Independent Engineer /PIU
A.12	Sand (all river beds used directly or indirectly for the project)	If the supplier of sand is another (third) party, the authentic copy of lease agreement that has been executed between the local Tehsildar and the supplier has to be submitted to PIU/PMU of the project, before any procurement is made from such a site. Environmental clearance for stone quarry and borrow area will be obtained from DEIAA/SEIAA.	Contractor	Independent Engineer /PIU
A.14	Labour Requirement	<ul style="list-style-type: none"> The contractor preferably will use unskilled/semiskilled labour from local areas to give the maximum benefit to the local community to avoid any additional stress on the existing facilities. On an average 150 labours/ day will be required during construction stage depending upon extent of construction work. All applicable labour regulation will be complied by the contractor. 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<ul style="list-style-type: none"> Necessary facilities will be provided to workers as per The Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 		
A.15	Traffic Management Plan- Planning for Traffic Diversions and Detours	<ul style="list-style-type: none"> Detailed traffic control plan shall be prepared by the contractor and same shall be submitted to the PIU for approval. The traffic control plans shall contain details of temporary diversions, traffic safety arrangements including night time safety measures, details of traffic arrangement after cessation of work each day, safety measures undertaken for transport of hazardous materials and arrangement of flagmen etc to regulate traffic congestion. The contractor shall provide specific measures for safety of pedestrians and workers as a part of traffic control plans. The contractor shall ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. The Contractor shall also inform local community about diversion in traffic routes and pedestrian access arrangements with assistance from PIU. 	Contractor	Independent Engineer /PIU
A-17	Stockyard/ Storage of Construction Material and Establishing Equipment Lay-down Area	<ul style="list-style-type: none"> Contractor in consultation with PIU shall identify the site for temporary use of land storage of construction materials including pipes etc. These sites shall not cause an inconvenience to local population / traffic movement. These locations shall be approved by the PIU. Selection of location for materials storage and equipment lay-down areas must take into account prevailing winds, distances to adjacent land uses, general on – site topography and water erosion potential of the soil. Impervious surfaces must be provided wherever necessary. Protect material stockpiles from storm water (e.g. by excavating a cut-off ditch around stockpiles to keep away storm water). Enclosed storage for fuel with non- permeable flooring. Contractor shall cover material stockpiles with tarpaulin or other materials. Avoid stockpiling material near natural streams. Proper cover and stacking of loose construction material will be ensured during construction of outfall structures at construction site to prevent surface runoff and contamination of receiving water body. Staff dealing with these materials / substances must be aware of their potential impacts and follow the appropriate safety measures. The 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		contractor must ensure that its staff is made aware of the health risks associated with any hazardous substances like bitumen, diesel, used oil and has been provided with the appropriate protective clothing/equipment in case of spillages or accidents and have received the necessary training. Necessary training and awareness program shall be carried out to make aware the contractor and its staff aware about hazardous nature of substances.		
A-18	Information Dissemination and Communication Activities	<ul style="list-style-type: none"> • Prior to construction activity, information dissemination will be undertaken by contractor at the project site. The wider dissemination of information to public will be undertaken through the disclosure of EA / EMP reports on the website of MORTH. • Project information Board showing the name of work, project cost, duration, date of commencement, date of completion, executing agency and contact details (including telephone numbers) shall be displayed both sides of the both roads in both English and in Vernacular. • Information boards will also be setup at the sites of construction camps and labour camps, plants and stockyard site. • Details of nodal officer with telephone numbers will be displayed for registering compliant/grievances by stakeholder/general public. 	PMU Contractor	PMU Independent Engineer /PIU
B.	Construction Stage			
B.1	Site Clearance (Clearing and Grubbing)			
B.1.1	Clearing, grubbing and Levelling	<ul style="list-style-type: none"> • If required vegetation will be removed from the construction zone only. • All works will be carried out such that the damage or disruption to flora other than those identified for cutting is minimum. Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works will be removed with prior approval of PIU. • The Contractor, under any circumstances will not cut or damage trees. • Trees identified under the project will be cut only after receiving necessary permissions. Vegetation with girth size of over 30 cm will be considered as trees and shall be compensated. 	Contractor	Independent Engineer /PIU
B.1.2	Dismantling of Culverts	Reconstruction of 38 culverts is proposed in the project road. All necessary measures shall be taken especially while working close to cross drainage channels to prevent earthwork, stonework, materials and appendage as well as the method of operation from impeding	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		cross-drainage at streams, water canals, existing irrigation and drainage systems. Demolition wastes will be collected and disposed as per the provision of Construction & Demolition Rule 2016.		
B.1.3	Generation & disposal of Debris	<ul style="list-style-type: none"> Debris generated due to the dismantling of the existing road shall be suitably reused in the proposed construction. Scarified asphalts and the other construction wastes shall be appropriately re-used in road construction with the permission of PIU. The dismantled road and scarified bitumen waste shall be utilized for the paving of cross roads, access roads and paving works in construction sites and campus, temporary traffic diversions, haulage routes, parking areas along the roads or in any other manner approved by the PIU. The Contractor will suitably dispose off unutilized debris and waste materials either through filling up of borrows areas located in wasteland or at pre-designated disposal locations, subject to the approval of the Environmental Expert of PIU. At locations identified for disposal of residual bituminous wastes, the disposal will be carried out over a 60 mm thick layer of rammed clay so as to eliminate the possibility of leaching of wastes into the ground water. The Contractor will ensure that the surface area of such disposal pits is covered with a layer of soil. All arrangements for transportation during construction including dismantling and clearing debris, will be considered incidental to the work and will be planned and implemented by the Contractor as approved and directed by the Environmental Expert of PIU. The pre-designed disposal locations will be a part of Solid Waste Management Plan to be prepared by Contractor in consultation and with approval of Environmental Expert of PIU. Debris generated from pile driving or other construction activities shall be disposed such that it does not flow into the surface water bodies or form mud puddles in the area. 		
B.1.4	Stripping, stocking and	The topsoil from areas to be permanently covered will be stripped to a specified depth of 150 mm and stored in stockpiles. A portion of the temporarily acquired area and/or right of use will be earmarked for	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
	preservation of top soil	<p>storing topsoil. The locations for stock piling will be pre-identified in consultation and with approval of Environmental Specialist of PIU. The following precautionary measures will be taken to preserve them till they are used:</p> <p>(a) Stockpile will be designed such that the slope does not exceed 1:2 (vertical to horizontal), and height of the pile is restricted to 2 m. To retain soil and to allow percolation of water, silt fencing will protect the edges of the pile.</p> <p>(b) Stockpiles will not be surcharged or otherwise loaded and multiple handling will be kept to a minimum to ensure that no compaction will occur. The stockpiles shall be covered with gunny bags or vegetation.</p> <p>(c) It will be ensured by the Contractor that the topsoil will not be unnecessarily trafficked either before stripping or when in stockpiles.</p> <p>Such stockpiled topsoil will be utilized for:</p> <ul style="list-style-type: none"> • Covering all disturbed areas including borrow areas, only in a case where there are to be rehabilitation • Dressing of slopes of road embankment • Agricultural fields of farmers acquired temporarily land. 		
B 1.5	Accessibility	The Contractor will provide safe and convenient passage for vehicles, pedestrians and livestock to and from roadsides and property accesses connecting the project road, providing temporary connecting road. The Contractor will also ensure that the existing accesses will not be undertaken without providing adequate provisions. The Contractor will take care that the cross roads are constructed in such a sequence that construction work on the adjacent cross roads are taken up one after one so that traffic movement in any given area not get affected much.	Contractor	Independent Engineer /PIU
B 1.6	Planning for Traffic Diversions And Detours	Temporary diversions will be constructed with the approval of the Environmental Specialist of PIU. Detailed Traffic Control Plans will be prepared by the Contractor and approved by Environmental Specialist, seven days prior to commencement of works on any section of road. The traffic control plans shall contain details of temporary diversions, traffic safety arrangements for construction under traffic, details of	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<p>traffic arrangement after cessation of work each day, safety measures for night time traffic and precaution for transportation of hazardous materials and arrangement of flagmen.</p> <p>The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow.</p> <p>The Contractor will also inform local community of changes to traffic routes, conditions and pedestrian access arrangements. The temporary traffic detours will be kept free of dust by sprinkling of water three times a day and as required under specific conditions (depending on weather conditions, construction in the settlement areas and volume of traffic).</p>		
B.2	Procurement of Construction Materials			
B.2.1	Procurement for Aggregate and other construction materials	<ul style="list-style-type: none"> No borrow area will be opened without permission of the Environmental Specialist and without obtaining necessary regulatory permission. The location, shape and size of the designated borrow areas will be as approved by the Environmental Specialist and in accordance to the IRC recommended practice for borrow pits for road embankments (IRC 36: 2010). The borrowing operations will be carried out as specified in the guidelines for siting and operation of borrow areas. The unpaved surfaces used for the haulage of borrow materials, if passing through the settlement areas or habitations; will be maintained dust free by the Contractor. Sprinkling of water will be carried out twice a day to control dust along such roads during their period of use. During dry seasons (winter and summer) frequency of water sprinkling will be increased in the settlement areas and Environmental Specialist of PIU will decide the sprinkling time depending on the local requirements. Contractor will rehabilitate the borrow areas as soon as borrowing of soil is over from a 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		particular borrow area in accordance with the approved borrow area Redevelopment Plan.		
B.2.2	Quarry Operations & Crushers	The Contractor shall obtain materials for approved quarries. The crushers will be operated after obtaining consent to establish and consent to operate from APPCB.	Contractor	Independent Engineer /PIU
B.2.3	Transporting Construction Materials	<ul style="list-style-type: none"> Contractor will maintain all roads, which are used for transporting construction materials, equipment and machineries. All vehicles delivering fine materials like aggregate, cement, earth, sand, etc, to the site will be covered by Tarpaulin to avoid spillage of materials and wind blown dust from the top of vehicles. Existing road used by vehicles of the contractor or any of his subcontractor or suppliers of materials will be kept clear of all dust/mud or other extraneous materials dropped by such vehicles. The contractor will make effort to transport materials to the site in non-peak hours 	Contractor	Independent Engineer /PIU
B.3	Construction Work			
B.3.1	Labour Camp Site	<ul style="list-style-type: none"> Project information board will be displayed at the labour camp site. Electrical cables and wires will be properly arranged with proper electrical safety. Loose electrical connections will not be allowed at the labour camp. Red danger sign with bone & skull will be displayed as per The Electrical Rules at three phase motors, electrical panels and electrical machines, DG sets, etc. Housekeeping at labour camp will be maintained properly. Daily sweeping and cleaning will be done at the labour camp. HIV Aid awareness posters will be displayed at the camp site. Solid waste generated at the camp site will be collected in covered waste bins. Then, it will be segregated as biodegradable (food waste, paper, etc) and non-biodegradable (plastic, polyethylene bag, etc) wastes. Polyethylene/plastic wastes will be stored in empty cement bags and to be sent for recycling through scrap dealer. Biodegradable (food waste, paper, etc) solid waste will be disposed in compost pit. Non-biodegradable inert wastes will be sent to nearest land fill site. 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<ul style="list-style-type: none"> • Proper drinking water, well ventilated accommodation, sanitation, canteen facilities will be provided to workers at the labour camp. • Suitable signages will be displayed at labour camps. 		
B.3.2	Drainage and Flood control	<ul style="list-style-type: none"> • Major bridge will be constructed at existing chainage Km 22.612 (Design Chainage Km 9.883) and minor bridge will be constructed at design chainage Km 26+511, Km 24+526, Km 17+570 and Km 10+092, while 71 pipe culverts and 18 box culverts are proposed to be constructed in the proposed project • The Contractor shall ensure that no construction materials/debris shall block the water flow or create water lodging at the work site. The Contractor shall take remedies to remove accumulated water (if any) from the construction sites, camp sites, storage yard, excavated areas etc. • Construction works should plan well in advance prior to on-set of monsoon to avoid water- pool besides providing temporary cross drainage systems. The contractor shall take all adequate precautions to ensure that construction materials and excavated materials are enclosed in such a manner that erosion or run off of sediments is controlled. • Silt fencing shall be installed prior to the onset of the monsoon at all the required locations, as directed by PIU/PMU. Prior to monsoon, the contractor shall provide either permanent or temporary drains to prevent water accumulation in surrounding residential, commercial and agricultural areas. 	Contractor	Independent Engineer /PIU
B.3.3	Siltation of Water Bodies and Degradation of Water Quality	<ul style="list-style-type: none"> • The project roads are crossing natural streams at design chainage Km 9.883, Km 26+511, Km 24+526, Km 17+570 and Km 10+092, which remain dry in non-rainy days. • The Contractor will not excavate beds of any stream/canals/ any other water body for borrowing earth for embankment construction. • Contractor will construct silt fencing at the base of the embankment construction for the entire perimeter of any water body (including wells) adjacent to the project road and around the stockpiles at the construction sites including ancillary sites close to water bodies. The fencing will be provided prior to commencement of earthwork and 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<p>continue till the stabilization of the embankment slopes, on the particular sub-section of the road.</p> <ul style="list-style-type: none"> • Contractor will ensure that construction materials containing fine particles are stored in an enclosure such that sediment-laden water does not drain into nearby watercourse. • On completion of construction of culverts and bridges, drainage channels will be cleared by collecting debris and disposed suitably. Detours/diversions constructed for construction of culverts and bridges will be also be cleared before onset of monsoon. 		
B.3.4	Slope Protection and Control of Soil Erosion	<ul style="list-style-type: none"> • For construction of two realignments at Bowdara Junction (Km 2.700 to Km 3.150) and Thatipudi (Km 9+680 to Km 11+150), earth filling will be required for embankment for new road construction, which will require slope protection and control of soil erosion. • The Contractor will construct slope protection works as per design, or as directed by PIU to control soil erosion and sedimentation through use of Breast walls, Retaining Walls, gabion wall, dykes, sedimentation chambers, basins, fibber mats, mulches, grasses, slope, drains and other devices. • All temporary sedimentation, pollution control works and maintenance thereof will be deemed as incidental to the earth work or other items of work and as such no separate payment will be made for them. Contractor will ensure the following aspects: • After construction of road embankment, the side slopes will be covered with grass and shrubs as per design specifications. • Turfing works will be taken up as soon as possible provided the season is favourable for the establishment of grass sods. Other measures of slope stabilization will include mulching netting and seeding of batters and drains immediately on completion of earthworks. • In borrow pits, the depth shall be so regulated that the sides of the excavation will have a slope not steeper than 1 vertical to 2 horizontal, from the edge of the final section of the bank. • Along sections abutting water bodies, pitching as per design specification will protect slopes. 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
B.3.6	Pedestrian and Vehicular Traffic Movement Management	<ul style="list-style-type: none"> Detailed traffic control plans will be prepared and submitted to the PIU for approval one week prior to commencement of works. The traffic control plans shall contain details of temporary diversion, details of arrangements for construction (road stretches, timing and phases). Provide the construction itinerary in advance so that the road users can use alternative routes. Erect warning and safety signs of ongoing works. Suitable retro reflective warning signs should be placed at near construction locations and should be visible at night. Alternative access ways should be communicated to the community by way of announcement appropriately for the public information. The contractor shall take all necessary measures for the safety of traffic during construction and shall provide, erect and maintain such barricades, including signs, markings, flagmen as proposed and approved by PIU. The contractor shall ensure that all signs, barricades, pavement markings are provided as per applicable IRC code and guidelines. <p>Install signage, barricading, fencing as required and include safety measures for transport of materials/ equipment's, which shall be limited to certain times, and arrangements for flagmen at intersection.</p>	Contractor	Independent Engineer /PIU
B.3.7	Excavation works for longitudinal drains along road corridor	<ul style="list-style-type: none"> As per DPR, proper drainage arrangement of earthen drain length of 46400 m and RCC drain length of 7400m (both sides) at built up locations are proposed along the project road. At the excavation site, warning sign boards will be displayed in vernacular language and English. Entry of general public/unauthorized person will be restricted. During excavation for laying of concrete (RCC) cover drains necessary safety measures will be taken by the contractor. Excavation of 1.5 meters deep or greater requires a sides protection (Close Timbering and step cutting) unless the excavation is made entirely in stable rock. Contractor to follow strict protocol during construction/ excavation for longitudinal drainage especially along the sensitive receptors like schools, mosque, community centers, religious places, shrines, grave yard etc. 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<ul style="list-style-type: none"> Excavated earth will be collected and disposed in pre-identified site with the approval of PIU. Excavated earth shall not be dump on the carriageway or shoulders. Casted drain block and drain cover will not be stacked on the road. To ensure elimination of excavation hazards, excavation will be carried in the presence of competent person. Suitable barricading will be provided around the excavation site. Suitable personal protective equipment will be provided to the workers. 		
B.3.8	Handling of Cement Bags	<ul style="list-style-type: none"> Cement bags will be stored and emptied in covered area to control fugitive dust emissions. While handling and emptying cement bags, workers will wear masks, hand gloves and protective goggles. Manual transferring of cement bags from one place to another place will not be allowed. For this purpose, trolley will be used. 	Contractor	Independent Engineer /PIU
B.3.9	Work-zone safety Management	<ul style="list-style-type: none"> The Contractor shall prepare the construction safety plan as per provisions under the IRC 67-2001, SP-55 for safe work zone to be duly approval by the environmental specialist of PIU/PMU prior to start of road works. Temporary barricades shall be provided to delineate construction zone as well material stacking areas. The construction site and the labour facility (if any) shall be appropriately barricaded to prevent entry and accidental tress passing of workers, staff and others into the construction site. All operational areas shall be access controlled. Watch and ward facilities at all times shall be provided by the contractor. Proper retro reflective warning signage will be installed on the access road next to the construction site about movement of construction machinery and vehicles. In excavations for longitudinal surface road drains, culverts etc., a high visibility warning and retro reflective signage shall be displayed in vermicular language and English. Entry of unauthorized persons should be restricted. Excavation of 1.5 metres deep or greater will be adequately barricaded. There shall be adequate lighting arrangement at night to prevent mishaps after construction activity ceases for the day 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<ul style="list-style-type: none"> All the retro reflective Safety signage as per IRC 55 will be erected at construction site for generating awareness among local community and road user during the construction. 		
B.3.10	Sensitive Receptors- Impact Management	<ul style="list-style-type: none"> At each sensitive receptor like schools, religious places, shrines, community centers, grave yards etc and in general residential houses, the construction operations in these areas should be limited to time period of 7:30 am to 6:00 pm. Periodic maintenance and calibration of construction equipment's/ vehicles to meet applicable CPCB emission standards. Contractor to ensure regular dust suppression measures by way of standard and efficient water sprinkling through water tankers at these designated sensitive receptors. Noise barriers shall be installed during the construction phase to protect the school from the noise from construction activities. Adequate barricading and safety measures to protect dust pollution and noise impacts on sensitive receptors like schools and religious places etc. due to vehicle movement to be ensured prior to the start of work and their effectiveness to be checked during construction. 	Contractor	Independent Engineer /PIU
B.3.11	Occupational Health and Safety of Workers	<ul style="list-style-type: none"> The contractor will prepare and follow the OHS plan, including provisions for emergency response plan All workers will be provided with requisite personal protective equipment Emergency Telephone Numbers shall be displayed at camp and plant site. Medical facilities shall be provided for workers at Labour camp and plant site. 	Contractor	Independent Engineer /PIU
B.4	Pollution			
B.4.1.1	Water Pollution from Construction Wastes	<ul style="list-style-type: none"> The project roads are crossing natural streams at design chainage Km 9.883, Km 26+511, Km 24+526, Km 17+570 and Km 10+092, which remain dry in non-rainy days. The contractor will take all precautionary measures to prevent entering of wastewater into streams, water bodies or the irrigation system during construction. Contractor will avoid construction works close to the streams or water bodies during monsoon. 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<ul style="list-style-type: none"> Contractor shall not wash his vehicles in river water and shall not enter riverbed for that purpose. Any type construction wastes will not be disposed in rivers or water bodies. 		
B.4.1.2	Water Pollution from Fuel and Lubricants	<ul style="list-style-type: none"> The Contractor will ensure that all construction vehicle parking locations, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and refuelling sites will be located at least 250 m away from rivers and irrigation canal/ponds. The Contractor will submit all locations and layout plans of such sites prior to their establishment and will be approved by the Environmental Specialist of PIU. Contractor will ensure that all vehicle/machinery and equipment operation, maintenance and refuelling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. Wastewater from vehicle parking, fuel storage areas, workshops, wash down and refuelling areas will be treated in an oil interceptor before discharging into on land or into surface water bodies or into other treatment system. In all, fuel storage and refuelling areas, if located on areas supporting vegetation, the top soil will be stripped, stockpiled and returned after cessation of such storage. Contractor will arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites All oil spills, used oil will be disposed off in accordance with Andhra Pradesh Pollution Control Board (APPCB) guidelines. 	Contractor	Independent Engineer /PIU
B.4.1.2	Waste Water from Labour Camp	<ul style="list-style-type: none"> Waste water generated from the sanitary facilities at labour camp will be treated in septic tank followed by soak pit. No untreated raw sewage/waste water will be discharged into any river and water body. Workers will not be allowed for open defecation. Proper toilets fitted with septic tank and soak pit will be provided for workers at camp site. At the bridge construction site portable toilets shall be provided for workers and sewage from portable toilets shall be passed through septic tank followed by soak pit. 	Contractor	Independent Engineer /PIU
B.4.2	Air Pollution			

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
B.4.2.1	Dust Pollution	<ul style="list-style-type: none"> Road construction works specially earth work and movement of construction vehicles plying during construction phase will may add to dust and gaseous air pollution along the project road. Frequent dust suppression will be ensured for this stretch of the road by use of water tankers. The contractor will procure the construction machineries, which conforms to the pollution control norms specified by the MoEF&CC/CPCB/APPCB. The excavated earth /construction materials will be stored properly so that it does not generate fugitive emissions. Regular maintenance of vehicles to be used for materials transportation and equipment will be carried and vehicular pollution check should be made mandatory. <p>Mask and other PPE should be provided as a mandatory effort to the construction workers in dust prone areas.</p>	Contractor	Independent Engineer /PIU
B.4.2.2	Emission from Construction Vehicles, Equipment and Machineries	<ul style="list-style-type: none"> The contractor will ensure that all vehicles, equipment and machinery used for construction works are regularly maintained and conform that pollution emission levels and comply with the requirements of CPCB and/Motor Vehicles Rules. The contractor will submit Pollution Under Control (PUC) certificates for all vehicles for the project. DG set will be provided with chimney of adequate height as per CPCB guidelines (Height of stack in meter = Height of the building + 0.2 \sqrt{KVA}). The environmental monitoring is to be conducted as per the monitoring plan. 	Contractor	Independent Engineer /PIU
B.4.3	Noise Pollution			
B.4.3.1	Noise Levels from Construction Vehicles and Equipment's	<p>The contractor will confirm the following:</p> <ul style="list-style-type: none"> All construction equipment used in excavation, concreting, etc, will strictly conform to the MoEF&CC/CPCB/APPCB noise standards. All vehicles and equipment used in construction works will be fitted with exhaust silencers/mufflers. Maintenance and servicing of all construction vehicles and machineries will be done regularly. Only acoustic enclosures fitted DG sets will be allowed at the construction site and labour camp. 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<ul style="list-style-type: none"> At the construction sites within 150 m of the nearest habitation, noisy construction work and use of high noise generation equipment will be stopped during the night time between 10.00 pm to 6.00 am. Working hours of the construction activities will be restricted around educational institutes/health centers (silence zones) up to a distance of 100 m from the sensitive receptors. Noise monitoring shall be carried out in construction areas through the approved monitoring agency. 		
B.5	Archaeological Resources and Cultural Properties			
B.5.1	Chance Found Archaeological Property	<ul style="list-style-type: none"> All fossils, coins, articles of value of antiquity, structures and other remains or things of geological or archaeological interest discovered on the site shall be the property of the Government and shall be dealt with as per provisions of the relevant legislation. The contractor will take reasonable precautions to prevent his workmen or any other persons from removing and damaging any such article or thing. He will, immediately upon discovery thereof and before removal acquaint the Environmental Expert of the PIU of such discovery and carry out the PIU's instructions for dealing with the same, waiting which all work shall be stopped. The PIU will seek direction from the Archaeological Survey of India (ASI) before instructing the Contractor to recommence the work in the site. 	Contractor	Independent Engineer /PIU
B.5.3	Impacts Cultural Properties	<ul style="list-style-type: none"> All necessary and adequate care shall be taken to minimize impact on cultural properties which includes cultural sites and remains, places of worship including mosques, temples, shrines, etc., graveyards, monuments and any other important structures as identified during design stage. Relocation and enhancement measures shall be taken up as per design and in consultation with local community. Access to such properties from the road shall be maintained clear and clean. 	Contractor	Independent Engineer /PIU
B.6	Personal Safety			
B.6.1	Personal Safety Measures for Labours and Staff	The contractor will take necessary measures for personal safety of workers:	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<ul style="list-style-type: none"> • Protective safety shoes, gum boots, hand gloves, protective goggles, etc (as required) will be provided to the workers employed in excavation, steel rebaring and bending, concrete works, erection of pump station, etc. • Welder's protective eye-shields will be provided to workers who are engaged in welding works. • Earplugs will be provided to the workers exposed to high noise levels. • Safety vests will be used by workers when on construction site. • The Contractor will comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress. • The contractor will comply with all the precautions as required for ensuring the safety of the workmen as far as those are applicable to this contract. • The contractor will make sure that during the construction work all relevant provisions of Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered to. • The Contractor will not employ any person below the age of 14 years for any work. 		
B.6.2	Traffic and Safety	<p>The Contractor will take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as proposed in the traffic control plan/drawings and as required by the Environmental Expert for the information and protection of traffic approaching or passing through the section of any existing cross roads.</p> <p>The Contractor will ensure that all signs, barricades, pavement markings are provided as per the MoRTH specifications.</p> <p>Before taking up of construction, a Traffic Control Plan will be devised and implemented to the satisfaction of the Environmental Expert of PIU.</p>	Contractor	Independent Engineer /PIU
B.63	Emergency Management	<ul style="list-style-type: none"> • Emergency numbers will be displayed at the construction sites and camp site, • First boxes will be made available at construction site and camp site, 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<ul style="list-style-type: none"> • Fire extinguishers for petroleum oil fire and electrical fire will be made available at camp site, fuel storage site, construction site etc. • Designated vehicles, which can be used as ambulance will be available at construction site at all the time. 		
B.6.4	Risk Force Measure	<ul style="list-style-type: none"> • The contractor will make required arrangements so that in case of any mishap during, operation of machinery/ construction vehicles, dismantling, excavation, concrete pouring, hot asphalt handling and erection of pumps, all necessary steps can be taken for prompt first aid treatment. • Construction Safety Plan for the all the road stretches, embankment development, protection works, works road longitudinal drains, ancillary sites to be prepared by the contractor and will identify necessary actions in the event of an emergency. 	Contractor	Independent Engineer /PIU
B.6.5	First Aid Facility	<p>The contractor will arrange for :</p> <ul style="list-style-type: none"> • A readily available first aid unit including an adequate supply of sterilized dressing materials, burn ointment and appliances as per the state Factories Rules will be maintained all the time by the contractor. • Availability of first aid trained persons will be ensured at the project site during construction phase. • Availability of suitable transport will be ensured at all times to take injured or sick person(s) to the hospital. 	Contractor	Independent Engineer /PIU
B.6.6	Informatory Signs and Hoardings	The Contractor will provide, erect and maintain informatory/safety signs, hoardings written in English and local language, wherever required or as suggested by the Environmental Specialist of PIU.	Contractor	Independent Engineer /PIU
B.7	Labour Camp and Project Site Management			
B.7.1	Accommodation for Laborers	<ul style="list-style-type: none"> • Contractor will follow all relevant provisions of the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labour camp. • The location, layout and basic facility provision of each labour camp will be submitted to Environmental Expert of PIU prior to their construction. • The construction will commence only upon the written approval of the Environmental Expert of PIU. 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<ul style="list-style-type: none"> The contractor will maintain necessary wellventilated living accommodation, toilets, bath rooms and ancillary facilities in functional and hygienic manner. Proper ventilation along with standard exhaust fans will be provided in labour accommodation rooms. Regular cleaning and sweeping will be ensured at the labour camp site. Systematic waste collection management at labour camp to be managed as per SWM Rules 2016. <p>Standard First Aid Kits/units including an adequate of sterilized dressing materials.</p>		
B.7.2	HIV/AIDS Prevention Measures	<ul style="list-style-type: none"> Necessary HIV/AIDS prevention measures will be taken at labour camp HIV/AIDS awareness program will be organized by the contractor's Environment & Safety Officer. 	Contractor	Independent Engineer /PIU
B.7.3	Potable Water for Workers	<ul style="list-style-type: none"> The contractor will construct and maintain labour accommodation in such a fashion that uncontaminated clean water is available for drinking, cooking, bathing and washing. The contractor will also provide potable water facilities within the precincts of workplace/pump stations in an accessible place, as per standards set by the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996. The contractor will also provide the following: <ol style="list-style-type: none"> Supply of sufficient quantity of potable water (as per IS) at construction site/labour camp (site at suitable and easily accessible places and regular maintenance of such facilities). If any water storage tank is provided that will be kept such that the bottom of the tank at least 1 meter above the surrounding ground level. If water is drawn from any existing well/ hand pump, which is within 30 meters proximity of any toilet, drain or other source of pollution, the well will be disinfected before water is used for the drinking. <p>Environmental Expert of PIU will be required to inspect the labour camp once in a week to ensure the compliance of the EMP.</p>	Contractor	Independent Engineer /PIU
B.7.4	Sanitation and Sewage System at Labour Camp	<p>The contractor will ensure that :</p> <ul style="list-style-type: none"> The sewage system for the camp will be designed, built and operated in such a fashion that no health hazard occurs and no pollution to the air, ground water or adjacent water courses take place, 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<ul style="list-style-type: none"> Separate toilets/bathrooms, as required, will be provided for men and women, marked in vernacular language, Toilets will be provided with septic tank followed by soak pit. Adequate water supply will be provided in all toilets and urinals, Night soil can be disposed of with the help of municipality or disposed of by putting layer of it at the bottom of a permanent pit prepared for the purpose and covered with 15 cm layer of waste or refuse and then covered with a layer of earth for a fortnight. 		
B.7.5	Waste Disposal	<ul style="list-style-type: none"> The contractor will provide garbage bins in the camp & construction site and ensure that these are regularly emptied and disposed off in a hygienic manner according to Solid Waste Management Plan as per Solid Waste Management Rule 2016. Burning of wastes at construction site & labour camp and road side will not be allowed. Solid waste generated at the construction site & labour camp, will be collected in covered waste bins and segregated as biodegradable (food waste, paper, etc) and non-biodegradable (plastic, polyethylene bag, etc) wastes. Polyethylene/plastic wastes will be stored in empty cement bags and to be sent for recycling through scrap dealer. Biodegradable (food waste, paper, etc) solid waste will be disposed in the compost pit. 	Contractor	Independent Engineer /PIU
B.8	Environmental Monitoring			
B.8.1	Environmental Monitoring- Construction Stage	<ul style="list-style-type: none"> Environmental monitoring for ambient air quality, noise levels and water quality will be carried out as per environmental monitoring plan and in accordance to instruction of Environmental Specialist of PIU. 	Contractor	Independent Engineer /PIU
B.8.2	Compensatory Plantation	<ul style="list-style-type: none"> Loss of trees will be compensated by 1:3 ratio (<i>i.e.</i> for loss of 1 tree 3 trees will planted) or greater and transplantation of the same trees may be envisaged wherever applicable. Regular monitoring will be carried out for plantation along the project road for cutting of trees. 	PIU	PMU
C.	Contractor's Demobilization			
C.1	Clean-up Operations, Restoration and	<ul style="list-style-type: none"> The contractor will prepare project and labour camp site restoration plan, which will be approved by the PIU / Environmental Expert. The clean-up and site restoration operations are to be implemented by the contractor 	Contractor	Independent Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
	Rehabilitation	<p>prior to demobilization from construction site and labour camp. The contractor will clear all temporary structures, debris, construction wastes, garbage, night soils, etc in environmental sound manner.</p> <ul style="list-style-type: none"> • All disposal pits or trenches will be filled in and effectively sealed off. • Construction places including camp and any other area used/affected due to the project operations will be left clean and tidy at the contractor's expense to the entire satisfaction to the PIU. 		
C.2	Land Rehabilitation	<ul style="list-style-type: none"> • All surfaces hardened due to construction activities will be ripped & imported materials thereon removed. • All rubbles to be removed from the site to an approved disposal site. Burying of rubble on site is prohibited. • Surfaces are to be checked for waste products from activities such as concreting or asphaltting and cleared in a manner approved by the Engineer. • All embankments are to be trimmed, shaped and replanted to the satisfaction of the PIU. • Borrow pits are to be closed and rehabilitated in accordance with the pre-approved management plan for each borrow pit. The Contractor shall liaise with the PIU regarding these requirements. 	Contractor	Independent Engineer /PIU
C.	Contractor's Demobilization			
C.1	Clean-up Operations, Restoration and Rehabilitation	<ul style="list-style-type: none"> • The contractor will prepare project and labour camp site restoration plan, which will be approved by the PIU / Environmental Expert. The clean-up and site restoration operations are to be implemented by the contractor prior to demobilization from construction site and labour camp. The contractor will clear all temporary structures, debris, construction wastes, garbage, night soils, etc in environmental sound manner. • All disposal pits or trenches will be filled in and effectively sealed off. • Construction places including camp and any other area used/affected due to the project operations will be left clean and tidy at the contractor's expense to the entire satisfaction to the PIU. 	Contractor	Independent Engineer /PIU
C.2	Land Rehabilitation	<ul style="list-style-type: none"> • All surfaces hardened due to construction activities will be ripped & imported materials thereon removed. • All rubbles to be removed from the site to an approved disposal site. Burying of rubble on site is prohibited. 	Contractor	Independent Engineer/PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		<ul style="list-style-type: none"> Surfaces are to be checked for waste products from activities such as concreting or asphaltting and cleared in a manner approved by the Engineer. All embankments are to be trimmed, shaped and replanted to the satisfaction of the PIU. Borrow pits are to be closed and rehabilitated in accordance with the pre-approved management plan for each borrow pit. The Contractor shall liaise with the PIU regarding these requirements. 		
D	Post Construction Stage			
D.1	Environmental Monitoring- Post Construction Stage	Environmental monitoring for ambient air quality, noise levels and water quality as per environmental monitoring plan and in accordance to instruction of Environmental Specialist of PMU.	PIU	PMU
D.2	Monitoring of Afforested and Landscape areas	Continuous watch and monitoring of plantation and landscape areas shall be done for its performance and survival rate. The plantation will be properly guarded by watch and ward personnel. Provision will be made for manure application and watering on schedule.	PIU	PMU
D.3	Soil Erosion and Monitoring of Borrow Areas	Visual monitoring and inspection of soil erosion at borrow areas, quarries (if closed and rehabilitated), embankments and other places expected to be affected, will be carried out once in every three months.	PIU	PMU

9.4 Clause for Nonconformity to Environmental Management Plan (EMP) - Protection of the Environment

The Contractor will implement necessary mitigation measures for which responsibility is assigned to him as stipulated in the EMP. Any lapse in implementing the same will attract the damage clause as detailed below:

- Any complaints of public, within the scope of the Contractor, formally registered with the PIU and communicated to the Contractor, which is not properly addressed within the time period intimated by the PIU shall be treated as a major lapse.
- Non-conformity to any of the mitigation measures like unsafe conditions, non-collection of excavated material (during laying of drainage pipes) regularly and other unattended Health, Safety & Environment (HSE) issues, as stipulated in the EMP Report (other than stated above) shall be considered as a minor lapse.
- On observing any lapses, PIU shall issue a notice to the Contractor, to rectify the same.
- Any minor lapse for which notice was issued and not rectified, first and second reminders shall be given after ten days from the original notice date and first reminder date respectively. Any minor lapse, which is not rectified, shall be treated as a major lapse from the date of issuing the second reminder.
- If a major lapse is not rectified upon receiving the notice PIU shall invoke reduction, in the subsequent interim payment certificate.
- For major lapses, 10% of the interim payment certificate will be withheld, subject to a maximum limit of about 0.5% of the contract value.
- If the lapse is not rectified within one month after withholding the payment, the amount withheld shall be forfeited immediately.

9.5 Environmental Monitoring Plan

The monitoring programme consists of performance indicators, reporting formats and necessary budgetary provisions. The contractors monitoring plan should be in accordance with the baseline environmental monitoring, locations provided in the Environmental impact assessment report.

The monitoring plan has the following objectives:

- To ensure effective implementation of EMP
- To evaluate the performance of mitigation measures proposed in the EMP
- To comply with all applicable environmental, safety, labour and local legislation
- To ensure that public opinions and obligations are taken into account and respected to the required satisfaction level
- To modify the mitigation measures or implementing additional measures, if required

The monitoring requirement for the different environmental components have been prepared is presented in **Table 9.2** below;

9.6 Performance Monitoring Indicators

Environmental components identified of a significance in affecting the environment at critical locations have been suggested as Performance Indicators. For example near the construction site, a thick layer of dust over the nearby vegetation/leaf is an indication that the dust control measures are not effective. The performance indicators will be evaluated under three heads as mentioned below:

- Environmental condition indicators to determine efficacy of environmental mitigation measures for controlling air, noise and water pollution.
- Environmental management indicators to determine compliance with the suggested environmental management measures.
- Operational performance indicators have also been devised to determine efficacy and usefulness of the proposed mitigation measures for the project road.

The performance indicators and monitoring plan prepared for the project road are presented in **Table 9.2**. Details of the performance indicators parameters for each of the component have to be identified and reported during all stages of the implementation.

Table 9.2: Performance Indicators and Monitoring Plan

Sn.	Description of Item	Indicator	Stage	Responsibility
1.	Verification and Identification of the earth borrow areas and stone quarries	Compliance of site selection Criteria	Pre Construction	Contractor
2.	Identification of locations for the construction camp and construction plants sites	Compliance of site selection Criteria	Pre Construction Phase	Contractor
3.	Progress on the Tree Removal	Tree Cutting	Pre Construction Phase	PIU/PMU
4.	Location of the temporary storage areas for excavated materials to be reused in road construction, embankment and sub grade.	Storage of excavated materials	Pre Construction and Construction Phase	Contractor
5.	Implementation of mitigation measures specified in the EMP	Prevention/ Control of Pollution	Construction Phase	Contractor
6.	Environmental monitoring as per the conditions stipulated in the consents / as described in environmental monitoring plan	Environmental Conditions at Construction Sites/Plants/ Camps	Construction Phase	Contractor
7.	Environmental monitoring in accordance with the frequency and duration of monitoring as well as the	Ambient Air Quality, Ambient Noise Level, Ground	Construction Phase	Contractor through External agency and will be

Sn.	Description of Item	Indicator	Stage	Responsibility
	locations as per the monitoring plan. Before the onset of monsoon all the debris/excavated materials will be cleaned from the work sites and disposed of temporarily stock piled debris for final disposal properly away from the water bodies.	and Surface Water Quality, Silting of Water bodies		supervised by the Environmental Specialist of Independent Engineer/PIU / PMC
8.	Monitoring of work zone safety	Use of PPEs and signages.	Construction Phase	Contractor and will be supervised by the Environmental Specialist of Independent Engineer / PMC
9.	Implementation of the enhancement measures suggested for the pond redevelopment areas, cultural/community properties and oxbow land development.	Enhancements/ Shifting	Construction Phase	Contractor
10.	Reporting of accidents at work sites/road construction sites	Accidents Reporting	Construction Phase	Contractor
11.	Plantation of shrubs and grass in high embankment/ enhancement sites and incidental spaces	Landscaping	Construction and Defect Liability Period	Contractor
12.	Compensatory tree plantation and Reporting of the Survival Rate. The survival rate should be monitored and reported on quarterly basis.	Tree Plantation and Survival Rate	Construction and Operation Stage	Forest Department and PMU/PIU
13.	Verification of the borrow area redevelopment as specified in the redevelopment plan and satisfaction of the owners/IRC guidelines	Status of Borrow Area	Construction and Operation Stage	Contractor & PMU/PIU
14.	De-mobilization of Camps and Plant on completion of works	Clean-up and restoration of the site.	De-mobilization	Contractor and will be supervised by the Environmental

Sn.	Description of Item	Indicator	Stage	Responsibility
				Specialist of Independent Engineer / PMC

9.7 Monitoring Parameters and Standards

The environmental monitoring parameters and National Ambient Air Quality Standards are discussed below:

9.7.1. Ambient Air Quality Monitoring (AAQM)

The ambient air quality parameters viz: Sulphur Dioxide (SO₂), Nitrogen Dioxide (NO₂), Carbon Monoxide (CO), Particulate Matter (PM₁₀, PM_{2.5}), shall be monitored six monthly at identified locations from the start of the construction activity. The ambient air quality parameters shall be monitored in accordance with the National Ambient Air Quality Standards as given in **Table 9.3**. The duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed out in the Environmental Monitoring Plan.

Table 9.3: National Ambient Air Quality Standards

Sl. No	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural & other areas	Ecologically Sensitive Area (Notified by Central Government)	Methods of Measurement
1	Sulphur Dioxide, (SO ₂), µg/m ³	Annual* 24 hours**	50 80	20 10	-Improved West and Gaeke -Ultraviolet fluorescence
2	Nitrogen Dioxide, (NO ₂) µg/m ³	Annual* 24 hours**	40 80	30 80	-Modified Jacob & Hochhieser (Na-Arsenite) -Chemiluminescence
3	Particulate Matter(size less than 10 µm), or PM ₁₀ µg/m ³	Annual* 24 hours**	60 100	60 100	-Gravimetric -TOEM -Beta attenuation
4	Particulate Matter(size less than 2.5 µm), or PM _{2.5} µg/m ³	Annual* 24 hours**	40 60	40 60	-Gravimetric -TOEM -Beta attenuation
5	Carbon Monoxide (CO), µg/m ³	8 hours* 1 hours**	02 04	02 04	-Non Dispersive Infra Red (NDIR) spectroscopy

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

**24 hourly Or (8 hourly or 01 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

9.7.2. Noise Quality Monitoring

The noise levels shall be monitored at designated locations in accordance with the Ambient Noise Quality standards given in **Table 9.4**. The duration and the noise pollution parameters to be monitored and the responsible institutional arrangements are detailed in the Environmental Monitoring Plan.

Table 9.4: National Ambient Noise Quality Standards

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

*Daytime shall mean from 6:00m to 10:00 pm and Night shall mean from 10:00 pm to 6:00 am

**Silence zone is defined an area up to 100 meters around premises of hospitals, educational institutions and courts, Use of vehicles horns, loud speakers and bursting of crackers are banned in these zones

9.7.3. Water Quality Monitoring

Water quality parameters such as pH, BOD, COD, DO coli form count, total suspended solids, total dissolved solids, Hardness, Conductivity etc. shall be monitored at all identified locations during the construction stage as per standards prescribed by Central Pollution Control Board specifications presented in **Table 9.5** The duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed out in the Environmental Monitoring Plan.

Table 9.5: Surface Water Standards

S. No	Parameters	IS:2296 (Class C)	Method Adopted
1.	pH	6.5-8.5	pH meter
2.	BOD (3 day, 27°C)	3.0	DO-Azide modification of Wrinkler's Method
3.	Temperature (°C)	NS	Thermometer
4.	Dissolved oxygen	4	Azide modification of Wrinkler's method
5.	Color (Hazen)	300	Visual Comparison method
6.	Chloride (Cl)	600	Argentometric Titration
7.	Total Dissolved Solids	1500	Gravimetric Analysis
8.	Sulphates (SO ₄)	400	Barium Chloride method
9.	Oil and Grease	0.1	Partition -Gravimetric method
10.	Nitrates	50	Chromotropic acid
11.	Total Coliform (MPN/100 ml)	5000	Multiple Tube Fermentation Technique

NS: Not specified. All the values in mg/l if otherwise mentioned

9.8 Monitoring Plans for Environment Conditions

For each of the environmental components, the environmental monitoring plan specifies the parameters to be monitored; location of the monitoring sites and duration of monitoring. The monitoring plan also specifies the applicable standards, implementation and supervising responsibilities. The monitoring plan for the various environmental condition indicators of the project in construction stages is presented in **Table 9.6**. Monitoring plan does not include the requirement of arising out of regulation provision such as obtaining Consents for plant site operation.

Table 9.6: Brief Description of Measures

Sl. No.	Locations of Work Site	Site Safety Measures
1	Construction Sites	Caution boards, Safety Cones, Delineators
2	Deep Cutting	The construction zone should be barricaded with G.I Sheet or arrangement to be made as per plan approved by the PIU / PMU. [Provide Safety Sign Boards and Safety Barriers marked with reflective tapes]
3	Temporary Diversion (if any)	Diversion Board, Barricading [Provide 'Diversion Ahead' boards at 50m, 100m and 150m ahead of diversions with reflective tape for illumination at night at the all diverted locations]
4	Safety for the Workers	Helmets, Safety-Shoes, Goggles, Dusk mask. etc

Furthermore, periodical site monitoring should be carried out by the Environmental Expert of PIU for surveillance & monitoring of road safety during the road construction. The brief description of measures has been given in **Table 9.7**:

Table 9.7: Environmental Monitoring Plan

Attribute	Timing	Parameter	Standards	Frequency	Duration	Location	Implementation
Ambient Air	Construction	PM _{2.5} , PM ₁₀ , SO ₂ , NO ₂ & CO	National Ambient Air Quality Standards (NAAQM) 2009	Two samples for one week (on non consecutive days) for in winter and summer seasons (six monthly).	24 Hours Sampling, 2 Samples in on Week	Construction labour camps, plants sites and settlements along the work zones (Locations will be decided by Environmental Expert of Independent Engineer /PMC)	Contractor
Ground Water	Construction	Organoleptic and Physical, Chemical & Bacteriological Parameters	Potable Water Standards (IS 10500: 2012)	Winter and Summer Seasons	Grab Sampling Once	Construction labour camp, plants sites, settlements along the work zones (locations will be decided by Environmental Expert of Independent Engineer /PMC)	Contractor
Surface Water	Construction	pH, Total Suspended Solids (TSS), Total Dissolved Solids (TDS), BOD, COD, Oil & Grease (O&G) and Turbidity	Indian Standards (IS:2296-1982) for inland surface waters	Winter and Summer Seasons	Grab Sampling Once from	Construction labour camp, plants sites, River and Ponds (locations will be decided by Environmental Expert of Independent Engineer /PMC)	Contractor
Noise	Construction	Level Equivalent L _{Day} and L _{Night} based on hourly Noise Measurements	Ambient Noise Standards	Winter and Summer Seasons	Hourly noise measurements for one day in winter and summer seasons	Construction labour camp, plants sites, settlements along the work zones (locations will be decided by Environmental Expert of Independent Engineer /PMC)	Contractor

9.9 Environmental Reporting System

The environmental reporting system for the suggested monitoring programme will function at two levels:

- Reporting for environmental condition indicators and environmental management indicators
- Reporting for operational performance indicators at the PMU/PIU level. Environmental monitoring involves regular checking of the environmental management issues detailed in the EMP and to ascertain whether the mitigation measures are achieving desired objectives for environmental protection, with the progress of the works. It provides the necessary feedback for the project management to keep the programme on schedule for achieving the expected outcomes.

The Contractor, Independent Engineer /PMC and PMU/PIU will operate the reporting system for environmental conditions and environmental management indicators. The reporting system is presented in **Table 9.8**. The reporting schedule for contractors and construction supervision consultant have been prepared, which are on the basis of the implementation of EMP by the Contractor and monitoring by the Independent Engineer /PMC and PMU/PIU.

The reporting system will start with the Contractor who is the main executor of the implementation EMP activities. The Contractor will report to the Independent Engineer /PMC, who in turn will report to the PMU/PIU. The reporting system will comprise the following:

- The contractor will submit monthly environmental compliance reports along with formal monthly project progress report to the Independent Engineer
- The Independent Engineer will submit separate quarterly environmental monitoring reports to PMU/PIU in addition to submission of the summary of the activities of the month in the formal monthly report including any deviations and corrective actions
- PMU/PIU will be responsible for the preparation of the targets for identified non compliances for the EMP compliance
- Solutions for further effective implementation may also emerge as a result of the compliance monitoring reports.

The photographic records will be kept to provide useful environmental monitoring tools. All material sources points, disposal locations, plants locations, camp locations, crusher locations etc will be photographed and kept as a record. A full record of construction activities and EMP implementation will be kept as part of normal contract monitoring system. The Reporting and Monitoring Systems for various stages of construction and related activities have been proposed in **Table 9.8**.

Table 9.8: Environmental Reporting System

Item	Contractor	Construction Supervision Consultant (Independent Engineer /PMC)		PMU/PIU	
	Implementation and Reporting to Independent Engineer /PMC	Supervision	Reporting to PMU/PIU	Oversee Compliance Monitoring	Report to World Bank
Pre Construction Stage					
Sites of Camps and Plants	Weekly	Weekly	Monthly	Monthly	Quarterly
Locations of Borrow Area	Weekly	Weekly	Monthly	Monthly	Quarterly
Location of Stone Quarry	Weekly	Weekly	Monthly	Monthly	Quarterly
Shifting of Community/ Cultural Structures	Weekly	Weekly	Monthly	Monthly	Quarterly
Tree cutting and Clearing of Vegetation	Weekly	Weekly	Weekly	Weekly	Monthly
Construction Stage					
Monitoring of construction site and construction Camp	Regular	Regular	Monthly	Monthly	Quarterly
Pollution Monitoring	Six Monthly	As required	In Monthly Report	In Quarterly Report	In Quarterly Report
Monitoring of Enhancements	Weekly	Weekly	Monthly	Monthly	Quarterly
Top soil Preservations	Weekly	Weekly	Monthly	Monthly	Quarterly
Borrow area/ quarry area/ debris disposal area	Weekly	Weekly	Monthly	Monthly	Quarterly
Tree plantation	Monthly	Monthly	Monthly	Monthly	Quarterly
Demobilization of Plants					
Clean-up of plants & camps sites and Restoration of Sites	Monthly	Monthly	Monthly	Monthly	Quarterly

9.10 Institutional Arrangements for Environmental Management

The environmental management requirements/guidelines/plans need to be applied and implemented at all stages of the project. This requires an institutional mechanism to deal with various processes and requirements at each stage. Within the institutional framework proposed for the project, preparation, implementation, supervision and monitoring of environment functions, particularly the Environment Management Plans (EMP), will be carried out at the three levels - national center, state level and the project/community level with an inbuilt mechanism for coordinating activities between the said levels.

Implementation Structure

The Externally-Aided Projects Cell (EAP-Cell) at MoRTH, supported by a Project Management Consultants (PMC), will have the overall project implementation responsibility.

At the central level, the Chief Engineer, Externally Assisted Projects (CE, EAP), MoRTH, Govt. of India will be responsible for the over-all implementation of EMF and EMP. The CE, EAP will have all delegated administrative and financial decisions regarding the implementation of the project as well as environment management and safeguard related functions. CE (EAP) will be assisted by a team comprising Executive Engineer (EE) designated as an Environment and Social Officer (ESO) and a suitable number of technical and secretarial staff. The EE will ensure that all project activities are complied with as per the EMF and EMP.

MoRTH will engage a Project Management Consultant (PMC), which will include an Environment Specialist, to work with the CE, EAP's team. The PMC will be responsible for training, guidance, and recommendations for handling policy and implementation issues at the state and sub-project levels to comply with the EMF and requirements laid out in the EMP.

At the state level, the National Highways (NH) divisions in the state Public Works Department will be responsible for the project execution. In Project Co-ordination Unit, there will be an Environment Officer who will coordinate the preparation/implementation of EMP. He/she will ensure that these comply with requirements laid out in the EMF for GNHCP and are implemented in accordance to provisions laid out in the contract documents.

Finally, for the project road, a Project Site Team (PST) or Project Implementation Unit (PIU) will be responsible. The PST, to be headed by Executive Engineer, will oversee day to day implementation of environment, health and safety plan, including

on issues pertaining to tree cutting, plantation works, utility relocation and worksite safety management.

Supervision consultant/ Independent Engineer to be engaged by MORTH will provide the regular supervision and administration services. The Construction Supervision Consultant/Independent Engineer's team will have Environment and Safety personnel for day-to-day supervision and monitoring. The Environmental and Safety Officer on the Contractor's team must ensure compliance with the environmental contractual clauses and will report on progress or challenges to the Construction Supervisory team, as per the requirements/obligations stated in the Contract Document.

Independent Quality Assurance Consultants (QAC) would be engaged to oversee the quality of the green national highway upgrading contracts, including environment management, health and safety related aspects. This will determine whether the project is complying with regulatory performance standards. It entails a systematic, documented and periodic review of project implementation and could be a useful tool to improve project management performance on EHS aspects.

9.11 Environmental Management – Budget

Implementation of Environmental Management

The environmental budget for the various environmental management measures proposed for construction and operation of the project road is detailed in **Table 9.9**. There are several other environmental issues that have been addressed as part of good engineering practices, the costs for which have been accounted for in the engineering cost.

Table 9.9 : Budget for Implementation of Environmental Management Plan

Sr. No	Component	Item	Unit Cost (INR)	Quantity	Total Cost
A. Construction Stage					
1.	Tree Cutting	Cutting of Road Side Trees for construction of road	Cost to be part of DPR		
2.	Environmental Monitoring	Ambient Air Quality noise and surface and ground water Monitoring as per monitoring plan,	Lump sum		750000
3.	Topsoil Management				
4.	Air	Dust Suppression Measures	Cost to be part of DPR		
5.	Labour camp and ancillary facilities	Labour Camp and all associated facilities as per EMP	Cost to be part of DPR		
6.	Personal Protective Equipment's (PPE's)	Personal Protective Equipments like vest, helmet, safety shoe, hand gloves, gumboots, earplug, Harness belt, Welding Glasses etc	Cost to be part of DPR		
7.	First Aid Kits	First Aid Kits at the construction site, camp and ancillary sites	Cost to be part of DPR		
8.	Compensatory Plantation	Replantation of Trees (3:1)	1500	10788	16182000
9.	Oil Interceptor	Oil Interceptor at Workshop at Camp Site	40000		40000
10.	Borrow Area Rehabilitation and Quarry Management	Rehabilitation and Restoration	Cost to be part of DPR		
11.	Debris and Waste Disposal	Solid Wastes, Demolition Wastes, Hazardous Wastes	Cost to be part of DPR		
12.	Display of Safety Signages and Work Zone Safety	Sign boards, retro reflective tapes, cones, barriers	Cost to be part of DPR		
Project Enhancement					
13.	Embankment Strengthening (By way of plantation)	Grass Engraining with indigenous shrubs	Cost to be part of DPR		
14.	Protection on bridges, culvert and on high embankment	Slope Protection Measures	Cost to be part of DPR		
14.	Shifting of Community Property Resources,	Shifting and Relocation	Cost to be part of DPR		
Contingency Cost @ 5%					848600
Total Budget Cost					17820600

Annexure

Annexure

Annexure 1

Guidelines For Siting, Management And Redevelopment of Labour Camp

A. Overview

Labour camp include accommodation for workers/labourers along with other basic amenities such as kitchen, potable water supply, sanitation (toilets, bathrooms, washing areas and water supply for such needs), first aid room as well as garbage collection and disposal facility. The guidelines outlined here aims to facilitate the contractor in implementing the measures in the EMP there by reducing the impact on the environment.

B. Criteria for Locating the Site

To the extent possible/agriculture fertile land shall be avoided for locating camp site.

C. Finalization of Selected Site

After identification of the site, the Contractor should fill up the prescribed reporting format provided in EMP as annexure and submit the same for approval to the Environmental Expert of PIU. The selected site shall be approved by Environmental Expert of PIU, after considering the compliance. No agreements or payments shall be made to the land owner/s prior to receipt of a written approval from the Environmental Expert of PIU. Any consequence of rejection prior to the approval shall be the responsibility of the Contractor and shall be restored at his own cost. After obtaining a written approval from the Environmental Expert of PIU for the selected site, the Contractor has to enter into an agreement with the landowner to obtain his/her consent before commencing any operation/activities in the land. The agreement should also mention its type, duration, amount and mode of payment as well as the preferences of the owner regarding site maintenance and redevelopment.

D. Designing And Setting Up of Labour Camp

The following facilities should be provided in a labour camp to ensure safe, clean and hygienic accommodation for the workers.

- (i) **Site preparation:** The site should be graded and rendered free from depressions such that the water does not get stagnant anywhere. Fencing should be constructed all around the camp to prevent the trespassing of humans and animals. The approved layout plan should be strictly adhered to while setting up the camp.
- (ii) **Accommodation:** Contractor will follow all relevant provisions of the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labour camp. The height of the worker's and labour accommodation shall not be less than 3m from floor level to the lowest part of the roof. The camp shall be floored with concrete, shall be kept clean, with proper cross ventilation, and the space provided shall be on the basis of one sqm per head or as per the relevant regulation, whichever is higher. Fire and electrical safety precautions shall be adhered to. Cooking, sanitation and washing areas shall be provided

separately. The contractor will maintain necessary living accommodation and ancillary facilities (including provision of clean fuel to prevent damage to forests and to prevent fuel wood cutting and burning by labour) in functional and hygienic manner. The site must be graded and rendered free from depressions such that water does not get stagnant anywhere. The entire boundary of the site should be fenced all around with barbed wire so as to prevent the trespassing of humans and animals.

- (iii) **Drinking Water:** The Contractor should provide potable water within the precincts of every workplace in a cool and shaded area, which is easily accessible as per standards set by the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996. All potable water storage facilities will be on a safely raised platform that is at least 1m above the surrounding ground level. Such facilities shall be regularly maintained from health and hygiene point of view. If necessary, water purifier unit shall be installed for providing potable water.
- (iv) **Sanitation Facilities:** Adequate nos. of toilets shall be provided separately for males and females (depending on their strength), with markings for identification in vernacular language. All such facilities must have adequate water supply with proper drainage and disposal facility. They shall be maintained, cleaned and disinfected daily using proper disinfectants. Location and design of soak pit should be in such a way that it doesn't pollute the ground water. Drains and ditches should be treated with bleaching powder on a regular basis. The sewage system for the camp must be properly designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place.

Portable toilets may be brought to use at construction site and the night soil from such units has to be disposed through designated septic tanks so as to prevent pollution of the surrounding areas. In the main camp, no night soil or sewerage shall be disposed of at any place other than the septic tanks constructed at the site. All these facilities shall be inspected on a weekly basis to check the hygiene standards.

- (v) **Waste Disposal:** The Contractor should provide garbage bins in the camp and ensure that these are regularly emptied and disposed off in a hygienic manner. No incineration or burning of wastes shall be carried out by the Contractor. Separate bins shall be provided for biodegradable and non-biodegradable wastes. The disposal of kitchen waste and other biodegradable matter shall be carried out in pits covered with a layer of earth within the camp site. Discarded plastic bags, paper and paper products, bottles, packaging material, gunny bags, hessian, metal containers, strips and scraps of metal, PVC pipe scrubber and poly urethane foam, auto mobile spares, tubes, tires, belts, filters, waste oil, drums and other such materials shall be either reused or sold /given out for recycling.
- (vi) **Day Crèche Facility:** At construction site, provision of a day crèche shall be made so as to enable women to leave behind their children while going to work. At least one attendant shall be provided to take care of the children at the crèche. At construction site where 20 or more women are employed, there shall be at least one shelter for use of children under the age of 6 years belonging to such women.

Shelters shall not be constructed to a standard lower than that of thatched roof, mud walls and floor with wooden planks spread over mud floor and covered with matting. Such areas shall be safely barricaded (no sharp sheets or barbed wires that may injure a child) from rest of the camp for the safety of children. Shelters shall be provided with suitable and sufficient openings for light and ventilation. There shall be adequate

provision to keep the place clean. The size of a crèche may vary according to the number of children on a camp site.

- (vii) **Mess and Kitchen Facilities:** The Contractor shall adhere to the sanitary/hygiene requirements of local medical, health and municipal authorities at all times. Adoption of such precautions as may be necessary to prevent soil and water pollution at the site while operating mess or kitchen facilities.
- (viii) **First Aid Facilities:** At every workplace, a readily available first-aid unit including an adequate supply of sterilized dressing materials and appliances should be provided. Suitable transport should be provided to facilitate taking injured and ill persons to the nearest hospital. Adequate personal protective equipments and fire fighting equipments as detailed out in EMP should be made available in the camp and provided to the staff / workers.
- (ix) **Health Care Facilities:** Health problems of the workers should be taken care of by providing basic health care facilities. If there is no hospital or clinic, which can be accessed in half an hour's time, then a temporary health center should be set up for the construction camp. The health centre should have at least a doctor and a nurse, duty staff, medicines and minimum medical facilities to tackle first aid requirements or minor accidental cases, linkage with nearest higher order hospital to refer patients of major illnesses or critical cases.

The health centre should carryout quarterly awareness programme of HIV – AIDS with the help of AIDS control society as well as about community living and hygiene practices in day to day living. Posters should be exhibited in the health care clinic.

E. Operation of Labour Camp

Throughout the functioning period of the camp, hygienic environment must be ensured by (i) provision of safe drinking water, (ii) proper maintenance of toilets including daily cleaning and disinfection using proper disinfectants, (iii) regular cleaning of drains by removing the silt and solid waste, (if any) and (iv) appropriate waste management practices. While it is of utmost importance to ensure that fire-fighting equipments like fire extinguishers are in working condition, it should also be monitored that construction workers use the personal protective equipments provided to them and they are replaced when necessary. All these facilities should be inspected on a weekly basis to achieve the desired levels of safety and hygiene standards.

F. Preparation of Labour Camp Management And Re-development Plan

After the site for the labour camp has been finalized and approved by Environmental Expert of PIU, the Contractor should prepare a labour camp management and redevelopment plan to be submitted to PIU for approval prior to setting up of the camp and it should comprise the following details:

- Section-1:** Details of site: Copy of approved site identification report along with location plan, showing the site, its survey no., access road, project stretch, distance form the project stretch, surrounding features and land use like residences, water bodies etc., photograph of the site showing the topography and other existing features.
- Section-2:** Site preparation: Activities that should be undertaken for preparing the site based on EMP and this guideline.

- Section-3:** Arrangements/ facilities within the camp: List of facilities to be provided along with its details like area, no of people to be accommodated and a layout plan showing the plan of the site with all the facilities planned like quarters, labour camp, mess, common facilities, toilet facilities, etc.
- Section-4:** Mitigation measures that should be undertaken as per the EMP and this guideline while setting up of the camp and operation of the camp should be separately listed out here.
- Sectoin-5:** Other details: Any other relevant detail like list of awareness camp to be provided to workers, details of information dissemination etc. should be included.
- Section 6:** Re-development plan, which should indicate following points: (i) List of structures to be demolished and list of the clean-up activities that needs to be undertaken, (ii) Proposed use of the land in the post construction phase, if it is a public property, (iii) Presence of existing facilities that could be put in use by the land owner if it is a leased out private land or by the community in case of a public property.
- Section-7:** Annexure-(a) Working drawings: Electrical plan showing the electrical network planned for the site, location of generators, master switch boards etc. and plumbing drawing showing the network of water supply lines, water tank, drainage facilities etc. (b) Copy of permissions obtained from local governing body / community etc. as applicable, (c) Copy of agreement entered with site owner, in case of leased out site.

All the drawings should have north direction marked in it along with prevailing wind direction. Necessary dimensions and specifications should be provided where ever necessary. The labour camp management plan should be submitted to the Environmental Expert of PIU for a written approval before any physical work is undertaken on a particular site. The Environmental Expert of PIU will carefully examine the proposals in light of the various EMP and regulatory provisions and provide suggestions, as necessary to the Contractor who shall incorporate it in the management plan. Contractor shall be responsible for satisfactory and timely implementation of these EMP requirements.

G. Re-development of The Labour Camp

The Contractor should clear all temporary structures; dispose all building debris, garbage, night soils and any other waste as per the approved debris management plan. All disposal pits or trenches should be filled in, disinfected and effectively sealed off. Entire camp area should be left clean and tidy, in a manner keeping the adjacent lands neat and clear, at the Contractor's expense, to the entire satisfaction of landowner and the Environmental Expert of PIU.

These activities should be completed by the Contractor prior to demobilization. Once the Contractor finishes his job, he needs to obtain a certificate from the owner, stating that the site has been re-developed to his/her satisfaction and in tune with the agreement. Then following documents needs to be submitted to the Environmental Expert of PIU by the

- Copy of approved site identification report
- Photographs of the concerned site 'before' and 'after' setting up the camp.
- Certificate from the owner stating his/her satisfaction about status of re-development of the site.

Engineer-in-charge/Environmental Specialist of PIU shall ensure, through site verification that all clean-up and restoration operations are completed satisfactorily and a written

approval should be given to the Contractor mentioning the same before the 'works completion' certificate is issued/recommended. The PIU shall ensure through site inspection that the Contractor has restored the site properly & completely. The site can then be handed over to the concerned owner or local bodies or for local communities as the case may be. Certification/documentation pertaining to approval for clean-up and restoration operations and thereafter handing-over to the owner shall be properly maintained by the Contractor.

Guidelines to Ensure Worker's Safety During Construction

In order to ensure worker's safety while undertaking various operations/stages of construction many safety measures needs to be followed, which are listed down below:

A. Labour Camp/ Site Office

- Install perimeter fencing.
- Ensure good visibility and safe access at site entrances.
- Provide adequate warning signs at the entrance and exit, as necessary.
- Provide adequate space/area for loading and unloading, storage of materials, equipment and machineries.
- Display emergency procedure and statutory notices at conspicuous locations.
- Provide areas for collecting garbage and other waste material, and also arrange for their regular/periodic disposal.
- Arrange appropriate storage, transportation and use of fuel, other flammable materials and explosives in line with the license requirements obtained from concerned authorities.
- Provide defined access roads and movement areas within the site.
- Ensure availability of first aid facilities and display notices at various work places showing the location of first aid facilities and emergency contact numbers. Provide and enforce use of PPE at construction sites.

B. House Keeping Practices

- Provide proper slope in kitchen, canteens, washrooms, toilets and bathrooms for easy and immediate draining of water.
- Keep all walkways and circulation areas clear and unobstructed at all times.
- Ensure that spillages of oil and grease are avoided and in case of accidental spills, these are immediately collected.
- Use metal bins for collection of oily and greasy rags.
- Do not leave tools on the floor or in any location where they can be easily dislodged.
- Keep windows and light fittings clean.
- Maintain the workplace floors dry and in a non-slippery condition
- Provide and maintain proper drainage system to prevent water logging and unhygienic conditions.
- Ensure that protruding nails in boards or walls are moved or bent over or removed so that they do not constitute a hazard to people.
- Store all flammable materials like HSD in appropriate container with proper cover and labels – as required for various products.
- Display 'no smoking' signs in areas with high risks of fire, (eg. near fuelling areas, diesel/oils/lubricant/paint storage area, hessians, rubber, wood and plastic etc.) in and around working area.

C. Safety During Excavation

- During excavation of foundations, necessary safety measures will be taken by the contractor.
- Excavation of 1.5 meters deep or greater require a sides protection unless the excavation is made entirely in stable rock
- Safe access and egress will be require including ladders, steps, ramps, or other safe means of exit of workers in excavated depth of 4 feet (1.22 meters) or deeper
- Excavated earth will be collected and disposed in pre-identified site with the approval of PIU.
- To ensure elimination of excavation hazards, excavation will be carried in the presence of competent person.
- Suitable barricading will be provided

D. Handling of Cement Bags

- Cement bags will be stored and emptied in covered area to control fugitive dust emissions.
- While handling and emptying cement bags, workers will wear mask and goggle and hand gloves.
- Manual transferring of cement bags from one place to another place will not be allowed. For this purpose, trolley will be used.

E. Steel Bars Reinforcement for Foundation and Roof

- Manual cutting of steel bars for reinforcement will be discouraged
- Only skilled workers will be deployed by the contractor for steel bar bending and rebaring reinforced structures.
- Correct hand and power tools will be used to tie and cut steel bars.
- Workers engaged in steel bar bending and reinforcement will be provided helmet, suitably strong and flexible leather gloves and safety shoes.
- Workers will take extra caution and attention when walking on steel bar mattes and areas that contain exposed steel bar.
- First aid facilities will be provided at the site to provide first aid incase of cuts or injuries to workers. After providing first aid, injured worker will be taken to hospital for further treatment.

F. Operation of Trucks And Dumpers

- Ensure that only trained, authorized and licensed drivers operate the vehicles.
- Enlist help of another worker before reversing the vehicle.
- Switch-off the engine when not in use to save fuel, prevent accidents and unnecessary noise and air pollution.

- Lower the tipping bodies when the machine is unattended, but if it is necessary to leave them in the raised position they should be blocked to prevent their fall by fixing a sturdy support below.
- Carryout periodic servicing as per the manufacturer's requirements. All records of maintenance and repairs should be in writing and available for verification.
- Keep the vehicle tidy and the cabin free from clumsy utilities, which might obstruct the controls and create hazards.
- Avoid carrying additional passengers in the cabin or on the body of the dumper, while in field operation other than the connected workers.
- Provide stop blocks when the vehicle is tipping into or running alongside excavations or when it is parked.
- Do not overload the vehicle.
- Carry only well secured loads and use proper covers and fasteners.

G. Manual Handling and Lifting

- Avoid manual handling of heavy materials.
- Pre-assess the actual requirement of manpower in case of emergency situations.
- All concerned persons shall be trained in proper methods of lifting and carrying.
- In all manual operations where groups of workers are involved, a team leader with necessary training to handle the entire work force in unison has to be provided for.
- Watch and ward to control/supervise/guide movement of equipments and machineries, loading and unloading operations, stability of the stockpiled materials and irregularly shaped objects have to be provided for safety and security of workers.
- Carriageway used by the workers must be free from objects.
- Loading and unloading from vehicles shall be under strict supervision.

H. Electrical Hazards

- Statutory warning leaflets/posters are to be distributed/displayed by the Contractor in the vicinity of work site for the benefit of all workers, officers and supervisors as well as the public, indicating the do's and don'ts and warning related to electrical hazards associated with operations to be executed/in progress.
- All wires shall be treated as live wires.
- Report about dangling wires to the site-in-charge and do not touch them.
- Only a qualified electrician should attempt electrical repairs.
- Train all workers about electrical safety.
- Shut down the equipment that is sparking or getting over heated or emitting smoke at the time of operation, if it is not the normal way of working of such machines.
- Inform technical person/s for required maintenance.
- Never use damaged wires for electrical connection.

I. Use And Storage of Flammable Gas

- Store filled gas/LPG cylinder in a secure area – mark this as a no smoking area.

- Transport, store, use and secure cylinders in upright position.
- Ensure proper ventilation at the ground level in locations where LPG is in use.
- Avoid physical damage to the cylinders.
- Never weld near the cylinder.
- Store empty cylinders secured and upright.
- Make sure that the cylinder is closed immediately after use.
- Investigate immediately if there is the smell of LPG or gas.
- Never use LPG on site.
- Make sure that there is no other unrelated fire in the vicinity of the cylinder.

J. Gas Welding

The welders and welding unit should follow all the basic principles of welding for safety and security:

- Use face shield to protect the eyes.
- Use goggles, particularly when chipping slag and cutting strips.
- Use gloves long enough to protect wrists and forearms against heat, sparks, molten metal and radiation hazards.
- Use high-top boots/gum boots to prevent sparks, splinters, sharp edges of metal and hot welded strips, welding rods, electric cables etc. from injuring the legs.
- Avoid inhaling the noxious fumes and gasses from burning electrodes by using gas masks and screen of the work area to prevent the glare moving outside it.
- Keep the key hung from the regulator control for split seconds operations to stop the valve in case of any accidental damage or leakage to supply pipeline that may catch fire and cause accidents in case Acetylene or LPG cylinder.
- The welding area should have sufficient openings with fixed exhaust ventilators or adequate air flow openings to remove poisonous fumes and gases.
- Take precautions of wearing hard hats or fiber helmets to prevent injury due to fall of any object and accidental injury from projections while welding.
- Welders operating above ground should have adequate safety belt secured to stable platform to prevent accidental fall or injury from the scaffold. All electrical and gas connection lines up to the welder should be sufficiently insulated and protected from sharp edges and sharp objects. These shall not come into contact with hot metal.
- Do not use gas cylinders for supporting work or as rollers.
- While using LPG cylinders for welding, follow all safety precautions as has been prescribed by the supplier company.
- Avoid fire hazards and accidents by posting safety supervisors to oversee the activities of workers.
- Do not store explosives, high inflammable materials, loose hanging overhead objects, hot welded strips etc. near gas cylinders.
- Close all valves, switches and circuits while leaving the work place under proper lock and key. In case of mobile units, proper carriage procedures have to be followed for safety and security of men and materials.

K. Fire Safety Practices

- Store flammable material in proper areas having adequate fire protection systems.
- Display sufficient warning signs.
- Install fire alarm wherever required and test regularly.
- Inspect fire extinguishers regularly and replace as necessary.
- Train selected personal on use of fire extinguishers
- Fire escape route should be kept clear at all times and clearly indicated
- Display escape route maps prominently on each side.
- Provide sufficient exit signs at prominent locations for directing people to the escape staircases and routes.
- Train workers about the escape route and assembly point/s.
- Carryout fire drill periodically.

L. Noise Hazards And its Control

- Plan camp lay-out in a manner that ensures barriers/buffers between residential/ office units and high noise generating zones.
- Use sound meters to measure the level of noise and if it exceeds 75 dB(A), then ensure preventive measures.
- Make personnel aware of noisy areas by using suitable warning signs and insist on use of ear protectors/ear plugs to prevent excess noise affecting the workmen.
- Reduce noise at source by: use of improved equipments; regular and proper maintenance of the machinery as per the manufacturer's manual; by replacing rickety and noisy equipments and machineries. Screening locations with noise absorbing material; making changes in the process/equipment; controlling machine speeds; ensuring that two noise-generating machines are not running at the same time close to each other at same location; using cutting oils and hydraulic noise breakers; providing vibration and noise absorbing platform and firm embedding of equipments with fasteners.
- Appoint a competent person to: carryout a detailed noise assessment of the site; designate ear protection zone/s; give training/instructions on the necessary precautionary measures to be observed by site personnel including using suitable type of ear protection equipments.

M. Personal Protective Equipment

General

- Provision of personal protective equipment has to be made over and above all measures taken for removing or controlling safety hazards on a work site.
- Ensure that sufficient personal protective equipments are provided and that they are readily available for every person who may need to use them.
- The Contractor's Project Manager shall ensure that all persons make full and proper use of the personal protective equipment provided.

- Provide instruction/s and training for the proper use and care of personal protective equipment.
- Ensure that the personal protective equipments are in good condition.
- Train workers to report unintentional damages for replacement and to always keep the personal protective equipment clean.
- PPE includes, but may not be limited to, hard hats, goggles, ear plugs, gloves, air filters/masks, boots, ropes etc.

Head Protection

- Hard hats are compulsory for all workers, supervisors and managers/officials while working and/or inspecting a work site.
- Hard hat areas shall be demarcated clearly.

Hearing Protection

- Provide ear plugs or ear muffs to the workers and to those who need to get in and out of a high noise area frequently. Use re-usable earplugs when the reduction required (15-25 dBA) is not excessive. Use earmuffs where a large attenuation of upto 40 dBA is demanded.
- Do not use dry cotton wool for hearing protection because it doesn't provide any such protection.
- Provide disposable ear plugs for infrequent visitors and ensure that these are never re-used.
- Replenish ear plugs from time to time for those who need to work continuously for a long period in a high noise area/s.
- Use ear muffs with replaceable ear cushions because they deteriorate with age or may be damaged in use.
- Avoid wearing spectacles with ear muffs.
- Use soap and water or the recommended solvent for cleaning ear muffs.

Respiratory (Protective) Equipment

- Wear suitable mask for protection when there is a potential for small particles entering the lungs, e.g. emptying of cement bags, etc.
- Provide training to all persons using the masks/respirators for their correct fitting, use, limitations and symptoms of exposure.
- Clean and inspect all respirators before and after use.
- Store respirators properly when not in use.

Safety Footwear

- Wear suitable footwear for work
- Use safety footwear on site or in other dangerous areas.

- Wear suitable safety shoes or ankle boots when working anywhere where there is high risk of foot injuries from slippery or uneven ground, sharp objects, falling objects etc.
- All safety footwear, including safety shoes, ankle boots and rubber boots, should be fitted with steel toecaps.
- Avoid wearing flip flops, high heeled shoes, slippers, light sport shoes in situations where there is a risk of foot injury.
- Keep shoelace knots tight.

Hand Protection

- Wear suitable gloves for selected activities such as welding, bending steel bars, cutting and manual handling of materials and equipment.
- Do not wear gloves where there is a risk of them becoming entangled in moving parts of machinery.
- Wash hands properly with disinfectant soap and clean water before drinking or eating.
- Wash hands immediately after each operation on site when the situation warrants.

N. First Aid

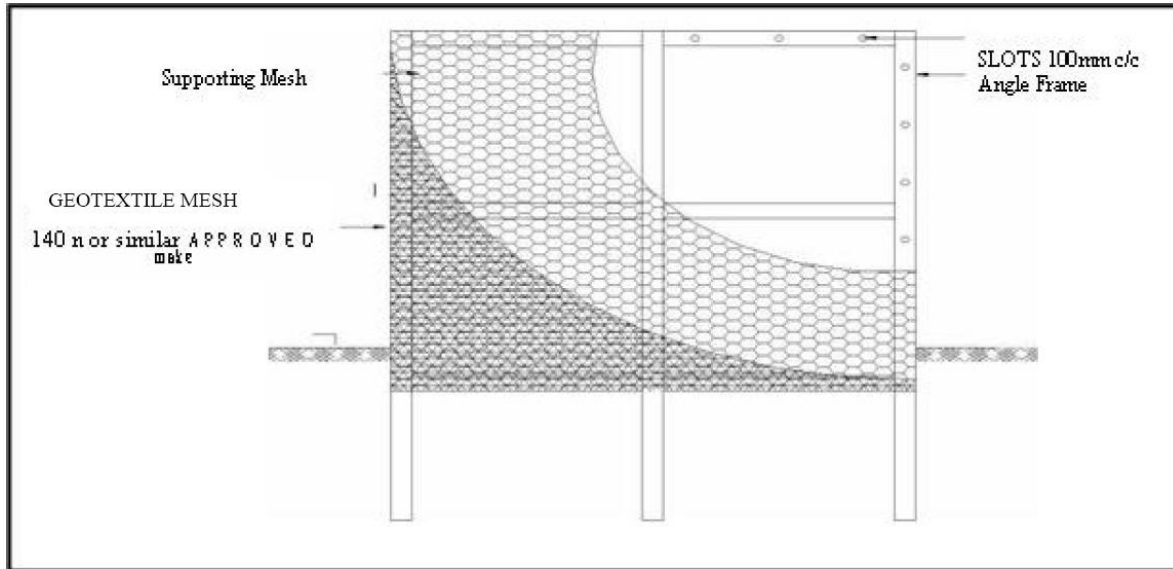
- Provide first aid boxes at every work site in a cool and shaded place.
- Ensure that training on the use of the first aid box is provided to at least every supervisor on the site.
- Display the list of persons along with their contact numbers who are trained on providing first aid.
- Ensure that every first aid box is marked "First Aid" in English and in local language.
- Check for expiry dates and replace the contents, as necessary.
- Maintain a register on health records including injuries/accidents.

O. Reporting of Accident and Investigations

- Any accident at the site will be reported.
- Carryout the investigation as quickly as possible.
- Investigation should be carried out both internally as well as through third party.
- Conduct interviews with as many witnesses as necessary including the affected persons and supervising officials.
- Do not rely on any one/limited source of evidence.
- Check all the log books, stock registers, issue registers, movement registers on site
- After completion of the investigation/enquiry, a summary of the facts recorded, sequence of happenings, persons-in-charge, persons examined, equipments and machineries tested, follow-up of action as per legal requirements, copy of station diary entry, hospital entry, safety regulations etc. to be prepared with a comparative analysis for proper assessment.

Annexure 3

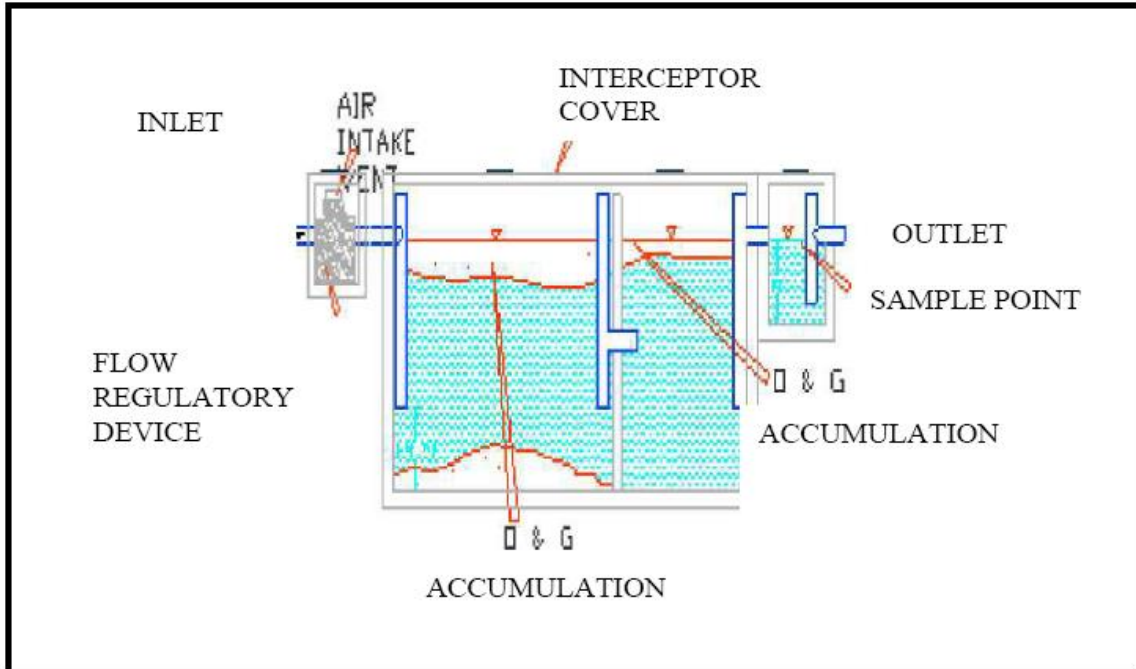
SILT TRAP



Note: Locations of silt traps will depend on Contractor's proposals for site facilities and work sites and should be provided in the Contractor's proposals. This will be checked by the Supervising Consultant and monitored by GEOTEXTILE MESH

Annexure 4

Oil Trap



Annexure 5

LIST OF PERSONAL PROTECTIVE EQUIPMENT

S.No	Part of the Body	Personal Protective Equipment
1.	Eye	Safety Glasses, Goggles
2.	Face	Face Shields
3.	Nose	Nose Masks
4.	Head	Helmets
5.	Feet	Safety Shoes
6.	Hands and arms	Gloves
7.	Bodies	Vests
8.	Hearing	Earplugs, Earmuffs

TREE PLANTATION STRATEGY

1.0 Introduction

This is the most common impact of any road-widening project. If the location of the project road is in dry areas, the degree of impact is more than in a wet area where the trees can be planted and grown easily. The project road passes through forest areas and plantation exists along the project road. Therefore, plantation should be done along the project road.

2.0 Purpose of Tree Plantation

The objectives of planting trees and shrubs at selected enhancement sites against the felled trees are the following:

- To reduce the impacts of air and dust pollution and act as a natural filter to traffic emissions.
- To provide shade for the traffic as well as the pedestrians:
- To reduce the impact of vehicular noise caused by vehicles
- To arrest soil erosion on slopes
- Beautification of sites by planting selective ornamental shrubs, landscaping and turfing with grasses
- Planting trees on the roadsides is to produce a softer greener landscape.
- To raise social forestry in order to improve the
- To act as a natural filter to the traffic emissions.

3.0 Selection of Trees Species

The selection of the plants for greenery development is to be made as per the following criteria;

- Plants should be tall and fast growing with dense canopy cover;
- Preferably perennial and evergreen with large leaf area index;
- Indigenous plants;
- Resistant to air pollutants involved; and
- Should help to maintain the ecological and hydrological balance of the region.

The plant species that are selected based on the climatic condition, soil characteristics and conditions of the area. The row closest to the main carriage way will be of shade plants. Similarly, subsequent rows will comprise of ornamental and flowering species. Mainly native deciduous species, which retain their foliage longest, with high crown forms, resistant to fungus and insects with rapid growth rate are selected for avenues.

4.0 Tree Planting During Construction

4.1 Tree Planting Along The Roadsides

Tree plantation will be the responsibility of the Forest department. Necessary budget will be allocated for tree plantation and provided in the EMP. The total no of trees to be planted will be triple the number of trees that will be removed from the roadsides for the improvement of the project road.

5.0 Protection Measures

The protection measures are discussed in this section.

5.1 Barbed Wire Fencing

Barbed wire fencing around the plantation area will be provided to protect the plants. Angle iron will be fixed at a spacing of 5 m. with 3-stand stretched barbed wire.

5.2 Precautionary Measures

- Plantation will be made in the monsoon months (July -August)
- The height of the plants should not be less than 1 ft. and should be supplied in polythene bags which are not to be removed until the moment of planting.
- All plants supplied must be planted within three days of removal from the nursery.
- Arrangements must be made to water in case of insufficient rains after planting
- 2 kgs of compost/manure are suggested for each pit before plantation.

5.2.1 Shrubs

Prior to planting it is suggested to remove all loose debris, fill up with good soil and level the area. To ensure better growth and survival of grasses and shrubs, the surface should have sufficient layer of good quality soil (up to 45 cms). Shrubs which are suggested for the road side and open area spaces where available should be selected from the following and agreed with the Environmental Specialist of the Construction Supervising Consultants Environmental Specialist.

The Contractor will be responsible for planting of shrubs at enhancement sites and along bridge approaches during construction phase.

5.2.2 Turfing with Grasses

The Contractor will be responsible for turfing at enhancement sites and along bridge approaches during construction phase.

The cost for the turfing along the bridge approaches and high embankments are part of the Civil construction contract.

Grass lines are used to provide a strong surface cover at the slope but it also needs a well-prepared surface. If grass is to be effective, then it must be allowed to establish properly on a slope which is not subject to undue stress from erosion and mass movement in its initial stages. To ensure this the following measures are suggested for the grass turfing.

- A cover of 25 grams of grass seed per square metre of surface will be prepared
- Bed will be prepared in June. The seed sowing must be carried out before the onset of monsoon so that they yield desired results. Till the onset of the monsoon, watering of the surface to be done by tankers with controlled flow sprinklers.
- After sowing, mulch of prepared and dried out herbs will be laid over the whole seeded area in a thin layer so that the direct sunlight and transpiration loss may not affect the grasses

Contractor will ensure that the condition of the site is good enough for the successful establishment of grasses and shrubs. They will also supervise all field operations like preparation of surface, sowing of grasses and quality of grass seeds used.

6.0 Maintenance of Trees Planted

The trees planted once will be maintained at any cost for the full growth of at least for a period of three years. A programme of compensatory afforestation has been proposed, not only to replace the trees, which must be cut to accommodate road widening and improvements in geometric design, but also to upgrade the condition of adjacent areas. Trees will be re - planted at a rate of two for each one removed depending upon the location. Tree felling in other sites such as borrow areas- will be accommodated by the Contractor in the borrow area management plan.

Annexure 7

FORMATS FOR ENVIRONMENTAL MONITORING

EMS 1: CONSTRUCTION CAMP/ PLANT SITE MANAGEMENT PLAN

Sn	Description	Compliance
1	Name of the location	
2	Nearest road chainage.	
3	Name of the owner	
4	Area involved	
5	Arrangements with the owner (agreement with land owner, including the restoration aspects, should be attached as an Annexure)	
6	Existing land use	
7	Photographs depicting the present condition of the construction camp and access road.	
8	Land use of the area surrounding the borrow area including a map	
9	Site layout plan of the construction camp	
10	Establishment and maintenance of demarcated and labeled different areas within the camp	
11	Number of trees to be removed, if any, along with compensation measures	
12	Proposed top soil management	
13	Activities planned in the construction camp	
14	Machinery & equipment to be used on site	
15	Labour camp facilities onsite	
16	Health facilities	
17	Site drainage provisions	
18	Copy of the consents to establish and operate should be attached as an Annexure	
19	Conditions laid down in the clearance / licenses and plans	
20	Staff strength and details such as contractor staff vs sub contractors, women labour, migrant vs local labour and skilled & unskilled labour	
21	Access road condition and proposed maintenance	
22	Safety provision such as fire protection equipment and personal protective measure.	
23	Closure / completion plan Format EMS: 1A	

EMS 1A: CLOSURE PLAN CONSTRUCTION CAMP SITE

S.No	Description	Compliance
1	Name / identity of location	
2	Distance from the Project Road and side	
3	Name of the owner	
4	Details of the Land i. Survey Number ii. Boundaries iii. Other Revenue Details	
5	Details of settlements, sensitive areas, water bodies, wells and bore wells with in 500 m Population in Numbers Name of the Village Distance from the construction camp Details of water bodies/ sensitive areas/ wells/ bore wells	
6	Physical Details Number of Labour Stationed Number of Dwellings Constructed Number of toilets provided were dwellings demolished Was the wastewater treatment facilities demolished and cleared Was the solid waste generated cleared and disposed of properly; if yes specify the location and quantity. Whether any soil was contaminated with oils and waste oils was cleared and disposed safely, if yes specify the location and quantity. Was scrap generated while the construction removed, if yes specify the details such as where, when, to whom and quantity.	
7	Land Use before Establishment Proposed Use after completion of works	

EMS 2: BORROW AREA NO:

Sn	Description	Compliance
1.	Name / identity of location	
2.	Nearest project road chainage	
3.	Name of the owner	
4.	Area involved/capacity/quantity	
5.	Type of material proposed to be taken	
6	Arrangement with the owner including restoration aspect.	
7.	Existing land use	
8.	Land use of the area surrounding the proposed area	
9.	A map of the area	
10.	Number of trees to be removed, if any along with the compensation measure	
11.	Top soil management if required	
12.	Access road condition and proposed maintenance	
13	Photograph depicting the present condition of the proposed area and access road	
14.	Closure / completion plan EMS2A	

EMS 2A: CLOSURE PLAN FOR BORROW AREA

Sn	Description	Compliance
1	Name / identity of location	
2	Nearest Project chainage, distance from the Project Road and side	
3	Name of the owner	
4	Details of the Land i. Survey Number ii. Boundaries Other iii. Revenue Details	
5	Details of settlements, sensitive areas, water bodies within 500 m Population in Number Name of the Village Distance from the borrow area Details of water bodies/ sensitive areas/ wells/ bore wells	
6	Physical Details Length and width in meters Depth excavated in meters Quantity Excavated in cum Type of materials excavated	
7	Land Use before Opening Proposed Use before opening Details of surroundings	
8	Drawing showing the dimensions of the borrow areas, access roads and features of surrounding	
9	Number of trees removed (girth>300mm), if any along with the compensation measure	
10	Details of top soil Quantity excavated in cum Where was it used	
11	Initial access road condition and final access road condition	
12	Photographs depicting the original condition, during the operation, top soil management, and after closure	
13	Copy of the agreement with the Owner Details of the agreed	
14	Land use after rehabilitation Details should be submitted if the final	
15	Satisfaction certificate from the owner	
16	Details of the practical problems faced and solutions adopted, if	

EMS 3: CONSTRUCTION CAMP AND ENVIRONMENTAL MANAGEMENT

Sn	Issue	Status	
		Camp -1	Camp -2
1	Drainage System 1 . Closed drainage		
2	Disposal for Wastewater 1. Kitchen wastewater 2. Wastewater from water closets 3. Wastewater from bathrooms 4. Wastewater from the vehicular washings.		
3	Collection and Disposal of Solid Waste 1. Waste from the office 2. Waste from the kitchen 3. Waste from sweeping		
4	Drinking Water facility Source with quantity No of bore wells with capacity Location of the well and bore well Any treatment facility No of overheads tanks Test results of the Drinking Water		
5	First Aid Facility		
6	Roads in Camp Site Type of road Dust suppression practicing or not, if the roads are not tarred. Condition of the road.		
7	Fuel Storage 1. Impervious Base 2. Spills and Wastewater will be collected in a sump 3. Number of drums where wastes are collected. 4. Number of drums disposed 8 Garbage & Night Soil 1. Provision of Garbage Bins 2. Separation of Polythene materials 3. Records of solid waste removal from septic tanks		

EMS 4: TOP SOIL MANAGEMENT

Sn	Chainage in Km	Quantity in cum	Whether Preserved in accordance with specifications	Remarks
1				
2				
3				
4				
5				

EMS 5: CONSTRUCTION PLANTS AND POLLUTION CONTROL

Sn	Construction Plant	Locations	Capacity	Description of Pollution Control System/ Equipment	Remarks
1					
2					
3					
4					
5					

EMS 6: MACHINERY/ VEHICLES AND POLLUTION CONTROL

Sn	Machinery/ vehicles with capacity	Diesel consumed during the month	Engine oil consumed during the month	PUC certificate no and validity	Machinery new/ old	Remarks
1						
2						
3						
4						
5						

EMS 7: DETAILS OF THE DG SETS WITH THE POLLUTION CONTROL EQUIPMENT

Sn	Capacity in KVA	Vertical Stack If provided height in m	Noise Control System	Remarks
Camp Site				
Crusher				
Plant Site Site				
Construction Works				

EMS 8: DETAILS OF OIL STORAGE

Sn	Type of Product	Location	Number of Barrels	Capacity of barrels in Litres	Increase/ Decrease in Storage	Stored on Impervious base (Yes/No)	Remarks
1	Diesel						
2	Petrol						
3	Engine Oils						
4	Lubricants						

EMS 9: WORKING AT WATER COURSE AND POLLUTION CONTROL MEASURES

Sn	Location	Type	Stream/ Canal Diversion	Silt Fencing	Remarks

EMS 10: DETAILS OF THE GROUND WATER EXTRACTION

Sn	Location	Capacity of Motor Installed	Quantity of water drawn in Kilolitres			Ground water department	Type of source
			During the month	Up to end of last month	Total		
1							
2							
3							
4							

EMS 11: PERSONAL PROTECTIVE EQUIPMENT

Sn	Details of Equipment	Total Procured in No	Distributed in No	Available in Store in No	Remarks
1	Helmets				
2	Safety Shoes				
3	Safety Shoes				
4	Nose Masks				
5	Hand Gloves				
6	Goggles				
7	Safety Belts				
8	Ear Plugs				
9	Reflective Jackets				
10	Gum Boots				

EMS 12: STATUS OF CONSENTS AND PERMISSIONS

Plant	Consent	Number / Status	Validity Date	Remarks
Hot Mix Plants				
Crusher				
Batching Plant				
WMM Plant				
Crusher				
Labour License				

EMS 13: DEVIATIONS WITH CORRECTIVE ACTIONS

Sn	Deviation	Corrective Actions	Schedule

EMS 14: DETAILS OF TREE AND SHRUBS PLANTATION

Sn	Location/ Chainage in km	NO Planted in Number		Survival rate in %age Remarks	
		Trees	Shrubs		

EMS 15: PLANTATION OF SHRUBS AND GRASS

Sn	Location/ Chainage	Number of Shrubs planted	Area of gross planted	Survival at 6 months interval	Remarks

EMS 16: IMPLEMENTATION OF ENHANCEMENT MEASURES

Sn.	Type of Enhancement	Side of the Road (R/L)	Progress of Completion		
			Target Date	Actual Completion date	Reasons of delay if any

Annexure 8

Reporting Format Camp Site

Project Details		Date of Reporting	
1.	Name of project		
2.	Name and address of the Contractor		
3.	Contract date and duration		
B Site Details			
1.	Place Name	Landmark	
2.	Area of site	Current land use	
3.	Ownership of the land	Owned / leased	Survey no.
4.	If leased / rented, name, address and contact details of owner		
5.	Distance from construction site		
6.	Distance from Water Body, Forest (if any)		
7.	Distance from the Populated Area		
8.	No of trees with girth > 0.3m on the site		
9.	No of trees to be cut		
10.	Is top soil conservation required (Yes/ No)		
List of enclosures:	(a) Location map		
	(b) Layout plan		
	(c) Photographs of the site		
	(d) List of machinery, equipments and vehicles to be used		
	(e) List of schools and hospitals with in 200 m distance from the boundary of the camp		
C. Submission Details	Submitted by (Environment & Safety Officer of Contractor)		Approved / Rejected by (Environmental Officer of PIU)
Signature & date			
Name			
Designation			
Remarks by Environmental Expert of PIU			
<p>* All distances are to be measured from the boundary of the site. Note: Contractor has to fill and submit this format to the Environmental Expert of PIU upon identification of labour camp site. Subsequently, the Environmental Expert of PIU has to visit the site and approve / reject the site with reasons. The Environmental Expert of PIU has to give a copy of this format to the contractor after his approval / rejection with remarks. On approval of a site, the Contractor has to prepare the Management and Redevelopment Plan for this site as per the Guidelines given in EMP and submit to Environmental Expert of PIU for approval</p>			

Format of Complaints (Grievance) and it's Reporting

A		Project Details		Information		
1.	Name of project					
2.	Name and address of the Contractor					
3.	Contract date and duration					
B		Details of Complaint Received		Site Name		
Sl. No.	Date of Complaint	Name and address of person with contact details	Complaint		Action taken with date	Signature of ESO of Contractor
1						
2						
3						
<p>A register in this format shall be maintained at each site office of the contractor. This same format shall be used to compile and report the details of complaints received at all site to the Environmental Expert of PIU along with the Monthly Report of the Contractor. The Environmental Expert of PIU has to give instruction to the Contractor, if any further action has to be taken on any complaint.</p>						

Checklist For Monitoring of Labour Camp Management

A	Project Details		Date of Monitoring:		
1.	Name of project.				
2.	Name and address of the Contractor				
3.	Contract date and duration				
4.	Name of Labour Camp				
B	Monitoring Details				
Sl. No.	Environmental Management Measures	Environmental Expert's observation (Yes / No / Not Applicable)	Corrective Proposed	Actions	Remarks
1.	Whether the camp are floored with concrete?				
2.	Are all the first aid facilities provided in the camp?				
3.	Whether the camp is located in such a way that there are no residences, public institutions or bio-sensitive area with in a radius of 500 m from the camp?				
4.	Whether the vehicle movement in and out of the camp is in a controlled manner?				
5.	Whether LPG for cooking is provided?				
6.	Whether safe drinking water is provided?				
7.	Whether all the drains and channels are covered?				
8.	Whether a green belt is provided along the periphery of camp?				
9.	Whether day care centres are provided with in the camp?				
10.	Whether sanitation facilities are provided separately for male and female?				
11.	Whether separate garbage bins are provided to collect the garbage?				
12.	Whether septic tanks with soak pits are provided?				
13.	Whether the location of soak pit is in such a away that it does not pollute the ground water?				

14.	Whether a qualified safety officer is appointed for ensuring safety?			
15.	Whether proper fencing of the camp is done?			
16.	Whether the workers are well aware of cleanliness, hygiene, community livings, AIDS etc.?			
17.	Whether all applicable clearances are obtained and valid till date?			
Signature of Environment and Safety Officer (ESO) of the Contractor with date			Signature of Environmental Expert of PIU with date	
<p>Note: The Environmental Expert of PIU has to use this format to monitor the implementation of Environmental Management Measures for each Labour Camp Quarterly. Corrective actions with specific timeframe should be proposed for each Environmental Management Measure, which is not implemented satisfactorily. A copy of the filled up format should be given to the ESO of the Contractor. Environmental Expert of PIU has to attach this format to the Quarterly Report, with details of corrective action taken by the Contractor.</p>				

Check List For Monitoring of Redevelopment of Labour Camp Site

A Project Details		Date of Monitoring:		
1.	Name of project			
2.	Name and address of the Contractor			
3.	Contract date and duration			
4.	Name of Labour Camp			
B Monitoring Details				
Sl. No.	Environmental Management Measures	Environmental Expert's observation (Yes / No / Not Applicable)	Corrective Actions Proposed	Remarks
1.	Are all the temporary structures cleared as per the list in the redevelopment plan?			
2.	Are all building debris, garbage, night soils and POL waste disposed off safely?			
3.	Are all disposal pits or trenches filled, disinfected and effectively sealed off?			
4.	Are the facilities that could be put to re-use maintained well?			
5.	Are all the spills within the camp site effectively disposed off from the site?			
6.	All the area within the camp site is leveled and spread over with stored top soil.			
7.	Has the residual top soil been utilized effectively?			
8.	Has the entire camp area been made clean and tidy without disturbing the adjacent lands?			
9.	Are the 'before' and 'after' scenarios of the site documented through photographs and submitted to PIU?			
10.	Are the conditions mentioned by the owner in the agreement adhered to?			

11	If not, mention the details of the conditions that are not adhered to and further steps to be taken.			
12.	Can 'works completion' certificate be issued to this site?			
Signature of Environment and Safety Officer (ESO) of the Contractor with date			Signature of Environmental Expert of PIU with date	
<p>Note: The Environmental Expert of PIU has to use this format to monitor the implementation of Environmental Management Measures for the redevelopment of each Labour Camp Site as and when it is closed. Corrective actions with specific timeframe should be proposed for each Environmental Management Measure, which is not implemented satisfactorily. A copy of the filled up format should be given to the ESO of the Contractor. Environmental Expert of PIU has to attach this format to the Quarterly Report, with details of corrective action taken by the Contractor.</p>				

Environmental Reporting Format

A	Project Details	Date of Reporting:	
1.	Name of project.		
2.	Name and address of the Contractor		
3.	Contract date and duration		
B	Implementation Status of Health and Safety Measures		
Sl. No.	Health and Safety Measures	Implementation Status (Yes / No)	Remarks
1	Appointment of qualified Environment and Safety Officer		
2	Approval for Construction Safety Management Plan by the Environmental Expert of PIU.		
3	Provision for flags and warning lights for potential hazards		
4	Provision of adequate staging, form work and access (ladders with handrail) for works at a height of more than 3.0 m		
5	Provision of adequate shoring / bracing / barricading / lighting for all deep excavations of more than 3.0 m depth.		
6	Provision for sufficient lighting especially for night time work		
7	Construction Workers safety – Provision of personnel protective equipment's		
	A. Helmets		
	B. Safety Shoe		
	C. Gumboot		
	D. Dust masks		
	E. Hand Gloves		
	F. Safety Belts		
	G. Reflective Jackets		
	H. Earplugs for labour		
8	Workers engaged in welding work shall be provided with welder protective shields		
9	All vehicles are provided with reverse horns.		
10	All scaffolds, ladders and other safety devices shall be maintained in as safe and sound condition		
11	Regular health checkup for labour/ Contractor's personnel		

12	Ensuring the sanitary conditions and all waste disposal procedures & methods in the camp.		
13	Provision for insurance coverage to the workers		
C.	Submission Details		
	Submitted by (Environment & Safety Officer of Contractor)	Approved by (Environmental Officer of PIU)	
Signature & date			
Name			
Designation			
Remarks by Environmental Expert of PIU			
<p>Note: Contractor has to fill and submit this format to the Environmental Expert of PIU along with the Monthly Report. The Environmental Expert of PIU has to visit the site and verify the details. Further mitigation measures, if required, can be suggested by the Environmental Expert of PIU. The Environmental Expert of PIU has to give back a copy of this format to the contractor after his approval with remarks.</p>			

Format For Register of Accidents and It's Reporting

A	Project Details	Date of Reporting:	
1.	Name of project		
2.	Name and address of the Contractor		
3.	Contract date and duration		
B	Details of Accident and People Involved in Accident		
	Name of site where accident happened		
	Name and address of people involved in the accident		
	Whether Contractor's personnel or General public		
	Details of Injury		
	Details of treatment given		
	Details of compensation given		
C	Type of Accident (√)		
	Fall of person from a height		Explosion
	Slip, trip or fall on same level		Fire
	Struck against fixed objects		Contact with hot or corrosive substance
	Struck by flying or falling objects		Contact with poisonous gas or toxic substances.
	Struck by moving objects		Contact with poisonous gas or toxic substances
	Struck / caught by cable		Hand tool accident
	Stepping on nail etc.		Vehicle / Mobile plant accident
	Handling without machinery		Machinery operation accident
	Crushing / burying		Other (please specify)
	Drowning or asphyxiation		
D	Agent Involved in Accident (√)		
	Machinery		Stair edge
	Portable power appliance		Excavation
	Vehicle or associated equipment /machinery		Ladder
	Material being handled, used or stored		Scaffolding
	Gas, vapor, dust, fume or oxygen		Construction formwork, shuttering and false work.
	Hand tools		Electricity supply cable, wiring switchboard and associated equipment
	Floor edge		Nail or chipping
	Floor opening		Other (Please specify)
	Left shaft		
E	Unsafe Action Relevant to the Accident (√)		
	Operating without authority		Failure to use proper footwear
	Failure to secure objects		Failure to use eye protector
	Making safety devices inoperative		Failure to use respirator
	Working on moving or dangerous equipment		Failure to use proper clothing

	Using un-safety equipment			Failure to use warn others or given proper signals
	Adopting unsafe position or posture			Horseplay
	Operating or working at unsafe speed			No unsafe action
	Unsafe loading, Placing, mixing et			Others (please specify)
	Failure to use helmet			
F	Lack of Safety Measures Relevant to the Accident (√)			
	No protective gear			Unsafe layout of job, etc.
	Defective protective gear			Unsafe process of job methods
	Improper dress / footwear			Poor housekeeping
	Improper guarding			Lack of warning system
	Improper ventilation			Defective tool, machinery or materials
	Improper illumination			No unsafe condition
	Improper procedure			Others (please specify)
G	Personal Factor Relevant to the Accident (√)			
	Incorrect attitude /motive			No unsafe personal factor.
	Unsafe act by another person			Other (please specify)
H	Details of Corrective and Preventive action taken			
1				
2				
3				
4				
I	Submission Details			
	Submitted by (Environment & Safety Officer of Contractor)		Approved by (Environmental Officer of PIU)	
Signature & date				
Name				
Designation				
Remarks by Environmental Expert of PIU				
<p>Note: Contractor has to fill this format as and when an accident happens and submit to the PIU along with the Monthly Report. The Environmental Expert of PIU has to visit the site and verify the details. Additional safety measures, if required, can be suggested by the PIU. The Environmental Expert of PIU has to give back a copy of this format to the contractor after his approval with remarks.</p>				

Reporting Format For Environmental Pollution Monitoring

A		Project Details		Date of Reporting:			
1.	Name of project						
2.	Name and address of the Contractor						
3.	Contract date and duration						
B							Environmental Monitoring Details
Sl. No	Details of Monitoring Location	Period of Monitoring	Details of values exceeding the relevant standards	Reasons for pollution	Details of Corrective actions taken	Remarks	
a. Ambient Air Monitoring							
1.							
2.							
b. Water Monitoring							
1.							
2.							
c. Noise Monitoring*							
1.							
2.							
C							Submission Details
		Submitted by (Environment & Safety Officer of Contractor)			Approved by (Environmental Officer of PIU)		
Signature & date							
Name							
Designation							
Remarks by PIU							
<p>* Noise monitoring at the site will be done by the PIU (ERA), using the Noise Meter. The PIU has to give the monitoring results to the Contractor for corrective actions, if any, required and including in this report.</p> <p>Note: The Contractor has to conduct Environmental Monitoring through a NABL approved Laboratory as per the Environmental Monitoring Plan given in the EMP, fill this format and submit to the PIU along with the Monthly Report, if monitoring was due in that month. A copy of the monitoring report given by the Laboratory has to be attached to this format. The PIU has to visit the site and verify the details. Additional mitigation measures, if required, can be suggested by the PIU. The Environmental Expert of PIU has to give back a copy of this format to the contractor after his approval with remarks.</p>							