Construction of new 6-lane Capital Region Ring Road (CRRR-1) from Rameswar (NH-16) to Gobindpur (NH-55) approx. 70.995 km in Odisha state by NHAI.

Draft Environment Impact Assessment & Environment Management Plan

EXECUTIVE SUMMARY

1. Introduction

Highway projects are undertaken to improve the socio-economic life of the people through the areas which they pass. At the same time, they may also create impacts on the surrounding environment. People and property in the direct path of the alignment are largely affected due to this. The environmental impact of road projects includes issues to sensitive ecosystems, soil erosion, changes to drainage pattern and thereby groundwater, interference with animal and plant life, loss of productive agricultural lands, resettlement of people, disruption of local economic activities, demographic changes, accelerated urbanization and increase in air pollution. To minimize these adverse effects that may be created by highway development projects, the techniques of Environmental Impact Assessment (EIA) become necessary. EIA is a technique which is necessary for identification, quantification and assessment of potential environmental impacts. The National Highways Authority of India (NHAI) is responsible for the development and improvement of the project roads for the connectivity of National Highways under the new NH (O) scheme.

NHAI has entrusted the work to M/s. Geo Design & Research Pvt. Ltd to carry out the Feasibility study and the Detailed Project Report for 6-laning NH configuration under NH(O) Scheme from Rameswar in Khordha district to Gobindpur in Dhenkanal district in Odisha state to augment capacity of the highway. M/s. Geo Design & Research Pvt. Ltd has appointed M/s. Chaitanya Projects Consultancy Ltd. for carrying out the EIA study

The new highway starts from its junction with NH-16 near Rameswar in Khordha district and terminating at its junction with NH-55 at Gobindpur in Dhenkanal district in the State of Odisha. The length of the proposed alignment is approx. 70.995 km. As per the EIA Notification issued on 14th September, 2006 by the MoEF&CC, GoI and amended Notification on 22nd August, 2013 on Highway projects, the proposed new highway project between Rameswar to Gobindpur falls under Category -A Project (Schedule -7f of Notification). The above proposal was considered by the Expert Appraisal Committee (EAC) for Infra-I Sector, in its 370th Expert Appraisal Committee during 23rd-24th July, 2024, recommended the project for grant of Terms of Reference (ToR).

The EIA & EMP report is prepared in accordance to the Terms of Reference (ToR) issued by MoEFCC, New Delhi, vide letter no. F. No. 10/18/2024-IA.III, and Proposal No. IA/OR/INFRA1/482782/2024 dated 09th September 2024.

Project Proponent & Description
National Highways Authority of India (NHAI) is an autonomous organisation under the Ministry of Road Transport & Highways (MoRTH) and was constituted by an Act of Parliament, the National Highways Authority of India Act, 1988.

Brief Description of the Project
The proposed project is construction of new six lane NH configuration under NH (O)/Bharatmala Scheme- starts from its junction with NH-16 near Rameswar village, Khordha district and terminating at its junction with NH-55 at Gobindpur in Dhenkanal district in the State of Odisha. Total length of the stretch is about 70.995 km. The project stretch is mainly lies in plain terrain.

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Construction of new 6-lane Capital Region Ring Road (CRRR-1) from Rameswar (NH-16) to Gobindpur (NH-55) approx. 70.995 km in Odisha state by NHAI.

Draft Environment Impact Assessment & Environment Management Plan

Importance of the Project

The proposed project is mostly green field alignment highway, and the main objective of the proposed project is to give connectivity to Dhenkanal, Angul and bypass the major cities of Cuttack, Bhubaneswar and Khordha as this alignment is the first part of Capital Region Ring Road. The project lays emphasis on development of these areas and to make them available with the socio-economic benefits that accrue with the development of highways. It will enhance economic development, provide employment opportunities to locals, strengthen tourist development, ensure road safety, and provide better transportation facilities and other facilities such as way side amenities, vehicular underpasses, culverts, etc. Vehicle operating cost and pollution will also be reduced due to improved road quality and road geometry. The compensatory plantation and road side plantation shall further improve the air quality of the region.

Salient Features of the Project

Some of the salient features of the project road are presented below.

Particulars	Details	
No, of affected villages by Land acquisition	65	
Total Length of the proposed project	70.995 km	
Total Area of Land Acquisition	547.51 ha (including Govt. and Revenue Forest land)	
Terrain	Plain	
Proposed Bridges	Major Bridge-03, Minor Bridge-23	
Proposed Underpasses / Flyover including Pedestrian underpass	VUP-12, LVUP-14, SVUP-10, EUP-10, Fly over-5, Viaduct-1, ROB-1	
Culverts	233 Culverts	
Right of Way	60m (Additional at WSA, Interchange, diversion locations)	
Design Speed	100 kmph	
Carriageway	6 Lane	
Embankment	2-5 m height (varying)	
Proposed Toll Plazas	1 number on Main Carriageway and 8 numbers on Entry/Exit Ramps.	
No. of Structures Affected	71	
Total Cost (Civil and Capital)	**Civil Construction Cost**	**Capital Cost**
PKG-1	Rs. 1584.36 Cr.	Rs. 2474.05 Cr.
PKG-2	Rs. 1314.22 Cr.	Rs. 2067.04 Cr.
Water bodies Impacted	34 Nos.	
Existing trees within ROW	13617	
No. of project affected persons (PAFs) & (PAPs)	3426 & 15621	
Resettlement Action Plan (RAP) including Land Acquisition Budget	Approx. Rs.778 Cr.	

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Objectives of the EIA Study

The objective of EIA is to foresee and address potential environmental problems/concerns at an early stage of project planning and design. EIA/EMP also assist planners and government authorities in the decision making process by identifying the key impacts / issues and formulating mitigation measures.

Scope of the EIA study

Review of national, state and local environmental regulatory requirements on environmental aspects, including assisting NHAI for getting necessary approvals from the statutory organisations and funding agencies.

• Establishing environmental baseline, covering the specific sensitive location of project sites, carry out environmental study in the light of baseline conditions and proposed project activities to identify key environmental issues and defining the scope of detailed environmental assessment to be carried out.
• Preparation of implementable EMP with budgetary provisions and suggesting post project monitoring plan.

Need for the EIA Study

To minimize these adverse impacts that may be created by road development projects, the techniques of EIA become necessary. EIA helps in Identification and assessment of potential environmental impacts should be an integral part of the project life cycle.

Policies, Legal and Administrative Framework

The Government of India and respective state Governments have enacted various Policies, Laws, Legal and Administrative Framework to minimise the impact of projects on the environment, project proponent has to abide by these so as not to attract any legal issues. Various statutory acts applicable for a project, some of the important ones are, Environmental (Protection) Act (1986), Environmental Impact Assessment (EIA) Notification (2006), Forest (Conservation) Act (1980), The National Highway Act (1956), and many other Central and State Government acts, rules and guidelines.

Approach and Methodology of EIA Process

An Environmental Impact Assessment study is proposed to be conducted as per the TOR received by MoEFCC. The approach is to follow the sequence of steps adopted in an EIA study that comprises of Data Collection (Primary and Secondary), identification of impacts, environmental management strategy, public consultation, preparation of the draft EIA report, public hearings, Final EIA report and final decision of the EAC committee for grant of EC.

2. Project Description and Project Features

The proposed project alignment starts from Ch. 0+000 near Rameswar in Tangi tehsil of Khordha district and ends at Ch. 70+995 in Gobindpur in Dhenkanal tehsil of Dhenkanal district of Odisha state of total length of 70+995 km., project road is divided in two construction packages i.e., Package-1 from Km. 0.000 to Km. 40.700 and Package-II from km. 40.700 to km. 70.995 considering nature of scope of work. The proposed highway is a greenfield with 6 lane configuration 60 m of proposed ROW. The alignment runs through mainly plain terrain with Agricultural land at most locations.

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Construction of new 6-lane Capital Region Ring Road (CRRR-1) from Rameswar (NH-16) to Gobindpur (NH-55) approx. 70.995 km in Odisha state by NHAI.

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The project highway is a 6 lane greenfield highway that follows highway standards as per IRC: SP:84: -2019. The various aspects of design that have been considered in the development of design for the proposed highway are discussed below:

- The proposed highway shall be a 6 lane greenfield highway with paved shoulders of 1.5-2.0 m width and a median of 5.0 m width. Each lane of the proposed highway will be of 3.5 m width.

- The project corridor passes through mainly plain terrain. The adopted design speed is 100 kmph throughout the stretch.

- The proposed project stretch is passing through total no. of 3 districts (Khordha, Cuttack and Dhenkanal), 7 tehsils (Khordha, Tangi, Begunia, Dampara, Banki, Athagarh and Dhenkanal) and 65 villages. The detailed list of villages is given in Chapter 2 of the report.

- The proposed land acquisition for the project is around 547.51 ha.

- An accurate estimate of the traffic that is likely to use the project road is very important as it forms the basic input in planning, design, operation and financing. Hence, detailed traffic surveys are carried out to assess the baseline traffic characteristics on the project road. As per new circular provided by GOI, Ministry of Shipping, Road Transport & Highways, 5% traffic growth rate as given in approved MCA is to be considered for determination of lane requirement/project preparation and also for viability of the project. So, the Growth rate has been taken 5% for all class of vehicles. The entire Project road has one homogeneous section. Total traffic projection for each Homogenous section for every year starting from 2021-22 till 2056-57 has been given in Chapter 2 of the report. A detailed traffic flow study has been conducted and has been presented in **Annexure 2-3.**

- A total of 312 structures are proposed to be provided in the entire length of the proposed project which includes major bridges, minor bridges, ROBs, VUP, LVUPs, SVUPs, EUPs, Interchanges and Culverts. The structure details are given below (Table-2 &3).

Table 2: Summary of Proposed Structures on Main Carriageway

Sl. No.	Name of the Structure	Package I	Package II	Total
1	Box Culvert	134	81	215
2	Minor Bridge	10	11	21
3	Major Bridge	Nil	3	3
4	ROB	1	-	1
5	Fly over	2	3	5
6	Viaduct	1	-	1
7	VUP	8	3	11
8	LVUP	8	6	14
9	SVUP	7	3	10
10	EUP	7	3	10
	Total	178	113	291

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Construction of new 6-lane Capital Region Ring Road (CRRR-1) from Rameswar (NH-16) to Gobindpur (NH-55) approx. 70.995 km in Odisha state by NHAI.

Draft Environment Impact Assessment & Environment Management Plan

Table 3: Summary of Proposed Structures on Main Carriageway

Sl. No.	Name of the Structure	Package I	Package II	Total
1	Box Culvert	9	9	18
2	Light Vehicular Underpass	-	1	1
3	Minor Bridges	-	2	2
	Total	**9**	**12**	**21**

- Flexible pavement has been proposed for 6 lane carriageway for 178 MSA considering a design period of 20 years with Design CBR value of 11% CBR as per IRC: 37: 2018.

- Unlined drain is proposed alongside the highway (without Service Road) in rural areas. In Urban areas lined drains with footpath are proposed at the extreme outside of Service Road.

Project Cost

The total Civil Construction Cost and Total Project Cost of the proposed project work out to be 2989.58 Crores and 4541.10 Crores respectively. The Total EPC Cost includes GST, Contingencies, Supervision Charge and Agency Charge as per MoRTH circular dated August 2021. Details of Project cost are mentioned in chapter 2 of this report.

Project Facilities

Various project features are proposed to be constructed, such as Toll plaza and way side amenities. There is no provision for truck lay-byes, bush shelters and highway mini nest. Details of project facilities are mentioned in chapter 2 of this report.

3. Description of Baseline Environment

Construction and operation of a highway may have both adverse and positive impacts on the physical and biological environment of an area it passes through viz. topography, micro climate, drainage pattern, floral and faunal habitats. Environmental Impact Assessment study becomes necessary to assess the possible adverse impact and find ways to mitigate them creating a balance between anthropogenic and natural settings. It is essential to consider environmental and socio economic aspects while planning or designing a road so as to let the benefits reach the community.

Primary data has been collected within 500 meters on either side of the proposed alignment. Primary baseline environment monitoring was carried out for the period of one season from October, 2024 to December, 2024. Secondary data such as meteorological data and census data were collected from the various departments of the government as well as published literature. Primary data was obtained through field sampling of environmental parameters such as air, water, noise, soil, etc. Field surveys were also conducted to get primary information on the major environmental features such as settlements, water bodies, forest areas, trees within the RoW, etc. The details of baseline environmental conditions are given below.

Climate

The State has a tropical climate, characterized by high temperature, high humidity, medium to high rainfall and short and mild winters. The minimum and maximum temperature recorded throughout

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Construction of new 6-lane Capital Region Ring Road (CRRR-1) from Rameswar (NH-16) to Gobindpur (NH-55) approx. 70.995 km in Odisha state by NHAI.

Draft Environment Impact Assessment & Environment Management Plan

the year are 11.7°C to 35.9°C respectively. The minimum and maximum rainfall recorded throughout the year are 7.6 mm to 322 mm. Humidity levels in Odisha typically range from 50% to 70%, with coastal areas experiencing higher levels compared to inland regions.

a. **Air Environment**

Air sampling was carried out at 7 locations for the proposed alignment option for estimating the concentration of various AAQ parameters such as PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO, O_3 and others. In the proposed alignment, PM10 varies between 67-75 µg/m3, PM2.5 ranges within 36-42 µg/m3. The concentration of SO2, NO2, O3 and CO ranges between 12-18 µg/m3, 16-19 µg/m3, 24-27 µg/m3 and 0.5-0.9 µg/m3 respectively.

All the gaseous air quality parameters were found to be well within the limits set in the National Ambient Air Quality Standards (NAAQS). The same is attached as **Annexure 3-4.** In general, ambient air quality of the region is satisfactory. The construction of the proposed highway will improve connectivity and reduce travel time which may lead to the reduction of the pollution levels of the region. Results of major parameters are given in table below along with permissible limits.

S. No.	Location code	Results					
		PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	SO_2 (µg/m³)	NO_2 (µg/m³)	CO (mg/m³)	O_3 (µg/m³)
1	AAQ-1	75	42	12	18	0.9	26
2	AAQ-2	67	40	13	18	0.5	24
3	AAQ-3	71	36	12	16	0.6	26
4	AAQ-4	71	40	13	16.9	0.5	24
5	AAQ-5	69	36	13	19	0.9	27
6	AAQ-6	71	43	18	16	0.5	26
7	AAQ-7	68	39	12	19	0.6	26
8	Average	70.29	39.43	13.29	17.56	0.64	25.57
9	**Permissible Limits as per CPCB guidelines**	**100**	**60**	**80**	**80**	**4**	**180**

b. **Water Environment**

i. **Surface Water Quality**

In order to assess the quality of water resources to keep in check the pollution during construction phase, sampling was carried out at 5 locations of the proposed alignment. The samples were analysed as per guidelines set in the IS: 3025 and compared with standards set in IS:10500. The values of important parameters were found to be within the acceptable limits of IS:10500.

pH was found within 7.45-7.69, Total Dissolve Solid between 876-1230 mg/l, Calcium (as Ca) ranges between 87-126 mg/l, Fluoride ranges between 0.15-0.69 mg/l, Magnesium (as Mg) ranges between 24.5-60 mg/l, total alkalinity (as CaCO3) and total hardness (as CaCO3) were found between 369-895 mg/l and 369-510 mg/l respectively. Dissolved Oxygen was found to be between 5.9-7.0 mg/l and BOD is within <2.0 mg/l. Total Coliform and E. Coli are not found in all sampling sites. Results of major parameters are given in table below.

Construction of new 6-lane Capital Region Ring Road (CRRR-1) from Rameswar (NH-16) to Gobindpur (NH-55) approx. 70.995 km in Odisha state by NHAI.

Draft Environment Impact Assessment & Environment Management Plan

Sl.	Parameters	Units	SW1	SW2	SW3	SW4	SW5	SW6	SW7
1	Colour	Hazen	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0
2	pH	-	7.69	7.45	7.49	7.45	7.49	7.69	7.69
3	Turbidity	NTU	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
4	Taste	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
5	TDS	mg/l	965	1230	1190	965	936	945	876
6	Calcium (as Ca)	mg/l	87	125	106	105	96	92	126
7	Magnesium (as Mg)	mg/l	50.4	47.9	25	47	60	58	24.5
8	Fluoride (as F)	mg/l	0.16	0.15	0.15	0.15	0.42	0.42	0.69
9	Chloride (as Cl)	mg/l	295	235	316	316	130	125	462
10	Nitrate (as NO3)	mg/l	2	2.6	2.6	2.6	2.9	3.1	3.6
11	Sulphate (as SO4)	mg/l	126	19	73	216	29	BLQ (0.05)	114
12	Total Alkalinity (as CaCO3)	mg/l	698	795	680	895	395	369	695
13	Total Hardness (as CaCO3)	mg/l	425	510	369	456	489	469	416
14	Cadmium (as Cd)	mg/l	BLQ (0.001)	BLQ (0.001)	BLQ (0.001)	BLQ (0.001)	BLQ (0.001)	BLQ (0.001)	BLQ (0.001)
15	Arsenic (as As)	mg/l	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)
16	Zinc (as Zn)	mg/l	BLQ (0.1)	BLQ (0.1)	BLQ (0.1)	BLQ (0.1)	BLQ (0.1)	BLQ (0.1)	BLQ (0.1)
17	Mercury (as Hg)	mg/l	BLQ (0.001)	BLQ (0.001)	BLQ (0.001)	BLQ (0.001)	BLQ (0.001)	BLQ (0.001)	BLQ (0.001)
18	Nickel (as Ni)	mg/l	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)
19	DO	mg/l	7	5.9	7	7	7	6	6.2
20	BOD	mg/l	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
21	Coliform	per 100 ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent
22	E. Coli	per 100 ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent

ii. Ground Water Quality

Groundwater sampling has been carried out at 7 locations of the proposed alignment to assess the baseline quality of the groundwater of the project location. The findings are given below:

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Draft Environment Impact Assessment & Environment Management Plan

Parameters	Unit	GW1	GW2	GW3	GW4	GW5	GW6	GW7	Standard as per IS 10500:2012	
									Acceptabe limits	Permissible limits
Colour	Hazen	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5 Max	15 Max
Odour	-	Agree-able	Agree-able	Agree-able	Agree-able	Agree-able	Agree-able	Agree-able	Agree-able	Agree-able
pH	-	7.63	7.45	7.45	7.45	7.45	6.69	7.39	6.5-8.5	No Relation
Turbidity	NTU	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0 Max	5.0 Max
Taste	-	Agree-able	Agree-able	Agree-able	Agree-able	Agree-able	Agree-able	Agree-able	Agree-able	Agree-able
Total Dissolved Solids	mg/l	395	306	298	415	392	316	265	500 Max	2000 Max
Calcium (as Ca)	mg/l	31.3	52	29	49	32	59	52	75 Max	200 Max
Magnesium (as Mg)	mg/l	11.3	9.4	12.7	10.3	18.4	7.6	13.6	30 Max	100 Max
Fluoride (as F)	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.0 Max	1.5 Max
Chloride (as Cl)	mg/l	53.98	102	39	92	64	129	39	250 Max	1000 Max
Nitrate (as NO3)	mg/l	BLQ (0.1)	BLQ (0.1)	BLQ (0.1)	BLQ (0.1)	BLQ (0.1)	BLQ (0.1)	BLQ (0.1)	45 Max	No Relation
Sulphate (as SO4)	mg/l	12.49	29	36	29	11.9	89	56	200 Max	400 Max
Total Alkalinity (as HCO3)	mg/l	190	126	105	136	132	129	136	200 Max	600 Max
Total Hardness (as CaCO3)	mg/l	125	169	125	165	1256	179	186	200 Max	600 Max
Copper (as Cu)	mg/l	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)	0.05 Max	1.5 Max
Cadmium (as Cd)	mg/l	BLQ (0.001)	BLQ (0.001)	BLQ (0.001)	BLQ (0.001)	BLQ (0.001)	BLQ (0.001)	BLQ (0.001)	0.003 Max	No Relation
Iron (as Fe)	mg/l	BLQ (0.1)	BLQ (0.1)	BLQ (0.1)	BLQ (0.1)	BLQ (0.1)	BLQ (0.1)	BLQ (0.1)	0.3 Max	No Relation
Arsenic (as As)	mg/l	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)	0.01 Max	0.05 Max
Zinc (as Zn)	mg/l	BLQ (0.1)	BLQ (0.1)	BLQ (0.1)	BLQ (0.1)	BLQ (0.1)	BLQ (0.1)	BLQ (0.1)	5 Max	15 Max
Mercury (as Hg)	mg/l	BLQ (0.001)	BLQ (0.001)	BLQ (0.001)	BLQ (0.001)	BLQ (0.001)	BLQ (0.001)	BLQ (0.001)	0.001 Max	No Relation
Nickel (as Ni)	mg/l	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)	BLQ (0.005)	0.02 Max	No Relation
Mineral Oil	mg/l	BLQ (0.5)	BLQ (0.5)	BLQ (0.5)	BLQ (0.5)	BLQ (0.5)	BLQ (0.5)	BLQ (0.5)	0.5 Max	No Relation

From the analysis results of various parameters of Groundwater given in the above table and the graph, it is clear that the parameters at most of the locations along the proposed highway are well within the permissible limits as prescribed in IS:10500. The pH ranges from 6.69-7.63, Total Dissolved Solids are

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Construction of new 6-lane Capital Region Ring Road (CRRR-1) from Rameswar (NH-16) to Gobindpur (NH-55) approx. 70.995 km in Odisha state by NHAI.

Draft Environment Impact Assessment & Environment Management Plan

found within 265-415 mg/l. The concentrations of Iron, Calcium, Magnesium, Sulphate, Fluoride, Total Alkalinity, Total Hardness were found to be within ranges BLQ (0.1) mg/l, 29-59 mg/l, 7.6-18.4 mg/l, 11.9-89 mg/l, <0.1 mg/l, 105-190 mg/l, 125-1256 mg/l, respectively and all are found to be within standards. All the metals (like Mn, Cu, Fe, As and Hg etc.) and all pesticide residues (like DDT, DDE and HCH etc.) were found below level of quantification and also found well below the standards as per IS:10500.

c. Noise Environment

The noise monitoring was carried out at 7 locations in the proposed alignment. The locations were categorized as per norms set in the Noise Pollution (Regulation and Control) Rules, 2000 of the CPCB, which is given in Chapter-3 of the EIA report. The equivalent noise levels in the area through which the proposed alignment will pass are varies between 43 dB(A) to 56 dB(A) at day time and ranges between 26 dB(A) to 42 dB(A) at night.

The results were found to be complying with the norms.

d. Land Environment
i. Land Use

The proposed alignment passes through a large part of greenfield area, agricultural fields, and some revenue forest areas across all the districts at identified project locations. Area required for the construction of the proposed alignment is approximately 267.75 ha. out of which majority is agricultural land, and around 30.59 ha. is revenue forest land.

The detailed land use map of the proposed alignment with 500m buffer length on either side has been prepared in 1:25000 scale based on recent satellite imagery, which have been presented as Annexure 3-2 for proposed alignment. Majority of the area in the project districts is net sown area followed by area under non-agricultural us and forest areas, least is under tree crops and groves. In khordha district, net sown area is 32% followed by area under non-agricultural use (15%) and forest (14%). In Cuttack district, net sown area is 35% followed by area under non-agricultural use (23%) and current fallow (13%). In Dhenkanal district, net sown area is 23% followed by forest (17%) area and under non-agricultural use (13%), current fallow (13%), culturable waste land (13%). The graphical representation of land use in the study area is given in the table below.

S. No.	Land Use Category	Area (ha)			
		Odisha	Khordha	Cuttack	Dhenkanal
1	Reporting area for Land Use	11571449	274081	333290	338206
2	Forest area	1941771	38740	24136	59160
3	Area under non-agricultural uses	1360567	41320	78319	42308
4	Barren and unculturable land	978010	27436	11881	11638
5	Permanent pasture and other grazing land	509290	13932	13061	12082
6	Land under miscellaneous tree crops and groves	251557	17208	8950	8531
7	Culturable waste land	576819	20849	12814	43343
8	Fallow lands other than current fallows	688167	17507	22977	38281

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Construction of new 6-lane Capital Region Ring Road (CRRR-1) from Rameswar (NH-16) to Gobindpur (NH-55) approx. 70.995 km in Odisha state by NHAI.

Draft Environment Impact Assessment & Environment Management Plan

9	Current fallows	943456	9731	43387	44284
10	Net area sown	4321812	87358	117765	78579
11	Cropped area	4997378	103380	144290	82055
12	Area sown more than once	675566	16022	26525	3476

Moreover, a detailed ground survey map was prepared on a scale of 1:2000 as per requirement of ToR, showing proposed structures which is presented as Annexure 3-3.

ii. Soil Quality

The soil of the project area is mostly of sandy clay type with average value of sand, silt and clay in all sampling sites are 74.86%, 8.57% and 16.57% respectively which indicate that the soil of the study area is sandy clay in nature. pH of soil along proposed project area was found in ranges from 7.19 to 7.69 which indicate neutral to slightly alkaline nature. Porosity is range from 26% to 32%, water holding capacity is range from 30% to 46 %, organic carbon is range from 0.46% to 0.96%, available nitrogen is range from 132 mg/kg to 152 mg/kg, available phosphorous is range from 9 mg/kg to 21 mg/kg and potassium is range from26 mg/kg to 46 mg/kg.

The summarized data of specific soil parameters are given in table below.

| S. No	Parameters	Units	SQ1	SQ2	SQ3	SQ4	SQ5	SQ6	SQ7
Physical Characteristics									
1	Sand	%	73	63	74	79	79	86	70
2	Silt	%	9	12	8	6	10	6	9
3	Clay	%	18	25	18	15	11	8	21
4	Porosity	%	26	26	29	29	26	32	26
5	Bulk Density	g/cc	1.16	1.1	1.12	1.16	1.1	1.16	1.09
6	Water Holding Capacity	%	40	36	46	45	30	32	40
Chemical Characteristics									
1	pH	-	7.19	7.69	7.42	7.69	7.69	7.62	7.29
2	Electrical Conductivity	µs/cm	326	616	416	630	416	698	419
3	Total Alkalinity	mg/kg	126	142	105	109	92	106	96
4	Organic Carbon	%	0.46	0.65	0.89	0.96	0.63	0.96	0.65
5	Calcium	mg/kg	316	817	985	516	495	936	316
6	Magnesium	mg/kg	196	216	269	169	216	216	195
7	Potassium	mg/kg	39	46	26	26	94	46	46
8	Phosphorous	mg/kg	12	12	10	9	10	21	13
9	Nitrogen	mg/kg	132	142	139	152	147	136	136

e. Biological Environment

Primary baseline study for ecology and biodiversity has been carried out in the month of October, 2024. Field visits in various landscapes viz. forest land, wasteland, agriculture land etc. have been carried out to get the maximum diversity of flora and fauna found in the study area.

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As per Champion and Seth classification of forest types (1968), the study area represents two main forest types viz. Northern Moist Mixed Deciduous Forest and Tropical Dry Evergreen Forest. In some parts mainly tropical dry deciduous is also found.

Analysis of the flora revealed that there are 155 plant species falling under 51 plant families. The most dominant plant family is Fabaceae (26 species) followed by Poaceae (8 species), Combretaceae (8 species) and Asteraceae (7 species). Among 155 floral species, 78 species of trees, 21 species of shrubs, 33 species of herbs, 15 species of climbers and 8 species of grasses were recorded. The dominant tree species observed in the study area are *Xylia xylocarpa, Lagerstroemia parviflora, Aegle marmelos, Shorea robusta, Bridelia retusa, Pterocarpus marsupium, Madhuca longifolia, Alangium salvifolium, Terminalia tomentosa, Terminalia arjuna, Careya arborea, Holarrhena pubescens, Acacia auriculiformis, Helicteres isora. Undergrowth has bushes of Phoenix acaulis, Flacourtia indica, Diospyros chloroxylon, Carissa spinarum, Casssia tora, Parthenium hysterophorus, Lantana camara and the ground flora is composed of Erathemum capense, Desmodium ganeticum, Chromolaena odorata, Peristrophe paniculata, Sisa acuta, Blumeopsis flava, Cynadon dactylon, Digitaria ciliaris, etc. Some climber species represents by Combretum roxburghii, Ichnocarpus frutescens, Hemidesmus indicus, Ampelocissus latifolia, Argyreia nervosa, etc.* No rare, Endangered and Threatened (RET) species of flora were found in the study area.

Percentage distribution of floral species in the study area is shown in the Figure below.
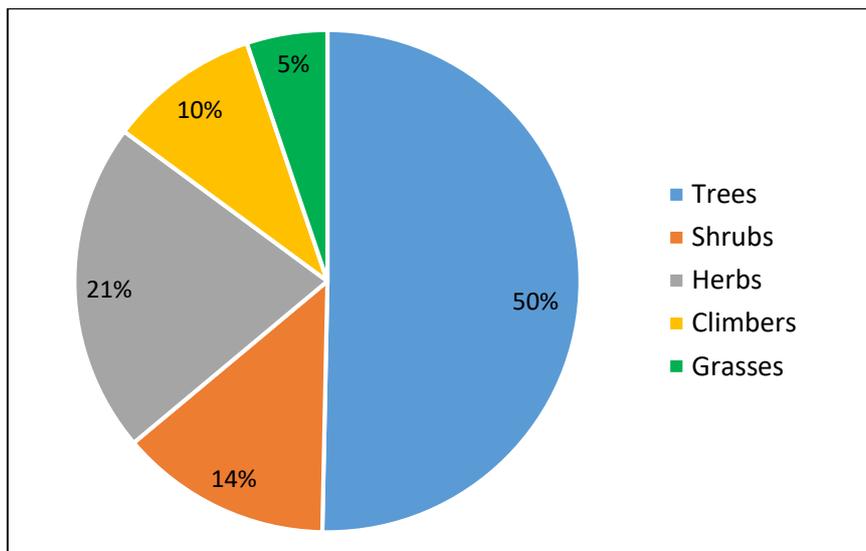
Total 98 numbers of faunal species recorded from the study area. Among faunal species, 19 species of mammals, 64 species of avifauna, 11 species of reptiles and 4 species of amphibians are recorded in the study area. The most common faunal species observed in the study area are Hanuman Langur, Rhesus Macaque, Five-Striped Palm Squirrel, Indian Grey Mongoose, Coppersmith Barbet, Rose-Ringed Parakeet, Rock Pigeon, Spotted Dove, Common Moorhen, Red Wattled Lapwing, Black Drongo, House Crow, Red Vented Bulbul, Indian Garden Lizard, Bark Gecko, Skink and Common Asian Toad. Percentage distribution of faunal species in the study area is shown in the Figure below.

Regarding the conservation status of the fauna, 16 faunal species (12 mammals, 1 avifauna and 3 reptiles) are identified from the study area which belong to Schedule-I species as per Wildlife

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Draft Environment Impact Assessment & Environment Management Plan

Protection (Amendment) Act, 2022. Most of them are common and widely distributed and the range of occurrence extended to wide geographical area.
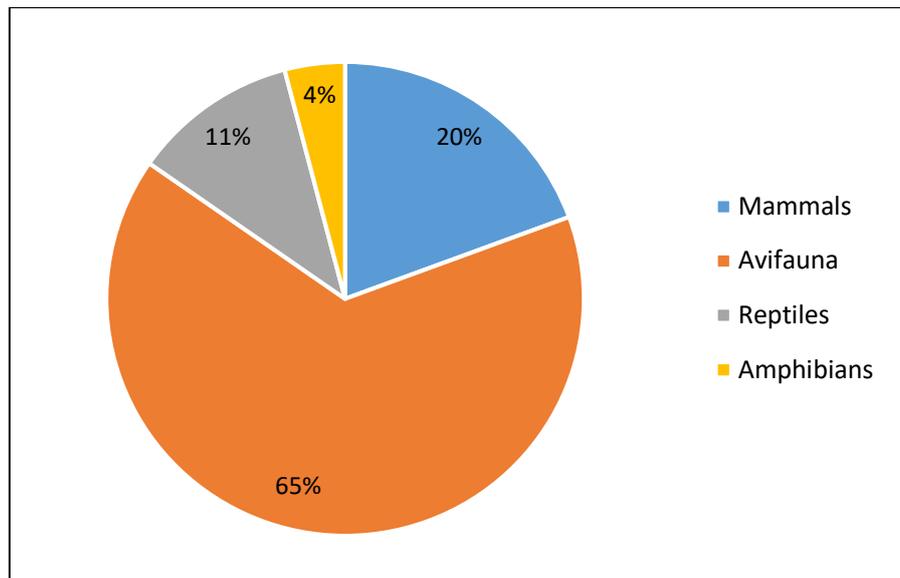
The proposed alignment does not pass through any wild life sanctuary. As per final notification notified vide S.O. no. 2906 dated 9th September, 2016 declaring Eco Sensitive Zone around Chandaka-Dampara Wildlife Sanctuary, alignment is passing at a minimum distance of 0.87 km and maximum distance of 6.67 km from the ESZ boundary of Chandaka-Dampara Wildlife Sanctuary.

As per the specific condition no. 2 of the ToR (File No: 10/18/2024-IA.III) granted by the MoEF&CC dated 19/09/2024, a Wildlife conservation/management plan for the area with special emphasis on elephants' management is prepared in consultation with State Forest Department. The report is presented to State Forest Department for the various mitigation measures required for proper animal movement at the project site. Elephant underpasses have been proposed at 10 locations after consultation with Forest department. Apart from these, 233 culverts have also been proposed for movement of smaller animals. Summary and recommendation is incorporated in the report and detail wildlife conservation/management plan is attached as Annexure 3-5.

f. **Social Environment**

Baseline socio-economic status of the project area helps to identify the present condition of the project area as well as provide some key indicators which may be considered important to mitigate the issues arising during the construction of the proposed highway. Primary survey along with secondary sources of socio-economic data like Directorate of Economics and Statistics, GoI and other such websites served to prepare the baseline socio-economic report of the project area.

The baseline socio-economic report revealed the following points:

• The state of Odisha is mainly a Hindu dominated state, with 93.63% Hindus and 2.17 % Muslim population. Christianity is followed by 2.77 % of the people of the state.

• The Gender ratio of the Project Influence Area (PIA) of the proposed alignment is 937 in Khordha district, 956 in Cuttack district and 968 in Dhenkanal district. In the same context, the sex ratio of

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Construction of new 6-lane Capital Region Ring Road (CRRR-1) from Rameswar (NH-16) to Gobindpur (NH-55) approx. 70.995 km in Odisha state by NHAI.

Draft Environment Impact Assessment & Environment Management Plan

the project districts Khordha, Cuttack and Dhenkanal stands out with 929, 940 and 947 respectively, while that of Odisha is 979. In comparison, the sex ratio of India is 940.

- The population density of the project districts viz. Khordha, Dhenkanal and Cuttack are 800, 667 and 331 persons/sq. km respectively, which are more than the national average of 382 persons per square kilometer.

- The sex ratio in Odisha stands at 979 females per 1000 males, which is higher than the national average of 943, according to the 2011 Census. The sex ratio of the project districts viz. Khordha, Cuttack and Dhenkanal were 929, 940 and 947 respectively.

- The literacy rate in Odisha has shown an upward trend, reaching 72.87% according to the 2011 Census. Project districts Khorda, Dhenkanal and Cuttack have literacy rates of 77.71%, 85.50% and 78.76% respectively. The PIA of the proposed alignment had a cumulative average literacy rate of 85.46%.

- As per Census 2011, project district wise data reveal that, among the four categories, other workers have maximum shares and household workers have minimum shares. As per districts stats, maximum other workers are recorded in Cuttack district with 54.15% shares whereas maximum household worker also recorded in Cuttack district with 5.48% shares.

  In project influence area (PIA) of the Khordha districts, people are engaged maximum in other worker and minimum in household works. In PIA Cuttack district, people are engaged maximum as other workers and minimum in household works, whereas in PIA of Dhenkanal district, maximum workers are engaged in other works and household workers are minimum. Shares of cultivators are maximum in Cuttack district (26.63%) and minimum in Dhenkanal district (18.34%). Agricultural labourers are recorded more in Dhenkanal district (35.68%) and minimum in Khordha district (19.10%). In household works, Cuttack district has maximum share (4.18%) and Dhenakanal district has minimum share (2.64%). In other workers categories, people of Khordha district have greater contribution (54.15%) and people of Cuttack district have lesser contribution (34.70%).

- Agricultural profile of the PIA suggests that the main crops grown are paddy, potato, sesamum, mustard and maize. Vegetable such as tomatoes, brinjals and leafy vegetables are also grown. Mango, banana, papaya, jackfruit, etc. Among crops, rice is cultivated in the largest area, followed by potato, rapeseed and mustard, sesame and maize.

- Odisha's rich mineral reserves constitute 28% Iron ore, 24% coal, 59% Bauxite and 98% Chromite of India's total deposits. Apart from large scale industries, major type of MSME operating in the state such as food & allied, chemical & allied, electrical & electronics, engineering & metal based, forest & wood based, glass & ceramics and miscellaneous manufacturing etc. According to recent data, there are 892246 registered MSMEs in Odisha, employing millions of people and contributing significantly to the state's GDP. As per the MSME udyam registration details, total 14636 no. of MSME are registered in project districts.

4. Anticipated Impacts and Mitigation Measures

The impacts of the proposed project and their probable mitigation measures, wherever required have been studied for ease in construction of the road. The impacts have been categorised regarding four main environmental parameters, viz. air, water, soil and noise. Impacts during construction as well as operation phase and their corresponding mitigation measures have been discussed in this section.

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Construction of new 6-lane Capital Region Ring Road (CRRR-1) from Rameswar (NH-16) to Gobindpur (NH-55) approx. 70.995 km in Odisha state by NHAI.

Draft Environment Impact Assessment & Environment Management Plan

a. **Impacts on Air Quality**

Air Quality of the project area may be impacted due to various construction activities such as removal of old structures, use of heavy machinery, mixing of road materials and transport of raw materials from quarry to site, earth filling on alignment, thereby increasing the amount of particulate matter (PM_{10} & $PM_{2.5}$). The movement of heavy machinery, oil tankers will most probably generate exhaust gases. High concentrations of harmful gases like SO_2, NO_2 as well as HCs likely to be generated from hot mix plant operations.

A mathematical air pollution dispersion modelling was performed using AERMOD and CALINEpro software, to assess the spread of the various pollutants during the construction phase (year 2024-25) as well as during the operation phase (year 2059-2060) to better mitigate the effects of air pollution. As per the modelling prediction, the increased air pollution levels will be within the prescribed limits set in the NAAQS of CPCB. Summary is given in Chapter 4 and the detailed modelling report has been presented as **Annexure 4-1**.

Mitigation measures include water sprinkling on haul roads to manage dust, regular pollution checks, plantation of broad-leaved trees which may absorb high concentration of pollutants and others.

b. **Impacts on Water Resources and Water Quality**

The water resources (surface and ground) may be affected due to various factors such as increased runoff due to deforestation, blocking of natural flow of water bodies, contamination of groundwater by seepage of harmful chemicals, etc. Mitigation measures include proper design of the proposed highway, proper management of solid and liquid wastes, provision of silt fencing, provision of adequate drainage systems, etc.

c. **Impacts on Soil Quality**

The soil quality of the proposed project area may be degraded following excavation of earth for construction of the road, removal of large numbers of trees, soil compaction due to movement of large vehicles, soil contamination due to improper waste disposal, etc. Mitigation measures include proper handling of the top soil after excavation, limited number of tree felling, proper management of wastes, etc.

d. **Impacts on Noise Quality**

The ambient noise levels will increase due to the various construction activities as well as movement of vehicles both during the construction phase as well as the operation phase. Mitigation measures such as provision of adequate noise barriers, proper maintenance of vehicles, etc. is absolutely necessary for effective control of noise pollution due to the construction of the road.

Mathematical prediction modelling for noise pollution has been done using dhwaniPRO software, using various point sources such as crusher, hot mix plant, DG sets, etc. as sources during construction phase and traffic data for operation phase. The baseline noise monitoring locations were considered as receptors for estimating the incremental values of noise during construction phase. The noise levels will be within the permissible limits during construction and operation period of the project. The details are given in Chapter 4 and **Annexure 4-2.**

Construction of new 6-lane Capital Region Ring Road (CRRR-1) from Rameswar (NH-16) to Gobindpur (NH-55) approx. 70.995 km in Odisha state by NHAI.

Draft Environment Impact Assessment & Environment Management Plan

e. **Impacts on Biological Environment**

The flora and fauna as well as the plantations or forest area falling in the project area will be affected due to the felling of trees to make way for the construction of the road. These impacts can be effectively mitigated through the use of proper fencing to avoid the animals wandering into the construction site, felling of minimum number of trees, provision of adequate number of cattle/animal underpasses, culverts so as to minimise the habitat fragmentation, etc.

Diversion of Forest Land- The alignment is passing through 3 districts namely Cuttack Khordha., and Dhenkanal. The forest area with in the PROW of the alignment is 28.32 ha. Total 13617 trees will be affected in total including forest areas.

The proposed project alignment does not pass through any national Park, Wildlife Sanctuary or protected area. It does not pass through any Eco-Sensitive Zone of any Wildlife Sanctuary/National Park. However, Chandaka-Dampara and Kapilash wildlife sanctuaries are lies near the project alignment. The NOC is obtained from DFO Chandaka Dampara Wildlife Sanctuary vide letter No. 5845/4F (F.C. Ac t& Lease)-90/2022 dated 04 November 2022.

During Construction Phase, major impact of concern is the fragmentation of habitat. The construction of the new road may fragment the forest areas and cause disruption to the movement of wildlife, threatening their survival. Construction near forest areas may lead to accidents due to human-wildlife conflict, which will result in the loss of life or workers or animals. No considerable impact is expected to occur in the operation phase of the project. And as the WL conservation and mitigation plan will be implemented by NHAI.

f. **Impacts on Socio-Economic Environment**

The proposed project will impact around 3426 families and 15621 persons. Due to major part of the proposed alignment passing through plain areas and agricultural fields, people will lose their livelihood. But the proposed project will also have some beneficial effects in the socio-economic characteristics of the region such as increase in income of small businesses, establishment of hotels, restaurants, hospitals, markets and others in the interchange locations and WSA locations, etc. Traffic may get congested on the pre-existing roads that the proposed highway is supposed to cut through in short term.

All these beneficial impacts are very much welcome for the betterment of the local community. As for the other non-beneficial impacts, some mitigation measures need to be put in such as proper compensation for the persons affected, provision of adequate service roads to maintain connectivity, provision of safety measures and traffic management systems, etc. The overall impact of the project during construction/operation phase is presented below.

Table: Impact Assessment Matrix

Environmental Parameters	Nature of Potential Impact during Construction & Operation phases										
	Local	Regional	Short Term	Long Term	Reversible	Irreversible	Adverse	Beneficial	No Impact	Significant	Insignificant
Meteorology	✓		✓		✓						✓

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Construction of new 6-lane Capital Region Ring Road (CRRR-1) from Rameswar (NH-16) to Gobindpur (NH-55) approx. 70.995 km in Odisha state by NHAI.

Draft Environment Impact Assessment & Environment Management Plan

Topography	✓			✓		✓					
Drainage	✓			✓	✓						✓
Soil	✓				✓						✓
Water Resources	✓		✓		✓						✓
Water Quality	✓				✓						✓
Land Use	✓			✓		✓		✓			✓
Air Quality	✓		✓		✓						✓
Noise	✓		✓	✓	✓						✓
Flora	✓		✓	✓		✓	✓			✓	
Fauna	✓		✓	✓		✓	✓			✓	
Employment	✓		✓	✓		✓		✓		✓	
Aesthetics	✓		✓	✓		✓				✓	

5. Analysis of Alternatives

Introduction

This section presents a comparative analysis of the various alternatives considered for alignment selection, to avoid, prevent and minimize the impacts that would be inevitable if technically (based on design speed and geometrics) if a best-fit alignment is not considered. A comparative analysis of alternatives helps to determine the best method of achieving project objectives while minimizing environmental impacts. Various alternatives selected for analysis usually includes the 'no project' or 'no action' alternative. The relative impact of each alternative is compared against the baseline environment to select a preferred alternative.

Construction of the Rameswar (Khordha) NH-16 to Gobindpur (Dhenkanal) NH-55, (Capital Region Ring Road (CRRR) -1) for Six Laning with Paved shoulder NH Configuration - in the State of Odisha by NHAI for a total length of 70.995 km was considered after finalization of various options such as realignments, bypasses, State Governments suggestions and different construction material options keeping in view objectives of the project, traffic condition, obligatory points, geometric designs, congestions and socioeconomic viability and environmental safety aspects.

Selection of Alternatives

Three alternative alignments were presented during the grant of ToR meeting and these have been considered for analysis and are as follows:

i. **Option 1**: Option 1 is basically considered as a Green field alignment from existing NH-16 to NH-55 from Rameswar to Gobindpur with a total length of 73.24 km.

ii. **Option 2**: Option 2 is basically considered as a new Green field alignment from Rameswar to Gobindpur, from existing NH-16 to NH-55. With a total length of 70.995 km. (**Proposed alignment)**.

iii. **Option 3:** This option starts from Palatotapada after Khordha town at NH-16 to Near Kuspangi at NH-55 and passes through Greenfield area the alignment is much closer and passes through to the Chandaka WLS in the middle sections.

Keeping in view of the selected alignment having less/minor effect on environmental and social components, alignment **Option-2** has been fixed and it appears more feasible as compared to the other

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Construction of new 6-lane Capital Region Ring Road (CRRR-1) from Rameswar (NH-16) to Gobindpur (NH-55) approx. 70.995 km in Odisha state by NHAI.

Draft Environment Impact Assessment & Environment Management Plan

options. It also provides better alternative for connection to the existing NH-16 and NH-55 coming to Tamilnadu and going upto Kolkata and bypassing the major towns of Khordha, Bhubaneshwar and Cuttack. It will lead to less impact on Environment & Social components than other two. The ringroad will further reduce the traffic congestion in the existing cities and reduce urban pollution loads in these cities.

Impact Scoring Matrix

An impact scoring matrix encompasses all the variables that may affect the local area through which the alignment passes. Various aspects (5 no.) are analysed in this matrix i.e.: Natural environment, Biological environment, Physical environment, Social environment and engineering considerations. Various micro attributes are further analysed in each of the major 5 aspects. Scores are then allocated to each of the attributes and all the analysed three alignment options. The option with the least score is the one that has the least impact on the local environment.

Alternative alignments and their impact score

Scoring Criteria	Total Weight	Option-1 Score	Option-2 Score	Option-3 Score
Natural Environment	80	35	32	41
Biological Environment	80	29	21	33
Physical Environment	50	16	16	17
Social Environment	60	25	23	25
Engineering	130	78	74	83
Total	**400**	**183**	**166**	**199**

The overall scoring matrix shows that Option-2 has the least score with 166 points followed by Option-1 with 183, and last is Option-3 with 199. Increasing number showing the increasing environmental, social impact due to the said option, hence option-2 has the lowest impact overall and is considered for construction.

New Materials and Technologies in Road Construction

The proposed project will use latest construction materials and methodologies to reduce the material usage and reduce the carbon foot print during construction period. New guidelines and notifications have been issued by the MoRTH, MoEF&CC, IRC to use new materials, use recycled materials in road construction, reduce wastage, etc. IRC guidelines are now available for use of Cement Treated Base (CTB), Cement Treated Sub-base (CTSB), Recycling, Fly-ash, Waste Plastic, Geo-Synthetics, modified Bitumen (CRMB, Polymer modified, Natural Rubber), Soil stabilization, embankment stabilization through coir mats, grasses, etc. in highway construction. It is necessary to promote these materials/technologies in construction and maintenance of National Highways for harnessing potential time and cost savings and reducing the environment impacts.

6. Environmental Monitoring Programme

The environmental monitoring program is a vital process of any Environmental Management Plan (EMP) of a development project for review of indicators and to take immediate preventive action. This helps in signalling the potential issues resulting from the proposed project activities and will allow for

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Construction of new 6-lane Capital Region Ring Road (CRRR-1) from Rameswar (NH-16) to Gobindpur (NH-55) approx. 70.995 km in Odisha state by NHAI.

Draft Environment Impact Assessment & Environment Management Plan

prompt implementation of corrective measures. NHAI has keen interest in environmental monitoring as it is an integral part towards better environmental management of air, noise, water, soil, etc., during construction and operation phase.

The proposed project's main activity envisages construction of road. Construction phase of the project is likely to be completed within 30 months. Thrice in a year monitoring for all the parameters excluding monsoon season is envisaged during construction and operation phase.

For air, important monitoring parameters like PM_{10}, $PM_{2.5}$, SO_2, NO_2, O_3, CO, etc. are to be monitored during construction and operation phase. For noise the sound decibel in dB is to be monitored for day and night time values. For soil various parameters like pH, electric conductivity, NPK values, various organic and inorganic chemicals are to be monitored. For water (surface and ground water) important parameters like pH, BOD, DO, TDS, Pb, Oil & Grease, Total Hardness, Sulphate, Chloride, Fe, Fl, etc. are to be monitored as per the sample.

Other aspects like local management of Ecology & Biodiversity, comprising of knowledge of indigenous plant species, local flora and fauna is to be monitored. Management of compensatory avenue and median plantation is to be followed. Proper adherence to local Disaster management, Health & Safety laws, protocols and procedures have also to be followed at project site. Formation of an Environment Management Cell with role and responsibilities will be decided before the commencement of work. The environment management cell / unit will ensure implementation and monitoring of environment safeguard during construction.

All the monitoring parameters have to be carried out by NABL certified private or government agency/laboratory. Prior finalising the sensitive locations of the project site the construction camps, Hot mix plants, crusher plant, batching plants, construction site, haul roads, borrow areas, sensitive ecology and environmental locations like forest areas, river/streams, wells, habitations, etc. where monitoring has to take place. The total environmental monitoring budget is calculated at around Rs.32.29 lacs.

7. Additional Studies

Additional studies have been undertaken as per the EIA Notification, 2006 and its amendments thereafter. These include public consultations, Social Impact Assessment, Census and Socio-Economic Survey, preparation of Disaster Management Plan & Risk Assessment as well as preparation of Resettlement Action Plan (RAP) and Resettlement and Rehabilitation (R&R) Budget. A total of 65 villages, 3426 families and 15621 persons will be impacted due to the proposed highway.

Consultations with the individual villagers and village headmen provided an insight into the view of the affected villagers with respect to the proposed project. More or less, the affected people are very welcoming to the proposed highway considering the economic benefits that will naturally come with it. The only major concern of the villagers was the provision of adequate connectivity between the villages and the agricultural fields as well as timely payment of compensation of land and affected structures. A total of 547.51 ha. of land will have to be acquired for the proposed alignment.

Preliminary survey indicates that a total of 71 structures will be impacted due to the construction of the proposed alignment. Most of these structures are semi-pucca structures, and are mainly owned by individual owners, majority of whom have joint families.

NHAI   GDRPL   CPCL

Construction of new 6-lane Capital Region Ring Road (CRRR-1) from Rameswar (NH-16) to Gobindpur (NH-55) approx. 70.995 km in Odisha state by NHAI.

Draft Environment Impact Assessment & Environment Management Plan

Majority of the Project Affected Population (PAP) are found to have an education level upto 8th level. The sex ratio in the affected area is 954 which is close to the rural sex ratio of the project districts. The majority of the PAFs of proposed alignment were found to be Hindus i.e. 96.11%, followed by 3.06% are Muslim, 0.45% Christians, 0.04% are Sikh and 0.33% of the PAFs in the proposed alignment were found to be in following others religions.

Overall, the proposed alignment majorly consists of people falling in the general category (42.23%) followed by OBC (32.19%), SC category (17.28%) and ST category (8.30%). Majority of the PAPs of the proposed alignment fall in the age group '11-20' (18.85%), followed by the age group '21-30' (18.24%) whereas the age group '80+' constitute least and have only 1.27% PAPs. Majority of the PAPs are found to be housewives (34%) followed by agriculturists (33%).

The majority of the PAFs of the proposed alignment fall in the <= 50000 income slab (74.82%), followed by 50001-100000 and 100001-500000 income slab, which constitute 8.16% and 6.51% of the PAFs respectively. This may also be attributed to the fact that villagers tend not to disclose this aspect and mention lesser annual incomes.

A comprehensive risk assessment has been performed and a disaster management plan has also been prepared taking into account every possible risk and hazard and their mitigation measures to effectively manage the hurdles due to any disaster wither natural or anthropogenic.

An R&R budget has been worked out which comes out to be around INR 880 Cr. for the proposed alignment. This budget includes the compensatory cost for land to be acquired, cost for replacement of structures as well as cost for assistance to PAFs. The detailed break-up of the R&R budget has been presented in Chapter 7 of the EIA report.

As per the specific condition no. 2 of the ToR granted by the MoEF&CC, a wildlife study in the proposed project area is carried out to understand the biodiversity of the proposed project area as well as to prepare a detailed Conservation Plan/management plan. Detail wildlife conservation/management plan is attached as **Annexure 3-5.**

8. Project Benefits

As the proposed project of Capital Region Ring Road (CRRR-2) is a greenfield project in basically rural area, it is aimed towards the overall development of the physical infrastructure of the region with creation of new road surface with superior quality, advanced safety features, high speed connectivity, reduction in travel times, access controlled and other way side amenities and facilities. Highway will further lead to the socio-economic development of the region with potential for increase in tourism, and agriculture activity. The highway will also lead to enhanced local employment generation during construction and operation phase. Additionally, this highway will reduce the traffic load on the existing NH 16, thereby reducing the deterioration of the environmental parameters such as Air quality, Noise levels, biological environment, etc. around 30-40% of the heavy vehicular traffic will then bypass the cities of Khordha, Bhubaneshwar and Cuttack in long term entire through traffic will use the ring road. Improved highway geometrics, avenue and median plantations along the highway will further improve the local environment and add to enhancing the local environment and green cover.

Construction of new 6-lane Capital Region Ring Road (CRRR-1) from Rameswar (NH-16) to Gobindpur (NH-55) approx. 70.995 km in Odisha state by NHAI.

Draft Environment Impact Assessment & Environment Management Plan

9. Environment Management Plan

Environmental Management Plan (EMP) is a necessary part of any developmental project to ensure that environmental impacts are kept well below the acceptable limits, as well as to improve environmental conditions of the project area at pre-construction, construction as well as operation phases, through comprehensive mitigation measures.

In general, NHAI, with assistance from Contractor and Monitoring Consultant, is responsible for carrying out mitigation measures as and when required. The PIU/Independent Engineer/Authority engineer has to ensure, through periodic audits and monitoring, so that all EMP requirements and mitigation measures are being implemented correctly by the contractor during various stages of the project.

The main components of EMP are: EMP Implementing Agency, Monitoring the Implementation of EMP, Training for correct implementation of EMP and Budgetary provisions for EMP implementation

The EMP to be implemented at various stages of the project i.e. Pre-construction, Construction and Operation are given in details in individual sections.

Checklist of Statutory Obligations

Project Proponent is required to attain a number of statutory as well as obey the provisions laid down by the Acts, Rules, Notifications and Orders relevant to the project. Some important National Acts which aim at prevention and control of industrial and urban pollution are:

- Water (Prevention and Control of Pollution) Act, 1974, amended 1988
- Air (Prevention and Control of Pollution) Act, 1981, amended 1987
- Environment (Protection) Act, 1986, (EPA)
- The Wildlife (Protection) Act, 1972
- The Forest (Conservation) Act, 1980 (With Amendments made in 1988)
- Forest (Conservation) Rules, 2003 (With Amendments made in 2004)
- Fly Ash Notification, 2009
- EIA Notification, 2006 and further amendments
- Ancient Monuments and Archaeological Sites and Remains Rules, 1959

Some other important acts/rules/notifications which are relevant to the highway projects are:

- National Highways Authority of India (Amendment) Act, 2013
- Motor Vehicles Act, 1988
- Central Motor Vehicle Rules, 1989
- Control of National Highways (Land and Traffic) Act, 2002
- National Highways Act, 1956

Environment Management Action Plan

The Environmental Management Action Plan is the synthesis of all proposed mitigation and monitoring actions, to be implemented within a time frame with specific responsibility assigned and follow-up actions defined. It contains all the information for the project proponents, the contractors and the regulatory agency to implement the project within a specified time frame.

NHAI   GDRPL   CPCL

Construction of new 6-lane Capital Region Ring Road (CRRR-1) from Rameswar (NH-16) to Gobindpur (NH-55) approx. 70.995 km in Odisha state by NHAI.

Draft Environment Impact Assessment & Environment Management Plan

The EMP is a plan of action for avoidance, mitigation and management of the negative impacts of the project. The Environmental Enhancement is also an important component of EMP. The EMP refers to all implementable task at different stages of project, namely, Pre-Construction Phase, Construction Phase, and Operation Phase. The EMP includes a list of all project-related activities and impacts and a clear reporting schedule.

Pre-Construction Stage

The pre-construction stage involves various technicalities and approvals as follows:

- Obtaining all necessary clearances/NOC's/consents from concerned regulatory authorities such as Environmental Clearance, Forest Clearance, Wildlife Clearance, etc.
- Identifying and selecting the sources of gathering materials for construction such as quarry, water, sand, etc.
- Fulfilling the conditions laid down by the respective NOCs.

Construction Stage

The construction stage involves various technicalities such as:

- Stone crushing and screening plants, hot mix plants, concrete batching plants etc. shall be located sufficiently away from habitation, agricultural operations.
- Precaution shall be taken to reduce the levels of noise, vibration, dust and emissions from plants.
- The contractor shall not use or generate any materials in the works which are hazardous to the health of person, animals or vegetation.
- Provision of protective clothing or appliances to workers
- Provision of drinking water for workers shall be made available.
- The use of firewood shall not be permitted.
- All equipment shall be provided with proven efficiency.
- Plants, equipment and instruments provided shall have adequate sensitivity facility for calibration to desired level and shall be robust.

Operation stage

The operation stage involves various technicalities such as:

- Road development may lead to establishment of petty shops and other commercial pursuits by the local people. The project proponent should prevent development of squatter settlements and encroachments on the vacant portions of the RoW of the road.
- There is possibility of accidents in the project stretch as a greater number of vehicles are expected in this road stretch. In the event of spillage of hazardous chemicals, a spillage containment mechanism will be developed along with the participation of police and the fire department.
- Avenue and median plantations along the stretch will improve the aesthetics of the project corridor. Public amenities and parking places are proposed in project design for long distance travelers.
- Traffic noise significantly affects human health, especially for people living in the vicinity to major roads/highways. There will be significant noise impact due to traffic which include different categories like small private vehicles to large goods vehicles.

NHAI   GDRPL   CPCL

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Draft Environment Impact Assessment & Environment Management Plan

Enhancement of Natural Environment

The natural environment can be improved by plantation of ornamental and shade providing avenue trees on the roadside, the shrubs and some important herbs besides developing ponds and providing bore wells along the roadside.

Plantation of Trees, Shrubs and Herbs along the proposed Highway

The plantation of trees can be done in different densities depending on the Habitat and soil type, Water table depth, Availability of indigenous species, Survival rate of plants and Forest department/People's choice.

Enhancement of Water Bodies

There are some surface water bodies crossing the project corridor. The water bodies are used for various purposes including bathing, washing, fishing, growing water-fruits, livestock drinking and often irrigating the agricultural fields. The landscape treatment includes, Provision of stepped access to the edge of water, Providing flat boulders for washing, Stone pitching for slope for high embankment stabilization, Plantation of trees and shrubs for stabilization of pond edge.

Conservation Status and Biodiversity Management

The proposed project alignment does not pass through any national Park, Wildlife Sanctuary or protected area. It does not pass through any Eco-Sensitive Zone of any Wildlife Sanctuary/National Park. However, Chandaka-Dampara and Kapilash wildlife sanctuaries are lies near the project alignment. The NOC is obtained from DFO Chandaka Dampara Wildlife Sanctuary vide letter No. 5845/4F (F.C. Act& Lease)-90/2022 dated 04 November 2022.

Threats to Biodiversity in the Project Site

The major threats are enumerated as follows: Shrinkage of wildlife habitat, Environmental pollution and habitat destruction due to economic development activities, tourism. Anthropogenic activities, over exploitation of species and spread of invasive alien species.

Physical Environment

Physical changes to the landscape will also include creation of NHAI Nest shops, Way side amenities, toll plazas, truck lay-byes, etc. All will be designed so as to be aesthetically pleasing with green shade and ornamental plantations. Quarries and borrow areas would also be maintained as per directives like removal of top soil, digging upto 2-3 m only, maintaining the embankment slopes, barricading, etc. Temporary structures like Camps, offices, ware houses, Hot mix plant, RMC plant, Kitchens, etc. will also be present during the construction stage.

Borrow areas will be properly closed and further use of the same for agriculture, irrigation pond, water recharging, aqua culture, tourism, etc. will be ensured.

Various pre-construction activities like tree cutting, utility shifting, Statutory clearances, plant and machineries, vehicles, labour, water, camps, traffic management etc. will be the responsibility of the contractor and will be further supervised by the PMU, Independent/Authority engineer and NHAI.
During construction activities like utility shifting, Land Acquisition, Slope protection, water use, drainage, flora and fauna, wildlife issues, environmental monitoring, traffic movement, safety of workmen, signage's, pollution control and monitoring, green belt development, etc. will be the

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Draft Environment Impact Assessment & Environment Management Plan

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Environmental Management Plan Budget

The cost of environmental protection measures has been estimated at Rs. 16.48 Cr. as per the following table.

Component	Stage	Items	Estimated Rate	Total Cost (Rs)
Environmental Training	Construction	Training of project staff	Lump Sum	20,00,000
Environmental Monitoring	Construction and Operation Period	Monitoring of air, water, soil, noise and Soil (Refer Table 6.2)	As per environmental monitoring plan	32,28,750
Air	Construction	Dust Suppression at the project site @ Rs 1800/trip x 2 trips/day x 365 days x 2.5 years	70.995 km (2 packages)	66,00,000
Solid waste	Construction	Demolition wastes and bituminous scrap disposal as per C& D rules 2016	Lump Sum	20,00,000
Soil	Construction	Provision for providing Oil Interceptors	2 Nos	4,50,000
Surface water	Construction	Silt Fencing for water bodies (4000m)	1500 Rs/mt	60,00,000
Noise Barrier	Construction	Provision of Noise Barrier (5000m)	7,500 Rs/mt	3,75,00,000
Flora	Construction	Plantation of trees along the proposed highway i.e. 22000 trees to be planted	Rs 2000/tree including tree guard	4,40,00,000
		Maintenance period of 2.5 years including causality replacement of tree	Lump Sum	30,00,000
		Ornamental Plantation on Inter Sections.	Lump Sum	40,00,000
		Shrub Plantation and grass carpeting in median	Lump Sum	30,00,000
Wildlife	Construction	Signage for wildlife	Lump Sum	3,00,000
	Operation	Proposed wildlife management plan (As per approval/Approx.)	Lump Sum	3,00,00,000
Safety	Construction	Demarcation of borrow areas clearly, using fencing if needed.	Lump Sum	30,00,000
		Provision of Hoarding /Posters at construction camps and provision of health checks at construction sites	Lump Sum	10,00,000

NHAI   GDRPL   CPCL

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Draft Environment Impact Assessment & Environment Management Plan

		Provision for helmet, gumboots, jackets, goggles etc. to labours	Lump Sum	15,00,000
Construction Camps	Construction	Sanitary Facilities (Bio-Toilet, Septic Tank, Soak pit, etc.	Lump Sum	10,00,000
Rain Water Harvesting	Construction and operation	Construction of RWH Structures as per site Geological condition	Approx. 70	40,00,000
		Maintenance of Rainwater Harvesting Structures during defect liability period	Lump Sum	4,00,000
Renewable energy	Construction	Installation of Solar Panel, and LED bulbs at project site (Camp area)	Lump Sum	40,00,000
Total				**15,69,78,750**
Contingency @ 5%				**78,48,938**
Total				**16,48,27,688**

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