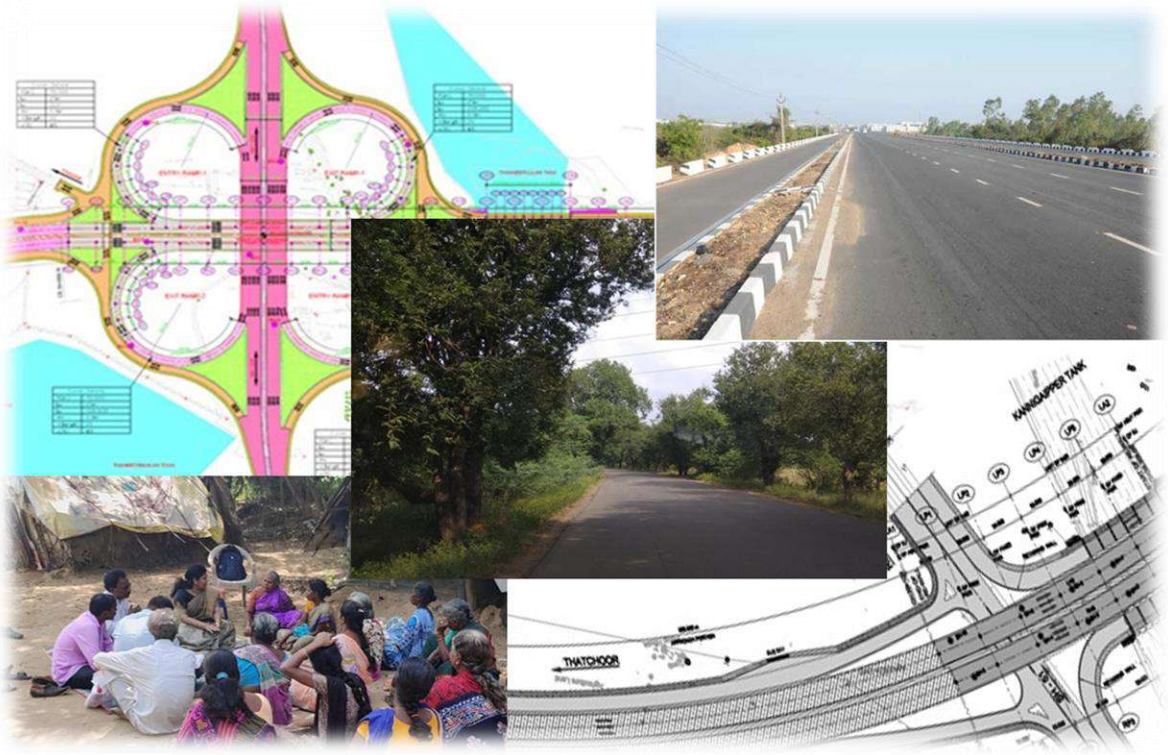
Environment Impact Assessment (EIA)



October 2020

Chennai Peripheral Ring Road Project
Section 2 & 3

Highways Department
(Government of Tamil Nadu)

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LIST OF ABBREVIATIONS

AIIB	:	Asian Infrastructure Investment Bank
AAQ	:	Ambient Air Quality
CMA	:	Chennai Metropolitan Area
CoI	:	Corridor of Impact
CPCB	:	Central Pollution Control Board
CPR	:	Common Property Resource
CPRR	:	Chennai Peripheral Ring Road
CTE	:	Consent to Establish
CTO	:	Consent to Operate
DLP	:	Defects Liability Period
DRO	:	District Revenue Officer
EC	:	Environmental Clearance
EIA	:	Environmental Impact Assessment
ESF	:	Environmental and Social Framework
EHS	:	Environment, Health, and Safety
EMP	:	Environmental Management Plan
FGD	:	Focus Group Discussion
GRC	:	Grievance Redress Committee
GRM		Grievance Redress Mechanism
GoTN	:	Government of Tamil Nadu
IRC	:	Indian Roads Congress
IRR	:	Inner Ring Road
ISFR	:	Indian State of Forest Report
JICA	:	Japan International Cooperation Agency
LARR	:	Land Acquisition Rehabilitation and Resettlement Act
MoEF&CC	:	Ministry of Environment, Forest and Climate Change
MoRTH	:	Ministry of Road Transport and Highways
NGO	:	Non-Governmental Organisation
NH	:	National Highways
NoC	:	No Objection Certificate
ORR	:	Outer Ring Road
PIU	:	Project Implementation Unit
PPE	:	Personnel Protective Equipment
PMU	:	Project Management Unit
PUC	:	Pollution under Control
R&R	:	Resettlement and Rehabilitation
ROB	:	Rail Over Bridge
RPF	:	Resettlement Planning Framework
ROW	:	Right of Way
SEIAA	:	State Environment Impact Assessment Authority
SIA	:	Social Impact Assessment
SH	:	State Highways
TNHD	:	Tamil Nadu Highways Department
TNRIDC	:	Tamil Nadu Road Infrastructure Development Corporation
TNPCB	:	Tamil Nadu Pollution Control Board
TPP	:	Tribal Peoples Plan
VUP	:	Vehicle Under Pass

Executive Summary

1. Chennai is one of the fastest-growing metro cities in India. Over a decade Chennai has witnessed a significant increase in urban agglomeration. Due to the increase in the population, there is a growing demand for infrastructure facilities, which includes Water supply, Underground sewerage, Electricity, and Roads. The major arterial road network in Chennai Metropolitan Area consists of National Highways (NH 16, NH 716, NH 48 and NH 32) as major radial roads and Inner Ring Road (IRR), Chennai Bypass and Outer Ring Road (ORR) as ring roads. However, the available road network observed to be limited concerning the growing population and hence to cater to the traffic congestion, Tamil Nadu Highways Department has chosen to develop Chennai Peripheral Ring Road (CPRR). The CPRR has 5 segments as follows.

Section	CPRR Break-up	Length (km)
1	Northern Port Access Road– Ennore port to Thatchur on NH 16	25.31
2	Thatchur on NH 16 to Start of Thiruvallur Bypass	26.10
3	Start of Thiruvallur Bypass to Sriperumbudur on NH 48	30.10
4	Sriperumbudur on NH 48 to Singaperumal Koil on NH 32	23.80
5	Singaperumal Koil on NH 32 to Mahabalipuram	27.471
	Total	**132.781**

2. Section 1 has been proposed to be developed under the Japan International Cooperation Agency (JICA) financial assistance. Section 2 and 3 are proposed to be developed under financial assistance from the Asian Infrastructure Investment Bank (AIIB). Section 4 has been implemented under the state fund and Section 5 is proposed to be developed in the later stage. The AIIB financing will focus on the implementation of section 2 and 3 (hereby referred as Project in this report). As per the Environmental and Social Framework (ESF) of the AIIB, this project has been categorized as “A” and accordingly, it mandates a full assessment of environmental and social impacts, and the preparation of the Environmental Impact Assessment (EIA) including Environmental management Plan (EMP).

3. The key national and state rules and regulations applicable for this project is as follows

- Environmental Impact Assessment Notification and Amendments
- Coastal Regulation Zone Notification and Amendments
- Notification on use of fly ash (subsequent amendments)
- Forest (Conservation) Act
- Wildlife (Protection) Act
- Biological Diversity Act
- Water (Prevention and Control of Pollution) Act (and subsequent amendments)
- Air (Prevention and Control of Pollution) Act (and subsequent amendments)
- Noise Pollution (Regulation and Control) rules
- Hazardous Waste (Management& Transboundary Movement) Rules and subsequent amendments
- The municipal solid waste management rules and subsequent amendments

- Environmental Clearance (EC) under EIA notification (and subsequent amendments) for new Quarry areas
- Central Motor Vehicle Act Central Motor Vehicle Rules
- The Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act
- The Right to Fair Compensation and Transparency in Land Acquisition Rehabilitation and Resettlement Act, 2013 (Act 30 of 2013) (LARR)
- The Tamil Nadu Protection of Tanks and Eviction of Encroachment Act, 2007
- Tamil Nadu Highways Act, (TNHA)

4. This project mandates Environmental Clearance (EC) as per the EIA notification 2006 (under category B1 and project schedule 7(F) for state highways and accordingly the Form – 1 and Form 1A have been submitted to the State Environment Impact Assessment Authority (SEIAA) and the EC for the same has been obtained in Aug 2018. Other clearance required for the project includes (i) Permission from WRD for construction of roads over the water bodies, (ii) Forest clearance[1] from the Forest Department for the Forest Land Acquisition of 0.28ha. (iii) Coastal regulation zone (CRZ)[2] clearance from Tamil Nadu State Coastal Zone Management Authority, (iv) Permission for felling of avenue trees from District Revenue Officer for the trees located outside the forest area and from the Forest department for the trees located within the Forest area. Other project-related clearances to be obtained by the Contractor are detailed in the EIA report.

5. The project area has flat terrain without much elevation and it slopes towards the eastern direction. For Section 2 the elevation ranges between 14m amsl to 35m amsl and for Section 3 the elevation ranges between 33m amsl to 77m amsl. The project area has a typical tropical climate, were the temperature raises during the summer (max 42°C) season and in winter the temperature is between 18°C to 20°C. Northeast Monsoon dominates the rain pattern in the project area, annual rainfall ranges between 950mm to 1214mm. The project area falls under the Zone III (Moderate Damage Risk Zone) for seismic activity and hence no major risks are anticipated to the proposed road formation as well as the ancillary facilities(including the bridge, CD's, Embankment, etc.,). Section 2 is dominated by the presence of the sandy soil and for section 3 it is dominated by the brown clayey soil.

6. The land use pattern in section 2 is predominately agriculture (nearly 85%) due to the proposed Greenfield road, followed by water bodies (nearly 10%) and settlements (5%). For Section 3, agriculture land constitutes 50%, followed by settlement areas (25%), water bodies (20%) and industries (5%). The Ambient Air Quality (AAQ) and the Ambient Noise levels in the project area are monitored and compared with the AAQ standards, from the comparison, it is evident that none of the monitored parameters are exceeding the stipulated standard limits prescribed by the CPCB. Similarly, water samples (surface water

[1] Till September 2020, the Forest clearance for diversion of 0.28ha of the forest land is in process, major activities like marking of the central line in the forest area have been completed, based on the forest officials estimation of the Tree loss as well as the Net Present Value (NPV), the compensation shall be arrived. Based on the current status, forest clearance is expected within 3 to 4 months.

[2] Section 1 triggered the requirement of CRZ clearance, which has been obtained from the Tamil Nadu State Coastal Zone Management Authority in Aug 2019 and is for the whole CPRR project. Hence, the given conditions in the CRZ clearance is applicable for the sections 2 and 3 as well.

and groundwater) have been collected and analysed for its Physico-chemical properties and from the outcome of the analysis, the water quality in the project area is observed to be good and suitable for the potable purpose. The presence of flora and fauna in the project area is very much limited.

7. As per the road inventory survey, 30 species of trees have been identified in the project area, among them, Tamarind trees (*Tamarindus indica*), Coconut trees (*Cocos nucifera*), Arasa Maram (*F. Religiosu*), Veppa Maram (*Azadirachta indica*) are observed to be dominating species. Among the faunal Species, Indian grey mongoose (*Herpestes edwardsi*), Rat snake (*Ptyas mucosa*), Russels Viper (*Daboia russelii*) are commonly observed in the Mannur RF areas and surrounding agriculture areas. The common avifauna includes Crows (*Corvus splendens*), Pigeon (*Columba livia*), Cattle egret (*Bulbulcus ibis*), and the mammals includes Rabbit (*Orytolagus cuniculus*), Bat (*Pteropus madius*) and Indian palm squirrel (*Funambulus palmarum*). The observed floral and faunal species in the project area is not coming under critically endangered/ endangered/ vulnerable category as per the IUCN red list.

8. As part of the project preparation work, public consultation (in 2014) was conducted at 3 locations (i. Sriperumbudur, ii. Melnallathur Village and iii. Jaganathapuram Village), the project interventions were detailed to the public/ local communities and the feedback /views from them have been obtained. Accordingly, suitable mitigation measures including realignment options, Sriperumbadur town bypass, Thiruvallur bypass, provision for addition culverts, Junction improvements were proposed. For obtaining Environmental Clearances for the project, one more Public Consultation has been organised in 2018 at two locations (Chengalpattu, Kanchipuram district and Thamaraipakkam, Thiruvallur district), representing the whole CPRR corridor . The suggestions and feedback shared by the public/ community were applicable to entire CPRR. In October2019, during AIIB's due diligence mission, a community consultation with around 50 participants was held at Polivakkam Village where 80 houses would be affected. AIIB explained the Bank's relevant policies and clarified what kind of issues could be addressed within the Project to manage the expectation. AIIB emphasized that the Traffic Management Plan (TMP) should be prepared considering the massive traffic disturbance of the construction. Accordingly the requirement for the TMP has been included in the EMP, the contractor shall hold the responsibility for preparing the same under the guidance of the supervision consultant.

9. Two-tier Grievance Redress Committee (GRC) has been proposed for this project, the affected person shall submit the grievances to the Retired District Revenue Officer (DRO). For environmental related issues, it shall be shared with the Environmental Cell for obtaining suitable measures/ guidance in sorting out the same. The received grievance, shall be redressed in 3 weeks and a written communication shall be sent to the complainant. If the complainant is still not satisfied with the outcome from the first level, he/she can approach the Project Director, CPRR (second level), on acceptance of the grievance it shall be redressed in 3 weeks and a written communication shall be sent to the complainant. If again, the complainant is still not satisfied with the outcome from the second level, he/she can approach the court of law.

10. Some of the significant environmental impacts of the proposed CPRR on the natural environment and nearby communities are discussed in the following section. These impacts could be largely mitigated through engineering design, good construction practices accompanied by site-specific mitigation measures.

11. Significant environmental impacts are anticipated in section 3, due to the removal/cutting of 2,274 avenue trees and impact to the water bodies. However, it has been minimised to the extent by proposing the Thiruvallur Bypass for a length of 15.6km and a realignment section near Sriperumbudur town for a length of 14km. There would be loss of habitat due to tree felling, and an increase in daytime temperature near the newly paved surfaces of the road due to an increase in the surface area of the blacktop of the widened road. This impact shall be mitigated by planting rows of avenue plantations.

12. Air quality along the CPRR alignment (sections 2 and 3) in the settlement locations, and at construction establishments such as batching plants, hot mix plants, crushers, etc. will be adversely impacted temporarily during construction activities. Asphalt plants, crushers, and batching plants shall be sited at least 1 km in the downwind direction from the nearest human settlement. Vehicles delivering loose and fine materials like sand and fine aggregates shall be covered to reduce spills on existing roads. Water will be sprayed on earthworks, temporary haulage, and detour roads regularly. The hot mix plants will be fitted with dust extraction units and cyclones/scrubbers to reduce exhaust gases. The assessed air quality impacts persists till the completion of the construction activities, during the operation stage, as per the air quality modelling and given traffic projection, the air quality in the project area shall improve due to the widening of the corridors as well as with less or no traffic congestion.

13. The noise impacts due to the project will be of significance in both the construction as well as the operation stages. The settlements/ communities abutting CPRR alignment and construction establishments will be adversely affected by an increase in noise level due to operating equipment and construction activities. All mitigation measures such as the use of enclosures, walls, installation of mufflers around noisy equipment; substituting quieter equipment or construction methods; timing of noisier construction and demolition activities; providing Personnel Protective Equipment (PPE) to the workers; locating construction establishments away from sensitive receptors, etc. have been proposed. Similar to the air quality, the assessed noise level impacts persists till the completion of the construction activities, during the operation stage due to the widening of the corridors and with no traffic congestion, the ambient noise level shall be reduced along the section 2 and 3.

14. The project corridor will have a direct impact on the existing flora (Avenue trees) especially in section 3, it is estimated nearly 2,274 avenue trees will be removed and in Section 2, 491 avenue trees will be removed. As a mitigation measure compensatory afforestation shall be done in a ratio of 1:10, hence it is proposed to plant 27,650 trees along the project corridor. As suggested by the SEIAA, based on the tree girth size (<30cm) nearly 414 trees are proposed for transplantation, which shall be carried out in assistance from the forest department.

15. The generated construction waste (such as removed concrete, wood, trees and plants, packaging materials, empty containers,, and other similar items) and hazardous wastes (including oils, lubricants etc.), will be managed through reuse, recycling, and disposal (at designated/approved disposal areas). With the help of Kanchipuram and Thiruvallur Urban Local bodies (ULB's), the construction and solid waste shall be managed.

16. Occupational health and safety impacts can arise from construction and maintenance works. Exposure to the work-related chemical, physical, biological and social hazard is typically intermittent and of short duration, but is likely to reoccur. Potential impacts are negative and long-term but reversible by mitigation measures. Overall, the contractor should comply with IFC EHS General Guidelines in terms of Occupational Health and Safety risks.

17. Manpower will be required during the 36 months construction phase. This can help generate contractual employment and an increase in local revenue. The Contractor shall employ the local labor force to the maximum extent (within the 2-km immediate area if manpower is available).

18. EMP deals with the implementation procedure of the guidelines and mitigation measures are recommended to avoid, minimize and mitigate environmental impacts anticipated during project implementation at various stages namely Pre-construction, Construction and Operation & Maintenance. The implementation of the EMP needs suitable organization set up and the success of any EMP depends on the efficiency of the group responsible for the implementation of the program. For this project, the approach/ standards adopted by the Tamil Nadu Highway Department (TNHD) in implementing the project, the GoI, AIIB, IFC guidelines whichever stringent shall be followed. The EMP given in the bid document will be implemented by the Contractor (Environmental and Safety Engineer) during construction. He/She will make sure that all the project related permissions/consents including the No Objection Certificate (NOC)/ Permissions from the competent authority will be obtained before contractors' mobilization. He/she will be responsible for conducting the environmental monitoring (as per the environmental monitoring plan) and the preparation and submission of the monthly monitoring report to the Supervision Consultantand the PIU who would be responsible for the implementation of the EMP, needs to be trained on environmental issues of specific road development projects. Suitable training programs have been worked out for the project as well as capacity building needs, which shall be conducted by the Supervision Consultant. The program consists of several training modules specific to target groups. Looking into the potential requirements of each of the target groups, several training modules have been planned. The training would cover the basic principles of environmental assessment and mitigation plans; implementation techniques; monitoring and management methods and reporting tools.

19. The environmental management budget has been worked out for the effective implementation of the EMP for a sum of INR **11.39** Crores, which covers various environmental mitigation measures, monitoring of environmental attributes during all the phases of the project.

20. Overall, the major environmental impacts associated with the project are limited to the construction phase and can be mitigated to an acceptable level by implementation of EMP and by best engineering practices. Project benefits far outweigh negative impacts.

1. Introduction

1.1 Project Rationale

21. Chennai Metropolitan Area (CMA) is one of the major metropolitan city in India, the growing population and urban agglomeration has led to an increase in the infrastructure demand including road facilities. The existing road infrastructure does not suffice the purpose of handling increased road traffic/ vehicle volume on day to day basis. The major arterial road network in CMA consists of National Highways (NH 16, NH 716, NH 48 and NH 32) as major radial roads, Inner Ring Road (IRR), Chennai Bypass, and Outer Ring Road (ORR) as ring roads. The implementation of the Chennai Peripheral Ring Road (CPRR) Project is expected to contribute to the further expansion of the Radial-Ring Road Network corresponding to the growing traffic demand.

22. Tamil Nadu Highways Department (TNHD)[3] has identified a tentative alignment for the proposed peripheral ring road. The proposed alignment along with various options was evaluated based on technical and financial viability by the Technical Sub- Committee, Technical Committee and Steering Committee. Based on the evaluation, the CPRR alignment was fixed, approved by the Steering Committee and finalized by the Principal Secretary, Highways and Minor Ports, Government of Tamil Nadu on 09.07.2014. The CPRR is proposed for a length of 133.381km by having 5 sections. The break-up is given as follows

Table 1: Various sections under Chennai Peripheral Ring Road

Section	CPRR Break-up	Length (km)
1.	Northern Port Access Road – Ennore port to Thatchur on NH 16	25.31
2.	Thatchur on NH 16 to Start of Thiruvallur Bypass	26.10
3.	Start of Thiruvallur Bypass to Sriperumbudur on NH 48	30.10
4.	Sriperumbudur on NH 48 to Singaperumal Koil on NH 32	23.80
5.	Singaperumal Koil on NH 32 to Mahabalipuram	27.471

Source: TNHD

1.2 Objectives of the Project

23. The key objective of the project is to address the rapidly increasing road traffic demand in the CMA by constructing CPRR. The Project is expected to improve the connectivity in and around Chennai City by:

- Formulating the Radial-Ring Road Network in CMA in collaboration with other ring roads such as IRR, the Chennai Bypass, and ORR to provide alternate routes for traffic as well as to improve the redundancy of the road network, and
- Providing direct access to Ennore Port and Kattupalli Port from industrial clusters located in suburban areas of CMA to accelerate industrial and economic growth.

[3] TNHD has vast experience in handling road projects funded by Multilateral funding agencies including World Bank , ADB, JICA etc., The Tamil Nadu Road Sector Project (TNRSP) 1 and 2 funded by world Bank is a successful project followed by the Chennai Kanyakumaru Industrial Corridor (CKIC) funded by ADB.

1.3 Project Status

24. Detailed Project Report (DPR) study has been conducted for the entire alignment (comprising of all 5 packages). Based on the study, suitable road designs, structural designs, environmental and social safeguard assessment reports have been prepared along with tentative project estimation.

Figure 1: Proposed CPRR alignment

25. Out of 5 sections, section 1 will be implemented with financial assistance from the Japan International Cooperation Agency (JICA), the DPR for that section has been scrutinised and finalised by the JICA. Section 2 and 3 are proposed to be implemented under financial assistance from the Asian Infrastructure Investment Bank (AIIB). The implementation of Section 4 of the CPRR has been completed by the TNRIDC[4] under the state fund. The remaining section 5 of the CPRR will be developed later.

26. As indicated, the TNHD has decided to opt for the loan from the AIIB for the development of sections 2 and 3 of the proposed CPRR. Accordingly, as per the prevailing policies of the AIIB, all the project documents are prepared in line with the AIIB requirement.

1.4 Purpose of Environmental Impact Assessment (EIA)

27. As per the AIIB's Environmental and Social Framework (ESF) this project has been assigned as a category "A" project, due the anticipated impacts are significantly adverse, irreversible, cumulative and mandates for the preparation of the Environmental Impact Assessment (EIA) Report including Environmental Management Plan (EMP). Accordingly, detailed assessments of the environmental impacts have been carried out following a suitable methodology. In this EIA, the environmental impacts due to the project, concerning construction-related environmental impacts, infringements with natural habitats and places of cultural heritage also in the context of 'chance-find', are covered. The findings of EIA will guide the effective development of the specific EMP and appropriately facilitate the implementation of safeguard measures. The specific objectives of EIA are given under:

1.4.1 The objective of the EIA

28. As per the requirement of the AIIB's ESF, the EIA has been performed for the proposed CPRR project with the following objectives:

- To collect the baseline data on the physical, biological and socio-economic conditions of the project area using primary as well as secondary sources.
- To carry out the environmental assessment, including the supporting administrative and legal frameworks applicable to the proposed CPRR project.
- To identify mitigation measures for the potential environmental impacts
- To prepare the specific EMP.
- To propose institutional responsibilities and methods of monitoring the mitigation measures and monitoring procedures.
- To prepare an indicative cost estimate for implementation of EMP

1.4.2 The methodology for conducting EIA study

29. To identify the environmental issues arising out of the current practices adopted for planning, design, and construction of the proposed CPRR, the environmental conditions along the CPRR proposed alignment was assessed. During the visits, consultations through group discussions with local communities, road users and panchayat/ village members were

[4] Tamil Nadu Road Infrastructure Development Corporation (TNRIDC) was established to formulate, undertake, implement upgrade and maintain the road infrastructure in the state of Tamil Nadu under any plan, programme, and scheme of the state as per the direction of Government of Tamil Nadu (GoTN).

contacted to understand their perceptions and needs. A standard methodology was adopted for fulfilling the EIA requirements; key features/tasks of the methodology are detailed as follows:

Task 1 Field Reconnaissance Survey and Review of Earlier Studies

30. The field reconnaissance survey was carried out on 8th January 2020 to understand the salient environmental and social features that are likely to cause adverse impacts, sensitive environmental and social issues vis-a-vis proposed project interventions. Experience of EIA study, as well as the implementation of EMP, was also taken into account from the earlier Roads and Highways project.

Task 2: Review and Assessment of Applicable Environmental Regulations

31. Various rules/regulations and guidelines applicable to the project roads vis-à-vis center (GoI), state (GoTN) statutory requirements and AIIB's ESF were reviewed and referred to for assessing current environmental impacts that are likely to emanate.

Task 3: Delineation of Study Area for Assessment

32. In road projects, while the influence area may vary vis-a-vis size of the road, location of the road, type of road, etc., hence, the study area was fixed based on the proposed interventions including the road sections undergoing new formation/ greenfield road sections, widening and strengthening (for the existing road section), RoW availability, structural works (culverts and bridges), presence of sensitive areas etc., to assess the direct impacts - Corridor of Impact i.e. proposed Right of Way (60m). In addition to this, the project influence area of 10 km on either side of road for impact assessment is also considered to understand direct or indirect impacts by the project activities during construction such as Hot Mix plants, sand quarries, source of raw material and material transport, etc.

Task 4: Assessment of Baseline Environmental and Social Conditions

33. This task comprises a collection of baseline data for the project road locations primarily on physical, biological and socio-economic conditions. The secondary source[5] of information was utilised for giving a generic snapshot of socio environment features. Also, existing environmental and social quality/features along the proposed CPRR was assessed based on a walk-through survey, public consultations, Focus Group Discussions (FGDs) and discussions with line department officials.

Task 5: Public Consultations/ Focus Group Discussions

34. Public consultations/ meetings were conducted at Sriperumbudur, Melnallathur Village and Panchetty Village on 31st July 2014 and at Chengalpattu (Kanchepuram District) and Thamaraipakkam (Thiruvallur District) on 10th to 12th July 2018 to understand the people's perception about the project as well as their issues and concerns. Overall project features,

[5] Secondary source of information for various socio-economic parameters were collected from government departments like Census of India, Department of Industries, Department of Economics and Statistics, Department of Agriculture, Directorate of Settlements and Land Records etc. This helped to understand the socio-economic profile of the project area with respect to indicators like population growth rate, literacy rate, work force participation rate (WFPR) etc. in comparison with the project districts and Tamil Nadu state.

environmental and social safeguards, and enhancement measures would be implemented in the project was also discussed with the public/ community. In October 2019, during an AIIB visit, a community consultation has been conducted at Polivakkam village, where 80 houses would be affected. Details of the consultations are given on the chapter 5.

Task 6: Prediction of Environmental Impacts (including social impacts)

35. The task identified likely impacts that would arise due to the construction of the proposed CPRR, through changes in the physical, biological or socio-economic environment. The assessment considered both positive and negative impacts at different stages of implementation, i.e. pre-construction, construction and operation stages.

Task 7: Preparation of Environment Management Plan (EMP)

36. A comprehensive Environmental Management Plan (EMP) was prepared which includes mitigation measures to avoid, reduce, mitigate, or compensate for all the identified negative impacts and enhancement measures for positive impacts, with related institutional arrangement, implementation schedule and cost estimates provided.

Task 8: Preparation of Environmental Management Budget

37. Based on the impact assessment for the environmental components, a suitable budget of INR 11.39 Crores has been estimated to compensate for the temporary and permanent impacts that are likely during the project implementation. The budget also includes compensatory afforestation measures for the loss of avenue trees due to road widening.

Task 9: Environmental Safeguard Clauses in the Bid Document

38. Suitable safeguard clauses have been prepared based on the EIA, the prepared clauses shall form part of the bid document either in the General condition or Specific conditions of the contract agreement/ bid document. The prepared EMP shall also be part of the bid document.

1.5 Structure of EIA Document

39. EIA report has been structured under various headings/subheadings and titles as depicted in the table below

Chapter 1- Introduction	:	briefs the Project rationale, Objective of the project, the project status of the project and the purpose of conducting the Environmental Impact Assessment
Chapter 2- Project Description	:	The road inventory for sections 2 and 3 has been discussed in detail. The proposed project interventions are also been discussed with facts and figures
Chapter 3- Legal Policy Framework	:	The applicable Government of India and Tamil Nadu State regulatory requirements for this project has been discussed along with necessary clearance to be obtained by the contractor has been detailed.

Chapter 4- Description of the Environment	:	The environmental baseline condition for various environs namely Physical, Biological and Social conditions has been detailed for the project area
Chapter 5- Grievance Redress Mechanism	:	The GRM proposed for this project along with the roles and responsibilities of the GRM members are discussed in detail
Chapter 6- Analysis of Potential Environmental Impact and Mitigation Measure	:	Various anticipated impacts during the project implementation have been discussed along with suitable mitigation measures
Chapter 7- Stakeholder Consultation and Information Disclosure	:	Public consultations conducted at the various locations along the section 2 and 3 have been detailed. The process of the consultation and the feedback obtained from the participants are discussed in this chapter
Chapter 8- Environmental Management Plan (Including Capacity Building and EMP Budget)	:	For the identified Environmental Impacts, suitable management/ mitigation measures have been provided to minimise the impacts with roles and responsibilities for implementing the same Various training modules for environmental awareness and EMP implementation has been discussed A suitable budget provision has been estimated based on the prepared EMP
Chapter 9 – Conclusion and Recommendations	:	Based on the conducted environmental assessment and its finding, a suitable conclusion chapter along with recommendations has been detailed

2. Project Description

40. This chapter details the project description for sections 2 and 3 of the proposed CPRR. The description includes the project location, the existing condition of the roads, analysis of alternatives adopted in finalising the road alignment and the proposed road interventions. This chapter also includes various methodologies adopted for conducting Engineering Survey and Investigations.

2.1 CPRR Section 2 (Thatchur on NH 16 to Start of Thiruvallur Bypass)

2.1.1 Location and Description of the Project Road

41. Section 2 is proposed to be a new alignment (Greenfield road) from km 21/100 of NH 16 near Thatchur to km 47/800 of SH 57 near Kizhanoor Village. The length of the section is 26.70 km. The alignment crosses SH 51 at km 29/100, SH 50A at km 37/200 and SH 57 at km 47/700. The proposed alignment traverses almost parallel to the SH 57 (km 41/100 to km 50/100 (some section of the road falls under section 3)) for a km of nearly 9.3 km. To avoid social impacts, the new alignment is proposed behind the settlements, it starts from the Velliyur village and ends at Ikkadu Kandigai village.

Figure 2: Section 2 Alignment Map

42. Section 2 will have 6-lane with paved shoulder carriageway with a 2-lane service road on both sides. The proposed right of way is 60m. Underpasses are proposed at important junctions and built-up sections. There are 3 vehicular underpasses and 8 light vehicular underpasses and 25 vehicular underpasses are proposed in this section. Section 2 crosses the Kosathalaiyar River (km 36/900) near Thamaraipakkam.

Section 2 start point at km 21/100 (NH 16)

Section 2 endpoint at km 47/300

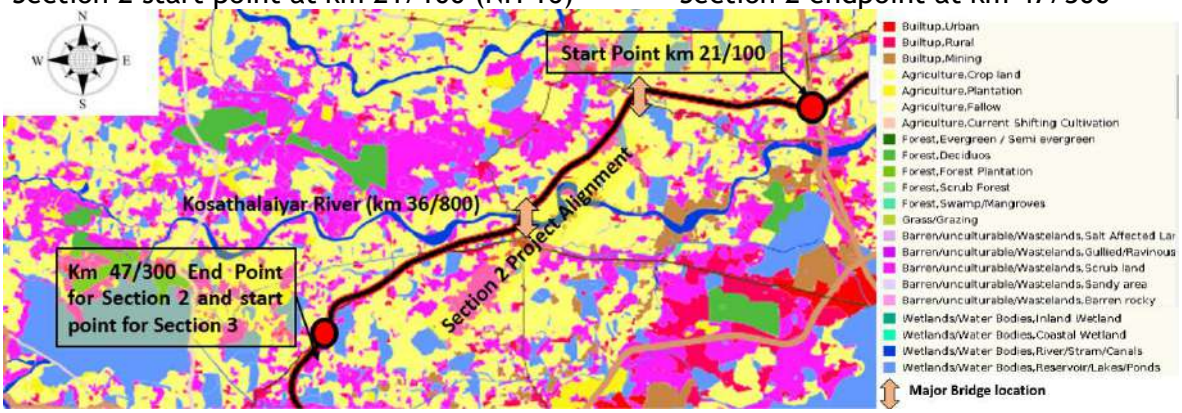


Figure 3: Land Use Map Along with Major Bridge Locations in the Section 2

43. There are 3 major bridges and 7 minor bridges and a VUP cum major bridge has been proposed in this section. Section 2 is developed as an access-controlled facility, entry/exit ramps from the service road to the main carriageway are proposed on both sides of the project road. This section is passing entirely through Thiruvallur district covering two taluks of Thiruvallur and Uthukottai passing nearly 15 villages along the project section.

2.1.2 Existing Condition of the New Alignment

44. As indicated in the earlier sections, the proposed alignment is Greenfield road, which is planned to avoid major social impacts like demolishing or rebuilding of any existing structures. The entire alignment traverses through agriculture land on either side from the proposed alignment (centreline).

View of Paddy field at km 42/200

View of Paddy field at km 47/300

2.2 CPRR Section 3 (Start of Thiruvallur Bypass to Sriperumbudur on NH 48)

2.2.1 Location and Description of the Project Road

45. Section 3 starts at km 47/800 of SH-57 i.e. start of Thiruvallur bypass and ends at km 76/900 of NH-16 in Sriperumbudur. The total length of this section is 30.1km out of which nearly 9.3km is the improvement of existing SH-57 and the remaining length is a new alignment. A bypass is proposed for Thiruvallur town and 2 realignment sections are proposed for Thodukkadu village and Sriperumbudur town.

- Thiruvallur bypass starts at km 47/800 of SH-57, crosses NH-205 at km 54/400 and SH-50 at km 57/700 and ends at km 62/900 of SH-57. The length of this bypass will be around 15.6 km. Being a Greenfield road, the Thiruvallur Bypass traverses mostly on the agricultural fields.
- The realignment of Thodukkadu village is from km 71/400 to km 74/300 of SH-57, for a length of 2.9 km.
- To avoid the built-up area of Sriperumbudur town, a new realignment is proposed along the Sriperumbudur tank bund from km 75/200 of SH-57 to km 76/900 of NH-4, for a length of 1.7 km

Figure 4: Section 3 Alignment Map

46. Section 3 will have 6-lane with paved shoulder carriageway with 2-lane service road on both sides. The proposed right of way is 60m. Cloverleaf type interchanges are proposed for NH-205 junction at km 54/300 and NH4 junction at km 77/000. Underpasses are proposed at important junctions and built-up sections. There are 6 vehicular underpasses and 5 light vehicular underpass proposed in this section. The project corridor crosses the Chennai-Arakonam Railway line, for which a new RoB is proposed at km 55/438. The project corridor crosses Coovam River near Thiruvallur, for which a major bridge is proposed at km 57/538.

47. There are 2 major bridges, one ROB and 7 minor bridges proposed in this section. Section 3 is proposed to develop as an access-controlled facility, hence entry/exit ramps from Service road to the Main carriageway are proposed on both sides of the project road. Section 3 is passing through two districts namely Kanchipuram and Thiruvallur. The road transverses through Sriperumpudur, and Thiruvallur Taluks and covers 11 settlements. The pattern

observed was predominantly agricultural fields all along the road with few commercial establishments.

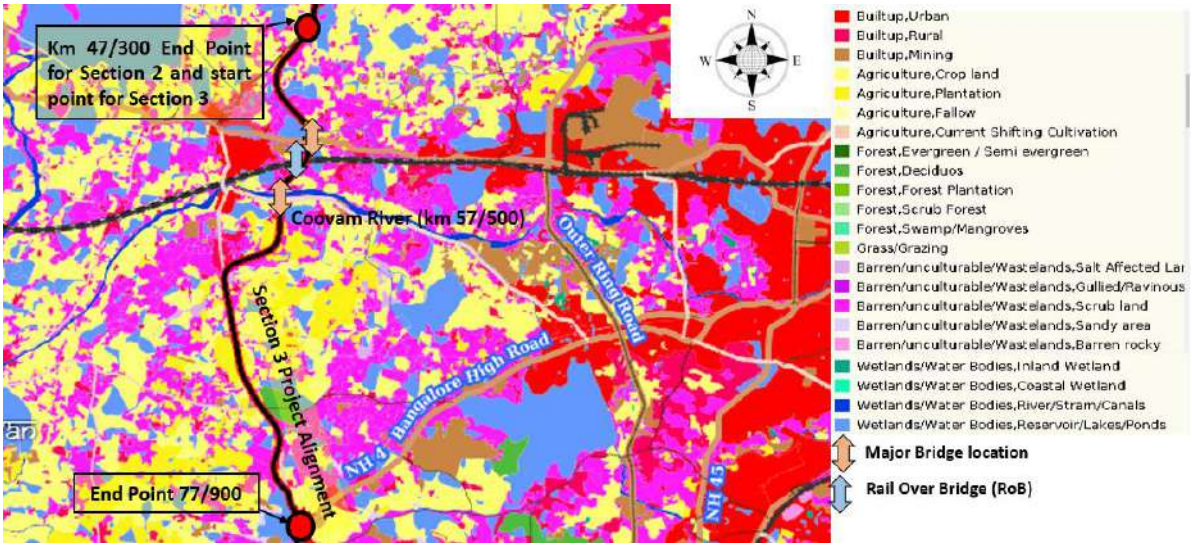


Figure 5: Land Use Map Along with Major Bridge Locations in the Section 3

Section 3 start point at km 47/300

Section 3 endpoint at km 76/900 (NH 48)

2.2.2 Existing Condition and Need for the Improvement

48. Section 3 has a combination of Greenfield corridor as well as widening and strengthening of the existing corridor (SH 57). The bypass section for Thiruvallur town starts at the km 47/800 and ends at km 62/900 in the SH 57. The entire alignment traverses the agriculture field. At km 53/700, the alignment crosses Krishna water Channel and NH 716 at km 54/400, where a major intersection (Cloverleaf) is proposed.

Krishna Water Channel crossing at km 53/700

Cloverleaf intersection at km 54/400

49. The construction of the intersection may have an impact on Ramapuram Lake, which is located at km 54/600. The alignment crosses the Chennai-Arakonam Railway line at km 55/400 for which a ROB has been proposed.

Ramapuram Lake located at km 54/600

View of an ongoing ROB construction (700m away from the proposed ROB km 55/400)

50. The project alignment crosses few settlements in the bypass section starting from km 55/400 to 56/300, it crosses Coovam River at km 57/500 for which a major bridge has been proposed. The bypass alignment gets terminated after merging with the existing State Highways 57 at km 62/900. The proposed alignment for Section 3 follows the existing SH 57 from km 62/900 to km 71/600 and 74/200 to 75/200, totaling a length of 9.6km. In this section, major impacts are anticipated to the avenue trees and seasonal water bodies. There are settlements scattered along the SH 57, including commercial and educational institutions. Some of the automobile spares manufacturing industries are also located along the SH 57.

Coovum River Crossing at km 57/500

Presence of a seasonal water body (km 63/300)

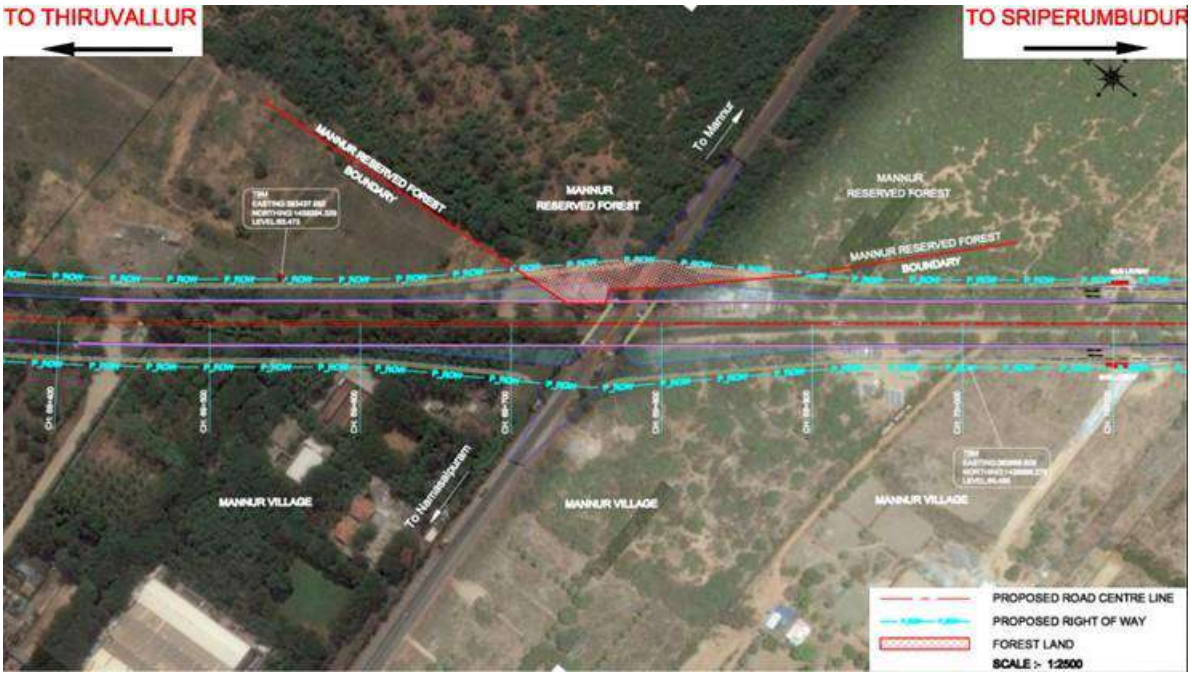
Petrol filling station located at km 64/100

St. Joseph Higher Secondary School at km 64/600

Avenue trees located at Km 67/600

Avenue trees located at Km 71/500

51. The section 3 alignment crosses Mannur Reserve Forest at 69/700, due to the widening of the existing SH 57, an area of 0.28ha of forest land is proposed to be acquired, for which the provisions as per the Forest Act shall be adopted. At km 71/400, a realignment section starts to bypass the Thodukkadu village, the realignment is proposed for a length of 2.9km. The realignment sections merge with the SH 57 at km 74/300.



Superimpose of the proposed alignment over the Manndur RF

52. Another realignment section has been proposed from km 74/200 to km 75/200 to bypass the Sriperumbudur town, it is proposed for a length of 1.7km and it traverses through the Sriperumbudur tank bund and reaches at NH 48 at km 76/900 (endpoint for section 3), where the intersection has been proposed.

2.3 Analysis of Alternatives

53. **Section 2**. As per the original alignment plan formulated by the TNHD, the settlement areas namely Vengal, Vadamadurai, Periyapalayam, and Puduvoyal will have significant social impacts (damage to the structures). As an alternative, a new alignment plan was formulated by avoiding the settlement areas. Being a Greenfield alignment, it has been designed to traverse behind the settlement areas in Velliyur and Tamaripakkam, by doing so the anticipated social impacts are very much reduced (demolishing the structures). The necessity for the Vengal bypass road, as well as Vadamadurai bypass road, are no longer necessary.

Figure 6: Alternative alignment study for section 2

54. **Section 3**. As per the original alignment plan formulated by the TNHD, Section 3 will follow nearly 80% of the SH 57 (existing State Highway). Due to this, the settlement areas namely Thirvallur, Kakkalur, Manavalangar, and Melnallathur industrial area will have a significant impact (damage to the structures). As an alternative, a new alignment plan was formulated by avoiding the settlement areas. Out of 30.1km, the proposed alternate alignment will have 20km Greenfield road, which is designed to traverse behind the settlement areas. It is also proposed to have a Thiruvallur bypass (to avoid Thiruvallur town) and 2 realignment sections at Thodukadu Village and Sriperumbadur Town to avoid major social impacts (damage to the structures). The proposed alignment also saves nearly 8,500 avenue trees (located along the SH 114) and significant numbers of road side water bodies, as per the economic analysis, the proposed new alignment plan is more economically viable than the original alignment plan.

Figure 7: Alternative alignment study for section 3

Table 2: Comparison of Positive and Negative Impacts of 'With' and 'Without' Project Scenario

With Project		Without Project	
Impacts		Impacts	
Positive	Negative	Positive	Negative
• The traffic congestion due to obstructed movement of vehicles will be minimized and thus exhaust emission will be reduced. • Better access to other part of Chennai. • Providing better level of service in terms of improved riding quality and smooth traffic flow.	• Minor change in topography is expected due to strengthening of embankments for Sriperumbudur lake and other water bodies along the section 2 and 3. • Minor changes in land use pattern. • Being a Greenfield corridor, moderate loss to properties and livelihood.	Nil	• Increase in travel time. • . • Increase in fuel consumptions. • Increase in dust pollution and exhausted emission. • Increase in accident rate. • Overall economy of Chennai will be affected.
• The design speed ranges between 80 to 100kmph and it is designed as access control road • Being an access control road, the accident rate will be very less/ insignificant	Nil	Nil	• The average speed is around 50 to 60kmph • Due to lack of road safety aspects, chances for accidents are more/ high.
All weather access reliability.	• Removal of vegetative cover along the road at selected locations and loss of trees. • Impacts of flora and fauna. • Diversion of 0.28ha Mannur RF forest land.	Nil	Increase in accidents.
Segregation of local and through traffic by the provision of bypasses or realignment will greatly relieve congestion.	Nil	Nil	Congestion In urban areas due to mixing of local, pedestrian and through traffic

With Project		Without Project	
Provision of Vehicular underpasses (VUP's) to provide safety for the road users from accidents	Nil	Nil	Frequent road accidents are a major concern
Service road has been provided besides pedestrian (zebra) crossings and Vehicular underpasses	Nil	Nil	Pedestrian safety is an issue of major concern especially along the settlements and congested sections
Employment to local workers during the execution of the project.	Nil	Nil	Arrest of possible significant enhancement and economic development of Chennai.
• Better access to health care centres and other social services. • Improved quality of life.	Nil	Nil	• Land degradation, dust pollution and damage to pastureland, contamination in water bodies due to vehicles travelling on the open ground. • Deep impact to human health in case of emergency.
Strengthening of local economies.	Nil	Nil	In absence of the project, it is extremely difficult to generate funds for such a massive improvement of the road infrastructure from its own resources.
Well connected to the industrial hubs/ estates for export of goods through the existing port facility	Nil	Nil	Port traffic is allowed in the night time to reduce the city traffic congestion and accidents
Provision of proper road markings, zebra crossings, service roads, crash barriers and improvement of geometry to reduce accidents	Nil	Nil	Accident incidents shall rise with an increased traffic volume
• Reduction in travel time for the transportation vehicles to reach Ennore and Kattupalli ports located in Chennai. • The corridor can operate 24 hours for Port Traffic	Nil	Nil	Affect the development of the area.
Besides tree plantation/ tree transplantation and provision of enhancement features shall not only provide aesthetics but also improve the quality of air	Nil	Nil	Poor environmental quality due to congestion and high emission levels because of slow movement of traffic in the existing road. A further deterioration

With Project		Without Project	
			in air quality is expected due to Increase in traffic volumes and further congestion
Drainage will be improved due to reconstruction of culverts / bridges with adequate hydraulics	Nil	Nil	These issues remain unaddressed without the project
Enhancement of community and cultural properties and also water bodies in an aesthetic manner.	Nil	Nil	No enhancement measures involved.
Higher potential for development due to improvement in access and consequent increase in connectivity	Nil	Nil	Developmental activities will be greatly hampered by the gross inadequacy of infrastructure

2.4 Engineering Surveys and Investigations

55. Methodology framed for the Engineering Surveys and Investigations are in line with the standard procedure (including the IRC). The methodology adopted for different tasks is discussed in this section.

- Detailed reconnaissance.
- Collection and review of secondary data.
- Inventory and condition survey of existing roads and structures.
- Detailed topographical survey.
- Traffic studies including axle load surveys.
- Pavement investigations.
- Sub-grade characteristics.

2.4.1 Reconnaissance Survey

56. The ground reconnaissance was undertaken on the section 2 and 3. The primary tasks of the reconnaissance surveys include,

- Topographical features of the area;
- Typical physical features along the existing alignment within and outside ROW i.e. land use pattern;
- Possible alignment alternatives, vis-à-vis, scheme for the construction of service lanes parallel to the proposed alignment;
- Realignment requirements including the provision of bypasses, ROBs / Flyovers and viaduct for pedestrian crossings with possible alignment alternatives;
- Preliminary identification of improvement requirements including treatments and measures needed for the crossroads;
- Traffic pattern and preliminary identification of traffic homogenous links;
- Sections through congested areas;
- Inventory of major aspects including land width, terrain, pavement type, carriageway type, bridges and structures (type, size and location), intersections (type, crossroad category, location) urban areas (location, extent), geologically sensitive areas, environmental features;
- Critical areas requiring detailed investigations; and
- Requirements for carrying out supplementary investigations.
- Drainage conditions
- Type and extent of existing utility services along the alignment (within ROW).

57. The data derived from the reconnaissance surveys were utilized for planning and programming the detailed surveys and investigations. All field studies, including the traffic surveys, were undertaken on the basis of information derived from the reconnaissance surveys.

2.4.2 Collection and Review of Secondary Data

58. The secondary data required for the development of study has been collected from various sources primarily from the Government/planning organizations. The secondary data includes:

- Climate;
- Road inventory;
- Road condition, year of original construction, year and type of major maintenance/rehabilitation works; TN RMS data in the available station will also be shared;
- Condition of bridges and cross-drainage structures;
- Sub-surface and geo-technical data for existing bridges;
- Hydraulic data, drawings and details of existing bridges;
- Detailed of sanctioned / on-going works;
- Survey and evaluation of locally available construction materials;
- Historical data on classified traffic volume;
- Available origin-destination and commodity movement characteristics;
- Available speed and delay characteristics;
- Available commodity-wise traffic volume;
- Accident statistics;
- Available vehicle loading behaviour (axle load spectrum);
- Type and location of existing utility services (e.g. Fibre Optical Cable, O/H and U/G Electric line, EB poles, Transformers, Telephone line, Water mains, Sewer, Trees, Water tanks, Taps etc.); and
- Environmental setting and social baseline of the project roads.

2.4.3 Field Surveys and Investigations

59. The field surveys and investigations has been carried out as outlined in IRC SP: 19-2001, IRC SP-54 and other relevant IS and IRC code provisions. The following are the field surveys and investigations for the project.

Table 3: Field Survey and Investigation

Sl.no	Surveys	Approach
1.	Topographical Surveys	The objective of the topographic survey is to collect the essential ground features along the project corridors. The data collected will be useful for the detailed design and for the computation of quantities. The topographic survey work consists of reconnaissance survey, establishing DGPS points, fixing of BM pillars, horizontal traversing, vertical traversing, levelling and detailed topographical survey to capture all details, preparation of drawing and submission
2.	Traffic Surveys	The necessary traffic surveys such as classified traffic volume counts, origin-destination and commodity movement surveys, Axle load surveys, speed-delay surveys, pedestrian counts, Parking surveys, passenger opinion and bus route network surveys has been carried out at the locations approved by TNHD, in accordance with the IRC guidelines and requirements (Refer Section 2.4).

Sl.no	Surveys	Approach
3.	Road and Pavement investigations	**Road inventory** survey of the existing road stretches was carried out. The objective of the road inventory survey is to assess the potential capacity of the road section. The information on road characteristics has been collected by physical measurement and visual evaluation. Team of Engineers have traverse the road sections with a specified format (given in Proforma) for the purpose of recording the data. The collected data was compiled in tabular statement. The database has been used in developing the base year road configuration, facilitating both qualitative and quantitative evaluation of the present sufficiency of roads Detailed **pavement condition** survey has been carried out using Advance Data Collection Equipment (ADCE) supplemented by actual measurements and in accordance with the widely accepted methodology to meet the study requirements
4.	Investigations for Bridges and Structures	Inventory and condition survey of all the existing structures like bridges, ROB's, etc., along the project stretch has been carried out. The data collected include type of existing superstructure, substructure and foundation, span and dimensions of existing bridge, hydraulic particulars like HFL, scour around piers, etc., river protection works, etc
5.	Material Survey	The information about existing stone Quarries, Moorrum Quarries/ Borrow pits, Sand Quarries, Manufactured / Crushed Sand Manufacturing Crushers, Water Sources, Bitumen Manufacturing Refineries and Petrochemicals, Solid Blocks / RCC Hume Pipe Manufacturing Industries, Cement Manufacturing Industries and other construction material sources has been collected from local PWD Divisional Offices and Sub divisional Offices, local Construction Contractors and local material suppliers throughout the project area, from other sources and also from direct observation through site Visits

2.5 Traffic Study

60. For the formulation of the design, the following traffic surveys were carried out in the project area.

- Classified Traffic Volume Count Survey - 9 locations
- Turning Movement Survey - 7 locations
- Origin-Destination & Commodity movement Survey- 15 locations
- Axle Load Survey - 6 locations
- Pedestrian Count Survey - 6 locations
- Speed and Delay Survey
- Truck Terminal survey - 1 location

61. Analysis of the traffic survey data brings out the Annual Average Daily Traffic (AADT) of existing roads in the project area, peak hour turning movement of existing junctions, traffic characteristics and movement pattern along the project corridor, pedestrian movements in the project locations, vehicle loading characteristics and existing speed-delay characteristics on the project area and requirement of truck parking facility.

62. The AADT of NH 16 and NH 48 are more than 50000 PCU and AADT in the stretch of SH-57 from NH-32 to NH-716, SH-50, NH-716, SH-50A and SH-51 are more than 10000 PCU. Peak

hour share is 5.5% to 6.7% and the peak hour is identified during morning and evening hours. It is observed that a significant movement of freight traffic takes place during night and early morning. The passenger traffic movement takes place during day time.

63. The expected traffic, which is mainly diverted traffic was identified which is 19000 PCU/day in Section 2 & 35000 PCU/day in Section 3. Considering various factors, only 5% of generated traffic has been considered for the first 5 years after the construction of the project. The traffic projection is made for the next 25 years (up to the year 2043). Traffic growth rate identified by the transport demand elasticity method for most likely scenario is given below.

Year	Two Wheeler	Passenger Auto	Car/Jeep	Bus	LCV	2 & 3 Axle Trucks	MAV
2018-2023	8.43%	5.00%	8.22%	5.00%	11.79%	6.59%	5.60%
2023-2028	7.59%	5.00%	7.40%	5.00%	10.61%	5.93%	5.04%
2028-2033	6.83%	3.89%	6.66%	4.05%	9.55%	5.34%	4.53%
2033-2038	6.15%	3.50%	5.99%	3.64%	8.59%	4.81%	4.08%
2038-2043	5.53%	3.15%	5.39%	3.28%	7.73%	4.33%	3.67%

64. The traffic projection is made for the next 25 years (up to the year 2043). The expected traffic, which is mainly diverted traffic, in each project section was identified from the combined O-D matrices. Considering various factors, 5% generated traffic has been considered for all the sections of the proposed Peripheral road for the first 5 years after the construction of the project. Even though the traffic requires more lanes in each section, considering the presence & proximity of Chennai Outer Ring Road (CORR) and Chennai Bypass and their influence on the projected traffic volumes, Steering Committee suggested restricting the number of lanes to 2 x 3 lane with paved shoulder (same as CORR).

2.6 Proposed Design Interventions (common for Section 2 and 3)

65. These sections comprise of 6-lane with paved shoulder carriageway and 2-lane service road with 3m wide footpath-cum-drain on both sides. The proposed Right of Way is 60m. The typical cross-section comprises of following elements:

- Main Carriageway - 10.5m wide, each side
- Paved Shoulder - 2.5m wide, each side
- Central Median – 8.5m wide with 0.5m wide shy away on both sides
- The divider between MCW and SR – 1.75m wide, each side
- Service Road - 7.0m wide, each side
- Shy away - 0.25m wide adjacent to the kerb, each side
- Footpath-cum-drain & utility corridor - 3.0m wide, on-road boundary side

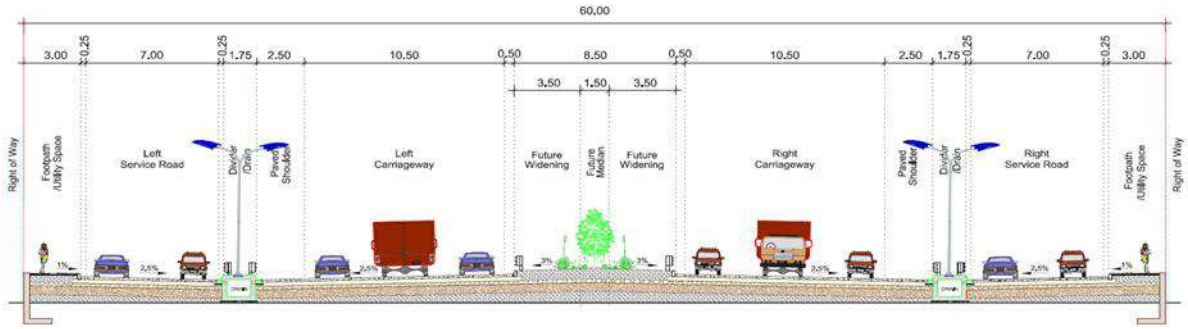


Figure 8: Proposed Cross section for Section 2 and Section 3

2.6.1 Vehicular Underpass

66. Based on the settlements and the local access road crossings, it is proposed to have 3 vehicular underpasses and 8 light vehicular underpasses for Section 2 and 6 vehicular underpasses and 5 light vehicular underpasses for Section 3. The typical cross-section for the proposed VUP is depicted in **Figure 9**.

Project Section	Vehicular Underpass	Light Vehicular Underpass	SVUP
Section 2	3	8	2
Section 3	6	5	2

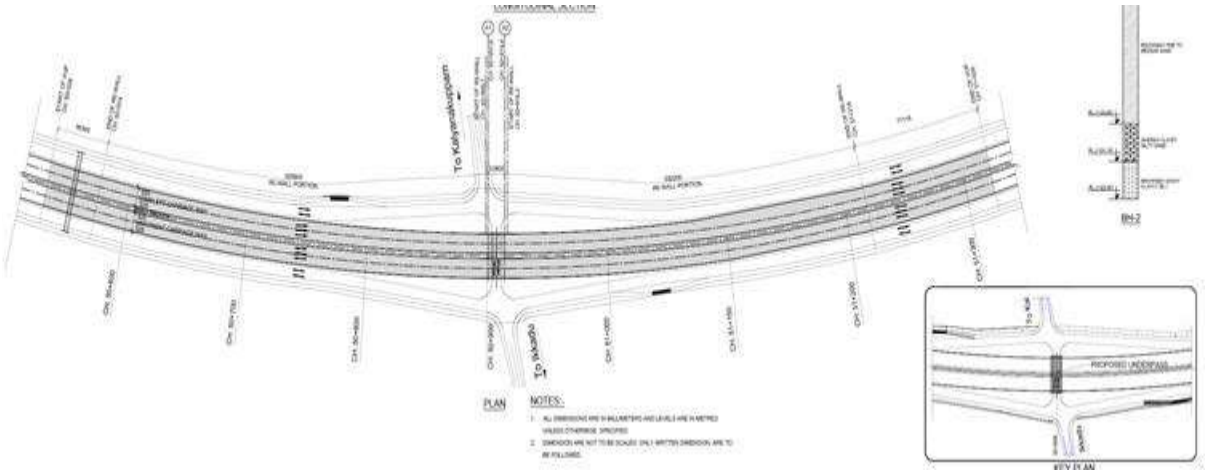


Figure 9: Vehicular Underpass proposed at km 50/908

2.6.2 Drain facility

67. Design of surface and sub-surface drains is carried out following IRC: SP: 87-2013 and IRC: SP: 42-1994. As per Flood Estimation Report for Coast Region of Central Water Commission, 25-years 24-hour rainfall in the project area is 300mm and 50 years 24-hour rainfall is 320 mm. considering the minor difference, 320mm rainfall is considered in the project for designing the drain facility. RCC rectangular covered drain is proposed for sections 2 and 3 with an inner width of 1.2m and a clear depth of 1.5m. As the CD structures are proposed in close intervals, the length of this drain varies between 150m to 250m. Box culverts are also proposed along the sections 2 and 3. It is proposed to have 100 box culverts and 4 double vent box culverts for section 2 and 97 box culverts and 61 pipe culverts for section 3.

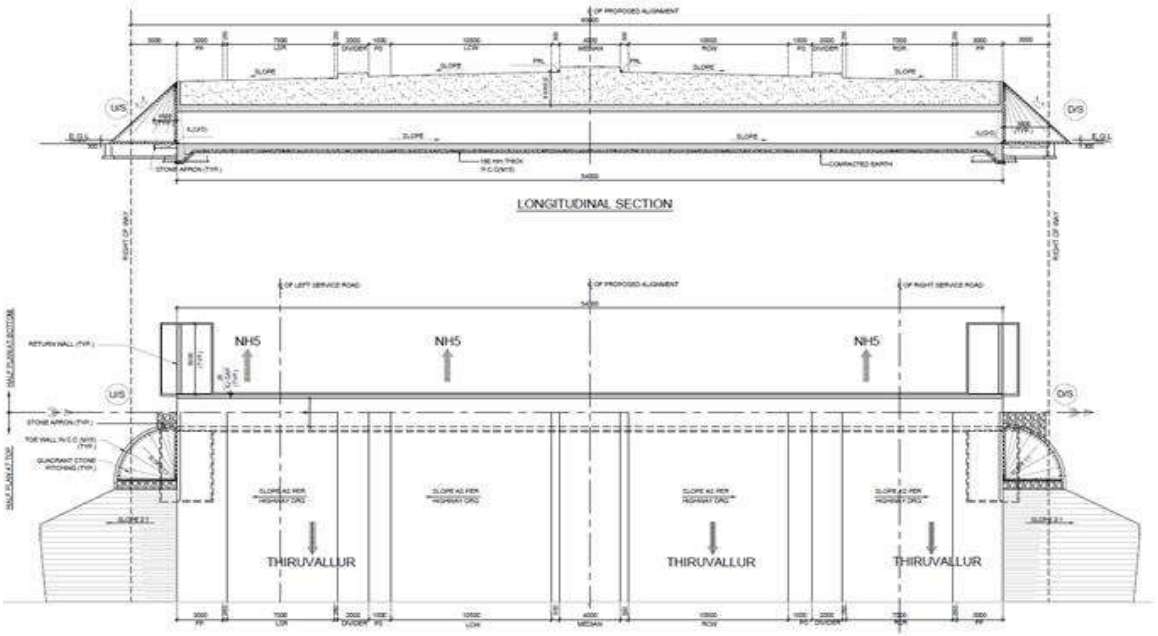


Figure 10: CD Structure (Box Culvert) Proposed at km 34/133

2.6.3 Major and Minor Bridges

68. It is proposed to construct 9 bridges in section 2, out of which 1VUP cum major bridge is proposed at surface water body crossings (km 29/172 (Kanigaipair surplus water outlet) and km 36/866 (Kosasthalaiyar River)) and 7 minor bridges at existing road crossings. For section 3, it is proposed to have 9 bridges of which 2 major bridges are located at km 54/300 (National Highway Crossing), km 57/537 (Coovum River crossing), and a Rail over Bridge (RoB) at km 55/438 and 7 minor bridges at existing road crossings.

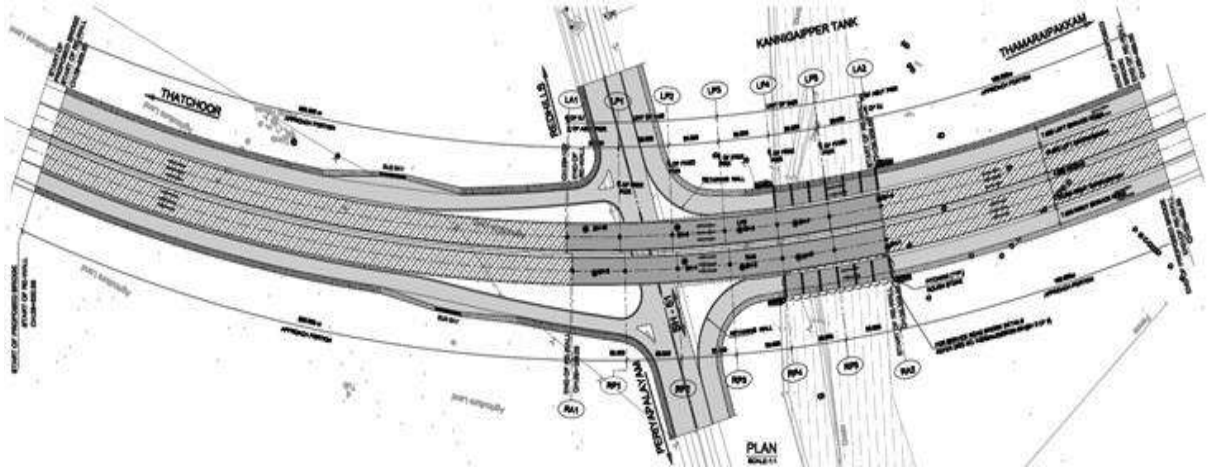


Figure 11: Major Bridge proposed at km 29/200

Table 4: Minor Bridges in Section 2 and Section 3

Sl.no	Sector	Type of Bridge	Chainage	Location
1.	Section 2	Minor Bridge	23/630	Natham Lake
			26/522	Kannigaipair canal
			29/332	Poorivakkam Lake
			34/170	Athagai kavanoor lake
			34/410	Athagai kavanoor Canal

Sl.no	Sector	Type of Bridge	Chainage	Location
			37/390	Ammanapakkam Canal
			42/350	Karikalavakkam kulam
			44/135	Kilanoor oodai
			46/630	Kilanoor Pond
2.	Section 3	Minor Bridge	50/206	Ikkadu lake
			51/602	Kalyanakupam Lake
			53/790	Krishna Canal
			58/335	Aranyoal Tank
			63/357	Athikulam Tank and Canal
			65/150	Chathram canal
			73/864	Polivakkam Surplus canal

Source: DPR, TNRIDC

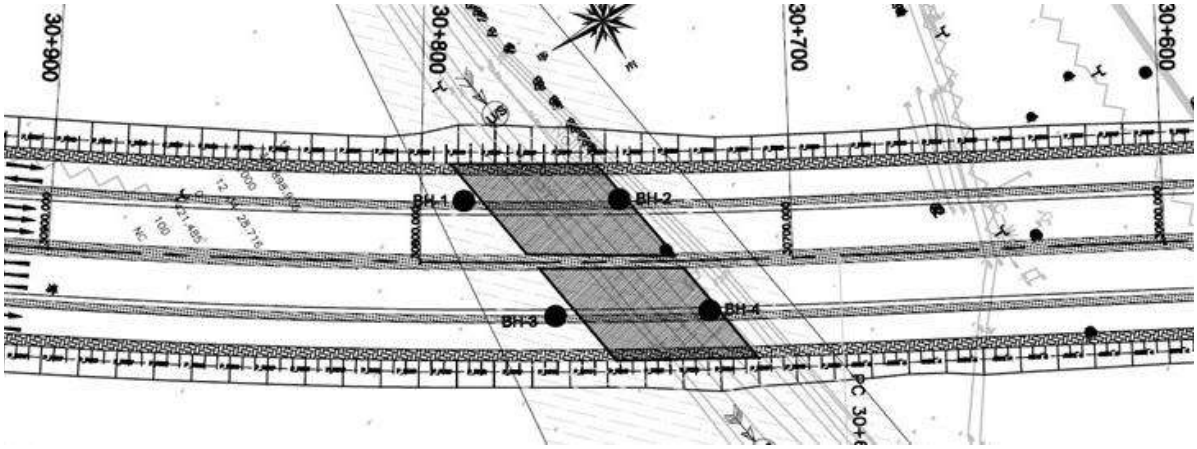


Figure 12: Minor Bridge proposed at km 30/750

2.6.4 Interchanges

69. Cloverleaf Interchange is proposed at the locations, where the alignment crosses the National Highways (NH). Since there are no NH crossings in section 2, the proposal for the interchanges does not envisage. For section 3 it crosses NH 48 (km 54/300) and NH 716 (km 77/000). The proposed interchange design is as per the Steering Committee recommendations.

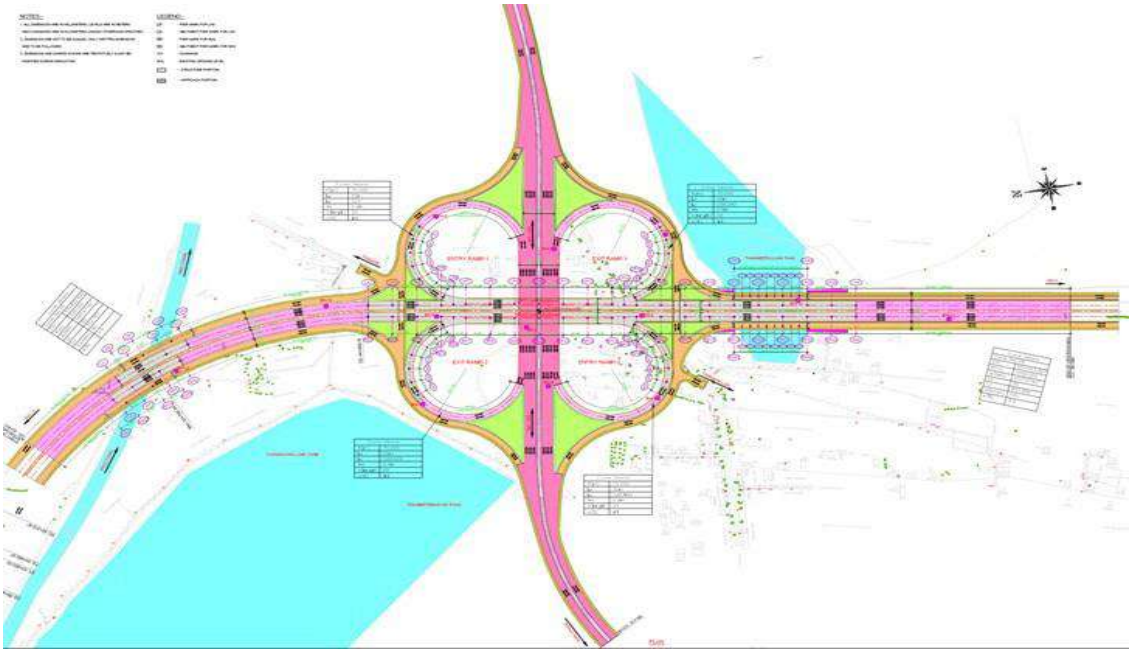


Figure 13: Interchange proposed in NH 716 (54/400)

Figure 14: Interchange proposed in NH 48 (km 76/900)

2.6.5 Road safety

70. Road safety refers to the methods and measures used to prevent road accidents. Safety features include

- Limited access from the properties and local roads.
- Grade separated junctions.
- Median dividers between opposite-direction traffic to reduce likelihood of head-on collisions.
- Removing roadside obstacles.
- Prohibition of more vulnerable road users and slower vehicles.
- Placements of energy attenuation devices (e.g. guard rails, wide grassy areas and sand barrels).

71. Section 2 and 3 has been designed with adequate road safety measures. The design considerations are listed in the following table.

Table 5: Proposed Road Safety Measures

Sl.no	Design considerations	Road Safety Measures
1.	Horizontal Geometry	None of the horizontal curve is designed for the radius lesser than the desirable minimum radius (i.e.400m) specified in IRC:SP:87-2019.
2.	Vertical Profile	Summit curves are designed for Intermediate Sight Distance and Valley curves are designed for Headlight Sight Distance.
3.	Segregation of Local Traffic	• Two lane bi-directional service road with footpath is proposed on both sides throughout the project. • This service roads will facilitate local traffic movements and access to adjoining/ surrounding areas.
4.	Access Control	• The project road is designed as an access controlled road due to its high-speed traffic movement. Service roads are proposed on both sides for local traffic movements. • No direct entry/exit in the Main Carriageway is permitted. (except in the location of Interchanges, Grade Separators and Vehicular Under Passes). • Entry/Exit ramps for traffic movement between Main Carriageway and Service road are proposed at selected locations (4 locations in Section-2 and 3 locations in Section-3) only.
5.	Central Median	• Raised median is proposed all along the project road. No median opening is proposed. • Metal beam crash barriers are proposed wherever necessary.
6.	Truck lay bye and Bus bays	• In order to avoid on-street parking on the project road, two truck lay byes are proposed in each section of the project road. • The local public transport buses will be operated on the service roads only to serve to adjoining/surrounding villages. • 40 number of bus bays are proposed in the project road (24 in Section 2 and 16 in Section 3) on the service road adjacent to underpasses.
7.	Warning Signals	• Flashing beacon is a traffic signal head having an amber lens in each face which is illuminated by rapid intermittent flashes. • The flashing beacons are proposed for the safety purpose at the at-grade junction in underpasses, truck lay byes locations and entry/exit ramps.
8.	Highway Lighting	• Flashing beacon is a traffic signal head having an amber lens in each face which is illuminated by rapid intermittent flashes. • The flashing beacons are proposed for the safety purpose at the at-grade junction in underpasses, truck lay byes locations and entry/exit ramps.

Sl.no	Design considerations	Road Safety Measures
9.	Road Furniture	Adequate road furniture including sign boards, markings, delineators, object markers raised pavement markers (Cat's Eyes/Road Studs), overhead sign boards, red reflector, etc., are proposed.
10.	Intelligent Transport System	• Intelligent Transportation System (ITS) helps in monitoring unsafe speed vehicles, dangerous weather conditions and heavy traffic location keeping driver's alert to the conditions around them. • Emergency Vehicles can be responded quickly in case of accidents.

2.6.6 Construction Methods

72. The Contractors highway engineer will update the DPR drawings and it will be submitted to the Supervision Consultant for verification and for further approval.

73. Site Clearing. Clearing and grubbing will be carried out before commencement of construction. Since this work will not obstruct traffic a reasonable section will be cleared at a time.

74. Embankment, Excavation including trenching required for widening. Sequence of activities as per the construction programme will be executed. Suitable materials that are excavated shall be ustilised (reuse) for construction of the embankment sections. The borrow pits and the quarry sites as identified in the DPR stage shall be visited for further testing the quality of the materials and accordingly it will be approved by the Supervision Consultant. Other requirements including the NOC/ Permission from the TNPCB, department of Mines and other competent authorities shall be verified.

75. Subbase and Base course. Subbase will be produced by blending soils and crushed aggregate as allowed in the Specifications. The aggregates shall be purchased/ procured from crusher plants that are already in operational and having valid license and clearances from the competent authority.

76. Priming and Surfacing. Similar to aggregates, the construction materials shall be procured from existing Asphalt Plant (having valid license and clearances from the competent authority). If not the contractors shall install their own plant, provided with necessary clearances including CTE and CTO from TNPCB. The availability of the Construction equipment's and machineries as given in the bid document shall be verified by the Supervision Consultant.

77. Culverts, Lined Drains, Retaining Walls, Bus bays, Ancillary works etc. These works are not critical. This shall be constructed by engaging sufficient number of teams to complete these works within the contract period. The concrete requirement will be procured from the existing batching plants (provided with necessary clearances including CTE and CTO from TNPCB) in the project area. If not, the contractor shall install his own batching plant after obtaining appropriate clearances from TNPCB.

78. Bridges. Diversion roads shall be constructed initially at the bridge locations. It is proposed to complete the foundation works in the dry season to take advantage of the lower ground water level. Coffer dam will be constructed to cast the foundation and abutments

and piers above water level. Pre-cast pre-stressed bridge beams will be purchased from reputed precast yard with the approval of Supervision Consultant.

79. Incidental Construction (Finishes). This work includes top soiling, grassing, riprap protection, sidewalks, Guard rails, Road marking and Signs. Top soiling and grassing of embankment slopes will be carried out on completion of embankment work. Riprap protection too will be completed well in advance of completion. Guard rails, signs and road marking will be the last items to be executed.

2.6.7 Associated Facilities

80. The other sections are being (will be) financed by JICA or government and will form as the associated facilities to the Project. The due diligence has been conducted for those sections and a separate due diligence report was prepared accordingly.

2.6.8 Project Implementation Schedule

81. Project implementation works are scheduled to begin in the month of February 2021 for Section 2 or Section 3 and it will have 3 years construction period.

3. Legal Policy Framework

3.1 National and State Rules and Regulations

82. To understand the extent of the environmental and social assessment for the proposed project, applicable laws, legislation, and policies have been reviewed. A summary of environmental legislation/regulations relevant to project roads is furnished in the following table.

Table 6: Applicable Acts, Rules and Regulation

Policy/ Acts/Rules	Year	Purpose	Responsible Institution	Applicability (Yes/ No)
Environmental Impact Assessment Notification and Amendments	2006, 2009, 2011, 2013 and 2014	To provide environmental clearance to new development activities following an environmental impact assessment	MoEF&CC and SEIAA	Yes, the CPRR as a whole (including 5 sections) mandates environmental clearance under category B1 and schedule 7(f) and.
Coastal Regulation Zone (CRZ)	2011 2018	Protect and manage coastal areas	State Coastal Zone Management Authority (SCZMA)- Department of Environment	Yes, the CRZ clearance has been obtained for the whole project as CPRR and hence it is applicable for all the sections (including section 2 and 3)
Notification on use of fly ash (subsequent amendments)	2003 2009 2016	To mandate reuse of large quantities of fly ash from thermal power plants for development projects within a 300km radius.	MoEF&CC	Yes, since, Ennore Thermal power plant is located with a 300 km radius, the fly ash should be used for construction purposes in the CPRR.
Forest (Conservation) Act	1980	To protect and manage forests, to check deforestation by restricting the conversion of forest areas into non-forest areas	Forest department, GoTN/ MoEF&CC	Yes, due to the road widening in Section 3, forest land acquisition in Mannur RF for an extent of 0.28ha is envisaged, for which this act is applicable
Wildlife Protection Act (subsequent amendments)	1972 2002	To protect wild animals and birds through the creation of National Parks / Sanctuaries and it also provides more stringent sections detailing punishments, including the penalty for offenses under the Act.	MoEF&CC (Wildlife Division)	No, there is no National Parks / Sanctuaries locations within or in the project influence area.

Policy/ Acts/Rules	Year	Purpose	Responsible Institution	Applicability (Yes/ No)
Biological Diversity Act	2002	Disclosure of species survey or collection activities to the National Biodiversity Authority	MoEF&CC	Yes, applicable for section 3 due to the presence of the Mannur RF
Water (Prevention and Control of Pollution) Act (and subsequent amendments)	1974	To provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water.	Central Pollution Control Board (CPCB)/ Tamil Nadu Pollution Control Board (TNPCB)	Yes, as per the Environmental Protection Act 1986
Air (Prevention and Control of Pollution) Act (and subsequent amendments)	1981	To provide for the prevention, control, and abatement of air pollution, and for the establishment of Boards to carry out these purposes.	CPCB/ TNPCB	Yes, as per the Environmental Protection Act 1986
Noise Pollution (Regulation and Control) rules	2000	Noise pollution regulation and controls	CPCB/ TNPCB	Yes, as per the Environmental Protection Act 1986
Hazardous Waste (Management& Transboundary Movement) Rules and subsequent amendments	2008 2016 2019	Storage, handling, transportation, and disposal of hazardous waste	TNPCB	Yes, storage and handling of Hazardous waste during construction
The municipal solid waste management rules and subsequent amendments	2000 2016	Management and handling of solid waste	TNPCB, and concern ULB's / Municipalities	Yes, for disposal of solid waste generated during construction
Environmental Clearance (EC) under EIA notification (and subsequent amendments) for new Quarry areas	2006	For new quarry operations	SEIAA, TNPCB	Yes, for new quarry operations it is mandatory to obtain EC from the SEIAA
Central Motor Vehicle Act	1988 1989	To control vehicular air and noise pollution. To regulate the	Transportation Department, GoTN	Yes, for all the vehicles used for construction purposes

Policy/ Acts/Rules	Year	Purpose	Responsible Institution	Applicability (Yes/ No)
Central Motor Vehicle Rules		development of the transport sector, check and control vehicular air and noise pollution.		
The Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act	2010	To amend the Ancient Monuments and Archaeological Sites and Remains Act, 1958, including a declaration of regulated and prohibited areas around the monuments.	Department of Archaeology, GoTN, National Monuments authority	Yes, in case of chance-find
The Right to Fair Compensation and Transparency in Land Acquisition Rehabilitation and Resettlement Act, 2013 (Act 30 of 2013) (LARR)	2013	set out rules for fair compensation and acquisition of land	The revenue department, GoTN	Yes, this will be applicable as there will be a land acquisition for widening, geometric improvements, and realignment
The Tamil Nadu Protection of Tanks and Eviction of Encroachment Act, 2007	2007	An Act to provide measures for checking the encroachment, eviction of encroachment in tanks which are under the control and management of the Public Works Department, protection of such tanks and for matters incidental thereto.	Water Resource Department (WRD), PWD	Yes, it will be applicable for the widening of roads near the water bodies
Tamil Nadu Highways Act, (TNHA)	2001	An Act to provide for the declaration of certain highways to be State highways, restriction of ribbon development along such highways, prevention and removal of encroachment thereon, construction, maintenance and development of highways, levy of	Tamil Nadu Highways Department, GoTN	Yes, this will be applicable as there will be a land acquisition for greenfield road, widening, geometric improvements, and realignment

Policy/ Acts/Rules	Year	Purpose	Responsible Institution	Applicability (Yes/ No)
		betterment charges and for matters connected therewith or incidental thereto		

Source: CPCB, MoEF&CC, TNPCB, and TNRIDC

3.2 AIIB Policy

83. AIIB recognizes that environmental and social sustainability is a fundamental aspect of achieving development outcomes consistent with its mandate to support infrastructure development and interconnectivity.

- AIIB screens and categorizes each proposed project based on their environmental and social risks and impacts
- Identifies actions to avoid, minimize, mitigate and/or offset impacts
- Includes provisions for disclosure of information and public consultation
- Every project should have Grievance Redress Mechanism (GRM) accessible to the general public/ community

84. The Environmental and Social Framework, 2016 and its amendment 2019 of AIIB, includes an Environmental and Social Policy (ESP) and Environmental and Social Standards (ESSs). The key objectives of the ESF are

- Ensure the environmental and social soundness and sustainability of each project
- Support integration of environmental and social aspects of projects into the decision-making process by all parties
- The Environment and Social Framework applies to all projects

85. The EIA study is being carried out in accordance to the AIIB's ESP which sets forth mandatory environmental and social requirements for each Project and ESSs which set out more detailed mandatory environmental and social requirements relating to the following[6]

- ESS 1: Environmental and Social Assessment and Management
- ESS 2: Involuntary Resettlement
- ESS 3: Indigenous Peoples

86. Based on the proposed alignment and reconnaissance survey outcome, the ESS I and ESS 2 are applicable for this CPRR (section 2 and 3).

87. **ESS 1 (Environmental and Social Assessment and Management)**. Aims to ensure the environmental and social soundness and sustainability of projects and to support the integration of environmental and social considerations into the Project decision-making process and implementation. ESS 1 is applicable if the Project is likely to have adverse environmental risks and impacts or social risks and impacts (or both). The scope of the environmental and social assessment and management measures are proportional to the risks and impacts of the Project. ESS 1 provides for both quality environmental and social

[6] https://www.aiib.org/en/policies-strategies/_download/environment-framework/Final-ESF-Mar-14-2019-Final-P.pdf

assessment and management of risks and impacts through effective mitigation and monitoring measures during the course of Project implementation. The ESS 1 defines the detailed requirements of the environmental and social assessment to be carried out for any project to be financed by the AIIB.

88. **ESS 2 (Involuntary Resettlement)**. Is applicable if the Project's screening process reveals that the Project would involve Involuntary Resettlement (including Involuntary Resettlement of the recent past or foreseeable future that is directly linked to the Project). Involuntary Resettlement covers physical displacement (relocation, loss of residential land or loss of shelter) and economic displacement (loss of land or access to land and natural resources; loss of assets or access to assets, income sources or means of livelihood) as a result of: (a) involuntary acquisition of land; or (b) involuntary restrictions on land use or on access to legally designated parks and protected areas. It covers such displacement whether such losses and involuntary restrictions are full or partial, permanent or temporary. The ESS 2 defined detailed requirements of resettlement planning of the projects involving involuntary resettlement.

89. Hence, the EIA study has been carried out to meet the requirements in AIIB's ESP and ESS 1. TNHD has engaged a Social Consultant to identify important social aspects such as places of worship, other community assets, socio-economic set up, related to land acquisition and resettlement. The Social Consultant has prepared a Social Impact Assessment and a Resettlement Action Plan (RAP) in accordance with AIIB's ESP and ESS 2.

3.3 Environmental Regulatory Clearance Requirements

90. The following environmental regulatory clearance has to be obtained by the Tamil Nadu Highways Department (TNHD)

- ***Environmental Clearance***: As per the EIA notification 2006, this project as a whole mandated Environmental Clearance (EC) under category B1 and Project schedule 7(F) for State Highways from SEIAA. Accordingly, the Form – 1 and Form 1A has been submitted by the Tamil Nadu Highways Department (TNHD) and the environmental clearance with special conditions for the same has been obtained on 10/8/2018 (Refer **Annexure 1**). The process adopted in obtaining the Environmental clearance is given in the Figure 15.
- ***Loss of Water bodies***: For the loss of water bodies, due to the proposed widening and strengthening operation, NOC/ permission from the Water Resource Department, PWG, GoTN is required, which shall be obtained by the Tamil Nadu Highways Department (TNHD) from the Water Resource Department (WRD).
- ***Forest Clearance***: For the Forest land diversion of 0.28ha in Mannur RF and felling of trees within the RF area, TNHD has to obtain Forest Clearance from the Tamil Nadu Forest Department by adopting the procedures as per the Forest Act 1980. The forest clearance has to be obtained prior to mobilization/ prior to construction activities in the forest area.

- ***Clearance for felling of Avenue trees***: TNHD has to get clearance from the Revenue Department for felling of the Avenue trees, which is located outside the Forest boundaries
- ***Coastal Regulation Zone(CRZ):*** Though Section 1 falls under the CRZ, the CRZ clearance has been obtained (refer Annexure 9) for the whole project as CPRR and hence the given conditions are applicable for all the sections (including section 2 and 3)

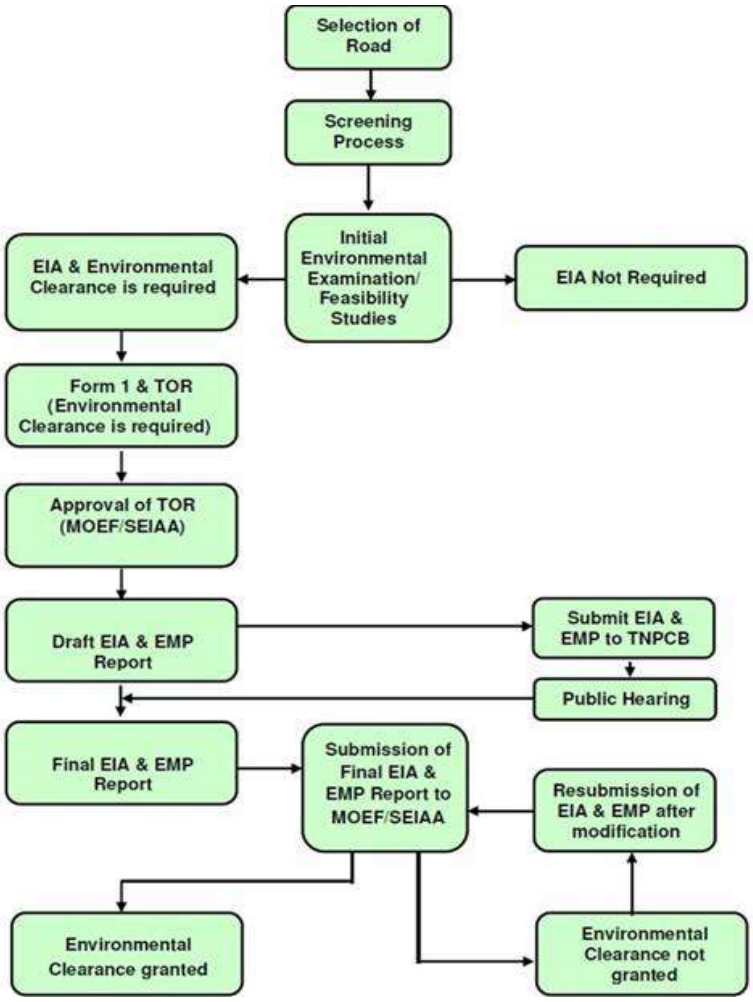


Figure 15: Environmental Clearance Procedures

91. The following environmental regulatory clearance has to be obtained by the Contractor

- The Clearances, NOC, Permissions requirements for the contractor is listed in **Table 7**. As part of the EMP, these requirements will be integrated into the construction contract documents.

Table 7: Environmental Clearance/ NOC/Permission for the Contractor

Sl.no	Clearances	Acts	Approving Agency	Time Frame	Responsibility	
					Execution	Supervision
1.	Consent to Establish and Operate Hot mix plant,	Water (Prevention and Control of Pollution) Act 1974	Tamil Nadu Pollution Control Board	3 months	Contractor	PIU/ Supervision Consultant

Sl.no	Clearances	Acts	Approving Agency	Time Frame	Responsibility	
					Execution	Supervision
	Crushers, Batching Plant and Labour Camps	Air (Prevention and Control of Pollution) Act. 1981				
2.	Permission for removal of avenue tree Trees within the RF	Forest (Conservation) Act,1980 and amendments and rules therein	Divisional Forest Office	3 - 6 months	Contractor (assisted by the Forest Dept, GoTN)	PIU/ Supervision Consultant
	Trees outside the forest area		Revenue Department		Contractor	
3.	Authorisation for Disposal of Hazardous Wastes	Hazardous Wastes (Management, Handling, and Transboundary Movement) Rules, 2016.	Tamil Nadu Pollution Control Board	2 months	Contractor	PIU/ Supervision Consultant
4.	Permission for Sand Mining from Riverbed	Mines and Minerals (Development and Regulation) Act, 1957 Environmental (Protection) Act 1986 Water (P& CP) Act 1974 and Air (P& CP) Act 1981	Commissioner of Geology and Mining, GoTN Environmental Clearance from SEIAA, Go TN CTE/CTO from TNPCB	2 months	Contractor	PIU/ Supervision Consultant
5.	Permission for Opening of New Quarry	Mines and Minerals (Development and Regulation) Act, 1957 Environmental (Protection) Act 1986 Water (P& CP) Act 1974 and Air (P& CP) Act 1981	Commissioner of Geology and Mining, GoTN Environmental Clearance from SEIAA, GoTN CTE/CTO from TNPCB	2 – 6 months	Contractor	PIU/ Supervision Consultant
6.	Storage of Hazardous Chemicals (Fuel Oils) and Explosives	Manufacturing Storage and Import of Hazardous Chemicals Rules 1989	Chief Controller of Explosive, Chennai	3 months	Contractor	PIU/ Supervision Consultant
7.	Permission for Withdrawal of Ground Water	Environmental (Protection) Act, 1986	Central/State Ground Water Board	3 months	Contractor	PIU/ Supervision Consultant
8.	Pollution Under Control Certificate	Central Motor Vehicles Act 1988	Transport Department (GoTN)	1 Month	Contractor	PIU/ Supervision Consultant
9.	Employing Labour	The Building And Other Construction Work	Labour & Employment Dept., GoTN	1 Week	Contractor	PIU/ Supervision Consultant

Sl.no	Clearances	Acts	Approving Agency	Time Frame	Responsibility	
					Execution	Supervision
		ers. (Regulation of Employment and Conditions of Service) Act, 1996				
10.	Registration of Workers	Labour Welfare Acts.	Labour & Employment Dept., GoTN	1 Month	Contractor	PIU/ Supervision Consultant

Source: CPCB and MoEF&CC

92. During the design, construction and operation of the project the PMU (CPRR) and PIU (TNRIDC) will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health and Safety Guidelines. These standards contain performance levels and measures that are normally acceptable and applicable to projects. When Government of India regulations differ from these levels and measures, the PMU and PIU will adopt whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the PMU and PIU will provide full and detailed justification for any proposed alternatives.

93. Comparison of national emissions standards and International Standards / Best Practices are provided in Table 8, and 8-1,2. Due to different measuring conditions, the emission values are not directly comparable. However, IFC Guidelines / WHO standards are stricter than the national standards if converted to comparable values.

Table 8-1: National Ambient Air Quality Standards and WHO Guidelines

Parameter	Location [a]	National Ambient Air Quality Standards [b]	WHO Air Quality Guidelines ($\mu g/m^3$)	
			Global Update 2005 [c]	Second Edition 2000 [d]
Particulate Matter PM10 ($\mu g/m^3$)	Industrial	60 (Annual)	20 (Annual)	-
	Residential, Rural and Other Areas	100 (24-hr)	50 (24-hr)	
	Sensitive Area	60 (Annual) 100 (24-hr)	20 (Annual) 50 (24-hr)	-
Particulate Matter $PM_{2.5}$ ($\mu g/m3$)	Industrial	40 (Annual)	10 (Annual)	-
	Residential, Rural and Other Areas	60 (24-hr)	25 (24-hr)	
	Sensitive Area	40 (Annual) 60 (24-hr)	10 (Annual) 25 (24-hr)	
Sulfur Dioxide SO_2 ($\mu g/m^3$)	Industrial	50 (Annual)	20 (24-hr)	-
	Residential, Rural and Other Areas	80 (24-hr)	500 (10-min)	
	Sensitive Area	20 (Annual) 80 (24-hr)	20 (24-hr) 500 (10-min)	-
Nitrogen Dioxide NO_2 ($\mu g/m^3$)	Industrial	40 (Annual)	40 (Annual)	-
	Residential, Rural and Other Areas	80 (24-hr)	200 (1-hr)	
	Sensitive Area	30 (Annual) 80 (24-hr)	40 (Annual) 200 (1-hr)	-

Parameter	Location [a]	National Ambient Air Quality Standards [b]	WHO Air Quality Guidelines (µg/m³)	
			Global Update 2005 [c]	Second Edition 2000 [d]
Carbon Monoxide CO (µg/m³)	Industrial	2,000 (8-hr)	-	10,000 (8-hr)
	Residential, Rural and Other Areas	4,000 (1-hr)		100,000 (15-min)
	Sensitive Area	2,000 (8-hr) 4,000 (1-hr)	-	10,000 (8-hr) 100,000 (15-min)
Ozone (O_3) (µg/m³)	Industrial	100 (8-hr)	100 (8-hr)	-
	Residential, Rural and Other Areas	180 (1-hr)		
	Sensitive Area	100 (8-hr) 180 (1-hr)	100 (8-hr)	-
Lead (Pb) (µg/m³)	Industrial,	0.5 (Annual)	-	0.5 (Annual)
	Residential, Rural and Other Areas	1.0 (24-hr)		
	Sensitive Area	0.5 (Annual) 1.0 (24-hr)	-	0.5 (Annual)
Ammonia (NH_3) (µg/m³)	Industrial	100 (Annual)	-	
	Residential, Rural and Other Areas	400 (24-hr)		
	Sensitive Area	100 (Annual) 400 (24-hr)	-	-
Benzene (C_6H_6) (µg/m³)	Industrial	5 (Annual)	-	-
	Residential, Rural and Other Areas			
	Sensitive Area	5 (Annual)	-	-
Benzo(o)	Industrial	1 (Annual)	-	-
Pyrene (BaP)	Residential, Rural and Other Areas			
(ng/m³)	Sensitive Area	1 (Annual)	-	-
Arsenic (As) (ng/m³)	Industrial	6 (Annual)	-	-
	Residential, Rural and Other Areas			
	Sensitive Area	60 (Annual)	-	-
Nickel (Ni) (ng/m³)	Industrial	20 (Annual)	-	-
	Residential, Rural and Other Areas			
	Sensitive Area	20 (Annual)	-	-

[a] Sensitive area refers to Ecologically sensitive areas notified by the India Central Government
[b] http://cpcb.nic.in/uploads/National_Ambient_Air_Quality_Standards.pdf
[c] WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide. *Global update 2005*. WHO. 2006.
[d] Air Quality Guidelines for Europe Second Edition. WHO 2000.

Table 8-2: National Noise Standards and WHO Guidelines

Receptor/ Source	Noise Level Standards [a] (dBA)	
	Day	Night
Industrial area	75	70

Receptor/ Source	Noise Level Standards [a] (dBA)	
	Day	Night
Commercial area	65	55
Residential Area	55	45
Silent Zone	50	40

[a] Noise Pollution (Regulation and Control) Rules, 2002 as amended up to 2010 (http://cpcb.nic.in/displaypdf.php?id=Tm9pc2UtU3RhbmRhcmRzL25vaXNlX3J1bGVzXzIwMDAucGRm)

WHO Guidelines Value For Noise Levels Measured Out of Doors [b] (One Hour LAeq in dBA)	
07:00 – 22:00	22:00 – 07:00
70	70
55	45

[b] Guidelines for Community Noise. WHO. 1999.

Table 8: National Drinking Water Quality Standards and WHO Guidelines

Group	National Standards for Drinking Water [a, b]			WHO Guidelines for Drinking Water Quality, 4th Edition, 2011[c]
	Parameter	Unit	Max. Concentration Limit	
Physical	Turbidity	NTU	1 (5)	-
	pH		6.5 – 8.5	None
	Color	Hazen Units	5 (15)	None
	Taste and Odor		Agreeable	-
	TDS	mg/l	500 (2,000)	-
	Iron	mg/l	0.3	-
	Manganese	mg/l	0.1 (0.3)	-
	Arsenic	mg/l	0.01 (0.05)	0.01
	Cadmium	mg/l	0.003	0.003
	Chromium	mg/l	0.05	0.05
	Cyanide	mg/l	0.05	None
	Fluoride	mg/l	1 (1.5)	1.5
	Lead	mg/l	0.01	0.01
	Ammonia	mg/l	0.5	none established
Chemical	Chloride	mg/l	250 (1,000)	none established
	Barium	mg/l	0.7	None
	Sulphate	mg/l	200 (400)	None
	Nitrate	mg/l	45	50
	Copper	mg/l	0.05 (1.5)	2
	Total Hardness	mg/l	200 (600)	-
	Calcium	mg/l	75 (200)	-
	Zinc	mg/l	5 (15)	none established
	Mercury	mg/l	0.001	0.006
	Aluminum	mg/l	0.1 (0.3)	none established
	Anionic Detergents	mg/l	0.2 (1.0)	None

Group	National Standards for Drinking Water [a, b]			WHO Guidelines for Drinking Water Quality, 4th Edition, 2011[c]
	Parameter	Unit	Max. Concentration Limit	
	Phenolic Compounds	mg/l	0.001(0.002)	None
	Residual Chlorine	mg/l	0.2	5
Microbial indicator	E-coli	MPN/100ml	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample
	Total Coliform	MPN/100ml		

[a] http://cgwb.gov.in/Documents/WQ-standards.pdf.
[b] Bureau of India Standard 10500: 2012 (Indian Standard, Drinking Water — Specification (Second Revision).
[c] Health-based guideline values.

3.4 International Treaties/ Conventions/ Declarations on Environment Management

94. India have signed the following international treaties/ conventions/ declarations on environmental protections. Hence, it is necessary that the given guidance and requirements are to be adopted.

Table 9: International Treaties/ Conventions/ Declarations on Environment

Sl. no	International Treaties/ Conventions/ Declarations	Description
1.	United Nations Conference on the Human Environment - Stockholm 1972	To coordinate global efforts to promote sustainability and safeguard the natural environment
2.	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1975	Its aim is to ensure that international trade in specimen of wild animals and plants does not threaten their survival
3.	Ramsar Convention, 1971, 1975	The Convention on Wetlands is the intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources
4.	The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes, 1989	The Convention aims to protect human health and the environment against the adverse effects resulting from the generation, transboundary movements and management of hazardous wastes and other wastes
5.	United Nations Conference on Environment and Development (UNCED), 1992, 2002	The conference had three objectives (Agenda - 21, Rio Declaration and Millennium Development Goals), to secure renewed political commitment for sustainable development, to assess the progress and implementation gaps in meeting previous commitments, and to address new and emerging challenges
6.	Framework Convention on Climate Change (FCCC), 1992 Kyoto Protocol, 1997	It operationalizes the United Nations Framework Convention on Climate Change by committing industrialized countries to limit and reduce greenhouse gas (GHG) emissions in accordance with agreed individual targets

Sl. no	International Treaties/ Conventions/ Declarations	Description
7.	The Vienna Convention, 1985 Montreal Protocol on Ozone depleting substances, 1992	It sets binding progressive phase out obligations for developed and developing countries for all the major ozone depleting substances, including chlorofluorocarbons (CFCs), halons and less damaging transitional chemicals such as hydrochlorofluorocarbons (HCFCs)
8.	Convention on Biological Diversity, 1992 Cartagena Protocol on Biosafety, Ratified on 17th January, 2003	It is an international treaty governing the movement of living modified organism (LMO) resulting from modern biotechnology from one country to another
9.	Convention to Combat Desertification, 1996	It is the only binding international agreement linking environment and development to sustainable soil management
10.	Rotterdam Convention on Prior Informed Consent Procedure for certain Hazardous Chemicals in International Trade, 2002	It is a multilateral treaty to promote shared responsibilities in relation to importation of hazardous chemicals
11.	Stockholm Convention on Persistent Organic Pollutants (POPs), 2001	It aims to eliminate or restrict the production and use of Persistent Organic Pollutants (POPs)

4. Description of the Environment

95. To assess the construction impacts, due to the implementation of the CPRR (section 2 and section 3) to the surrounding environment, field visits and baseline environmental monitoring were conducted. The field visits include an inspection of sensitive locations, consultations with the locals/ communities and recording the visual observations. Secondary information was collected from the various stakeholders, government agencies, literature and publications (including internet information). Based on the secondary information, the data gap has been identified and it is fulfilled by collecting primary information, which includes baseline environmental monitoring for key environs and conducting FGD's, public consultation, etc. This chapter comprises of the following:

- Physical environmental components such as meteorology, geology, topography, soil characteristics, air quality, noise quality, surface, and sub-surface water quality, etc;
- Ecological environmental components such as terrestrial flora, fauna, and aquatic biodiversity; and
- The socio-cultural and economic environment in terms of demography, land use, etc.

96. Section 2 and Section 3 traverses through two districts namely Thiruvallur and Kanchipuram, hence the secondary information on the environmental profile of the districts have been taken for discussion.

4.1 Physical Environment

4.1.1 Topography

97. In Thiruvallur, the elevation of the area ranges from 183 m amsl in the west to sea level in the east. The major part of the area is characterised by an undulating topography. In Kanchipuram, the elevation of the area ranges from 100 m amsl in the west to a sea level in the east. It is also characterised by an undulating topography with innumerable depressions, which are used as water bodies/irrigation tanks. For section 2 the elevation ranges between 35m amsl to 14m amsl. In the Kosasthalayar River, the elevation is observed to be 19m amsl. For section 3 the elevation ranges between 77m amsl to 33m amsl with the Coovum River crossing the elevation is at 33m amsl. The recorded profile shows a clear slope towards the eastern direction.

Figure 16: Elevation Profile in Section 2

Figure 17: Elevation Profile in Section 3

Source: Google Earth

4.1.2 Climate and Temperature

98. Thiruvallur District has a tropical climate. In April to June, the weather is generally hot and dry. The weather is pleasant during the period from November to January. The annual mean maximum temperature is 32.9°C and the minimum temperature is 24.3°C. The day time heat is oppressive and the temperature is as high as 41.2°C. The lowest recorded temperature is 18.1°C. The relative humidity varies between 65% and 85% in the mornings while in the afternoon it varies between 40 and 70%. Similarly, being a neighbouring district Kanchipuram also has a tropical climate. The temperature is very high during the summer seasons, which starts from April to June, where the recorded annual mean maximum temperature is 37°C and the minimum temperature is 20°C. The daytime heat is oppressive and the temperature is as high as 43°C. The relative humidity varies between 65 and 85% in the mornings while in the afternoon it varies between 40 and 70%.

4.1.3 Rainfall

99. Both districts receive rainfall during the southwest monsoon (June to September) as well as the northeast monsoon (October to December). Most of the precipitation occurs in the form of cyclonic storms caused due to the depressions in the Bay of Bengal mostly during Northeast monsoon. The southwest monsoon rainfall is highly unpredictable and summer rains are negligible. Rainfall data analysis shows that in Thiruvallur district, the annual rainfall varies from 950mm to 1152mm. The rainfall projection shows a decrease in rainfall by 5% in the year 2080. Whereas in Kanchipuram district, the annual rainfall over the district varies from 1105 mm to 1214mm. The rainfall projection shows a decrease in rainfall by 1% in the year 2080.

4.1.4 Seismicity

100. Section 2 and Section 3 of the CPRR is categorised under Zone III (Moderate Damage Risk Zone). Given this, the project components including the structures (intersections, bridges, and culverts) will be constructed to withstand the level of seismic activity as per ISI specifications for Zone III.

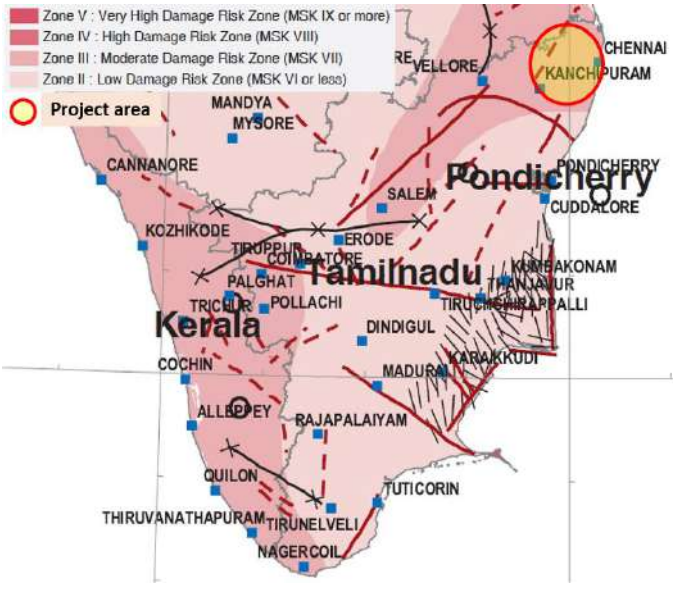


Figure 18: Earthquake Hazard Map

4.1.5 Soil Types

101. Soils in Thiruvallur district have been classified into i) Red soil ii) Black soil iii) Alluvial soil iv) colluvial soil. The major part is covered by Red soil of red sandy/clay loam type. Ferrugineous red soils are also seen at places. Black soils are deep to very deep and generally occur in the depressions adjacent to hilly areas, in the western part. Alluvial soils occur along with the river courses and the eastern part of the coastal areas. Sandy coastal alluvium

(arenaceous soil) are seen all along the sea coast as a narrow belt. In Kanchipuram district, Soils have been classified into i) clayey soil, ii) red sandy or red loamy soil iii) Red sandy brown clayey soil and iv) Alluvial soil. Of the above soils, brown clayey soil is the most predominant, covering more than 71% of the aerial extent of Kanchipuram district. Alluvial soils are found on the banks of Palar, Cheyyar, and other rivers. The river alluvium is transported and is seen in the coastal area of this district. Sandy coastal alluvial (arenaceous soil) occurs along the seacoast as a narrow belt.

4.1.6 Hydrogeology

102. Thiruvallur district is underlain by both porous and fissured formations. The important aquifer systems in the district are constituted by i) unconsolidated & semi-consolidated formations and ii) weathered, fissured and fractured crystalline rocks. The porous formations in the district include sandstones and clays of upper gondwana, marine sediments of Cretaceous age, sandstones of tertiary age and recent alluvial formations. As the Gondwana formations are well-compacted and poorly jointed, the movement of groundwater in these formations is mostly restricted to shallow levels. Kanchipuram district is underlain by both sedimentary and fissured formations. The important aquifer system in the district is constituted by i) unconsolidated and semi consolidated formations and ii) weathered, fissured and fractured crystalline rocks.

4.1.7 Land Use

103. The geographical area of Kanchipuram district is much larger than the Thiruvallur district. Except for barren and uncultivable land, Kanchipuram district has an edge over Thiruvallur district. The statistical information on land use collected from the Central Research Institute for Dry land Agriculture (CRIDA) is presented in the following table.

Land use pattern (ha)	Geo-graphical area	Forest area	Land under non-agricultural use	Permanent pastures	Cultivable wasteland	Land under Misc. tree crops and groves	Barren and uncultivable land	Current fallows	Other fallows
Thiruvallur	342.2	19.7	107.9	8.1	8	7.7	13.6	26.3	39.3
Kanchipuram	443.2	23.9	146.5	18.3	10.7	12.9	10.9	34.9	56.5

Source: Central Research Institute for Dry land Agriculture

104. As per the road inventory, the land use pattern in section 2 is predominantly agriculture (nearly 85%) due to the proposed Greenfield road, followed by water bodies (nearly 10%) and settlements (5%). For Section 3, agriculture land constitutes 50%, followed by settlement areas (25%), water bodies (20%) and industries (5%).

4.1.8 Ambient Air Quality

105. Ambient Air Quality (AAQ) monitoring was conducted for 10 locations in 2020 (5 locations in each section), along the project corridor. Monitoring was carried out by taking 24 hourly samples at each location as per the guidelines of the Central Pollution Control Board. The purpose of the monitoring is to set the indicators for the air quality and to monitor it during the project construction and operation. The monitoring locations are fixed based on the proposed interventions including the major bridge locations, major

intersections, and settlements areas. The monitoring stations along with geo-coordinates are given in **Table 10**.

Table 10: Ambient Air and Noise Quality Sampling Locations

Sl.no	Location	Geo-coordinates
Section - 2		
1	Athipedu	13°17'15.53"N 80°13'10.55"E
2	Alinjivakkam	13°16'40.17"N 80° 8'58.74"E
3	Jayapuram	13°17'2.82"N 80° 4'21.82"E
4	Thamaraipakkam	13°13'37.68''N 80°1'43.69''E
5	Kilanoor	13°11'50.17''N 79°57'31.64''E
Section - 3		
6	Ramapuram	13° 8'0.42"N 79°56'42.31"E
7	Putlur	13° 7'11.50''N 79°56'14.53''E
8	Pethnapalli	13° 5'28.17"N 79°56'10.11"E
9	Polivakkam	13°03'22.37"N 79°54'46.73"E
10	Sriperumbudur	12°58'2.80"N 79°56'30.73"E

106. The AAQ has been conducted for the key parameters including the PM_{10}, $PM_{2.5}$, SO_x, NO_x, and CO for 24 hours monitoring. A high volume air sampler has been used for collecting the samples. The outcome of the monitoring is presented in the following table.

Table 11: Ambient Air Quality Monitoring Results

Sl.no	Location	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	SO_x ($\mu g/m^3$)	NO_x ($\mu g/m^3$)	CO (mg/m^3)
Section - 2						
1	Athipedu	74.6	32.9	21.7	25.3	BDL
2	Alinjivakkam	69.7	35.3	25.6	30.2	BDL
3	Jayapuram	68.3	36.1	24.3	30.9	BDL
4	Thamaraipakkam	61.7	32.1	20.5	24.2	BDL
5	Kilanoor	64.9	30.9	22.6	27.3	BDL
Section - 3						
6	Ramapuram	74.9	34.1	28.3	32.5	BDL
7	Putlur	70.5	33.6	23.1	27.4	BDL
8	Pethnapalli	65.4	29.1	13.8	19.6	BDL
9	Polivakkam	74.7	32.9	18.3	22.5	BDL
10	Sriperumbudur	71.4	30.2	22.6	28.1	BDL
AAQ Standard values		**100**	**60**	**80**	**80**	**4.0**
WHO Air Quality Guidelines		**50**	**25**	**20**	**-**	**-**

Source: Primary Monitoring, 2020

AAQ station at Alinjivakkam (section 2)


AAQ station at Polivakkam (section 3)

107. From the analysis, it is evident that none of the air quality parameters exceeded the stipulated values of the AAQ standard. Though the PM_{10} values are less than the AAQ standards, it is observed to be slightly nearing the standard values. This is due to the frequent movement of the vehicles in the SH 57. Other key noxious parameters are well within the limits indicating a healthy environment. In comparison with the WHO Air Quality Guidelines, it is observed that the recorded values for the parameters PM_{10}, $PM_{2.5}$ and SO_x are above the stipulated limits for 24 hours monitoring. For the parameters NO_x and CO, 24 hours monitoring values are not available.

4.1.9 Noise levels

108. Ambient noise levels were recorded for both the sections in 2020, the monitoring locations are similar to the AAQ stations. The noise levels were monitored using the Integrating/logging sound level meter. The day noise levels have been monitored from 6.00 am to 10.00 pm and night noise levels, from 10.00 pm to 6.00 am. Weighted equivalent has been estimated for the recorded sound level in decibels.

Table 12: Ambient Noise Level Monitoring Results

Sl.no	Location	Category of the area	Noise Levels in dB(A)	
			Day Time (Leq)	Night Time (Leq)
Section - 2				
1	Athipedu	Commercial	54.8	46.6
2	Alinjivakkam	Commercial	49.7	37.3
3	Jayapuram	Commercial	54.8	36.2
4	Thamaraipakkam	Commercial	54.3	34.6
5	Kilanoor	Residential	50.7	41.5
Section - 3				
6	Ramapuram	Commercial	59.3	41.5
7	Putlur	Commercial	54.1	35.3
8	Pethnapalli	Commercial	48.3	36.7
9	Polivakkam	Commercial	52.6	38.1
10	Sriperumbudur	Commercial	51.1	39.1
CPCB Noise standard		**Residential**	**55**	**45**
		Commercial	**65**	**55**
WHO Noise Level Guidelines		**Residential**	**55**	**45**
		Commercial	**-**	**-**

Source: Primary Monitoring, 2020

Noise level Monitoring at Jayapuram (section 2)

Noise level Monitoring at Ramapuram (section 3)

109. From the observation, it is evident that the noise monitoring stations located close to the Highways have recorded high noise levels due to the movement of traffic vehicles. However, the recorded noise levels are very much under the stipulated noise standard values. In comparison with the WHO noise level guidelines, the recorded noise levels are very much under the stipulated values.

4.1.10 Surface Water Bodies

110. As per the road inventory, there are 33 water bodies identified along the sections 2 and 3 which include the lake, pond, and canal crossing. In that, all other water bodies are seasonal / monsoon dependent. The list of water bodies is given in the following table.

Table 13: Surface water bodies along sections 2 and 3

Sl.no	Chainage	Water Bodies	Village	Remarks
Section 2				
1	23/600	Natham Lake	Natham	Crossing The Road
2	26/500	Kannigaipair Canal	Kannigaipair	Crossing The Road
3	29/280	Kannigaipair Lake	Kannigaipair	Crossing The Road
4	29/330	Kannigaipair Lake	Kannigaipair	Crossing The Road
5	30/740	Poorivakkam Lake	poorivakkam	Crossing The Road
6	32/800	Kilambakkam Lake	poorivakkam	Crossing The Road
7	34/300	Athagai Kavanoor Lake	Athagai Kavanoor	Influenced by the Project
8	34/400	Athagai Kavanoor Canal	Athagai Kavanoor	Crossing The Road
9	36/150	Punnapakkam Lake	Punnapakkam	Crossing The Road
10	36/800	Kosasthalaiyar River	Punnapakkam	Crossing The Road
11	37/400	Ammanambakkam Canal	Ammanambakkam	Crossing The Road
12	41/500	Velliyur Lake	Velliyur	Influenced by the Project
13	42/400	Pond	Karikalavakkam	Crossing The Road
14	44/100	Vishnuvakkam Canal	Keelanur	Crossing The Road
15	45/000	keelanur pond	Keelanur	Influenced by the project
16	46/650	keelanur Canal	Melanur	Crossing The Road
17	46/800	keelanur pond	Melanur	Influenced by the Project
Section 3				
18	47/700	Ikkadu Canal	Ikkadu	Along the Alignment
19	50/300	Ikkadu Tank	Ikkadu	Crossing The Road
20	51/650	Kalyanakuppam Lake	Thandalam	Crossing The Road
21	53/500	Thannerkulam Tank	Thannerkulam	Influenced by the Project
22	53/800	Krishna Canal	Thannerkulam	Crossing The Road
23	54/500	Thannerkulam Pond	Thozur	Crossing The Road
24	55/600	Ramapuram Lake (Thozhur)	Putlur	Influenced by the Project
25	55/800	Putlur Pond	Putlur	Influenced by the Project
26	57/550	Coovum River	Putlur	Crossing The Road
27	58/350	Aranvayoal Tank	Vengathur	Crossing The Road
28	62/900	Athikulam Tank (Polivakkam Chithi)	Polivakkam	Influenced by the Project
29	63/350	Athikulam Tank & Canal	Polivakkam	Crossing The Road
30	65/150	Chathram Canal	Polivakkam	Crossing The Road
31	70/500	Parangusapuram lake	Thodukadu	Influenced by the Project
32	73/840	Surplus Canal	Sriperumbudur	Crossing The Road
33	77/000	Sriperumbudur lake	Sriperumbudur	Influenced by the Project

Source: Road Inventory

Vishnuwakkam canal at km 44/100

Pagalmedu Lake at km 32/400

4.1.11 Water Quality

111. To assess the water quality in the proposed alignment for sections 2 and 3, two types of water samples (surface water and groundwater) have been collected and analysed. Surface water samples have been collected from the 3 major surface water bodies namely Kosasthalaiyar River, Coovum River, and Sriperumbudur Lake in 2020. The details of the water sampling locations are given in **Table 14**.

Table 14: Water Quality Sampling Locations

Sl.no	Location	Geo-coordinates
Surface water Sampling Locations		
1	Kosasthalaiyar River	13°13'50.97"N 80°1'35.84"E
2	Coovum River	13°06'33.99"N 79°56'7.65"E
3	Sriperumbudur Lake	12°58'03.1"N 79°56'29.6"E
Groundwater Sampling Locations		
Section - 2		
4	Athipedu	13°16'32.844"N 80°9'2.616"E
5	Thamaraipakkam	13°13'13.002"N 80°1'48.798"E
6	Kilanoor	13°11'52.686"N 79°57'44.718"E
Section - 3		
7	Putlur	13°07'10.3"N 79°56'34.7"E
8	Polivakkam	13°4'42.576"N 79°54'32.148"E
9	Sriperumbudur	12°58'14.076N 79°56'25.644"E

4.1.11.1 Surface water Quality

112. As indicated in the earlier section, surface water samples have been collected from the Kosasthalaiyar River, Coovum River, and Sriperumbudur Lake. The collected samples have been analysed for the physicochemical parameters as per the IS:2296 requirements. There are other surface water bodies located along the proposed alignment of sections 2 and 3, however, the condition remains seasonal. The outcome of the surface water analysis is given in the following table.

Table 15: Surface Water Quality Results

Sl.no	Parameters	Kosasthalaiyar River	Sriperumbudur Lake	Coovam River	Limits as per IS 2296:1982[7]
1	pH @ 25°C	7.46	7.59	8.02	6.5 to 8.5
2	Turbidity	3.1	5.9	2.7	-
3	Total Dissolved Solids (TDS) @ 180°C	347	206	610	1500.0
4	Dissolved Oxygen (mg/l)	4.6	5.5	6.1	40
5	Total Suspended Solids @ 105°C (mg/l)	2.13	7.26	5.13	-
6	Calcium (as Ca) mg/l	34.9	21.4	46	75.0
7	Chloride (as Cl) mg/l	47	30.8	124	600.0
8	Fluoride (as F) mg/l	0.33	0.27	0.5	1.5
9	Iron (as Fe) mg/l	0.26	0.25	0.09	50.0
10	Magnesium (Mg) mg/l	14.4	6.3	20.2	-
11	Total Nitrogen mg/l	14.6	16.5	9.1	-
12	Hexavalent Chromium (as Cr+6) mg/l	0.032	0.058	0.044	-
13	Organic Phosphorous mg/l	0.16	0.12	BDL	-
14	Nitrate (as NO_3) mg/l	7.94	8.51	8.37	-
15	Sulphates (as SO_4) mg/l	24.8	21.6	40.8	200.0
16	Ammonical Nitrogen (as N) mg/l	1.3	2.3	BDL	-
17	Total Kjehdahl Nitrogen (as N) mg/l	1.9	4.7	BDL	-
18	Zinc (as Zn) mg/l	0.93	0.14	1.1	-
19	Total Phosphate (mg/l)	0.44	BDL	0.62	-
20	BOD,3 days 27°C as O_2 (mg/l) mg/l	BDL	BDL	4.6	3
21	Dissolved Phosphate (as PO_4) mg/l	0.29	BDL	0.41	-
22	Total Hardness (as $CaCO_3$) mg/l	147	79.2	198	-
23	Sodium (as Na) mg/l	18.7	9.23	42.6	-
24	Potassium (as K) mg/l	2.66	4.7	7.01	-
25	Total Alkalinity (as $CaCO_3$) mg/l	141	76.8	192	-
26	Escherichia coli (MPN/100ml)	12	12	8	-
27	Total coliform (MPN/100ml)	23	23	23	-
28	Fecal Coliform (MPN/100ml)	8	21	11	-

Source: Primary Monitoring, 2020

Surface water sampling at Coovum River

Surface water sampling at Kosasthalaiyar River

113. From the analysis, the pH remains alkaline across all the water samples and ranges between 7.46 to 8.02. The Dissolved Oxygen levels are observed to be too low in comparison with the surface water quality standard, indicating the water is contaminated with organic

[7] More stringent than WHO Guidelines for Drinking Water Quality, 4th Edition 2011.

pollution preferably due to the sewage or dumping of solid wastes in the river water. For two samples the BOD values are observed to be negligible and in the Coovam River the BOD is recorded as 4.6 mg/l, which is higher than the stipulated limit, again it indicated the presence of the organic pollution. The rest of the physicochemical parameters are observed to be well within the IS 2296 standard values. The presence of coliforms confirms the water samples are contaminated by the domestic sewage.

4.1.11.2 Groundwater Quality

114. Major settlement areas and agriculture areas (Athipedu, Thamaraipakkam, Kilanoor, Putlur, Polivakkam, and Sriperumbudur have been chosen for collecting groundwater samples. The source of water may be open well or hand pump. The collected samples are analysed for its physicochemical analysis as per the IS: 10500 requirements. The key purpose is to check the suitability of the water for the potable and domestic purposes for the use of labours. Other requirements include to check the pollution level in the water and to set the information as a base and to record the water quality during the construction period to check the impacts. The outcome of the analysis is given in the table.

Table 16: Groundwater Quality Results

S.No	Parameters	Units	Section 2			Section 3			IS: 10500 Permissible Limits
			Athipedu	Thamarai-pakkam	Keelanur	Putlur	Polivakkam	Sriperum-budur	
1	pH @ 25°C	-	7.41	7.53	7.27	7.28	7.51	7.59	6.5 - 8.5
2	Total Dissolved Solids (TDS) @ 180°C	mg/L	533	249	876	1011	853	1018	2000
3	Calcium (as Ca)	mg/L	47.6	22.2	82.5	92.1	77.8	110	200
4	Chloride (as Cl)	mg/L	81.7	21	186	201	183	130	1000
5	Fluoride (as F)	mg/L	0.5	0.43	0.3	0.93	0.93	0.69	1.5
6	Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
7	Taste	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
8	Iron (as Fe)	mg/L	0.13	0.08	0.09	0.14	0.11	0.13	0.3
9	Magnesium (Mg)	mg/L	19.3	12.5	28.9	26.5	56.3	43.3	100
10	Total Nitrogen	mg/L	37.1	7.86	8.12	31.6	8.1	23.1	-
11	Hexavalent Chromium (as Cr+6)	mg/L	0.032	BDL	0.03	0.034	0.04	0.032	-
12	Nitrate (as NO_3)	mg/L	34.7	7.53	7.19	28.8	7.92	20.6	45
13	Sulphates (as SO_4)	mg/L	52.6	27.3	61.3	84.2	66.7	130	400
14	Zinc (as Zn)	mg/L	0.56	0.15	0.19	1.63	0.14	0.56	-
15	Total Hardness (as $CaCO_3$)	mg/L	198	107	325	339	426	451	600
16	Sodium (as Na)	mg/L	34.7	12.3	54	78.4	42.2	58.1	-
17	Potassium (as K)	mg/L	3.1	2.61	6.24	7.72	1.57	4.28	-
18	Total Alkalinity (as $CaCO_3$)	mg/L	164	103	232	311	424	325	600
19	Escherichia coli (MPN)	MPN/ 100ml	<2.0	<2.0	<2.0	4	<2.0	<2.0	-
20	Total coliform (MPN)	MPN/ 100ml	<2.0	<2.0	<2.0	12	<2.0	8	-
21	Fecal Coliform	MPN/ 100ml	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-

Source: Primary Monitoring, 2020

115. The pH of the groundwater is in alkaline and ranges between 7.27 to 7.59. The recorded Total Dissolved Solids (TDS) is high for Putlur (1011 mg/l) and Sriperumbudur (1018 mg/l), though, the values are very much less than the stipulated standard, it is an indication that the groundwater quality is deteriorating. Nitrate concentration is observed to be high in Athipedu (34.7 mg/l) in comparison with other sampling locations. Similarly, Total Alkalinity is high at Polivakkam (424 mg/l) in comparison with other sampling locations. In general, the groundwater quality in the project area is observed to be good for potable and domestic purposes.

4.2 Biological Environment

4.2.1 Flora

116. As per the Indian State of Forest Report (ISFR), the presence of very dense forest is completely absent in the Kanchipuram district. In the comparison of the forest area with the geographic area, Thiruvallur district has a higher percentage in comparison to the Kanchipuram district. The presence of floral species in the proposed alignment (sections 2 and 3) are recorded as part of the road inventory. For avenue trees, the species information and the girth size have been recorded.

Table 17: Forest Cover in Project Districts (units in Sq.km)

Sl.no	District	Geographical Area (GA)	Very Dense Forest	Moderately Dense Forest	Open Forest	Total	% of GA
		Areas in Sq.km					
1.	Kanchipuram	4,474	0	34	209	296	6.6
2.	Thiruvallur	3,413	10	46	191	247	7.2

Source: Indian State of Forest Report (ISFR)

117. As indicated in chapter 2, the section 2 alignment is a Greenfield corridor and hence, the impact on the flora is very much limited as it traverses through the agriculture land/area. However, section 3 is having a significant number of avenue trees, the details regarding the tree species are given in the following table. No species with ecological conservation value is noticed in the Project area.

Table 18: Details of the Tree Species in the Project Area

Sl.no	Name of the Species	Vernacular Name	IUCN status
1.	*Acacia auriculformis*	Golden shower	Least Concern
2.	*Albizia lebbek*	Vakai	Least Concern
3.	*Annona squamosa*	Seethapal	Least Concern
4.	*Areca catechu L*	Pakkumara	Data Deficient
5.	*Artocarpus integrifolia*	Jack	Data Deficient
6.	*Azadirachta indica*	Veppa maram	Least Concern
7.	*Banhinia purpurea*	Mandari	Data Deficient
8.	*Butea monosperona*	Flame of the forest	Least Concern
9.	*Calotropis gigantea R.Br.*	Erukku	Least Concern
10.	*Carica papaya L.*	Pappalimaram	Data Deficient
11.	*Cascabela thevitia*	Arali Psidium guajava	Least Concern
12.	*Cassia fistula L.*	konrai	Least Concern

Sl.no	Name of the Species	Vernacular Name	IUCN status
13.	*Casuarina equisetifolia Forst.*	Cavukkumaram	Least Concern
14.	*Ceiba pentandra L.) Gaertn*	Ilavam	Least Concern
15.	*Citrus limonia*	Puvarasam	Least Concern
16.	*Delonix regia.*	Gulmohar	Least Concern
17.	*Emblica officinalis*	Indian gooseberry	Least Concern
18.	*Eucalyptus lanceolatus*	Thaila maram	Least Concern
19.	*F. Religiosu*	Arasa maram	Least Concern
20.	*Ficus benghalensis*	Ala maram	Least Concern
21.	*Jatropha oligandrus*	Kattamanakku	Least Concern
22.	*Mangifera indica*	Mango	Least Concern
23.	*Phoenix sp*	Palmyra	Least Concern
24.	*Pithecellobium dulce*	Kodukka puli	Data Deficient
25.	*Polyathia longifolia*	Ashoka	Least Concern
26.	*Pongamia glabra*	Poongan	Least Concern
27.	*Punicia granatum*	Pomegranate	Least Concern
28.	*Spathodea campanulata*	Tulip tree	Least Concern
29.	*Tamarindus indica*	Puliya maram	Least Concern
30.	*Cocos nucifera*	Thennai maram	Least Concern

Source: Road Inventory, CPRR

118. The details of trees (including the girth size) that are likely to be affected during the project implementation are given in the following table.

Table 19: Details of the Affected Trees

CPR Section	Girth: 300 to 600 mm	Girth: 600 to 900 mm	Girth: 900 to 1800 mm	Girth: above 1800 mm	Trees to be felled	Trees to be transplanted
II	140	240	0	1	**381**	110
III	768	727	145	330	**1,970**	304
Total	**908**	**967**	**145**	**331**	**2,351**	**414**

Source: DPR, CPRR

Avenue trees at km 64/200

Avenue trees at km 70/600

119. The identified plant species have been classified into crops, shrubs, climbers, and herbs. The crop species include *Oryza sativa, Zea mays, Lycopersicum esculentam, Solanum melongina, Abolmoscus esculentus, Ixora coccinea, Amaranthus viridis, Saccharum*

officinarum, Brassica juncea, Capsicum annuum, Gossypium hirsutum, Momordica charantia, Sesamum indicum, and *Solanum nigrum*. The shrub species include *Calotropis gigantea, Euphorbia antiquorum, Euphorbia royleana, Euphorbia tirucalli, Punica granatum,* and *Ricinus communis*. The climber species includes *Cissampelos pareira, Cissus quadrangularis, Citrullus colocynthis, Coccinea indica, Cyclea burmanni, Cyclea peltata, Daemia extensa, Derris scandens,* and *Diplocyclos palmatus*. The Herbs species include *Abutilon indicum, Acalypha indica, Achyranthes aspera, Aerva lanata, Ageratum conyzoides, Altrernanthera sessilis, Amaranthus spinosus, Ammania baccifera, Argemon maxicana, Crotons parviflora, and Tephrosia purpurea*.

120. Trees with economic importance including *Moringa oleifera, Pithecelobium dulce, Psidium guazava, Artocarpus heterophyllous, Borassus flabellifer, Cocos nucifera, Mangifera indica, Phyllanthus emblica, Punica granatum,* and *Tamarindus indica* are also observed in the project area.

4.2.1.1 Mannur Reserve Forest (RF)

121. In section 3, the proposed alignment traverses through the Mannur Reserve Forest, due to the proposed widening, it is estimated to acquire 0.28 hectare of forest land. To assess the impact of road construction on the floral population, an inventory has been conducted in the forest area. The trees species including Pongan (*Pongamia glabra)*, Puliyamaram (*Tamarindus indica*), Veepa maram (*Azadirachta indica*), Vagai (*Albizia lebbeck*), Thaila maram (*Eucalyptus globulus*), Indian Jujube (*ziziphus trinervia*), Lemon (*atalantia monophylla*) are observed with the forest area. Some of the plant species include Touch me not plant (*mimosa pudica*), Nannari plant (*Hemidesmus indicus*), Pumppillu (Ageratum conyzoides), Eliyotti (*Argemone Mexicana*) are also observed in the RF area.

Figure 19: Mannur Reserve Forest (the area to be diverted)

View of Mannur Reserve Forest

4.2.2 Fauna

122. The project alignment (sections 2 and 3) does not have environmentally sensitive/ protected areas. The nearest wildlife sanctuary (Pulicat Bird Sanctuary) is located at a distance of 27.8km radius from the Section 2 start point. The distance is far from the stipulated construction restrictions zone of 10km. Hence the construction works do not have any impact on the Pulicat Bird Sanctuary. The presence of water bodies (refer **Table 13**) along the sections 2 and 3 attracts birds during the monsoon seasons (October to mid-December), however, it is temporary and lasts till the start of the summer seasons (March to June).

Figure 20: Presence of Pulicat Bird Sanctuary

123. As per the secondary information, the common reptiles, birds, and mammals observed in the project area are listed in the following table

Table 20: Faunal Species in the Project area

Sl.no	Zoological Name	Local Name	IUCN Status
	Reptiles		
1.	*Bungarus caeruleus*	Krait	Least Concern
2.	*Calotes versicolor*	Garden lizard	Least Concern
3.	*Calotes calotes*	Green Forest Lizard	Least Concern

Sl.no	Zoological Name	Local Name	IUCN Status
4.	*Herpestes edwardsi*	Indian grey mongoose	Least Concern
5.	*Chameleon sps*	Pachonthi	Least Concern
6.	*Dryophis sps*	Eye plucker	Least Concern
7.	*Enhydrina valakadayan*	Water snakes	Data Deficient
8.	*Ptyas mucosa*	Rat snake	Least Concern
9.	*Hemidactylus brooki*	House lizard	Least Concern
10.	*Echis carinatus*	Saw Scaled Viper	Least Concern
11.	*Naja naja*	Indian Cobra	Data Deficient
12.	Xenochrophis piscator	Checkered keelback (Water snake)	Data Deficient
13.	*Daboia russelii*	Russels Viper	Least Concern
	Birds		
14.	*Alcedo meninting*	Wood-pecker	Least Concern
15.	*Acridotheres tristis*	Common Myna	Least Concern
16.	*Bubulcus ibis*	Cattle egret	Least Concern
17.	*Columba livia*	Pigeon	Least Concern
18.	*Corvus splendens*	Crows	Least Concern
19.	*Milvus migrans*	Pariah kite	Least Concern
20.	*Passer domesticus*	Indian house sparrow	Least Concern
21.	*Pelicanus sps*	Water bird	Least Concern
22.	*Phoenicopterus roseus*	Poomarai	Least Concern
23.	*Psittacula eupatria*	Indian parakeet	Least Concern
	Mammals		
24.	*Bandicota indica*	Larger bandicoot rat	Least Concern
25.	*Funambulus palmarum*	Indian palm squirrel	Least Concern
26.	*Mus cervicolor*	Fawn-coloured mouse	
27.	*Mus musculus*	House mouse	Least Concern
28.	*Mus platithrix*	Indian brown spiny mouse	Least Concern
29.	*Orytolagus cuniculus*	Rabbit	Least Concern
30.	*Pteropus madius*	Bat	Least Concern
31.	*Sus Scrofa*	Pig	Least Concern
	Fish Species		
32.	*Mystus keletius*	Kelethi	Least Concern
33.	*Esomus danricus*	Flying Barb	Least Concern
34.	*Oreochromis mossambica*	Tilapia	Least Concern
35.	*Puntius chola*	Swamp Barb or Chola Barb	Least Concern
36.	*Channa punctatus*	Spotted Snakehead	Least Concern
37.	*Etroplus maculates*	Orange Chromide	Least Concern

4.2.2.1 Aquatic Ecology (Coovum and Kosasthalaiyar River)

124. Both the river systems (Coovum and Kosasthalaiyar River) are not perennial, both are monsoon dependent and act as a discharge channel for surplus water from their concern reservoirs (i.e surplus water from Coovum tank for Coovum River and Poondi reservoir for Kosasthalaiyar River).

View of Coovum River at km 57/500

View of Kosasthalaiyar River at km 37/000

i. ***Coovum River***: The Coovum River originates from the surplus course of Coovum tank in the Thiruvallur District. It runs east for a distance of about 65 kilometres and confluences with the Bay of Bengal downstream of Napier Bridge, traversing a distance of 20 kilometres within Chennai city limits. The river has aquatic life in the end section of the river, where it has a tidal influence. In the project area at km 57/500, where the proposed alignment crosses the Coovum River, it has no aquatic life and hence the proposed bridge construction across the river will not have any aquatic impact

ii. ***Kosasthalaiyar River***: Kosasthalaiyar River flows into the Poondi reservoir and from the poondi reservoir the river flows through the Thiruvallur district, enters the Chennai metropolitan area, it travels to a distance of 16km and joins the sea at Ennore creek. This river is not perennial and it acts as a drain for carrying surplus water from the Poondi reservoir and also as a storm water drain during monsoon season. Hence it does not have any ecological importance. The river is influenced by tidal action near the Ennore creek, which is far away (nearly 19km aerial distance from the start point of Thachur (section 2)) from the project area (km 37/000). Hence, the proposed bridge construction across the river will not have any aquatic impact.

125. However, to discuss the entire profile of both the rivers, the information collected from the secondary sources has been taken for discussion.

- **Coovum river**, as indicated in one of the literature (*Ecological Studies on the Coovum River with Special Reference to Pollution*), the Coovum river has been polluted by the discharge of the effluents from the surrounding settlements. The water sample has been analysed for the presence of the Plankton, which not only indicates the level of pollution but provides insight into the composition of their substratum. Based on the analysis, three groups of algae were reported viz. Bacillariophyceae (diatoms), Cyanophyceae and Chlorophyceae, in which Bacillariophyceae dominates the other two algae and it is also an indication that the water is polluted. However, the population of the algae changes based on the seasons. The quality and quantity of zooplankton offer additional evidence for the poor quality of water. 14 species of zooplankton were identified from the Coovum River, among these, Vorticella, Rotifers, and Moina were represented abundantly,

and in some samples, Copepods and Ostrocodes are also observed. *Brachionus calvciflorus Pallus*, *B. ruben* Ehr, *B. guadridenta*, *B. jorficula*, *Filium longiseta* were found to be predominant in Coovum River suggesting that these five species are more pollution tolerant than the other species. The macro invertebrates are also valuable indicators of environmental quality in the aquatic ecosystem, the larvae and pupae of dipterans are the second large group of macro-invertebrates in Coovum River. The semi-aquatic insects such as *Gerrid* sp. and *Hydrometra*, *Micronecta punctata* were also present in the Coovum River. Crustaceans like *Macrobrackium rosenbergi*, *Macrobrachium lamarrei*, *Macrobrackium javanicum*, and *Scylla serrate* were observed in the water samples. Fifteen species of fishes were observed in which the *Magalops oyprinoides* (Broussonel), *Etroplus maculates, Mugil cephalus* (Linnaeus), *Esomus danricus, Mugil macrolepis* (Smith) and *P'herapon jarbuva* (Forsk) are dominating species. The amphibian-like *Rana cyanophyclis*, *Rana limnocharis,* and *reptile Natrix sp.* were observed in some areas of the Coovum River.

- **Kosasthalaiyar River**, the total number of phytoplankton taxa recorded varied between 14 to 20 species. The percentage composition of phytoplankton was dominated by diatoms which include Centrales (42.62%) Pennales (38.44%), dinoflagellates (15.60%) and Cynophyacea (3.34%), *Coscinodiscus subbulliens* was most dominant than other species like *Nitzschia sp.*, *Pleurosigma sp.* and *Pleurosigma elongatum*. For Zooplanktons, the species composition fluctuated from 19 to 23 species. *Acartia danae* was the most dominant zooplankton followed by *Penilia avirostris*, *Lucifer sp.* and *Evadne sp.* than other zooplankton species. The benthic fauna population was observed to be moderate and dominated by the presence of polychaete worms, crustacean, and bivalves. Around eight fish species has been identified in the Kosasthalaiyar River some of the dominating species are *Mystus keletius, Esomus danricus, Oreochromis mossambica, Mugil cephalus, Puntius chola, Channa punctatus and Etroplus maculates*.

4.3 Socio-Economic Environment

4.3.1 Demographic and Administrative Profile of Project Areas

126. The following sections give a comparative picture of the various demographic and socio-economic indicators (as per census 2011) for the project areas. Detailed social baseline is discussed in the social impact assessment report.

127. **Ponneri:** Ponneri is a Town Panchayat in the district of Thiruvallur, Tamil Nadu with a total of 100,866 households. Ponneri has a total population of 389,862 out of which 195,181 are males while 194,681 are females. The total literates of Ponneri are 275,736 out of which male literates are 149,141 and female literates are 126,595. The total illiterates in Ponneri are 114,126. The total SC & ST population is 124,094 and 7,942 respectively. The population of Children age 0-6 is 42,836. The total work population in Ponneri is 164,036. The total main work population is 126,951 and the number of people working as cultivators, agricultural labourers, household industry workers, and other workers is 7,638, 25,875, 3,104 and 90,334 respectively. The total marginal workers are 37,085 and non-workers are 225,826.

128. **Uthukottai:** Uthukkottai is a Town Panchayat city in the district of Thiruvallur, Tamil Nadu with a total of 40,313 households. Uthukkottai has a total population of 152,631 out of which 195,181 are males while are 77,156 females. The total literates of Uthukkottai are 94,212 out of which male literates are 52,339 and female literates are 41,873. The total illiterates in Uthukkottai are 58,419. The total SC & ST population is 52,738 and 6,609 respectively. The population of Children age 0-6 is 16,801. The total work population in Uthukkottai is 75,543. The total main work population is 58,332 and the number of people working as cultivators, agricultural labourers, household industry workers, and other workers is 6,621, 30,745, 1,799 and 19,167 respectively. The total marginal workers are 17,211 and non-workers are 77,088.

129. **Thiruvallur**: Thiruvallur has a total population of 407,048 out of which 203,911 are males while are 203,137 females. The total literates of Thiruvallur are 292,841 out of which male literates are 158,836 and female literates are 134,005. The total illiterates in Thiruvallur are 114,207. The total SC & ST population is 138,049 and 7,057 respectively. The total number of households in Thiruvallur is 103,241. The population of Children age 0-6 is 41,871. The total work population in Thiruvallur is 178,511. The total main work population is 130,973 and the number of people working as cultivators, agricultural labourers, household industry workers, and other workers is 9,666, 31,402, 3,490 and 86,415 respectively. The total marginal workers are 47,538 and non-workers are 228,537.

130. **Sriperumbudur:** Sriperumbudur is a Town Panchayat city in the district of Kancheepuram, Tamil Nadu and has a total population of 510,836 out of which 258,881are males while are 251,955 females. The total literates of Sriperumbudur are 379,192 out of which male literates are 205,236 and female literates are 173,956. The total illiterates in Sriperumbudur are 131,644. The total SC & ST population is 143,544 and 4,130 respectively. The total number of households in Sriperumbudur is 125,938. The population of Children age 0-6 is 58,036. The total work population in Sriperumbudur is 210,632. The total main work population is 170,566 and the number of people working as cultivators, agricultural labourers, household industry workers, and other workers is 6,132, 11,733, 4,849 and 147,852 respectively. The total marginal workers are 40,066 and non-workers are 300,204.

4.3.2 Economic importance of the Project Districts

131. **Kanchipuram**: The major occupations of Kanchipuram are silk saree weaving and agriculture. More than 5,000 families were involved in saree production. The main industries are cotton production, light machinery, and electrical goods manufacturing and food processing. There are 25 silk and cotton yarn industries, 60 dyeing units, 50 rice mills and 42 other industries in the Kanchipuram. Another important occupation is tourism and service-related segments like hotels, restaurants and local transportation. Section 3 falls under the Kanchipuram District, the predominant occupation is observed to be agriculture followed by industrial activities.

132. **Thiruvallur**: Thiruvallur district is one of the fastest developing districts in Tamil Nadu in terms of Industrial Development. The district has many leading industries like Kamarajar Port, North Chennai Thermal Power Station, National Thermal Power Corporation, L&T Ship Build, NIOT, ITC, IOCL, HPCL, BPCL, and Hindustan Motors. It also

boasts of the Ennore Thermal Power Station and the Avadi Tank Factory. The District has 9 Industrial Estates, all in operation out of which 6 are developed by the Government and 3 by Private Organisation. This district has 16,940 Small Scale Industries, notable among them being food, wood, textile, chemical, engineering, non-metallic and leather industries. A portion of section 3 and full alignment of Section 2 falls under the Thiruvallur District, the predominant occupation is agriculture, which is followed by industrial activities.

4.3.3 Common Property Resources (CPRs)

133. As per the outcome from the public consultation, some ancient stones representing the Stone Age period are observed in the village Putlur (Not an ASI site), which is located at a distance of 4.5km from the project area.

134. The impact on the Common Property Resources (CPRs) shows that 21 CPRs in the section 2 and 53 CPRs in the section 3 are likely to be affected. The details of the CPR's are given in the following table

Table 21: Common Property Resources in the Section 2

SL.No	Right/ Left	Highway chainage	Name of the Village	Type of the CPR	Significant Impact	Remarks
1	Right	23/300	Natham	Over Head Tank	Yes	Replace
2	Left	30/600	Athivakkam	Athivakkam Burial Ground	Yes	Replace
3	Left	30/700	Athivakkam	Boorivakkam Burial Ground	Yes	Replace
4	Left	32/800	Kilampakkam	Kilambakkam Bus Stop	Yes	Replace
5	Left	37/300	Ammanapakkam	Over Head Tank	Yes	Replace
6	Left	37/300	Ammanapakkam	Anganwadi	Yes	Replace
7	Right	37/300	Ammanapakkam	Agri seed office and Godown	Yes	Replace
8	Left	41/100	Velliyur	Pump House	Yes	Replace
9	Left	41/100	Velliyur	Pump House	Yes	Replace
10	Left	41/100	Velliyur	Pump House	Yes	Replace
11	Left	41/100	Velliyur	Pump House	Yes	Replace
12	Right	41/800	VV Kandigai	Sri Perumal Koil	Yes	Replace
13	Right	41/800	VV Kandigai	TN Co-op Bank	Yes	Replace
14	Right	41/800	VV Kandigai	Over Head Tank	Yes	Unimportant
15	Right	41/800	VV Kandigai	Pump House	Yes	Unimportant
16	Left	42/300	Karikalavakkam	Sri Bavani Amman koil	Yes	Replace
17	Left	42/300	Karikalavakkam	Over Head Tank	Yes	Unimportant
18	Left	46/600	Meiyur	Pump House	Yes	Replace
19	Left	46/600	Meiyur	Pump House	Yes	Replace
20	Left	46/600	Meiyur	Pump House	Yes	Replace
21	Left	46/600	Meiyur	Pump House	Yes	Replace

Source: Census and Baseline Socio- Economic Survey, December 2019 – February 2020

Table 22: Common Property Resources in the Section 3

SL.No	Right / Left	Highway chainage	Name of the village	Type of CPR	Significant Impact	Remarks:
1	RHS	54/400	Thaneerkulam	OHT	Yes	Replace
2	RHS	54/400	Thaneerkulam	Pump House	Yes	Replace
3	RHS	54/400	Thaneerkulam	Burial Ground	Yes	Replace
4	RHS	62/890	Athikulam	Athikulam Bus stop	Yes	Replace
5	RHS	62/890	Athikulam	Pump House	Yes	Replace
6	LHS	63/580	Polivakkam	Putru Koil	Yes	NA
7	LHS	63/660	Polivakkam	Polivakkam bus Stop	Yes	Replace
8	LHS	64/600	Chatiram	Vet. hospital	Yes	NA
9	LHS	64/700	Chatiram	Syntax Tank	Yes	Replace
10	RHS	64/800	Chatiram	Vinayakar Koil	Yes	Replace
11	RHS	64/850	Chatiram	Chatram Bus Stop	Yes	Replace
12	LHS	64/850	Chatiram	Chatram Bus Stop	No	NA
13	LHS	64/850	Chatiram	Primary School	Yes	Replace
14	RHS	64/900	Chatiram	Dharmasastha Koil	Yes	Replace
15	RHS	64/900	Chatiram	Syntax Tank	Yes	Replace
16	LHS	64/900	Chatiram	Nagathamman Koil	Yes	Replace
17	LHS	65/130	Chatiram	Pump House	Yes	Replace
18	RHS	65/130	Chatiram	Pump House	Yes	Replace
19	RHS	65/150	Chatiram	Pump House	Yes	Replace
20	RHS	65/160	Chatiram	Pump House	Yes	Replace
21	RHS	66/500	Gandhi Ngr	Gandhi Ngr Bus stop	Yes	Replace
22	RHS	67/850	Sengadu	Sri Amman Koil	Yes	Replace
23	RHS	67/850	Sengadu	Syntax Tank	Yes	NA
24	LHS	67/970	Sengadu	Sengadu Bus Stop	Yes	Replace
25	RHS	67/980	Sengadu	OHT	Yes	Replace
26	LHS	69/860	Mannur	Sri Batrakali Koil	Yes	Replace
27	LHS	69/900	Mannur	Pump House	Yes	Replace
28	LHS	70/090	Thodukadu	Power grid Office	No	REPLACE
29	LHS	70/100	Thodukadu	Pump House	Yes	Replace
30	LHS	70/100	Thodukadu	Pump House	Yes	Replace
31	LHS	70/120	Thodukadu	Pump House	Yes	Replace
32	LHS	70/130	Thodukadu	Pump House	Yes	Replace
33	LHS	70/240	Thodukadu	Pump House	Yes	Replace
34	LHS	70/280	Thodukadu	Pump House	Yes	Replace
35	LHS	70/380	Thodukadu	Syntax Tank	No	NA
36	LHS	70/570	Thodukadu	Temple Arch	No	NA
37	RHS	70/570	Thodukadu	Sri Vinayagar Koil	Yes	Replace
38	RHS	70/570	Thodukadu	Parasungapuram ITI Bus Stop	Yes	Replace
39	RHS	72/200	Thodukadu	Pump House	Yes	Replace
40	LHS	72/200	Thodukadu	Ponniamman Koil	Yes	Replace
41	RHS	72/800	Ayakulathur	Burial Ground	No	NA
42	LHS	73/780	Ayakulathur	Kanaga Kaleesara Koil	No	Replace

SL.No	Right / Left	Highway chainage	Name of the village	Type of CPR	Significant Impact	Remarks:
43	LHS	75/200	Sriperumpudur	AG Church	Yes	Replace
44	LHS	75/200	Sriperumpudur	Ration Shop	Yes	Replace
45	LHS	75/200	Sriperumpudur	Pump House	Yes	Replace
46	LHS	75/300	Sriperumpudur	Anganwadi	Yes	Replace
47	LHS	75/300	Sriperumpudur	Panchayat office	Yes	Replace
48	LHS	75/650	Sriperumpudur	Metro Office	Yes	Replace
49	LHS	75/650	Sriperumpudur	Murugan koil	Yes	Replace
50	LHS	75/950	Sriperumpudur	Kanniamman Koil	Yes	Replace
51	LHS	77/130	Sriperumpudur	DSP Office	Yes	Replace
52	RHS	76/900	Sriperumpudur	Vinayagar Koil	Yes	Replace
53	LHS	68/000	Sengadu	Temple Arch	Yes	Replace

Source: Census and Baseline Socio- Economic Survey, December 2019 – February 2020

5. Grievance Redress Mechanism

5.1 Composition Function of Grievance Redressal Committee (GRC)

135. The GRC is aimed to provide a time-bound and transparent mechanism to voice and resolve environmental and social concerns linked to the project and to be an effective way to address the Affected Person's (AP's) concerns without allowing it to escalate resulting in delays in project implementation. The GRC is not intended to bypass the government's inbuilt redressal process, nor the provisions of the statute, but rather it is intended to address affected persons concerns and complaints promptly, making it readily accessible to all segments of the affected persons and is scaled to the risks and impacts of the project.

136. The GRC is expected to resolve the grievances of the eligible persons within a stipulated time. The decision of the GRC is final unless vacated by the LARR Authority (constituted following Section 51(1) of the RFCTLARR Act, 2013). The GRC will continue to function, for the benefit of the APs, during the entire life of the project including the defects liability period. The response time prescribed for the GRC would be three weeks. Since the entire resettlement component of the project has to be completed before the construction starts, the GRC, at division and regional level, will meet at least once in three weeks to resolve the pending grievances. Other than disputes relating to ownership rights and apportionment issues on which the LARR Authority has jurisdiction, GRC will review grievances involving all resettlement benefits, environmental issues (loss of trees, impact to water bodies, impacts on cultural properties, any other construction related nuisances etc.), relocation and payment of assistance.

137. The GRC has been constituted at Divisional level headed/chaired by a Retired District Revenue Officer (DRO) as the chairperson of the committee. The jurisdictional Divisional Engineer (H), CPRR will be the member secretary of the committee. The concerned Revenue Divisional Officer will be a member. A local person of repute and standing in the society as a member has been nominated by the Project Director, CPRR.

138. The Project Director, CPRR will be the appellate authority and any affected person whose grievance is unresolved at the regional level GRC can approach the appellate authority for relief. The Superintending Engineer (H), CPRR, as member secretary and one social / resettlement expert from the RP implementation monitoring consultant as a member, will assist the Project Director in addressing the grievances. The NGO will assist affected persons in registering their grievances and being heard.

139. For environmental related issues, the grievance shall be shared with the Environmental cell, PIU for their scrutiny, based on their recommendations/ suggestions the grievance shall be sorted out.

5.2 Approach to GRC

140. Two-tier Grievance Redress Committee (GRC) has been proposed for this project, the affected person shall submit the grievances to the Retired District Revenue Officer (DRO). For environmental related issues, it shall be shared with the Environmental Cell for obtaining suitable measures/ guidance in sorting out the same. The received grievance,

shall be redressed in 3 weeks and a written communication shall be sent to the complainant. If the complainant is still not satisfied with the outcome from the first level, he/she can approach the Project Director, CPRR (second level), on acceptance of the grievance it shall be redressed in 3 weeks and a written communication shall be sent to the complainant. If the complainant is still not satisfied with the outcome from the second level, he/she can approach the court of law.

141. For social related issues/ grievances, similar approach shall be taken, in which the grievance shall be sorted out by the DRO in the first level, if not it shall be solved by the Project Director in the second level. If the complainant is still not satisfied with the outcome from the second level, he/she can approach the Jurisdictional LARR Authority. The complainant can access the appropriate LARR Authority at any time and not necessarily go through GRC.

142. Any lost-time accidents will be reported to TNHD and AIIB immediately with a time-bound corrective action plan proposed to remediate the risks.

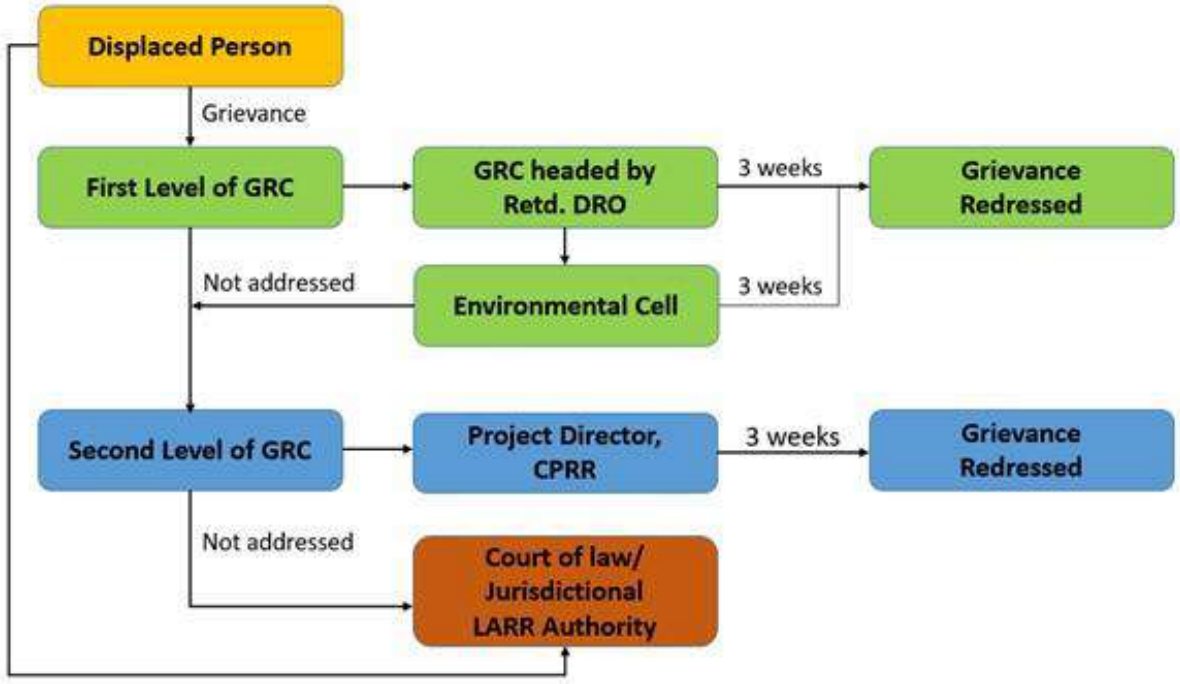


Figure 21: Grievance Redressal Committee for CPRR

6. Analysis of Potential Environmental Impact and Mitigation Measure

6.1 Assessment of Environmental Impacts

144. The assessment for environmental impacts due to the implementation of the CPRR project has been carried out for the potential impacts envisaged during the various stages of the project planning and implementation. However, the Contractor should prepare site specific Construction EMPs based on final design and locations of construction camps, quarries and borrow areas etc.

- ***Location impacts***: Impacts associated with site selection, including impacts on environment and resettlement or livelihood related impacts on communities and impacts to the environmental sensitive locations (Sanctuaries, forest areas, national parks, etc.)
- ***Design impacts***: Impacts arising from project design, including fixing of alignment/ curve improvements, safety measures, etc.
- ***Construction impacts***: Impacts resulting from construction activities including site clearance, earthworks, civil works, etc.
- ***O&M impact***: Impacts associated with the operation and maintenance of the roads

6.1.1 Land Acquisition and Resettlement Impacts.

145. It is estimated to acquire 208 ha of private land and alienation of 64.56 ha of government land. Maximum private land acquisition is expected in Section 2 of the CPRR, due to the new Greenfield alignment. The land acquisition is as per the Tamil Nadu Highways Act, 2001 and the compensation is being determined following the RFCTLARR Act, 2013. For the HR&CE temple land, No objection certificate shall be obtained from HR&CE on payment of 250 percent of the guideline value to HR&CE. Government land of 64.56 ha shall be utilised through alienation. The transfer proposal shall be prepared by DE (H) and LARRU for all government land required for the project and it will be submitted to District Collectors (Thiruvallur and Kanchipuram districts) for initiating the transfer orders before handing over the lands to the contractors. Land alienation will be completed as soon as possible after obtaining the enter upon permission from the District Collector.

146. As per the detailed design, it has been estimated that nearly 495 structures are getting affected, in that 437 structures are fully affected and the remaining 58 are partially or having minor impacts. In the total affected structures, nearly 50% (246) of them are Squatters and 49% (245) of them are Titleholders, only one percent of Encroachers have been recorded. The compensation for the structure loss and the livelihood assistance shall be estimated as per the Entitlement Matrix formulated for the CPRR. Further details on the land acquisition and the R&R assistance are given in the Social Impact Assessment (SIA) report.

6.1.2 Design Considerations to Avoid Environmental Impacts

147. Based on the assessment, the following are the design considerations to avoid or to minimise the environmental impacts

- Incorporation of adequate drainage provisions
- Straight lines and simple geometry in the proposed design
- Provision for major intersections at NH 48 and NH 716 to avoid traffic congestion
- Provision for service roads, underpass facilities, pedestrian and street light facilities in the settlement areas
- Provision for adequate signage's and safety measures in the settlement areas
- Provision for avenue tree plantation/ landscaping at major junctions

148. Significant environmental impacts are anticipated in section 3, due to the removal/cutting of the avenue trees and impact to the water bodies. However, it has been minimised to the extent by proposing the Thiruvallur Bypass (km 47/300 to km 62/900) for a length of 15.6km, Thodukkadu village realignment section (km 71/400 to 74/300) for a length of 2.9km and a realignment section (km 75/200 to 76/900) near Sriperumbudur town for a length of 14km. Various options adopted in minimising the environmental and social impacts are discussed in the alternate analysis section (Chapter 2).

6.1.3 Climate Risks and Adaptation Measures

149. The Tamil Nadu government's strategy for coping with climate change and its impacts are articulated in Tamil Nadu State Action Plan on Climate Change (TNSAPCC). The approach of the TNSAPCC is to create and define an overarching climate response framework at the State Government level to reduce vulnerability; reduce hazards and exposure; pool, transfer, and share risks; prepare and respond effectively; and increase capacity to cope with unforeseen events.

150. Road projects are highly vulnerable to changes in climate variables, expected changes in the frequency and intensity of extreme weather events. Based on the assessment of the section 2 and Section 3, the following climate variables are having direct impact for which suitable mitigation measures were suggested.

- Temperature
- Rainfall Intensity
- Submergence due to rise in surrounding Water Levels

151. **Temperature**. Changes in temperature, both a gradual increase in temperature and an increase in extreme temperatures are likely to impact road pavement and structures (including major and minor bridges) due to heat induced heaving and buckling of joints. For the pavement, Increase in surface deformations and for bridges, Increase in expansion and stresses are observed to be the key climate associated risks in this project. The identified risk shall be mitigated through adoption of suitable construction materials, which can withstand the increased moisture and salinity and also less corrosive materials. By choosing so, the expected lifetime of the pavement and the structures shall be extended.

152. **Rainfall Intensity.** During the North East monsoon, increase in rainfall intensity leading to flash floods has direct impact on the pavement as well as the bridges and culverts. The following impacts are anticipated due to increased rainfall.

- Damage to roads, and drainage systems due to flooding

- Increase in scouring of roads, bank erosion for bridges, and support structures
- Damage to road infrastructure due to landslides,
- Overloading of drainage systems
- Reduced hydraulic capacity
- Deterioration of structural integrity of roads and bridges due to increase in soil moisture levels

153. To mitigate the risks due to the increased rainfall, the following measures are proposed.

- Upstream river training to stabilize channels.
- 4 Major Bridges and 14 Minor Bridges proposed across water bodies.
- More CD structures (Box culverts at required locations) on green field alignment.
- Design the Bridges and culverts for peak flows by increasing the height of piers of the bridges and constructing deeper well foundations for the bridges.
- Drain on both sides of the road throughout the length.
- GSB drainage layer for full width of ROW for effective sub-surface drainage.

154. **Submergence due to increase in Water Levels**. District level analysis by Byravan et al (2011), show that the area at greatest risk are the five coastal districts, Nagapattinam, Thiruvallur (project area), Thanjavur, Pudukottai, and Ramanathapuram, as along the coast line the areas in these districts are below 10 m of the current mean sea level. They are constantly at risk because of the storm surges that already affect them. Hence, another key issue due to the intense rainfall is stagnant of water which leads to the submergence of structures, being a Greenfield alignment which traverses more than 60 to 70% in the agriculture land, the changes of stagnant of water is anticipated to be high. To counteract the risk the following mitigation measures shall be adopted

- Bottom of subgrade will be 1m above the existing ground level (as per Cl. 4.2.1 of IRC:SP:87-2019) for green field alignment to avoid pavement failure by capillary action.
- Retaining wall is proposed on both sides of CPRR at Proposed RoW to retain the embankment.

6.2 Pre – Construction Impacts and Mitigation Measures

155. Necessary consents, permits and NoC as indicated in Table 4, shall be obtained before the start of construction work. Failure to obtain necessary consents, permits, NOCs, etc. can result in the delay of works. The following will be conducted during the detailed design phase:

- Obtain all necessary consents, permits, clearance, NOCs, etc. before the start of civil works.
- Acknowledge in writing and provide a report on compliance with all obtained consents, permits, clearance, NOCs, etc.
- Include in detailed design drawings and documents all conditions and provisions if necessary.

156. **Erosion Control**: Most of the impacts will occur due to excavation and earth movements during the construction phase. Before the commencement of civil works, the Contractor will be required to:

- Develop an erosion control measures to minimize soil loss and reduce sedimentation to protect water quality.
- Minimize the potential for erosion by balancing cuts and fills to the extent feasible.
- Identify and avoid areas with unstable slopes and local factors that can cause slope instability
- Minimize the amount of land disturbed as much as possible. Use existing roads, disturbed areas, and borrow pits and quarries when possible. Minimize vegetation removal.

157. **Utilities**: Interruption of services (water supply, toilets, bathing areas, etc.) will be scheduled and intermittently related to localized construction activities. To mitigate impacts, Supervision Consultant and PIU will:

- Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during the construction phase.
- Require Contractor to prepare a contingency plan to include actions to be done in case of unintentional interruption of services.
- Require Contractor to obtain from the Supervision Consultant and PIU the list of affected utilities and operators;
- If relocations are necessary, Contractor along with Supervision Consultant will coordinate with the providers to relocate the utility

158. **Social and Cultural Resources:** Any work involving ground disturbance can uncover and damage archaeological and historical remains. As per the outcome from the public consultation, some ancient stones representing the Stone Age period are observed in the village Putlur (Not an ASI site), which is located at a distance of 4.5km from the project area. Hence during the excavation operation, care should be taken not to damage any chance finds. The Supervision Consultant and PIU will:

- Consult Archaeological Survey of India and/or State Department of Archaeology to obtain an expert assessment of the archaeological potential of the site.
- Consider alternatives if the site is found to be of medium or high risk.
- Include state and local archaeological, cultural and historical authorities and interest groups in consultation forums as project stakeholders so that their expertise can be made available.
- Develop a protocol for use by the Contractors in conducting any excavation work, to ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved.

159. **Sites for Construction Work Camps and Areas for Stockpile, Storage, and Disposal**: The priority is to locate the construction camp; storage and area of stockpile are adjacent/

near to the project sites. The Contractor will be required to meet the following criteria for the sites:

- Will not promote instability and result in the destruction of property, vegetation, irrigation and drinking water supply systems, etc.
- Residential areas will not be considered to protect the human environment (i.e., to curb accident risks, health risks due to air and water pollution and dust, noise, and to prevent social conflicts, shortages of amenities and crime).
- The disposal will not be allowed into a nearby watercourse or any nearby sensitive areas which may pollute surface water or can cause inconvenience to the community.
- The construction camp, storage of fuel and lubricants should be avoided at the river bank. Any construction campsite will be finalized in consultation with the Supervision Consultant and PIU.

160. **Sources of Construction Materials**: Significant amounts of gravel, sand, and cement will be required for the construction of proposed CPRR. Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding, waterlogging and water pollution. The Contractor will be required to:

- Use quarry sites and sources permitted by Government.
- Verify the suitability of all sourced material and obtain approval from the Supervision Consultant and PIU.
- If additional quarries are required after construction has started, obtain written approval from the Supervision Consultant and PIU.
- Submit to Supervision Consultant and PIU on monthly basis the documentation detailing the source of materials

161. **Quarries and borrow pits**. The excavation of quarries and borrow pits used for obtaining soil and aggregate materials for road construction can cause direct and indirect long-term adverse impacts on the environment. The proposed CPRR (section 2 and 3) envisage use of significant quantities of earth, stone and grit and sand along with bitumen. The principal construction materials required for the corridor includes:

- Quarry materials, used in asphalt and aggregate for upper pavement layers
- Sand, gravel, laterite, clay and other materials for fill and lower pavement layers

162. Contract documents specify the materials to be used, but not specific quarries, pits or borrow sites for obtaining the various materials. The contractor shall identify the source of materials and use them with the consent of the PIU and Supervision Consultant. The sources of construction material that the contractor needs to tap and the management measures include:

- Quarry materials from licensed existing quarries
- Sand from riverbeds (purchase directly from GoTN website www.tnsand.in)
- Clays from tanks, many of which are near the project area
- Laterites available in the vicinity of project area

- The selection and recommendations for borrow areas will be based on environmental as well as engineering considerations
- Transport of material will be in compliance with the environmental requirements of the MoEF&CC, Ministry of Road Transport and Highways (MoRTH) and as specified in IRC: 10-1961
- For the redevelopment of the borrow area, the contractor shall evolve site-specific redevelopment plan for each borrow area location, which shall be implemented after the approval of the Engineer–in charge
- The haul roads and borrow areas will be managed and maintained by the Contractor
- Borrowing of earth shall be avoided on productive lands and within or 1 km of settlement areas
- The depth of borrow pits shall not exceed 45 cm and it may be dug out to a depth of not more than 30 cm after stripping the 15 cm top soil aside
- Topsoil shall be preserved in stockpiles

163. **Access**: Hauling of construction materials and operation of equipment on-site can cause traffic problems and conflicts in ROWs. Construction traffic will access most work areas from the existing roads therefore potential impacts will be of short-duration, localized and can be mitigated. The Contractor will need to adopt the following mitigation measures:

- Plan transportation routes so that heavy vehicles do not use narrow local roads, except nearby delivery sites.
- Schedule transport and hauling activities during non-peak hours.
- Locate entry and exit points in areas where there is low potential for traffic congestion.
- Keep the site free from all unnecessary obstructions.
- Drive vehicles in a considerate manner.
- Provide free access to households and businesses/shops along the ROWs during the construction phase

164. **Avenue trees**: as per the proposed design, it is estimated to remove 2,765 trees (491 trees in section 2 and 2,274 trees in section 3) and removing other vegetation in the project shall have a minor impact on the microclimate. As suggested by the State Expert Appraisal Committee (SEAC), TNHD has revisited the proposed alignment and carried out changes to minimise the loss of trees, it is also decided to transplant the trees having <30 cm girth size. By doing so, out of 2,765 trees that are proposed to be removed has been minimised to 2,351 trees, which is nearly 15% has been saved. However, as per the prevailing norms for the compensatory afforestation ratio of 1:10, nearly 27,650 trees shall be planted along the ROW. The following table depicts the details.

CPR Section	Girth: 300 to 600 mm	Girth: 600 to 900 mm	Girth: 900 to 1800 mm	Girth: above 1800 mm	Trees to be felled	Trees to be transplanted	Total Trees
II	140	240	0	1	**381**	110	491
III	768	727	145	330	**1,970**	304	2274
Total	**908**	**967**	**145**	**331**	**2,351**	**414**	**2765**

165. The Contractor will need to adopt the following mitigation measures:

- Efforts shall be made to minimize the number of trees being cut during design by realigning the section with green tunnels.
- Efforts to minimize the impact on trees have to be continued during the project implementation in coordination with the Supervision Consultant.
- Possibilities of tree transplantation (trees having 30 cm girth at breast height) have to be explored in guidance/ coordination with the Supervision Consultant.
- Approximately, 27,650 avenue plantations (including trees to be transplanted) shall be taken up along both sides of the road, for which additional land has been proposed to acquire along with the LA for the road formation. Additional plantation works shall be taken up on available oxbow land locations and within RoW as enhancement measures to reduce the impacts of air and dust pollution and act as a natural filter to traffic emissions.
- Species of Tamarinal, Azhinjal, Pongam and Banayan should be preserved
- Planting trees along PROW as part of compensatory afforestation as per IRC:SP: 21
- The Contractor shall take responsibility for maintaining the avenue tree plantation as part of the compensatory afforestation measures (Guideline for afforestation is given in the Annexure 7).

6.3 Anticipated Impacts during Construction Phase and Mitigation Measures

166. **Erosion Hazards**: As per the assessment conducted for the CPRR, the risks involved due to erosion in the project areas are relatively low and limited during the construction phase and are not expected to have any negative impact on the drainage and hydrology of the project areas. The runoff will produce a highly variable discharge in terms of volume and quality, and in most instances will have no discernible environmental impact. The Contractor will be required to

- Save topsoil removed during excavation and use to reclaim disturbed areas, as soon as it is possible to do so.
- Use dust abatement such as water spraying to minimize windblown erosion.
- Maintain vegetative cover within unused land to prevent erosion and periodically monitor the area to assess erosion.
- Clean and maintain drainage ditches and culverts regularly at km 26/522, km 30/750, km 37/390, km 44/135, km 63/340 and 73/800.
- Conduct routine site inspection to assess the effectiveness and the maintenance requirements for erosion and sediment control systems

167. **Impacts on Water Quality**: Excavated materials may end up in drainage and water bodies adjacent to the project sites, particularly during monsoon season. Other risks of water pollution may be caused by (i) poorly managed construction sediments, wastes and hazardous substances; and (ii) poor sanitation practices of construction workers. The Contractor will be required to:

- Schedule civil works near the Kosathalaiyar River (km 36/800), Krishna canal (km 53/700), Ramapuram Lake (km 54/600), Coovum River (km 57/500) and a seasonal

water body (km 63/300) during the non-monsoon season, to the maximum extent possible.

- Use silt fencing to arrest silt runoff into the nearby water bodies
- Ensure drainages and water bodies within the construction zones are kept free of obstructions.
- Keep loose soil material and stockpiles out of drains, flow-lines, and watercourses.
- Re-use/utilize, to the maximum extent possible, excavated materials.
- Dispose of any residuals at the identified disposal site.
- Dispose of waste oil and lubricants generated as per provisions of Hazardous Waste (Management and Handling) Rules, 1989.
- Refuel equipment within the designated refueling containment area away from drainages, nallahs, or any water body.
- Inspect all vehicles daily for fluid leaks before leaving the vehicle staging area, and repair any leaks before the vehicle resumes operation

168. **Run-off and Drainage.** One of the unavoidable aftermaths of road construction is the increased surface runoff. The addition of hard paved shoulders, which essentially increase paved impervious surface, will cause increased surface runoff along the roadsides. Increase in surface run-off is due to the creation of impervious surfaces that prevent the flow of water into the ground. The increased runoff from the project has been worked out as follows:

*Increase in runoff (cum.) = increase in runoff co-efficient due to construction * annual rainfall in the area (m) * area of the newly constructed surface.*

169. The increase of the black top width has been considered as per the cross section proposed. The runoff coefficient used for the calculations are 0.2 for red sandy and reddish-brown loam, 0.15 for recent sandy and 0.55 for black cotton soil. The black top has a run-off coefficient of 0.95. Increase in the runoff co-efficient has been worked out as the difference between the runoff co-efficient of black top surface and different soil types.

170. The increased run-off so calculated is estimated to be 211,277 cum for Section 2 and 715,107 cum for Section 3. Increased runoff in Section 3 is due to the soil type as well as the length of the road. Impacts due to surface runoff includes increased soil erosion and local flooding or water logging. However, the Sections 2 and 3 has been designed with adequate drains (107 culverts for section 2 and 106 culverts for section 3) to take care of runoff, surface runoff shall be drained to the nearest cross drainage structure.

171. As an enhancement measure, 13 water bodies has been identified along the project corridor for which deepening of water body has been suggested, which shall help to increase the water storage capacity and as also groundwater recharge potential. The geo coordinates of the water bodies are given in the following table

Table 23: Surface water bodies along the section 2 and 3

Sl.no	Water body	Latitude	Longitude
	Section 2		

Sl.no	Water body	Latitude	Longitude
1	Water Pond	13°16'25.63"N	80° 7'37.61"E
2	Water Tank	13°16'36.09"N	80° 4'56.84"E
3	Water Pond	13°16'11.20"N	80° 4'13.33"E
4	Water Pond	13°16'19.58"N	80° 4'1.74"E
5	Water Tank	13°15'41.44"N	80° 3'22.70"E
6	Water Tank	13°14'58.80"N	80° 2'37.34"E
7	Water Tank	13°12'52.60"N	79°59'58.19"E
8	Water Tank	13°11'27.89"N	79°57'22.81"E
	Section 3		
9	Water Tank	13° 8'10.89"N	79°56'37.24"E
10	Water Tank	13° 7'54.15"N	79°56'57.01"E
11	Water Tank	13° 6'9.94"N	79°56'15.32"E
12	Water Pond	12°59'57.95"N	79°55'47.04"E
13	Water Tank	12°57'50.48"N	79°56'23.62"E

172. **Impacts on Air Quality**: During construction air quality may be degraded for short periods due to (i) the exhaust emissions from the operation of construction machinery; (ii) fugitive emissions from brick, concrete, and asphalt plants; (iii) the dust generated from the haulage of materials, exposed soils and material stockpiles; (iv) cleaning of the road; (v) material loading; (vi) unloading; and (vii) blasting activities. The impact is expected to be localised, temporary and confined to construction areas.

Table 24: Impact on Air Quality during Construction Stage

Sl. No.	Impact	Source
1.	Generation of Dust (SPM)	• • Transportation of raw materials from quarries and borrow sites; • Stone crushing, handling and storage of aggregates in asphalt plants; • Site levelling, clearing of trees, laying of asphalt, construction of bridges; • Concrete batching plants; • Asphalt mix plants – due to the mixing of aggregates with bitumen; and • Construction of structures and allied activities
2.	Generation of polluting gases including SO_2, NOx	• Hot mix plants; • Large construction equipment, trucks and asphalt producing and paving equipment; • The movement of heavy machinery, oil tankers etc. on steep slopes will cause much higher emissions of gases; • Toxic gases released through the heating process during bitumen production; and • Inadequate vehicle maintenance and the use of adulterated fuel in vehicles.

173. As described in Table 27 above, there is a potential for increased dust particularly during summer/dry season due to stockpiling of excavated materials. Emissions from vehicles transporting workers, construction materials and debris/materials to be disposed off may cause an increase in air pollutants within the construction zone. These are inherent impacts that are site-specific, low magnitude, short in duration and can be

easily mitigated. The Contractor shall pay attention to the nearby settlement areas (refer to **Annexure 4**) in minimising the air quality impacts. The Contractor will be required to:

- Conduct regular water spraying on earth piles, trenches, and sand piles.
- Conduct regular visual inspection along alignments and construction zones to ensure no excessive dust emissions.
- The contractor will submit a dust suppression and control programme to the PIU prior to construction – this plan details actions to be taken to minimise dust generation and identify equipment to be used.
- Maintain construction vehicles and obtain "Pollution under Control (PUC)" certificate.
- Regular check-up and maintenance of construction equipment and long idling of engines are discouraged.
- Vehicles delivering loose and fine materials should be covered to reduce spills.
- Obtain Consents for Establishment and Consents for Operation for hot mix plants, crushers, diesel generators, etc., if they are to be used in the project.
- Construction establishments such as batching plants, hot mix plants, crushers, etc. will be adversely impacted temporarily during construction activities. Asphalt plants, crushers and batching plants shall be operated within the permissible limits of CPCB and WB EHS whichever stringent, and shall be sited at least 1 km in the downwind direction from the nearest human settlement.
- The hot mix plants will be fitted with dust extraction units and cyclones/scrubbers to reduce exhaust gas.
- Bitumen emulsion should be used wherever feasible, and bitumen heaters should be used and the use of wood for fuel prohibited.

174. **Noise and Vibration Impacts**: Noise and vibration-emitting construction activities include earthworks, rock crushing, concrete mixing, movement and operation of construction vehicles and equipment, and loading and unloading of coarse aggregates. The significance of noise and vibration impacts will be high in settlement areas (refer to **Annexure 4**), where noise-sensitive institutions such as health care and educational facilities are situated.

Table 25: Construction Noise / Distance Relationship

Distance from construction site (m)	Range of Typical Noise Level dB(A)
8	82 – 102
15	75 – 95
30	69 – 89
61	63 – 83
91	59 – 79
122	57 – 77
152	55 – 75
305	49 - 69

175. During the construction period, noise will be generated from the operation of heavy machinery, blasting works, the haulage of construction materials to the construction

yard and the general activities at the yard itself. Concrete mixing and material movements will be the primary noise generating activities and will be uniformly distributed over the entire construction period. As presented in Table 28 above, these construction activities are expected to produce noise levels in the range of 82-102 dB (A) at a distance of about 8 m from the source. These impacts will be temporary, short-term and intermittent. The Contractor will be required to ensure the following:

- Plan activities in consultation with the Supervision Consultant and the PIU, so that activities with the greatest potential to generate noise are conducted during the day which will result in the least disturbance.
- Minimize the noise from construction equipment by using vehicle silencers and by fitting jackhammers with noise-reducing mufflers.
- Avoid loud random noise from sirens, air compression, etc.
- Train the drivers to ensure that they do not honk unless it is necessary to warn other road users or animals of the vehicle's approach.
- If specific noise complaints are received during construction, the contractor may be required to implement one or more of the following noise mitigation measures:
    - Locate stationary construction equipment as far as possible from nearby noise-sensitive areas.
    - Installations of noise barriers at sensitive locations.
    - Turn off idling equipment.
    - Reschedule construction operations to avoid periods of noise annoyance identified in the complaint.
    - Notify nearby residents whenever extremely noisy work is planned.
    - Controlled blasting shall only be carried out with prior approval from the Engineer in charge.
    - Contractors should be required to fit noise shields on construction machinery and to provide earplugs to the operators of heavy machines.
    - Follow Noise Pollution (Regulation and Control) Rules, 2000, day time ambient noise levels should not exceed 65 dB(A) in commercial areas, 55 dB(A) in residential areas and 50 dB(A) in a silence zone. If the background noise levels already exceed the limits for respective zones, only 3 dB(A) increase due to construction activity at the location is allowed.
    - Ensure vehicles comply with the Government of India noise regulations for vehicles.

176. Piling works for the construction of bridges across Kosasthalaiyar River in section 2 and Coovum River in Section 3 will have noise and vibration related impacts. The piling activity is expected to have 85 to 90 dB (A). As per the survey, though there is no immediate settlement, the contractor has to adopt the following mitigation measures

- Prohibit the use of noisy diesel, pneumatic and steam hammers for percussive piling
- Notify the neighbourhood on the schedule of noisy piling works
- Erect noise barrier to screen noisy piling works from noise sensitive receivers

177. Noise impacts are an unavoidable consequence of construction that should be mitigated by limiting the times of construction to daylight hours in the vicinity of sensitive receptors. Further to minimize noise impacts near sensitive receptors (particularly residential areas, religious areas, hospitals and schools), operation of excavator and other heavy machineries will be carried out mostly during off-hours. Baseline noise will be established for all sensitive areas prior to construction and follow up noise monitoring will be carried out during the construction.

178. **Impacts on Flora and Fauna**: As per the proposed road configuration/ design, significant impacts are anticipated in the Mannur RF area as well as to the avenue trees located in section 3. It is estimated to remove 2,765 trees (which includes the 414 trees proposed to be transplanted). The mitigation and enhancement measures shall include:

- Compensatory tree plantation at the ratio of 1:10
- Transplantation of small trees (<30 cm girth size)
- Plantation at Government institutional premises

179. Avenue plantation shall be carried out as per IRC SP 21 – 2009 "Guidelines on Landscaping and Tree Plantation". Such plantations will be initiated once the construction is complete. The objective behind such plantation is to cover / re-vegetate the areas within the PRoW. To maintain the present character of strip plantation, similar indigenous trees should be planted. The possibilities for tree transplantation (Small trees (<30 cm)) shall be explored wherever possible to minimize the impacts of loss of trees. List of indigenous tree species recommended in "Annex E (clause 11.11.1)" in IRC SP 21 -2009 for plantation of Tamil Nadu State is presented as **Table 26**.

Table 26: List of Indigenous Trees Species Suggested for Avenue Plantation

Sl No.	Botanical Name	Common Name
1	*Albizzia procera*	Safed Siris
2	*Albizzia amara*	Cylone Siris
3	*Amhertia nobilis*	Tree of Heaven / Pride of Burma
4	*Bischofia javanica*	Paniala / Pankain
5	*Colvelia recemosa*	Kilbili
6	*Dalbergia latifolia*	Black shisham / Rosewood
7	*Delonix regia*	Gulmohar
8	*Mengifera indica*	Desi mango
9	*Michelia champaka*	Swarnachampa
10	*Peltophorum pherugenium*	Fellow Gulmohar
11	*Polyalthia longifolia*	Ashok
12	*Arecaceae*	Palm trees
13	*Saraca asoca*	Sita Ashok
14	*Santalum album*	White sandal
15	*Tamrindus Indica*	Imli

180. All plantation work shall take place at the onset of monsoon season. The plant should be provided with adequate protection from animals and proper monitoring should be carried out to ensure their growth and survival rate. Costing has been done as per the estimates given in the Environmental Clearance. The compensatory plantation should be maintained/

managed by the contractor as per the guideline given in the **Annexure** 7 (Tree Cutting and Afforestation).

181. The clearing operation in the Mannur RF shall have an impact on the flora and fauna, hence it is suggested to get assistance from the forest department during the clearance operation and construction works to contain the wild animals (including mongoose, snakes, lizards etc.,) in the forest area as well as protecting them from any harm. However, in discussion with the Forest Department, it has been informed that no wildlife has been categorized as RET by IUCN in the Mannur RF. All wild fauna reported in the RF fall under LC category. These faunal are commonly reported in any degraded forest / scrub jungle. The diversity of species in Mannur RF is trivial and cannot be compared with the rich bio-diversity present in protected areas like a wildlife sanctuary.

182. As indicated in the section 4.2.2.1 (Aquatic Ecology), both the rivers (Kosasthalaiyar River in section 2 and Coovum River in Section 3) and other surface water bodies located along the section 2 and 3 are seasonal and hence it is suggested to carry out the construction works in the summer season / lean flow season to avoid impact on the Aquatic ecology.

183. Construction workers may hunt, fish or carry out other activities that will negatively impact wildlife. No construction or labour camps, batching plants, stone crushing plants, and quarrying activities will be allowed within or 1 km radius of ecologically sensitive areas. The contractor will clearly brief the construction workers on strict forestry rules on illegal harvesting of forest products, poaching of wildlife and illegal fishing. Contractor will ensure supply of all necessary food items, cooking fuel and proper housing is provided to prevent illegal hunting and tree felling.

184. **Impact due to Waste Generation**: Construction activities will produce excavated soils, construction materials and solid wastes (such as removed concrete, wood, trees and plants, packaging materials, empty containers, oils, lubricants, and other similar items).

Sl.no	Item	Unit	Quantity	
			Section 2	Section 3
1	Bituminous Material	Cum	2,11,425	1,98,081
2	Pavement Crust	Cum	12,95,077	13,93,432
3	Stone Masonry	Cum	135	203
4	RCC	Cum	9,77,089	11,81,019
5	Hume Pipes	m	400	380

185. These impacts are negative but short-term and reversible by mitigation measures. The Contractor will need to adopt the following mitigation measures.

- Manage solid waste according to the following hierarchy: reuse, recycling, and disposal (at designated/approved disposal areas).
- Coordinate with ULB's (Kanchipuram and Thiruvallur Municipalities) for beneficial uses of excavated soils/silts/sediments or immediately dispose of designated areas.
- Recover used oil and lubricants and reuse; or remove from the sites.
- Avoid stockpiling and remove immediately all excavated soils, excess construction materials and solid waste (removed concrete, wood, trees and plants, packaging materials, empty containers, oils, lubricants, and other similar items).

- Prohibit disposal of any material or wastes (including human waste) into drainage, nallah, or watercourse.

186. **Impacts on Topography and Appearance:** Construction activities of the project will bring permanent changes in the local-level topography and appearance of the project site. There will be loss in aesthetic beauty of the project area mainly due to the earthwork. The following table, elaborates potential effects on the topography and appearance and appropriate mitigation measures.

Table 27: Potential Effects on Topography by the Proposed CPRR (Section 2 and 3)

Sl. No.	Construction activity	Potential effect on topography and appearance	Mitigation measures
2.	Stone quarrying	Scarring of landscape and potential landslides (rock slides/falls). There may be permanent changes in the landscape.	Stone quarrying should only be undertaken in legally approved areas. Controlled and environmentally friendly quarrying should be carried out to minimise landslides and erosion.
3.	Earthwork from borrow areas	Scarring of landscape due to unearthing activities. Minor but permanent changes in landscape.	Borrow areas should be in legally approved locations. As soon as construction activities are complete, they should be re-vegetated and brought back as far as possible to their previous appearance.
4	Waste disposal	Disposal of cut soils and debris at improper locations such as hillside below the road will make the area look untidy and unattractive.	Cut off material should be used to widen the road or disposed of at proper disposal sites.
5	Establishment of labour camps	Disposal of waste and litter at improper locations and deforestation for fire-wood will make the area look dirty and unattractive.	Provision and allocation of proper waste disposal bins and sites are required. A supply of cooking gas should be provided by the contractor to eliminate the use of fire wood.

187. **Impacts on Occupational Health and Safety**: Workers need to be mindful of occupational hazards that can arise from construction works. Exposure to work-related chemical, physical, biological and social hazard is typically intermittent and of short duration, but is likely to reoccur. Potential impacts are negative and long-term but

reversible by mitigation measures. Overall, the contractor should comply with IFC EHS Guidelines on Occupational Health and Safety[8].

- Disallow worker exposure to noise level greater than 85 dBA for more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.
- Develop a comprehensive site-specific health and safety (H&S) plan. The overall objective is to guide contractors on establishing a management strategy and applying practices that are intended to eliminate, or reduce, fatalities, injuries, and illnesses for workers performing activities and tasks associated with the project.
- Include in H&S plan measures such as (i) type of hazards during excavation works; (ii) corresponding personal protective equipment for each identified hazard; (iii) H&S training for all site personnel; (iv) procedures to be followed for all site activities; and (v) documentation of work-related accidents.
- Provide H&S orientation training to all new workers to ensure that they are apprised of the rules of work at the site, personal protective protection and preventing injury to fellow workers.
- Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site as well as at construction camps.
- Provide medical insurance coverage for workers.
- Secure construction zone from unauthorized intrusion and accident risks.
- Provide potable drinking water.
- Provide clean eating areas where workers are not exposed to hazardous or noxious substances.
- Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted.
- Ensure the visibility of workers through the use of high visibility vests when working in or walking through heavy equipment operating areas.
- Ensure moving equipment is outfitted with audible back-up alarms.
- Mark and provide signboards in the construction zone and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors and the general public/ community as appropriate.
- **COVID-19**: WHO has declared COVID-19 as a pandemic which has affected entire world including India. In view of the prevailing COVID-19 pandemic, the contractors and workers would need to take additional measures to avoid the spread of the disease and shall follow various guidelines/guidance notes issued by the national/state government, WHO, ILO, World Bank/IFC from time to time. As described in these guidelines, the Contractors shall undertake a COVID-19 risk

[8] https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines

assessment of project area and prepare a COVID-19 Response and Management Plan (C-R&MP) and submit to PIU and Supervision Consultant for approval. A brief guidance on "To Do" List prepared from these documents is provided in the **Annexure 10**.

188. **Impacts on Socio-Economic Activities**: Manpower will be required during the 24 months construction phase. This can help generate contractual employment and an increase in local revenue. Thus potential impact is positive and short-term. However, the contractor will need to adopt the following mitigation measures:

- Leave space for access between mounds of soil.
- Provide walkways and metal sheets that were required to maintain access to shops/businesses along trenches.
- Consult businesses and institutions regarding operating hours and factoring this into work schedules.
- Provide signboards for pedestrians to inform the nature and duration of construction works and contact numbers for concerns/complaints.
- Employ at least 50% of the labor force, or to the maximum extent, local persons within the 2-km immediate area if manpower is available

189. **Sensitive location such as School, College and Hospital along the Project.** As per the safeguard survey (refer table 24 and table 25), very few sensitive locations has been identified along the section 2 and 3. Though the proposed alignment traverses 10.1km of the existing road (highway) in the section 3, there are no sensitive locations (schools, colleges and hospitals) that were observed. . However, for the other CPR structures located along the CPRR alignment (section 2 and 3) are kept unaffected by the proposed improvement proposal. Short term impacts during the construction stage are expected. Measures such as timely scheduling of construction activities in these areas, provision of sign boards, appropriate barriers such as planting trees and / or raised boundary walls are adopted to minimize impacts.

190. **Interference with Utilities and Traffic.** On the project road, utilities interfere with the ROW at few locations that will have to be shifted / removed prior to construction. This will not raise significant impacts. Traffic may experience minor delays when diverted around construction areas, however, will be more severely hampered at the locations where temporary road closures are necessary. Such hazard points will have proper signs indicating the nature of the problem envisaged.

191. Contractor will ensure that information on the timing of construction works and notifications of road closure (if any) is provided via the local media (radio, TV, newspaper etc.) or through the local community heads.

192. **Impacts on Cultural Resources.** There are no adverse impacts anticipated on historical places/monuments. However, care must be taken to avoid any damage to any structures with conservation value. Earthworks, as associated with the road construction/improvement works, or deriving from secondary sites such as quarries or borrow pits, may reveal sites or artefacts of cultural/archaeological significance. In the

event of such discovery, the concerned authorities should be informed and the requirement to take such action should be incorporated in contract documents. Chance find procedure will be prepared by contractor in the site-specific EMP.

193. **Impact on Community Health and Safety**. During the Pre-construction and Construction Phases dismantling of the structures for Corridor of Impact (CoI) clearance and road construction may result in health hazards. To minimise this potential negative impact the following recommendations should be adopted:

- To avoid the psychological impacts due to the demolition of properties that might result to the owners and other tenants. The advance notice as per RAP will be given to the owners of the affected properties. An advance notice will be served at least one month before construction commences. For squatters needing relocation, all R&R activities will be undertaken and entitlements will be completed before construction starts.
- Debris generated from the demolition of properties will be properly disposed off to avoid the health problems in the safeties. Earth material, if required will be dumped in borrow areas as approved by the Engineer-in charge (SC). Borrow areas will be filled to avoid health hazards from stagnant water collecting in these areas. The Contractors will make all arrangements for dismantling and cleaning up of debris. Implementation will be as per the approval and direction of the engineer.

194. During the construction period the potential negative community impacts arising from imported labour in the labour camps will be avoided as per following:

- Comply with IFC EHS Guidelines on Occupational Health and Safety
- All contractors will be encouraged to recruit the local people as labourer's at least for unskilled and semi-skilled jobs. This would automatically reduce the magnitude of impact expected due to outside labour. Wherever the local labourers are not available the contractor should ensure the following provision for imported labour.
    - The additional stress on the facilities like medical services, power, water supply due to a labour camp in a local area will be avoided by the contractor providing these facilities for the labourers as per the direction of the Engineer – in charge (SC)
    - Construction workers shall be instructed how to protect natural resources, fauna and flora
    - In the labour camps, all temporary accommodation must be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking and washing.

195. Allied activities during construction period may cause local disruption

- In the construction phase, there may be inconvenience to the local people as well as the highway passengers due to traffic jams and congestion, loss of access and other road accident risk as a result of construction. Detailed traffic control plans shall be prepared and submitted to the Engineer– in charge (SC) for approval 5 days prior to

commencement of work on any section of road. In the preparation of the traffic control plan, special consideration shall be given to the safety of pedestrians and workers at night.

196. Accidents and Safety

- To avoid the accidents during construction phase, Contractors shall take all necessary measures to ensure traffic safety. The Contractors will provide, erect and maintain barricades, including signs marking flags lights and flagmen as required by the Engineer- in charge (SC).
- In the operation phase, traffic control measures such as speed breakers and sign boards (including speed limits) will be provided and strictly enforced in residential areas, near schools and water bodies like ponds and tanks.

6.4 Labour Influx Management

197. According to preliminary estimates, approximately 200-250 workers would be required for each of the project corridors, of which 30%-50% may be brought in from other states including West Bengal, Bihar and North-eastern states of India. Migrant labour may be semi-skilled or may be brought in where the requirement of labour is large. Preference would be given to offering these jobs to PAPs and other local people. The bid documents specify that the contractor shall give preference to local villagers for unskilled labour requirement. However skilled labour would also be required for technical support and construction. The skilled workers could be primarily migrant labours from places outside the state of Tamil Nadu. Labor influx for construction works can lead to a variety of adverse social and environmental risks and impacts.

i. Environmental Risks and Impacts

- **Inadequate waste disposal and illegal waste disposal sites**: Large population of migrant labours generate increased amounts of waste, for which no sufficient local waste management capacities may exist, which would likely lead to improper disposal practices.
- **Wastewater discharges**: Project-related activities, along with workers' camps and a lack of appropriate wastewater discharges may pollute nearby water resources. Major health risks can occur if latrine pits spill over into local streams that are used for drinking water by the host community. However, in corridors 2 and 3 all the identified surface water sources are observed to be seasonal and hence the anticipated impact will be marginal, even though appropriate mitigation measure as suggested in the EMP have to be adopted.
- **Increased demand on freshwater resources**: The provision of clean drinking water and water for hygiene purposes can result in increased pressure on freshwater resources in the project or camp site area.
- **Camp related land use, access roads, noise and lights**: In ecologically sensitive areas, workers' camps can have impacts on the local wildlife. This may include disturbance of species, as well as illegal hunting. In the same context, new access routes for workers' camps may have impacts on natural habitats. Though, none of

the corridors traverse ecological sensitive areas, precautionary measure have to be taken to reduce impact on the available wild species (as discussed in the section 4.2 Biological Environment).

- **Increased deforestation, ecosystem degradation, and species loss**: These can result from forest or land conversion for worker housing/ labour shed and migrant labours' agricultural subsistence activities
- **Increased use of / demand for natural resources**: This can include logging for construction, fuel wood collection, use of water resources, farming and grazing, hunting and fishing, potential introduction of invasive or non-native species, and land degradation

ii. Social Risks and Impacts

- **Risk of social conflict**: Conflicts may arise between the local community and the migrant labours, which may be related to religious, cultural or ethnic differences, or based on competition for local resources. Tensions may also arise between different groups within the labor force and pre-existing conflicts in the local community may be exacerbated. Ethnic and regional conflicts may be aggravated if workers from one group are moving into the territory of the other.
- **Increased risk of illicit behaviour and crime**: The influx of migrant labours into communities may increase the rate of crimes and/or a perception of insecurity by the local community. Such illicit behaviour or crimes can include theft, physical assaults, substance abuse, prostitution and human trafficking. Local law enforcement may not be sufficiently equipped to deal with the temporary increase in local population.
- **Influx of additional population ("followers")**: Especially in projects with longer timeframe, people can migrate to the project area in addition to the labor force, thereby exacerbating the problems of labor influx. These can be people who expect to get a job with the project, family members of workers, as well as traders, suppliers and other service providers, particularly in areas where the local capacity to provide goods and services is limited.
- **Impacts on community dynamics**: Depending on the number of migrant labours and their engagement with the host community, the composition of the local community, and with it the community dynamics, may change significantly. Pre-existing social conflict may intensify as a result of such changes.
- **Increased burden on and competition for public service provision**: The presence of migrant labours (including their families) can generate additional demand for the provision of public services, such as water, electricity, medical services, transport, education and social services. This is particularly the case when the influx of migrant labours is not accommodated by additional or separate supply systems.
- **Increased risk of communicable diseases and burden on local health services**: The influx of migrant labours may bring communicable diseases to the project area, including sexually transmitted diseases (STDs), or the incoming migrant labours may be exposed to diseases to which they have low resistance. This can result in an additional burden on local health resources. Workers with health concerns relating

to substance abuse, mental issues or STDs may not wish to visit the project's medical facility and instead go anonymously to local medical providers, thereby placing further stress on local resources. Local health and rescue facilities may also be overwhelmed and/or ill-equipped to address the industrial accidents that can occur in a large construction site.

- **Child labor and school dropout:** Increased opportunities for the host community to sell goods and services to the incoming migrant labours can lead to child labor to produce and deliver these goods and services, which in turn can lead to enhanced school dropout.
- **Local inflation of prices**: A significant increase in demand for goods and services due to labor influx may lead to local price hikes and/or crowding out of community consumers.
- **Increased pressure on accommodations and rents**: Depending on project worker income and form of accommodation provided, there may be increased demand for accommodations, which again may lead to price hikes and crowding out of local residents.
- **Increase in traffic and related accidents**: Delivery of supplies for migrant labours and the transportation of migrant labours can lead to an increase in traffic, rise in accidents, as well as additional burden on the transportation infrastructure.

MANAGEMENT MEASURES

Sl.no	Labour Influx Risks and Impacts	Management Measures
Environmental Risks and Impacts		
1.	Inadequate waste disposal and creation of illegal waste disposal sites	• Reduction of waste generation; • Sound practices for waste disposal
2.	Wastewater Discharges	• Ensuring workers' camp and ancillary facilities are connected to septic tank or other wastewater systems which are appropriate and of sufficient capacity for the number of workers and local conditions.
3.	Increased demand on freshwater resources	• Water conservation and recycling of water; • Consideration of use of rainwater where feasible; • Avoiding contamination of fresh water sources
4.	Camp related land use, access roads, noise and lights	• Placement of workers' camp away from environmentally sensitive areas to avoid impacts on the local wildlife; • Routing of new access routes for workers' camp to avoid/minimize environmentally sensitive areas.
5.	Increased deforestation, ecosystem degradation, and species loss	• Only wood from commercial sources to be used on the project; • Use of wood for fuel prohibited; • Reduction in energy demand, reduced noise and light generation, reduced and safe use of dangerous chemical substances.

Sl.no	Labour Influx Risks and Impacts	Management Measures
6.	Increased use/demand on natural resources	• Minimized land use change and use of other natural resources; • Avoidance of deforestation around camp area; • Prompt and effective response to environmental and social issues raised by supervision engineer.
Social Risks and Impacts		
7.	Risk of social conflict	• Provision of information regarding Worker Code of Conduct in local language(s); • Provision of cultural sensitization training for migrant labours regarding engagement with local community.
8.	Increased risk of illicit behaviour and crime (including prostitution, theft and substance abuse)	• Paying adequate salaries for migrant labours to reduce incentive for theft; • Paying salaries into workers' bank accounts rather than in cash; • Sourcing of local workforce; • Creation of supervised leisure areas in workers' camp; • Cooperation with local law enforcement; • Introduction of sanctions (e.g., dismissal) for workers involved in criminal activities; • Provision of substance abuse prevention and management programs
9.	Adverse impacts on community dynamics	• Provision of services in the workers' camp to reduce the need for workers to use local community facilities; • Provision of entertainment and events for migrant labours within camp to reduce incentives for mixing with local community
10.	Influx of Additional Population ("Followers")	• Contractor to hire workers through recruitment offices and avoid hiring "at the gate" to discourage spontaneous influx of job seekers.
11.	Increased burden on public service Provision	• Workers' camp to include wastewater disposal and septic systems; • Identification of authorized water supply source and prohibition of use from other community sources; • Separate service providers for community and workers' camp/construction site; • Worker Code of Conduct on water and electricity consumption.
12.	Increased risk of communicable diseases (including STDs and HIV/AIDS)	• Vaccinating migrant labours against common and locally prevalent diseases; • Contracting of an HIV service provider to be available on-site; • Implementation of HIV/AIDS education program;

Sl.no	Labour Influx Risks and Impacts	Management Measures
		• Information campaign on STDs among the migrant labours and local community; • Education about the transmission of diseases; • Provision of condoms
13.	Child labor and school drop out	• Ensuring that children and minors are not employed directly or indirectly on the project.
14.	Local inflation of prices and crowding out of local consumers	• Appropriate mix of locally and non-locally procured goods to allow local project benefits while reducing risk of crowding out of and price hikes for local consumers
15.	Increased pressure on accommodation and rents	• When accommodation supply is limited establishment of workers' camp facilities with sufficient capacity for workers including sub-contractors and associated support staff
16.	Increased traffic and rise in accidents	• Preparation and implementation of a traffic management plan to be approved by Engineer – in charge; • Building additional/separate roads to project and workers' camp sites; • Organization of commute from camp to project to reduce traffic; • Road safety training and defensive driving training for staff; • Sanctions for reckless driving

6.5 Post – Construction Impacts and Mitigation Measures

198. **Impacts on Air Quality (Air quality Emissions).** As discussed in the section 4.1.8 ambient air quality, the existing air quality in the section 2 and 3 are in good condition. However, with the implementation of the project, there will be emissions from the traffic as well as emissions from developmental activities in addition to the domestic emissions resulting in increased pollution level. Major contributor to the air pollutants in the area during project operation would be the road traffic. Emissions from asphalt hot-mix plants, transportation of construction materials and vehicular movement along the stretch which will have temporary but significant impact on air quality during the construction stage. Likely contribution of the vehicular traffic to the pollutant concentration is estimated using prediction models such as the CALINE-4[9] for the operation period. Modelling exercise has been undertaken considering the Traffic scenario in Year 2041-42.

Traffic and Emission Rate used for the Model

Section	Chainage (km)		Length (km)	Projected Traffic 2042-43 (AADT)	CO Emission Factor (gm/mile)
	From	To			
Section 2	21/160	47/300	26.20	83969	2.75
Section 3	47/300	77/900	30.60	162593	2.94

[9]CALINE4 is a line source air quality model developed to assess air quality impacts of Carbon Monoxide (CO) near roadways

199. The concentration so worked out are presented in the following table.

Predicted Ground Level Concentration

Location	CO Incremental Concentration (mg/m^3)									
	5m	10m	15m	20m	25m	30m	35m	40m	45m	50m
Section 2	1.55	1.21	1.72	1.61	1.38	1.38	1.27	1.15	1.15	1.15
Section 3	2.15	1.65	2.10	1.80	1.76	1.72	1.66	1.55	1.55	1.55

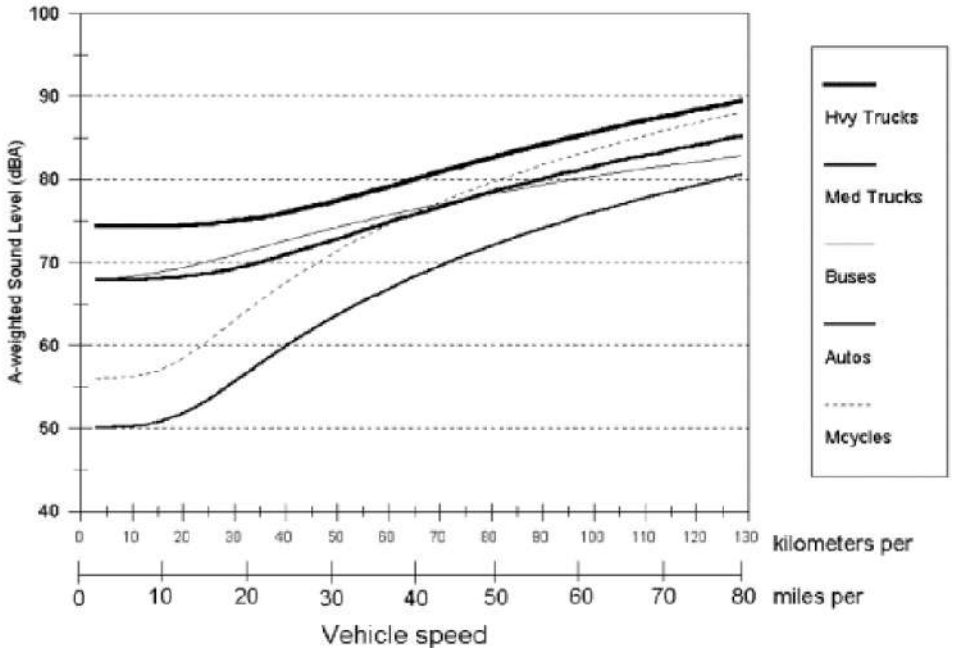
Source: CALINE 4 model output

200. The modelling result shows high concentration of CO in the Section 3, the maximum concentration of 2.15 mg/m^3 has been recorded at a distance of 5m. However, in comparison with the NAAQ standards, the observed values are less than stipulated 4 mg/m^3 for CO (hourly monitoring). Hence, predicted CO concentration across both the sections 2 and 3 of the CPRR remain well within the National Ambient Air Quality Standards for the projected years 2041-42.

201. **Noise and Vibration Impacts (Prediction of Traffic Noise levels).** For prediction of the noise levels, the Federal Highway Administration Traffic Noise Model (FHWA TNM) has been used. The Federal Highway Administration Traffic Noise Model (FHWA TNM) computes a predicted noise level through a series of adjustments to a reference sound level. In the TNM, the reference level is the Vehicle Noise Emission Level, which refers to the maximum sound level emitted by a vehicle passing by at a reference distance of 15 meters (50 feet). Adjustments are then made to the emission level to account for traffic flow, distance, and shielding. The vehicular noise emission levels vary significantly with vehicle speed. **Error! R eference source not found.** shows the A-weighted noise emission level as a function of speed for autos (cars), medium trucks (LCV), heavy trucks (HCV) and buses under cruise conditions and traveling over average pavement. For prediction of noise levels due to traffic on proposed project, the vehicular speeds used for different class of vehicles are given in the following table and are taken in accordance to the design speed.

Vehicular speed and noise emission levels used for modelling

Vehicle Type	Cars	LCVs	HCVs	Buses
Vehicular Speed	100 km/hr	80 km/hr	80 km/hr	80 km/hr



Source – FHWA Traffic Noise Model ®, Version 1.0 Technical Manual

Figure 22: A-Weighted Vehicle Noise Emission Levels

202. **Traffic Data.** Peak (highest) hour traffic and non-peak (lowest) hour traffic volume for both day time and night time (day and night time are as per Ambient Noise Quality Standards (Table 24)) were estimated based on AADT.

203. **Road Geometry**. The Right of Way (RoW) of proposed project is 60m. The project shall be developed into 6-lane access control road. For prediction of noise levels, a representative straight section of one-kilometre length having RoW width of 60m, 3+3 lane carriageway was taken in FHWA-TNM.

204. **Receptors.** The FHWA-TNM predicts A-weighted hourly equivalent noise levels (Leq1h) at receptor points along the road. The distance of receptor point (representing ambient noise monitoring station) from CPRR is taken at 30m from centerline i.e. on the edge of RoW.

205. **Assumptions used for Modelling**

- Noise modelling has been done in worst case scenario i.e. with zero shielding from any other obstacle / trees / barrier / walls etc.
- No significant change in the vehicle characteristics is considered during the design period;
- The representative section is considered as straight with zero gradient;
- The traffic along the road sections is assumed to flow simultaneously in both the carriageways in opposite directions;
- Both carriageways are assumed to carry equal traffic;
- There is no major grade difference in the project area. All the receptors are located at same ground level as the road section;
- Noise from other new sources apart from traffic on proposed highway is not accounted for in the model; and
- The default ground type is considered as hard soil

206. **Predicted Noise Levels.** The predicted hourly equivalent noise levels are logarithmically combined to calculate L_{day} and L_{night} noise. The results noise modelling superimposed on baseline noise levels at ambient noise monitoring locations for day and night times are presented in

L_{day} Results of Noise Modelling

S. No.	Project Corridors	Km	Land use	Noise standard	Baseline	2022			2032			2042		
						Predicted Value	Resultant Value	Increase over Baseline	Predicted Value	Resultant Value	Increase over Baseline	Predicted Value	Resultant Value	Increase over Baseline
1	Section 2	26.1	Residential	55.0	52.9	54.2	55.8	3.0	56.2	58.7	5.9	59.2	64.5	11.6
2	Section 3	30.1	Residential	55.0	53.1	55.2	56.9	3.8	57.2	59.8	6.7	60.2	65.5	12.4

L_{night} Results of Noise Modelling

S. No.	Location Code	Km	Land use	Noise standard	Baseline	2022			2032			2042		
						Predicted Value	Resultant Value	Increase over Baseline Level	Predicted Value	Resultant Value	Increase over Baseline Level	Predicted Value	Resultant Value	Increase over Baseline Level
1	Section 2	26.1	Commercial	45.0	39.2	42.2	43.5	4.2	44.2	46.2	6.9	47.2	52.5	13.3
2	Section 3	30.1	Commercial	45.0	38.1	43.4	44.7	6.6	45.4	47.4	9.3	48.4	53.7	15.6

207. **Noise modelling Interpretation**

- Noise modelling has been performed in worst case scenario i.e. with zero shielding from any other obstacle / trees / barrier / walls etc. Hence, under actual site conditions, the actual noise level increase due to the proposed project shall be lower than the model predicted values.
- The predicted noise levels are at the edge of the alignment/ RoW, hence for the receptors located away from the alignment/ RoW shall have lesser/lower noise levels.
- The predicted noise levels are higher than the baseline noise level for night time (in comparison with day time noise levels). The magnitude is higher as it is a Greenfield corridor.
- The noise level increase in over 22 years design period is not significant in comparison to more than 300% increase in traffic volume.

208. **Mitigations.** It is found that an incremental increase of about 3 dB(A) noise level is expected due to increased traffic over the designed life of the project. Most of these increase in noise level will be attenuated by natural means i.e. distance form source, obstacles from nearby and surrounding building and structures, difference in levels of vehicle and receptor as well as installation of recommended mitigation measures such as installation of noise barriers at sensitive location, planning of trees etc.

209. **Vibration:** Because vehicles traveling on highway are supported on flexible suspension systems and pneumatic tires, these vehicles are not an efficient source of ground

vibration. They can, however, impart vibration into the ground when they roll over pavement that is not smooth. Continuous traffic traveling on a smooth highway creates a fairly continuous but relatively low level of vibration. Where discontinuities exist in the pavement, heavy truck passages can be the primary source of localized, intermittent vibration peaks. These peaks typically last no more than a few seconds and often for only a fraction of a second. Because vibration drops off rapidly with distance, there is rarely a cumulative increase in ground vibration from the presence of multiple trucks. In general, more trucks result in more vibration peaks, though not necessarily higher peaks. Automobile traffic normally generates vibration amplitudes that are one-fifth to one-tenth the amplitude of truck vibration amplitudes. Accordingly, ground vibration generated by automobile traffic is usually overshadowed by vibration from heavy trucks.

210. **Mitigations.** Because vibration from vehicle operations is almost always the result of pavement discontinuities, the solution is to smooth the pavement to eliminate the discontinuities. This step will eliminate perceptible vibration from vehicle operations in virtually all cases.

211. **Ecological Impacts.** To mitigate operational impacts it is proposed to carry periodic visual check of functionality of measures taken for the protection of animals. Periodic data pertaining to plant survive rate, animals accidents and animal as well human deaths, movement frequency of wild animals, route followed by wild animals will be collected. Suitable corrective actions like maintenance of guide rails will be initiated in-case conflict level is found increasing. Relevant expertise (environmental expert) or external monitor or others may be employed for this matter.

212. **Construction Site Restoration**: Site clean-up is necessary after construction activities. The Contractor will be required to:

- Backfill any excavation and trenches, preferably with excess excavation material generated during the construction phase.
- Use removed topsoil to reclaim disturbed areas.
- Re-establish the original grade and drainage pattern to the extent practicable.
- Restore access roads, staging areas, and temporary work areas.
- Stabilize all areas of disturbed vegetation using weed-free native shrubs, grasses, and trees.
- Remove all tools, equipment, barricades, signs, surplus materials, debris, and rubbish. Demolish buildings/structures not required for O&M. Dispose of in designated disposal sites.
- Request in writing from Supervision Consultant and PIU that construction zones have been restored
- Encroachment of any type may be on the shoulder or within the RoW, shall be discouraged. A systematic awareness among road-side communities shall be carried out, in association with the Local Governing Bodies.
- Monitor the success of revegetation and tree re-planting. Replace all plants determined to be in an unhealthy condition.

213. **Occupational, Health and Safety**. Highway/ Road maintenance operations require labours to be on the alert to protect themselves, fellow team members and the traveling public/ road users. Performing jobs safely is a priority and an integral part of maintenance operations. Labours must therefore be trained to know the rules, policies and practices intended to promote a safe work environment. In addition, every labours needs to develop the habit of thinking safety before and during the work to be done. A positive attitude toward safety will not only help to protect the labours from injury, but will also lead to continued job satisfaction. The followings are some of the OHS measures.

- **Traffic Safety Drums** – used on highways due to greater target value and imposing size.
- **Barricades** – They protect spot hazards and close roadways and sidewalks with appropriate signing. Barricades can also be used to provide additional protection to work areas.
- **Temporary Pavement Markings** – These markings delineate lanes and tapers on long-term projects. If it is necessary to divert traffic across existing pavement markings, the channelizing device used must be so dominant that a motorist's attention is drawn completely away from the existing marking. Reduced device spacing is recommended.
- **High Level Warning Devices** – They are tall, portable stands with flags or flashing lights visible above traffic. Used with flags only, they may have a sign or flashing light attached, or be attached to vehicles used in moving or mobile work operations.
- **Temporary Barriers** – There are several types of barrier protection used in work zones: concrete barrier, movable concrete barrier, steel barrier and water-filled barrier. While barriers are effective and provide positive protection to work operations, they may result in more damage to an impacting vehicle.
- **Lighting Devices** – Use to call attention to hazardous situations, especially at night. Includes warning lights, flashing vehicle lights, floodlights, and flashing arrow boards.

7. Stakeholder Consultation and Information Disclosure

7.1 Process for Consultation followed

214. Public consultation has been conducted twice in the years 2014 and 2018, and consultations were further conducted in 2019 and 2020. As part of the project preparation work, the earlier public consultation (in 2014) was conducted at 3 locations (i. Sriperumbudur, ii. Melnallathur Village and iii. Panchetty Village). At Sriperumbudur, the consultation has been organised by the Assistant Divisional Engineer (H), C&M, Chengalpattu Sub-division, in Melnallur Village, the consultation has been organised by the Divisional Engineer (H), C&M, Thiruvallur Division, and in Panchetty Village, the consultation meeting has been organised by Assistant Divisional Engineer (H), C&M, Ponneri Sub-division. The meeting was attended by the other stakeholders and NGOs. Prior notice has been issued to the public about the consultation and the procedures.

215. The key points of discussion are highlighted as follows

- At Sriperumbudur (Around 250 public representatives from various villages participated):
    - The participants have requested for a bypass road to reduce the impact on the Sriperumbudur town
    - It was suggested to construct bridge along the Sriperumbudur Lake to avoid impact on the residences and the water body
    - Project interventions have been discussed including the carriageway width, proposed bridges, and treatment near the Water bodies, etc., the project duration/ schedule has also been discussed
    - Impact on the structures and the loss of livelihood has been discussed
- At Melnallur Village (Around 53 public representatives from various villages were participated):
    - Land acquisition information has to be detailed including the ownership of the land, survey number and the extent of land getting affected in advance to the PAP's.
    - Highlighted the requirement for road safety near the schools, hospitals and sensitive locations
    - Traffic congestion due to the movement of container and other vehicles have to be reduced by the widening of the existing roads
    - The project should not have any impact on the water supply channels used for irrigation purposes
    - Protection of water bodies has been discussed
    - Compensation for land should be as per the latest LA&RR Act 2013
    - Alignment shall be planned such a way that it is not affecting houses and agricultural assets
    - Laymen's livelihood should be protected.
- At Panchetty Village (Around 51 public representatives from various villages participated)
    - Requested for a service road for local users and to link village roads with the new road

- Land acquisition information including the survey numbers, the extent of the land have to be informed in detail
- Requested entitlement details for agriculture land, structure and the mode of compensation


Snapshots from Public Consultation at Sriperumbudur Town


Snapshots from Public Consultation at Melnallur Village


Snapshots from Public Consultation at Panchetty Village

216. Based on the outcomes of the public consultations, a bypass has been proposed along the Sriperumbudur tank to minimise the social impacts in Sriperumbudur Town. The bypass is designed to traverse near the tank bund (without disturbing it) to minimise the environmental impacts as well. The environmental and social impacts in Melnallur Village have been nullified by proposing Thiruvallur bypass. For the Panchetty Village, as requested by the public, it is proposed to have service lane with footpath and at appropriate location Vehicle Under Passes has been proposed for the free movement of the local vehicles. The

compensation for the land, structure and the loss of livelihood shall be as per the LA&RR Act 2013 requirements. The details of the public consultation are given in **Annexure 3**.

217. One of the requirements for obtaining the Environmental Clearance for the CPRR is to conduct the Public Consultation, because of that a public consultation has been conducted on 12/07/2018 at Thamaripakkam, Thiruvallur District. The views/ feedback of the project obtained from the public is very much similar to the earlier consultation outcome. The details of the consultation are given in **Annexure 3.**

218. Informal community consultation has been conducted during the AIIB mission from October 15-18, 2019. The consultation was held with 50 participants at Polivakkam Village where 80 houses will be affected. The Mission explained the Bank's relevant policies and clarified what kind of issues could be addressed within the Project. The Mission emphasized that the traffic management plan should be prepared considering the massive traffic disturbance of the construction.

7.2 Plan and Continual Public Participation

219. To ensure continued public participation, provisions for regular and continued stakeholder participation, at all stages during the project design and implementation are proposed. A Grievance Redressal Committee (refer to chapter 6) will be set up within the PIU to register grievances of the people regarding technical, environmental and social aspects. This participatory process will ensure that all views of the people are adequately reviewed and suitably incorporated in the design and implementation process. Further, to ensure effective disclosure of the project proposals to the stakeholders and the communities in the vicinity of the project locations, extensive project awareness campaigns will be carried out.

220. For the benefit of the communities, the Executive Summary of EIA will be translated in the local language (Tamil) with hard copies made available at (i) Office of the PMU (CPRR); (ii) Office of the PIU (TNRIDC) and, (iii) Office of the District Collector, Kanchipuram and Thiruvallur Districts. An electronic version of the EIA will be placed on the official website of the Tamil Nadu Highways Department and in the website of AIIB after approval. The PMU will issue notification on the disclosure mechanism in local newspapers, ahead of the initiation of implementation of the project, providing information on the project, as well as the start dates, etc. The notice will be issued by the PMU in local newspapers well ahead of the implementation works. This will create awareness of the project implementation among the public. Local communities will be continuously consulted regarding the location of construction camps, access and hauling routes and other likely disturbances during construction.

7.3 AIIB Information Disclosure Requirements

221. As per the AIIB's ESF, two types of information disclosures have to be adopted. i.e. (i) Information disclosure by the TNHD and (ii) Information disclosure by the AIIB.

(i) **Information disclosure by the TNHD**: AIIB requires TNHD to ensure that the relevant information about environmental and social risks and impacts of the CPRR is made

available in the project area in a timely and accessible manner and a form and language (Tamil) understandable to the Project-affected people, other stakeholders, and the general public, so they can provide meaningful inputs into the design and implementation of the Project. The documentation for disclosure includes Draft and Final documents (including Environmental Impact Assessment (EIA), Social Impact Assessment (SIA), Resettlement Planning Framework, (RPF) and Tribal Peoples Plan (TPP), ES due diligence report and other documents as applicable to the project). As per the ESF requirements, this English EIA and its Tamil executive summary will be disclosed on the TNHD website.

(ii) **Information disclosure by the AIIB**: AIIB will disclose the project documents by sharing the web link of the TNHD on their website so that the general public can download and review the safeguard documents as and when needed.

8. Environmental Management Plan

8.1 EMP Table

222. The Environmental Management Plan (EMP) is prepared based on the assessment of Environmental Impacts (refer to Chapter 7) concerning Location impacts, Design impacts, Construction related impacts, and Operational and maintenance related impacts. The EMP is prepared to cover all the project related activities that are to be implemented during the project pre-construction, construction, and post-construction stages.

8.2 Summary of Site and Activity Specific Plan as per EMP

223. **Table 28** summarizes site and activity-specific plans to be prepared as per the EMP Table (**Table 29**).

Table 28: Site and Activity Specific Plans/Programs as per EMP

To be Prepared During	Specific Plan/Program	Purpose	Responsible for Preparation	Responsible for Implementation
Detailed Design Phase	Environmental monitoring program as per Detailed design	Indicate sampling locations, methodology, and parameters	Supervision Consultant	Contractor
Detailed Design Phase	Erosion control Plan/ measures	Mitigate impacts due to erosion	Supervision Consultant	Contractor
Detailed Design Phase	List and maps showing utilities to be shifted	Utilities shifting	Supervision Consultant during the preliminary stage, Contractor as per detailed design	Contractor
Detailed Design Phase	Contingency plan	Mitigate impacts due to interruption of services during utilities shifting Traffic Management	Supervision Consultant	Contractor
Detailed Design Phase	Chance find protocol	Address archaeological or historical finds	Supervision Consultant	Contractor
Detailed Design Phase	List of pre-approved sites	Location/s for work camps, areas for the stockpile, storage, and disposal	Supervision Consultant	Contractor
Detailed Design Phase	Waste management plan (measures)	Mitigate impacts due to waste generation	Supervision Consultant	Contractor

To be Prepared During	Specific Plan/Program	Purpose	Responsible for Preparation	Responsible for Implementation
Detailed Design Phase	H&S plan	Occupational health and safety	Supervision Consultant	Contractor
Detailed Design Phase	Spill prevention and containment plan	Mitigate impacts of accidental spills of oil, lubricants, fuels, concrete, and other hazardous materials	Supervision Consultant	Contractor
Post Construction Phase	Restoration of the construction campsite/ area	Restoring the area to the usable condition	Contractor under the guidance of Supervision Consultant	Contractor

Table 29: Environmental Management Plan

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
I.	PRE-CONSTRUCTION STAGE				
1.	Land Acquisition	The land will be acquired following the provisions of Tamil Nadu Highway Act, 2001 and the compensation will be determined following India's new Land Acquisition and Rehabilitation and Resettlement Act, (RFCTLARR Act, 2013)	Corridor of Impact.	PIU, Revenue Dept., and NGOs,	PMU(CPRR)
2.	Obtaining Clearance, Permission and Consents	• Consultation and coordination with relevant authorities to prepare the documents to obtain clearance, permission and consents (as indicated in the table 7). • Conditions set in CRZ clearance, Environmental clearance and other permission and consents are to strictly adhere to	Project clearance/ NoC/ Permissions	Contractor	PIU and PMC
3.	Baseline collection	A full set of baselines of air, water, soil and noise will be collected by contractor prior to the mobilization	As specified in the environmental monitoring plan	Contractor	PIU and PMC
4.	Tree Felling and Transplantation The total number of trees to be affected for the project is 2,351.	• As far as possible maximum efforts shall be made to minimize the number of trees proposed to be felled by adopting suitable on the spot adjustment of engineering designs. • Trees shall be removed from the Corridor of Impact (CoI) and construction sites before the commencement of construction. • Prior Permission shall be obtained from the Revenue Department for the avenue trees and the Forest Department for the trees located within the Forest areas • The trees cut shall be disposed of through auction (inclusive of tree stumps). This disposal shall be done immediately to ensure that the traffic movement is not disrupted. Progress of tree cutting shall be reported to the PIU.	Corridor of Impact.	PIU, Revenue Department and Forest Department. Tree Felling Contractor	PMU(CPRR)
5.	Utility Relocation and Common Property Resources (CPRs)	• All community utilities and common property resources such as stand posts bore wells, wells, water supply lines, toilets, sewage lines, drainage systems, optical fibre cables, electric power supply lines, transformers, irrigation pump houses, telephone	Corridor of Impact.	PIU, Concerned Agencies/	PMU(CPRR)

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		and television cables shall be relocated and restored before the commencement of the road improvement activity. • 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 accidents including accidental fall into boreholes, pits, drains both during demolition and construction/ relocation of such facilities. Standard safety practices shall be adopted for all such works. • Early completion of works for schools, colleges and health centers including shifting of gates and construction of boundary walls shall be planned during holidays so that the risk of accidents and disturbance to the day-to-day activity of such institutions are minimized. • Proper placement (as per codes) of passenger shelters/bus stops shall be ensured to prevent distress to the commuters and passengers. • Access to the Common Property Resources (CPR's) shall be maintained • Relocation sites for all CPRs shall be selected in consultation with concerned communities, local administrative authorities/departments.		Departments, Contractor	
6.	Relocation of Cultural and Religious Properties	• All cultural properties within the CoI, whose structure is getting affected fully, shall be relocated at suitable locations, as desired by the community; and for partially impacted structures enhancement measures shall be applied at the same sites before construction begins, depending on the availability of space, the requirement of the communities and fund availability. • No cultural properties or religious structures shall be removed or relocated without the knowledge and written consent of the concerned parties or communities and local administration as the case may be. Sites for the relocation of these religious structures shall be identified following the choice of the community.	Corridor of Impact. 11 Temples, 3 churches, 2 burial grounds, and one school	PIU, NGOs, Contractor, Concerned Community	PMU(CPRR)

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		• As far as possible, the architectural elements of the structure should be conserved/reflected/translated into the design of new structures following the wishes of the community • Proper drainage and garbage disposal at such sites shall be ensured to prevent unhygienic conditions, blocking of drains, etc. at/near relocated structures. Garbage collection bins, soak pits or other appropriate measures shall be provided apart from the simple enhancement of such sites.			
7.	Onsite Training	The PIU shall organize orientation sessions during all stages of the project. This shall include on-site training (general as well as specific to the context of this subproject) as well. These sessions shall involve the concerned division-level staff of the CPRR involved in the project, Staff of the Site Engineer/ Supervision Consultant and the Contractor.		PIU, Site Engineer/ Supervision Consultant	PMU(CPRR)
8.	Joint Field Verification	• The Engineer - In charge of Supervision Consultant and the Contractor shall carry out joint field verification to ascertain the necessity of saving trees, environmental and community resources wherever such representations or suggestions in writing have been received and forwarded by the project authority or by the site engineer following the local situations (in consultation with the local authority/ interest of community representation). • The complaints/suggestions together with the observations and expert opinion of the joint verification team containing the need for additional protection measures or changes in design/scale/nature of protection measures including the efficacy of enhancement measures suggested in the EMP shall be summarized in a written document containing all the details with date, time, place, and signature of the individuals involved and this shall be sent to PIU/CPRR for approval. • The PIU shall maintain proper documentation and justifications/reasons in all such cases where deviation from the original EMP is proposed.	Project Corridor	Contractor and Environmental Officer of SC	PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
9.	Assessment of Impacts due to Changes/ Revisions in the Project Work	The Engineer - In charge of Supervision Consultant shall assess the anticipated impacts and revise/modify the EMP in consultation with the PIU/CPRR in accordance to the recommendation made by the field survey party in the event of changes /revisions (including addition or deletion) in the project's scope of work	Project Corridor	Contractor and Environmental Officer of SC	PIU
10.	COVID-19 response	• Taking cognizance of situation at time of mobilisation, the Contractor shall undertake a COVID-19 risk assessment of project area and prepare a COVID-19 Response and Management Plan (C-R&MP) and submit to PIU and Supervision Consultant for approval. • The preparation of C-R&MP shall consider guidance of Government of India, World Health Organisation, International Labour Organisation, International Financial Corporation and World Bank's interim guidance note etc. The key points include but not limited to, o Consider ways to minimize/control movement in and out of construction areas/site. o If workers are accommodated on site require them to minimize contact with people outside the construction area/site or prohibit them from leaving the area/site for the duration of their contract. o Implement procedures to confirm workers are fit for work before they start work, paying special to workers with underlying health issues or who may be otherwise at risk. o Check and record temperatures of workers and other people entering the construction area/site or require self-reporting prior to or on entering. o Provide daily briefings to workers prior to commencing work, focusing on COVID-19 specific considerations including cough etiquette, hand hygiene and distancing measures.	All locations	Contractor	Environmental Officer of SC and PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		○ Require workers to self-monitor for possible symptoms (fever, cough) and to report to their supervisor if they have symptoms or are feeling unwell. ○ Prevent a worker from an affected area or who has been in contact with an infected person from entering the construction area/site for 14 days. ○ Preventing a sick worker from entering the construction area/site, referring them to local health facilities if necessary or requiring them to quarantine at home for 14 days. • The contractor shall submit a weekly monitoring and progress report to PIU and Supervision Consultant.			
11.	Crushers, Hot-mix Plants & Batching Plants	• Crushers, hot mix plants, and batching plants shall comply with the requirements and specifications of the relevant current emission control legislation. • Hot-mix and batching plants shall be located 1000m (1km) away from residential/ settlements, forests, wildlife movement areas, and commercial establishments, preferably in the downwind direction. • The Contractor shall submit a detailed layout plan for all such sites and seek prior approval of Engineer - In charge of Supervision Consultant before entering into a formal agreement with a landowner for setting-up such sites. Actions by Supervision Consultant and PIU/CPRR against any non-compliance shall be borne by the Contractor at his own cost. • Arrangements to minimize dust pollution through the provision of windscreens, mist spray units, and dust encapsulation shall have to be provided at all such sites. Specifications of crushers, hot mix plants, and batching plants shall comply with the requirements of the relevant current emission control legislation and Consent / NOC for all such plants shall be submitted to the Supervision Consultant and PIU/ CPRR.	Project Corridor All construction machineries (Crushers, Hot-mix Plants & Batching Plants) should be kept/ stationed 1000 m away from settlements (refer to Annexure 4)	Contractor	Environmental Officer of SC and PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		• No such installation by the Contractor shall be allowed till all the required legal clearances are obtained from the competent authority and the same is submitted to the PIU/ CPRR and the Supervision Consultant. • Environmental Monitoring (dust and emission) have to be conducted to demonstrate compliance			
12.	Other Construction Vehicles, Equipment and Machinery	• The discharge standards promulgated under the Environment Protection Act, 1986 shall be strictly adhered to. All vehicles, equipment, and machinery to be procured for construction shall conform to the relevant Bureau of Indian Standard (BIS) norms. • Noise limits for construction plant equipment are to be procured such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB (A), when measured at one-meter distance from the edge of the equipment in free field, as specified in the Environment (Protection) Rules, 1986. • Efficient and environmentally friendly equipment confirming to the latest noise and effluent emission control measures available in the market shall be used in the project. • The Contractor shall maintain a record of Pollution under Control (PUC) certificate for all vehicles and machinery used during the contract period, which shall be produced to the PIU/ CPRR and the Supervision Consultant for verification whenever required.	Project Corridor	Contractor	Environmental Officer of SC and PIU
13.	Borrow Areas	• Arrangement for locating the source of supply of material for embankment and subgrade as well as compliance with environmental requirements, as applicable, shall be the sole responsibility of the Contractor. The environmental personnel shall be required to inspect every borrow area location before approval. • Format for reporting shall be as per the Reporting Format enclosed in the EMP for Borrow Area. The Engineer - In charge of the Supervision Consultant shall be required to inspect every borrow area location and evaluate such proposals following	Ecologically sensitive area (Mannur RF)	Contractor	Environmental Officer of SC and PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		environmental requirements before issuing approval for use of such sites. • No borrow areas shall be opened within 500m of wildlife movement zones and forest areas. The borrow areas shall be at least 300m from schools and village access roads. • Borrow area should be located at a minimum distance of 300m from the residential/ settlement area. Proper fencing should be provided and access to the borrow areas should be restricted for the locals • The Contractor shall not borrow the earth from the selected borrow area until a formal agreement is signed between landowner and Contractor and a copy of the agreement is to be submitted to the Engineer – In-charge of the Supervision Consultant. The Supervision Consultant shall report these facts to the PIU/ CPRR along with the remarks in the prescribed format with documentary proofs. • Planning of haul roads for accessing borrows materials shall be undertaken during this stage. The haul roads shall be routed to avoid agricultural areas. In case agricultural land is disturbed, the Contractor shall rehabilitate it as per Borrow Area guideline given in the Environmental Management Framework (EMF) or as approved by the Engineer – In-charge of Supervision Consultant. • Haul roads shall be maintained throughout the operation period of the borrow areas by undertaking the required maintenance and repair works, which may include strengthening, pothole repairing, and diversions. Improvements shall be done to reduce inconvenience to users of these roads, residents living along the haul roads and minimize air and water pollution. • Such measures shall include, but not limited to, frequent sprinkling of water, repairing of the road, road safety provisions (warning and informatory signage, flagmen, etc.), and ensuring covering of loaded vehicles by waterproof tarpaulin; consultation with public and special precautions are required			

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		when measures are implemented near schools, health centers, and settlement areas. • All borrow areas whether in private, community or govt. the land shall be restored either to the original condition or as per the approved rehabilitation plan immediately upon completion of the use of such a source.			
14.	Quarries	• The Contractor shall identify materials from existing licensed quarries with suitable materials for construction. Apart from approval of the quality of the quarry materials, the Engineer's representative shall verify the legal status of the quarry operation, as to whether approval from the Department of Geology and Mining, GoTN is obtained. • No quarry and/or crusher units shall be selected or used, which is within 1000m from the forest boundary, wildlife movement path, breeding and nesting habitats, and national parks/sanctuaries. No quarry plants can be set-up within 1000m from the residential/ settlement locations • Contractor shall also work out haul road network used for quarry transport and report to Engineer - In charge of Supervision Consultant who shall inspect and in turn report to PIU/ CPRR on the suitability of such haul roads from the safety of residents, biodiversity and other environment points of views.	Quarry area should be located 1000m from the settlement locations (refer to Annexure 4)	Contractor	Environmental Officer of SC and PIU
15.	Arrangement for Construction Water	• The Contractor shall source the requirement of water preferentially from surface water bodies, as rivers and tanks in the project area. The Contractor shall be allowed to pump only from the surface water bodies. Boring of any tube wells shall be prohibited. To avoid disruption/disturbance to other water users, the Contractor shall extract water from fixed locations. The Contractor shall consult the local people before finalizing the locations. • Only at locations where surface water sources are not available, the Contractor can contemplate the extraction of groundwater. Consent from the Engineer that "no surface water resource is available in the immediate area for the project" is a pre-	All rivers/ surface water bodies that can be used in the project	Contractor	Environmental Officer of SC and PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		requisite before extraction of groundwater. The Contractor shall need to comply with the requirements of the PWD – Water Resources Department. GoTN and seek their approval for doing so.			
16.	Sand (all river and stream beds used directly or indirectly for the project)	• The Contractor shall identify sand quarries with requisite approvals for the extraction of sand. In case of selection of new sites for sand quarrying, the Contractor shall obtain prior approval and concurrence from Competent District Authority and the Engineer – In charge of the Supervision Consultant keeping in view the objections and convenience of the local population, who may restrain such activities for their security and safety. • Where the supplier of sand is another party, the authentic copy of the lease agreement that has been executed between the local Tahasildar and the supplier has to be submitted to Supervision Consultant and PIU/ CPRR of the project, before any procurement is made from such a site. • To avoid accidents and caving in of sandbanks at quarry sites, and shall be removed layer by layer. Digging deeper than the permissible limit has to be completely avoided by the Contractor. Such quarry shall be barricaded 10m away from the periphery on all sides except the entry point, to prevent the accidental fall of domestic cattle, wildlife, and human beings.	All riverbeds recommended for sand extraction for the project	Contractor	Environmental Officer of SC and PIU
17.	Labour Requirements	The Contractor shall use unskilled labor drawn from local communities to avoid any additional stress on the existing facilities (medical services, power, water supply, etc.)	Along the project corridor at construction sites	Contractor	Environmental Officer of SC and PIU
18.	Construction Camp Locations – Selection, Design & Layout	• Construction camps shall not be proposed: ○ Within 1000m of Ecologically sensitive areas/ zones ○ Within 1000m from the nearest habitation to avoid conflicts and stress over the infrastructure facilities, with the local community. The layout of construction camps has to be	All Construction Workers Camps including areas in the	Contractor	Environmental Officer of SC and PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		prepared and approved by the Engineer – In charge of the Supervision Consultant. • The location for the stockyard for construction materials shall be identified at least 1000 m from watercourses. The waste disposal and sewage system for the camp shall be designed, built and operated such that there will no contamination to the soil, groundwater and also ensure that there is no odor generation. • Unless otherwise arranged by the ULB's, arrangements for disposal of excreta suitably approved by the local medical health or municipal authorities or as directed by Engineer shall be provided by the Contractor.	immediate vicinity		
19.	Arrangements for Temporary Land Requirement	• The Contractor as per prevalent rules shall carry out negotiations with the landowners for obtaining their consent for temporary use of lands for construction sites/ hot mix plants /traffic detours /borrow areas etc. • The Engineer shall ensure that the site is cleared before handing over to the owner (after construction or completion of the activity) and it is included in the contract.	Areas temporarily acquired for construction sites / hot mix plants / borrow areas / diversions / detours	Contractor	Environmental Officer of SC and PIU
II.	**CONSTRUCTION STAGE**				
	Site Clearance				
20.	Clearing and Grubbing	• Site clearance including clearance of marked trees for felling and removal has to be carried out much before the actual road construction takes place. • Structures and utilities (cabins, commercial properties, hoardings, overhead power transmission lines, cable connections, telephone lines, bore wells, stand posts, wells, statues, temples, etc.) shall be compensated/relocated as per RAP and EMP provisions before tree felling; clearing or grubbing activities are to be undertaken as these activities may damage structures (private and govt.) and essential facilities/utilities of public use.	Corridor of Impact	Contractor	Environmental Officer of SC and PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		• All works shall be carried out in a manner such that the damage or disruption to flora is minimum. Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works shall be removed with prior approval from Engineer - In charge of Supervision Consultant. • The Contractor, under any circumstances, shall not cut or damage trees. Vegetation above 30 cm girth shall be considered as trees and shall be compensated.			
21.	Dismantling of Bridgework / Culverts	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 cross-drainage at rivers, streams, water canals, and existing irrigation and drainage systems or causing flooding	At locations were bridge works and culverts are proposed.	Contractor	Environmental Officer of SC and PIU
22.	Generation & disposal of Debris	Debris generated due to the dismantling of the existing road shall be suitably reused in the proposed construction as follows: • Eighty percent (80%) of the sub-grade excavated from the existing road surface, excluding the scarified layer of bitumen, shall be reused in the civil works after improving the soil below the subgrade through the addition of sand and suitable cementing material for qualitative up-gradation. • The dismantled scraps of bitumen shall be utilized for the paving of crossroads, access roads and paving works in construction sites and campus, temporary traffic diversions, haulage routes, parking areas along the corridor or in any other manner approved by the Engineer - In charge of Supervision Consultant. • At locations identified for disposal of residual bituminous wastes, the disposal shall be carried out over a 60 mm thick layer of rammed clay to eliminate the possibility of leaching of wastes into the groundwater. • The Contractor shall suitably dispose of unutilized non-toxic debris either through filling up of borrows areas located in the wasteland or at pre-designated disposal sites, subject to the approval of the Engineer - In charge of Supervision Consultant.	Throughout Project Corridor	Contractor	Environmental Officer of SC and PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		• Debris generated from pile driving or other construction activities along the rivers and streams drainage channels shall be carefully disposed of in such a manner that it does not flow into the surface water bodies or form puddles in the area. • The pre-designated disposal locations shall be part of the Comprehensive Solid Waste Management Plan to be prepared by the Contractor in consultation and with approval of Engineer - In charge of Supervision Consultant and approval local competent authority.			
23.	Non-bituminous construction wastes disposal	The location of disposal sites shall be finalized before completion of the earthworks on any particular section of the road. The Engineer shall approve these disposal sites conforming to the following o These are not located within the designated forest area o The dumping does not impact natural drainage courses o No endangered/rare flora is impacted by such dumping. o Settlements are located at least 1000 m away from the site.	Disposal site locations	Contractor	Environmental Officer of SC and PIU
24.	Bituminous wastes disposal	The disposal of residual bituminous wastes shall be done by the Contractor at secure landfill sites, with the requisite approvals for the same from the concerned government agencies.	Throughout Project Corridor	Contractor	Environmental Officer of SC and PIU
25.	Stripping, stacking and preservation of topsoil	• The topsoil from all sites including roadside widening and working area, cutting areas, quarry sites, borrows areas, construction camps, haul roads in agricultural fields (if any) and areas to be permanently covered shall be stripped to a specified depth of 150mm and stored in stockpiles for reuse. • A portion of the temporarily acquired area and/or RoW edges shall be earmarked for storing topsoil. The locations for stacking shall be pre-identified in consultation and with approval of Engineer - In charge of Supervision Consultant. The following precautionary measures shall be taken by the Contractor to preserve the stockpiles until they are re-used: • Stockpile shall be arranged such that the slope does not exceed 1:2 (vertical to horizontal), and height is restricted to 2 m.	Throughout Project Corridor	Contractor	Environmental Officer of SC and PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		• To retain soil and to allow percolation of water, the edges of the pile shall be protected by silt fencing. • Multiple handling is to be kept to a minimum to ensure that no compaction occurs. • Such stockpiles shall be covered with empty gunny bags or shall be planted with grasses to prevent loss during rains. • Such stockpiled topsoil shall be utilized for o Covering reclamation sites or other disturbed areas including borrow areas (not those in barren areas) o Topdressing of road embankment and fill slopes o Filling up of tree pits and in the agricultural fields of farmers, acquired temporarily that need to be restored. • Residual topsoil, if there is any, shall be utilized for the plantation works along the road corridor. • The utilization as far as possible shall be in the same area/close to the same area from where the topsoil was removed. • The stripping, preservation, and reuse shall be carefully inspected, closely supervised and properly recorded by the Supervision Consultant.			
26.	Accessibility	• The Contractor shall provide a safe and convenient passage for vehicles, pedestrians, and livestock to and from roadsides and property access connecting the project road by providing temporary connecting road and footpath, as necessary. • Construction activities that shall affect the use of side roads and existing accesses to individual properties, access to works, whether public or private, shall not be undertaken without providing adequate provision approved by the Supervision Consultant. • The Contractor shall take care that the crossroads are constructed in such a sequence that construction work over the adjacent crossroads are taken up in a manner that traffic movement in any given area does not get affected.	All along the project corridor, all access roads.	Contractor	Environmental Officer of SC and PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
27.	Planning for Traffic Diversions and Detours	• Detailed traffic control plans shall be prepared by the Contractor and the same shall be submitted to the Engineer - In charge of Supervision Consultant 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 are undertaken for the transport of hazardous materials and arrangement of flagmen, etc. to regulate traffic congestion. • The Contractor shall provide specific measures for the 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 the local community of changes in traffic routes and pedestrian access arrangements with assistance from the Supervision Consultant and PIU/ CPRR.	All along the project corridor, all access roads	Contractor	Environmental Officer of SC and PIU
	Construction Materials				
28.	Earth from Borrow Areas for Construction	• No borrow area shall be opened without permission of the Engineer – In charge of Supervision Consultant. • Borrow pits shall not be dug continuously in a stretch. The location, shape, and size of the designated borrow areas shall be as approved by the Engineer and following the IRC recommended the practice for borrow pits for road embankments (IRC 10: 1961). • The borrowing operations shall 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 shall be maintained dust-free by the Contractor. Since dust rising is the most significant impact along the hauled roads, a sprinkling of water shall be carried out twice a day along such roads during their period of use.	All along the project corridor, all access roads sites temporarily acquired & all borrow areas	Contractor	Environmental Officer of SC and PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
29.	Quarries	• The Contractor shall obtain materials for quarries only after the approval of the Department of Geology and Mining, GoTN. A copy of this consent must be submitted to PIU/ CPRR through Engineer –In charge of Supervision Consultant. • The Contractor shall develop a Comprehensive Quarry Redevelopment Plan, as per the Mining Rules of the State and submit a copy to PIU/ CPRR and Supervision Consultant before the opening of the quarry site. • The quarry operations shall be undertaken within the rules and regulations in vogue.	All along the project corridor and all haul roads	Contractor	Environmental Officer of SC and PIU
30.	Blasting	• Except as may be provided in the contract or ordered or authorized by the Engineer, the Contractor will not use explosives. Where the use of explosives is so provided or ordered or authorized, the Contractor shall comply with the requirements of the following Sub-Clauses of MoRTH 302 besides the law of the land, as applicable. • The Contractor shall at all times take every possible precaution and shall comply with appropriate laws and regulations relating to the importation, handling, transportation, storage and use of explosives. The Contractor shall at all times when engaged in blasting operations, post sufficient warning flagmen, to the satisfaction of the Engineer. • The Contractor shall at all times make full liaison with and inform well in advance and obtain such permission as is required from all Government Authorities, public bodies and private parties whomsoever concerned or affected or likely to be concerned or affected by blasting operations. • Blasting shall be carried out only with the permission of the Engineer. All the statutory laws, regulations, rules, etc., about the acquisition, transport, storage, handling and use of explosives shall be strictly followed. • Blasting shall be carried out during fixed hours (preferably during mid-day) or as permitted by the Engineer. The timing shall be	All blasting and Pre-splitting Sites.	Contractor	Environmental Officer of SC and PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		made known to all the people within 1000m (200m for pre-splitting) from the blasting site in all directions. • Blast Management Plan shall be prepared by the Contractor and it needs to be approved by the Engineer – in charge of Supervision Consultant			
31.	Water Extraction	Procurement of water is to be carried out as per "Arrangement for Construction Water". The Contractor shall minimize the wastage of water during construction.	All water bodies recommended being used in the project	Contractor	Environmental Officer of SC and PIU
32.	Transporting Construction Materials	• All vehicles delivering materials to the site shall be covered to avoid spillage of materials. • All existing highways and roads used by vehicles of the Contractor, or any of his sub -Contractor or suppliers of materials and similarly roads which are part of the works shall be kept clean and clear of all dust/mud or other extraneous materials dropped by such vehicles • The unloading of materials at construction sites close to settlements shall be restricted to daytime only. • Transportation vehicles shall be cleaned before leaving the site	All along the Project corridor and all haul roads	Contractor	Environmental Officer of SC and PIU
	Construction work				
33.	Disruption to other users of Water	• While working across or close to any perennial water bodies, the Contractor shall not obstruct/ prevent the flow of water. • Construction over and close to the non-perennial streams shall be undertaken in the dry season and if such activity is likely to disrupt, constrain or impact the community use of the water body, adequate prior information (at least two weeks in advance) shall be provided to such community. Such water bodies may be limited to ponds, water harvesting structures (WHS), feeder channels to the pond, irrigation sources, etc. • If the supply of water or access to a source is being completely cut off, then the Contractor shall make necessary arrangements	Water withdrawal locations	Contractor	Environmental Officer of SC and PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		to provide water in the interim period. A water quality test shall be done before providing/supplying water. • Wherever excavation results in diversion of water flow shall be required as per the engineering designs, the Contractor shall ensure that such diversion channels have no stepper slopes than 1:2 (V to H). Proper slope protection measures have to be taken as approved by the Engineer - In charge of Supervision Consultant and PIU/ CPRR. • The Contractor shall take prior approval from PWD –Water Resource Department, GoTN and Supervision Consultant for any such activity. The PIU/CPRR shall ensure that Contractor has served the notice to the downstream users of water well in advance where such diversion of the flow is likely to affect the downstream population subject to the condition that under no circumstances the downstream flow shall be stopped putting the wildlife, the aquatic fauna, and the shoreline settlement under distress.			
34.	Drainage and Flood Control	• The Contractor shall ensure that any construction materials like earth, stone, ash or appendage are disposed off such that it does not block the flow of water of any watercourse and cross drainage channels. • Where necessary adequate mechanical devices to bailout accumulated water from construction sites, campsites, storage yard, excavation areas are to be pre-settled and arranged well in advance of the rainy season 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 before the onset of the monsoon at all the required locations, as directed by Engineer - In charge of Supervision Consultant and PIU/ CPRR. • The Contractor shall also ensure that no material blocks the natural flow of water in any watercourse or cross drainage	Surface water sources/ drains/ Nalahs/ Ponds etc	Contractor	Environmental Officer of SC and PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		channel. Before monsoon, the Contractor shall provide either permanent or temporary drains to prevent water accumulation or flooding in surrounding residential, commercial and agricultural areas.			
35.	Siltation of Water Bodies and Degradation of Water Quality	• The contractor shall construct silt fencing at the base of the embankment construction near all water bodies (including wells) and around the stockpiles at the construction sites. • Silt fencing shall be provided before the commencement of earthwork and shall continue till the stabilization of the embankment slopes is complete on the particular sub-section of the road. • The Contractor shall also put up sedimentation cum grease traps at the outer mouth of the drains located in truck lay byes and bus bays which are ultimately entering into any surface water bodies/water channels with a fall exceeding 1.5 m.	Surface water sources/ drains/ Nalahs/ Ponds etc.	Contractor	Environmental Officer of SC and PIU
36.	Slope Protection and Control of Soil Erosion	• The Contractor shall construct slope protection works as per design, or as directed by the Engineer - In charge of Supervision Consultant to control soil erosion and sedimentation through use of dykes, sedimentation chambers, basins, fiber mats, mulches, grasses, slope drains and other devices as required under specific local conditions. • Contractor shall ensure the following: o After construction of road embankment, the side slopes of all cut and fill areas shall be graded and covered with stone pitching, grass and shrub as per design specifications. o Turfing works shall be taken up as soon as possible provided the season is favorable for the establishment of grass sods. o Other measures of slope stabilization shall include mulching netting and seeding of batters and drain immediately on completion of earthworks with the sowing of seeds of grass, shrub and bushes 30cm interval from line to line across the slope and sprinkling of water on such slopes after completion of the earthwork.	High raise embankment and surface water bodies locations	Contractor	Environmental Officer of SC and PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		○ In borrow pits, the depth shall be regulated so that the sides of the excavation shall not be steeper than 1 vertical to 2 horizontal, from the edge of the bank. ○ Stabilization of the embankment with appropriate technique/s shall commence soon after the embankment formation.			
	Pollution Control				
	Water Pollution				
37.	Water Pollution from Construction Wastes	• The Contractor shall take all precautionary measures to prevent the wastewater generated during construction from entering into streams, water bodies or the irrigation system. The contractor shall avoid construction works close to the streams or water bodies during monsoon. • All waste arising from the project is to be disposed of in the manner that is acceptable to the Tamil Nadu State Pollution Control Board (TNPCB) or as directed by Engineer – In charge of Supervision Consultant. The Engineer – In charge shall certify that all liquid wastes disposed of from the sites meet the discharge standards.	Surface water sources/ drains/ Nalahs/ Ponds etc.	Contractor	Environmental Officer of SC and PIU
38.	Water Pollution from Fuel, Lubricants, and Chemicals	• The contractor shall ensure that all vehicle/machinery and equipment operation, maintenance and refueling shall be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. Oil interceptors shall be provided for vehicle parking, wash down and refueling areas as per the design provided. • In all, fuel storage and refueling areas are located on agricultural land or areas supporting vegetation, the topsoil shall be stripped, stockpiled and returned after cessation of such storage. • The contractor shall arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites approved by the Engineer – In charge. All spills and collected petroleum	Surface water sources/ drains/ Nalahs/ Ponds etc.	Contractor	Environmental Officer of SC and PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		products shall be disposed of following MoEF&CC and TNPCB guidelines. • Engineer – In charge shall certify that all arrangements comply with the guidelines of TNPCB/ MoEF&CC.			
	Air Pollution				
39.	Dust Pollution	• The Contractor shall take every precaution to reduce the level of dust (PM_{10} and $PM_{2.5}$) from crushers, material storage yards, haul roads and construction sites (including earthwork, dismantling, scarification and material mixing sites) by sprinkling of water, mist spray, encapsulation of dust source and erection of screen /barriers. • Hot mix plant and batch mix plant shall be fitted with dust extraction units and mist spray to keep down the dust emission levels. The PM_{10} value at a distance of 40m from a unit located in such a cluster should be less than 500 µg/m^3. • The Contractor shall provide necessary certificates to confirm that all crushers used in the project conform to relevant dust emission control legislation. Air pollution monitoring shall be conducted as per the Environmental Monitoring Plan and results shall be used to strengthen/rectify problematic areas. If other existing crushers are used, such units need to have a valid license from the TNPCB.	Construction area/ site, Construction camps, Materials Loading/ unloading facilities	Contractor	Environmental Officer of SC and PIU
40.	Emission from Construction Vehicles, Equipment and Machineries	• The contractor shall ensure that all vehicles, equipment, and machinery used for construction are regularly maintained and conform to the emission standards specified by the TNPCB. Certification issued for such contrivances obtained from designated/approved authority shall be submitted along with the specified reporting format. • The contractor shall maintain a separate file and submit Pollution under Control (PUC) certificates for all vehicles/equipment/machinery used for the project. Monitoring results shall also be submitted to Supervision Consultant and	Construction camps, Materials Loading/ unloading facilities	Contractor	Environmental Officer of SC and PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		PIU/ CPRR as per the Environmental Monitoring Plan in the specified format.			
	Noise Pollution				
41.	Noise Pollution: Noise from Vehicles, Plants and Equipment's	The Contractor shall confirm the following: • All plants and equipment used in construction shall strictly conform to the MoEF&CC/ TNPCB noise standards. • All vehicles and equipment used in construction shall be fitted with exhaust silencers. • Servicing of all construction vehicles and machinery shall be done regularly and during routine servicing operations, the effectiveness of exhaust silencers shall be checked and if found defective shall `be replaced. • Limits for construction equipment used in the project such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB (A) (measured at one-meter distance from the edge of equipment in the free field), as specified in the Environment (Protection) Rules, 1986. • Maintenance of vehicles, equipment, and machinery shall be regular and up to the satisfaction of the Engineer to keep noise levels at the minimum. • Idling of temporary trucks or other equipment shall not be permitted during periods of unloading or when they are not in active use. (MoRTH - Section: 201.2) • At the construction sites within 150m of the nearest habitation, noisy construction work such as crushing, concrete mixing, batching shall `be stopped during the night time between 9.00 pm to 6.00 am. • No noisy construction activities shall be permitted around educational institutes/health centers (silence zones) up to a distance of 100 m from the sensitive receptors. • The contractor shall provide noise barriers to the suggested locations of select schools/ Temples/health centers.	Sensitive locations including Schools, Hospitals, and Temples (refer to Annexure 4)	Contractor	Environmental Officer of SC and PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		• Monitoring shall be carried out at the construction sites as per the monitoring schedule and results shall be submitted to Engineer-In charge of Supervision Consultant. The engineer shall be required to inspect regularly to ensure the compliance of EMP. (Refer MoRTH - Section 111.3)			
	Health and Safety				
42.	Personal Safety Measures for Labour, Material handling, Painting, etc.	• The contractor shall provide all necessary safety appliances such as safety goggles (high visibility), helmets, safety belts, earplugs, masks, vests, boots, etc. to workers and staff. • Protective footwear and protective goggles to all workers employed on mixing asphalt materials, cement, lime mortars, concrete, etc. • Welder's protective eye-shields to workers engaged in welding works • Protective goggles and clothing to workers engaged in stone breaking activities and workers shall be seated at sufficiently safe intervals • Earplugs to workers exposed to loud noise (above 75dB (A)), and workers working in crushing compaction, or concrete mixing operation. • Adequate safety measures for workers during the handling of materials at the site are taken up. • The Contractor shall comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress. • The Contractor shall not employ any person below the age of 14 years for any work and no woman shall be employed for the work of painting with products containing lead in any form. • The Contractor shall also ensure that no paint containing lead or lead products is used except in the form of paste or readymade paint.	Construction sites	Contractor	Environmental Officer of SC and PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		• The contractor shall provide facemasks to the workers when the paint is applied in the form of a spray or a surface having dry lead paint is rubbed and scrapped. • The Contractor shall mark 'hard hat' and 'no smoking' and other 'high risk' areas and enforce non-compliance of use of PPE with zero tolerance. These shall be reflected in the Construction Safety Plan to be prepared by the Contractor during mobilization and shall be approved by Engineer.			
43.	Traffic and Safety & Pedestrian Safety	• 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, flags, lights and flagmen as proposed in the Traffic Control Plan/Drawings and as required by the Engineer – In charge for the information and protection of traffic approaching or passing through the section of any existing crossroads. • The Contractor shall ensure that all signs, barricades, pavement markings are provided as per the MoRTH specifications. • Pedestrian Safety shall be ensured. Pedestrian circulation shall be demarcated before start & unsafe areas shall be cordoned off	All along the project corridor and all haul roads	Contractor	Environmental Officer of SC and PIU
44.	The risk from Electrical Equipment(s)	The Contractor shall take all required precautions to prevent danger from electrical equipment and ensure that - • No material shall be so stacked or placed as to cause danger or inconvenience to any person or the public. • All necessary fencing and lights shall be provided to protect the public in construction zones. • All machines to be used in the construction shall conform to the relevant Indian Standards (IS) codes, shall be free from patent defect, shall be kept in good working order, shall be regularly inspected and properly maintained as per IS provision and to the satisfaction of the Engineer - Incharge. • Precautionary measures shall be taken when working close to the underground or overhead cables	All construction equipment	Contractor	Environmental Officer of SC and PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
45.	First Aid	The contractor shall arrange for - • A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone • Availability of suitable transport at all times to take an injured or sick person(s) to the nearest hospital • Equipment and trained nursing staff at the construction camp.	All construction equipment	Contractor	Environmental Officer of SC and PIU
Cultural Property					
46.	Chance Found Archaeological Property	• All fossils, coins, articles of the value of antiquity, structures, and other remains or things of geological or archaeological interest discovered on the site are the property of the Government and shall be dealt with as per provisions of the relevant legislation. • The Contractor shall take reasonable precautions to prevent his workmen or any other persons from removing and damaging any such article or thing. He shall, immediately upon discovery thereof and before removal acquaint the Engineer-Incharge of such discovery and carry out the Supervision Consultant instructions for dealing with the same, waiting which all work shall be stopped. • The Engineer shall seek direction from the Archaeological Survey of India (ASI) before instructing the Contractor to recommence the work in the site.	Along the project road.	Contractor	Environmental Officer of SC, , State Archaeological Department and PIU
Labour Camp Management					
47.	Location of Construction labor camps: Accommodation	• The Contractor shall provide, if required, erect and maintain necessary (temporary) living accommodation and ancillary facilities during the progress of work for labor to standards and scales approved by the Engineer- In charge. • The contractor shall follow all relevant provisions of the Factories Act, 1948 and the Building & other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction & maintenance of labor camp.	Along the project corridor at the location of construction labor camps	Contractor	Environmental Officer of SC and PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		• Construction camps shall not be proposed within 1000m from the nearest habitation to avoid conflicts and stress over the infrastructure facilities, with the local community. The location, layout and basic facility provision of each labor camp shall be submitted to Engineer before their construction. • The construction shall commence only upon the written approval of the Engineer - In charge.			
48.	Potable Water	• The Contractor shall construct and maintain all labor accommodation in such a fashion that uncontaminated water is available for drinking, cooking, and washing. within the precincts of every workplace 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 shall also guarantee the following: o Supply of sufficient quantity of potable water (as per IS) in every workplace/labor campsite at suitable and easily accessible places and regular maintenance of such facilities. o If any water storage tank is provided that shall be kept such that the bottom of the tank is at least 1m. from the surrounding ground level. o If water is drawn from any existing well, which is within 30mt. the proximity of any toilet, drain or other sources of pollution, the well shall be disinfected before water is used for drinking. o All such wells shall be entirely covered and provided with a trap door, which will be dustproof and waterproof. o A reliable pump shall be fitted to each covered well. The trap door shall be kept locked and opened only for cleaning or inspection, which will be done at least once in a month. o Testing of water shall be done every month as per the parameters prescribed in IS 10500:1991.	Construction labor camps	Contractor	Environmental Officer of SC and PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		• Compliance with EMP shall be reported to Engineer - In charge every week. Engineer - In charge shall inspect the labor camp periodically, to ensure compliance of the EMP.			
49.	Sanitation and Sewage System	The Contractor shall ensure that - • The sewage system for the camp are designed, built and operated in such a fashion that no health hazards occur and no pollution to the air, groundwater or adjacent watercourses take place • Separate toilets/bathrooms, wherever required, screened from those from men (marked in vernacular) are to be provided for women • Adequate water supply is to be provided in all toilets and urinals • All toilets in workplaces are with the dry-earth system (receptacles) which are to be cleaned and kept in a strict sanitary condition • Night soil is to be disposed of by putting a layer of it at the bottom of a permanent tank 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. • Adequate health care is to be provided for the workforce during the entire phase.	Construction labor camps	Contractor	Environmental Officer of SC and PIU
50.	Waste Disposal	The contractor shall provide garbage bins in the camps and ensure that these are regularly emptied and disposed of hygienically as per the Comprehensive Solid Waste Management Plan approved by the Engineer - In charge. Unless otherwise arranged by ULB's, the Contractor has to make arrangements for disposal of night soils (human excreta) either by suitably approved by the local medical health or municipal authorities or as directed by Engineer - In charge as provided by the Contractor.	Construction labor camps	Contractor	Environmental Officer of SC and PIU
51.	Stock-yards	• Location for stockyards for construction materials shall be identified at least 1000 m from the watercourse and separated and sufficiently away from the labor camps.	Construction labor camps	Contractor	Environmental Officer of SC and PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		• Separate enclosures shall be planned for storing construction materials containing fine particles such that sediment-laden water does not drain into nearby storm water drain & underground sewerage pipes.			
52.	Fuel storage and refueling areas	• The Contractor shall ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance, and refueling sites are located at least 500 m from rivers and irrigation canal/ponds • All location and lay-out plans of such sites shall be submitted by the Contractor before their establishment and shall be approved by the Engineer. • In all fuel storage and refueling areas, if located on agriculture land or areas supporting vegetation, the topsoil shall be stripped, stockpiled and returned after completion of such storage and refueling activities. Fuel storage shall be provided with bunds. • The plan for the construction campsite shall also include the process of collection and disposal of spent oil and grease. The collection and disposal methods for the spent oil and grease submitted as part of the construction camp plan should be duly approved by the Engineer - In charge.	Construction labor camps	Contractor	Environmental Officer of SC and PIU
Contractor Demobilization					
53.	Clearing of Construction of Camps & Restoration	• Contractor to prepare site restoration plans for approval by the Engineer. The plan has to be implemented by the contractor before demobilization. • On completion of the works, all temporary structures shall be cleared away, all rubbish burnt, excreta or other disposal pits or trenches filled in and effectively sealed off and the site left clean and tidy, at the Contractor's expense, to the entire satisfaction of the Engineer. • Residual topsoil shall be distributed on adjoining/proximate barren/rocky areas as identified by the Engineer in a layer of a thickness of 75mm - 150mm.	All Construction Workers' Camps	Contractor and Environment Officer of SC	PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
54.	Redevelopment of Borrow Areas	Redevelopment of borrow areas shall be taken up following the plans approved by the Engineer.	At all borrow area locations suggested for the project.	Contractor and Environment Officer of SC	PIU
55.	Ambient Environmental Data Collection	To collect a full set of post-construction data to be compared with the pre-construction baseline and analyse the impacts due to the project construction	As specified in the environmental monitoring plan	Contractor	PIU and PMC
Environmental Enhancement and Special Issues					
56.	Enhancement Measures	• Enhancement of all incidental spaces shall be planned and carried out before completion of construction, along the project road. Some of the enhancement measures to be considered along the project roads include avenue tree plantation, restoration of water bodies, providing public amenities, planting of shrubs in medians, rainwater harvesting, adequate storm water drainage, Landscaping at junctions to improve aesthetics, etc.	At suitable locations along the project road	Contractor and Environment Officer of SC	PIU
57.	Roadside Plantation Strategy, Tree Planting & Protection	• The Contractor/identified agency (were specifically identified) shall do the plantation at the median and/or turfing at embankment slopes as per the tree plantation strategy prepared for the project. The Contractor/ identified agency shall plant Indigenous plant varieties to the extent possible, guidance from the forest department shall be taken for the same. • Minimum 80 percent survival rate of the saplings shall be acceptable otherwise the Contractor shall replace dead plants at his own cost (Refer Annexure 7). The Contractor shall maintain the plantation until they handover the project site to CPRR. • Giving due protection to the trees that fall in the shoulders /corridor of impact/ trees planted outside clear zone shall be the prime focus during Construction/post-construction.	All tree plantation/ greenery areas of the project	Contractor / Forest Department and Environment Officer of SC	PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		• Re-plantation of at least ten times the number of trees (1:10) cut should be carried out along the project road. Since the major portion of the project road may pass through open lands, planting of trees along the entire stretch of the road is recommended as an enhancement measure, which would also serve as a mechanism to delineate ROW and prevent future encroachments/squatters into the right of way, wherever possible. • Growth and survival of trees planted shall be ensured and monitoring is done at least for 3 years. Survival status shall be reported every month to Engineer – In charge. • The Engineer – In charge shall inspect regularly the survival rate of the plants and compliance of tree plantation guidelines.			
58.	Transplantation	All trees up to 30 cm girth at breast height and naturally occurring medicinal shrubs/bushes/grass clumps within the RoW shall be uprooted mechanically with ball of earth intact for relocation and transplantation at various pre-identified locations such as degraded sites, embankments of road-side water bodies, temples, near-by market places, religious properties, schools and along road corridors for preventing loss of diverse vegetative cover and for reducing growth period.	Along the project road	Contractor / Forest Department and Environment Officer of SC	PIU
59.	Flora and Chance found Fauna	• The Contractor shall take reasonable precautions to prevent his workmen or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal. • If any wild animal is found near the construction site at any point in time, the Contractor shall immediately upon discovery thereof acquaint the Engineer – In charge and execute the Engineer's instructions for dealing with the same. • The Engineer-In charge shall report to the nearby forest office (range office or divisional office) and shall take appropriate	Along the project road	Contractor / Forest Department and Environment Officer of SC	PIU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		steps/ measures if required in consultation with the forest officials.			
60.	Sensitive Areas	• The sensitive areas like schools, hospitals are provided with permanent noise barriers before the start of work to minimize the dust and noise impacts due to vehicle movement (during / post-construction). Their effectiveness to be checked during the operation phase. • Construction activities shall be confined within the present available RoW, regularly strict monitoring/supervision should be done to minimize/control air-noise pollution and abatement of dust particles at the minimum level possible using well maintain modern machineries. Crushers, Hot-mix Plants and Batching Plants should be placed at least 10km aerial distance away from the sanctuary boundary.	Concerned locations	Contractor / Forest Department and Environment Officer of SC	PIU
III.	**OPERATION STAGE (Activities to be Carried Out by the Contractor (till the DLP) and then CPRR /Forest Department, GoTN)**				
61.	Monitoring and Evaluation of Environmental Mitigation Measures provided in the Project	• The PIU/CPRR shall monitor the operational performance of the various mitigation/ enhancement measures carried out as a part of the project.	All along the project corridor	Contractor (DLP) and PIU	PMU
62.	Maintenance of Drainage	• PIU/CPRR shall ensure that all drains (side drains and all cross drainages) are periodically cleared especially before monsoon season to facilitate the quick passage of rainwater and avoid flooding without damaging the land, properties, spurs and check dams erected to stabilize the course and flow of all such drainage channels. • PIU/CPRR shall ensure that all the sediment/oil and grease traps set up at the truck and bus lay bye are cleared once in every three months.	All along the project corridor	Contractor (DLP) and PIU	PMU
63.	Road Maintenance	Establishment of work zones to separate workers on foot from traffic and equipment by:	All along the project corridor	Contractor (DLP) and PIU	PMU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
		• Provide barricades, adequate lighting, warning signs or signals where person on foot must work or travel through or near heavy equipment operations or congested travel areas • Provide turn-around and lay out for internal traffic control patterns to eliminate congestion • Provide high visibility safety apparel of proper classification to all workers • Ensure worksite vehicles have working adjustable side mirrors • Prohibit equipment operators from backing up long distances, and work to minimize the distance trucks need to back up to access the work area • Each worker should have a designated back-up person or spotter to signal when it is safe for operators to back equipment into work areas and to make sure everyone keeps clear of the moving equipment. • Educate workers on the concept of teamwork along with safety • Establish a policy to prohibit use of wireless devices and cell phones while walking or working around moving equipment			
64.	Pollution Monitoring	• The frequency of monitoring of the ambient air quality, noise level, water (both ground and surface water) quality, soil pollution/contamination are to be continued at pre-designated locations as identified in the Environmental Monitoring Plan and if necessary, at additional locations for comparative study of pre and post-operation data to ensure further improvement/modification in similar future works. • PIU/CPRR shall appoint a specific pollution monitoring agency for this purpose.	All along the project corridor	Contractor (DLP) and PIU	PMU
65.	Atmospheric Pollution	• Ambient air concentrations of various pollutants shall be monitored as envisaged in the Environmental Monitoring Plan at pre-designated locations to compare the levels with the pre-construction data. • Additional data at other locations may be collected as per any site-specific requirement.	All along the project corridor	Contractor (DLP) and PIU	PMU

Sl.No.	Project Activities	Management Measure	Location	Responsibility	
				Planning and Execution	Supervision and Monitoring
66.	Noise Pollution	• Noise pollution shall be monitored as per the Environmental Monitoring Plan at sensitive locations where pre-construction noise data was collected. The functioning of the noise barriers has to be specifically supervised and monitored for further improvement/replication at other affected points if necessary. • Signage indicating 'no horn zones' near sensitive locations shall be maintained and kept clean. Monitoring the effectiveness of the pollution attenuation barriers shall be taken up thrice in the operation period.	All along the project corridor	Contractor (DLP) and PIU	PMU
67.	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, shall be carried out before monsoon, during monsoon, and after winter rains to record and monitor the effectiveness of such structures after the completion of project, to evaluate the beneficial effects of each type of activity together with the cost involved.	Borrow areas	Contractor (DLP) and PIU	PMU
68.	Avenue Trees	• The PIU/CPRR with the assistance from Forest Department, GoTN shall do survival monitoring of avenue trees for every quarter.	All along the project corridor	PIU and Forest Department	PMU
69.	Road Safety and Maintenance of Assets	• No advertisement/hoardings shall be allowed within the Right of Way limits of the project road. • Regular maintenance and cleaning of assets such as signboards, bus stops, drains, etc. shall be undertaken. • OHS measures	All along the project corridor	Contractor (DLP) and PIU	PMU

8.3 Responsibilities for EMP Implementation

224. The Project Director (PD), CPRR will head the overall safeguard implementation. The Project Implementation Unit (PIU) shall have an Environmental cell. The PIU shall be supported/ assisted by a Supervision Consultant to ensure good construction practices and the implementation of the safeguard provisions. The roles and responsibilities are as follows

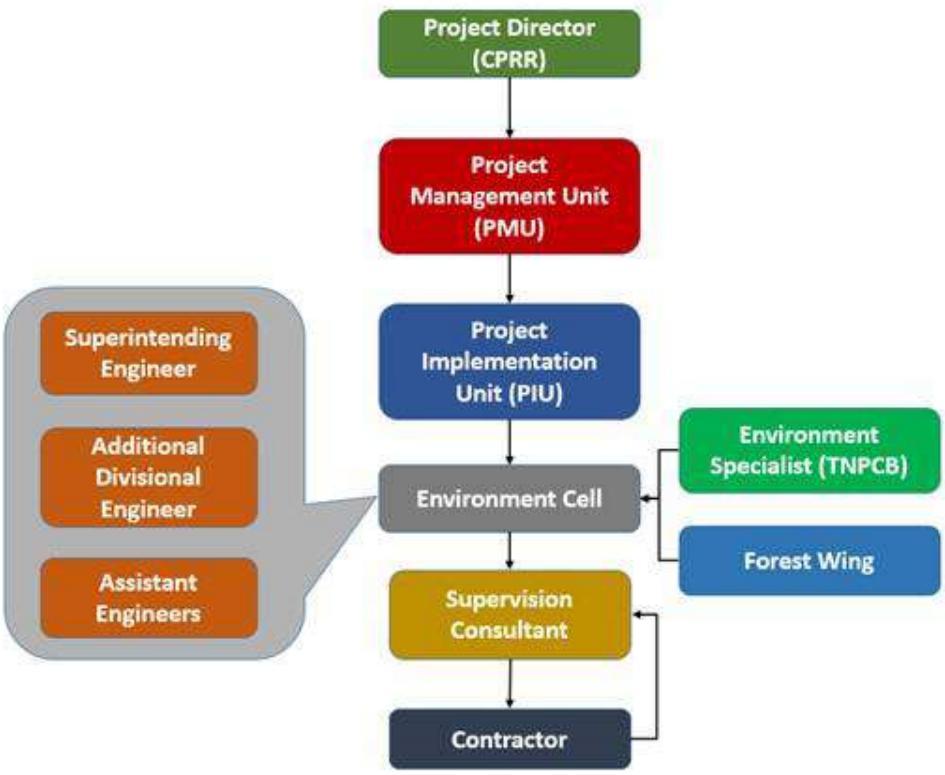


Figure 23: Implementation Arrangement for EMP

- ***Environmental Cell*** comprises of a Superintending Engineer (SE), an Assistant Divisional Engineer (ADE), and Assistant Engineers (for HO and field works). The Additional Divisional Engineer and the Assistant Engineers will have full responsibility for ensuring EMP implementation. One Environment Specialist, deputed from Pollution Control Board has been inducted to provide support to the Environmental Cell. The forest wing of the Environmental Cell comprises one Assistant Conservator of Forest, Rangers, and field staffs. The forest officials will supervise and coordinate compensatory plantation, which has been built into the construction contracts under the project.
- ***Implementation of EMP:*** The EMP given in the bid document will be implemented by the Contractor (Environmental and Safety Engineer), he will make sure that all the project related clearance including the NOC/ Permissions from the competent authority is obtained before the start of the construction works. He will be responsible for conducting the environmental monitoring (as per the environmental monitoring plan) and the preparation and submission of the monthly EMP report to the Supervision Consultant. The Supervision Consultant (Environmental Officer) will

verify the project related clearances (including the NoC/ permissions) and he will review the environmental monitoring outcomes, as well as the monthly EMP reports and guide/ advise the contractor in implementing the EMP. The Supervision Consultant (Environmental Officer) will submit the revised monthly EMP report to the PIU. The Environmental cell in the PIU will review the monthly EMP reports and it will be consolidated biannually and shared with the AIIB through TNHD HQ for review and disclosure in the format agreed with AIIB. In addition, the environmental related grievances received by the GRM shall be scrutinised by the Environmental cell and suitable measures shall be suggested to the GRM in sorting out the issues.

8.4 Environmental Monitoring Program

225. To ensure the effective implementation of the EMP, it is essential to design an effective monitoring program. For this CPRR project, the monitoring plan is based on the following objectives.

- To evaluate the performance of mitigation measures proposed in the EMP;
- To suggest improvements in the management plans, if required;
- To satisfy the statutory and community obligations; and,
- To provide feedback on the adequacy of Environmental Impact Assessment

226. The monitoring program has a monitoring plan for all performance indicators and reporting systems.

8.4.1 Performance Indicators

227. The performance indicators are based on the physical, biological and environmental management components identified as of particular significance in affecting the environment at critical locations. The Performance Indicators are evaluated under three heads as:

- **Environmental condition indicators** to determine the efficacy of environmental management measures in control of air, noise, water and soil pollution;
- **Environmental management indicators** to determine compliance with the suggested environmental management measures
- **Operational performance indicators** have also been devised to determine the efficacy and utility of the mitigation/enhancement designs proposed

228. The performance Indicators and monitoring plans prepared for project Implementation are presented in the following table.

Table 30: Performance Indicators for Project Implementation

Sl. No.	Indicator	Details	Stage	Responsibility
A	**Environmental Condition Indicators and Monitoring Plan**			
1	Air Quality	The parameters to be monitored, frequency and duration of monitoring as well as the locations to be monitored will be	Pre-Construction	Contractor through approved monitoring agency
			Construction	
			Operation	PIU through approved monitoring agency
2	Noise Levels		Pre-Construction	Contractor through approved monitoring agency

Sl. No.	Indicator	Details	Stage	Responsibility
		as per the Monitoring Plan prepared **(Refer Table 34)**	Construction	
			Operation	PIU through approved monitoring agency
3	Water Quality		Pre-Construction	Contractor through approved monitoring agency
			Construction	
			Operation	PIU through approved monitoring agency
4	Soil Quality		Construction	Contractor through approved monitoring agency
			Operation	PIU through approved monitoring agency
B	**Environmental Management Indicators and Monitoring Plan**			
1	Construction Camps	Location of construction camps have to be identified and parameters indicative of environment in the area has to be reported	Pre-construction	Contractor and Supervision Consultant
2	Borrow Areas	Location of borrow areas have to be identified and parameters indicative of environment in the area has to be reported.	Pre-construction	Contractor and Supervision Consultant
3	Tree Cutting	Progress of tree removal marked for cutting is to be reported	Pre-construction	Revenue Department and Contractor (under the supervision of Supervision Consultant)
4	Tree Plantation	Progress of measures suggested as part of the Strategy is to be reported	Construction	Forest Wing (Assisted by supervision of Supervision Consultant)
5	Disposal Site	No. of locations Approved for Debris disposal; Quantity disposed off at each location; No. site Rehabilitated and hand overed	Construction	Contractor and Supervision Consultant
6	Reuse and recycle of waste	Quantity of waste reused/recycled; location and type of construction activity	Construction	Contractor and Supervision Consultant
7	Sensitisation / awareness Training	No. and frequency of sensitisation training; No. and type of target audience trained	Construction	Contractor and Supervision Consultant
8	Accidents/Incidents	No of accidents/incidents recorded	Construction	Contractor and Supervision Consultant

Sl. No.	Indicator	Details	Stage	Responsibility
9	Health and Safety (including COVID-19)	As per the H&S plan requirements (refer Guideline for COVID-19, Annexure 10)	Construction	Contractor and Supervision Consultant
C	**Management & Operational Performance Indicators**			
1	Survival Rate of Trees	The number of trees surviving during each visit will be compared with the number of saplings planted	Operation	Contractor (till the DLP) and then PIU will be responsible
2	Status Regarding Rehabilitation of Borrow Areas	The Contractor and PIU will undertake site visits to determine how many borrow areas have been rehabilitated in line with the landowner's request and to their full satisfaction.	Operation	Contractor (till the DLP) and then PIU will be responsible.
3	Soil Erosion	Visual monitoring and operation inspection of embankments will be carried out once in three months.	Operation	Contractor (till the DLP) and then PIU will be responsible

8.4.2 Monitoring Parameters and Standards

229. The environmental monitoring of the parameters involved and the threshold limits with respect to the Indian standards are discussed below. However, it is suggested to utlise the most stringent threshold limits in comparison with WHO (as discussed in the section 3.3 (Environmental Regulatory Clearance Requirements))

8.4.2.1 Ambient Air Quality Monitoring (AAQM)

230. The air quality parameters namely Sulphur Dioxide (SO_2), Oxides of Nitrogen (NO_X), Carbon Monoxide (CO), Hydro-Carbons (HC), Particulate Matter (PM_{10}), Particulate Matter ($PM_{2.5}$), Ammonia (NH_3), Ozone (O_3), Lead (Pb), Benzo (a) pyrene (BaP), Arsenic (As) and Nickel (Ni) shall be regularly monitored at identified locations from the start of the construction activity. The air quality parameters shall be monitored in accordance with the National Ambient Air Quality Standards as given in table below.

Table 31: National Ambient Air Quality Standards

Sl. No	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
1	Sulphur Dioxide (SO_2), µg/m^3	Annual* 24 hours**	50 80	20 80	-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)

Sl. No	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
					-Chemiluminescence
3	Particulate Matter (size less than 10µm) or PM_{10} µg/m^3	Annual* 24 hours**	60 100	60 100	-Gravimetric -TOEM -Beta attenuation
4	Particulate Matter (size less than 2.5µm) or PM_{25}µg/m^3	Annual* 24 hours**	40 60	40 60	-Gravimetric -TOEM -Beta attenuation
5	Ozone (o_2) µg/m^3	8 hours* 1 hours**	100 180	100 180	-UV photometric -Chemiluminescence -Chemical Method
6	Lead (Pb) µg/m^3	Annual* 24 hours**	0.50 1.0	0.50 1.0	-AAS/ICP method after sampling on EMP 2000 or equivalent filter paper -ED-XRF using Tefloa filter
7	Carbon Monoxide (CO) µg/m^3	8 hours* 1 hours**	02 04	02 04	-Non Dispersive Infra-Red (NDIR)spectroscopy
8	Ammonia (NH_3) µg/m^3	Annual* 24 hours**	100 400	100 400	-Chemiluminescence -Indophenol blue method
9	Benzene (C_6H_6) µg/m^3	Annual*	05	05	-Gas chromatography based continuous analyser -Adsorption and Desorption followed by GC analysis
10	Benzo(a)Pyrene (BaP) particulate phase only, µg/m^3	Annual*	01	01	-Solvent extraction followed by HPLC/GC analysis
11	Arsenic (As) µg/m^3	Annual*	06	06	-AAS/ICP method after sampling on EMP 2000 or equivalent filter paper
12	Nickel (Ni) µg/m^3	Annual*	20	20	-AAS/ICP method after sampling on EMP 2000 or equivalent filter paper

**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.*

8.4.2.2 Noise Quality Monitoring

231. The noise levels shall be monitored at identified locations in accordance with the Ambient Noise Quality standards given in **Table 32**.

Table 32: National Ambient Noise Quality Standards

Area Code	Category of Zones	imits 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 6.00am to 10.00 pm and Night shall mean from 10.00 pm to 6.00 am*
*** Silence zone is defined as area up to 100 meters around premises of hospitals, educational institutions and courts. Use of vehicles horns, loud speakers and bursting of cracking are banned in these zones.*

8.4.2.3 Water Quality Monitoring

232. Water quality parameters such as pH, BOD, COD, DO coliform count, total suspended solids, total dissolved solids, Iron, etc. shall be monitored at all identified locations during

the construction stage as per standards prescribed by Central Pollution Control Board and Indian Standard Drinking water specifications, presented in **Table 33**.

Table 33: National Standard of Water

Sl. No	Parameters	IS:2296 (Class C)	Method Adopted
1	pH	6.5-8.5	pH meter
2	BOD (3 days 27ºC)	3.0	DO-Azide modification of Wrinkler's method
3	Temperature (ºC)	NS	Thermometer
4	Dissolved oxygen	4	Azide Modification of Wrinkler's method
5	Color (Hazen)	300	Visual Comparison method
6	Fluorides (F)	1.5	SPANDS method
7	Chlorides (Cl)	600	Argentometric Titration
8	Total Dissolved Solids	1500	Gravimetric Analysis
9	Sulphates (SO_4)	400	Barium Chloride method
10	Iron (Fe)	50	Phenanthrolin method
11	Oil and Grease	0.1	Partition – Gravimetric method
12	Nitrates	50	Chromotropic acid
13	Chromium (Cr^{6+})	0.05	Atomic Absorption Spectrophotometry
14	Cadmium (Cd)	0.01	Atomic Absorption Spectrophotometry
15	Lead (Pb)	0.1	Atomic Absorption Spectrophotometry
16	Copper (Cu)	1.5	Atomic Absorption Spectrophotometry
17	Cyanide (CN)	0.05	Chloramine-T-method
18	Selenium (Se)	0.05	Atomic Absorption Spectrophotometry
19	Arsenic (As)	0.2	Atomic Absorption Spectrophotometry
20	Phenols	0.005	Spectrophotometer
21	Detergents	1.0	Spectrophotometer
22	DDT	Absent	Spectrophotometer
23	Total Coliform (MPN/100 ml)	5000	Multiple Tube Fermentation Technique

NS: Not specified; Brackets ([ ]) indicates extended limits. All the values in mg/l if otherwise mentioned

8.4.2.4 Monitoring Plans for Environment Condition

233. For each of the environmental components, the 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 and operation stages is presented in **Table 34**. Monitoring plan does not include the requirement of arising out of regulation provision such as obtaining NOC/ consent for plant site operation.

Table 34: Environmental Monitoring Plan

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
Air	Pre - construction	SO_2, NO_x, PM_{10}, $PM_{2.5}$, O_3,Pb, CO, NH_3, C_6H_6, BaP, As and Ni	High volume sampler to be located 50m from the plant in the Downwind direction. Use method specified by CPCB for analysis	Air (prevention and Control of Pollution) Rules, CPCB, 2009	One season sampling before civil works	24 hours Sampling	Along the project road	Contractor under the supervision of SC
	Construction				Three seasons per year		Along the project road, Hot mix / batching plant & crusher	
	Operation				Two seasons in a year for three years		Along the project road	Contractor (till the DLP) and PIU
Water	Pre-construction	All essential characteristics and some of desirable characteristics as decided by the Environmental Specialist of the SC and PIU	Grab sample collected from source and Analyse as per Standard Methods for Examination of Water and Wastewater	Indian Standards for Inland Surface Waters (IS: 2296, 1982)	One season sampling before civil works	Grab Sampling	Along the road Surface water sources	Contractor under the supervision of SC
	Construction				Four seasons per year			
	Operation				Four seasons for three years			Contractor (till the DLP) and PIU
Noise	Pre-construction	Noise levels on dB (A) scale	Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement	MoEF&CC Noise Rules, 2000	One season sampling before civil works	Leq in dB(A) of day time and night time	Along the project road	Contractor under the supervision of SC
	Construction				Three seasons per year		Along the project road, Hot mix / batching plant & crusher	

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
	Operation				Three seasons per year for three years.		Along the project road	Contractor (till the DLP) and PIU
Soil	Pre-construction	Monitoring of Pb, SAR and Oil & Grease	Sample of soil collected to acidified and analysed using absorption Spectrophotometer	Threshold for each contaminant set by IRIS database of USEPA until national standards are promulgated	One season sampling before civil works	Grab Sampling	Along the project road	Contractor under the supervision of SC
	Construction				Four seasons per year		Along the project road, Hot mix / batching plant	
	Operation				Four seasons for three years		Along the project road	Contractor (till the DLP) and PIU
H&S (including COVID-19)	Construction	As per the H&S plan requirements (refer Annexure 10 for COVID-19 Guidelines)	Comply with IFC EHS Guidelines on Occupational Health and Safety		Once a month for Normal Health check-up	Biweekly for COVID 19	Construction and labour camps	Contractor under the supervision of SC
	Operation							
Borrow area	Construction	As per Guidelines	Visual Observation	-	Once in a month	-	Borrow area location	Contractor under the supervision of SC
Tree plantation/ Tree Transplantation	Operation stage	As per Design			Quarterly	-	Areas where plantation is being done	Contractor (till the DLP) and then PIU will be responsible

8.4.3 Reporting System

234. Reporting system suggested for the CPRR operate at two levels as:

- Reporting for environmental condition indicators and environmental management indicators (except tree cutting indicator)
- Reporting for operational performance indicators at the PIU level

235. Contractor and Supervision Consultant operates the reporting system for environmental conditions (EC) and environmental management (EM) indicators (except tree cutting). The Environmental Management Cell of PIU will operate the reporting system for environmental management (EM) tree cutting indicators and operational performance (OP) indicators. The PIU will set the targets for each activity envisaged in the EMP beforehand and all reports will be against these targets.

236. The Contractor will report to the Supervision Consultant of the progress of the implementation of environmental conditions and management measures as per the EMP. The Supervision Consultant will in turn report to the PIU every quarter. Reporting formats have been prepared, which will form the basis of monitoring, by the Contractor, Supervision Consultant and/or the Environmental Cell as required and presented as **Annexure 5** and **Annexure 6**.

Table 35: Summary details of Reporting

Format No.	Item	Stage	Contractor	Environmental Cell	Supervision Consultant (SC)		Project Implementation Unit (PIU)
			Implementation & Reporting to SC	Implementation & Reporting to PIU	Supervision	Reporting to PIU	Oversee / Field Compliance Monitoring
EM1	Identification of Disposal Locations	Pre-Construction	One Time	-	One Time	One Time	One Time
EM2	Setting up of Construction Camp	Pre-Construction	One Time	-	One Time	One Time	One Time
EM3	Borrow Area Identification	Pre-Construction	One Time	-	One Time	One Time	One Time
EM4	Tree Cutting/ Tree Transplantation	Pre-Construction	-	Monthly	-	-	Quarterly
EM5	Tree Plantation	Construction	-	Monthly	-	-	Quarterly
EM6	Top Soil Monitoring	Construction	Quarterly		Continuous	Quarterly	Quarterly
EM7	Redevelopment of Borrow Areas	Operation	One Time		One Time	One Time	One Time
EM8	Checklist for Construction Safety	Construction	Quarterly		Continuous	Quarterly	Quarterly
EC1	Pollution Monitoring	Construction	As Per Monitoring Plan	-	Quarterly	Quarterly	Quarterly
EC2	Pollution Monitoring	Operation	-	-	-	-	As Per Monitoring Plan
OP1	Survival Rate of Trees	Operation	-	Quarterly	-	-	Quarterly

Format No.	Item	Stage	Contractor	Environmental Cell	Supervision Consultant (SC)		Project Implementation Unit (PIU)
OP2	Status Regarding Rehabilitation of Borrow Areas	Operation	-	-	-	-	Half Yearly

8.5 Capacity Building

237. The Environmental officer of the Supervision Consultant will provide the basic training required for environmental awareness. Specific modules customized for the available skill set will be devised after assessing the capabilities of the members of the Training Programme and the requirements of the project. The entire training would cover basic principles of AIIB safeguards requirements, Regulatory Requirements (National and State act and rules), Impact assessment, EMP implementation techniques, monitoring, and reporting methods, and tools. The proposed training program along with the frequency of session is presented in Table

Table 36: Training Modules for Environmental Management

Sl.No.	Training Program	Duration	Target Group	Responsibility
1.	Sensitization Workshop on • Introduction to EMP requirement • Basic Concept of Environment • Environmental Regulations and Statutory requirements as per Govt. of India, Government of Tamil Nadu and AIIB applicable for CPRR project	Half Working Day	Contractors, Supervision Consultant (Site supervisors, Field Engineers) and PIU	Environmental officer of the Supervision Consultant
2.	EMP implementation arrangements, good engineering practices as per EMP implementation requirement	Half Working Day	Contractors, Supervision Consultant (Site supervisors, Field Engineers) and PIU	Environmental officer of the Supervision Consultant
3.	Improved Co-ordination with other Departments: • Statutory Permissions - Procedural Requirements • Co-operation & Co-ordination with other Departments.	¼ Working Day	Contractors, Supervision Consultant (Site supervisors, Field Engineers) and PIU	Environmental officer of the Supervision Consultant
4.	Roles and Responsibilities of Contractors/Supervision consultant/ PIU officials towards the implementation of EMP	¼ Working Day	Contractors, Supervision Consultant (Site supervisors, Field Engineers) and PIU	Environmental officer of the Supervision Consultant
5.	Monitoring and reporting system	Half Working Day	Contractors, Supervision Consultant (Site supervisors, Field Engineers) and PIU	Environmental officer of the Supervision Consultant
6.	The orientation of contractors at the time of issuing work orders on the implementation of EMP	¼ Working Day	Contractors	Environmental officer of the Supervision Consultant
7.	The orientation of Contractors on the implementation of EMP	¼ Working Day for	Contractors	Environmental officer of the

Sl.No.	Training Program	Duration	Target Group	Responsibility
		every six month		Supervision Consultant

8.6 EMP Budget

238. As part of good engineering practices in the project, there have been several measures like safety, signage, dust suppression, procurement of personal protective equipment, provision of drains, etc. and the costs for which are included in the design / civil cost of the project. Therefore, these items of costs have not been included in the EIA budget. Only those items not covered under budgets for construction are considered in the EIA budget.

239. The costs of water sprinkling for dust suppression and providing personal protective equipment to construction workers shall be borne by the contractor as part of the conditions of the contract. In addition, the sources of funds for Mitigation measures during the construction stage including environmental monitoring during the construction stage are also to be borne by the contractor. These are deemed to be included as part of the contract price amount quoted by the contractor for the works. The cost of components for monitoring in the operation stage and the capacity building costs are to be funded by the PMU. The EMP cost is given in the following table.

Table 37: Environmental Management Budget (Section 2 and Section 3)

Item No.	Description	Unit	Quantity		Rate (INR)	Amount
			Section 2	Section 3		
A	**PRE CONSTRUCTION PHASE**					
1	***Monitoring of Environmental Attributes during Pre-Construction Activity***					
1.1	Monitoring of Air Quality	No. of Samples	4	6	8000	80,000.00
1.2	Monitoring of Noise Level	No. of Samples	4	6	5000	50,000.00
1.3	Water Quality Monitoring					
1.4	Surface Water Bodies	No. of Samples	2	3	8000	40,000.00
1.5	Ground Water	No. of Samples	4	6	8000	80,000.00
1.6	Soil Quality	No. of Samples	2	3	8000	40,000.00
					Sub Total A: Cost of Mitigation Measures	**290,000.00**
B	**CONSTRUCTION PHASE**					
2	***Mitigation Measures***					
2.1	Oil Interceptors	No's	10	8	6500	117,000.00
2.2	Recharge pits	No's	52	62	20000	2,280,000.00
2.3	Silt Fencing	Length (m)	2500	3000	1250	6,875,000.00
2.4	Deepening of Ponds/ water body enhancement[10]	No's	14	12	1089000	28,314,000.00
2.5	Avenue Plantation, fencing & maintenance of Saplings for 5 years	No's	10,910	16,740	2,180	60,277,000.00
					Sub Total B1: Cost of Mitigation Measures	**97,863,000.00**

[10] Detailed Cost estimate for each water body is given in the Annexure 8

Item No.	Description	Unit	Quantity		Rate (INR)	Amount
			Section 2	Section 3		
3	***Monitoring of Environmental Attributes during Construction Activity***					
3.1	Monitoring of Air Quality	No. of Samples	45	45	8000	7,20,000.00
3.2	Monitoring of Noise Level	No. of Samples	45	45	5000	4,50,000.00
3.3	Water Quality Monitoring					
3.3.1	Surface Water Bodies	No. of Samples	18	18	8000	2,88,000.00
3.3.2	Ground Water	No. of Samples	45	45	8000	7,20,000.00
3.4	Soil Quality	No. of Samples	27	27	8000	4,32,000.00
Sub Total B2: Cost of Monitoring Measures						**26,10,000.00**
Sub Total B (B1+B2): Construction phase (Mitigation and Monitoring)						**10,04,73,000.00**
C	**OPERATIONAL PHASE**					
4	***Monitoring of Environmental Attributes during Operational phase***					
4.1	Monitoring of Air Quality	No. of Samples	41	39	8000	6,40,000.00
4.2	Monitoring of Noise Level	No. of Samples	41	39	5000	4,00,000.00
4.3	Water Quality Monitoring					
4.3.1	Surface Water Bodies	No. of Samples	16	15	8000	2,48,000.00
4.3.2	Ground Water	No. of Samples	41	39	8000	6,40,000.00
4.4	Soil Quality	No. of Samples	25	24	8000	3,92,000.00
4.5	Safeguard Training/ Capacity Building	LS			500000	5,00,000.00
Sub Total C: Operational phase (Enhancement and monitoring)						**28,20,000.00**
Grand Total A+B+C=						**10,35,83,000.00**
Grand Total cost of Environmental Budget exclusive cost of measures included under good engineering practices (A+B+C+10% contingency) INR						**11,39,41,300.00**

8.7 EMP and EMoP in Bid Documents

- The EMP (Table 32) and EMoP (Table 37) have to be incorporated in the bid document's work requirements
- The prepared EMP cost estimates/ budget should be incorporated in Bill of Quantities with a suitable bill number, which forms part of the Bid Documents.
- Preparation of work requirement (addendum/corrigendum to MoRTH specifications) and Corrigendum / Addendum to FIDIC as Special provisions to be incorporated in Bid Document.
- Penalty clauses for not complying with EMP requirements to be incorporated in the Bid Document. Indicative penalty clauses proposed in the projects are as follows.

8.7.1 Clause for Nonconformity to EMP - Protection of the Environment

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

i. All lapse in obtaining clearances/permissions under statutory regulations and violations of any regulations with regard to eco-sensitive areas shall be treated as a major lapse.

ii. Any complaints of public, within the scope of the Contractor, formally registered with the Supervision Consultant, PIU or with the GoTN and communicated to the Contractor, which is not properly addressed within the period intimated by the Supervision Consultant / PIU, GoTN shall be treated as a major lapse.
iii. Non-conformity to any of the mitigation measures stipulated in the EMP Report (other than stated above) shall be considered as a minor lapse.
iv. On observing any lapses, Supervision Consultant shall issue a notice to the Contractor, to rectify the same.
v. 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.
vi. If a major lapse is not rectified upon receiving the notice Supervision Consultant shall invoke reduction, in the subsequent interim payment certificate.
vii. For major lapses, 10% of the interim payment certificate will be withheld, subject to a maximum of 0.5% of the contract value.
viii. If the lapse is not rectified within one month after withholding the payment, the amount withheld shall be forfeited.

9. Conclusion and Recommendations

241. Based on the environmental impact assessment, the proposed CPRR alignment at section 2 and 3 do not have any major impact on the environmental and social aspects. The anticipated impacts are common for construction of any highways/ road projects. The modelling study performed for the air quality and noise levels also predicts the same. The proposed CPRR shall have traffic safety measures for safeguarding the road users. Climate risk adaptation measures like providing adequate culverts, bridges and use of anticorrosive materials shall extend the life of the proposed structures and the pavement from flooding or other natural disasters.

242. Being a Greenfield corridor, the presence of the receptors are almost negligible and hence during the project construction and operation significant impacts are not envisaged. However, the given EMP will be implemented by the Contractor for which the EMP has been included in the Bid Document to make it mandatory for implementation. For the loss of land and structures, adequate compensation has been worked out and given in the RAP. The suggested enhancement measures including the compensatory afforestation, deepening of water bodies shall add positive environmental benefits.

243. The Contractor should prepare site specific Construction EMPs based on final design and locations of construction camps, quarries and borrow areas etc. The assessment outcomes shall have limitations, however it shall be managed through appropriate action as given in the following table

EIA Limitation	Actions to be taken	Responsibility
Changes in the proposed alignment	The assessment has to be conducted to capture the major impacts and accordingly the EMP has to be updated	Supervision Consultants and the PIU
Amendment in the rules, regulations and policies	The EIA has to be updated as per the amended rules, regulation and policy and accordingly the assessment has to be revised (including the EMP)	Supervision Consultants and the PIU
Availability of limited secondary information for the project area	During the project implementation, primary information has to be collected and compared with the baseline information and accordingly the monitoring approach has to be revised	Supervision Consultants and the PIU
Meaningful consultations	Consultation with the local/public and the stakeholders should be conducted throughout the construction period to record and to sort the likely issues from the project site	Supervision Consultants and the PIU

Annexure

Annexure – 1

Environmental Clearance for CPRR (Entire Corridor)

THIRU A.UDHAYAN,I.F.S
MEMBER SECRETARY

STATE LEVEL ENVIRONMENT IMPACT
ASSESSMENT AUTHORITY – TAMIL NADU
3rd Floor, Panagal Maaligai,
No.1 Jeenis Road, Saidapet,
Chennai-15.
Phone No.044-24359973
Fax No. 044-24359975

ENVIRONMENTAL CLEARANCE (EC)

Letter No. SEIAA/TN/F. 6474/EC/ 7(f)/ 61 /2018 dated: 10.08.2018.

To,

The Divisional Engineer (Highways),
Highways Department,
Construction and Maintenance,
Chengalpattu – 603 001

Sir,

Sub: SEIAA, TN - Environmental Clearance - Proposed project of forming Chennai Peripheral road connecting Poonjeri junction in Mahabalipuram to Ennore Port (via) Singaperumalkoil – Sriperumbudur – Thiruvallur – Tamaraipakkam – Periyapalayam – Puduvoyal and Kattupalli covering 79 villages of Tiruvallur & Kancheepuram District by M/s. Highways Department, Construction and Maintenance, Chengalpattu, Tamil Nadu – Category "B1" and Schedule S.No. 7(f) Highways - Issued - Regarding.

Ref: 1) Your application dated: 24.11.2017.
2) Letter No.SEIAA-TN/F.No. 6474/SEAC – CII/6(b)/ToR -305/2017 dated: 05.03.2018
3) Proponent EIA Report Submitted on 02.08.2018
4) Minutes of the 118th SEAC meeting held on 03.08.2018
5) Proponent reply dated 09.08.2018
6) Minutes of the 119th SEAC meeting held on 09.08.2018
7) Minutes of the 332th SEIAA meeting held on 10.08.2018.

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This has reference to your application 3rd cited, the proposal is for obtaining Environmental Clearance to establish a construction for forming Chennai Peripheral

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road connecting Poonjeri junction in Mahabalipuram to Ennore Port (via) Singaperumalkoil – Sriperumbudur – Thiruvallur – Tamaraipakkam – Periyapalayam – Puduvoyal and Kattupalli project under Category B1 and Schedule S.No. 7(f) Highways under the Environment Impact Assessment Notification, 2006, as amended.

The Competent Authority and Authorized signatory furnished detailed information in Form 1 and Form 1A and liquidate enclosures are as Annexures:

Annexure 1

		Project Details
1.	Name of the Project:	Proposed project of Forming Chennai Peripheral road connecting Poonjeri junction in Mahabalipuram to Ennore Port (via) Singaperumalkoil – Sriperumbudur – Thiruvallur – Tamaraipakkam – Periyapalayam – Puduvoyal and Kattupalli covering 79 villages of Tiruvallur & Kancheepuram District.
2.	Name of Sector: Schedule No(in the EIA Notification, 2006)	7(f) Highways
	Details of activity	Out of a total length of alignment of 132.871 km, length of the existing alignment is 35.4km and the length of new alignment is 97.47 km. ➢ Section 1: Northern Port Access Road - Ennore Port to Thatchur on NH-5 (24.60Km) ➢ Section 2: Thatchur on NH-5 to Start of Thiruvallur Bypass (26.40Km) ➢ Section 3: Start of Thiruvallur Bypass to Sriperumbudur on NH-4 (30.60Km) ➢ Section 4: Sriperumbudur on NH-4 to Singaperumalkoil on NH-45 (23.80km) ➢ Section 5: Singaperumalkoil on NH-45 to Mahabalipuram (27.471Km)

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Part- A- SPECIFIC CONDITIONS

1. **All mandatory clearances under the applicable law including the Forest Clearance under the Forest (Conservation) Act, 1980 shall be obtained and cutting of roadside trees notified as protected forest.**
2. **The project proponent has to obtain CRZ clearance from State Coastal Zone Management Authority and proponent should fulfill all the conditions imposed in the CRZ clearance. Only then the Environmental Clearance accorded for set project is valid. The proponent should furnish the copy of the CRZ clearance to submit to SEIAA for record.**
3. All naturally and planted trees like Tamarind, Azhinjal, pongam, Banayan should be retained.
4. All the assurance made to SEAC regarding retention, transportation of trees should be strictly adhered, removal of trees should not open thick canopy resulting in ecological alteration of the site.
5. There shall be no trespass within the Reserved Forest and reserve land during preconstruction, construction and operation phase.
6. The development shall strictly be as per the provisions of CRZ Notification 2011 in the CRZ area. The project shall not affect the coastal ecology of the area including flora and fauna.
7. The EMP Cost shall be deposited in a nationalized bank by opening separate account and head wise expense statement shall be furnished to TNPCB with a copy to SEIAA annually.
8. The structures which are subjected to vibration resulting to damage/ removal shall be identified and shall be part of Resettlement & Rehabilitation.
9. There should be no threat to biodiversity, water bodies and Forests due to the road construction activities.
10. No agriculture activities should be disturbed during the construction phase and thereafter, affecting livelihood.
11. EMP monitoring team shall be established with qualified expertise right from the preconstruction to the operation phase.

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12. The construction should not disturb and impact the top soil and should not alter the chemical properties, physiology and Biological features of the soil.
13. The stream ecology of Kosasthalai river, River of Cooum, Buckingham canal, other canal systems and lakes should not be affected due to this project.
14. The construction activities and the usage in no way shall disturb the groundwater regimes and water flow patterns.
15. The water drawl for the construction and operation phase shall be from the water source ensuring adequate yield is available and with the required approval/consent from competent authority.
16. The construction activities in no way shall disturb the village social pattern, cultural systems and lifestyle patterns.
17. The construction activity should not in any way impact the ecology of Mannur forest, Sengundram Forest, Konthamangalam forest.
18. During the project phase, there should not be undue traffic, resulting in congestion and unnecessary diversion of traffic, impacting movement of villagers.
19. Common property resources (CPRs) should not way be disturbed due to the project activities and thereafter.
20. Baseline data of all major water bodies should be studied and tanks should be monitored to ensure the ecological productivity.
21. The construction activity and thereafter operations should not result in changes in the weather pattern, temperature rises and thereby leading to climate changes.
22. Every stage of the activity of the project should be informed to the Department of Forest, TNPCB, Department of Environment, Regional office of MoEF, Chennai and SEIAA – TN.
23. The Traffic movement and construction activity should not result in noise pollution disrupting/disturbing the wildlife and human existence in the area. The vehicles / machineries movement may be staggered wherever required.
24. The road construction in no way should impact the aesthetics of the natural landscape.
25. The green belt shall be developed with indigenous species and maintained for five years as committed.

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26. Wherever possible/required, bridges should be constructed to allow free movement/migration of wildlife.
27. The road should not result in man - wildlife conflicts/ animal kills due to speeding vehicles. Speed limits signage should be displayed in all the vital stretches, particularly in forest stretches and speed tracking devices shall be installed to monitor & ensure the safety speed limits.
28. Wherever possible and feasible, elevated road approach may be provided for free movement of animals, particularly nocturnal animals.
29. Adequate check posts shall be provided for monitoring safe use of the road.
30. Locations for stockyards for construction materials and labor camps shall be away from the CRZ. Movement of machinery, workforce shall be restricted around the water body and no waste from construction camps or sites shall be disposed into it.
31. Cut and fill works shall be carried out strictly in accordance with the design drawings.
32. The coastal stretches shall be protected with suitable protection measures from coastal erosion.
33. The effective barriers shall be provided along the eco-sensitive and vulnerable portions of the highway facing the sea with no habitation, and also to be protected from aesthetic and other forms of destruction.
34. The bridge elevation shall be decided based on highest flood level, analyzing Tsunami and storm surge.
35. Appropriate provisions through pipe/box culvert shall be provided to ensure free flow of tidal water. The size of opening shall be decided on the basis of the site conditions.
36. The proponent shall use the fly ash where ever possible for the proposed project to comply with the Fly Ash Notification, 1999, as amended.
37. The proponent shall have to carry out tree/mangrove plantation in consultation with Tamil Nadu Forest Department. There shall be no dressing or alteration of the sand dunes, natural features including landscape changes for beautification, recreation and other such purpose.

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38. There shall no ground water drawl within the CRZ areas.
39. Rehabilitation of project affected families shall be carried out as per the extant policy of the Central/ State Government, as provided under the law.
40. All entry / exit/ access points on this highway shall be appropriately designed and preferably frozen to avoid traffic congestion and pollution, defeating the very purpose of this expensive project.
41. Rain water harvesting including oil and grease trap shall be provided. Water harvesting structures shall be located at every 500m along the road. Vertical drain type rainwater harvesting structures shall be set up minimize surface runoff losses of rainwater.
42. IRC guidelines shall be followed for widening & up-gradation of road.
43. Green belt development shall be undertaken as suggested in EMP.
44. The seismic nature of the area shall be taken into account while designing the project.
45. The project proponent shall obtain necessary permission from the State Irrigation Department before drawing water from the river sources for the purpose of the proposed construction activity.
46. Longitudinal drains shall be provided all along the project road to ensure proper drainage of the area. In addition, adequate number of under passes and culverts to act as cross drainage structures shall also be provided.
47. The solid waste generated shall be used for rehabilitating the borrow areas.
48. For providing safety to the crossing animals and avoid road accidents speed breakers/rumbled strips shall be constructed at the identified locations of the animal movements. Enough hoardings and signage's shall also be put up for the public and vehicles convenience.
49. Proper signage shall be installed at appropriate locations for the convenience of the traffic movement.
50. The embankments/ slopes and the slopes left after cutting shall be provided with vegetative turning to avoid soil erosion.
51. The hot mix plant/Ready mix plant shall be located at least 500m away from habitation and on the barren land to avoid its adverse impact on the human population. The proponent should obtain consent from TNPCB for the same.

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52. Noise barriers shall be provided at appropriate locations particularly in the areas where the alignment passes through inhabited areas so as to ensure that the noise levels do not exceed the prescribed standards.
53. For road safety, IRC guidelines in respect of road signages, service roads, bus bays, inter-sections, pedestrians crossings, etc. shall be strictly adhered to.
54. The responses/ commitments made to the issues raised during public hearing shall be complied with in letter and spirit. A hard copy of the action taken shall be submitted to the MoEF&CC.
55. A monitoring of the effectiveness of the pollution attenuating barriers shall be taken up after 5 years from the planting of roadside trees. The results, of the monitoring programme shall be conveyed to the concerned forest department/ State Pollution Control Board.
56. Permission from the various statutory authorities such as CRZ, TNPCB, Forest Dept., Dept. of Geology & mines, Petroleum and Explosives Safety Organization (PESO), labour, Agriculture, Archaeology Dept, etc should be obtained as applicable before the commencement of the project operation.
57. Environmental monitoring plan should be implemented scrupulously.
58. Road safety audit needs to be conducted with a view of improvising the safety and environmental aspects for the entire length of the road especially near the habitations.
59. Rehabilitation for the people for the loss of property and displacement needs to be implemented as per the recommendations of the Social Impact Assessment report.
60. Labour laws are to be followed during the construction period for the workmen deployed in the project, especially occupational safety and health aspects.
61. The Reserve Forests contain spontaneously grown trees of varying heights. Hence, necessary clearances shall be obtained from Central Empowered Committee before felling the spontaneously grown trees in the forest.
62. For the purpose of construction of proposed peripheral road, the road construction materials should be obtained only from the existing quarries with required environmental clearances.

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SEIAA-TN

63. It is understood from the report that 450 structures are identified and likely to be affected with more than 1/3rd or fully affected during the census survey. It is also identified 73 CPRs (Church, temples, Government School, Government Building and a Police booth) are affected in the road stretch. The High ways department should have a re-look at their proposals and make efforts to eliminate or minimize adverse impact on such structures.
64. In sections 1 & 2 of the proposed road connecting Ennore port and Thiruvallur, the provision of service road at the junctions is not considered near the existing village roads connecting the proposed highway. Provision for service roads needs to be provided in other areas also including in the said section.
65. Solar lamps along the length of the proposed road shall be provided for the safety of the people.
66. The proponent should implement all Environment Management Measures listed in the EIA report.
67. The Project activity should not affect any water bodies such as streams, canals, lakes, ponds etc.
68. Ecological sensitive habitats like mangroves, protected and endangered species (Flora and Fauna) should not be affected.
69. The funds under the Corporate Environment Responsibility (CER), which works out to Rs. 28.82 Crores (0.25% of the Project cost – 11528 Crores) shall be utilized to address the concerns of the people as expressed during the public hearings. The amount should be deposited with District Collectors of Thiruvallur (Rs. 18.82 Crores) & Kanchipuram (Rs. 10 Crores) to meet the above requirements
70. The EMP Cost shall be deposited in a nationalized bank by opening separate account and head wise expense statement shall be furnished to TNPCB with a copy to SEIAA annually.
71. Appropriate measures must be taken while undertaking digging activities to avoid any likely degradation of water quality.
72. Adequate precautions shall be taken during transportation of the construction material so that it does not affect the environment adversely.

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SEIAA-TN

Annexure – 2

Environmental Quality Monitoring Report

Ambient Air Quality

Alinjivakkam

Report No	: PCEI/TR-AAQ-130	**Report Date**	: 18.01.2020
ULR No	: ULR-TC7446200000128P		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 5182 (Part 23) 2006 (RA 2017)		
Sampled by	: Laboratory		
Sample Collected Date	: 09.01.2020	**Sample Reference No**	: PCEI/AAQ-N130-01-20
Sample Description	: **Ambient Air Quality**	**Sample Received On**	: 10.01.2020
Qty of Sample Received	: Filter Paper & 30ml	**Test Commenced On**	: 10.01.2020
Sample Condition	: Fit for Analysis	**Test Completed On**	: 17.01.2020
Sampling Location	: **Alinjivakkam**		

Weather Condition			
Ambient Temperature	: 31°C	Relative Humidity	: 59%
Predominent Wind Direction	: Passing Clouds	Climate Condition	: SW-NE
Latitude	: 13°16'40.17"N		
Longitude	: 80°8'58.74"E		

S.No	Parameters	Units	Test Method	Results	CPCB Max. Permissible Limits of NAAQ Standards for Industrial Area (TWA for 24 Hrs)
1	Respirable Particulate Matter (PM_{10})	$\mu g/m^3$	IS 5182 (Part 23) 2006 (RA 2017)	69.7	100
2	Respirable Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	NAAQMS/36/2012-13 (Volume 1)	35.3	60
3	Sulphur dioxide (as SO_2)	$\mu g/m^3$	IS 5182 (Part 2) 2001 (RA 2017)	25.6	80
4	Oxides of Nitrogen (as NO_x)	$\mu g/m^3$	IS 5182 (Part 6) 2006 (RA 2017)	30.2	80
5	Carbon Monoxide (as CO)	mg/m^3	IS 5182 (Part 10) 1999 (RA 2014)	BDL(DL:1.2)	4*

Note: i) NAAQS - National Ambient Air Quality Standards Issued by CPCB (Central Pollution Control Board) in Nov 2009
ii) TWA - Time Weighted Average iii) *- TWA for 1 Hour
BDL - Below Detection Limit ; DL - Detection Limit

..... **End of Report** .....
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Verified By

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Athipedu

Report No	: PCEI/TR-AAQ-131	**Report Date**	: 18.01.2020
ULR No	: ULR-TC744620000129P		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 5182 (Part 23) 2006 (RA 2017)		
Sampled by	: Laboratory		
Sample Collected Date	: 09.01.2020	**Sample Reference No**	: PCEI/AAQ-N131-01-20
Sample Description	: **Ambient Air Quality**	**Sample Received On**	: 10.01.2020
Qty of Sample Received	: Filter Paper & 30ml	**Test Commenced On**	: 10.01.2020
Sample Condition	: Fit for Analysis	**Test Completed On**	: 17.01.2020
Sampling Location	: **Athipedu**		

Weather Condition			
Ambient Temperature	: 30°C	Relative Humidity	: 61%
Predominent Wind Direction	: Passing Clouds	Climate Condition	: SW-NE
Latitude	: 13.27606 N 13°16'33.8334"		
Longitude	: 80.15074 E 80°9'2.6715"		

S.No	Parameters	Units	Test Method	Results	CPCB Max. Permissible Limits of NAAQ Standards for Industrial Area (TWA for 24 Hrs)
1	Respirable Particulate Matter (PM_{10})	$\mu g/m^3$	IS 5182 (Part 23) 2006 (RA 2017)	74.6	100
2	Respirable Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	NAAQMS/36/2012-13 (Volume 1)	32.9	60
3	Sulphur dioxide (as SO_2)	$\mu g/m^3$	IS 5182 (Part 2) 2001 (RA 2017)	21.7	80
4	Oxides of Nitrogen (as NO_x)	$\mu g/m^3$	IS 5182 (Part 6) 2006 (RA 2017)	25.3	80
5	Carbon Monoxide (as CO)	mg/m^3	IS 5182 (Part 10) 1999 (RA 2014)	BDL(DL:1.2)	4*

Note: i) NAAQS - National Ambient Air Quality Standards Issued by CPCB (Central Pollution Control Board) in Nov 2009
ii) TWA - Time Weighted Average iii) *- TWA for 1 Hour
BDL - Below Detection Limit ; DL - Detection Limit

..... **End of Report** .....
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Verified By

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

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Jayapuram

Report No	: PCEI/TR-AAQ-132	**Report Date**	: 18.01.2020
ULR No	: ULR-TC7446200000130P		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 5182 (Part 23) 2006 (RA 2017)		
Sampled by	: Laboratory		
Sample Collected Date	: 09.01.2020	**Sample Reference No**	: PCEI/AAQ-N132-01-20
Sample Description	: **Ambient Air Quality**	**Sample Received On**	: 10.01.2020
Qty of Sample Received	: Filter Paper & 30ml	**Test Commenced On**	: 10.01.2020
Sample Condition	: Fit for Analysis	**Test Completed On**	: 17.01.2020
Sampling Location	: **Jayapuram**		

Weather Condition			
Ambient Temperature	: 31°C	Relative Humidity	: 63%
Predominent Wind Direction	: Passing Clouds	Climate Condition	: SW-NE
Latitude	: 13°17'2.82"N		
Longitude	: 80°4'21.82"E		

S.No	Parameters	Units	Test Method	Results	CPCB Max. Permissible Limits of NAAQ Standards for Industrial Area (TWA for 24 Hrs)
1	Respirable Particulate Matter (PM_{10})	µg/m³	IS 5182 (Part 23) 2006 (RA 2017)	68.3	100
2	Respirable Particulate Matter ($PM_{2.5}$)	µg/m³	NAAQMS/36/2012-13 (Volume 1)	36.1	60
3	Sulphur dioxide (as SO_2)	µg/m³	IS 5182 (Part 2) 2001 (RA 2017)	24.3	80
4	Oxides of Nitrogen (as NO_x)	µg/m³	IS 5182 (Part 6) 2006 (RA 2017)	30.9	80
5	Carbon Monoxide (as CO)	mg/m³	IS 5182 (Part 10) 1999 (RA 2014)	BDL(DL:1.2)	4*

Note: i) NAAQS - National Ambient Air Quality Standards Issued by CPCB (Central Pollution Control Board) in Nov 2009
ii) TWA - Time Weighted Average iii) *- TWA for 1 Hour
BDL - Below Detection Limit ; DL - Detection Limit

..... **End of Report** .....
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Verified By

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Thamaraipakkam (Thiruvallur Road), Ammanambakkam

Report No	: PCEI/TR-AAQ-133	**Report Date**	: 18.01.2020
ULR No	: ULR-TC7446200000131P		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 5182 (Part 23) 2006 (RA 2017)		
Sampled by	: Laboratory		
Sample Collected Date	: 09.01.2020	**Sample Reference No**	: PCEI/AAQ-N133-01-20
Sample Description	: **Ambient Air Quality**	**Sample Received On**	: 10.01.2020
Qty of Sample Received	: Filter Paper & 30ml	**Test Commenced On**	: 10.01.2020
Sample Condition	: Fit for Analysis	**Test Completed On**	: 17.01.2020
Sampling Location	: **Thamaraipakkam (Thiruvallur Road), Ammanambakkam**		

Weather Condition			
Ambient Temperature	: 31°C	Relative Humidity	: 60%
Predominent Wind Direction	: Passing Clouds	Climate Condition	: SW-NE
Latitude	: 13.22104 N 13°13'15.75602"		
Longitude	: 80.02827 E 80°1'41.75627"		

S.No	Parameters	Units	Test Method	Results	CPCB Max. Permissible Limits of NAAQ Standards for Industrial Area (TWA for 24 Hrs)
1	Respirable Particulate Matter (PM_{10})	$\mu g/m^3$	IS 5182 (Part 23) 2006 (RA 2017)	61.7	100
2	Respirable Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	NAAQMS/36/2012-13 (Volume 1)	32.1	60
3	Sulphur dioxide (as SO_2)	$\mu g/m^3$	IS 5182 (Part 2) 2001 (RA 2017)	20.5	80
4	Oxides of Nitrogen (as NO_x)	$\mu g/m^3$	IS 5182 (Part 6) 2006 (RA 2017)	24.2	80
5	Carbon Monoxide (as CO)	mg/m^3	IS 5182 (Part 10) 1999 (RA 2014)	BDL(DL:1.2)	4*

Note: i) NAAQS - National Ambient Air Quality Standards Issued by CPCB (Central Pollution Control Board) in Nov 2009
ii) TWA - Time Weighted Average iii) *- TWA for 1 Hour
BDL - Below Detection Limit ; DL - Detection Limit

..... **End of Report** .....
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Verified By

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Keelanur

Report No	: PCEI/TR-AAQ-134	**Report Date**	: 18.01.2020
ULR No	: ULR-TC7446200000132P		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 5182 (Part 23) 2006 (RA 2017)		
Sampled by	: Laboratory		
Sample Collected Date	: 09.01.2020	**Sample Reference No**	: PCEI/AAQ-N134-01-20
Sample Description	: **Ambient Air Quality**	**Sample Received On**	: 10.01.2020
Qty of Sample Received	: Filter Paper & 30ml	**Test Commenced On**	: 10.01.2020
Sample Condition	: Fit for Analysis	**Test Completed On**	: 17.01.2020
Sampling Location	: **Keelanur**		

Weather Condition			
Ambient Temperature	: 31°C	Relative Humidity	: 60%
Predominent Wind Direction	: Passing Clouds	Climate Condition	: SW-NE
Latitude	: 13.19837 N 13°11'54.12037"		
Longitude	: 79.9627 E 79°57'45.72738"		

S.No	Parameters	Units	Test Method	Results	CPCB Max. Permissible Limits of NAAQ Standards for Industrial Area (TWA for 24 Hrs)
1	Respirable Particulate Matter (PM_{10})	$\mu g/m^3$	IS 5182 (Part 23) 2006 (RA 2017)	64.9	100
2	Respirable Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	NAAQMS/36/2012-13 (Volume 1)	30.9	60
3	Sulphur dioxide (as SO_2)	$\mu g/m^3$	IS 5182 (Part 2) 2001 (RA 2017)	22.6	80
4	Oxides of Nitrogen (as NO_x)	$\mu g/m^3$	IS 5182 (Part 6) 2006 (RA 2017)	27.3	80
5	Carbon Monoxide (as CO)	mg/m^3	IS 5182 (Part 10) 1999 (RA 2014)	BDL(DL:1.2)	4*

Note: i) NAAQS - National Ambient Air Quality Standards Issued by CPCB (Central Pollution Control Board) in Nov 2009
ii) TWA - Time Weighted Average iii) *- TWA for 1 Hour
BDL - Below Detection Limit ; DL - Detection Limit

..... **End of Report** .....
Page 1 of 1

Verified By

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Ramapuram

Report No	: PCEI/TR-AAQ-135	**Report Date**	: 18.01.2020
ULR No	: ULR-TC7446200000133P		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 5182 (Part 23) 2006 (RA 2017)		
Sampled by	: Laboratory		
Sample Collected Date	: 09.01.2020	**Sample Reference No**	: PCEI/AAQ-N135-01-20
Sample Description	: **Ambient Air Quality**	**Sample Received On**	: 10.01.2020
Qty of Sample Received	: Filter Paper & 30ml	**Test Commenced On**	: 10.01.2020
Sample Condition	: Fit for Analysis	**Test Completed On**	: 17.01.2020
Sampling Location	: **Ramapuram**		

Weather Condition			
Ambient Temperature	: 30°C	Relative Humidity	: 56%
Predominent Wind Direction	: Passing Clouds	Climate Condition	: SW-NE
Latitude	: 13°8'0.42"N		
Longitude	: 79°56'42.31"E		

S.No	Parameters	Units	Test Method	Results	CPCB Max. Permissible Limits of NAAQ Standards for Industrial Area (TWA for 24 Hrs)
1	Respirable Particulate Matter (PM_{10})	$\mu g/m^3$	IS 5182 (Part 23) 2006 (RA 2017)	74.9	100
2	Respirable Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	NAAQMS/36/2012-13 (Volume 1)	34.1	60
3	Sulphur dioxide (as SO_2)	$\mu g/m^3$	IS 5182 (Part 2) 2001 (RA 2017)	28.3	80
4	Oxides of Nitrogen (as NO_x)	$\mu g/m^3$	IS 5182 (Part 6) 2006 (RA 2017)	32.5	80
5	Carbon Monoxide (as CO)	mg/m^3	IS 5182 (Part 10) 1999 (RA 2014)	BDL(DL:1.2)	4*

Note: i) NAAQS - National Ambient Air Quality Standards Issued by CPCB (Central Pollution Control Board) in Nov 2009
ii) TWA - Time Weighted Average iii) *- TWA for 1 Hour
BDL - Below Detection Limit ; DL - Detection Limit

..... **End of Report** .....
Page 1 of 1

Verified By

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Putlur, Kakkalur-Putlur Road, Teachers Colony

Report No	: PCEI/TR-AAQ-136	**Report Date**	: 18.01.2020
ULR No	: ULR-TC7446200000134P		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 5182 (Part 23) 2006 (RA 2017)		
Sampled by	: Laboratory		
Sample Collected Date	: 09.01.2020	**Sample Reference No**	: PCEI/AAQ-N136-01-20
Sample Description	: **Ambient Air Quality**	**Sample Received On**	: 10.01.2020
Qty of Sample Received	: Filter Paper & 30ml	**Test Commenced On**	: 10.01.2020
Sample Condition	: Fit for Analysis	**Test Completed On**	: 17.01.2020
Sampling Location	: **Putlur, Kakkalur-Putlur Road, Teachers Colony**		

Weather Condition			
Ambient Temperature	: 32°C	Relative Humidity	: 63%
Predominent Wind Direction	: Scattered Clouds	Climate Condition	: NE
Latitude	: 13.12474 N 13°7'29.04818"		
Longitude	: 79.93765 E 79°56'15.55134"		

S.No	Parameters	Units	Test Method	Results	CPCB Max. Permissible Limits of NAAQ Standards for Industrial Area (TWA for 24 Hrs)
1	Respirable Particulate Matter (PM_{10})	$\mu g/m^3$	IS 5182 (Part 23) 2006 (RA 2017)	70.5	100
2	Respirable Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	NAAQMS/36/2012-13 (Volume 1)	33.6	60
3	Sulphur dioxide (as SO_2)	$\mu g/m^3$	IS 5182 (Part 2) 2001 (RA 2017)	23.1	80
4	Oxides of Nitrogen (as NO_x)	$\mu g/m^3$	IS 5182 (Part 6) 2006 (RA 2017)	27.4	80
5	Carbon Monoxide (as CO)	mg/m^3	IS 5182 (Part 10) 1999 (RA 2014)	BDL(DL:1.2)	4*

Note: i) NAAQS - National Ambient Air Quality Standards Issued by CPCB (Central Pollution Control Board) in Nov 2009
ii) TWA - Time Weighted Average iii) *- TWA for 1 Hour
BDL - Below Detection Limit ; DL - Detection Limit

..... **End of Report** .....
Page 1 of 1

Verified By

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

SH 57, Polivakkam

Report No	: PCEI/TR-AAQ-137	**Report Date**	: 18.01.2020
ULR No	: ULR-TC7446200000135P		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 5182 (Part 23) 2006 (RA 2017)		
Sampled by	: Laboratory		
Sample Collected Date	: 09.01.2020	**Sample Reference No**	: PCEI/AAQ-N137-01-20
Sample Description	: **Ambient Air Quality**	**Sample Received On**	: 10.01.2020
Qty of Sample Received	: Filter Paper & 30ml	**Test Commenced On**	: 10.01.2020
Sample Condition	: Fit for Analysis	**Test Completed On**	: 17.01.2020
Sampling Location	: **SH 57, Polivakkam**		

Weather Condition			
Ambient Temperature	: 30°C	Relative Humidity	: 60%
Predominent Wind Direction	: Broken Clouds	Climate Condition	: EW
Latitude	: 13.0699 N 13°4'11.64717"		
Longitude	: 79.91044 E 79°54'37.57843"		

S.No	Parameters	Units	Test Method	Results	CPCB Max. Permissible Limits of NAAQ Standards for Industrial Area (TWA for 24 Hrs)
1	Respirable Particulate Matter (PM_{10})	$\mu g/m^3$	IS 5182 (Part 23) 2006 (RA 2017)	65.4	100
2	Respirable Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	NAAQMS/36/2012-13 (Volume 1)	29.1	60
3	Sulphur dioxide (as SO_2)	$\mu g/m^3$	IS 5182 (Part 2) 2001 (RA 2017)	13.8	80
4	Oxides of Nitrogen (as NO_x)	$\mu g/m^3$	IS 5182 (Part 6) 2006 (RA 2017)	19.6	80
5	Carbon Monoxide (as CO)	mg/m^3	IS 5182 (Part 10) 1999 (RA 2014)	BDL(DL:1.2)	4*

Note: i) NAAQS - National Ambient Air Quality Standards Issued by CPCB (Central Pollution Control Board) in Nov 2009
ii) TWA - Time Weighted Average iii) *- TWA for 1 Hour
BDL - Below Detection Limit ; DL - Detection Limit

..... **End of Report** .....
Page 1 of 1

Verified By

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Pethnapalli

Report No	: PCEI/TR-AAQ-138	**Report Date**	: 18.01.2020
ULR No	: ULR-TC7446200000136P		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 5182 (Part 23) 2006 (RA 2017)		
Sampled by	: Laboratory		
Sample Collected Date	: 09.01.2020	**Sample Reference No**	: PCEI/AAQ-N138-01-20
Sample Description	: **Ambient Air Quality**	**Sample Received On**	: 10.01.2020
Qty of Sample Received	: Filter Paper & 30ml	**Test Commenced On**	: 10.01.2020
Sample Condition	: Fit for Analysis	**Test Completed On**	: 17.01.2020
Sampling Location	: **Pethnapalli**		

Weather Condition			
Ambient Temperature	: 30°C	Relative Humidity	: 65%
Predominent Wind Direction	: Scattered Clouds	Climate Condition	: NW-SE
Latitude	: 13°5'28.17"N		
Longitude	: 79°56'10.11"E		

S.No	Parameters	Units	Test Method	Results	CPCB Max. Permissible Limits of NAAQ Standards for Industrial Area (TWA for 24 Hrs)
1	Respirable Particulate Matter (PM_{10})	$\mu g/m^3$	IS 5182 (Part 23) 2006 (RA 2017)	74.7	100
2	Respirable Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	NAAQMS/36/2012-13 (Volume 1)	32.9	60
3	Sulphur dioxide (as SO_2)	$\mu g/m^3$	IS 5182 (Part 2) 2001 (RA 2017)	18.3	80
4	Oxides of Nitrogen (as NO_x)	$\mu g/m^3$	IS 5182 (Part 6) 2006 (RA 2017)	22.5	80
5	Carbon Monoxide (as CO)	mg/m^3	IS 5182 (Part 10) 1999 (RA 2014)	BDL(DL:1.2)	4*

Note: i) NAAQS - National Ambient Air Quality Standards Issued by CPCB (Central Pollution Control Board) in Nov 2009
ii) TWA - Time Weighted Average iii) *- TWA for 1 Hour
BDL - Below Detection Limit ; DL - Detection Limit

..... **End of Report** .....
Page 1 of 1

Verified By

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Sriperumbudur

Report No	: PCEI/TR-AAQ-139	**Report Date**	: 18.01.2020
ULR No	: ULR-TC7446200000137P		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 5182 (Part 23) 2006 (RA 2017)		
Sampled by	: Laboratory		
Sample Collected Date	: 09.01.2020	**Sample Reference No**	: PCEI/AAQ-N139-01-20
Sample Description	: **Ambient Air Quality**	**Sample Received On**	: 10.01.2020
Qty of Sample Received	: Filter Paper & 30ml	**Test Commenced On**	: 10.01.2020
Sample Condition	: Fit for Analysis	**Test Completed On**	: 17.01.2020
Sampling Location	: **Sriperumbudur**		

Weather Condition			
Ambient Temperature	: 31°C	Relative Humidity	: 65%
Predominent Wind Direction	: Scattered Clouds	Climate Condition	: NW-SE
Latitude	: 12.9683 N 12°58'5.88075"		
Longitude	: 79.94319 E 79°56'35.49903"		

S.No	Parameters	Units	Test Method	Results	CPCB Max. Permissible Limits of NAAQ Standards for Industrial Area (TWA for 24 Hrs)
1	Respirable Particulate Matter (PM_{10})	$\mu g/m^3$	IS 5182 (Part 23) 2006 (RA 2017)	71.4	100
2	Respirable Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	NAAQMS/36/2012-13 (Volume 1)	30.2	60
3	Sulphur dioxide (as SO_2)	$\mu g/m^3$	IS 5182 (Part 2) 2001 (RA 2017)	22.6	80
4	Oxides of Nitrogen (as NO_x)	$\mu g/m^3$	IS 5182 (Part 6) 2006 (RA 2017)	28.1	80
5	Carbon Monoxide (as CO)	mg/m^3	IS 5182 (Part 10) 1999 (RA 2014)	BDL(DL:1.2)	4*

Note: i) NAAQS - National Ambient Air Quality Standards Issued by CPCB (Central Pollution Control Board) in Nov 2009
ii) TWA - Time Weighted Average iii) *- TWA for 1 Hour
BDL - Below Detection Limit ; DL - Detection Limit

..... **End of Report** .....
Page 1 of 1

Verified By

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Ambient Noise Quality

Alinjivakkam

Report No	: PCEI/TR-N-140	**Report Date**	: 13.01.2020
ULR No.	: ULR-TC74461900000138F		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 9989 – 1981 (RA 2008)		
Sampled by	: Laboratory		
Sample Collected Date	: 09.01.2020		
Sample Description	: **Noise Monitoring**	**Sample Reference No**	: PCEI/N-N140-01-20
Category of Area	: **Commercial Area**	**Sample Received On**	: 10.01.2020
Latitude	: 13°16'40.17"N	**Test Commenced On**	: 10.01.2020
Longitude	: 80°8'58.74"E	**Test Completed On**	: 10.01.2020
Sampling Location	: **Alinjivakkam**		

Time	Day Time	Night Time
	Readings dB(A)	Readings dB(A)
06:00 - 07:00	53.6	
07:00 - 08:00	54.1	
08:00 - 09:00	56.9	
09:00 - 10:00	57.4	
10:00 - 11:00	57.3	
11:00 - 12:00	52.1	
12:00 - 13:00	56.9	
13:00 - 14:00	54.7	
14:00 - 15:00	55.1	
15:00 - 16:00	52.9	
16:00 - 17:00	51.5	
17:00 - 18:00	50.8	
18:00 - 19:00	51.3	
19:00 - 20:00	55.7	
20:00 - 21:00	56.1	
21:00 - 22:00	51.4	
22:00 - 23:00		49.7
23:00 - 00:00		48.3
00:00 - 01:00		48.5
01:00 - 02:00		43.1
02:00 - 03:00		42.6
03:00 - 04:00		41.5
04:00 - 05:00		40.7
05:00 - 06:00		48.3
Daytime	**Min**	**50.8**
	Max	**57.4**
	Leq	**54.8**
	Day Limit	**65 dB(A)**
Night Time	**Min**	**40.7**
	Max	**49.7**
	Leq	**46.6**
	Night Limit	**55 dB(A)**

Ambient Air Quality Standards in respect of Noise in Industrial Area Daytime 65 dB(A) & Night Time 55 dB(A)

*** End of Report ***

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Verified By

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Athipedu

Report No	: PCEI/TR-N-141	**Report Date**	: 13.01.2020
ULR No.	: ULR-TC74461900000139F		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 9989 – 1981 (RA 2008)		
Sampled by	: Laboratory		
Sample Collected Date	: 09.01.2020		
Sample Description	: **Noise Monitoring**	**Sample Reference No**	: PCEI/N-N141-01-20
Category of Area	: **Commercial Area**	**Sample Received On**	: 10.01.2020
Latitude	: 13.27606 N 13°16'33.8334"	**Test Commenced On**	: 10.01.2020
Longitude	: 80.15074 E 80°9'2.6715"	**Test Completed On**	: 10.01.2020
Sampling Location	: **Athipedu**		

Time	Day Time	Night Time
	Readings dB(A)	Readings dB(A)
06:00 - 07:00	46.5	
07:00 - 08:00	48.2	
08:00 - 09:00	50.3	
09:00 - 10:00	53.1	
10:00 - 11:00	52.8	
11:00 - 12:00	52.6	
12:00 - 13:00	51.3	
13:00 - 14:00	51.8	
14:00 - 15:00	49.3	
15:00 - 16:00	48.5	
16:00 - 17:00	48.1	
17:00 - 18:00	47.6	
18:00 - 19:00	46.2	
19:00 - 20:00	45.5	
20:00 - 21:00	44.8	
21:00 - 22:00	45.2	
22:00 - 23:00		39.8
23:00 - 00:00		38.2
00:00 - 01:00		37.1
01:00 - 02:00		38.2
02:00 - 03:00		38.4
03:00 - 04:00		35.7
04:00 - 05:00		34.9
05:00 - 06:00		31.5
Daytime	**Min**	**44.8**
	Max	**53.1**
	Leq	**49.7**
	Day Limit	**65 dB(A)**
Night Time	**Min**	**34.9**
	Max	**39.8**
	Leq	**37.3**
	Night Limit	**55 dB(A)**

Ambient Air Quality Standards in respect of Noise in Industrial Area Daytime 65 dB(A) & Night Time 55 dB(A)

*** End of Report ***

Verified By

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Jayapuram

Report No	: PCEI/TR-N-142	**Report Date**	: 13.01.2020
ULR No.	: ULR-TC74461900000140F		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 9989 – 1981 (RA 2008)		
Sampled by	: Laboratory		
Sample Collected Date	: 09.01.2020		
Sample Description	: **Noise Monitoring**	**Sample Reference No**	: PCEI/N-N142-01-20
Category of Area	: **Commercial Area**	**Sample Received On**	: 10.01.2020
Latitude	: 13°17'2.82"N	**Test Commenced On**	: 10.01.2020
Longitude	: 80°4'21.82"E	**Test Completed On**	: 10.01.2020
Sampling Location	: **Jayapuram**		

Time	Day Time	Night Time
	Readings dB(A)	Readings dB(A)
06:00 - 07:00	46.8	
07:00 - 08:00	48.2	
08:00 - 09:00	55.1	
09:00 - 10:00	58.4	
10:00 - 11:00	59.8	
11:00 - 12:00	52.3	
12:00 - 13:00	50.8	
13:00 - 14:00	57.6	
14:00 - 15:00	53.9	
15:00 - 16:00	50.0	
16:00 - 17:00	57.8	
17:00 - 18:00	59.1	
18:00 - 19:00	47.6	
19:00 - 20:00	46.8	
20:00 - 21:00	45.8	
21:00 - 22:00	44.3	
22:00 - 23:00		38.3
23:00 - 00:00		37.2
00:00 - 01:00		37.5
01:00 - 02:00		36.5
02:00 - 03:00		35.1
03:00 - 04:00		34.4
04:00 - 05:00		33.5
05:00 - 06:00		35.2
Daytime	**Min**	**44.3**
	Max	**59.8**
	Leq	**54.8**
	Day Limit	**65 dB(A)**
Night Time	**Min**	**33.5**
	Max	**38.3**
	Leq	**36.2**
	Night Limit	**55 dB(A)**

Ambient Air Quality Standards in respect of Noise in Industrial Area Daytime 65 dB(A) & Night Time 55 dB(A)

*** End of Report ***

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Verified By

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Thamaraipakkam (Thiruvallur Road), Ammanambakkam

Report No	: PCEI/TR-N-143	**Report Date**	: 13.01.2020
ULR No.	: ULR-TC74461900000141F		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 9989 – 1981 (RA 2008)		
Sampled by	: Laboratory		
Sample Collected Date	: 09.01.2020		
Sample Description	: **Noise Monitoring**	**Sample Reference No**	: PCEI/N-N143-01-20
Category of Area	: **Commercial Area**	**Sample Received On**	: 10.01.2020
Latitude	: 13.22104 N 13°13'15.75602"	**Test Commenced On**	: 10.01.2020
Longitude	: 80.02827 E 80°1'41.75627"	**Test Completed On**	: 10.01.2020
Sampling Location	: **Thamaraipakkam (Thiruvallur Road), Ammanambakkam**		

Time	Day Time	Night Time
	Readings dB(A)	Readings dB(A)
06:00 - 07:00	40.3	
07:00 - 08:00	43.6	
08:00 - 09:00	49.8	
09:00 - 10:00	54.1	
10:00 - 11:00	58.6	
11:00 - 12:00	49.3	
12:00 - 13:00	41.4	
13:00 - 14:00	53.7	
14:00 - 15:00	56.5	
15:00 - 16:00	51.9	
16:00 - 17:00	58.7	
17:00 - 18:00	60.3	
18:00 - 19:00	53.1	
19:00 - 20:00	50.8	
20:00 - 21:00	49.6	
21:00 - 22:00	44.3	
22:00 - 23:00		37.8
23:00 - 00:00		35.2
00:00 - 01:00		34.2
01:00 - 02:00		33.8
02:00 - 03:00		33.1
03:00 - 04:00		32.1
04:00 - 05:00		33.4
05:00 - 06:00		34.6
Daytime	**Min**	**40.3**
	Max	**60.3**
	Leq	**54.3**
	Day Limit	**65 dB(A)**
Night Time	**Min**	**32.1**
	Max	**37.8**
	Leq	**34.6**
	Night Limit	**55 dB(A)**

Ambient Air Quality Standards in respect of Noise in Industrial Area Daytime 65 dB(A) & Night Time 55 dB(A)

*** End of Report ***

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Verified By

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Keelanur

Report No	: PCEI/TR-N-144	**Report Date**	: 13.01.2020
ULR No.	: ULR-TC74461900000142F		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 9989 – 1981 (RA 2008)		
Sampled by	: Laboratory		
Sample Collected Date	: 09.01.2020		
Sample Description	: **Noise Monitoring**	**Sample Reference No**	: PCEI/N-N144-01-20
Category of Area	: **Residential Area**	**Sample Received On**	: 10.01.2020
Latitude	: 13.19837 N 13°11'54.12037"	**Test Commenced On**	: 10.01.2020
Longitude	: 79.9627 E 79°57'45.72738"	**Test Completed On**	: 10.01.2020
Sampling Location	: **Keelanur**		

Time	Day Time	Night Time
	Readings dB(A)	Readings dB(A)
06:00 - 07:00	46.5	
07:00 - 08:00	47.9	
08:00 - 09:00	48.5	
09:00 - 10:00	50.6	
10:00 - 11:00	49.8	
11:00 - 12:00	51.7	
12:00 - 13:00	53.4	
13:00 - 14:00	50.8	
14:00 - 15:00	53.4	
15:00 - 16:00	50.8	
16:00 - 17:00	53.1	
17:00 - 18:00	50.0	
18:00 - 19:00	51.8	
19:00 - 20:00	49.8	
20:00 - 21:00	47.5	
21:00 - 22:00	46.2	
22:00 - 23:00		43.8
23:00 - 00:00		42.3
00:00 - 01:00		43.2
01:00 - 02:00		42.1
02:00 - 03:00		40.2
03:00 - 04:00		38.6
04:00 - 05:00		37.5
05:00 - 06:00		40.3
Daytime	Min	46.2
	Max	53.4
	Leq	50.7
	Day Limit	55 dB(A)
Night Time	Min	37.5
	Max	43.8
	Leq	41.5
	Night Limit	45 dB(A)

Ambient Air Quality Standards in respect of Noise in Residential Area Daytime 55 dB(A) & Night Time 45 dB(A)

*** End of Report ***

Page 1 of 1

Verified By

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Ramapuram

Report No	: PCEI/TR-N-145	**Report Date**	: 13.01.2020
ULR No.	: ULR-TC74461900000143F		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 9989 – 1981 (RA 2008)		
Sampled by	: Laboratory		
Sample Collected Date	: 09.01.2020		
Sample Description	: **Noise Monitoring**	**Sample Reference No**	: PCEI/N-N145-01-20
Category of Area	: **Commercial Area**	**Sample Received On**	: 10.01.2020
Latitude	: 13°8'0.42"N	**Test Commenced On**	: 10.01.2020
Longitude	: 79°56'42.31"E	**Test Completed On**	: 10.01.2020
Sampling Location	: **Ramapuram**		

Time	Day Time	Night Time
	Readings dB(A)	Readings dB(A)
06:00 - 07:00	56.9	
07:00 - 08:00	58.6	
08:00 - 09:00	57.1	
09:00 - 10:00	61.8	
10:00 - 11:00	63.4	
11:00 - 12:00	59.8	
12:00 - 13:00	56.1	
13:00 - 14:00	60.4	
14:00 - 15:00	64.2	
15:00 - 16:00	61.8	
16:00 - 17:00	57.9	
17:00 - 18:00	56.4	
18:00 - 19:00	55.1	
19:00 - 20:00	48.5	
20:00 - 21:00	44.3	
21:00 - 22:00	45.9	
22:00 - 23:00		44.7
23:00 - 00:00		43.2
00:00 - 01:00		42.3
01:00 - 02:00		41.6
02:00 - 03:00		38.3
03:00 - 04:00		39.4
04:00 - 05:00		36.7
05:00 - 06:00		40.8
Daytime	Min	44.3
	Max	64.2
	Leq	59.3
	Day Limit	65 dB(A)
Night Time	Min	36.7
	Max	44.7
	Leq	41.5
	Night Limit	55 dB(A)

Ambient Air Quality Standards in respect of Noise in Industrial Area Daytime 65 dB(A) & Night Time 55 dB(A)

*** End of Report ***

Page 1 of 1

Verified By

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Putlur, Kakkalur-Putlur Road, Teachers Colony

Report No	: PCEI/TR-N-146	**Report Date**	: 13.01.2020
ULR No.	: ULR-TC74461900000144F		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 9989 – 1981 (RA 2008)		
Sampled by	: Laboratory		
Sample Collected Date	: 09.01.2020		
Sample Description	: **Noise Monitoring**	**Sample Reference No**	: PCEI/N-N146-01-20
Category of Area	: **Commercial Area**	**Sample Received On**	: 10.01.2020
Latitude	: 13.12474 N 13°7'29.04818"	**Test Commenced On**	: 10.01.2020
Longitude	: 79.93765 E 79°56'15.55134"	**Test Completed On**	: 10.01.2020
Sampling Location	: **Putlur, Kakkalur-Putlur Road, Teachers Colony**		

Time	Day Time	Night Time
	Readings dB(A)	Readings dB(A)
06:00 - 07:00	42.1	
07:00 - 08:00	45.9	
08:00 - 09:00	59.6	
09:00 - 10:00	55.2	
10:00 - 11:00	55.6	
11:00 - 12:00	56.3	
12:00 - 13:00	54.8	
13:00 - 14:00	52.6	
14:00 - 15:00	57.1	
15:00 - 16:00	56.8	
16:00 - 17:00	55.4	
17:00 - 18:00	51.7	
18:00 - 19:00	43.5	
19:00 - 20:00	42.8	
20:00 - 21:00	41.9	
21:00 - 22:00	39.3	
22:00 - 23:00		39.5
23:00 - 00:00		34.9
00:00 - 01:00		32.1
01:00 - 02:00		32.4
02:00 - 03:00		35.2
03:00 - 04:00		34.8
04:00 - 05:00		34.5
05:00 - 06:00		33.8
Daytime	Min	39.3
	Max	59.6
	Leq	54.1
	Day Limit	65 dB(A)
Night Time	Min	32.1
	Max	39.5
	Leq	35.3
	Night Limit	55 dB(A)

Ambient Air Quality Standards in respect of Noise in Industrial Area Daytime 65 dB(A) & Night Time 55 dB(A)

*** End of Report ***

Verified By

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

SH 57, Polivakkam

Report No	: PCEI/TR-N-147	**Report Date**	: 13.01.2020
ULR No.	: ULR-TC74461900000145F		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 9989 – 1981 (RA 2008)		
Sampled by	: Laboratory		
Sample Collected Date	: 09.01.2020		
Sample Description	: **Noise Monitoring**	**Sample Reference No**	: PCEI/N-N147-01-20
Category of Area	: **Commercial Area**	**Sample Received On**	: 10.01.2020
Latitude	: 13.0699 N 13°4'11.64717"	**Test Commenced On**	: 10.01.2020
Longitude	: 79.91044 E 79°54'37.57843"	**Test Completed On**	: 10.01.2020
Sampling Location	: **SH 57, Polivakkam**		

Time	Day Time	Night Time
	Readings dB(A)	Readings dB(A)
06:00 - 07:00	41.6	
07:00 - 08:00	42.5	
08:00 - 09:00	43.4	
09:00 - 10:00	48.6	
10:00 - 11:00	48.1	
11:00 - 12:00	47.3	
12:00 - 13:00	49.6	
13:00 - 14:00	47.5	
14:00 - 15:00	52.9	
15:00 - 16:00	50.3	
16:00 - 17:00	51.7	
17:00 - 18:00	49.5	
18:00 - 19:00	47.8	
19:00 - 20:00	46.3	
20:00 - 21:00	45.7	
21:00 - 22:00	43.1	
22:00 - 23:00		41.9
23:00 - 00:00		37.1
00:00 - 01:00		36.5
01:00 - 02:00		34.5
02:00 - 03:00		33.7
03:00 - 04:00		33.1
04:00 - 05:00		34.6
05:00 - 06:00		33.5
Daytime	**Min**	**41.6**
	Max	**52.9**
	Leq	**48.3**
	Day Limit	**65 dB(A)**
Night Time	**Min**	**33.1**
	Max	**41.9**
	Leq	**36.7**
	Night Limit	**55 dB(A)**

Ambient Air Quality Standards in respect of Noise in Industrial Area Daytime 65 dB(A) & Night Time 55 dB(A)

*** End of Report ***

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Verified By

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Pethnapalli

Report No	: PCEI/TR-N-148	**Report Date**	: 13.01.2020
ULR No.	: ULR-TC74461900000146F		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 9989 – 1981 (RA 2008)		
Sampled by	: Laboratory		
Sample Collected Date	: 09.01.2020		
Sample Description	: **Noise Monitoring**	**Sample Reference No**	: PCEI/N-N148-01-20
Category of Area	: **Commercial Area**	**Sample Received On**	: 10.01.2020
Latitude	: 13°5'28.17"N	**Test Commenced On**	: 10.01.2020
Longitude	: 79°56'10.11"E	**Test Completed On**	: 10.01.2020
Sampling Location	: **Pethnapalli**		

Time	Day Time	Night Time
	Readings dB(A)	Readings dB(A)
06:00 - 07:00	52.7	
07:00 - 08:00	55.1	
08:00 - 09:00	56.8	
09:00 - 10:00	52.9	
10:00 - 11:00	52.4	
11:00 - 12:00	56.8	
12:00 - 13:00	51.9	
13:00 - 14:00	49.5	
14:00 - 15:00	52.7	
15:00 - 16:00	50.3	
16:00 - 17:00	52.6	
17:00 - 18:00	51.3	
18:00 - 19:00	49.5	
19:00 - 20:00	48.2	
20:00 - 21:00	44.7	
21:00 - 22:00	39.1	
22:00 - 23:00		41.4
23:00 - 00:00		39.6
00:00 - 01:00		38.2
01:00 - 02:00		38.4
02:00 - 03:00		35.8
03:00 - 04:00		35.2
04:00 - 05:00		35.6
05:00 - 06:00		36.7
Daytime	**Min**	**39.1**
	Max	**56.8**
	Leq	**52.6**
	Day Limit	**65 dB(A)**
Night Time	**Min**	**35.2**
	Max	**41.4**
	Leq	**38.1**
	Night Limit	**55 dB(A)**

Ambient Air Quality Standards in respect of Noise in Industrial Area Daytime 65 dB(A) & Night Time 55 dB(A)

*** End of Report ***

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Verified By

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Sriperumbudur

Report No	: PCEI/TR-N-149	**Report Date**	: 13.01.2020
ULR No.	: ULR-TC74461900000147F		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 9989 – 1981 (RA 2008)		
Sampled by	: Laboratory		
Sample Collected Date	: 09.01.2020		
Sample Description	: **Noise Monitoring**	**Sample Reference No**	: PCEI/N-N149-01-20
Category of Area	: **Commercial Area**	**Sample Received On**	: 10.01.2020
Latitude	: 12.9683 N 12°58'5.88075"	**Test Commenced On**	: 10.01.2020
Longitude	: 79.94319 E 79°56'35.49903"	**Test Completed On**	: 10.01.2020
Sampling Location	: **Sriperumbudur**		

Time	Day Time	Night Time
	Readings dB(A)	Readings dB(A)
06:00 - 07:00	48.2	
07:00 - 08:00	49.5	
08:00 - 09:00	50.2	
09:00 - 10:00	51.6	
10:00 - 11:00	52.4	
11:00 - 12:00	53.2	
12:00 - 13:00	54.8	
13:00 - 14:00	53.5	
14:00 - 15:00	52.4	
15:00 - 16:00	51.7	
16:00 - 17:00	52.1	
17:00 - 18:00	50.2	
18:00 - 19:00	48.2	
19:00 - 20:00	47.3	
20:00 - 21:00	44.0	
21:00 - 22:00	41.2	
22:00 - 23:00		41.5
23:00 - 00:00		39.6
00:00 - 01:00		40.2
01:00 - 02:00		39.9
02:00 - 03:00		39.1
03:00 - 04:00		37.2
04:00 - 05:00		36.1
05:00 - 06:00		36.5
Daytime	**Min**	**41.2**
	Max	**54.8**
	Leq	**51.1**
	Day Limit	**65 dB(A)**
Night Time	**Min**	**36.1**
	Max	**41.5**
	Leq	**39.1**
	Night Limit	**55 dB(A)**

Ambient Air Quality Standards in respect of Noise in Industrial Area Daytime 65 dB(A) & Night Time 55 dB(A)

*** End of Report ***

Page 1 of 1

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Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Water Quality Monitoring

Putlur Tap Water

Report No	: PCEI/TR-W-070	**Report Date**	: 18.01.2020
ULR No.	: ULR-TC74462000000068P		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 3025 (Part 1) 1987 (RA 2003)		
Sampled by	: Laboratory		
Sample Collected Date	: 08.01.2020	**Sample Reference No**	: PCEI/W-N070-01-20
Sample Description	: **Water**	**Sample Received On**	: 08.01.2020
Qty of Sample Received	: 2.5 Litre	**Test Commenced On**	: 08.01.2020
Sample Condition	: Fit for Analysis	**Test Completed On**	: 17.01.2020
Latitude	: 13.119525,N 13°07'10.3"	**Longitude**	: 79.942960 E 79°56'34.7"
Sampling Location	: **Putlur Tap Water**		

S.No	Parameters	Units	Test Method	Results
1	pH @ 25°C	-	IS 3025 (Part 11) 1983 (RA 2017)	7.28
2	Turbidity	NTU	IS 3025 (Part 10) 1984 (RA 2017)	BDL(DL:0.5)
3	Total Dissolved Solids (TDS) @ 180°C	mg/L	IS 3025 (Part 16) 1984 (RA 2014)	1011
4	Aluminium (as Al)	mg/L	IS 3025 (Part 55) 2003 (RA 2014)	BDL(DL:0.01)
5	Ammonia (as total Ammonia - N)	mg/L	IS 3025 (Part 34) 1988 (RA 2003)	BDL(DL:1.0)
6	Total Suspended Solids @ 105°C	mg/L	IS 3025 (Part 17) 1984 (RA 2017)	BDL(DL:2.0)
7	Barium (as Ba)	mg/L	IS 13428:2014 (Annex K)	BDL(DL:0.01)
8	Boron (as B)	mg/L	IS 3025 (Part 57) 2005 (RA 2017)	BDL(DL:0.01)
9	Calcium (as Ca)	mg/L	IS 3025 (Part 40) 1991 (RA 2014)	92.1
10	Chloride (as Cl)	mg/L	IS 3025 (Part 32) 1988 (RA 2014)	201
11	Copper (as Cu)	mg/L	IS 3025 (Part 42) 1992 (RA 2014)	BDL(DL:0.01)
12	Fluoride (as F)	mg/L	APHA 23rd Edition 4500 F-D	0.93
13	Iron (as Fe)	mg/L	IS 3025 (Part 53) 2003 (RA 2014)	0.14
14	Magnesium (Mg)	mg/L	IS 3025 (Part 46) 1994 (RA 2014)	27
15	Manganese (as Mn)	mg/L	IS 3025 (Part 59) 2006 (RA 2017)	BDL(DL:0.01)
16	Total Nitrogen	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	31.6
17	Hexavalent Chromium (as Cr^{+6})	mg/L	IS 3025 (Part 52) 2003 (RA 2014)	0.034
18	Organic Phosphorous	mg/L	APHA 23rd Edition 4500 P	BDL(DL:0.1)

Verified by

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Report No		: PCEI/TR-W-070	Report Date	: 18.01.2020
S.No	**Parameters**	**Units**	**Test Method**	**Results**
19	Vanadium (as V)	mg/L	IS 3025 (Part 2)	BDL(DL:0.01)
20	Nitrate (as NO_3)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	28.8
21	Phenolic Compounds (C_6H_5OH)	mg/L	IS 3025 (Part 43) 1992(RA 2009)	BDL(DL:0.001)
22	Selenium (as Se)	mg/L	IS 3025 (Part 56) 2003 (RA 2014)	BDL(DL:0.002)
23	Silver (as Ag)	mg/L	IS 13428:2005 (Annex J)	BDL(DL:0.001)
24	Sulphates (as SO_4)	mg/L	IS 3025 (Part 24) 1986 (RA 2014)	84.2
25	Sulphide (as H_2S)	mg/L	IS 3025 (Part 29) 1986 (RA 2003)	BDL(DL:1.0)
26	Ammonical Nitrogen (as N)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	BDL(DL:1.0)
27	Total Kjehdahl Nitrogen (as N)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	BDL(DL:1.0)
28	Zinc (as Zn)	mg/L	IS 3025 (Part 49) 1994 (RA 2014)	1.63
29	Cadmium (as Cd)	mg/L	IS 3025 (Part 41) 1992 (RA 2014)	BDL(DL:0.01)
30	Cyanide (as CN)	mg/L	IS 3025 (Part 27) 1986 (RA 2014)	BDL(DL:0.01)
31	Lead (as Pb)	mg/L	IS 3025 (Part 47) 1994 (RA 2014)	BDL(DL:0.01)
32	Mercury (as Hg)	mg/L	IS 3025 (Part 48) 1994 (RA 2014)	BDL(DL:0.0001)
33	Nickel (as Ni)	mg/L	IS 3025 (Part 54) (RA 2003)	BDL(DL:0.01)
34	Total Phosphate	mg/L	IS 3025 (Part 31) 1988 (RA 2019)	BDL(DL:0.1)
35	Dissolved Phosphate (as PO_4)	mg/L	IS 3025 (Part 31) 1988 (RA 2019)	BDL(DL:0.1)
36	Arsenic (as As)	mg/L	IS 3025 (Part 37) 1988 (RA 2014)	BDL (DL:0.5)
37	Chromium (as Cr)	mg/L	IS 3025 (Part 52) 2003 (RA 2014)	BDL (DL:0.5)
38	Total Hardness (as $CaCO_3$)	mg/L	IS 3025 (Part 21) 2009 (RA 2014)	339
39	Sodium (as Na)	mg/L	IS 3025 (Part 45) 1993 (RA 2014)	78.4
40	Potassium (as K)	mg/L	IS 3025 (Part 45) 1993 (RA 2014)	7.72
41	Total Alkalinity (as $CaCO_3$)	mg/L	IS 3025 (Part 23) 1986 (RA 2014)	311
Micro-Biological Parameters				
42	Escherichia coli (MPN)	MPN/100ml	IS 1622:1981 (RA 2009)	4
43	Total coliform (MPN)	MPN/100ml	IS 1622:1981 (RA 2009)	12
44	Fecal Coliform	MPN/100ml	IS 1622:1981 (RA 2009)	<2.0

Note: BDL - Below Detection Limit; DL - Detection Limit

..... End of Report .....

Verified by

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

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Sriperumbudur Tap Water

Report No	: PCEI/TR-W-071	**Report Date**	: 18.01.2020
ULR No.	: ULR-TC744620000000069P		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 3025 (Part 1) 1987 (RA 2003)		
Sampled by	: Laboratory		
Sample Collected Date	: 08.01.2020	**Sample Reference No**	: PCEI/W-N071-01-20
Sample Description	: **Water**	**Sample Received On**	: 08.01.2020
Qty of Sample Received	: 2.5 Litre	**Test Commenced On**	: 08.01.2020
Sample Condition	: Fit for Analysis	**Test Completed On**	: 17.01.2020
Latitude	: 12.97058 N 12°58'14.076	**Longitude**	: 79.94046 E 79°56'25.644"
Sampling Location	: **Sriperumbudur Tap Water**		

S.No	Parameters	Units	Test Method	Results
1	pH @ 25°C	-	IS 3025 (Part 11) 1983 (RA 2017)	7.59
2	Turbidity	NTU	IS 3025 (Part 10) 1984 (RA 2017)	BDL(DL:0.5)
3	Total Dissolved Solids (TDS) @ 180°C	mg/L	IS 3025 (Part 16) 1984 (RA 2014)	1018
4	Aluminium (as Al)	mg/L	IS 3025 (Part 55) 2003 (RA 2014)	BDL(DL:0.01)
5	Ammonia (as total Ammonia - N)	mg/L	IS 3025 (Part 34) 1988 (RA 2003)	BDL(DL:1.0)
6	Total Suspended Solids @ 105°C	mg/L	IS 3025 (Part 17) 1984 (RA 2017)	BDL(DL:2.0)
7	Barium (as Ba)	mg/L	IS 13428:2014 (Annex K)	BDL(DL:0.01)
8	Boron (as B)	mg/L	IS 3025 (Part 57) 2005 (RA 2017)	BDL(DL:0.01)
9	Calcium (as Ca)	mg/L	IS 3025 (Part 40) 1991 (RA 2014)	110
10	Chloride (as Cl)	mg/L	IS 3025 (Part 32) 1988 (RA 2014)	130
11	Copper (as Cu)	mg/L	IS 3025 (Part 42) 1992 (RA 2014)	BDL(DL:0.01)
12	Fluoride (as F)	mg/L	APHA 23rd Edition 4500 F-D	0.69
13	Iron (as Fe)	mg/L	IS 3025 (Part 53) 2003 (RA 2014)	0.13
14	Magnesium (Mg)	mg/L	IS 3025 (Part 46) 1994 (RA 2014)	43
15	Manganese (as Mn)	mg/L	IS 3025 (Part 59) 2006 (RA 2017)	BDL(DL:0.01)
16	Total Nitrogen	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	23.1
17	Hexavalent Chromium (as Cr^{+6})	mg/L	IS 3025 (Part 52) 2003 (RA 2014)	0.032
18	Organic Phosphorous	mg/L	APHA 23rd Edition 4500 P	BDL(DL:0.1)

Verified by

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Report No		: PCEI/TR-W-071	Report Date	: 18.01.2020
S.No	**Parameters**	**Units**	**Test Method**	**Results**
19	Vanadium (as V)	mg/L	IS 3025 (Part 2)	BDL(DL:0.01)
20	Nitrate (as NO_3)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	20.6
21	Phenolic Compounds (C_6H_5OH)	mg/L	IS 3025 (Part 43) 1992(RA 2009)	BDL(DL:0.001)
22	Selenium (as Se)	mg/L	IS 3025 (Part 56) 2003 (RA 2014)	BDL(DL:0.002)
23	Silver (as Ag)	mg/L	IS 13428:2005 (Annex J)	BDL(DL:0.001)
24	Sulphates (as SO_4)	mg/L	IS 3025 (Part 24) 1986 (RA 2014)	130
25	Sulphide (as H_2S)	mg/L	IS 3025 (Part 29) 1986 (RA 2003)	BDL(DL:1.0)
26	Ammonical Nitrogen (as N)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	BDL(DL:1.0)
27	Total Kjehdahl Nitrogen (as N)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	BDL(DL:1.0)
28	Zinc (as Zn)	mg/L	IS 3025 (Part 49) 1994 (RA 2014)	0.56
29	Cadmium (as Cd)	mg/L	IS 3025 (Part 41) 1992 (RA 2014)	BDL(DL:0.01)
30	Cyanide (as CN)	mg/L	IS 3025 (Part 27) 1986 (RA 2014)	BDL(DL:0.01)
31	Lead (as Pb)	mg/L	IS 3025 (Part 47) 1994 (RA 2014)	BDL(DL:0.01)
32	Mercury (as Hg)	mg/L	IS 3025 (Part 48) 1994 (RA 2014)	BDL(DL:0.0001)
33	Nickel (as Ni)	mg/L	IS 3025 (Part 54) (RA 2003)	BDL(DL:0.01)
34	Total Phosphate	mg/L	IS 3025 (Part 31) 1988 (RA 2019)	BDL(DL:0.1)
35	Dissolved Phosphate (as PO_4)	mg/L	IS 3025 (Part 31) 1988 (RA 2019)	BDL(DL:0.1)
36	Arsenic (as As)	mg/L	IS 3025 (Part 37) 1988 (RA 2014)	BDL (DL:0.5)
37	Chromium (as Cr)	mg/L	IS 3025 (Part 52) 2003 (RA 2014)	BDL (DL:0.5)
38	Total Hardness (as $CaCO_3$)	mg/L	IS 3025 (Part 21) 2009 (RA 2014)	451
39	Sodium (as Na)	mg/L	IS 3025 (Part 45) 1993 (RA 2014)	58.1
40	Potassium (as K)	mg/L	IS 3025 (Part 45) 1993 (RA 2014)	4.28
41	Total Alkalinity (as $CaCO_3$)	mg/L	IS 3025 (Part 23) 1986 (RA 2014)	325
Micro-Biological Parameters				
42	Escherichia coli (MPN)	MPN/100ml	IS 1622:1981 (RA 2009)	<2.0
43	Total coliform (MPN)	MPN/100ml	IS 1622:1981 (RA 2009)	8
44	Fecal Coliform	MPN/100ml	IS 1622:1981 (RA 2009)	<2.0

Note: BDL - Below Detection Limit; DL - Detection Limit

..... End of Report .....

Verified by

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Polivakkam Tap Water

Report No	: PCEI/TR-W-072	**Report Date**	: 18.01.2020
ULR No.	: ULR-TC74462000000070P		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 3025 (Part 1) 1987 (RA 2003)		
Sampled by	: Laboratory		
Sample Collected Date	: 08.01.2020	**Sample Reference No**	: PCEI/W-N072-01-20
Sample Description	: **Water**	**Sample Received On**	: 08.01.2020
Qty of Sample Received	: 2.5 Litre	**Test Commenced On**	: 08.01.2020
Sample Condition	: Fit for Analysis	**Test Completed On**	: 17.01.2020
Latitude	: 13.07849 N 13°4'42.576"	**Longitude**	: 79.90893 E 79°54'32.148"
Sampling Location	: **Polivakkam Tap Water**		

S.No	Parameters	Units	Test Method	Results
1	pH @ 25°C	-	IS 3025 (Part 11) 1983 (RA 2017)	7.51
2	Turbidity	NTU	IS 3025 (Part 10) 1984 (RA 2017)	BDL(DL:0.5)
3	Total Dissolved Solids (TDS) @ 180°C	mg/L	IS 3025 (Part 16) 1984 (RA 2014)	853
4	Aluminium (as Al)	mg/L	IS 3025 (Part 55) 2003 (RA 2014)	BDL(DL:0.01)
5	Ammonia (as total Ammonia - N)	mg/L	IS 3025 (Part 34) 1988 (RA 2003)	BDL(DL:1.0)
6	Total Suspended Solids @ 105°C	mg/L	IS 3025 (Part 17) 1984 (RA 2017)	3.0
7	Barium (as Ba)	mg/L	IS 13428:2014 (Annex K)	BDL(DL:0.01)
8	Boron (as B)	mg/L	IS 3025 (Part 57) 2005 (RA 2017)	BDL(DL:0.01)
9	Calcium (as Ca)	mg/L	IS 3025 (Part 40) 1991 (RA 2014)	77.8
10	Chloride (as Cl)	mg/L	IS 3025 (Part 32) 1988 (RA 2014)	183
11	Copper (as Cu)	mg/L	IS 3025 (Part 42) 1992 (RA 2014)	BDL(DL:0.01)
12	Fluoride (as F)	mg/L	APHA 23rd Edition 4500 F-D	0.93
13	Iron (as Fe)	mg/L	IS 3025 (Part 53) 2003 (RA 2014)	0.11
14	Magnesium (Mg)	mg/L	IS 3025 (Part 46) 1994 (RA 2014)	56.3
15	Manganese (as Mn)	mg/L	IS 3025 (Part 59) 2006 (RA 2017)	BDL(DL:0.01)
16	Total Nitrogen	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	8.1
17	Hexavalent Chromium (as Cr^{+6})	mg/L	IS 3025 (Part 52) 2003 (RA 2014)	0.04
18	Organic Phosphorous	mg/L	APHA 23rd Edition 4500 P	BDL(DL:0.1)

Verified by

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Report No		: PCEI/TR-W-072	Report Date	: 18.01.2020
S.No	**Parameters**	**Units**	**Test Method**	**Results**
19	Vanadium (as V)	mg/L	IS 3025 (Part 2)	BDL(DL:0.1)
20	Nitrate (as NO_3)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	7.92
21	Phenolic Compounds (C_6H_5OH)	mg/L	IS 3025 (Part 43) 1992(RA 2009)	BDL(DL:0.001)
22	Selenium (as Se)	mg/L	IS 3025 (Part 56) 2003 (RA 2014)	BDL(DL:0.002)
23	Silver (as Ag)	mg/L	IS 13428:2005 (Annex J)	BDL(DL:0.001)
24	Sulphates (as SO_4)	mg/L	IS 3025 (Part 24) 1986 (RA 2014)	66.7
25	Sulphide (as H_2S)	mg/L	IS 3025 (Part 29) 1986 (RA 2003)	BDL(DL:1.0)
26	Ammonical Nitrogen (as N)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	BDL(DL:1.0)
27	Total Kjehdahl Nitrogen (as N)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	BDL(DL:1.0)
28	Zinc (as Zn)	mg/L	IS 3025 (Part 49) 1994 (RA 2014)	0.14
29	Cadmium (as Cd)	mg/L	IS 3025 (Part 41) 1992 (RA 2014)	BDL(DL:0.01)
30	Cyanide (as CN)	mg/L	IS 3025 (Part 27) 1986 (RA 2014)	BDL(DL:0.01)
31	Lead (as Pb)	mg/L	IS 3025 (Part 47) 1994 (RA 2014)	BDL(DL:0.01)
32	Mercury (as Hg)	mg/L	IS 3025 (Part 48) 1994 (RA 2014)	BDL(DL:0.0001)
33	Nickel (as Ni)	mg/L	IS 3025 (Part 54) (RA 2003)	BDL(DL:0.01)
34	Total Phosphate	mg/L	IS 3025 (Part 31) 1988 (RA 2019)	BDL(DL:0.1)
35	Dissolved Phosphate (as PO_4)	mg/L	IS 3025 (Part 31) 1988 (RA 2019)	BDL(DL:0.1)
36	Arsenic (as As)	mg/L	IS 3025 (Part 37) 1988 (RA 2014)	BDL (DL:0.5)
37	Chromium (as Cr)	mg/L	IS 3025 (Part 52) 2003 (RA 2014)	BDL (DL:0.5)
38	Total Hardness (as $CaCO_3$)	mg/L	IS 3025 (Part 21) 2009 (RA 2014)	426
39	Sodium (as Na)	mg/L	IS 3025 (Part 45) 1993 (RA 2014)	42.2
40	Potassium (as K)	mg/L	IS 3025 (Part 45) 1993 (RA 2014)	1.57
41	Total Alkalinity (as $CaCO_3$)	mg/L	IS 3025 (Part 23) 1986 (RA 2014)	424
Micro-Biological Parameters				
42	Escherichia coli (MPN)	MPN/100ml	IS 1622:1981 (RA 2009)	<2.0
43	Total coliform (MPN)	MPN/100ml	IS 1622:1981 (RA 2009)	<2.0
44	Fecal Coliform	MPN/100ml	IS 1622:1981 (RA 2009)	<2.0

Note: BDL - Below Detection Limit; DL - Detection Limit

..... End of Report .....

Verified by

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Keelanur Tap Water

Report No	: PCEI/TR-W-073	**Report Date**	: 18.01.2020
ULR No.	: ULR-TC74462000000071P		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 3025 (Part 1) 1987 (RA 2003)		
Sampled by	: Laboratory		
Sample Collected Date	: 08.01.2020	**Sample Reference No**	: PCEI/W-N073-01-20
Sample Description	: **Water**	**Sample Received On**	: 08.01.2020
Qty of Sample Received	: 2.5 Litre	**Test Commenced On**	: 08.01.2020
Sample Condition	: Fit for Analysis	**Test Completed On**	: 17.01.2020
Latitude	: 13.19797 N 13°11'52.686"	**Longitude**	: 79.96242 E 79°57'44.718"
Sampling Location	: **Keelanur Tap Water**		

S.No	Parameters	Units	Test Method	Results
1	pH @ 25°C	-	IS 3025 (Part 11) 1983 (RA 2017)	7.27
2	Turbidity	NTU	IS 3025 (Part 10) 1984 (RA 2017)	BDL(DL:0.5)
3	Total Dissolved Solids (TDS) @ 180°C	mg/L	IS 3025 (Part 16) 1984 (RA 2014)	876
4	Aluminium (as Al)	mg/L	IS 3025 (Part 55) 2003 (RA 2014)	BDL(DL:0.01)
5	Ammonia (as total Ammonia - N)	mg/L	IS 3025 (Part 34) 1988 (RA 2003)	BDL(DL:1.0)
6	Total Suspended Solids @ 105°C	mg/L	IS 3025 (Part 17) 1984 (RA 2017)	BDL(DL:2.0)
7	Barium (as Ba)	mg/L	IS 13428:2014 (Annex K)	BDL(DL:0.01)
8	Boron (as B)	mg/L	IS 3025 (Part 57) 2005 (RA 2017)	BDL(DL:0.01)
9	Calcium (as Ca)	mg/L	IS 3025 (Part 40) 1991 (RA 2014)	82.5
10	Chloride (as Cl)	mg/L	IS 3025 (Part 32) 1988 (RA 2014)	186
11	Copper (as Cu)	mg/L	IS 3025 (Part 42) 1992 (RA 2014)	BDL(DL:0.01)
12	Fluoride (as F)	mg/L	APHA 23rd Edition 4500 F-D	0.30
13	Iron (as Fe)	mg/L	IS 3025 (Part 53) 2003 (RA 2014)	0.09
14	Magnesium (Mg)	mg/L	IS 3025 (Part 46) 1994 (RA 2014)	29
15	Manganese (as Mn)	mg/L	IS 3025 (Part 59) 2006 (RA 2017)	BDL(DL:0.01)
16	Total Nitrogen	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	8.12
17	Hexavalent Chromium (as Cr^{+6})	mg/L	IS 3025 (Part 52) 2003 (RA 2014)	0.03
18	Organic Phosphorous	mg/L	APHA 23rd Edition 4500 P	BDL(DL:0.1)

Verified by

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Report No		: PCEI/TR-W-073	Report Date	: 18.01.2020
S.No	**Parameters**	**Units**	**Test Method**	**Results**
19	Vanadium (as V)	mg/L	IS 3025 (Part 2)	BDL(DL:0.1)
20	Nitrate (as NO_3)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	7.19
21	Phenolic Compounds (C_6H_5OH)	mg/L	IS 3025 (Part 43) 1992(RA 2009)	BDL(DL:0.001)
22	Selenium (as Se)	mg/L	IS 3025 (Part 56) 2003 (RA 2014)	BDL(DL:0.002)
23	Silver (as Ag)	mg/L	IS 13428:2005 (Annex J)	BDL(DL:0.001)
24	Sulphates (as SO_4)	mg/L	IS 3025 (Part 24) 1986 (RA 2014)	61.3
25	Sulphide (as H_2S)	mg/L	IS 3025 (Part 29) 1986 (RA 2003)	BDL(DL:1.0)
26	Ammonical Nitrogen (as N)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	BDL(DL:1.0)
27	Total Kjehdahl Nitrogen (as N)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	BDL(DL:1.0)
28	Zinc (as Zn)	mg/L	IS 3025 (Part 49) 1994 (RA 2014)	0.19
29	Cadmium (as Cd)	mg/L	IS 3025 (Part 41) 1992 (RA 2014)	BDL(DL:0.01)
30	Cyanide (as CN)	mg/L	IS 3025 (Part 27) 1986 (RA 2014)	BDL(DL:0.01)
31	Lead (as Pb)	mg/L	IS 3025 (Part 47) 1994 (RA 2014)	BDL(DL:0.01)
32	Mercury (as Hg)	mg/L	IS 3025 (Part 48) 1994 (RA 2014)	BDL(DL:0.0001)
33	Nickel (as Ni)	mg/L	IS 3025 (Part 54) (RA 2003)	BDL(DL:0.01)
34	Total Phosphate	mg/L	IS 3025 (Part 31) 1988 (RA 2019)	0.23
35	Dissolved Phosphate (as PO_4)	mg/L	IS 3025 (Part 31) 1988 (RA 2019)	0.11
36	Arsenic (as As)	mg/L	IS 3025 (Part 37) 1988 (RA 2014)	BDL (DL:0.5)
37	Chromium (as Cr)	mg/L	IS 3025 (Part 52) 2003 (RA 2014)	BDL (DL:0.5)
38	Total Hardness (as $CaCO_3$)	mg/L	IS 3025 (Part 21) 2009 (RA 2014)	325
39	Sodium (as Na)	mg/L	IS 3025 (Part 45) 1993 (RA 2014)	54
40	Potassium (as K)	mg/L	IS 3025 (Part 45) 1993 (RA 2014)	6.24
41	Total Alkalinity (as $CaCO_3$)	mg/L	IS 3025 (Part 23) 1986 (RA 2014)	232
Micro-Biological Parameters				
42	Escherichia coli (MPN)	MPN/100ml	IS 1622:1981 (RA 2009)	<2.0
43	Total coliform (MPN)	MPN/100ml	IS 1622:1981 (RA 2009)	<2.0
44	Fecal Coliform	MPN/100ml	IS 1622:1981 (RA 2009)	<2.0

Note: BDL - Below Detection Limit; DL - Detection Limit

..... End of Report .....

Verified by

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Thamaraipakkam Tap Water

Report No	: PCEI/TR-W-074	**Report Date**	: 18.01.2020
ULR No.	: ULR-TC744620000000072P		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 3025 (Part 1) 1987 (RA 2003)		
Sampled by	: Laboratory		
Sample Collected Date	: 08.01.2020	**Sample Reference No**	: PCEI/W-N074-01-20
Sample Description	: **Water**	**Sample Received On**	: 08.01.2020
Qty of Sample Received	: 2.5 Litre	**Test Commenced On**	: 08.01.2020
Sample Condition	: Fit for Analysis	**Test Completed On**	: 17.01.2020
Latitude	: 13.22028 N 13°13'13.002"	**Longitude**	: 80.03022 E 80°1'48.798"
Sampling Location	: **Thamaraipakkam Tap Water**		

S.No	Parameters	Units	Test Method	Results
1	pH @ 25°C	-	IS 3025 (Part 11) 1983 (RA 2017)	7.53
2	Turbidity	NTU	IS 3025 (Part 10) 1984 (RA 2017)	BDL(DL:0.5)
3	Total Dissolved Solids (TDS) @ 180°C	mg/L	IS 3025 (Part 16) 1984 (RA 2014)	249
4	Aluminium (as Al)	mg/L	IS 3025 (Part 55) 2003 (RA 2014)	BDL(DL:0.01)
5	Ammonia (as total Ammonia - N)	mg/L	IS 3025 (Part 34) 1988 (RA 2003)	BDL(DL:1.0)
6	Total Suspended Solids @ 105°C	mg/L	IS 3025 (Part 17) 1984 (RA 2017)	BDL(DL:2.0)
7	Barium (as Ba)	mg/L	IS 13428:2014 (Annex K)	BDL(DL:0.01)
8	Boron (as B)	mg/L	IS 3025 (Part 57) 2005 (RA 2017)	BDL(DL:0.01)
9	Calcium (as Ca)	mg/L	IS 3025 (Part 40) 1991 (RA 2014)	22.2
10	Chloride (as Cl)	mg/L	IS 3025 (Part 32) 1988 (RA 2014)	21
11	Copper (as Cu)	mg/L	IS 3025 (Part 42) 1992 (RA 2014)	BDL(DL:0.01)
12	Fluoride (as F)	mg/L	APHA 23rd Edition 4500 F-D	0.43
13	Iron (as Fe)	mg/L	IS 3025 (Part 53) 2003 (RA 2014)	0.08
14	Magnesium (Mg)	mg/L	IS 3025 (Part 46) 1994 (RA 2014)	12.5
15	Manganese (as Mn)	mg/L	IS 3025 (Part 59) 2006 (RA 2017)	BDL(DL:0.01)
16	Total Nitrogen	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	7.86
17	Hexavalent Chromium (as Cr^{+6})	mg/L	IS 3025 (Part 52) 2003 (RA 2014)	BDL(DL:0.03)
18	Organic Phosphorous	mg/L	APHA 23rd Edition 4500 P	0.12

Verified by

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Report No		: PCEI/TR-W-074	Report Date	: 18.01.2020
S.No	**Parameters**	**Units**	**Test Method**	**Results**
19	Vanadium (as V)	mg/L	IS 3025 (Part 2)	BDL(DL:0.01)
20	Nitrate (as NO_3)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	7.53
21	Phenolic Compounds (C_6H_5OH)	mg/L	IS 3025 (Part 43) 1992(RA 2009)	BDL(DL:0.001)
22	Selenium (as Se)	mg/L	IS 3025 (Part 56) 2003 (RA 2014)	BDL(DL:0.002)
23	Silver (as Ag)	mg/L	IS 13428:2005 (Annex J)	BDL(DL:0.001)
24	Sulphates (as SO_4)	mg/L	IS 3025 (Part 24) 1986 (RA 2014)	27.3
25	Sulphide (as H_2S)	mg/L	IS 3025 (Part 29) 1986 (RA 2003)	BDL(DL:1.0)
26	Ammonical Nitrogen (as N)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	BDL(DL:1.0)
27	Total Kjehdahl Nitrogen (as N)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	BDL(DL:1.0)
28	Zinc (as Zn)	mg/L	IS 3025 (Part 49) 1994 (RA 2014)	0.15
29	Cadmium (as Cd)	mg/L	IS 3025 (Part 41) 1992 (RA 2014)	BDL(DL:0.01)
30	Cyanide (as CN)	mg/L	IS 3025 (Part 27) 1986 (RA 2014)	BDL(DL:0.01)
31	Lead (as Pb)	mg/L	IS 3025 (Part 47) 1994 (RA 2014)	BDL(DL:0.01)
32	Mercury (as Hg)	mg/L	IS 3025 (Part 48) 1994 (RA 2014)	BDL(DL:0.0001)
33	Nickel (as Ni)	mg/L	IS 3025 (Part 54) (RA 2003)	BDL(DL:0.01)
34	Total Phosphate	mg/L	IS 3025 (Part 31) 1988 (RA 2019)	0.21
35	Dissolved Phosphate (as PO_4)	mg/L	IS 3025 (Part 31) 1988 (RA 2019)	0.14
36	Arsenic (as As)	mg/L	IS 3025 (Part 37) 1988 (RA 2014)	BDL (DL:0.5)
37	Chromium (as Cr)	mg/L	IS 3025 (Part 52) 2003 (RA 2014)	BDL (DL:0.5)
38	Total Hardness (as $CaCO_3$)	mg/L	IS 3025 (Part 21) 2009 (RA 2014)	107
39	Sodium (as Na)	mg/L	IS 3025 (Part 45) 1993 (RA 2014)	12.3
40	Potassium (as K)	mg/L	IS 3025 (Part 45) 1993 (RA 2014)	2.61
41	Total Alkalinity (as $CaCO_3$)	mg/L	IS 3025 (Part 23) 1986 (RA 2014)	103
Micro-Biological Parameters				
42	Escherichia coli (MPN)	MPN/100ml	IS 1622:1981 (RA 2009)	<2.0
43	Total coliform (MPN)	MPN/100ml	IS 1622:1981 (RA 2009)	<2.0
44	Fecal Coliform	MPN/100ml	IS 1622:1981 (RA 2009)	<2.0

Note: BDL - Below Detection Limit; DL - Detection Limit

..... **End of Report** .....

Verified by

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Kosaisthalai River

Report No	: PCEI/TR-WW-075	**Report Date**	: 18.01.2020
ULR No.	: ULR-TC74462000000073P		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 3025 (Part 1) 1987 (RA 2003)		
Sampled by	: Laboratory		
Sample Collected Date	: 08.01.2020	**Sample Reference No**	: PCEI/WW-N075-01-20
Sample Description	: **Waste Water**	**Sample Received On**	: 08.01.2020
Qty of Sample Received	: 2.5 Litre	**Test Commenced On**	: 08.01.2020
Sample Condition	: Fit for Analysis	**Test Completed On**	: 17.01.2020
Latitude	: 13.26225 N 13° 15'44.112"	**Longitude**	: 80.13468 E 80°8'4.86"
Sampling Location	: **Kosaisthalai River**		

S.No	Parameters	Units	Test Method	Results
1	pH @ 25°C	-	IS 3025 (Part 11) 1983 (RA 2017)	7.46
2	Turbidity	NTU	IS 3025 (Part 10) 1984 (RA 2017)	3.1
3	Total Dissolved Solids (TDS) @ 180°C	mg/L	IS 3025 (Part 16) 1984 (RA 2014)	347
4	Dissolved Oxygen	mg/L	IS 3025 (Part 38) 1989 (RA 2019)	4.6
5	Aluminium (as Al)	mg/L	IS 3025 (Part 55) 2003 (RA 2014)	BDL(DL:0.01)
6	Ammonia (as total Ammonia - N)	mg/L	IS 3025 (Part 34) 1988 (RA 2003)	BDL(DL:1.0)
7	Total Suspended Solids @ 105°C	mg/L	IS 3025 (Part 17) 1984 (RA 2017)	2.13
8	Barium (as Ba)	mg/L	IS 13428:2014 (Annex K)	BDL(DL:0.01)
9	Boron (as B)	mg/L	IS 3025 (Part 57) 2005 (RA 2017)	BDL(DL:0.01)
10	Calcium (as Ca)	mg/L	IS 3025 (Part 40) 1991 (RA 2014)	34.9
11	Chloride (as Cl)	mg/L	IS 3025 (Part 32) 1988 (RA 2014)	47
12	Copper (as Cu)	mg/L	IS 3025 (Part 42) 1992 (RA 2014)	BDL(DL:0.01)
13	Fluoride (as F)	mg/L	APHA 23rd Edition 4500 F-D	0.33
14	Iron (as Fe)	mg/L	IS 3025 (Part 53) 2003 (RA 2014)	0.26
15	Magnesium (Mg)	mg/L	IS 3025 (Part 46) 1994 (RA 2014)	14
16	Manganese (as Mn)	mg/L	IS 3025 (Part 59) 2006 (RA 2017)	BDL(DL:0.01)
17	Total Nitrogen	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	14.6
18	Oil & Grease	mg/L	IS 3025 (Part 39) 1991 (RA 2014)	BDL(DL:5.0)
19	Hexavalent Chromium (as Cr^{+6})	mg/L	IS 3025 (Part 52) 2003 (RA 2014)	0.032
20	Biochemical Oxygen Demand (BOD) (3 days at 27°C)	mg/L	IS 3025 (Part 44) 1993 (RA 2014)	BDL(DL:2.0)
21	Chemical Oxygen Demand (COD)	mg/L	IS 3025 (Part 58) 2006 (RA 2017)	BDL(DL:4.0)
22	Organic Phosphorous	mg/L	APHA 23rd Edition 4500 P	0.16

Verified by

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Report No		: PCEI/TR-WW-075	Report Date	: 18.01.2020
S.No	**Parameters**	**Units**	**Test Method**	**Results**
23	Vanadium (as V)	mg/L	IS 3025 (Part 2)	BDL(DL:0.01)
24	Nitrate (as NO_3)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	7.94
25	Phenolic Compounds (C_6H_5OH)	mg/L	IS 3025 (Part 43) 1992(RA 2009)	BDL(DL:0.001)
26	Selenium (as Se)	mg/L	IS 3025 (Part 56) 2003 (RA 2014)	BDL(DL:0.002)
27	Silver (as Ag)	mg/L	IS 13428:2005 (Annex J)	BDL(DL:0.001)
28	Sulphates (as SO_4)	mg/L	IS 3025 (Part 24) 1986 (RA 2014)	24.8
29	Sulphide (as H_2S)	mg/L	IS 3025 (Part 29) 1986 (RA 2003)	BDL(DL:1.0)
30	Ammonical Nitrogen (as N)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	1.3
31	Total Kjehdahl Nitrogen (as N)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	1.9
32	Zinc (as Zn)	mg/L	IS 3025 (Part 49) 1994 (RA 2014)	0.93
33	Cadmium (as Cd)	mg/L	IS 3025 (Part 41) 1992 (RA 2014)	BDL(DL:0.01)
34	Cyanide (as CN)	mg/L	IS 3025 (Part 27) 1986 (RA 2014)	BDL(DL:0.01)
35	Lead (as Pb)	mg/L	IS 3025 (Part 47) 1994 (RA 2014)	BDL(DL:0.01)
36	Mercury (as Hg)	mg/L	IS 3025 (Part 48) 1994 (RA 2014)	BDL(DL:0.0001)
37	Nickel (as Ni)	mg/L	IS 3025 (Part 54) (RA 2003)	BDL(DL:0.01)
38	Total Phosphate	mg/L	IS 3025 (Part 31) 1988 (RA 2019)	0.44
39	Dissolved Phosphate (as PO_4)	mg/L	IS 3025 (Part 31) 1988 (RA 2019)	0.29
40	Arsenic (as As)	mg/L	IS 3025 (Part 37) 1988 (RA 2014)	BDL (DL:0.5)
41	Chromium (as Cr)	mg/L	IS 3025 (Part 52) 2003 (RA 2014)	BDL (DL:0.5)
42	Total Hardness (as $CaCO_3$)	mg/L	IS 3025 (Part 21) 2009 (RA 2014)	147
43	Sodium (as Na)	mg/L	IS 3025 (Part 45) 1993 (RA 2014)	18.7
44	Potassium (as K)	mg/L	IS 3025 (Part 45) 1993 (RA 2014)	2.66
45	Total Alkalinity (as $CaCO_3$)	mg/L	IS 3025 (Part 23) 1986 (RA 2014)	141
Micro-Biological Parameters				
46	Escherichia coli (MPN)	MPN/100ml	IS 1622:1981 (RA 2009)	12
47	Total coliform (MPN)	MPN/100ml	IS 1622:1981 (RA 2009)	23
48	Fecal Coliform	MPN/100ml	IS 1622:1981 (RA 2009)	8

Note: BDL - Below Detection Limit; DL - Detection Limit

..... End of Report .....

Verified by

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

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Athipedu Higher Secondary School Tank

Report No	: PCEI/TR-W-076	**Report Date**	: 18.01.2020
ULR No.	: ULR-TC74462000000074P		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 3025 (Part 1) 1987 (RA 2003)		
Sampled by	: Laboratory		
Sample Collected Date	: 08.01.2020	**Sample Reference No**	: PCEI/W-N076-01-20
Sample Description	: **Water**	**Sample Received On**	: 08.01.2020
Qty of Sample Received	: 2.5 Litre	**Test Commenced On**	: 08.01.2020
Sample Condition	: Fit for Analysis	**Test Completed On**	: 17.01.2020
Latitude	: 13.27579 N 13° 16'32.844"	**Longitude**	: 80.15073 E 80°9'2.616"
Sampling Location	: **Athipedu Higher Secondary School Tank**		

S.No	Parameters	Units	Test Method	Results
1	pH @ 25°C	-	IS 3025 (Part 11) 1983 (RA 2017)	7.41
2	Turbidity	NTU	IS 3025 (Part 10) 1984 (RA 2017)	BDL(DL:0.5)
3	Total Dissolved Solids (TDS) @ 180°C	mg/L	IS 3025 (Part 16) 1984 (RA 2014)	533
4	Aluminium (as Al)	mg/L	IS 3025 (Part 55) 2003 (RA 2014)	BDL(DL:0.01)
5	Ammonia (as total Ammonia - N)	mg/L	IS 3025 (Part 34) 1988 (RA 2003)	BDL(DL:1.0)
6	Total Suspended Solids @ 105°C	mg/L	IS 3025 (Part 17) 1984 (RA 2017)	BDL(DL:2.0)
7	Barium (as Ba)	mg/L	IS 13428:2014 (Annex K)	BDL(DL:0.01)
8	Boron (as B)	mg/L	IS 3025 (Part 57) 2005 (RA 2017)	BDL(DL:0.01)
9	Calcium (as Ca)	mg/L	IS 3025 (Part 40) 1991 (RA 2014)	47.6
10	Chloride (as Cl)	mg/L	IS 3025 (Part 32) 1988 (RA 2014)	81.7
11	Copper (as Cu)	mg/L	IS 3025 (Part 42) 1992 (RA 2014)	BDL(DL:0.01)
12	Fluoride (as F)	mg/L	APHA 23rd Edition 4500 F-D	0.50
13	Iron (as Fe)	mg/L	IS 3025 (Part 53) 2003 (RA 2014)	0.13
14	Magnesium (Mg)	mg/L	IS 3025 (Part 46) 1994 (RA 2014)	19
15	Manganese (as Mn)	mg/L	IS 3025 (Part 59) 2006 (RA 2017)	BDL(DL:0.01)
16	Total Nitrogen	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	37.1
17	Hexavalent Chromium (as Cr^{+6})	mg/L	IS 3025 (Part 52) 2003 (RA 2014)	0.032
18	Organic Phosphorous	mg/L	APHA 23rd Edition 4500 P	BDL(DL:0.1)

Verified by

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Report No		: PCEI/TR-W-076	Report Date	: 18.01.2020
S.No	**Parameters**	**Units**	**Test Method**	**Results**
19	Vanadium (as V)	mg/L	IS 3025 (Part 2)	BDL(DL:0.01)
20	Nitrate (as NO_3)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	34.7
21	Phenolic Compounds (C_6H_5OH)	mg/L	IS 3025 (Part 43) 1992(RA 2009)	BDL(DL:0.001)
22	Selenium (as Se)	mg/L	IS 3025 (Part 56) 2003 (RA 2014)	BDL(DL:0.002)
23	Silver (as Ag)	mg/L	IS 13428:2005 (Annex J)	BDL(DL:0.001)
24	Sulphates (as SO_4)	mg/L	IS 3025 (Part 24) 1986 (RA 2014)	52.6
25	Sulphide (as H_2S)	mg/L	IS 3025 (Part 29) 1986 (RA 2003)	BDL(DL:1.0)
26	Ammonical Nitrogen (as N)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	BDL(DL:1.0)
27	Total Kjehdahl Nitrogen (as N)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	BDL(DL:1.0)
28	Zinc (as Zn)	mg/L	IS 3025 (Part 49) 1994 (RA 2014)	0.56
29	Cadmium (as Cd)	mg/L	IS 3025 (Part 41) 1992 (RA 2014)	BDL(DL:0.01)
30	Cyanide (as CN)	mg/L	IS 3025 (Part 27) 1986 (RA 2014)	BDL(DL:0.01)
31	Lead (as Pb)	mg/L	IS 3025 (Part 47) 1994 (RA 2014)	BDL(DL:0.01)
32	Mercury (as Hg)	mg/L	IS 3025 (Part 48) 1994 (RA 2014)	BDL(DL:0.0001)
33	Nickel (as Ni)	mg/L	IS 3025 (Part 54) (RA 2003)	BDL(DL:0.01)
34	Total Phosphate	mg/L	IS 3025 (Part 31) 1988 (RA 2019)	0.26
35	Dissolved Phosphate (as PO_4)	mg/L	IS 3025 (Part 31) 1988 (RA 2019)	0.16
36	Arsenic (as As)	mg/L	IS 3025 (Part 37) 1988 (RA 2014)	BDL (DL:0.5)
37	Chromium (as Cr)	mg/L	IS 3025 (Part 52) 2003 (RA 2014)	BDL (DL:0.5)
38	Total Hardness (as $CaCO_3$)	mg/L	IS 3025 (Part 21) 2009 (RA 2014)	198
39	Sodium (as Na)	mg/L	IS 3025 (Part 45) 1993 (RA 2014)	34.7
40	Potassium (as K)	mg/L	IS 3025 (Part 45) 1993 (RA 2014)	3.1
41	Total Alkalinity (as $CaCO_3$)	mg/L	IS 3025 (Part 23) 1986 (RA 2014)	164
Micro-Biological Parameters				
42	Escherichia coli (MPN)	MPN/100ml	IS 1622:1981 (RA 2009)	<2.0
43	Total coliform (MPN)	MPN/100ml	IS 1622:1981 (RA 2009)	<2.0
44	Fecal Coliform	MPN/100ml	IS 1622:1981 (RA 2009)	<2.0

Note: BDL - Below Detection Limit; DL - Detection Limit

..... End of Report .....

Verified by

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Sriperumbudur Lake Water

Report No	: PCEI/TR-WW-077	**Report Date**	: 18.01.2020
ULR No.	: ULR-TC744620000000075P		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 3025 (Part 1) 1987 (RA 2003)		
Sampled by	: Laboratory		
Sample Collected Date	: 08.01.2020	**Sample Reference No**	: PCEI/WW-N077-01-20
Sample Description	: **Waste Water**	**Sample Received On**	: 08.01.2020
Qty of Sample Received	: 2.5 Litre	**Test Commenced On**	: 08.01.2020
Sample Condition	: Fit for Analysis	**Test Completed On**	: 17.01.2020
Latitude	: 12.97084 N 12°58'15.024"	**Longitude**	: 79.94101 E 79°56'27.63"
Sampling Location	: **Sriperumbudur Lake Water**		

S.No	Parameters	Units	Test Method	Results
1	pH @ 25°C	-	IS 3025 (Part 11) 1983 (RA 2017)	7.59
2	Turbidity	NTU	IS 3025 (Part 10) 1984 (RA 2017)	5.9
3	Total Dissolved Solids (TDS) @ 180°C	mg/L	IS 3025 (Part 16) 1984 (RA 2014)	206
4	Dissolved Oxygen	mg/L	IS 3025 (Part 38) 1989 (RA 2019)	5.5
5	Aluminium (as Al)	mg/L	IS 3025 (Part 55) 2003 (RA 2014)	BDL(DL:0.01)
6	Ammonia (as total Ammonia - N)	mg/L	IS 3025 (Part 34) 1988 (RA 2003)	BDL(DL:1.0)
7	Total Suspended Solids @ 105°C	mg/L	IS 3025 (Part 17) 1984 (RA 2017)	7.26
8	Barium (as Ba)	mg/L	IS 13428:2014 (Annex K)	BDL(DL:0.01)
9	Boron (as B)	mg/L	IS 3025 (Part 57) 2005 (RA 2017)	BDL(DL:0.01)
10	Calcium (as Ca)	mg/L	IS 3025 (Part 40) 1991 (RA 2014)	21.4
11	Chloride (as Cl)	mg/L	IS 3025 (Part 32) 1988 (RA 2014)	30.8
12	Copper (as Cu)	mg/L	IS 3025 (Part 42) 1992 (RA 2014)	BDL(DL:0.01)
13	Fluoride (as F)	mg/L	APHA 23rd Edition 4500 F-D	0.27
14	Iron (as Fe)	mg/L	IS 3025 (Part 53) 2003 (RA 2014)	0.25
15	Magnesium (Mg)	mg/L	IS 3025 (Part 46) 1994 (RA 2014)	6
16	Manganese (as Mn)	mg/L	IS 3025 (Part 59) 2006 (RA 2017)	BDL(DL:0.01)
17	Total Nitrogen	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	16.5
18	Oil & Grease	mg/L	IS 3025 (Part 39) 1991 (RA 2014)	BDL(DL:5.0)
19	Hexavalent Chromium (as Cr^{+6})	mg/L	IS 3025 (Part 52) 2003 (RA 2014)	0.058
20	Biochemical Oxygen Demand (BOD) (3 days at 27°C)	mg/L	IS 3025 (Part 44) 1993 (RA 2014)	BDL(DL:2.0)
21	Chemical Oxygen Demand (COD)	mg/L	IS 3025 (Part 58) 2006 (RA 2017)	BDL(DL:4.0)
22	Organic Phosphorous	mg/L	APHA 23rd Edition 4500 P	0.12

Verified by

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Report No		: PCEI/TR-WW-077	Report Date	: 18.01.2020
S.No	**Parameters**	**Units**	**Test Method**	**Results**
23	Vanadium (as V)	mg/L	IS 3025 (Part 2)	BDL(DL:0.01)
24	Nitrate (as NO_3)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	8.51
25	Phenolic Compounds (C_6H_5OH)	mg/L	IS 3025 (Part 43) 1992(RA 2009)	BDL(DL:0.001)
26	Selenium (as Se)	mg/L	IS 3025 (Part 56) 2003 (RA 2014)	BDL(DL:0.002)
27	Silver (as Ag)	mg/L	IS 13428:2005 (Annex J)	BDL(DL:0.001)
28	Sulphates (as SO_4)	mg/L	IS 3025 (Part 24) 1986 (RA 2014)	21.6
29	Sulphide (as H_2S)	mg/L	IS 3025 (Part 29) 1986 (RA 2003)	BDL(DL:1.0)
30	Ammonical Nitrogen (as N)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	2.3
31	Total Kjehdahl Nitrogen (as N)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	4.7
32	Zinc (as Zn)	mg/L	IS 3025 (Part 49) 1994 (RA 2014)	0.14
33	Cadmium (as Cd)	mg/L	IS 3025 (Part 41) 1992 (RA 2014)	BDL(DL:0.01)
34	Cyanide (as CN)	mg/L	IS 3025 (Part 27) 1986 (RA 2014)	BDL(DL:0.01)
35	Lead (as Pb)	mg/L	IS 3025 (Part 47) 1994 (RA 2014)	BDL(DL:0.01)
36	Mercury (as Hg)	mg/L	IS 3025 (Part 48) 1994 (RA 2014)	BDL(DL:0.0001)
37	Nickel (as Ni)	mg/L	IS 3025 (Part 54) (RA 2003)	BDL(DL:0.01)
38	Total Phosphate	mg/L	IS 3025 (Part 31) 1988 (RA 2019)	BDL(DL:0.1)
39	Dissolved Phosphate (as PO_4)	mg/L	IS 3025 (Part 31) 1988 (RA 2019)	BDL(DL:0.1)
40	Arsenic (as As)	mg/L	IS 3025 (Part 37) 1988 (RA 2014)	BDL (DL:0.5)
41	Chromium (as Cr)	mg/L	IS 3025 (Part 52) 2003 (RA 2014)	BDL (DL:0.5)
42	Total Hardness (as $CaCO_3$)	mg/L	IS 3025 (Part 21) 2009 (RA 2014)	79.2
43	Sodium (as Na)	mg/L	IS 3025 (Part 45) 1993 (RA 2014)	9.23
44	Potassium (as K)	mg/L	IS 3025 (Part 45) 1993 (RA 2014)	4.7
45	Total Alkalinity (as $CaCO_3$)	mg/L	IS 3025 (Part 23) 1986 (RA 2014)	76.8
Micro-Biological Parameters				
46	Escherichia coli (MPN)	MPN/100ml	IS 1622:1981 (RA 2009)	12
47	Total coliform (MPN)	MPN/100ml	IS 1622:1981 (RA 2009)	23
48	Fecal Coliform	MPN/100ml	IS 1622:1981 (RA 2009)	21

Note: BDL - Below Detection Limit; DL - Detection Limit

..... End of Report .....

Verified by

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Koovam River Water

Report No	: PCEI/TR-WW-078	**Report Date**	: 18.01.2020
ULR No.	: ULR-TC744620000000076P		
Issued to	: **M/S. Tamilnadu Road Infrastructure Development Corporation (TNRIDC)** LLA Building, 4th Floor, 735, Anna Salai, Chennai - 600 002		
Sampling Method	: IS 3025 (Part 1) 1987 (RA 2003)		
Sampled by	: Laboratory		
Sample Collected Date	: 08.01.2020	**Sample Reference No**	: PCEI/WW-N078-01-20
Sample Description	: **Waste Water**	**Sample Received On**	: 08.01.2020
Qty of Sample Received	: 2.5 Litre	**Test Commenced On**	: 08.01.2020
Sample Condition	: Fit for Analysis	**Test Completed On**	: 17.01.2020
Latitude	: 13.108897 N 13°06'32.0"	**Longitude**	: 79.959359E 79°57'33.7"
Sampling Location	: **Koovam River Water**		

S.No	Parameters	Units	Test Method	Results
1	pH @ 25°C	-	IS 3025 (Part 11) 1983 (RA 2017)	8.02
2	Turbidity	NTU	IS 3025 (Part 10) 1984 (RA 2017)	2.7
3	Total Dissolved Solids (TDS) @ 180°C	mg/L	IS 3025 (Part 16) 1984 (RA 2014)	610
4	Dissolved Oxygen	mg/L	IS 3025 (Part 38) 1989 (RA 2019)	6.1
5	Aluminium (as Al)	mg/L	IS 3025 (Part 55) 2003 (RA 2014)	BDL(DL:0.01)
6	Ammonia (as total Ammonia - N)	mg/L	IS 3025 (Part 34) 1988 (RA 2003)	BDL(DL:1.0)
7	Total Suspended Solids @ 105°C	mg/L	IS 3025 (Part 17) 1984 (RA 2017)	5.13
8	Barium (as Ba)	mg/L	IS 13428:2014 (Annex K)	BDL(DL:0.01)
9	Boron (as B)	mg/L	IS 3025 (Part 57) 2005 (RA 2017)	BDL(DL:0.01)
10	Calcium (as Ca)	mg/L	IS 3025 (Part 40) 1991 (RA 2014)	46
11	Chloride (as Cl)	mg/L	IS 3025 (Part 32) 1988 (RA 2014)	124
12	Copper (as Cu)	mg/L	IS 3025 (Part 42) 1992 (RA 2014)	BDL(DL:0.01)
13	Fluoride (as F)	mg/L	APHA 23rd Edition 4500 F-D	0.5
14	Iron (as Fe)	mg/L	IS 3025 (Part 53) 2003 (RA 2014)	0.09
15	Magnesium (Mg)	mg/L	IS 3025 (Part 46) 1994 (RA 2014)	20.2
16	Manganese (as Mn)	mg/L	IS 3025 (Part 59) 2006 (RA 2017)	BDL(DL:0.01)
17	Total Nitrogen	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	9.1
18	Oil & Grease	mg/L	IS 3025 (Part 39) 1991 (RA 2014)	BDL(DL:5.0)
19	Hexavalent Chromium (as Cr^{+6})	mg/L	IS 3025 (Part 52) 2003 (RA 2014)	0.044
20	Biochemical Oxygen Demand (BOD) (3 days at 27°C)	mg/L	IS 3025 (Part 44) 1993 (RA 2014)	4.6
21	Chemical Oxygen Demand (COD)	mg/L	IS 3025 (Part 58) 2006 (RA 2017)	16
22	Organic Phosphorous	mg/L	APHA 23rd Edition 4500 P	BDL(DL:0.1)

Verified by

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Report No		: PCEI/TR-WW-078	Report Date	: 18.01.2020
S.No	**Parameters**	**Units**	**Test Method**	**Results**
23	Vanadium (as V)	mg/L	IS 3025 (Part 2)	BDL(DL:0.01)
24	Nitrate (as NO_3)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	8.37
25	Phenolic Compounds (C_6H_5OH)	mg/L	IS 3025 (Part 43) 1992(RA 2009)	BDL(DL:0.001)
26	Selenium (as Se)	mg/L	IS 3025 (Part 56) 2003 (RA 2014)	BDL(DL:0.002)
27	Silver (as Ag)	mg/L	IS 13428:2005 (Annex J)	BDL(DL:0.001)
28	Sulphates (as SO_4)	mg/L	IS 3025 (Part 24) 1986 (RA 2014)	40.8
29	Sulphide (as H_2S)	mg/L	IS 3025 (Part 29) 1986 (RA 2003)	BDL(DL:1.0)
30	Ammonical Nitrogen (as N)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	BDL(DL:1.0)
31	Total Kjehdahl Nitrogen (as N)	mg/L	IS 3025 (Part 34) 1988 (RA 2014)	BDL(DL:1.0)
32	Zinc (as Zn)	mg/L	IS 3025 (Part 49) 1994 (RA 2014)	1.1
33	Cadmium (as Cd)	mg/L	IS 3025 (Part 41) 1992 (RA 2014)	BDL(DL:0.01)
34	Cyanide (as CN)	mg/L	IS 3025 (Part 27) 1986 (RA 2014)	BDL(DL:0.01)
35	Lead (as Pb)	mg/L	IS 3025 (Part 47) 1994 (RA 2014)	BDL(DL:0.01)
36	Mercury (as Hg)	mg/L	IS 3025 (Part 48) 1994 (RA 2014)	BDL(DL:0.0001)
37	Nickel (as Ni)	mg/L	IS 3025 (Part 54) (RA 2003)	BDL(DL:0.01)
38	Total Phosphate	mg/L	IS 3025 (Part 31) 1988 (RA 2019)	0.62
39	Dissolved Phosphate (as PO_4)	mg/L	IS 3025 (Part 31) 1988 (RA 2019)	0.41
40	Arsenic (as As)	mg/L	IS 3025 (Part 37) 1988 (RA 2014)	BDL (DL:0.5)
41	Chromium (as Cr)	mg/L	IS 3025 (Part 52) 2003 (RA 2014)	BDL (DL:0.5)
42	Total Hardness (as $CaCO_3$)	mg/L	IS 3025 (Part 21) 2009 (RA 2014)	198
43	Sodium (as Na)	mg/L	IS 3025 (Part 45) 1993 (RA 2014)	42.6
44	Potassium (as K)	mg/L	IS 3025 (Part 45) 1993 (RA 2014)	7.01
45	Total Alkalinity (as $CaCO_3$)	mg/L	IS 3025 (Part 23) 1986 (RA 2014)	192
Micro-Biological Parameters				
46	Escherichia coli (MPN)	MPN/100ml	IS 1622:1981 (RA 2009)	8
47	Total coliform (MPN)	MPN/100ml	IS 1622:1981 (RA 2009)	23
48	Fecal Coliform	MPN/100ml	IS 1622:1981 (RA 2009)	11

Note: BDL - Below Detection Limit; DL - Detection Limit

..... End of Report .....

Verified by

Authorised Signatory
Name: Krishnan G
Designation: Technical Manager

Annexure - 3

Public Consultation

Purpose: Environmental Clearance

Location: S.V.Rajammal Thirumana Mahal, Thamaraipakkam

Date: 12/07/2018

Tamil Nadu Highways Department (TNHD) with assistance from the Tamil Nadu Pollution Control Board (TNPCB) has conducted the public hearing/ consultation on 12/07/2018 at Thamaraipakkam, Thruvallur District. The public hearing/ consultation has been chaired by the Thiruvallur District Collector. The group of officials from the TNHD and the Consultants who have designed the road alignment are also presented in the meeting to clarify the queries from the Public. With a brief introduction to the project, the public hearing has been initiated. The views shared by the public were noted and a suitable response was given.

Sl.no	Participants	Views expressed by the Public
1.	Mr. Kannan, Pungamedu Minjur village	• Information on the project traffic is not clearly defined in the report (DPR) • Highlighted the water stagnant issues if the road has been constructed without adequate storm water drain • Requested to look for an alternate alignment to safeguard the residential plots • Proposal for control of dust pollution during project operation to prevent the unhygienic living condition to the locals residing near the CPRR • Requested to estimate the carbon sink with project scenario and without project scenario • Requested for a bypass near Minjur to avoid heavy traffic
2.	Mr. N.Arumugam, Bharathinagar, Minjur	• As part of the project, he requested the district collector to clear a canal from encroachment for waterway • Requested to realign the Road without affecting his residential area
3.	Mr. Duraiarasu, Krishna Nagar, Putlur	• Project uncertainty, whether the project will come to existence or not • He had requested the project alignment on the village map should be made available in the VO office or Panchayat Office for public reference • He was assuming that the project was funded by JICA, hence requested to share the projected related information with the public for better understanding • The proposed road will promote the container movement to the Ennore and Kattupalli port, hence the Thiruvallur public is not benefited from this project • He had requested to consider the LA in Thiruvallur District as there are more Dalit people living and hence the LA for the project should not affect them. • He informed that in Village Putlur some ancient stones are representing the stone age period are available and hence suggested to safeguard the stone during the construction • He insisted there may be archaeological chance find possible

Sl.no	Participants	Views expressed by the Public
4.	Mr. Athiseshan, Pungamedu Minjur	• Requested for alternate alignment for safeguarding the residents • He had requested for repair works in the surrounding areas for smooth traffic
5.	Mr. G. Sampath, Thamaraipakkam	• He objected to the LA of agriculture areas and referred to the Chennai-Salem highway case as an example. • Due to the proposed 6 lane, there will be a significant agriculture land loss and it will affect the small farmers • He requested the District collector to widen the existing road rather than for a new road alignment
6.	Mr. Kannan Athangikavanur	• He expressed that the project report is silent on the impact on the farmers. • An alternate arrangement for the farmers are not detailed in the project • Requested to share the project report with the farmers with land details for their references • He requested for bore well and water supply as part of the compensation measures • For loss of structures, he has requested for an alternate structure
7.	Mr. Satheeshan Ramanujathasan	• Due to the LA, there is Loss of livelihood for the villagers and hence it has to be compensated through the provision of jobs • He shared that the road has been designed for the corporate and not for the local people • He raised compensation paid by the government is only 50% of the market cost and requested for more • He suggested not to disturb the Cultural Resource Properties (CPR's).
8.	Mr. Venugopal, Melsanpattu Village	• He raised issues that use of flyash as embankment material, contaminate/ pollute the surface water quality and also it causes eye problems (irritation) • He had requested to form the road using government land rather than private land • He requested to remove the roadblocks properly after the completion of the construction to avoid the accidents
9.	Mr. Ramalingam, Natham Village, Ponneri Taluk	• Because of the road construction, his bore well and the agriculture land will be affected and hence he requested to avoid the road formation through his land
10.	Mr. Dhanjayan Natham Village, Ponneri Taluk	• Due to the road formation, his small scale industry is getting affected • He requested clarifications on the road classification whether it is an expressway or Highways
11.	Mr. Kuppan, Punnapakkam	• Requested for 10 times the compensation for the loss of land and a government job • He requested not to transfer the land to any private parties • He suggested using government land for the formation of the road
12.	Mr. Devendran, Punnapakkam	• Information given in the draft report is not mentioned about the villages, area and survey numbers • Provisions for water carrying pipeline are not indicated in the road alignment

Sl.no	Participants	Views expressed by the Public
		• He had requested for the adequate compensation for the farmers' livelihood losses
13.	Mr. Palani, Ammanapakkam	• He requested for alternate land for the farmers, those who are losing the agriculture land • He also suggested providing government jobs for the project affected peoples • He requested to plant more trees/ compensatory afforestation for the loss of avenue trees
14.	Mr. Gopi, Consultant	• He assured that the points raised for alternate alignment will be considered • For the queries related to the air and noise pollution, he informed that the baseline studies have been conducted and suitable mitigation measure has been prepared in the EMP • He clarified that the project is not a highway or expressway, it is only a peripheral road • He explained the VUP's, intersections and the CD structure information to detail the movement of traffic and the drain management adopted in the project • The information about the 15(2) notification is under preparation and it shall be shared with the PAP's • To control water pollution, instead of Flyash for the embankment, normal soil shall be utilised/ suggested in the report • He detailed the project construction schedule
15.	Mr. Ramalingam, Nandhiyambakkam	• Earlier (in 2007) it was informed that 4 times the compensation shall be paid, but now it is informed that only 1.25times compensation shall be paid within 30km distance, 1.5 times for above 30km and 2 times for above 50km, which is causing confusion • He requested for realignment options
16.	Mr. Ilangovan, Putlur	• He requested for clarity in the villages, that are getting affected and also to check the possibilities of utilising the government land
17.	Mr. Sasikumar, Minjur	• Requested for the entitlement for the loss of land • Compensation has to be made as per the market cost
18.	Mr. Suresh Kumar, Vishnuvakkam	• He requested to utilise the available government land for the widening purposes rather than using agriculture land • The remaining land after LA is not suitable for any purpose and hence he requested to acquire the while • He had requested to pay compensation as per the market value (not as per the guideline value)
19.	Mr. Vivekandhan, Nanthiyambakkam	• Based on the earlier design his house was not affected, however, as per the new design, his property along with the house is getting affected. Hence, requested to adopt the earlier design
20.	Mrs. Sujatha, Pungamedu	• Suggested to construct the road without affecting the public interest • She objected the road formation within the settlement areas • She has raised her concern regarding the livelihood loss

Sl.no	Participants	Views expressed by the Public
21.	Mr. Jayakumar, Putlur	• Requested to share the Project informing the exact map, measurement, passing through villages, affected survey no's, total length and width.
22.	Mr. Gunasekeran, Bandikkavanoor Village	• The public is not aware of the proposed road • Already he had suffered from the HTL and ONGC pipeline projects and now he has been impacted due to the proposed CPRR • Raised concern about the loss of livelihood
23.	Mrs. Kesavammal, Pungamedu, Madura Nagar	• Requested the district collector to take action on the petition submitted earlier to prevent the construction of the link road
24.	Mr. Gokul Raj, (Voice of Nature)	• Loss of water bodies to be compensated • An alternate site for bypassing the forest area getting affected due to the proposed project should have been identified • Requested for compensatory afforestation during the construction phase itself.
25.	Mr. Vijayaraghavan	• Suggested to utilise the government land for widening purposes
26.	Mr. Gopi, Consultant	• Concerning the PAP's land information, it was informed that landowner, survey no will be specified in the land plan schedule after verification at the site • For the impact on the water bodies, it was informed that appropriate provisions including CD's, bridges are provided in the design to reduce the impact on the loss of water bodies • For the loss of forest land, it was informed that 2 times the area of the acquired forest land has been handed over to the forest department as compensation • For the loss of avenue trees, tree transplantation measures as been proposed and nearly 2000 trees located in the footpath and the median will be retained
27.	DEE, TNPCB Thiruvallur	• He had informed that all the views shared by the public are recorded and suitable measures/ responses shall be taken accordingly

Annexure – 4

Settlements along the CPRR (Section 2 and Section 3)

Section – 2 (Ch : 21.100 to 47.300)						
Sl. No.	**Starting Chainage**	**Ending Chainage**	**District**	**Taluk**	**Village Name**	**Length (km)**
1	21/100	21/465	0.365	Thiruvallur	Ponneri	Panjetti
2	21/465	22/762	1.297	Thiruvallur	Ponneri	Ernavakkam
3	22/762	23/600	0.838	Thiruvallur	Ponneri	Natham
4	23/600	24/534	0.934	Thiruvallur	Uthukkotai	Kurambakkam
5	24/534	29/576	5.042	Thiruvallur	Uthukkotai	Kannigaipair
6	29/576	32/928	3.352	Thiruvallur	Uthukkotai	Alapakkam
7	32/928	35/065	2.137	Thiruvallur	Uthukkotai	Athankinikavanoor
8	35/065	37/017	1.952	Thiruvallur	Uthukottai	Punnapakkam
9	37/017	38/051	1.034	Thiruvallur	Uthukottai	Ammanampakkam
10	38/051	42/307	4.256	Thiruvallur	Thiruvallur	Velliyur
11	42/307	42/973	0.666	Thiruvallur	Thiruvallur	Karikalavakkam
12	42/973	43/826	0.853	Thiruvallur	Thiruvallur	Vishnuvakkam
13	43/826	45/867	2.041	Thiruvallur	Thiruvallur	Kizhanoor
14	45/867	47/300	1.433	Thiruvallur	Thiruvallur	Melanoor
Total Length			**26.20**			

Section - 3 (Ch : 47.300 to 77.900)						
Sl. No.	**Starting Chainage**	**Ending Chainage**	**District**	**Taluk**	**Village Name**	**Length (km)**
1	47/300	47/727	0.427	Thiruvallur	Thiruvallur	Kizhanoor
2	47/727	51/485	3.758	Thiruvallur	Thiruvallur	Ikkadu
3	51/485	51/849	0.364	Thiruvallur	Thiruvallur	Thandalam
4	51/849	54/151	2.302	Thiruvallur	Thiruvallur	Thanneerkulam
5	54/151	55/461	1.310	Thiruvallur	Thiruvallur	Thozhuvur
6	55/461	57/668	2.207	Thiruvallur	Thiruvallur	Putlur
7	57/668	60/881	3.213	Thiruvallur	Thiruvallur	Vengathur
8	60/881	65/967	5.086	Thiruvallur	Thiruvallur	Polivakkam
9	65/967	67/340	1.373	Kancheepuram	Sriperumbudur	Kandamangalam
10	67/340	68/321	0.981	Kancheepuram	Sriperumbudur	Sengadu
11	68/321	70/034	1.713	Kancheepuram	Sriperumbudur	Mannur
12	70/034	72/757	2.723	Thiruvallur	Thiruvallur	Thodukadu
13	72/757	73/566	0.809	Kancheepuram	Sriperumbudur	Ayakolathur
14	73/566	77/900	4.334	Kancheepuram	Sriperumbudur	Sriperumbudur
Total Length			**30.60**			

Annexure - 5

Environmental Monitoring Formats

Format EM1: Selection of disposal site locations

From _____ To _____

(Give chainage and nearest settlements from both ends)

Criteria on which information for each site is to be collected	Site 1	Site 2	Site 3	Site 4
Area covered (m^2)				
Total Material that can be dumped within the site (m^3)				
Depth to which disposal is feasible (m)				
The distance of nearest watercourse (m)				
Nearest Settlement (m)				
Date/s of Community Consultation/s				
Whether the community is agreeable to siting of dumping site (Y/N)				
Date of Permission from Village Council President(VCP)				
Proposed future use of the Site				

Selected Site (tick anyone column only)
Certified that the above information is correct to the best of my knowledge and belief.

(Contractor)

Verified: Date:

Recommendation on the suitability of the site

Signed: Date:
Name & Designation:

Decision Taken (tick one): Approved/Not Approved

Signed: Date:

Name and Designation of Deciding Authority

Enclosures
(Tick as appropriate)
1 Maps of each location
2 Photographs
a Each disposal location
b Each community consultation
3 Photocopies of permissions from VCPs

Name and Designation of Verifier:

Format EM2: Construction Camp and Storage Area

Construction Stage: Report - Date____ Month_____ Year_____

(Site Layout of Construction camp and working drawings of dwelling units with allied facilities to be attached with format)

Format to be submitted before the target date (decided by PIU) of establishing camps

Location of Camp (km_____)

Sl. No	Item	Unit	Details	Remarks
1	Detail of item camp			
a	Size of Camp	m x m		
b	Area of Camp	sq.m		
c	Distance from Nearest Settlement			
d	Distance from Nearest Water Source	Type/Size/Capacity/Present Use/Ownership		
e	Date of the camp being operational dd/mm/yy			
f	Present land use			
g	No other trees with girth > 0.3m.			
h	Details of Storage area(Availability of impervious surface)	m x m		
i	Availability of separate waste disposal from storage area	Cum		
2	Details of top soil stacking			
a	Quantity of top soil removed	sq.m		
b	Detail of storage of topsoil	Describe stacking arrangement		
3	Details of workforce			
a	Total No of Labourers	nos		
b	Total no of Male Workers	nos		
c	No of Male Workers below 18 years of age	nos		
d	Total No of Female Workers	nos		
e	No of Female workers below 18 years of age	nos		
f	No of children	nos		
4	Details of dwelling units			
a	No of dwellings/huts	nos		
b	Minimum Size of Dwelling	m x m		
c	No of openings per dwelling	nos		
d	Minimum size of opening	m x m		
e	Walls	specifications		
f	Roofing	specifications		
g	Flooring	specifications		
h	Drinking-Water Tank	specifications		
i	Capacity of Drinking water Tank	cum		
j	Size of Drinking Water Tank	m x m x m		
k	Total no of WC	nos		
l	No of Wcs for female workers	nos		
m	Minimum Size of WC	m x m		
n	Total No of Bathrooms for female workers	nos		
o	Size of septic tank for WC/Baths	m x m x m		
p	Capacity of Water Tank for WCs/ Bathrooms and general-purpose			
q	Fencing around camp	Y/N		
5	Details of facilities			
a	Availability of security guard 24 hrs a day	Yes/No		
b	Details of First Aid Facility	Yes/No		
c	Availability of Day Care Centre	Yes/No		
d	Availability of dust bins (capacity 60 ltr)	nos		

Certified that the furnished information is correct the quality of work is as per god practice and all relevant information as required is attached

Supervision Consultant

Format EM3: Reporting for Borrow Areas

Construction Stage Report: Date ____ Month_____ Year_____ Site Layout of Borrow Area and Proposed Borrow Area Redevelopment Plan to be attached with format Format to be submitted before target date as (decided by PIU) for establishing Borrow Areas Borrow Area No. BA_____
Location of Borrow Area (Km_____)

Sl. No	Item	Unit	Details	Remarks by SC, if any
1	Details of Borrow Area			
a	Date of Borrow Area becoming operational dd/mm/yy			
b	Current Landuse			
c	Distance from Nearest Settlement	Km		
d	No of settlements within 200m of Haul Road	No.		
e	No of settlements within 500m of Borrow Area	No.		
f	Total Capacity	cum		
g	No of Trees with girth more than 0.3 m	No.		
h	Length of Haul Road	km		
i	Width of Haul road	m		
j	Type of Haul Road	metal/dirt		
k	Size of Borrow Area	Sq.km		
l	Area of Borrow Area	km x km		
m	Quantity Available	cum		
n	The distance of Nearest Water Source	Type/Size/Capacity/Present Use/Ownership		
o	Quantity of top soil removed	cum		
p	Detail of storage of topsoil			
q	Daily/occasional use of the Borrow Area by the community, if any	-		
r	Probable reuse of Borrow pit-ask community	-		
s	Drainage channels/slope/characteristics of the area	-		
2	Enhancement Elements			
a	Quantity of top soil removed	sq.m		
b	Detail of storage of topsoil	sq.m		
c	Adjoining land use/Natural elements			
d	Nearby catchment for storing water			
e	Erosion Control Programme			
f	Preventive measures for			
i	Leaching			
ii	Mosquito Breeding			
iii	Water run-off/contamination			
iv	Any other environmental degradation			
3	Details of the workforce			
a	Total No of Labourers	No.		
b	Total no of Male Workers	No.		
c	No of Male Workers below 18 years of age	No.		
d	Total No of Female Workers	No.		
e	No of Female workers below 18 years of age	No.		
4	Details of redevelopment, Plan to be enclosed			

Certified that the furnished information is correct the quality of work is as per good practice and all relevant information as required is attached

Supervision Consultant Contractor

Format EM4: Tree Felling/ Tree Transplantation

S.No	Links	Physical Target				Completion Target		
		Total	Target	Target Achieved	% of task completed	Target Date	Date of Completion if task completed	Reason for Delay if any
		Unit						
1		nos						
2		nos						
3		nos						
4		nos						

(Signed)

PIU

Format EM5: Tree Plantation

Construction Stage: Quarterly Report –Date____ Month_____ Year_____

Sl. No	Activity	Physical Target					Financial Target			Completion Target		
		Target (tree/shrubs to be planted in Package) for this Quarter		Target Achieved		% of task completed	Total (lakhs)	Budget Spent	% used	Target Date	Date of Completion/% completed	Reason for Delay if any
		Km (From) / No.	Km (To) / No.	No. of Trees	Survival Rate (%)							
1	Tree Plantation along roadside											
2	Plantation at Locations identified for enhancement											
3	Survival status of Transplanted trees											

Certified that the above information is correct

PIU

EM6: Topsoil Conservation Monitoring

Contract _____

Report No. _____ Date_____

Location (Chainage)	Original Use of Topsoil removed	Measures for preventing spillage of topsoil on Haul Roads(Earthen/ Metalled)	Present Method of Storage	Anticipated period of Storage (Months)	Distance of nearest Water course (m)	Present Slope of Pile (V: H)	Whether silt fencing provided?	Is any other covering / measure provided? If yes, what is it?	Improvements required	Extent of Compliance as on date of report

Certified that the above is true.

Signed_____

(Authourised Representative of the contractor)

Verified

Signed_____

(Environmental Specialist of the Supervision Consultant)

EM7: Redevelopment of Borrow Areas

Operation Stage: Report: Date ____ Month_____ Year_____
To be monitored by Supervision Consultant during operation period
Details of remarks to be appended wherever necessary.

Sl.no	Activity	Particulars	Drawbacks Identified			Improvements Required		
			Construction	Financial	Others (Ask Community)	Technical	Financial	Remarks/ Suggestions
1	Details of Borrow area and Surrounding Landuse							
2	End use of the borrow area							
3	Whether rehabilitation has been carried out in line with owners request							
4	Erosion Control Measures							
5	Number of trees planted							
6	Reuse of topsoil							
7	Preventive measures taken for -Mosquito Breeding -Water runoff/ contamination -Other Environmental Degradation							
8	Any problems faced by owner							
9	Any problems faced by the local community							
10	If it has been developed as a fish pond							
a	Details of available catchment for storing water							
b	Economic Benefits/Utility							
11	If it has been developed as an orchard							
a	Details of suitability of soil and water.							
B	Type of Plantation							
c	Economic Benefits/Utility							
12	Any Other End use							
a	Particulars							
b	Economic Benefits/Utility							

Supervision Consultant Contractor

EM8: Checklist for Construction Safety

Sl. No.	Safety Issues	Yes	No	Non compliance	Corrective Action	Penalty	Remarks
Safety during Construction Stage							
1	Appointment of qualified Construction safety officers						
2	Approval for Construction Safety Management Plan by the Engineer.						
3	Approval for Traffic Management/control Plan in accordance with IRC: SP: 55-2001						
4	Maintenance of the existing road stretches handed over to the Contractor.						
5	Provision of Temporary Traffic Barriers/Barricades/caution tapes in construction zones						
6	Provision of traffic sign boards						
7	Provision for flags and warning lights						
8	Provision of metal drum/empty bitumen drum delineator, painted in circumferential strips of alternate black and white 100mm wide 2 coats fitted with reflectors 3 Nos of 7.5cm diameter						
9	Providing plastic crash barrier						
10	Provision of adequate staging, form work and access (ladders with handrail) for works at a height of more than 3.0 m						
11	Provision of adequate shoring / bracing / barricading / lighting for all deep excavations of more than 3.0 m depth.						
12	Demarcations (fencing, guarding and watching) at construction sites						
13	Provision for sufficient lighting especially for night time work						
14	Arrangements for controlled access and entry to Construction zones						
15	Safety arrangements for Road users / Pedestrians						
16	Arrangements for detouring traffic to alternate facilities						
17	Regular Inspection of Work Zone Traffic Control Devices by authorized contractor personnel						

Sl. No.	Safety Issues	Yes	No	Non compliance	Corrective Action	Penalty	Remarks
18	Construction Workers safety - Provision of personnel protective equipment						
19	A. Helmets						
	B. Safety Shoe						
	C. Dust masks						
	D. Hand Gloves						
	E. Safety Belts						
	F. Reflective Jackets						
	G. Earplugs for labour						
20	Workers employed on bituminous works, stone crushers, concrete batching plants etc. provided with protective goggles, gloves, gumboots etc.						
21	Workers engaged in welding work shall be provided with welder protective shields						
22	All vehicles are provided with reverse horns.						
23	All scaffolds, ladders and other safety devices shall be maintained in as safe and sound condition						
24	Regular health checkup for labour/ Contractor's personnel						
25	Ensuring the sanitary conditions and all waste disposal procedures & methods in the camps.						
26	The Contractor shall provide adequate circuit for traffic flow around construction areas, control speed of construction vehicles through road safety and training of drivers, provide adequate signage, barriers and flag persons for traffic control						
27	Provision for insurance coverage to the contractor's personnel						
28	COVID 19 Health check-up for labour/ Contractor's personnel						

Supervision Consultant Contractor

Format EC1: Target Sheet for Pollution Monitoring

Construction Stage: Report - Date_____ Month_____ Year_____

(Locations at which monitoring to be conducted as per EMP)

Sl. No	Chainage	Details of Location	Duration of Monitoring	Instruments Used	Completion Target		Reason for Delay if any
					Target Date	Date of Completion if task completed	
Air Monitoring							
1							
2							
3							
4							
5							
Water Monitoring							
1							
2							
3							
4							
5							
Noise Monitoring							
1							
2							
3							
4							
5							

Certified that the Pollution Monitoring has been conducted at all the locations specified in the EMP

Supervision Consultant Contractor

Format EC 2: Target Sheet for Pollution Monitoring

Operation Stage: Report - Date_____ Month_____ Year_____

(Locations at which monitoring to be conducted)

Sl. No	Chainage	Details of Location	Duration of Monitoring	Instruments Used	Completion Target		Reason for Delay if any
					Target Date	Date of Completion if task completed	
Air Monitoring							
1							
2							
3							
4							
5							
Water Monitoring							
1							
2							
3							
4							
5							
Noise Monitoring							
1							
2							
3							
4							
5							

Certified that the Pollution Monitoring has been conducted at all the locations specified in the EMP

Supervision Consultant

Format OP 1: Survival Rate of Trees

Operation Stage: Report - Date_____ Month_____ Year_____

S. No.	Landscape Section	Roadside Trees			Landscaping at Junctions			Turfing on Embankment		
	Km-Km	Total Trees Planted	Total Surviving	% Survival	Total Shrubs Planted	Total Surviving	% Survival	Total Area Turfed	Total Turfed Area Surviving	% Survival
		Nos.	Nos.	%	Nos.	Nos.	%	Sqm.	Sqm.	%

Certified that the above information is correct

Forest Wing of PIU

Format OP2: Redevelopment of Borrow Areas

Operation Stage: Report: Date ____ Month_____ Year_____
To be monitored by PIU during operation period
Details of remarks to be appended wherever necessary.

Sl. No	Activity	Particulars	Drawbacks Identified			Improvements Required		
			Construction	Financial	Others (Ask Community)	Technical	Financial	Remarks/ Suggestions
1	Details of Borrow area and Surrounding Landuse							
2	End use of the borrow area							
3	Whether rehabilitation has been carried out in line with owners request							
4	Erosion Control Measures							
5	Number of trees planted							
6	Reuse of topsoil							
7	Preventive measures taken for -Mosquito Breeding -Water runoff/ contamination -Other Environmental Degradation							
8	Any problems faced by owner							
9	Any problems faced by the local community							
10	If it has been developed as a fish pond,							
A	Details of available catchment for storing water							
B	List of Fish species that can survive in that area							
C	Economic Benefits/Utility							
11	If it has been developed as an orchard							
A	Details of suitability of soil and water.							
B	Type of Plantation							
C	Economic Benefits/Utility							
12	Any Other End use							
A	Particulars							
B	Economic Benefits/Utility							

Signed

(Environmental Specialist of PIU)

Annexure – 6

Environmental and Social Monitoring Report

Reporting Period {From Month Year to Month Year}
Date {Month Year}

Title of the Project

{Example: India: Chennai Peripheral Ring Road}

Prepared by Client {replace with the full name} for the Asian Infrastructure Investment Bank

Environmental and Social Monitoring Report

{Red text serves as guide for report preparation, please delete when report is finalized.}

TITLE PAGE

TABLE OF CONTENTS

LIST OF ABBREVIATIONS {All abbreviations in the report test should be listed here}

EXECUTIVE SUMMARY

{a summary of the project's status and environmental and social (ES) compliance during the reporting period}

1. Introduction

1.1 Brief Project Description {Include maps showing site location and vicinity if needed}

1.2 Land Acquisition Progress

Name of the Place	Govt Land Required	Govt Land Obtained	Private Land Required	Private Land Acquired
Total				

{A brief description of the status of land acquired, procedure of land acquisition and any major bottleneck}

1.3 Summary of Resettlement & Compensation

Total Land Required	Total Land Acquired	Balance land to be acquired	Total number of PAPs		
			Land sellers	Physically displaced	Commercially displaced

{A brief description of the status of land acquired, number of PAPs involved, number of PAPs already compensated. If a RP has been prepared for the project, please provide progress on the implementation of the RP in section 6}

1.4 Project Progress Status and Implementation Schedule

{Describe the project milestones during the reporting period and highlight any change from original scope, alignment, methodology, and/or schedule.}

{The project Gantt chart may be included}

{Include a simplified table like the sample below}

Project Component • Stage	Commencement Date	Target Date {and Revised Target Date if delayed}	Progress Status {not yet started; ongoing; completed}	Percent Completed	Remarks
Elevated Component	*Example for reporting period Jan-June 2020*				
• Contract Award		31 Jan 2019	Completed	100%	Contract Awarded to XYZ Contractor
• Construction (e.g. civil works, installation of equipment, …)	1 Apr 2019	31 Mar 2022 (original target completion was 31 Dec 2021)	On-going	15%	There was a delay in the delivery of equipment…
•					
•					

2. Compliance with Applicable Regulations/Standards

{Include the applicable ES Regulations/Standards following the sample table below}

Regulations/Standards	Compliance Requirements under the Regulation	Compliance Status {complied; not complied; n/a at current stage of the project}	Remarks {provide details to show how compliance was achieved; or explain the corrective action done if there was non-compliance}
	e.g. clearance/permit/consents etc.		

3. Compliance with Environmental and Social Covenants from the AIIB Loan Agreement

{Include Loan Agreement covenants on environment and social following the sample table below}

Schedule #, Para. #	Covenant	Compliance Status {complied; not complied; n/a at current stage of the project}	Remarks {provide details to show how compliance was achieved; or explain the corrective action done if there was non-compliance}

4. Compliance with the Civil Work Contracts

{Include EHS and Labor Clauses following the sample table below}

Schedule #, Para. #	EHS and Labor Clauses	Compliance Status {complied; not complied; n/a at current stage of the project}	Remarks {provide details to show how compliance was achieved; or explain the corrective action done if there was non-compliance}
	GCC Sub-Clause Health and Safety		

5. Compliance with Environmental and Social Management Plan

{With reference to the ESMP and its cost, include a table with the compliance status during the reporting period, with remarks to show how compliance was achieved or not}

6. Compliance with Resettlement Plan

{With reference to the RP and its budget, include a table with the compliance status during the reporting period, with remarks to show how compliance was achieved or not}

7. Compliance with Gender Action Plan

{With reference to the GAP and its budget, include a table with the compliance status during the reporting period, with remarks to show how compliance was achieved or not}

8. Compliance with Indigenous People's Plan (If Any)

{With reference to the IPP, include a table with the compliance status during the reporting period, with remarks to show how compliance was achieved or not}

9. Summary of Monitoring Results

9.1 Environmental and Social Monitoring

{With reference to the Environmental and Social Monitoring Plan (ESMoP) (if any) of the project, include a table to summarize the results of the monitoring done during the reporting period, covering all monitoring elements in the ESMoP. Please summarize the inspections of implementation status, the analysis results, to suggest corrective actions in section 12. Please indicate the environmental elements monitoring locations, date, time (or duration as applicable), parameters measured, the standards, tests and limits used, and provide the corrective action plan in section 12 if there was any exceedance to the standards}

9.2 Capacity Building Monitoring

{With reference to the ES instruments of the project, include the trainings/drills conducted during the reporting period following the table below. Include as appendices the training/drill agenda, attendance sheets, and photos}

Trainings/Drills/ Inspections	Number and Position of Participant/s	Location/s and Date/s	Remarks
Example: Fire Drill	50 Laborers	15 Aug 2020	Participants safely evacuated the site…

9.3 Health and Safety Monitoring

{If there was any accident, near-miss, illness, or other incidents during the reporting period (or previously reported accident with ongoing rectification), provide the corrective action done following the table below. Include as appendices the work safety checklists, incident reports, and other relevant supporting documents}

Health and Safety	Number and Position of Person/s Involved	Location/s and Date/s of Incident	Description of Incident	Root Cause Analysis	Corrective Action
Fatality					
Non-fatal Injury					
Near-miss					
Illness					
Other Incidents					

9.4 Highlighted Actions

Items	Description
Vulnerable Groups	
Differently Abled	
Climate	
Others	

10. Stakeholder Engagement

{Summarize the stakeholder engagement activities and the results of the consultations conducted during the reporting period; assess if they conform to the Stakeholder Engagement Plan (SEP, if any); update the SEP for next stages if needed}

11. Implementation of Grievance Redress Mechanism and Complaints Received

{Include a description of the GRM, provide a flowchart and list of grievance redress committee members}

{If there was any grievance or complaint during the reporting period (or previously reported complaint with ongoing rectification), provide remarks following the table below}

Complainant/s (Worker or PAP)	Location/s and Date/s of Complaint	Description of Grievance/Complaint	Timeline*	Remarks (Resolution Status)

*As specified in the GRM arrangement of ES instruments

12. Corrective Action Plan

{Based on all the analysis above, prepare a time-bound corrective action plan if there was non-compliance or unanticipated ES impacts, and check the implementation status in the subsequent phase monitoring}

13. Conclusion and Recommendations

{Limit the conclusion to ES highlights or issues resolution during the reporting period, and the recommendations or actions to be done in the next period}

APPENDICES

Photographs {Include photographs of the project site taken during the reporting period. For each photo, provide a caption with description, location and date}

Supporting Documents {Laboratory results, meeting agenda and attendance, minutes, checklists, etc.}

Annexure - 7

Guideline for Tree Cutting and Afforestation

This Guideline discusses the issue of tree cutting and afforestation. Loss of trees creates adverse environmental impacts. In order to mitigate there impacts, suitable measures have been suggested as part of this Guideline. These measures have been given for each of the stages of the road construction activities.

1. PROJECT PLANNING AND DESIGN STAGE

During alignment finalisation, due consideration shall be given to minimise the loss of existing tree cover, encroachment of forest areas / protected areas etc, as specified in guideline on, "Site preparation". Tree felling, if unavoidable, shall be done only after compensatory plantation of ten saplings for every tree cut is done.

The plantation/afforestation would be done by the Contractor. It should be ensured that plantation is carried out only in areas where water can be made available during dry seasons and the plant can be protected during the initial stages of their growth. The species shall be identified giving due importance to local flora (suggested in **Table 1**). It is recommended to plant mixed species in case of both avenue or cluster plantation.

The plantation strategy shall suggest the planting of fruit bearing trees and other suitable trees. Development of cluster plantations will be encouraged in the community lands, at locations desired by the community. The choice of species will be based on the preferences of the community. The PIU shall oversee the plantation to check the following:

- Whether trees are obstructing live of right at junctions;
- Whether trees are at the inside of the junctions;
- Whether trees are within 5 mts of the proposed centerline.

2. POST-CONSTRUCTION STAGE

The maintenance of the saplings (including activities much as weeding, watering, planting of replacement saplings, etc application of manure etc) shall be the responsibility of the forest department. The PIU shall ensure the following:

- Shoulder of roads to be kept clear of weeds/undesirable undergrowth; and
- Branches of trees do not obstruct clear view of the informatory and cautions signs.

Table 1: Common Species (or) Localized Species of Tamil Nadu

Sl.no	Local name	Botanical name
1.	Neem	*Azadirachta indica*
2.	Pungan	*Pongamia glabra*
3.	Kadam Tree	*Neolamarkia cadamba*
4.	Bullet Wood	*Mimusops elangii*
5.	Fry Wood Tree	*Albizia lebbeck*
6.	Tamarind	*Tamarindus indica*
7.	Indian Almond Tree	*Terminalia Catappa*
8.	North Indian Rose wood Tree	*Dalbergia sissoo*
9.	Flame of the Forest	*Butea Monosperma*
10.	Dita Bark Tree	*Alstonia scholaris*
11.	Mahua	*Madhuca Longifolia*

Sl.no	Local name	Botanical name
12.	Bael	*Aegle marmelos*
13.	Indian tulip tree	*Thespesia populnea*
14.	Joy perfume tree	*Magnolia champaca*
15.	Arjun tree	*Terminalia arjuna*
16.	Bahera	*Terminalia bellerica*
17.	Peepal tree	*Ficus religiosa*
18.	Purple orchid tree	*Bauhinia variegata*
19.	Banyan tree	*Ficus benghalensis*
20.	Mango	*Mangifera indica*
21.	Jamun	*Syzigium cumini*
22.	Indian Laural Fig	*Ficus retusa*

Annexure - 8

Details of water bodies for CPRR Section II & Section III (Km 21/100 to 77/900)

Sl.no	Chainage	Water Bodies	Village	District	Remarks	Provisions	Estimation
Section 2							
1	23/600	Natham Lake	Natham	Thiruvallur	Crossing The Road	Minor Bridge of Span - 3X15	Rs.10.00Lakh
2	26/500	Kannigaipair Canal	Kannigaipair	Thiruvallur	Crossing The Road	Minor Bridge of Span- 1X15	Rs.5.00Lakh
3	29/280	Kannigaipair Canal & Lake	Kannigaipair	Thiruvallur	Crossing The Road	Major Bridge of Span - 11X30	Rs.10.00Lakh
4	29/330	Kannigaipair Lake	Kannigaipair	Thiruvallur	Crossing The Road	Major Bridge of Span - 18X10	Rs.5.00Lakh
5	30/740	Poorivakkam Lake	poorivakkam	Thiruvallur	Crossing The Road	Minor Bridge of Span - 2X15	Rs.15.00Lakh
6	32/800	Kilambakkam Lake	poorivakkam	Thiruvallur	Crossing The Road	Box culvert - 2X2m (Desilting of Supply Channel)	Rs.10.00Lakh
7	34/300	Athagai Kavanoor Lake	Athagai Kavanoor	Thiruvallur	Influenced by the Project	Box culvert - 2X2m (Desilting of Supply Channel)	Rs.10.00Lakh
8	34/400	Athagai Kavanoor Canal	Athagai Kavanoor	Thiruvallur	Crossing The Road	Minor Bridge of Span - 1X30 (Desilting of Supply Channel)	Rs.10.00Lakh
9	36/150	Punnapakkam Lake	Punnapakkam	Thiruvallur	Crossing The Road	Box culvert - 2X2m9 (Strengthening of Tank Bund)	Rs.30.00Lahs
10	36/800	Kosasthalaiyar River	Punnapakkam	Thiruvallur	Crossing The Road	Major Bridge of Span - 9X30	-
11	37/400	Ammanambakkam Canal	Ammanambakkam	Thiruvallur	Crossing The Road	Minor Bridge of Span - 1X30 (Desilting of Supply Channel)	Rs.10.00Lakh
12	41/500	Velliyur Lake	Velliyur	Thiruvallur	Influenced by the Project	Box culvert - 2X2m (Strengthening of Tank Bund)	Rs.10.00Lakh
13	42/400	Pond	Karikalavakkam	Thiruvallur	Crossing The Road	Minor Bridge of Span - 2X15	PU Pond
14	44/100	Vishnuvakkam Canal	Keelanur	Thiruvallur	Crossing The Road	Minor Bridge of Span- 1X15	Rs.5.00 Lakh
15	45/000	keelanur pond	Keelanur	Thiruvallur	Influenced by the project	Box culvert - 2X2m	PU Pond
16	46/650	keelanur Canal	Melanur	Thiruvallur	Crossing The Road	Minor Bridge of Span - 1X15	Rs.8.00Lakh
17	46/800	keelanur pond	Melanur	Thiruvallur	Influenced by the Project	Box culvert - 2X2m	PU Pond

Sl.no	Chainage	Water Bodies	Village	District	Remarks	Provisions	Estimation
18	47/700 to 48/700	Ikkadu Canal	Ikkadu	Thiruvallur	Along the Alignment	Land Required New Canal proposed parallel to alignment	Rs.10.00Lakh
						Total	**148.00 lakh**
Section 3							
19	50/300	Ikkadu Tank	Ikkadu	Thiruvallur	Crossing The Road	Minor Bridge of Span - 4X15	Rs.10.00Lakh
20	51/650	Kalyanakuppam Lake	Thandalam	Thiruvallur	Crossing The Road	Minor Bridge of Span- 4X15	Rs.5.00Lakh
21	53/500	Thannerkulam Tank	Thannerkulam	Thiruvallur	Influenced by the Project	Box culvert - 2X2m (Strengthening of Tank Bund)	Rs.15.00Lakh
22	53/800	Krishna Canal	Thannerkulam	Thiruvallur	Crossing The Road	Bridge Approach with Clover Leaf	Rs.5.00 Lakh
23	54/500	Thannerkulam Pond	Thozur	Thiruvallur	Crossing The Road	Bridge Approach with Clover Leaf	PU Pond
24	55/600	Ramapuram Lake (Thozhur)	Putlur	Thiruvallur	Influenced by the Project	Box culvert - 2X2m (Strengthening of Tank Bund)	Rs.10.00Lakh
25	55/800	Putlur Pond	Putlur	Thiruvallur	Influenced by the Project	Box culvert - 2X2m	PU Pond
26	57/550	Coovum River	Putlur	Thiruvallur	Crossing The Road	Major Bridge of Span- 14X30	-
27	58/350	Aranvayoal Tank	Vengathur	Thiruvallur	Crossing The Road	Minor Bridge of Span - 2X30 (Strengthening of Tank Bund)	Rs.20.00Lakh
28	62/900	Athikulam Tank (Polivakkam Chithi)	Polivakkam	Thiruvallur	Influenced by the Project	Box culvert - 2X2m	Rs.5.00Lakh
29	63/350	Athikulam Tank & Canal (Alijivakkam Odai)	Polivakkam	Thiruvallur	Crossing The Road	Minor Bridge of Span - 2X30 (Desilting of Odai)	Rs.15.00Lakh
30	65/150	Chathram Canal	Polivakkam	Thiruvallur	Crossing The Road	Minor Bridge of Span - 1X10	Rs.5.00 Lakh
31	70/500	Parangusapuram lake	Thodukadu	Thiruvallur	Influenced by the Project	Box culvert - 2X2m (Strengthening of Tank Bund)	Rs.10.00 Lakh
32	73/840	Surplus Canal	Sriperumbudur	Kancheepuram	Crossing The Road	Major Bridge of Span - 6X30	Rs.5.00 Lakh
33	75/500 to 77/000	Sriperumbudur lake	Sriperumbudur	Kancheepuram	Influenced by the Project	Elevated Bridge	Rs.30.0 Lakh
						Total	**135.00 Lakh**

Annexure – 9

Coastal Regulatory Zone Clearance

F.No.11-8/2019-IA-III
Government of India
Ministry of Environment, Forest and Climate Change
(IA.III Section)

Indira Paryavaran Bhawan,
Jor Bagh Road, New Delhi-3
Dated: 05th August, 2019

To,

The Divisional Engineer (H),
Construction & Maintenance,
Highways Department, Government of Tamil Nadu
Chengalpattu - 603001

Sub: CRZ Clearance for Development of peripheral road connecting Mahabalipuram to Ennore Port- via- Singaperumalkoil, Sriperumbudur, Thiruvallur, Thamaraipakkam, Periyapalayam, Puduvoyal and Kattupalli - reg.

Sir,

This has reference to your online proposal No. IA/TN/CRZ/87782/2018, received in this Ministry for CRZ Clearance of the above mentioned project, in accordance with the provisions of the Coastal Regulation Zone (CRZ) Notification, 2011 issued under the Environment (Protection) Act, 1986.

2. The proposal was considered by the Expert Appraisal Committee (EAC) for Infrastructure Development, Coastal Regulation Zone, Building/ Construction and Miscellaneous projects, in its meetings held on 21.05.2019 & 28.06.2019. The details of the project as per the documents submitted and presented during the aforesaid meetings are as under:

(i) The Peripheral road will start at Ennore Port and ends Poonjeri in Mahabalipuram. The proposed road will connect four National Highways – NH-5, NH-205, NH-4 and NH-45 and eight State Highways – SH-51, SH-50A, SH-50, SH-48, SH-57, SH-49B (OMR) and SH-49 (ECR). Length of proposed peripheral road will be around 133.381 km which is split into 5 sections as under:

- Section 1: Northern Port Access Road – Ennore Port to Thatchur on NH-5 (24.60 km)
- Section 2: Thachur on NH-5 to Start of Thiruvallur Bypass (26.40 km)
- Section 3: Start of Thiruvallur Bypass to Sriperumbudur on NH-4 (30.60 km)
- Section 4: Sriperumbudur on NH-4 to Singaperumalkoil on NH-45 (23.80 km)
- Section 5: Singaperumalkoil on NH-45 to Mahabalipuram (27.471 km).

S.No.	Description	Section-1	Section- 2	Section- 3	Section- 4	Section-5
1.	Right of way (RoW)	100m	60m	60m	40-60m	50m
2.	Number of lanes in Main Carriageway	2 X 2-lane with paved shoulder	2 X 3-lane with paved shoulder	2 X 3-lane with paved shoulder	2 X 3-lane with paved shoulder	2 X 2-lane with paved shoulder
3	Central Median	4.00m	4.00m	4.00m	1.0m	4.00m

4.	Service Road	2 X 2-lane	2 X 2-lane	2 X 2-lane	2 X 2-lane	2 X 2-lane
5.	Footpath/Drain/Utility Corridor	2 X 2m & 2 X 3	2 X 3m	2 X 3m	2 X 2.5m	2 X 3m
6.	Width of Main Carriageway in Structures	2 X 12.5m	2 X 12.5m	2 X 12.5m	2 X 12.5m	2 X 12.5m

(ii) *Section-1: Northern Port Access Road- Ennore Port to Thatchur on NH-5* along with the said chainage falls under Ponneri Taluk, Tiruvallur District. The North Port Access Road (NPAR) from norther gate of Ennore Port to thatchur on NH-5 (km 30/270) with connecting road to Tiruvottiyur-Ponneri-Panchetty (TPP) Road. The length of NPAR will be 21.12 km and TPP link road is 4.35 km.

(a) Ennore- Thatchur Road:

S.No.	Chainage (km)	Classification
1	0+000 to 0+639.374	Between HTL of creek and 100 m setback line from HTL of creek
2	0+639.374 to 0+706	
3	0+706 to 0+754	Creek water
4	0+754 to 0+782	Between HTL of creek and 100 m setback line from HTL of creek
5	0+782 to 1+051	Creek water
6	1+051 to 1+151	Between HTL of creek and 100 m setback line from HTL of creek
7	1+151 to 1+339	Non-CRZ
8	1+339 to 1+442	Between HTL of creek and 100 m setback line from HTL of creek
9	1+442 to 1+949	Salt Pan
10	1+949 to 2+427	Creek water
11	2+427 to 2+537	Between HTL of creek and 100 m setback line from HTL of creek
12	2+537 to 2+800	Non-CRZ

(b) Kattupalli Ramp

S.No.	Chainage (km)	Classification
1	0+000 to 0+406.652	Between HTL of creek and 100 m setback line from HTL of creek
2	0+406.652 to 0+409.652	Non-CRZ

(iii) The project road will cross two rivers viz. Cooum river and Kosathalai river, and a number of tanks, channels, nallahs, back water, Buckingham canal etc. Bridges are proposed for these waterway crossings. The project road requires diversion of forest land (10.23 Ha) in three reserve forests as follows: Mannur Reserve Forest (0.28 Ha); Thirutteri Reserve Forest (1.86 Ha); and Sengundram Reserve Forest (8.09 Ha).

(iv) For widening of existing road and construction of underpass, about 0.28 Ha of forest land in Mannur RF needs to be diverted in Section-3 segment. For forming new road,

about 9.95 Ha of forest land in Thirutteri RF and Sengundram RF needs to be diverted in Section-5 segment. Diversion of forest land are in progress.

(v) The NPAR is start at Ennore Port and will cross Buckingham Canal which falls in CRZ area. Length of project road within CRZ area is about 2.762 km covering about 82.64 ha. A major bridge is proposed for crossing the CRZ area.

(vi) Total number of piers in CRZ area will be 151 piers in which 19 piers will be on the existing road along the bund of Buckingham canal.

(vii) The above proposed development in CRZ areas are at CRZ-1B (intertidal area), CRZ – I, CRZ III & CRZ-IV as per the CRZ Notification, 2011 and are permissible activities regulated under para 8(I), CRZ-I (ii) (g); 8(i) III CRZ-III A (j) & B (viii) of CRZ Notification, 2011.

(viii) There are 4797 trees falling within the project corridor of entire length of Chennai Peripheral Road. As suggested by SEAC, 2168 number of trees will be retained in the median, divider, footpath etc. and the remaining 2629 will be transplanted, dismantling of 802 buildings within proposed right of way is required.

(ix) The environmental clearance for this Chennai peripheral road project has been issued by SEIAA Tamil Nadu vide their letter No. SEIAA/TN/F.6474/EC/7(f)/61/2018, dated 10th August, 2018.

(x) While the total project cost is around Rs. 11528 Crores, which includes the land acquisition cost of Rs. 4855 Crores, the cost of the portion under CRZ areas will be Rs. 49 crores.

(xi) DCZMA-Thiruvallur has forwarded its recommendation vide letter No.DEE/TNPCB/GMP/DCZMA/2018 dated 05.07.2018 and TNCZMA has recommended the project for CRZ clearance vide its letter No. 19509/EC.3/2018-1 dated 14.11.2018.

3. Based on the recommendation of the Tamil Nadu Coastal Zone Management Authority issued vide its letter No. 19509/EC.3/2018-1, dated 14.11.2018 and information submitted as at para no. 2 above and information provided during the presentation before the Expert Appraisal Committee and others, the Ministry of Environment, Forest and Climate Change, in acceptance of the recommendation of the Expert Appraisal Committee (CRZ), hereby accords CRZ Clearance to the above project viz '*Development of peripheral road connecting Mahabalipuram to Ennore Port- via- Singaperumalkoil, Sriperumbudur, Thiruvallur, Thamaraipakkam, Periyapalayam, Puduvoyal and Kattupalli*, under the provision of CRZ Notification, 2011 and amendments thereto and circulars issued thereon, and subject to compliance of the following specific and general conditions as under:

PART A – SPECIFIC CONDITIONS:

(i) No excavated material during the construction shall be dumped in water bodies or adjacent areas. The site shall be restored to its near original condition after completion of construction of bridge.

(ii) Temporary structures raised for construction activity shall be removed within one month of completion of construction activity.

(iii) Mangrove afforestation shall be undertaken in consultation with the Forest Department.

(iv) Any condition stipulated by TNCZMA vide its letter No. 19509/EC.3/2018-1 dated 14.11.2018 shall be complied with as may be applicable.

(v) 0.25 % CER as per the Office Memorandum issued by the Ministry, dated 01.05.2018, on CER, for activities to be undertaken under CER shall be earmarked. A detailed plan of action contemplated for CER shall be submitted to the concerned agencies within six months of receipt of clearance letter.

(vi) The CER amount to be spent exclusively for mangrove and marine biodiversity conservation and plan for the same to be submitted to the Ministry accordingly within three months.

(vii) No groundwater shall be extracted to meet with the water requirements during the construction and/or operation phases.

(viii) Flow of natural tidal water to mangroves should remain un-affected and thus adequate measures to be provided to maintain un-interrupted tidal water to mangroves.

(ix) Construction camps (if any) shall be located outside the CRZ areas.

(x) Solid wastes generated during execution of the proposed project shall be disposed of in accordance with the Solid Wastes Management Rules, 2016.

(xi) Temporary toilets will be provided for all construction labour. Suitable toilet fixtures for water conservation shall be provided. Fixtures for showers, toilet flushing and drinking should be of low flow either by use of aerators or pressure reducing devices or sensor based control.

(xii) Topsoil excavated during construction activities shall be stored for use in horticulture/landscape development etc. within the project site.

(xiii) Water quality of all the creek should be monitored regularly to see the impact of construction and reclamation activities.

(xiv) Construction materials and structures/scaffoldings erected for construction at site shall be cleared immediately after finishing construction and it shall be ensured that no construction waste, garbage and machinery or equipment are left post construction.

PART B - GENERAL CONDITIONS:

(i) A copy of the clearance letter shall be uploaded on the website of the concerned State Coastal Zone Management Authority/ State Pollution Control Board. The Clearance letter shall also be displayed at the Regional Office, District Industries centre and Collector's Office/ Tehsildar's office for 30 days.

(ii) A six-monthly monitoring report shall need to be submitted by the project proponent to the concerned regional Office of this Ministry regarding the implementation of the stipulated conditions.

(iii) The Ministry of Environment, Forest & Climate Change or any other competent authority may stipulate any additional conditions or modify the existing ones, if necessary in the interest of environment and the same shall be complied with.

(iv) Concealing factual data or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract action under the provisions of Environment (Protection) Act, 1986.

(v) The above stipulations would be enforced among others under the provisions of the Water (Prevention and Control of Pollution) Act, 1974, the Air (Prevention and control of Pollution) Act, 1981, the Environment (Protection) Act, 1986, the Public Liability (Insurance) Act, 1991, the EIA Notification, 2006 and the extant CRZ regulations.

(vi) Full co-operation shall be extended to the officials from the Regional Office of MoEF&CC, during monitoring of implementation of environmental safeguards stipulated. It shall be ensured that documents/data sought pertinent is made available to the monitoring team. A complete set of all the documents submitted to MoEF&CC shall be forwarded to the concerned Regional Office of MoEF&CC.

(vii) In the case of any change(s) in the scope of the project, the project would require a fresh appraisal by this Ministry.

(viii) The Ministry reserves the right to add additional safeguard measures subsequently, if considered necessary, and to take action to ensure effective implementation of the suggested safeguard measures in a time bound and satisfactory manner, including revoking of the environment clearance under the provisions of the Environmental (Protection) Act, 1986, for non compliance.

(ix) All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire Department, Civil Aviation Department, Forest Conservation Act, 1980 and Wildlife (Protection) Act, 1972 etc. shall be obtained, as applicable by project proponent from the respective competent authorities.

(x) The project proponent should advertise in at least two local Newspapers widely circulated in the region, one of which shall be in the vernacular language informing that the project has been accorded CRZ Clearance and copies of clearance letters are available with the State Pollution Control Board (SPCB) and may also be seen on the website of the Ministry of Environment, Forest and Climate Change at http://www.envfor.nic.in. The advertisement should be made within Seven days from the date of receipt of the Clearance letter and a copy of the same should be forwarded to the concerned Regional Office of this Ministry.

4. This Clearance is subject to final order of the Hon'ble Supreme Court of India in the matter of Goa Foundation Vs Union of India in Writ Petition (Civil) No.460 of 2004 as may be applicable to this project.

5. Any appeal against this clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.

6. A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, Zilla Parisad/Municipal Corporation, Urban Local Body and the Local NGO, if any, from whom suggestions/ representations, if any, were received while processing the proposal.

7. The proponent shall upload the status of compliance of the stipulated conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional Office of MoEF&CC, the respective Zonal Office of CPCB and the SPCB.

8. The environmental statement for each financial year ending 31st March in Form-V as is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of clearance conditions and shall also be sent to the respective Regional Office of the Ministry by e-mail.

(**W. Bharat Singh**)
Director (CRZ)

Copy to:

1. The Principal Secretary, Environment & Forests Department (EC-3), Government of Tamil Nadu, Secretariat, Chennai - 600 009
2. The Chairman, Tamil Nadu Coastal Zone Management Authority, Environment & Forests Department (EC-3), Government of Tamil Nadu, Secretariat, Chennai - 600 009
3. The Member Secretary, Central Pollution Control Board, Parivesh Bhavan, CBD cum Office Complex, East Arjun Nagar, Delhi - 32
4. The Member Secretary, Tamil Nadu Pollution Control Board, No. 76, Anna Salai, Guindy Industrial Estate, Race View Colony, Guindy, Chennai - 600 032
5. The Member Secretary, Tamil Nadu Coastal Zone Management Authority, Department of Environment, No.1, Jeenis Road, Panagal Building, Ground Floor, Saidapet, Chennai - 600 015
6. The Additional Principal Chief Conservator of Forests (C), Ministry of Environment, Forest and Climate Change, Regional Office (SEZ), I and II Floor, Handloom Export Promotion Council, 34, Cathedral Garden Road, Nungambakkam, Chennai - 34
7. Guard File/ Record File/ Monitoring Cell.

(**W. Bharat Singh**)
Director (CRZ)

Annexure - 10

Guidance for Construction Workers/ Contractors In view of COVID-19

Ministry of Home Affairs and Ministry of Health and Family Welfare, GoI have issued various Guidelines to be followed during COVID-19:-(https://www.mha.gov.in/notifications/circulars-covid-19, https://www.mha.gov.in/sites/default/files/PR_ConsolidatedGuidelinesofMHA_28032020_0.pdfhttps://www.mohfw.gov.in/. Further, amendments on COVID-19 various orders are updated from time to time on https://www.mha.gov.in/media/whats-new, need to be followed in all operations. In addition, various guidelines / interim notes for construction sites have been prepared by institutions and organizations, some of which are listed below:

a. ILO's Guidance: Considerations for employment intensive works in response to COVID 19 (April 12, 2020). https://www.ilo.org/wcmsp5/groups/public/---edemp/documents/publication/wcms_741669.pdf
b. WB's ESF/Safeguards interim note: COVID-19 considerations in construction/civil works projects (April 7, 2020)
c. WHO's guidelines: Getting your workplace ready for COVID-19 (March 03, 2020) https://www.who.int/docs/default-source/coronaviruse/getting-workplace-ready-for-covid-19.pdf; Water, sanitation, hygiene, and waste management for the COVID-19 virus (March 19, 2020)https://www.who.int/publications-detail/water-sanitation-hygiene-and-waste-management-for-covid-19; Rational use of personal protective equipment (PPE) for coronavirus disease (March 19, 2020)https://apps.who.int/iris/bitstream/handle/10665/331695/WHO-2019-nCov-IPC_PPE_use-2020.3-eng.pdf .
d. IASC Interim Guidance: Scaling-Up COVID-19 Outbreak Readiness and Response Operations in Humanitarian Situations, Including Camps and Camp-Like Settings (March 17, 2020)https://interagencystandingcommittee.org/other/interim-guidance-scaling-covid-19-outbreak-readiness-and-response-operations-camps-and-camp
e. IDB's Guidance for infrastructure projects on COVID-19 https://www.idbinvest.org/en/download/9625
f. IFC Guidance: Workers' accommodation: processes and standards (2009) http://documents.worldbank.org/curated/en/604561468170043490/pdf/602530WP0worke10Box358316B01PUBLIC1.pdf

Labor would continue to be the major player in construction activities in CPRR. In view of the prevailing COVID-19 pandemic, the contractors and workers would need to take additional measure to avoid the spread of the disease. On the basis of above guidelines/guidance notes, a brief "To Do" list is summarized below (sl.no.in brackets refer to the above mentioned guidelines/guidance notes). For details and preparation of COVID-19 Response and Management Plan, the above documents may be referred.

Brief 'To Do' List

Daily Drill:

- All workers to report some time earlier before the start of the shift. An attendance register is to be maintained for each shift. Social distancing of at least 2m to be followed in the holding area. The focal point to provide information update. (a, c, d)
- The workers need to wash their hands thoroughly (for at least 20-30 seconds) with soap or use sanitizers just before reporting screening. Adequate provision for hand washing, soaps, sanitizers needs to be made at the reporting location. (a, b, c)
- Health screening to be done for all workers in the shift - including temperature monitoring using a non-contact thermometer. Any worker reporting with temperature higher than 37.3°C shall be sent to the isolation quarters and periodic observation be made. (a, b, c, d)
    - In case the worker shows symptoms of the pandemic (including COVID-19), the procedures as laid down by the national and state laws need to be followed for testing, quarantine of at least 14 days or hospitalization, depending upon individual case.

- All the co-workers in the shift, and other persons with known contact history in the construction site should be quarantined for a period of at least 14 days, followed by regular check-ups/ observation/ examinations as laid down by the national and state laws.

- The workers found fit need to proceed to work with all required personal protective equipment, e.g. masks, gloves, goggles, boots, helmets, harness, etc. (a, b, c)
- The workers be encouraged to avoid contact with co-workers as far as possible and wash their hands at regular intervals. (a, b, c)
- Lunch/meal break be staggered into two so that workers proceed for lunch/meal at different times (a).
- There needs to be a provision of separate drinking bottles/cups for each worker, and these need to be cleaned thoroughly after meals. (a)
- Proper hand washing arrangement (water/soaps/sanitizers) needs to be ensured at eating locations. Hand washing facilities are ideally to be located within 5m of toilets and at close range of eating space. (a, b)
- The workers returning to the shift after lunch/meal break need to thoroughly wash their hands and follow the same procedure as that followed at the start of the shift. (a, b)
- At the close of shift, the workers need to thoroughly wash their hands with soap/sanitizers etc. (a, b)
- The PPE should be thoroughly washed/cleaned/sanitized (depending upon the type of PPE) after the shift ends. (a)
- The meal timings should be phased in each shift during which the sensitive areas of the workplace should be cleaned / sanitized as far as possible. (b)
- The time between two shifts should be used for cleaning and sanitizing machines, hand tools and areas of regular contact – grab handles, control levers, steering wheels, control panels - shall be regularly cleaned, and at the end of shifts used across shifts (or continuous operations) where operators/helpers change. (a)

General Guidance for contractors:

- Site specific Risk assessment needs to be undertaken and COVID-19 Response and Management Plan be prepared for all sites. (a, b, d, e)
- Protocols for medical treatment, etc. should be prepared/followed, including for reporting, referral, treatment and discharge as per national and state laws and other guidelines. (a, b, c, d)
- A health and safety officer to be deployed as the focal point at all project sites, and wherever, the same is not in place, urgent action needs to be taken by the contractor to recruit someone. (a, b)
- Register for all the workers needs to be maintained, along with their health records (a, b, d).
- Limit the number of workers on site at any one time to minimize contact, including exploring operations for multi-shift working rotation. (a, b, d)
- Entry/exit to the site should be documented. Transport vehicles used during construction activities to carry construction materials should be sanitized on regular basis (at least once a day). (a, b)
- Hygienic living conditions need to be ensured in the camp sites with regular/daily cleaning, adequate hand washing facilities. Adequate provision for solid waste management needs to be provided. (a, b, d, f)
- Provide health and safety training/orientation on COVID-19, or any other pandemic, to all workers and staff.(a, b, d)
- Ensure adequacy of necessary supplies of energy, water, food, medical supplies, cleaning equipment, PPE (both for regular use and those for medical exigencies) etc. (a, b, c, d, f)
- Quarantine and isolation facilities should be established in the camps (WHO Guidelines). The isolation facilities should have separate and dedicated toilets with proper arrangement for cleaning and removal of faeces. (c)
- Any medical waste produced during the care of ill workers should be disposed as per the national and state laws or relevant guidelines (e.g. WHO guidelines from time to time). PPE used for medical treatment/care purposes should be stored securely and kept separate from other waste. Current WHO recommendations are to clean utility gloves or heavy duty, reusable plastic aprons

with soap and water and then decontaminate them with 0.5% sodium hypochlorite solution after each use. Single-use gloves (nitrile or latex) and gowns should be discarded after each use and not reused; (a, b, c)

- Incentivize workers lodging in the local community to move to site accommodation. (b)
- The community should be made aware, through posters etc., of procedures put in place at site to address issues related to COVID-19. This should include all measures being implemented to limit or prohibit contact between workers and the community. (a, b, c, d)