Public Disclosure Authorized

Environmental and Social Management Plan (ESMP)

Maliyakarai to Athur Corridor (SH 30)

Tamil Nadu Road Sector Project – II

(Roads Under Additional Financing)

Highways Department
(Government of Tamil Nadu)

June 8, 2020

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1 Introduction

The Government of Tamil Nadu (GoTN), has proposed to take up upgrading of about 574km length of roads with financial assistance from the World Bank. In line with the prioritization exercise, fourteen corridors have been selected in total, aggregating to about 574 km length under TNRSP- II, where there are no sensitive environmental and major social issues are involved. Out of fourteen, eleven corridors have been proposed to implement through EPC mode and remaining three corridors through PPP mode. For the EPC mode contract packages (for a length of 428 km) the safeguard documents are prepared and disclosed. For the PPP mode contract (for a length of 146 km), the safeguard documents are under preparation.

In addition, the Government of Tamil Nadu (GoTN), has now proposed to seek Additional Finance (AF) from the World Bank for improving seven road projects totalling about 109km under TNRSP II. Out of the seven road packages, the DPR's were prepared for four corridors during the year 2015 to 2016, which had to be updated to suit the current scenario in 2020. For other three corridors, DPRs had to be prepared afresh. Based on the project readiness, the roads are proposed to be implemented under two phases as depicted in the following Table.

Table 1: Road Corridors under TNRSP-II (Additional Financing)

Phasing of the Project	Project Roads	Description	Length (km)
Phase - 1	State Highways (SH) - 222	Omalur to Mecheri	14.600
	State Highways (SH) - 30	Malliyakarai to Attur	10.146
	State Highways (SH) - 15	Chithode to Erode	8.020
Phase - 2	State Highways (SH) - 116	Kanchipuram to Cheyyar[1]	17.170
	Major District Road (MDR) - 108	Erode to Chennimalai	24.000
	State Highways (SH) - 139	Ariyalur to Reddipalayam	12.400
	State Highways (SH) - 4	Arcot to Arani	24.600

Source: TNRSP

These roads will be improved from existing two lane to two/four lane with paved shoulder/ four lane configuration with road furniture and other safety accessories. This Environmental and Social Management Plan (ESMP) has been prepared for Maliyakarai to Athur Corridor (SH 30) of length 10.146km, to define the Environmental and Social Management requirements to ensure environmental and social safeguards during construction and operation phase.

1.1 Project Corridor

The road starts from the existing km 81/125 on SH 30 (Junction with SH 79) in Malliyakarai and ends at km 91/200 in Narasingapuram Junction (Salem- Cuddalore Main Road) in Attur. The coordinates of the project stretch are from 11°34'15.40"N latitude and 78°29'58.39"E longitudes to 11°36'4.70"N latitude and 78°34'56.42"E longitude. Location map of the project road is given in **Figure 1** below.

[1] Including the Vandavasi Bypass, connecting SH 116 to SH 05 (km 36/457 to km 39/829)

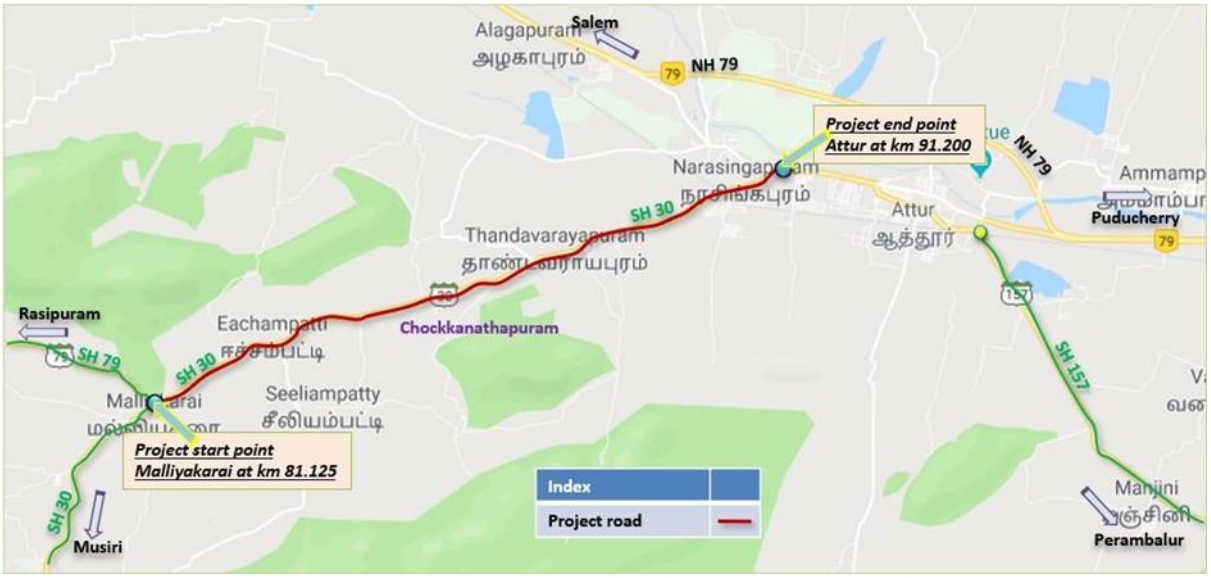

Figure 1: Location Map of Malliyakarai – Attur Road (SH 30)

Salient Feature of Maliyakarai to Athur Road (SH 30)

S.No	Project Component	Details
1.	Location of Project	Starting point – Malliyakarai Junction with SH 79) End point – Attur
2.	Length of road	10.146km
3.	Terrain	Plain terrain
4.	Major settlements	Malliakarai, Eachampatti, Chockkanathapuram, Thandavarayapuram, Kamraj Nagar and Narasingapuram villages in Salem district
5.	Sensitive Locations	2 schools, 2 hospitals, 5 temples and a Church
6.	Rivers	km 86/430 (Kombai River)
7.	Ponds/Tanks	Nil
8.	Forest Area	Nil
9.	Wildlife Sanctuary/National Parks/Notified Eco-sensitive area within 10km from project road	Nil
10.	Existing Right of Way	11m to 43m
11.	Existing lane configuration	2 lane configuration without paved shoulder
12.	Major Bridges	Nil
13.	Minor Bridges	2
14.	Culverts	11
15.	Major Junctions	2
16.	Minor Junctions	15
17.	Bus shelter	4
18.	Railway Level Crossing	1 (km 90/320)
19.	Truck Lay byes	Nil

1.2 Proposed Project Improvements

Study mandates the improvement of the project road to two-lane with paved shoulder standards with other improvements to make the road a standard facility. Improvement

proposals formulated are based on the IRC guidelines and site-specific requirements. The proposed improvements are aimed at easing traffic congestion, reducing the road accidents by improving physical characteristics of the road, which includes geometry, pavement strength, drainage, and enhancing the aesthetics. General philosophy followed in formulating the improvement proposals are:

- Limit the improvements within the land identified for the project.
- Introduce transition to all the curves along the alignment
- Utilize the available Right of Way to the maximum extent possible so as to avoid additional land acquisitions
- Improve and introduce the project facilities
- Improvement of road safety features

Accordingly, the following optimum level of improvements is proposed:

- Widening of the project road as the traffic warrants;
- Strengthening/reconstruction of the existing pavement for the entire length;
- Provision of footpath cum built-up drain at urban locations;
- Provision of open lined drain at village areas;
- Improving / redesigning sharp curves;
- Widening/ reconstruction of existing culverts and provision of additional culverts depending on the cross drainage requirements;
- Bridge and cross drainage rehabilitation, widening and reconstruction.
- Junction improvements;
- Provision for pedestrian crossing facilities;
- Street lights will be provided at urban and village areas;
- Provision of traffic signs and road furniture;
- Provision of bus shelters

1.3 Anticipated Environmental and Social Impacts

The planning of project intervention and its impacts on the environmental, social and cultural components were studied for pre-construction, construction and operation stages. Matrix method wasfollowed for the identification and evaluation of impacts. The activity - impact identification matrix is presented as **Annexure 1.**

1.4 Environmental Enhancement Measures

General environmental enhancement measures proposed for the project are construction of noise barriers to attenuate sound for sensitive receptors, construction of artificial groundwater recharge structures in drains in rural areas and in ponds and lakes, planting trees on the inner side of the noise barriers as additional noise barriers for sensitive receptors, planting trees on both sides of the road at places where land available, landscaping of major junctions, plantation of trees at government premises and cultural properties, turfing of embankments, etc., Apart from this, public utilities such as construction of bus shelters at bus bays, and improvement of ponds and lakes will be undertaken along the project corridor. Following table provides the details of site-specific environmental enhancement and mitigation measures

Sl. No.	Existing Chainage	LHS/ RHS	Particulars	Site Specific Enhancement Measure
Enhancement Measures for Cultural Properties (Refer section 8.1.8.7 Trees and				

Sl. No.	Existing Chainage	LHS/ RHS	Particulars	Site Specific Enhancement Measure
Vegetation in the ESIA Report)				
1	81/050	RHS	Vinayagar Shrine	Tree plantation as part of Compensatory Plantation (From the list of CRP's, the Contractor and the Engineer – in charge shall check for the availability of space for the compensatory planation with appropriate consent from the owner/ temple trust)
2	81/070	RHS	Murugan Shrine	
3	81/280	LHS	Vinayagar Kovil	
4	82/600	LHS	Amman Kovil	
5	82/860	LHS	Amman Kovil	
6	83/030	RHS	Ayyanar Kovil	
7	83/160	LHS	Amman kovil	
8	83/225	LHS	Temple	
9	83/238	LHS	Temple	
10	84/100	LHS	Amman Kovil	
11	85/000	LHS	Kovil	
12	86/050	RHS	Ayyanar Kovil	
13	87/380	RHS	Kovil	
14	87/400	RHS	Kovil	
15	87/410	RHS	Kovil	
16	87/510	RHS	Kovil	
17	87/990	LHS	Kovil	
18	88/090	RHS	Church	
19	88/630	RHS	Temple	
20	89/050	RHS	Temple	
21	89/250	RHS	Kovil	
22	90/650	RHS	Kovil	
23	90/830	LHS	Shivan Temple	
24	91/000	LHS	Kaliyamman Temple	
25	91/100	LHS	Thriruvangam Temple	
Enhancement Measures for Government Buildings(Refer section 8.1.8.7 Trees and Vegetation in the ESIA Report)				
1	81/000	LHS	Govt. Library	Tree plantation as part of Compensatory Plantation (From the list of Government offices, the Contractor and the Engineer – in charge shall check for the availability of space for the compensatory planation with appropriate consent from the officials)
2	81/200	LHS	Govt. Veterinary Hospital	
3	82/830	RHS	Child Welfare Office	
4	82/840	RHS	VAO Office	
5	83/080	RHS	Aavin Milk Bank	
6	83/200	LHS	Government Store	
7	84/430	LHS	Government Milk Store	
8	87/560	LHS	Government Building	
9	87/810	RHS	VAO Office	
10	87/810	RHS	Post Office	
11	87/990	RHS	Library	
12	88/100	RHS	Govt. Rice Shop	
13	89/100	RHS	EP Office	
14	89/130	RHS	EP Office	
15	90/320	RHS	Railway Room	
16	90/910	RHS	Bus Depot	
17	90/990	RHS	Bus Depot Office	
Enhancement Measures for Sensitive Noise Receptors (No Noise Barriers proposed for this Corridor**)**				
1	81/170	LHS	Government Veterinary Hospital	Compound wall not affected. Noise Barrier not required.

Sl. No.	Existing Chainage	LHS/ RHS	Particulars	Site Specific Enhancement Measure
				Tree plantation proposed as part of Compensatory Plantation.
2	81/970	LHS	Rasi Metric Higher Secondary School	Compound wall not affected. Noise Barrier not required. Tree plantation proposed as part of Compensatory Plantation.
3	82/900	RHS	Government School	Compound wall not affected. Noise Barrier not required. Tree plantation proposed as part of Compensatory Plantation.
4	88/450	LHS	First Aid Medical Center	Small clinic in one room of a building. Noise barrier not required.
Enhancement Measures for Ponds and Lakes				
	There are no ponds and lakes along the project road			
Enhancement Measures for Bus Stops (Design Chainage) - Refer section 3.4.4 (table 18) Bus Bays with Passenger's Shelters in the ESIA Report				
1	81/370	RHS	Bus bay with Shelter	
2	81/440	LHS	Bus bay with Shelter	
3	82/240	LHS	Bus bay with Shelter	
4	82/240	RHS	Bus bay with Shelter	
5	83/190	RHS	Bus shelter	
6	83/240	LHS	Bus shelter	
7	84/470	LHS	Bus bay with Shelter	
8	84/680	RHS	Bus bay with Shelter	
9	85/520	RHS	Bus bay with Shelter	
10	85/600	LHS	Bus bay with Shelter	
11	87/605	LHS	Bus shelter	
12	87/655	RHS	Bus shelter	
13	88/680	LHS	Bus bay with Shelter	
14	88/960	RHS	Bus bay with Shelter	
15	89/540	LHS	Bus bay with Shelter	
Enhancement Measures for Major Junctions				
1	91/200	BHS	Major T Junction	Landscaping in median
Enhancement Measures for Groundwater Recharge- Refer Figure 16 (section 8.1.6.5 Water Quality) in the ESIA Report				
1	81/620	LHS	Drain	Artificial Groundwater Recharge Structure in drains at 500 m interval in rural areas
2	82/120	RHS	Drain	
3	82/710	RHS	Drain	
4	83/500	LHS	Drain	
5	83/970	RHS	Drain	
6	84/560	LHS	Drain	
7	85/040	RHS	Drain	
8	85/520	LHS	Drain	
9	86/100	RHS	Drain	
10	86/640	LHS	Drain	
11	87/110	RHS	Drain	
12	88/210	RHS	Drain	

Sl. No.	Existing Chainage	LHS/ RHS	Particulars	Site Specific Enhancement Measure
13	88/720	LHS	Drain	
14	89/240	LHS	Drain	

2 Environmental and Social Management Plan

Environmental and Social Management Plan (ESMP) deals with the implementation procedure of the guidelines and measures recommended to avoid, minimize and mitigate environmental and social impacts of the project. It also includes management of measures suggested for enhancement of the environmental quality along the Maliyakarai to Athur Corridor (SH 30). The institutional arrangement made under project will look into the implementation of project as well as ESMP and the various legal settings applicable to the project.

The avoidance, mitigation & enhancement measures for protection of the environment and social along Maliyakarai to Athur Corridor (SH 30) have been discussed in detail in ESIA (Chapter 8). Although the social environmental impacts, its mitigation and management are an essential component of the ESMP, this section excludes it for the purpose of clarity and procedural requirements. Social environmental elements have been separately dealt in separate volume namely, Resettlement Action Plan (RAP).

As also explained in detail in the ESIA (Chapter 2), in case of emergency and that the PIU requests the World Bank to activate the Contingent Emergency Response Component (CERC), the ESMF will also be updated within three months from activating the CERC, including adding a positive list of eligible activities/expenditures at the time of activation. No activity under CERC shall be activated till ESMF/ESMP corresponding to CERC is in place.

2.1 Objective of ESMP

The ESMP is a plan of action for mitigation / management / avoidance of the negative impacts of the project and enhancement of the project corridor. For each measure to be taken, its location, implementation and overseeing / supervision responsibilities are listed. A description of the various management measures during various stages of the project is provided in the **Table 2**.

2.1.1 Pre-Construction Stage

Pre-Construction Activities by PIU

Prior to the Contractor mobilization, the PIU will ensure that an encumbrance free CoI is handed over to enable the start of construction. The PRoW clearance involves the following activities:

- Clearance of the RoW including removal of trees, and
- Relocation of common property resources impacted, including cultural properties as temples and community assets as hand pumps and other utilities

Pre-Construction Activities by Contractor/Engineer - in charge

The pre-construction stage involves mobilisation of the Contractor, the activities undertaken by the contractor pertaining to the planning of logistics and site preparation necessary for commencing construction activities. The activities include:

- Joint field verification of ESMP by the Engineer – in charge and the Contractor
- Modification (if any) of the contract documents by the Engineer – in charge

- Procurement of construction equipment / machinery such as crushers, hot mix plants, batching plants and other construction equipment and machinery
- Identification and selection of material sources (quarry and borrow material, water, sand etc.)
- Selection, design and layout of construction areas, hot mix and batching plants, labour camps etc.
- Planning traffic diversions and detours, including arrangements for temporary land acquisition

2.1.2 Construction Stage

Construction stage activities by the Contractor

Construction stage activities require careful management to avoid environmental impacts. Activities that trigger the need for environmental measures to be followed include:

- Imbibing environmental principles at all stages of construction as good engineering practices
- Implementation of site-specific mitigation/management measures suggested
- Monitoring the quality of environment along the construction sites (as air, noise, water and soil)

There are several other environmental issues that have been addressed as part of good engineering practices, the costs for which have been accounted for in the Engineering Costs/ Civil Work costs. They include improvement of roadside drainage, provision of additional cross drainage structures or rising of road height in flood prone stretches and reconstruction and improvement of bunds of the affected water bodies etc.

Construction Stage Activities by the PIU

The construction stage involves the following activities by PIU:

- Tree plantation along the project corridor, government buildings, cultural properties and landscaping along junctions.
- Monitoring of environmental conditions through approved monitoring agency

2.1.3 Operation Stage

Operation stage actives are to be carried out by the Environmental Cell includes mostly environmental monitoring of operational performance of the various mitigation/enhancement measures.

Other Activities

- Orientation of Implementation agency staff towards project specific issues of ESMP implementation
- Conducting additional studies for issues identified during any stage of project preparation/ implementation.

Table 2: Environmental and Social Management Plan – Maliyakarai to Athur Corridor (SH 30)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
PRE-CONSTRUCTION STAGE				
Pre-construction activities by PIU				
Land Acquisition (LA) It is estimated to acquire 3.14 ha of private land	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). The land acquisition and compensation procedures are as per the Resettlement Policy Framework (RPF) and the World Bank's OP/BP 4.12 (Involuntary resettlement) . The details of the LA are given in the RAP (Chapter 2).	Corridor of Impact.	SDU (TNRSP), Revenue Dept., and NGOs,	PIU (TNRSP)
Tree Cutting The total number of trees to be felled for the project is 538 (484 Govt. trees and 54 Private trees)	• 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 Divisional officer concerned for the felling of trees. • 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. (Refer Annexure 2)	Environment Cell (PIU, TNRSP) and Revenue Department. Tree Felling Contractor	PIU (TNRSP)
Utility Relocation and Common Property Resources (CPR's) 2 CPR's are getting affected of which.1	• All community utilities and common property resources such as stand posts bore wells, wells, water supply lines, toilets, sewage lines, drainage systems, optical fiber cables, electric power supply lines, transformers, irrigation pump houses, telephone 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.	Corridor of Impact.	PIU (TNRSP), Concerned Agencies/ Departments, Contractor	PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
Government office (EB) and 1 Pump house	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. • The budget provision for the reconstruction / compensation of the 2 Common Property Resources (CPR's) is included in the RAP			
Relocation of Cultural and Religious Properties 3 (temples) culture and religious properties are impacted by the project	• 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. • 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	Corridor of Impact.	SDU (TNRSP), NGOs, Contractor, Concerned Community	PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	the simple enhancement of such sites. • The budget provision for the reconstruction / compensation of the 3 Cultural and Religious Properties is included in the RAP			
Orientation of Implementing Agencies and Communities	• 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 TNRSP involved in the project, Staff of the Site Engineer/ Supervision Consultant and the Contractor. • Briefing sessions shall be held for sub-project community representatives before and during implementation.		PIU (TNRSP), Site Engineer/ Supervision Consultant	PIU (TNRSP)
Pre-construction activities by the Contractor/Engineer of Supervision Consultant				
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/TNRSP 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 CSC	PIU (TNRSP)
Assessment of Impacts due to Changes/	The Engineer - In charge of Supervision Consultant shall assess the anticipated impacts and revise/modify the ESMP in consultation with the PIU/TNRSP in accordance with the recommendations made by the	Project Corridor	Contractor and Environmental Officer of CSC	PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
Revisions in the Project Work	field survey party in the event of changes /revisions /unanticipated impacts (including addition or deletion) in the project's scope of work			
COVID response	Taking cognizance of situation at time of mobilisation, the Contractor shall undertake a COVID risk assessment of project area and prepare a COVID Response and Management Plan (C-R&MP) and submit to TNRSP and CSC 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. Some of the key points on COVID Response and Management measures is given in Guideline 18 of Annexure 5. The contractor shall submit a weekly monitoring and progress report to TNRSP and CSC.	All locations	Contractor	Environmental Officer of CSC and TNRSP.
Procurement of Machinery				
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 and contract specifications. • Crushers, hot-mix and batching plants shall be located at least 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/TNRSP 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	Project Corridor All the construction machineries (Crushers, Hot-mix Plants & Batching Plants) should be keep/ station 1000 m away from the following urban/ settlement locations km 81/000 to km 82/000 km 82/000 to km 83/400 km 83/400 to km 86/000	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	requirements of the relevant current emission control legislation and Consent / NOC for all such plants shall be submitted to the CSC and PIU/ TNRSP. • 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/ TNRSP and the Supervision Consultant. • Environmental Monitoring (dust and emission) have to be conducted to demonstrate compliance	km 86/800 to km 88/400 km 88/400 to km 88/800 km 88/800 to km 91/200		
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 and equipment that 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/ TNRSP and the Supervision Consultant for verification whenever required.	Project Corridor	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Identification & Selection of Material Sources				
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 and Safety Engineer from the Contractor shall be required to inspect every	Ecologically sensitive area / Eco-Sensitive Zones (ESZs) or Ecologically Fragile	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	borrow area location before approval. • Format for reporting shall be as per the Reporting Format enclosed (Annexure 4, Format EM3) in the ESMP for Borrow Area. The Engineer - Incharge of the Supervision Consultant shall be required to inspect every borrow area location and evaluate such proposals following 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/TNRSP 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 Annexure 4 (Guideline 3 Borrow area) 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	Areas (EFAs) are areas notified by the Ministry of Environment, Forests and Climate Change (MoEF&CC)		

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	sprinkling of water, repairing of the road, road safety provisions (controlling speed and driving standards, warning and informatory signage, flagmen, etc.), and ensuring covering of loaded vehicles by waterproof tarpaulin; consultation with public and special precautions are required 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.			
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 (including environmental clearance, NoC from competent authorities (TNPCB, Dept. of mines) etc.,) 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 or associated 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 - Incharge of Supervision Consultant who shall inspect and in turn report to PIU/TNRSP 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 following locations: km 81/000 to km 82/000 km 82/000 to km 83/400 km 83/400 to km 86/000 km 86/800 to km 88/400 km 88/400 to km 88/800 km 88/800 to km 91/200	Contractor	Environmental Officer of CSC and PIU (TNRSP)
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	All rivers/ surface water bodies that can be used in the project	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	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-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.			
Sand	• To the extent possible the Contractor shall explore the possibilities of utilising the Fly ash for the construction purposes as specified in the Notification on use of fly ash (subsequent amendments). • The Contractor shall procure sand through online system as instructed by the Government of Tamil Nadu. No new sand quarries will be allowed.		Contractor	Environmental Officer of CSC and PIU (TNRSP)
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.). • The recruitment of women and members of vulnerable groups shall be prioritized. • The Contractor shall provide training to build the skills of locally-recruited labour. • All staff, skilled and unskilled labour employed on a site shall be required to sign Codes of Conduct that shall ensure compliance with the Environmental, Social, Health and Safety provisions of civil works and consultancy contracts.	Along the project corridor at construction sites	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Labour Influx				
Risk of social conflict	• Provision of information regarding Worker Code of Conduct in local language(s); • Workers will required to sign a contract including the CoC. • Provision of cultural sensitization training for migrant labours	Construction Workers Camps including areas in the immediate vicinity	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	regarding engagement with local community.			
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	Construction Workers Camps including areas in the immediate vicinity	Contractor	Environmental Officer of CSC and PIU (TNRSP)
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	Construction Workers Camps including areas in the immediate vicinity	Contractor	Environmental Officer of CSC and PIU (TNRSP)
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.	Construction Workers Camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)
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.	Construction Workers Camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)
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; • Information campaign on STDs among the migrant labours and local community; • Education about the transmission of diseases; • Provision of condoms	Construction Workers Camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
Child labor and school drop out	• Ensuring that children and minors are not employed directly or indirectly on the project (Children are below 14 years and minor are below 18 years).	Construction site	Contractor	Environmental Officer of CSC and PIU (TNRSP)
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	Areas in the immediate vicinity of the construction camp	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Inadequate waste disposal and creation of illegal waste disposal sites	• Reduction of waste generation; • Sound practices for waste disposal	Construction Workers Camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Wastewater Discharges	• Ensuring workers' camp and associated 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.	Construction Workers Camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Increased demand on freshwater resources	• Water conservation and recycling of water; • Consideration of use of rainwater where feasible; • Avoiding contamination of fresh water sources	Construction Workers Camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)
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.	Construction Workers Camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)
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.	Construction Workers Camps including areas in the immediate vicinity	Contractor	Environmental Officer of CSC and PIU (TNRSP)
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 Engineer – incharge (CSC).	Construction Workers Camps including areas in the immediate	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
		vicinity		
Possibility of gender-based violence arising from influx of migrant labour	To address this a GBV risk mitigation plan shall be prepared. It shall comprise o Code of Conduct for signing by project workers (Annexure 12) o Integrate GBV into existing IEC strategy/materials, GRM, safety talks, tool box meeting and regular trainings o Community consultation and identification of GBV focal points within the community. o Training of labours on occupational health and safety issues o Mapping of Service Providers for GBV prevention and Response o Identify Hot Spots for GBV within the project include construction work and labour camps alongside local communities, schools, vocational training centers, liquor shops and, migrant labourers residing in rented accommodations within the villages • These areas need to be clearly identified and closely monitored throughout the project cycle.	Construction Workers Camps including areas in the immediate vicinity	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Setting up construction sites				
Construction Camp Locations – Selection, Design & Layout	• Construction camps shall not be proposed: o Within 1000m of Ecologically sensitive areas/ zones o 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 prepared and approved by the Engineer – Incharge 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 be 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.	All Construction Workers Camps including areas in the immediate vicinity Refer Annexure 3 (Schematic Drawing of Construction Camp)	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
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 CSC and PIU (TNRSP)
CONSTRUCTION STAGE				
Construction Stage Activities by Contractor				
Site Clearance				
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 ESMP 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. • 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 - Incharge 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.	Corridor of Impact	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Dismantling or construction 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. Minor Bridge location at: km 82/442 and	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
		km 86/379 Other culvert locations are at km 81/876, km 82/522, km 84/641, km 86/670, km 87/565, km 87/661, km 88/040, km 88/653, km 89/530, km 89/752, km 89/920 and km 90/481		
Generation & disposal of Debris	It is estimated to generate 14,622cum of Bituminous Material and 56,784cum of Pavement Crust 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 - Incharge 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.0 • 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 - Incharge of Supervision Consultant.	Throughout Project Corridor	Contractor	Environmental Officer of CSC and PIU (TNRSP)

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 - Incharge of Supervision Consultant and approval local competent authority.			
Non-bituminous construction wastes disposal	The location of disposal sites shall be finalized before starting 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 CSC and PIU (TNRSP)
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 CSC and PIU (TNRSP)
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 - Incharge 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 2m. • To retain soil and to allow percolation of water, the edges of the	Throughout Project Corridor	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	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.			
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. • The Contractor shall take measures necessary to prevent access to the works, borrow pits and quarry sites by members of the public and animals. • Construction activities that shall affect the use of side roads and existing accesses to individual properties, 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 CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
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 - Incharge of Supervision Consultant for approval. The traffic control plans shall contain details of temporary diversions, traffic safety arrangements including layouts for signs and barriers, 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. • Appropriate and safe speed limits through working areas and along detours shall be established and enforced. • 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/ TNRSP.	All along the project corridor, all access roads. Some of the key junctions are as follows Major Junction at km 81/125 (SH 79) and km 91/200 (SH 30) Minor Intersections at km 83/150 (+ Staggered at Keeripatty), km 84/652 (ODR at Seeliampatty), km 88/120 (ODR at Kirapatti), km 88/670 (+ Staggered at Narasingapuram)	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Construction Materials				
Earth from Borrow Areas for Construction It is estimated 81,568.02 cum of earth from	• No borrow area shall be opened without permission of the Engineer – Incharge 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	All along the project corridor, all access roads sites temporarily acquired & all borrow areas	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
borrow is required for the construction	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.			
Quarries It is estimated 87,926 cum of aggregate is required for construction	• 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/ TNRSP through Engineer –Incharge 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/ TNRSP 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 CSC and PIU (TNRSP)
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	All blasting and Pre-splitting Sites.	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	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 made known to all the people within 1000m (200m for pre-splitting) from the blasting site in all directions. • A Blast Management Plan that sets out procedures and measures needed for the safe implementation of blasting activities at each blasting site shall be prepared by the Contractor and approved by the Engineer – incharge of Supervision Consultant			
Water Extraction It is estimated to use 230KLD of water for construction	Procurement of water is to be carried out as per "Arrangement for Construction Water". The Contractor shall minimize the wastage of water during construction. During the pre-Construction stage the contractor should preferably identify local depressions along the alignment in consultation with the local panchayat to be developed as water storage areas. The Contractor to consult and make agreement with the panchayat for development of this water body and using the water stored on it for construction purpose. The Contractor shall consider development of new surface water bodies at suitable places in the vicinity of the project road and or renovation of existing surface water bodies with prior permission of the village panchayat for harvesting of water during rainy season. This water can be used for construction purpose and on completion of the construction the same can be handed over to the community for maintenance and use. The contractor shall explore and adopt use of plasticizers/super plasticizers in concrete production to reduce water consumption. The water usage pattern within the construction camps can be minimized by adopting following best practices: i. Use of auto shut off taps (without sensors) in labour	All water bodies recommended being used in the project	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	accommodation; ii. Install water meters with main supply pipes/water tanks/bore well to assess quantity of consumed water. Create awareness among the camp site, work force camp sites at all levels.			
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 contractor shall take measures such as GPS monitoring to ensure that all project vehicles are driven at safe speeds and within specified speed limits at all times • 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 CSC and PIU (TNRSP)
Construction work				
Disruption to other users of Water	• While working across or close to any perennial / seasonal 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 to provide water in the interim period. A water quality test shall be done before providing/supplying water.	Water withdrawal locations	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	• 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 - Incharge of Supervision Consultant and PIU/ TNRSP. • The Contractor shall take prior approval from PWD –Water Resource Department, GoTN and Supervision Consultant for any such activity. The PIU/TNRSP 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.			
Drainage and Flood Control	• The Contractor shall ensure that any construction materials like earth, stone, ash or appendage are disposed of 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. Areas with accumulated water shall be securely fenced and guarded. • 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 (refer section8.1.6.10 Water Quality in the ESIA report (Figure 17)) shall be installed before the onset of the monsoon at all the required locations, as directed by Engineer - Incharge of Supervision Consultant and PIU/ TNRSP. • 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 Drains located at km 81/876, km 82/522, km 84/641, km 86/670, km 87/565, km 87/661, km 88/040, km 88/653, km 89/530, km 89/752, km 89/920 and km 90/481	Contractor	Environmental Officer of CSC and PIU (TNRSP)

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.			
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 for a length of 240m (total length) at the mentioned water body locations 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 provide oil interceptor in the construction vehicle parking area, vehicle repair area and the workshops to prevent oil and grease road run-off (refer section 8.1.6.10 Water quality in the ESIA report (Figure 18)).	Surface water sources/ drains/ Nalahs/ Ponds etc. Drains located at km 81/876, km 82/522, km 84/641, km 86/670, km 87/565, km 87/661, km 88/040, km 88/653, km 89/530, km 89/752, km 89/920 and km 90/481	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Slope Protection and Control of Soil Erosion	• The Contractor shall construct slope protection works as per design, or as directed by the Engineer - Incharge 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 embankments and cuttings, 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 Catchwater drains shall be installed at the top of cut and fill slopes. o Other measures of slope stabilization shall include mulching netting and seeding of batters and drain immediately on	High raise embankment	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	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. o 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 embankments and cuttings with appropriate technique/s shall commence soon after the embankment formation, to be in place in advance of the rainy season.			
Pollution Control				
Water Pollution				
Water Pollution from Fuel, Lubricants, Bituminous Products and Chemicals	• 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 – Incharge of Supervision Consultant. The Engineer – Incharge shall certify that all liquid wastes disposed of from the sites meet the discharge standards.	Surface water sources/ drains/ Nalahs/ Ponds etc. Drains located at km 81/876, km 82/522, km 84/641, km 86/670, km 87/565, km 87/661, km 88/040, km 88/653, km 89/530, km 89/752, km 89/920 and km 90/481	Contractor	Environmental Officer of CSC and PIU (TNRSP)
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 (Refer section 8.1.6.10 water quality (Figure 18) in the ESIA report) 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	Surface water sources/ drains/ Nalahs/ Ponds etc. Drains located at km 81/876, km 82/522, km 84/641, km 86/670, km	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	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 – Incharge. All spills and collected petroleum products shall be disposed of following MoEF&CC and TNPCB guidelines. • Engineer – Incharge shall certify that all arrangements comply with the guidelines of TNPCB/ MoEF&CC.	87/565, km 87/661, km 88/040, km 88/653, km 89/530, km 89/752, km 89/920 and km 90/481		
Air Pollution				
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 10m from a unit located in such a cluster should be less than 600 $\mu g/m^3$. • 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 CSC and PIU (TNRSP)
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	Construction camps, Materials Loading/ unloading facilities	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	vehicles/equipment/machinery used for the project. Monitoring results shall also be submitted to Supervision Consultant and PIU/ TNRSP as per the Environmental Monitoring Plan in the specified format.			
Noise Pollution				
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. • Monitoring shall be carried out at the construction sites as per	Sensitive locations including Schools, Hospitals, and Temples located at km 81/070 Government Veterinary Hospital, km 81/970 Rasi Metric Higher Secondary School, km 82/950 Government School, km 82/950 Temple km 87/390 Temple km 88/060 Church km 88/450 First Aid Medical Center km 89/990 Temple km 91/020 Temple km 91/180 Temple urban/ settlement locations km 81/000 to km 82/000 km 82/000 to km 83/400 km 83/400 to km	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	the monitoring schedule and results shall be submitted to Engineer-Incharge of Supervision Consultant. The engineer shall be required to inspect regularly to ensure the compliance of EMP. (Refer MoRTH - Section 111.3)	86/000 km 86/800 to km 88/400 km 88/400 to km 88/800 km 88/800 to km 91/200		
Safety				
Personal Safety Measures for Labour, Material handling, Painting, etc.	• The contractor shall continually monitor that the implementation of health and safety complies with measures set out in the contract. Risk assessments for ongoing and new activities shall be carried out at regular intervals. • All personnel working on the site shall receive induction training in health and safety, and regular safety training related to their tasks. • The contractor shall provide all necessary safety appliances such as safety goggles high visibility vests, helmets, gloves, safety belts, earplugs, masks, boots, etc. to workers and staff with additional equipment for specific activities in accordance with risk. • Protective footwear, gloves and protective goggles to all workers employed on mixing asphalt materials, cement, lime mortars, concrete, etc. • Welder's protective eye-shields and gloves 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	Construction sites	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	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. • 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.			
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 - Incharge 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 Major Junction at km 81/125 (SH 79) and km 91/200 (SH 30) Minor Intersections at km 83/150 (+ Staggered at Keeripatty), km 84/652 (ODR at Seeliampatty), km 88/120 (ODR at Kirapatti),	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
		km 88/670 (+ Staggered at Narasingapuram)		
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 CSC and PIU (TNRSP)
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 CSC and PIU (TNRSP)
Cultural Property				
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	Along the project road.	Contractor	Environmental Officer of CSC, , State Archaeological Department and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	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.			
Labour Camp Management				
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- Incharge. • 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. • 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. Lighting shall be provided in the camp area and facilities. • The construction shall commence only upon the written approval of the Engineer - Incharge.	Along the project corridor at the location of construction labor camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Potable Water It is estimated to provide 3.75 KLD of water for potable purposes	• 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.	Construction labor camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	○ 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. ○ 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. ○ All such wells shall be entirely covered and provided with a trap door, which will be dustproof and waterproof. ○ 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. ○ Testing of water shall be done every month as per the parameters prescribed in IS 10500:1991. • Compliance with EMP shall be reported to Engineer - Incharge every week. Engineer - Incharge shall inspect the labor camp periodically, to ensure compliance of the EMP.			
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	Construction labor camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	the entire phase.			
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 - Incharge. 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 - Incharge as provided by the Contractor.	Construction labor camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)
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. • 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.	Construction labor camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)
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 - Incharge.	Construction labor camps	Contractor	Environmental Officer of CSC and PIU (TNRSP)
Contractor Demobilization				

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
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 CSC	PIU (TNRSP)
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 CSC	PIU (TNRSP)
Environmental Enhancement and Special Issues				
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 Refer section 1.4 (Environmental Enhancement Measures) in the ESMP	Contractor and Environment Officer of CSC	PIU (TNRSP)
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. The Contractor shall maintain the plantation until	All tree plantation/ greenery areas of the project Compensatory plantation of 5,380 trees should be planted in the road side as well as	Contractor / Forest Department and Environment Officer of CSC	PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	they handover the project site to TNRSP. • 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. • 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 - Incharge. • The Engineer - Incharge shall inspect regularly the survival rate of the plants and compliance of tree plantation guidelines.	Government buildings and cultural properties (Refer Annexure 8 in the ESIA report for the location and land availability for compensatory plantation)		
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 CSC	PIU (TNRSP)
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 - Incharge and execute the Engineer's instructions for dealing with the same. • The Engineer-Incharge shall report to the nearby forest office	Along the project road	Contractor / Forest Department and Environment Officer of CSC	PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	(range office or divisional office) and shall take appropriate steps/ measures if required in consultation with the forest officials.			
Sensitive Areas	• In this corridor, the necessity for having Noise barrier does not envisage. However, the contractor is advised to consult the schools and hospitals 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 CSC	PIU (TNRSP)
OPERATION STAGE (Activities to be Carried Out by the Contractor (till the DLP) and then TNRSP /Forest Department, GoTN)				
Monitoring and Evaluation of Environmental Mitigation Measures provided in the Project	• The PIU/TNRSP 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	PIU (TNRSP)
Maintenance of Drainage and recharge pits	• PIU/TNRSP shall ensure that all drains (side drains and all cross drainages) silt trap/filtration chamber & recharge pits 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/TNRSP shall ensure that all the sediment/oil and grease traps set up at the truck and bus lay bye are cleared once in	All along the project corridor Minor Bridge location at: km 82/442 and km 86/379 Other culvert locations are at km 81/876, km	Contractor (DLP) and PIU	PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	every three months.	82/522, km 84/641, km 86/670, km 87/565, km 87/661, km 88/040, km 88/653, km 89/530, km 89/752, km 89/920 and km 90/481 Recharge well located at km 81/810, km 82/940, km 85/500 and km 88/705 Recharge pit located at km 81/620, km 82/120, km 82/710, km 83/500, km 83/970, km 84/560, km 85/040, km 85/520, km 86/100, km 86/640, km 87/110, km 88/210, km 88/720 and km 89/240		
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.	All along the project corridor	Contractor (DLP) and PIU	PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	• PIU/TNRSP shall appoint a specific pollution monitoring agency for this purpose.			
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	PIU (TNRSP)
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	PIU (TNRSP)
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	PIU (TNRSP)
Avenue Trees	• The PIU/TNRSP with the assistance from Forest Department, GoTN shall do survival monitoring of avenue trees for every quarter.	All along the project corridor and the additional area identified for compensatory afforestation	PIU and Forest Department/identified agency	PIU (TNRSP)
Road Safety and Maintenance of Assets	• Monitor data on any road traffic accidents, and identify and implement any remedial measures that may be necessary. • No advertisement/hoardings shall be allowed within the Right of Way limits of the project road.	All along the project corridor	Contractor (DLP) and PIU	PIU (TNRSP)

Project Activities	Management Measure	Location	Responsibility	
			Planning and Execution	Supervision and Monitoring
	• Regular maintenance and cleaning of assets such as signboards, bus stops, drains, etc. shall be undertaken.			

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Table 3: Gender Action Plan

Gender Objectives	Gender Activities/ Actions	Performance Indicators/ Targets	Responsible Agencies
Output 1: Public Transport Access, Facilities and Services			
Safety and secured highways	Conduct endline survey covering a sample of women, men, bus/ vehicle drivers, children and persons with disabilities to determine satisfaction of residents with the new bus stops, footpaths, ramps, pedestrian crossing, lighting and signage	By 2023, Ensure at least 70% of public transport users, agree that access to public transport, facilities and services in the Phase 1 corridor have been improved by the project	Contractor and CSC/ PIU
Ensure social and gender inclusion in community participation during the project implementation	Encourage participation of local people including women in consultations during the project implementation (record women participation in terms of numbers, percentage, and how their suggestions and concerns have been addressed).	• Number of local people who participate in consultations on project design and implementation disaggregated by sex. Target: at least 40% women for each road • Relevant clauses on core labor standards (including gender-specific ones such as equal pay for equal work, equal opportunities for employment) are included in all bidding and contract documents	Contractor and CSC/ PIU
Generate unskilled jobs in road construction /maintenance for women	Ensure women benefit from unskilled jobs. - Facilitate safe and conducive environment for women's employment in road works through creation of women's groups if appropriate; skill enhancement; - linkages to government owned Industrial Training Institutions (ITIs) locate din the vicinity; on-site clean toilets	Contractors' cumulative unskilled labor days will be for at least 20% women, for all Phase 1 corridors by 2022.	Contractor and CSC/ PIU
Ensure gender responsive social protection for the labor force during project implementation and maintenance	Raise awareness on core labor standards (CLS) among contractors and road workers. - Include compliance with CLS in the bidding documents and contracts for the road labour and as part of their induction training.	All workers including all women in road works understand CLS	Contractor and CSC/ PIU
	Ensure that contractors enforce CLS and the protection of labor rights and interests of employees, including equal pay	Average daily wage paid for unskilled labor to women and to men per major types of work. Target: no gender	Contractor and CSC/ PIU

Gender Objectives	Gender Activities/ Actions	Performance Indicators/ Targets	Responsible Agencies
	for work of equal value between men and women. - Keep accurate records of number or percent of men and women labor days and salary for skilled and unskilled labor per road	difference	
Output 2: Pedestrian Safety Facilities and Residents' Safety Awareness			
Road safety Awareness	Conduct endline survey of road users on road safety conducted with drivers and pedestrians. The sample should include, women, adolescent girls and children The sample should gather gender-disaggregated responses	By 2023, 50% of residents of the project corridor report enhanced awareness of road safety key risk factors and appropriate road user behaviours (speeding, drunk-driving, no parking on sidewalk, vehicles yield to pedestrians at crossings, pedestrians cross at designated crossings)	Contractor and CSC/ PIU
Increase women's involvement in and benefits from road safety awareness and enforcement	Involve communities and local people including women in road safety activities Contractor should keep records of number of men and women participating in these events as (i) participants and (ii) facilitators. - Involve directly women as facilitators through schools, parent-teacher groups, local authorities, etc. - Target local taxi, bus, truck drivers in the awareness activities	All project roads have road safety signage and speed bumps to slow down traffic in local communities/ built up areas, especially in front of basic facilities, Schools, Hospitals and Cultural properties At least 50% of the participants and 30% of the facilitators in community based road safety awareness activities are women in all school and hospital areas, by 2022	Contractor and CSC/ PIU
Pedestrian safety	Construction of Accessible pedestrian crossings and increased safety along the Phase 1 corridors	Construction of pedestrian crossing at sensitive receptor and other locations as indicated in the DPR as per the schedule	Contractor and CSC/ PIU
Residential safety and awareness	Using the data / information from the consultation to map hotspots and areas where residents feel unsafe and in consultation with the community, identify the appropriate locations for CCTV cameras	By 2023, all the CCTV cameras as indicated in the DPR should be installed for safety along the Phase 1 corridors	Contractor and CSC/ PIU

2.2 Environmental Monitoring Plan

To ensure the effective implementation of the ESMP, it is essential that an effective monitoring program has to be designed and carried out. For the Maliyakarai to Athur Corridor (SH 30), the monitoring plan is based on the following objectives:

- To evaluate the performance of mitigation measures proposed in the ESMP
- To suggest improvements in the management plans, if required
- To satisfy the statutory and community obligations

The monitoring programme contains monitoring plan for all performance indicators and reporting formats, which is presented in the following sections.

2.2.1 Performance Indicators

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:

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

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

Table 4: 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 as per the Monitoring Plan prepared **(Refer Table 8)**	Pre-Construction	Contractor through approved monitoring agency
			Construction	
			Operation	PIU through approved monitoring agency
2	Noise Levels		Pre-Construction	Contractor through approved monitoring agency
			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	Pre-	Contractor and CSC

Sl. No.	Indicator	Details	Stage	Responsibility
		construction camps have to be identified and parameters indicative of environment in the area has to be reported	construction	
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 CSC
3	Tree Cutting	Progress of tree removal marked for cutting is to be reported	Pre-construction	Revenue Department and Contractor (under the supervision of CSC)
4	Tree Plantation	Progress of measures suggested as part of the Strategy is to be reported	Construction	Forest Department (under the supervision of CSC)
5	Disposal Site	Number of locations approved for Debris disposal; Quantity disposed off at each location; Number. site Rehabilitated and handed over	Construction	Contractor and CSC
6	Reuse and recycle of waste	Quantity of waste reused/recycled; location and type of construction activity	Construction	Contractor and CSC
7	Sensitisation / awareness Training	No. and frequency of sensitisation training; No. and type of target audience trained	Construction	Contractor and CSC
8	Accidents/Incidents	No of accidents/incidents recorded	Construction	Contractor and CSC
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	Forest Department and 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	Operation	Contractor (till the DLP) and then PIU will be responsible.

Sl. No.	Indicator	Details	Stage	Responsibility
		and to their full satisfaction.		
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

2.2.2 Monitoring Parameters and Standards

The environmental monitoring of the parameters involved and the threshold limits specified are discussed below:

2.2.2.1 Ambient Air Quality Monitoring (AAQM)

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 5**.

Table 5: 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 10	-Improved West and Gaeke -Ultraviolet fluorescence
2	Nitrogen Di oxide (NO_2), µg/m^3	Annual* 24 hours**	40 80	30 80	-Modified Jacob & Hochhieser (Na-Arsenite) -Chemiluminescence
3	Particulate Matter (size less than 10µm) or PM_{10} µg/m^3	Annual* 24 hours**	60 100	60 100	-Gravemetric -TOEM -Beta attenuation
4	Particulate Matter (size less than 2.5µm) or PM_{25}µg/m^3	Annual* 24 hours**	40 60	40 60	-Gravemetric -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

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
					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.*

2.2.2.2 Noise Quality Monitoring

The noise levels shall be monitored at identified locations in accordance with the Ambient Noise Quality standards given in **Table 6**.

Table 6: National Ambient Noise Quality Standards

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

** Daytime shall mean from 6.00am 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.*

2.2.2.3 Water Quality Monitoring

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 7**.

Table 7: 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

2.2.2.4 Monitoring Plans for Environment Condition

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 8**. Monitoring plan does not include the requirement of arising out of regulation provision such as obtaining NOC/ consent for plant site operation.

Table 8: Environmental Monitoring Plan

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
Air	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	Three seasons per year	24 hours Sampling	Along the project road, Hot mix / batching plant	Contractor under the supervision of CSC
	Operation				Three seasons in a year for two years		Along the project road	Contractor (till the DLP) and PIU
Water	Construction	All essential characteristics and some of desirable characteristics as decided by the Environmental Specialist of the CSC 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	Three seasons per year	Grab Sampling	Along the road Surface water sources	Contractor under the supervision of CSC
	Operation				Three seasons per year for two years			Contractor (till the DLP) and PIU
Noise	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	Noise Rules, 2000	Three seasons per year	Leq in dB(A) of day time and night time	Along the project road, Hot mix / batching plant	Contractor under the supervision of CSC
	Operation				Three seasons per year for two years.		Along the project road	Contractor (till the DLP) and PIU
Soil	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	Three seasons per year	Grab Sampling	Along the project road, Hot mix / batching plant	Contractor under the supervision of CSC
	Operation				Three		Along the	Contractor (till

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
				standards are promulgated	seasons for two years		project road	the DLP) and PIU
Borrow area	Construction	As per Guidelines	Visual Observation	-	Once in a month	-	Borrow area location	Contractor under the supervision of CSC
Tree plantation	Operation stage	As per Design			Quarterly	-	Areas where plantation is being done	Forest Department and Contractor (till the DLP) and then PIU will be responsible

2.2.3 Reporting System

Reporting system suggested for the Maliyakarai to Athur Corridor 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

Contractor and Engineer - in charge operate the reporting system for environmental conditions and environmental management indicators (except tree cutting). The Environmental Management Cell of PIU will operate the reporting system for environmental management tree cutting indicators and operational performance indicators. The PIU will set the targets for each activity envisaged in the ESMP beforehand and all reports will be against these targets.

The Contractor will report to the Engineer - in-charge of the progress of the implementation of environmental conditions and management measures as per the ESMP. The Engineer- in-charge will in turn report to the PIU every quarter. Reporting formats have been prepared, which will form the basis of monitoring, by the Engineer- in charge and/or the Environmental Cell as required and presented as **Annexure 2.**

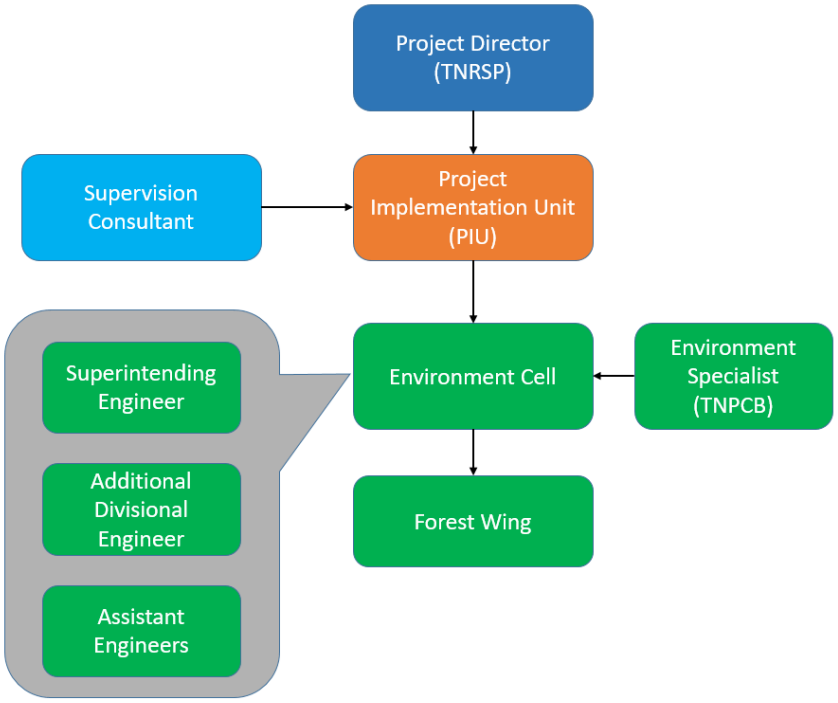
Table 9: Summary details of Reporting

Format No.	Item	Stage	Contractor	Environmental Cell	Supervision Consultant (CSC) / Concessionaire		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	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
OP2	Status Regarding Rehabilitation of Borrow Areas	Operation	-	-	-	-	Half Yearly

2.2.4 Implementation Arrangement for ESMP

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

The 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 comprises one Assistant Conservator of Forest, Rangers, and field staffs. The forest officials will supervise and coordinate compensatory plantation and Forest related issues which has been built into the construction contracts for each corridor under the project. At present one Assistant Conservator of Forests has been posted in the Forest Wing.



The roles and responsibilities of various persons involved in implementation of ESMP is **Table 10**.

Table 10: Institutional Responsibilities for ESMR Implementation

System	Designation	Responsibilities
Coordinating/ Facilitating Agency	Project Director, PIU TNRSP-II	• Overview of the project implementation • Ensure timely budget for the ESMP • Coordination with the different state-level committee, to obtain Regulatory Clearances • Participate in state-level meetings • Monthly review of the progress.

System	Designation	Responsibilities
	Chief Engineer/ Superintending Engineer PIU	• Overall responsible for ESMP implementation • Reporting to various stakeholders (World Bank, Regulatory bodies) on the status of ESMP implementation • Coordination with PIU Staff (Environmental Specialist). • Responsible for obtaining Regulatory Clearances • Review of the progress made by contractors • Ensure that environmental safeguards in ESMP are executed as per specification and schedules.
	Environment and R&R Specialist (PIU)	• Assisting SE in the overall implementation of ESMP • Review of periodic reports on ESMP implementation and advising PIU in taking corrective measures. • Conducting periodic field inspection of ESMP implementation • Assisting SE in reporting various stakeholders (World Bank, Regulatory bodies) on the status of EMP implementation • Preparing an environmental training program and conducting the same for field officers and engineers of contractor
Implementing/ Monitoring Agency	Engineer (Supervision consultant SC)	• Responsible for supervision of effective implementation of ESMP measures by the contractor • Review progress reports and periodic reporting to PIU about the status of EMP implementation • Work in close coordination with ERRS (PIU)and contractor
	RAP implementation NGO	• Conducting awareness campaigns for all construction personnel (including labourers, supervisors, engineers, and consultants) about HIV/AIDS/STDs in the construction and labour camps. • Facilitating the medical testing/ routine check-up for labours as suggested in the HPP
Contractor	Environmental Manager of Contractor	• Responsible for ensuring the implementation of ESMP as per provision in the document. • Directly reporting to the Project Manager of the Contractor • Discuss the various environmental/social issues and environmental/social mitigation, enhancement and monitoring actions with all concerned directly or indirectly • Assist the project manager to ensure social and environmentally sound and safe construction practices are adopted • Conduct periodic environmental and safety training for contractor's engineers, supervisors and workers along with

System	Designation	Responsibilities
		sensitization on social issues that may arise during the construction stage of the project • Assist the PIU on various environmental monitoring and control activities including pollution monitoring; and • Prepare and submit monthly reports to PIU on the status of implementation safeguard measures

2.2.5 Good Environmental Construction Guidelines

Comprehensive environmental construction guidelines have been prepared to guide the planning and implementing agency in preparing the project specific environmental code of conduct for contractor. The list of good environmental practices is as follows. All guidelines listed are presented as **Annexure 3** for reference and implementation into the Environmental Management Plans for the specific projects.

Table 11: Guideline for Good Environmental Practices

Guidelines	Activities
Guideline-1	Site Preparation
Guideline-2	Construction and Labour Camps
Guideline-3	Borrow Areas
Guideline-4	Topsoil Salvage, Storage and Replacement
Guideline-5	Quarry Management
Guideline-6	Water for Construction
Guideline-7	Slope Stability and Erosion Control
Guideline-8	Waste Management and Debris Disposal
Guideline-9	Water Bodies
Guideline-10	Drainage
Guideline-11	Construction Plants & Equipment Management
Guideline-12	Labour and Worker's Health and Safety
Guideline-13	Cultural Properties
Guideline-14	Tree Cutting and Afforestation
Guideline-15	Forests and Other Natural Habitats
Guideline-16	Air and Noise Pollution
Guideline-17	Environmental Monitoring
Guideline-18	COVID Response Guidelines
Guideline-19	Salient Provision for Sand Mining in the State of Tamil Nadu

2.3 ESMP Budget

The ESMP budget has been estimated under 3 heads as follows.

- Environmental management measures to be abided by the Contractor under the civil cost. The management measures indicated in the civil cost includes rainwater harvesting structures, silt fencing, barricading, oil interceptors, enhancement of community and cultural properties, restoration of surface water bodies, safety measures (including road user safety and construction safety), etc.,
- Monitoring of environmental attributes during project construction activity and operation activity

Table 12: Environmental Management Budget for Maliyakarai to Athur Corridor (SH 30) (Contract BOQ Bill no 6)

S. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)	Remarks
1.1	**Mitigation Measures other than Good Engineering practices**					
1.1.1	Readymade Oil and Grease interceptors at vehicle maintenance and hot mix plant areas in construction camp	Number	25000	2	50000	
1.1.2	Artificial Groundwater Recharge Structures in roadside drains in rural areas at every 500 m alternatively on both sides	Number	41000	14	0	Cost covered under Engineering Cost
1.1.3	**Noise Barriers for Sensitive Noise Receptors**					
1.1.3.1	Government Veterinary Hospital	Length	9172	0	0	Compound Wall not affected
1.1.3.2	Rasi Metric Higher Secondary School	Length	9172	0	0	Compound Wall not affected
1.1.3.3	Government School	Length	9172	0	0	Compound Wall not affected
1.1.3.4	First Aid Medical Center	Length	9172	0	0	Noise Barrier not required
	Sub Total				**50000**	
1.2	**Enhancement Measures**					
1.2.1	Artificial Groundwater Recharge Structures in Ponds and lakes	Number	1760605	4	7042420	CSC shall get consent of the pond owner
1.2.2	Desilting/expansion of Ponds and Lakes	Number	200000	4	800000	CSC shall get consent of the pond owner
1.2.3	Provision of Toilet blocks at Bus Bays	Number	56423	11	0	Cost covered under Engineering Cost
1.2.4	Provision of Drinking Water Facility at Bus Shelters	Number	60000	18	0	Cost covered under Engineering Cost

S. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)	Remarks
1.2.5	Landscaping at 1 Major Junction	Covered under Engineering Cost				
	Sub Total				**7842420**	
1.3	**Compensatory Plantation (1:10 Ratio)**					
1.3.1	**Avenue Plantation**					
1.3.1.1	Plantation, fencing & maintenance of Saplings for 5 years	Number	2180	5,260	1,14,66,800	Trees shall be planted within available Existing RoW at 2 m interval. Remaining trees shall be planted within the premises of Government buildings and cultural properties along the road.
1.3.1.2	Tree Cutting Cost	Covered under Site Clearing cost (Engineering cost)				
1.3.2	**Plantation within the premises of Government buildings and cultural properties as part of Compensatory Plantation**					
1.3.2.1	Plantation, fencing & maintenance of Saplings for 5 years within the premises of Government buildings and cultural properties along the road	Number	2180	0	0	Avenue plantation is sufficient to meet the requirement of compensatory plantation
	Sub Total				**1,14,66,800**	
1.4	**Transplantation of Small Trees**					
1.4.1	Transplantation of Govt. trees with girth size beween 10 cm and 30 cm in Govt. land including transportation of tree and maintenance up to two months	Nos.	10800	12	129600	Refer Annexure 3.56 Govt. trees with girth size between 10 cm and 30 cm only will be transplanted
	Sub Total				**129600**	
1.5	**Monitoring of Environmental Attributes during Construction Phase**					
1.5.1	**Air Quality**					
1.5.1.1	Monitoring of Air Quality at Project facilities	Per Samples	2800	24	67200	Four location for three season in a year for 2 years
1.5.1.2	Monitoring of Air Quality at Critical Locations	Per Samples	2800	12	33600	Two locations for three season in a year for 2 years
1.5.2	**Noise Levels**					

S. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)	Remarks
1.5.2.1	Monitoring of Noise Level at Project Facilities	Per Samples	1200	24	28800	Four location for three season in a year for 2 years
1.5.2.2	Monitoring of Noise Levels at Critical Locations	Per Samples	1200	18	21600	Three locations for three season in a year for 2 years
1.5.3	**Water Quality**					
1.5.3.1	Monitoring of Water Quality at Critical Locations	Per Samples	5500	6	33000	One location for three season in a year for 2 years
1.5.4	**Soil Quality**					
1.5.4.1	Monitoring of Soil Quality at Critical Locations	Per Samples	4675	12	56100	Two locations for three season in a year for 2 years
1.5.4.2	Additional Soil Monitoring during Spills at Project Facilities	Per Samples	4675	12	56100	Two locations for three season in a year for 2 years
	Sub Total				**296400**	
Total Cost During Construction Stage (A)					**1,97,85,220**	
1.6	**Monitoring of Environmental Attributes during Operation Phase**					
1.6.1	Monitoring of Air Quality at Critical Locations	Per Sample	2800	12	33600	Two locations for three season in a year for 2 years
1.6.2	Monitoring of Noise Levels at Critical Locations	Per Sample	1200	18	21600	Three locations for three season in a year for 2 years
1.6.3	Monitoring of Water Quality at Critical Locations	Per Sample	5500	6	33000	One location for three season in a year for 2 years
1.6.4	Monitoring of Soil Quality at Critical Locations	Per Sample	4675	12	56100	Two locations for three season in a year for 2 years
Total Cost During Operation Stage (B)					**1,44,300**	
Grand Total (A+B)					**1,99,29,520**	

Annexure

Annexure – 1

Impacts type, Nature and Magnitude – Maliyakarai to Athur Corridor (SH 30)

Sl. No.	Activity	Environmental Attribute	Potential Impact	Degree of impact (Major/ Medium/ Minor)	Nature of impact (+ve/-ve, T/P)
A.	**Project Preparation Phase**				
A.1.	Preparation of Detailed Project Report	Land	Loss of productive land	Major	-ve, P
			Impacts due to siting of project related facilities	Major	-ve, P
			Soil erosion	Major	-ve, P
			Destabilization of slope	Medium	-ve, P
			Soil contamination due to spillage of oil and lubricants	Medium	-ve, P
			Blocking of natural drainages and filling of water bodies leading to water logging / flooding of adjacent low lying areas	Major	-ve, P
		Water	Contamination of water due to spillage of oil and lubricants and surface runoff with sediments from construction camps	Medium	-ve, P
			Contamination of water due to sewage from construction camps, labour camps, toll plazas, rest areas and truck lay byes	Medium	-ve, P
			Contamination of water due to foundation work for bridges.	Medium	-ve, T
			Alterations to natural drainage patterns	Major	-ve, P
			Reduced ground water recharge due to impervious pavement	Major	-ve, P
			Exploitation of ground water for construction.	Major	-ve, P
		Air	Increase in air pollution	Major	-ve, P
		Noise	Increase in noise levels	Major	-ve, P
		Biological	Loss of trees	Major	-ve, P
			Impact on forests and natural habitats	Major	-ve, P
		Socio-economic	Loss of land, structures and livelihoods	Major	-ve, P
			Loss of cultural properties	Major	-ve, P
			Shifting of community utilities and CPRs	Major	-ve, T
			Loss of access due to cutting of hill slopes / embankment construction	Major	-ve, P
			Road accidents	Major	-ve, P
		Solid Waste management	Generation of debris	Medium	-ve, P
B.	**Pre-Construction Phase**				
B.1.	Land Acquisition	Land	No impact	-	-
		Water	No impact	-	-

Sl. No.	Activity	Environmental Attribute	Potential Impact	Degree of impact (Major/ Medium/ Minor)	Nature of impact (+ve/-ve, T/P)
		Air	No impact	-	-
		Noise	No impact	-	-
		Biological	No impact	-	-
		Socio-economic	Loss of land, buildings and livelihood, loss of cultural properties and common property resources (CPRs)	Major	-ve, P
		Solid waste management	No impact	-	-
B.2.	Relocation of utilities	Land	No impact	-	-
		Water	No impact	-	-
		Air	No impact	-	-
		Noise	No impact	-	-
		Biological	No impact	-	-
		Socio-economic	Damages to utilities and inconvenience to public	Medium	-ve, T
		Solid waste management	No impact	-	-
B.3	Identification of site for construction camp	Land	Loss of topsoil, soil contamination due to spillage of fuel, lubricants and hazardous chemicals	Medium	-ve, T
		Water	Surface water pollution due to run off from the site containing oil and silt, and waste water from vehicle washing area and sewage from toilets.	Medium	-ve, T
		Air	Air pollution due to fugitive dust and gaseous emissions from hot mix plant and diesel generator.	Medium	-ve, T
		Noise	Noise pollution due to generator, machineries and movement of vehicles	Medium	-ve, T
		Biological	Loss of trees, Impact on forests and wildlife habitats	Medium	-ve, T
		Socio-economic	Inconvenience to local traffic in access roads to construction camp	Medium	-ve, T
		Solid waste management	No impact	-	-
B.4.	Identification of site for labour camps	Land	Loss of top soil and soil productivity due to soil compaction	Medium	-ve, T
		Water	Unsafe disposal of domestic sewage to nearest water body.	Medium	-ve, T
		Air	No impact	-	-
		Noise	No impact	-	-
		Biological	Cutting of trees / collection of fire wood and non-timber forest	Minor	-ve, T

Sl. No.	Activity	Environmental Attribute	Potential Impact	Degree of impact (Major/ Medium/ Minor)	Nature of impact (+ve/-ve, T/P)
			produce (NTFP) from forest, hunting of wild animals, occurrence of forest fire.		
		Socio-economic	Impact on Public health and law and order	Medium	-ve, T
		Solid waste management	No Impact	-	-
B.5.	Identification of site for quarrying and stone crushing operations	Land	Loss of productive land, destabilization of slopes due to modification of natural conditions	Major	-ve, P
		Water	Surface water pollution due to run off from the site	Minor	-ve, T
		Air	Increased air pollution due to fugitive dust	Medium	-ve, T
		Noise	Increase in noise levels	Medium	-ve, T
		Biological	Loss of trees, Impact on forests and wildlife habitats	Minor	-ve, T
		Socio-economic	Risk for local inhabitants and passengers through nearby roads, railways, ropeways and waterways. Inconvenience to local traffic in access roads to quarry and crusher	Medium	-ve, T
		Solid waste management	Impacts due to improper disposal of overburden from quarry site.	Minor	-ve, T
B.6.	Identification of borrow sites	Land	Loss of productive land, loss of top soil, soil erosion, alterations in local topography, flooding of land due to collapse of river bund / irrigation tank bund.	Major	-ve, P
		Water	Collapse of irrigation tank bund and loss of irrigation water.	Minor	-ve, T
		Air	Increased air pollution due to fugitive dust	Minor	-ve, T
		Noise	Increase in noise levels	Minor	-ve, T
		Biological	Loss of trees, Impact on forests and wildlife habitats	Minor	-ve / T
		Socio-economic	Inconvenience to local traffic in access roads to borrow area, Occurrence of water borne diseases due to accumulation of water in borrowed lands.	Medium	-ve / T
		Solid waste management	No impact	-	-
B.7.	Identification of water sources	Land	No impact	-	-
		Water	Ground water depletion	Major	-ve, P
		Air	No impact	-	-
		Noise	No impact	-	-
		Biological	No impact	-	-

Sl. No.	Activity	Environmental Attribute	Potential Impact	Degree of impact (Major/ Medium/ Minor)	Nature of impact (+ve/-ve, T/P)
		Socio-economic	Reduction in water available for agriculture and domestic purposes	Major	-ve, P
		Solid Waste Management	No impact	-	-
B.8.	Identification of site for debris / excess soil disposal	Land	Loss of soil productivity, soil contamination, soil erosion	Medium	-ve, P
		Water	Surface water pollution due to run off from the debris and soil	Minor	-ve, T
		Air	Air pollution due to fugitive dust during dumping of debris and soil	Medium	-ve, T
		Noise	Noise pollution due to movement of vehicles and dumping of debris.	Minor	-ve, T
		Biological	Loss of vegetative cover, impact on wildlife habitats	Medium	-ve, P
		Socio-economic	Obstruction to movement of local inhabitants, affect the safety and aesthetical beauty of the locality.	Minor	-ve, P
		Solid waste management	No impact	-	-
C.	**Construction Phase**				
C.1.	**Site Preparation Activities**				
C.1.1.	Setting up of construction camp	Land	Soil contamination due to spillage of fuel and lubricants, soil erosion due to surface run off.	Medium	-ve, P
		Water	Contamination of water due to spillage of oil and lubricants and surface runoff with sediments from construction camps. Contamination of water due to sewage from construction camps	Medium	-ve, T
		Air	Air pollution due to fugitive dust and gaseous emissions from hot mix plant and diesel generator	Medium	-ve, T
		Noise	Increase in noise level due to diesel generator, other machineries and vehicles	Medium	-ve, T
		Biological	Loss of vegetation	Medium	-ve, P
		Socio-economic	Occupational health and safety impacts for workers	Medium	-ve, P
		Solid Waste management	Unscientific disposal of debris / solid waste	Medium	-ve, P
C.1.2.	Setting up of labour camp	Land	Loss of soil productivity	Medium	-ve, T
		Water	Pollution of water bodies with sewage	Medium	-ve, T
		Air	No impact	-	-
		Noise	No impact	-	-

Sl. No.	Activity	Environmental Attribute	Potential Impact	Degree of impact (Major/ Medium/ Minor)	Nature of impact (+ve/-ve, T/P)
		Biological	Loss of vegetation	Minor	-ve, T
			Deforestation	Minor	-ve, T
		Socio-economic	Health impact due to fire accidents, Increase in communicable diseases	Medium	-ve, P
		Solid Waste management	Unhygienic environment due to unsafe disposal of waste generated.	Minor	-ve, T
C.1.3.	Setting up of Quarry and Crusher	Land	Loss of top soil	Major	-ve, P
		Water	Surface water pollution due to run off with sediments from the site	Medium	-ve, T
		Air	Air pollution due to fugitive dust and emissions from diesel generator	Major	-ve, T
		Noise	Noise pollution due to Crusher	Major	-ve, T
		Biological	Loss of vegetation	Medium	-ve, P
		Socio-economic	Occupational health and safety impacts for workers, Risk for local inhabitants and passengers through nearby roads, railways, ropeways and waterways.	Medium	-ve, P
		Solid Waste Management	No impact	-	-
C.1.4.	Setting up of borrow area	Land	Loss of topsoil, soil erosion	Major	-ve, P
		Water	Pollution of water bodies due to surface run off.	Medium	-ve, T
		Air	Air pollution due to fugitive dust.	Medium	-ve, T
		Noise	No impact	-	-
		Biological	Loss of trees	Medium	-ve, P
		Socio-economic	Risk for local inhabitants due to trespassing	Medium	-ve, T
		Solid Waste Management	No impact	-	-
C.1.5.	Preparation of debris disposal site	Land	Loss of productive land, erosion of disposed soil	Major	-ve, P
		Water	Surface water pollution due to run off from the site	Minor	-ve, T
		Air	No impact	-	-
		Noise	No impact	-	-
		Biological	Loss of trees	Minor	-ve, P
		Socio-economic	Risk for local inhabitants due to trespassing	Minor	-ve, T
		Solid waste	No impact	-	-

Sl. No.	Activity	Environmental Attribute	Potential Impact	Degree of impact (Major/ Medium/ Minor)	Nature of impact (+ve/-ve, T/P)
		management			
C.1.6.	Clearing, Grubbing and Stripping	Land	Destabilization of slopes, soil erosion.	Medium	-ve, T /P
		Water	No impact	-	-
		Air	Change in micro climate	Minor	-ve, T
		Noise	Increase in noise levels	Minor	-ve, T
		Biological	Loss of vegetative cover and impact on fauna	Major	-ve, P
		Socio-economic	Loss of tree shade. Safety of pedestrians and passersby.	Minor	-ve, T
		Solid waste management	Unscientific / unsafe disposal of tree waste	Minor	-ve, T
C.1.7.	Cutting of Earth	Land	Loss of topsoil, water logging due to alterations in natural drainage patterns.	Major	-ve, P
		Water	Blocking of cross drainage and water logging, contaminating water bodies	Major	-ve, P
		Air	Increased air pollution due to fugitive dust/ emissions.	Medium	-ve, T
		Noise	Increase in noise levels	Medium	-ve, T
		Biological	No impact	-	-
		Socio-economic	No impact	-	-
		Solid waste management	Unscientific/ unsafe disposal of over burden	Medium	-ve, P
C.1.8.	Filling	Land	Loss of topsoil, alteration of natural drainage patterns.	Major	-ve, P
		Water	Diversion of natural surface water flows, alterations/blocking of cross drainage and water logging.	Medium	-ve, P
		Air	Increased air pollution due to fugitive dust / emissions.	Medium	-ve, T
		Noise	Increase in noise levels	Medium	-ve, T
		Biological	No impact	-	-
		Socio-economic	Flooding of adjacent low lying land	Medium	-ve, P
		Solid waste management	No impact	-	-
C.1.9.	Stripping	Land	Loss of topsoil, removal of vegetation.	Major	-ve, P
		Water	Pollution of water bodies due to irresponsible handling of stripped earth.	Medium	-ve, P
		Air	Increased air pollution	Major	-ve, T

Sl. No.	Activity	Environmental Attribute	Potential Impact	Degree of impact (Major/ Medium/ Minor)	Nature of impact (+ve/-ve, T/P)
		Noise	Increase in noise levels	Medium	-ve, T
		Biological	No impact	-	-
		Socio-economic	No impact	-	-
		Solid waste management	No impact	Medium	-ve, T
C.1.10.	Demolition	Land	No impact	-	-
		Water	No impact	-	-
		Air	Increased air pollution due to fugitive dust	Medium	-ve, T
		Noise	Increase in noise levels due to demolition activity	Medium	-ve, T
		Biological	No impact	-	-
		Socio-economic	No impact	-	-
		Solid waste management	Unscientific / unsafe disposal of debris	Medium	-ve, P
D.2.	**Construction Activities**				
D.2.1.	Operation of construction camp	Land	Complete elimination of productive capacity of soil, spillage of fuel, lubricants and hazardous chemicals.	Medium	-ve, T
		Water	Surface water pollution due to run off and waste water / sewage disposal from the camps.	Medium	-ve, T
		Air	Increase in air pollution due to operation of machineries.	Medium	-ve, T
		Noise	Increase in noise level due to operation of machineries.	-	-
		Biological	Loss of vegetation	-	-
		Socio-economic	Occupational health and safety impacts for workers	Major	-ve, P
				Major	-ve, P
		Solid waste management	Unscientific / unsafe disposal of debris / waste	Major	-ve, P
D.2.2.	Functioning of labour camp	Land	Contamination of soil due to waste water	Medium	-ve, T
		Water	Surface water pollution due to run off from the site	Medium	-ve, T
		Air	Air pollution due to burning of dry waste/ fire wood.	Minor	-ve, T
		Noise	No impact.	-	-
		Biological	Loss of trees, Impact on forests, spread of forest fire	Minor	-ve, T
		Socio-economic	Increase in communicable diseases Increase in crime rate Indulgence in hunting and collection of forest produces.	Medium	-ve, T

Sl. No.	Activity	Environmental Attribute	Potential Impact	Degree of impact (Major/ Medium/ Minor)	Nature of impact (+ve/-ve, T/P)
			Collection of firewood if camp is near the forest Chances of forest fires	Medium	-ve, T
			Occurrence of accidents	Medium	-ve, T
		Solid waste management	Unhygienic environment due to unsafe disposal of solid waste generated.	Minor	-ve, T
D.2.3.	Quarrying and operation of crushers	Land	Loss of soil productivity, soil contamination	Major	-ve, P
		Water	Surface water pollution due to run off from the site	Medium	-ve, P
		Air	Air pollution due to fugitive dust.	Medium	-ve, T
		Noise	Noise pollution due to stone blasting	Medium	-ve, T
		Biological	No impact	-	-
		Socio-economic	Safety of labourers	Medium	-ve, P
		Solid waste management	No impact	-	-
D.2.4.	Borrowing of earth	Land	Loss of fertile lands, loss of topsoil, soil contamination, removal of vegetation, soil erosion, destabilization of slopes due to modification of natural conditions.	Major	-ve, P
		Water	Alterations in local drainage pattern, diversion of natural surface water flows, blocking of cross drainage and water logging.	Medium	-ve, P
		Air	Increased air pollution due to fugitive dust	Medium	-ve, T
		Noise	Increase in noise levels	Medium	-ve, T
		Biological	No impact	-	-
		Socio-economic	Occupational health and safety impacts	Medium	-ve, P
				Major	-ve, P
		Solid waste management	No impact	-	-
D.2.5.	Extraction of Surface water	Land	No impact	-	-
		Water	Over exploitation of surface water	Major	-ve, P
		Air	No impact	-	-
		Noise	No impact	-	-
		Biological	Impact on fauna in lakes and rivers	Major	-ve, P
		Socio-economic	Reduction in water available for agriculture and domestic purposes	Major	-ve, P
		Solid waste	No impact	-	-
D.2.6.	Transportatio	Land	Spillage of fuel, lubricants and hazardous chemicals.	Major	-ve, P

Sl. No.	Activity	Environmental Attribute	Potential Impact	Degree of impact (Major/ Medium/ Minor)	Nature of impact (+ve/-ve, T/P)
	n of materials		Damage of haul road due to over usage.	Major	-ve, P
		Water	Contamination of water due to washing of vehicles, construction equipments and machineries	Major	-ve, P
		Air	Increased air pollution due to fugitive dust	Major	-ve, T
		Noise	Increase in noise levels	Medium	-ve, T
		Biological	No impact	-	-
		Socio-economic	Inconvenience to local travelers. Increase in accidents	Medium	-ve, T
		Solid waste management	No impact	-	-
D.2.7.	Scarifying of existing bituminous layer	Land	No impact	-	-
		Water	No impact	-	-
		Air	Increased air pollution due to fugitive dust	Medium	-ve, T
		Noise	Increase in noise levels	Medium	-ve, T
		Biological	No impact	-	-
		Socio-economic	Health impact on workers due to air and noise pollution	Medium	-ve, P
		Solid waste management	Unscientific / unsafe disposal of debris / waste	Medium	-ve, P
D.2.8.	Compacting earth and laying of sub-base course	Land	No impact	-	-
		Water	No impact	-	-
		Air	Increased air pollution	Medium	-ve, T
		Noise	Increase in noise levels	Medium	-ve, T
		Biological	No impact	-	-
		Socio-economic	Disruption of Traffic	Medium	-ve, T
			Occurrence of accidents	Major	-ve, P
		Solid waste management	Utilisation of fly ash	Major	+ve, P
			Unscientific/ unsafe disposal of excess soil	Major	-ve, P
D.2.9.	Laying base course and surface course	Land	No Impact	-	-
		Water	No Impact	-	-
		Air	Increased air pollution due to fugitive dust generation	Major	-ve, T
		Noise	Increase in noise levels	Medium	-ve, T
		Biological	No impact	-	-
		Socio-economic	Disruption of Traffic	Major	-ve, T
			Occurrence of accidents	Major	-ve, P

Sl. No.	Activity	Environmental Attribute	Potential Impact	Degree of impact (Major/ Medium/ Minor)	Nature of impact (+ve/-ve, T/P)
		Solid waste management	No impact	-	-
D.2.10.	Construction of bridges, culverts	Land	Spillage of fuel, lubricants and hazardous chemicals	Major	-ve, P
		Water	Water pollution due to infusion of slurry into the water body during foundation construction. Impact on water quality due to remnants of construction materials.	Major	-ve, P
		Air	Increased air pollution	Medium	-ve, T
		Noise	Increase in noise levels	Medium	-ve, T
		Biological	Impact on aquatic biota due to disposal of construction material	Major	-ve, P
		Socio-economic	Disruption of Traffic	Medium	-ve, T
			Occurrence of accidents	Major	-ve, P
		Solid waste management	Unscientific / unsafe disposal of debris	Medium	-ve, P
D.2.11.	Construction of flyovers, grade separators, ROBs.	Land	Spillage of fuel, lubricants and hazardous chemicals	Medium	-ve, P
		Water	No impact	-	-
		Air	Increased air pollution	Medium	-ve, T
		Noise	Increase in noise levels	Medium	-ve, T
		Biological	No impact	-	-
		Socio-economic	Disruption of Traffic	Medium	-ve, T
			Occurrence of accidents	Major	-ve, P
		Solid waste management	Unscientific / unsafe disposal of debris	Medium	-ve, P
D.2.12.	Construction of underpasses (pedestrian/ cattle and wild animal)	Land	Contamination of soil due to spillage of oil, lubricants and hazardous chemicals	Major	-ve, P
		Water	Contamination water due to spillage and careless handling of oil and lubricants	Medium	-ve, T
		Air	Increased air pollution	Medium	-ve, T
		Noise	Increase in noise levels	Medium	-ve, T
		Biological	No impact	-	-
		Socio-economic	Disruption of Traffic	Medium	-ve, T
			Occurrence of accidents	Major	-ve, P
		Solid waste management	Unscientific / unsafe disposal of debris	Medium	-ve, P
D.2.13.	Construction	Land	Spillage of fuel, lubricants and hazardous chemicals	Medium	-ve, P

Sl. No.	Activity	Environmental Attribute	Potential Impact	Degree of impact (Major/ Medium/ Minor)	Nature of impact (+ve/-ve, T/P)
	of drains, utilities, RWH pits etc.	Water	No Impact	-	-
		Air	Increased air pollution	Medium	-ve, T
		Noise	Increase in noise levels	Medium	-ve, T
		Biological	No impact	-	-
		Socio-economic	Occurrence of accidents	Major	-ve, P
		Solid waste management	Unscientific / unsafe disposal of debris	Medium	-ve, P
D.2.14.	Debris disposal	Land	No impact	-	-
		Water	No impact		
		Air	No impact	-	-
		Noise	No impact	-	-
		Biological	No impact	-	-
		Socio-economic	No impact	-	-
		Solid waste management	No impact	-	-
D.2.15.	Roadside plantation and landscaping	Land	Beautification, vegetation cover, protects soil erosion	Medium	+ve
		Water	Facilitates ground water recharge	-	-
		Air	Improvement in air quality	-	-
		Noise	Reduces noise pollution to adjacent areas.	-	-
		Biological	Increase in vegetation cover	-	-
		Socio-economic	Improved aesthetics	-	-
		Solid waste management	Unscientific / unsafe disposal of debris	Medium	-ve
E.	**Post Construction Phase**				
E.1.	Redevelopment of construction camp sites	Land	Rejuvenation of land	Major	+ve
		Water	Increased water recharge	Major	+ve
		Air	Improvement in air quality	Medium	+ve
		Noise	No impact	-	-
		Biological	Increased vegetation	Medium	+ve
		Socio-economic	No impact	-	-
		Solid waste	No impact	-	-

Sl. No.	Activity	Environmental Attribute	Potential Impact	Degree of impact (Major/ Medium/ Minor)	Nature of impact (+ve/-ve, T/P)
		management			
E.2.	Redevelopment of quarry sites	Land	Rejuvenation of land	Major	+ve
		Water	Increased water recharge	Major	+ve
		Air	Improvement in air quality	-	-
		Noise	No impact		
		Biological	Increased vegetation	Medium	+ve
		Socio-economic	Involvement of local community and enhancement of their livelihood	Medium	+ve
		Solid waste management	No impact	-	-
E.3.	Redevelopment of borrow sites	Land	Rejuvenation of land	Major	+ve
		Water	Increased water recharge	Major	+ve
		Air	Improvement in air quality	Medium	+ve
		Noise	No impact	-	-
		Biological	Increased vegetation	Medium	+ve
		Socio-economic	Involvement of local community and enhancement of their livelihood	Medium	+ve
		Solid waste management	No impact	-	-
E.4.	Redevelopment of labour camp sites	Land	Rejuvenation of land	Major	+ve
		Water	Increased water recharge	Major	+ve
		Air	Improvement in air quality	Medium	+ve
		Noise	No impact	-	-
		Biological	Increased vegetation	Medium	+ve, P
		Socio-economic	No impact	-	-
		Solid waste management	No impact	-	-
E.5.	Operationalization of the project stretch	Land	Improvement of road geometry and pavement condition	Major	+ve, P
		Water	Water logging during monsoon will not take place.	Major	+ve, P
		Air	Reduced dust generation from road. Increased vehicular emissions due to increased traffic	Medium	-ve and +ve, P
		Noise	Increase in the ambient noise levels, especially during night time along the project road.	Medium	-ve, T
		Biological	Improved biodiversity and aesthetics	Medium	+ve, P

Sl. No.	Activity	Environmental Attribute	Potential Impact	Degree of impact (Major/ Medium/ Minor)	Nature of impact (+ve/-ve, T/P)
		Socio-economic	Less chances of accidents.	Major	+ve, T
			Safety	Major	+ve, P
		Solid waste management	No impact	-	-

Annexure – 2

Chainage-wise Details of Trees proposed to be removed for the Improvement

I. Malliyakarai to Attur Corridor (SH 30)

Summary of Government Trees to be Cut / Transplanted																								
Chainage		Girth Size at Brest Height (GBH)																						
From	To	< 30 cm			30 to 60 cm			60 to 90 cm			90 to 120 cm			120 to 150 cm			150 to 180 cm			180 to 210 cm			> 210 cm		
		LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total
81+100	82+000	0	0	0	0	2	2	2	1	3	4	0	4	0	1	1	0	0	0	1	2	3	1	12	13
82+000	83+000	0	0	0	2	0	2	4	3	7	3	0	3	4	1	5	2	2	4	0	3	3	3	13	16
83+000	84+000	0	0	0	6	6	12	7	10	17	1	6	7	1	3	4	0	0	0	1	1	2	9	17	26
84+000	85+000	5	0	5	0	1	1	0	3	3	1	0	1	1	1	2	1	0	1	7	0	7	0	29	29
85+000	86+000	0	7	7	0	3	3	0	0	0	0	1	1	0	1	1	2	7	9	1	7	8	9	32	41
86+000	87+000	0	0	0	2	3	5	0	9	9	1	0	1	2	2	4	0	4	4	2	3	5	0	17	17
87+000	88+000	0	0	0	0	0	0	2	4	6	1	3	4	2	4	6	3	6	9	3	2	5	2	12	14
88+000	89+000	0	0	0	2	0	2	1	4	5	0	0	0	0	1	1	2	2	4	1	4	5	1	19	20
89+000	90+000	0	0	0	1	1	2	5	2	7	3	0	3	4	8	12	3	1	4	0	7	7	11	13	24
90+000	91+000	0	0	0	0	2	2	4	11	15	6	2	8	1	4	5	1	3	4	1	2	3	4	17	21
Sub Total		**5**	**7**	**12**	**13**	**18**	**31**	**25**	**47**	**72**	**20**	**12**	**32**	**15**	**26**	**41**	**14**	**25**	**39**	**17**	**31**	**48**	**40**	**181**	**221**
Total Number of Trees to be Transplanted (GBH<30 cm)											**12**														
Total Number of Trees to be Cut (GBH>30 cm)											**484**														

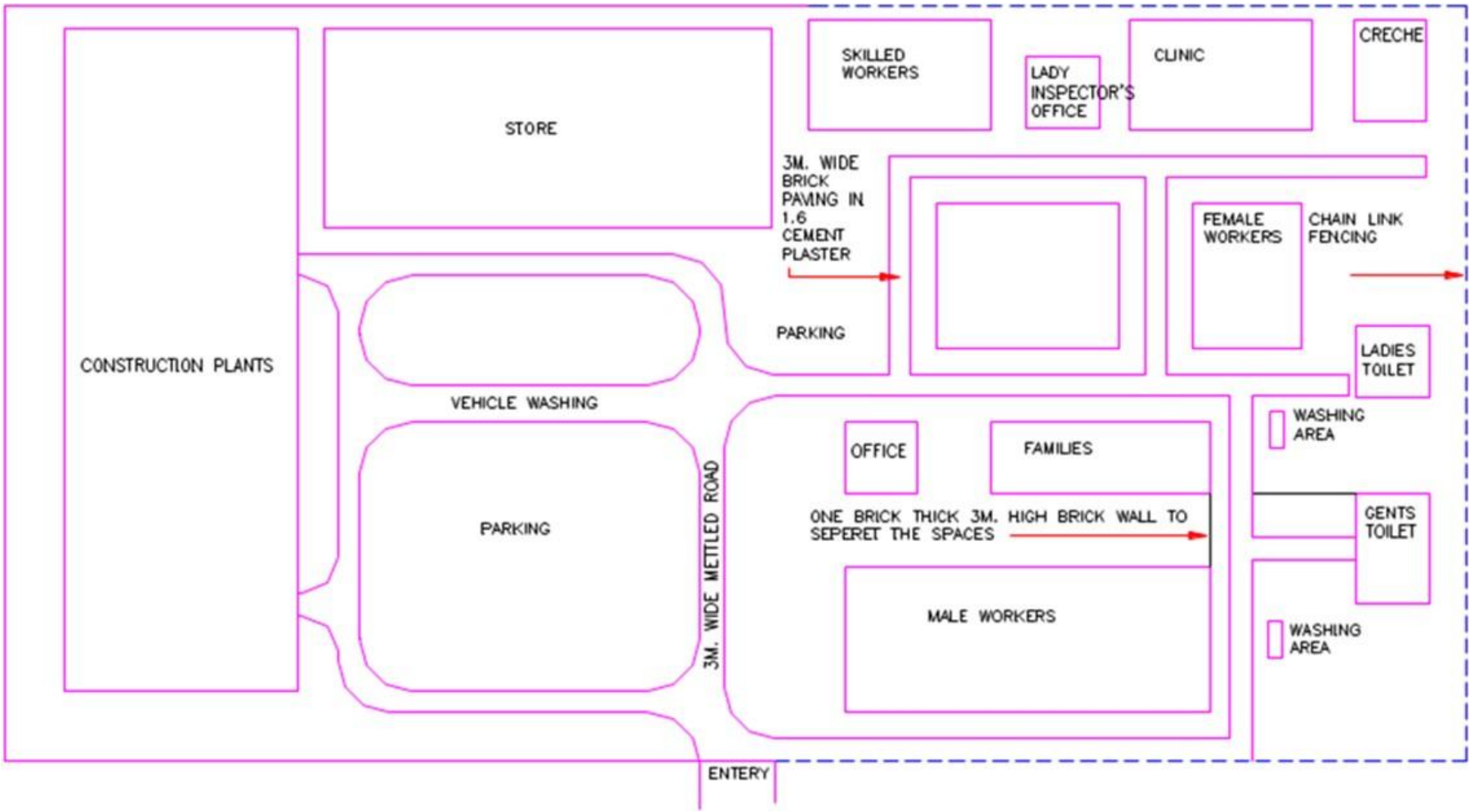
Summary of Private Trees to be Cut / Transplanted																									
Chainage		**Girth Size at Brest Height (GBH)**																							
From	**To**	**< 30 cm**			**30 to 60 cm**			**60 to 90 cm**			**90 to 120 cm**			**120 to 150 cm**			**150 to 180 cm**			**180 to 210 cm**			**> 210 cm**		
		LHS	**RHS**	**Total**	**LHS**	**RHS**	**Total**	**LHS**	**RHS**	**Total**	**LHS**	**RHS**	**Total**	**LHS**	**RHS**	**Total**	**LHS**	**RHS**	**Total**	**LHS**	**RHS**	**Total**	**LHS**	**RHS**	**Total**
81+100	82+000	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
82+000	83+000	0	1	1	2	0	2	0	0	0	1	0	1	0	1	1	0	0	0	0	1	1	0	0	0
83+000	84+000	0	0	0	0	0	0	5	0	5	3	0	3	1	0	1	0	0	0	0	0	0	4	0	4
84+000	85+000	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
85+000	86+000	0	7	7	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	6	0	6
86+000	87+000	0	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
87+000	88+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
88+000	89+000	0	0	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3
89+000	90+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90+000	91+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub Total		0	12	**12**	4	1	**5**	5	6	**11**	4	0	**4**	1	1	**2**	2	0	**2**	0	1	**1**	16	1	**17**
Total Number of Trees to be Transplanted (GBH<30 cm)										**12**[2]															
Total Number of Trees to be Cut (GBH>30 cm)										**42**															

[2]Private trees are not proposed to be transplanted

Summary of Government Trees Saved																									
Chainage		Girth Size at Brest Height (GBH)																							
From	To	< 30 cm			30 to 60 cm			60 to 90 cm			90 to 120 cm			120 to 150 cm			150 to 180 cm			180 to 210 cm			> 210 cm		
		LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total
81+100	82+000	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	1	1	1	0	1	23	5	28
82+000	83+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	0	21
83+000	84+000	0	0	0	2	0	2	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4
84+000	85+000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	0	29
85+000	86+000	0	0	0	2	0	2	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	20	1	21
86+000	87+000	0	0	0	0	1	1	0	2	2	0	1	1	0	2	2	0	3	3	0	4	4	22	2	24
87+000	88+000	0	0	0	0	0	0	3	0	3	2	0	2	4	0	4	2	0	2	1	0	1	12	0	12
88+000	89+000	0	0	0	0	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	30	2	32
89+000	90+000	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	1	0	1	0	0	0	8	0	8
90+000	91+000	0	0	0	0	1	1	1	1	2	0	0	0	0	1	1	0	2	2	2	0	2	16	1	17
Sub Total		0	0	0	4	3	7	5	5	10	2	2	4	7	5	12	3	6	9	4	4	8	185	11	196
Total		246																							

Annexure – 3

Schematic Drawing of Construction Camp



Annexure – 4

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 CSC, 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

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											

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						
18	Construction Workers safety - Provision of personnel protective equipment						
19	A. Helmets						
	B. Safety Shoe						

Sl. No.	Safety Issues	Yes	No	Non compliance	Corrective Action	Penalty	Remarks
	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						

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 – 5

Guidelines for Environmental Management

GUIDELINE-1: SITE PREPARATION

1. GENERAL

The preparation of site for construction involves: (i) clearing of land required for construction; and (ii) management of activities such as traffic during construction. These activities have been detailed out for road construction activities separately.

2. ROAD CONSTRUCTION

2.1 Site Preparation Activities

After obtaining the consent of the community on the alignment, the Project Implementation Unit (PIU) of the Divisional Office shall be responsible to stake out the alignment by establishing working benchmarks on ground. It shall be the responsibility of the PIU to take over the possession of the proposed RoW and hand over the land width required clear of all encumbrances to the Contractor. Activities pertaining to the clearance of land and relocation of utilities need to be initiated by the PIU well in advance to avoid any delays in handing over of site to the Contractor. Assistance of the Revenue Department shall be sought in accomplishing the task. To summarize, the PIU's responsibilities before handing over the site to the contractor include:

- Clearance of encroachments within proposed RoW;
- Initiation of process for legal transfer of land title;
- Alignment modification or Relocation of common property resources in consultation with the local community;
- Alignment modification or Relocation of utilities in consultation with the various government departments; and
- Obtain clearances required from government agencies for
  - Cutting of trees; and
  - Land Diversion of forestlands, etc.

2.2 Site Preparation Activities by the Contractor

Site preparation shall involve formation of the road base wherein it is ready for construction of protective/drainage works, carriageway, shoulders, parapets and other road furniture. The PIU shall transfer the land for civil works to the Contractor after peg marking of the alignment.

The Contractor shall verify the benchmarks soon after taking possession of the site. The Contractor, prior to initiation of site preparation activities, shall highlight any deviations/discrepancies in these benchmarks to the PIU in writing. The contractor shall submit the schedules and methods of operations for various items during the construction operations to the PIU for approval. The Contractor shall commence operations at site only after the approval of the schedules by the PIU.

The activities to be undertaken by the contractor during the clearing and grubbing of the site are as follows:

The clearance of site shall involve the removal of all materials such as trees, bushes, shrubs, stumps, roots, grass, weeds, part of topsoil and rubbish. Towards this end, the Contractor shall adopt the following measures: (i) Limiting the surface area of erodible earth material exposed by clearing and grubbing; (ii) Conservation of top soil and stock piling as per the measures suggested as part of **Guideline 4**, "Top Soil Salvage Storage and Replacement"; and (iii) Carry out necessary backfilling of pits resulting from uprooting of trees and stumps with excavated or approved materials to the required compaction conforming to the surrounding area.

To minimize the adverse impact on vegetation, only ground cover/shrubs that impinge directly on the permanent works shall be removed. Cutting of trees and vegetation outside the working area shall be avoided under all circumstances. In case the alignment passes through forest areas, The Forest Ranger shall be consulted for identification of presence of any rare/endangered species within the proposed road way. Protection of such species if found shall be as per the directions of the Forest Department.

The locations for disposal of grubbing waste shall be finalized prior to the start of the works on any particular section of the road. The selection of the site shall be approved by the PIU. The criteria for disposal of wastes shall be in accordance with the measures given in Guideline on, "Waste Management and Debris Disposal" (**Guideline 8**).

In locations where erosion or sedimentation is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion and sedimentation control features can follow immediately, if the project conditions permit.

Dismantling of CD structures and culverts shall be carried out in a manner as not to damage the remaining required portion of structures and other surrounding properties. The disposal of wastes shall be in accordance with the provisions given in **Guideline 8**, "Waste Management and Debris Disposal". The following precautions shall be adopted: (i) The waste generated shall not be disposed off in watercourses, to avoid hindrance to the flow, and (ii) All necessary measures shall be taken while working close to cross drainage channels to prevent earthwork, stonework as well as the method of operation from impeding cross drainage at rivers, streams, water canals and existing irrigation and drainage systems.

The designated sites duly approved by Implementing Agency shall be cleared of its existing cover for setting up of the construction sites, camps and related infrastructure facilities, borrow areas and other locations identified for temporary use during construction. The contractor shall comply with all safety requirements in consideration as specified in the **Guideline 12** on, "Labour & Worker's Health and Safety". Before initiation of site preparation activities along these lands to be used temporarily during construction, it shall be the responsibility of the Contractor to submit and obtain approval of the site redevelopment plan from the implementing agency. The letter/contract agreement between the owner(s) of the land parcel for temporary usage shall include site redevelopment to its original status. The guidelines for the same are furnished in the Guideline on, "Construction Plants & Equipment Management"; guideline, "Construction and Labour Camps"; and "Borrow areas".

2.3 Traffic management during construction

Traffic management during construction is an activity specific to the contractors. Contractors must ensure a reasonably smooth flow of traffic during construction. The following are the general principles to be followed for traffic management during construction:

Partial pavement construction over long lengths will not be permitted. The contractor should concentrate his activities over sections such that he can complete continuous fronts of up to a maximum of 1 km before starting the adjacent front. The contractor may open more than one continuous 1 km front provided that he has the separate resources to do so. The resources working on a 1 km front may not be shifted to another front until no longer required on that front.

- The construction activities should be staggered over sub-sections to the extent that the use of plant and equipment is optimized to maximum efficiency and to avoid idling. For road widening operations, excavation **adjacent to the existing road shall not be permitted on both titles simultaneously.** Earthworks must be completed to the level of the existing road before excavation work on the opposite side will be permitted.
- The construction operations taking place on a particular front must be managed efficiently such that delays between successive pavement layers are minimized.

- Before the start of the monsoon season (June) the contractor shall ensure that the pavement over any front is complete, full width, at least upto Dense Bituminous Macadam, DBM level, but preferably with Asphaltic Concrete, AC wearing course. The contractor **should not start any sections of pavement that he cannot complete by the start of the monsoon season.**
- In the absence of permanent facilities, temporary drainage and erosion control measures, as required by the Specifications, are to be implemented prior to the onset of the monsoon.

In cases where separate traffic diversions are not essential or cost effective the construction methodology should be in accordance with the guidelines following:

On a 1km section, the pavement construction (except new alignments) should be limited to 500m subsections with a minimum of 1 to 1.5 km between successive sub-sections to ease traffic management and safety issues. The earthworks in the widening portions are not limited in, this respect. Excavation on both sides of the existing, road over the same sub-section simultaneously shall not be permitted for reasons of safety to the traffic, particularly at night.

Sub-sections longer than 500 m may be authorized by the Engineer if two-way traffic flow can be comfortably managed and the Contractor can demonstrate his ability to maintain dust control, proper road edge delineation, proper signage and traffic control. Where single file traffic is permitted ('only applicable to final wearing course operations), the sub-sections shall be reduced to a maximum length whereby safe traffic regulation can be physically managed. Single file traffic may not be permitted at certain locations or times of the day when traffic volumes are such that excessive congestion shall occur.

GUIDELINE-2: CONSTRUCTION AND LABOUR CAMPS

1. INTRODUCTION

The scope of this guideline pertains to the siting, development, management and restoration of construction and labour camps to avoid or mitigate impacts on the environment. The area requirement for the construction camp shall depend upon the size of contract, number of labourers employed and the extent of machinery deployed. The following sections describe the siting, construction, maintenance, provision of facilities in the camps and finally rehabilitation of the construction and labour camps. These are described in three stages, pre-construction, construction and post-construction stage. The issues related to construction camps are similar in the case of road construction and hence have been taken together.

2. PRE-CONSTRUCTION STAGE

Identification of site for construction and labour camps is the first task. The Contractor shall identify the site for construction camp in consultation with the individual owners in case of private lands and the concerned department in case of Government lands. The suitable sites shall be selected and finalized in consultation with the PIU. **Table 1** gives the lands that could be avoided for construction camps and conversely those that could be preferred.

Table 1: Selection Criterion for Construction Camps.

Avoid the following …	Prefer the following …
• Lands close to habitations. • Irrigated agricultural lands. • Lands belonging to small farmers. • Lands under village forests. Lands within 100m of community water bodies and water sources as rivers. • Lands within 100m of watercourses. • Low lying lands. • Lands supporting dense vegetation. • Grazing lands and lands with tenure rights. • Lands where there is no willingness of the landowner to permit its use.	• Waste lands. • Waste Lands belonging to owners who look upon the temporary use as a source of income. • Community lands or government land not used for beneficial purposes. • Private non-irrigated lands where the owner is willing. • Lands with an existing access road.

The contractor will work out arrangements for setting up his facilities during the duration of construction with the land owner/concerned department. These arrangements shall be in the form of written agreement between the contractor and the land owner (private/government) that would specify:

a) photograph of the proposed camp site in original condition;

b) activities to be carried out in the site;

c) environmental mitigation measures to be undertaken to prevent land, air, water and noise pollution;

d) detailed layout plan for development of the construction and labour camp that shall indicate the various structures to be constructed in the camp including temporary, drainage and other facilities (**Figure 1** gives a layout plan for a construction camp); and

e) Restoration plan of camp site to previous camp conditions.

The arrangements will be verified by the PIU to enable redressal of grievances at a later stage of the project.

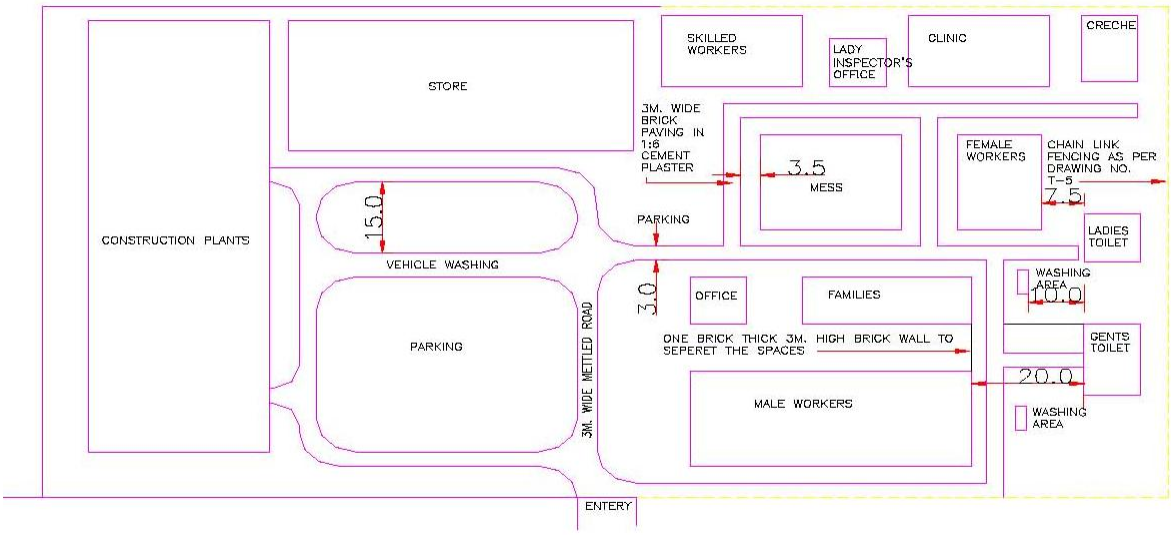


Figure 1: Layout Plan for Construction Camp

2.1 Setting up of labour camp

The contractor shall provide, free of cost in the camp site, temporary living accommodation to all the migrant workers employed by him for complete construction/maintenance work is in progress. A minimum area of 6 sq.mts per person shall be provided. The rooms of labour shall be well lighted and ventilated. The facilities to be provided for the labour are discussed below:

a) Drinking Water

Towards the provision and storage of drinking water at the construction camp, the contractor shall ensure the following provisions

- The contractor shall provide for a continuous and sufficient supply of potable water in the camps, in earthen pots or any other suitable containers.
- The contractor shall identify suitable community water sources for drinking. Only in the event of non-availability of other sources of potable water, the Contractor shall obtain water from an unprotected source only after the testing for its potability. Where water has to be drawn from an existing open well, the well shall be properly chlorinated before water is drawn from it for drinking. All such wells shall be entirely closed in and be provided with dust proof trap door.
- Every water supply or storage shall be at a distance of not less than 15m from any wastewater / sewage drain or other source of pollution. Water sources within 15m proximity of toilet, drain or any source of pollution will not be used as a source of drinking water in the project.
- A pump shall be fitted to covered well used as drinking water source, the trap door shall be kept locked and opened only for cleaning or inspection, which shall be done at least once a month.

b) Washing and Bathing Facilities

In every site, adequate and suitable facilities for washing clothes and utensils shall be provided and maintained for the use of contract labor employed therein. Separate and adequate bathing shall be provided for the use of male and female workers. Such facilities shall be conveniently accessible and shall be kept in clean and hygienic conditions.

c) Toilets Facilities

Sanitary arrangements, latrines and urinals shall be provided in every work place separately for male and female workers. The arrangements shall include:

- A latrine for every 15 females or part thereof (where female workers are employed).
- A latrine for every 10 males.

- Every latrine shall be under cover and so partitioned as to secure privacy, and shall have a proper door and fastenings.
- Where workers of both sexes are employed, there shall be displayed outside each block of latrine and urinal, a notice in the language understood by the majority of the workers "For Men Only" or "For Women Only" as the case may be.
- The latrines and urinals shall be adequately lighted and shall be maintained in a clean sanitary condition at all times and should have a proper drainage system;
- Water shall be provided in or near the latrines and urinals by storage in suitable containers.

d) Waste Disposal

- Disposal of sanitary wastes and excreta shall be into septic tanks.
- Kitchen waste water shall be disposed into soak pits/kitchen sump located preferably at least 15 meters from any water body. Sump capacity should be at least 1.3 times the maximum volume of wastewater discharged per day. The bottom of the pit should be filled with coarse gravel and the sides shored up with board, etc. to prevent erosion and collapse of the pit. New soak pits shall be made ready as soon as the earlier one is filled.
- Solid wastes generated in the kitchen shall be reused if recyclable or disposed off in land fill sites.

e) Medical and First Aid Facilities

Medical facilities shall be provided to the labour at the construction camp. Visits of doctor shall be arranged twice a month wherein routine checkups would be conducted for women and children. A separate room for medical checkups and keeping of first aid facilities should be built. The site medical room should display awareness posters on safety facilitation hygiene and HIV/AIDS awareness.

- First Aid Box will be provided at every construction campsite and under the charge of a responsible person who shall always be readily available during working hours. He shall be adequately trained in administering first aid-treatment. Formal arrangement shall be prescribed to carry injured person or person suddenly taken ill to the nearest hospital. The first aid box shall contain the following.
  - 6 small sterilized dressings
  - 3 medium size sterilized dressings
  - 3 large size sterilized dressings
  - 3 large sterilized burns dressings
  - 1 (30 ml) bottle containing 2 % alcoholic solution of iodine
  - 1 (30 ml) bottle containing salvolatile
  - 1 snakebite lancet
  - 1 (30 gms) bottle of potassium permanganate crystals
  - 1 pair scissors
  - Ointment for burns
  - A bottle of suitable surgical antiseptic solution
  - In case, the number of labour exceeds 50, the items in the first aid box shall be doubled.

f) Provision of Shelter during Rest

The work place shall provide four suitable sheds, two for meals and two for rest (separately for men and women). The height of the shelter shall not be less than 3.0m from the floor level to the lowest part of the roof. These shall be kept clean.

g) Crèches

In case 20 or more women workers are employed, there shall be a room of reasonable size for use of children under the age of six years. The room should have adequate light and realisation. A caretaker is to be appointed to look after the children. The use of the room shall be restricted to children, their mothers and the caretaker.

2.2 Storage of Construction Material in Construction Camps

For storage of Petrol/Oil/Lubricants, brick on edge flooring or sand flooring will be provided at the storage places of Petrol/Oil/Lubricants to avoid soil and water contamination due to spillage. These should be kept away from labour residential areas. The storage of cement shall be at Damp-proof flooring, as per IS codes. All materials shall be stored in a barricaded area. In case of electrical equipments, danger signs shall be posted. The batch mix plant is to be located away from the residential area and not in the wind direction. Separate parking areas for vehicles and also workshop areas need to be provided.

2.3 Firefighting arrangement

- The following precautions need to be taken:
- Demarcation of area susceptible to fires with cautionary signage;
- Portable fire extinguishers and/or sand baskets shall be provided at easily accessible locations in the event of fire;
- Contractor shall educate the workers on usage of these equipment's.

2.4 Interactions with host communities

To ensure that there is no conflict of the migrant labor with the host communities, the contractor shall issue identity cards to labourers and residents of construction camps.

3. CONSTRUCTION STAGE

Construction camps shall be maintained free from litter and in hygienic condition. It should be kept free from spillage of oil, grease or bitumen. Any spillage should be cleaned immediately to avoid pollution of soil, water stored or adjacent water bodies. The following precautions need to be taken in construction camps.

- Measures to ensure that no leaching of oil and grease into water bodies or underground water takes place.
- Wastewater should not be disposed into water bodies.
- Regular collection of solid wastes should be undertaken and should be disposed off safely.
- All consumables as the first aid equipment, cleaning equipment for maintaining hygiene and sanitation should be recouped immediately.
- The debris/scrap generated during construction should be kept in a designated and barricaded area.

The PIU will monitor the cleanliness of construction campsites and ensure that the sites are properly maintained throughout the period of the contract.

4. POST CONSTRUCTION STAGE

At the completion of construction, all construction camp facilities shall be dismantled and removed from the site. The site shall be restored to a condition in no way inferior to the condition prior to commencement of the works. Various activities to be carried out for site rehabilitation include:

- Oil and fuel contaminated soil shall be removed and transported and buried in waste disposal areas.
- Soak pits, septic tanks shall be covered and effectively sealed off.
- Debris (rejected material) should be disposed off suitably (Refer Guideline - 10 on "Waste Management and Debris Disposal").
- Ramps created should be levelled.
- Underground water tank in a barren/non-agricultural land can be covered. However, in an agricultural land, the tank shall be removed.
- If the construction camp site is on an agricultural land, top soil can be spread so as to aid faster rejuvenation.

- Proper documentation of rehabilitation site is necessary. This shall include the following: –Photograph of rehabilitated site;
  - Land owner consent letter for satisfaction in measures taken for rehabilitation of site;
  - Undertaking from contractor; and
  - Certification from Engineer in-charge of the PIU.

In cases, where the construction camps site is located on a private land holding, the contractor would still have to restore the campsite as per this guideline. Also, he would have to obtain a certificate for satisfaction from the landowner.

GUIDELINE-3: BORROW AREAS

1. INTRODUCTION

Embankment fill material is to be procured from borrow areas designated for the purpose. Borrow areas cause significant adverse environmental impacts if appropriate mitigation measures are not taken. The scope of this guideline includes measures that are required during project planning and design stage, pre-construction, construction stage and post construction stage. Borrow areas are related only to road construction activities.

2. PROJECT PLANNING AND DESIGN STAGE

Design measures for reduction in the quantity of the earthwork will have to be undertaken to reduce the quantity of material extracted and consequently decrease the borrow area requirement. Borrow area siting should be in compliance with IRC: 10-1961. The DPR shall contain (i) Guidelines for locating site of borrow areas (ii) The arrangements to be worked out with the land owner/community for the site and (iii) Sample designs for redevelopment of borrow areas.

3. PRE-CONSTRUCTION STAGE

The contractor shall identify the borrow area locations in consultation with the individual owners in case of private lands and the concerned department in case of government lands, after assessing suitability of material. The suitable sites shall be selected and finalized in consultation with the PIU. Borrowing to be avoided on the following areas:

- Lands close to toe line.
- Irrigated agricultural lands (In case of necessity for borrowing from such lands, the topsoil shall be preserved in stockpiles. The subsequent Guidelines discuss in detail the conservation of topsoil.
- Grazing land.
- Lands within 0.8km of settlements.
- Environmentally sensitive areas such as Reserve Forests, Protected Forests, Sanctuary, wetlands (including beel). Also, a distance of 500 m should be maintained from such areas.
- Designated protected areas / forests.
- Unstable side-hills.
- Water-bodies.
- Streams and seepage areas.
- Areas supporting rare plant/ animal species;
- Ensure unsuitable soft rock is not prominent within the proposed depth of excavation which will render rehabilitation difficult.

3.1 Arrangements for Borrow Area

The Contractor will work out arrangements for borrowing with the land owner/concerned department. The arrangements will include the redevelopment after completion of borrowing. The arrangements will be verified by the PIU to enable redressal of grievances at a later stage of the project. The Engineer of PIU shall approve the borrow area after inspection of the site to verify the reclamation plan and its suitability with the contractor and landowner. The contractor shall commence borrowing soil only after the approval by the PIU. The contractor shall submit to the PIU the following before beginning work on the borrow areas.

- Written No-objection certificate of the owner/cultivator;
- Estimate extent of earth requires;
- Extent of land required and duration of the agreement;
- Photograph of the site in original condition; and
- Site redevelopment plan after completion.

The depth of excavation should be decided based on natural ground level of theland and the surroundings, and rehabilitation plan. In case higher depth of excavation is agreed with backfilling by unsuitable excavated soil (from roadway), then filling should be adequately compacted except topsoil, which is to be spread on the top most layer (for at least 20m thick). The guidelines for location, depth, size and shape of the borrow areas are available in the following:

- Clause 305.2.2.2 of MoRTH specification for roads and bridge works of IRC;
- Guidelines for environmental impact assessment of highway projects, Indian Roads Congress, 1989: (IRC: 104-1988);
- IRC: 10-1961-Recommended practice for borrow pits for road embankments constructed by manual operations, as revised in 1989;
- IRC SP: 58-2001 guideline for use of fly ash in road construction;
- EIA manual of MoEF, 2001;
- MoEF notification on utilisation of fly ash dated 27 August, 2005.

3.2 Documentation of Borrow Pit

The contractor must ensure that following data base must be documented for each identified borrow areas that provide the basis of the redevelopment plan.

- Chainage along with offset distance;
- Area (Sq.m);
- Photograph of the pit from all sides;
- Type of access/width/kutcha/pucca etc from the carriageway;
- Soil type;
- Slope/drainage characteristics;
- Water table of the area or identify from the nearest well, etc;
- Existing landuse, for example barren/agricultural/grazing land;
- Location/name/population of the nearest settlement from borrow area;
- Present usage of borrow area; and
- Community facility in the vicinity of borrow pit.

3.3 Redevelopment Plans for Borrow Pits

The following checklist provides guidelines in order to ensure that redevelopment of borrow areas must comply with MoRTH, clause 305.2.2.2 and EMP requirement. Borrow areas can be developed as:

- Ponds (various types) (e.g. Drinking Water only; Washing and for other Domestic Chores; Only for Cattle; Mixed Uses etc.) (a large pond can be divided into two parts - each having a defined use)
- Farmland
- Water Recharging Zones
- Pastureland
- Fish Ponds (pissiculture)
- Waste disposal Sites (depending upon the location, distance from settlements, pollution risks, safety, associated environmental risks and hazards, regulations/ permissions of appropriate authority and other such factors)
- Plantation Zones
- Recreational Zones (depending upon location, size, potential of the site, willingness of the local bodies to develop it)
- Wildlife Refuge and Drinking Area (applicable only in case of sensitive environs with appropriate planning and understanding including regulation of depth for safety of animals etc.)
- The rehabilitation measures for the borrow areas shall be dependent on the following factors:
- Land use objectives and agreed post-borrowing activities;
- Physical aspects (landform stability, erosion, re-establishment of drainage);
- Biological aspects (species richness, plant density,) for areas of native re vegetation;

- Water quality and soil standards; and
- Public safety issues.

Rehabilitation should be simple and maintenance free. Depending on the choice of the individual land owner/community, the contractor shall prepare redevelopment plans for the borrow areas. The options can be: (i) Restoring the productive use of the land (ii) Development of detention ponds in barren areas.

Option I: Suitable in locations with high rainfall **and productive areas**

Topsoil must be placed, seeded, and mulched within 30 days of final grading if it is within a current growing season or within 30 days of the start of the next growing season. Vegetative material used in reclamation must consist of grasses, legumes, herbaceous, or woody plants or a combination thereof, useful to the community for the fuel and fodder needs.

Plants must be planted during the first growing season following the reclamation phase.

Selection and use of vegetative cover must take into account soil and site characteristics such as drainage, pH, nutrient availability, and climate to ensure permanent growth. The vegetative cover is acceptable if within one growing season of seeding, the planting of trees and shrubs results in a permanent stand, or regeneration and succession rate, sufficient to assure a 75% survival rate.

Option II: In barren land, the borrow areas can be redeveloped into detention ponds.

These will be doubled up as water bodies and also for removal of sediment from runoff flowing through the ponds. Design of the detention basin depends upon the particle size, settling characteristics, residence time and land area. A minimum of 0.02 mm size particle with a settling velocity of 0.02 cm/sec (assuming specific gravity of solids 2.65) can be settled in the detention basin.

Following parameters are to be observed while setting up a detention pond:

- Pond should be located at the lowest point in the catchment area. Care should be taken that the horizontal velocity should be less then settling velocity to prevent suspension or erosion of deposited materials.
- Minimum Effective Flow Path: 5 times the effective width
- Minimum Free Board: 0.15 m
- Minimum Free Settling Depth: 0.5 m
- Minimum Sediments Storage Depth: 0.5 m
- Maximum interior slope: 2H : 1V
- Maximum exterior slope: 3H : 1V

The inlet structure should be such that incoming flow should distribute across the width of the pond. A pre-treatment sump with a screen should provide to remove coarse sediments. Settled sediment should be removed after each storm event or when the sediment capacity has exceeded 33% of design sediment storage volume. Accumulated sediment must be disposed of in a manner, which will prevent its re-entry into the site drainage system, or into any watercourse.

4. CONSTRUCTION STAGE

No borrow area shall be operated without permission of the Engineer. The procurement of borrow material should be in conformity to the guidelines laid down in IRC: 10-1961. In addition, the contractor should adopt precautionary measures to minimise any adverse impacts on the environment. Checklists for monitoring borrow areas operation and management has been prepared (**Table 1**).

Table 1: Checklist for Monitoring Borrow Area Operation and Management

Attributes	Requirements

Attributes	Requirements
Access Road	Access road shall be used for hauling only after approved
Top soil preservation	To soil, if any, shall be stripped and stored at corners of the area before the start of excavation for material collection; Top soil should be reused / re-laid as per agreed plan; In case of riverside, borrow pit should be located not less than 15m from the toe of the bank, distance depending on the magnitude and duration of flood to be withstood. In no case shall be borrow pit be within 1.5m from the Toe line of the proposed embankment.
Depth of excavation	For agricultural land, the total depth of excavation should be limited to 150cm including top 30 cm for top soil preservation; For river side borrow area, the depth of excavation shall be regulated so that the inner edge of any borrow pit, should not be less than 15m from the toe of the bank and bottom of the pit should not cut the imaginary line of 1:4 projected from the edge of the final section of the embankment. To avoid any embankment slippage, the borrow areas will not be dug continuously, and the size and shape of borrow pits will be decided by the Engineer.
Damage to surrounding land	Movement of man and machinery should be regulated to avoid damage to surrounding land. To prevent damages to adjacent properties, the Contractor shall ensure that an undisturbed buffer zone exists between the distributed borrow areas and adjacent land. Buffer zone shall be 3 m wide or equal to the depth of excavation whichever is greater.
Drainage control	The Contractor shall maintain erosion and drainage control in the vicinity of all borrow pits and make sure that surface drains do not affect the adjacent land or future reclamation. This needs to be rechecked by the engineer of the PIU.
Dust Suppression	Water should be sprayed on kutcha haul road twice a day or as may be required to avoid dust generation during transportation of material; Depending on moisture content, 0.5 to 1.5% water may be added to excavated soil before loading during dry weather to avoid fugitive dust emission.
Covering material for transport material	Material transport shall be provided with tarpaulin cover
Personal Protective Equipment	Workers should be provided with helmet, gumboots and air mask and their use should be strictly enforced.
Redevelopment	The area should be redeveloped within agreed timeframe on completion of material collection as per agreed rehabilitation plan.

5. POST CONSTRUCTION STAGE

All reclamation shall begin within one month of abandonment of borrow area, in accordance with the redevelopment plan. The site shall be inspected by the PIU after implementation of the reclamation plan. Certificate of Completion of Reclamation is to be obtained by the Contractor from the landowner that “the land is restored to his satisfaction”. The final payment shall be made after the verification by PIU.

6. CHECKLIST FOR INSPECTION OF REHABILITATION AREA

Inspection needs to be carried out by the PIU for overseeing the redevelopment of borrow areas as per the plan. The checklist for the inspection by the PIU is given below.

- Compliance of post-borrowing activities and land use with the restoration plan;
- Drainage measures taken for inflow and outflow in case borrow pit is developed as a detention pond;
- Levelling of the bottom of the borrow areas;

- In case the borrow area is on private property, the contractor shall procure written letter from landowner for satisfaction on rehabilitation. In case of no rehabilitation is desired by the landowner, the letter should include statement "no responsibility of R&BD on contractor in the event of accident.

- Condition of the reclaimed area in comparison with the pre-borrowing conditions.

GUIDELINE-4: TOPSOIL SALVAGE, STORAGE AND REPLACEMENT

1. INTRODUCTION

Loss of topsoil is a long term impact along roads due to (i) site clearance and widening for road formation (ii) development of borrow areas (iii) temporary construction activities such as construction camps, material storage locations, diversion routes etc. The environmental measures for both these activities during all stages of construction activity are discussed in the subsequent sections.

2. PROJECT PLANNING & DESIGN STAGE

At the project preparation stage, the following shall be estimated: (i) Extent of loss of top soil due to widening and siting of construction activities (ii) Estimates of borrow area requirements and (iii) Area requirement for topsoil conservation. The bid document shall include provisions that necessitate the removal and conservation of topsoil at all locations opened up for construction by the Contractor.

3. PRE-CONSTRUCTION STAGE

The arrangements for temporary usage of land, borrowing of earth and materials by the Contractor with the land owner/concerned department shall include the conservation / preservation of topsoil.

4. CONSTRUCTION STAGE

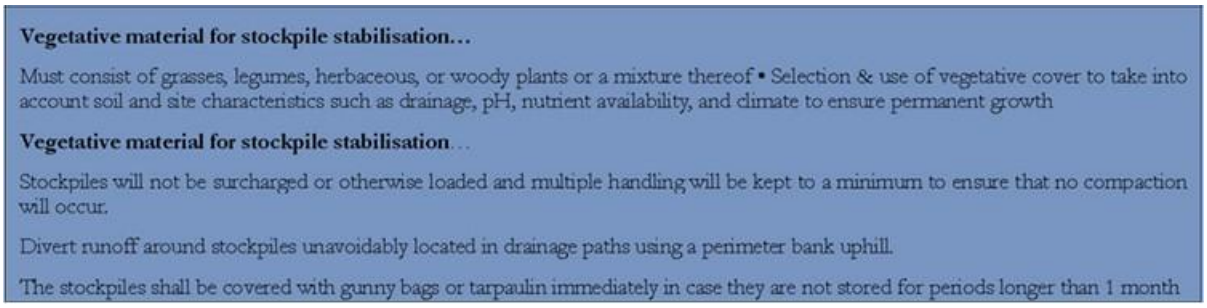
It shall be the responsibility of the Contractor to strip the topsoil at all locations opened up for construction. The stripped topsoil should be carefully stockpiled at suitable accessible locations approved by the PIU. At least 10% of the temporarily acquired area shall be earmarked for storing topsoil. In case of hilly and desert areas, topsoil with humus wherever encountered while opening up the site for construction shall be stripped and stockpiled. The stockpiles shall be located at:

- Areas away from Grade, Subsoil & Overburden materials;
- Areas away from pit activities and day-to-day operations;
- Areas that do not interfere with future pit expansion; and
- Areas away from drainage paths and uphill of sediment barriers.

The stockpiles for storing the topsoil shall be designed such that the slope should not be less than 1:2 (Vertical to horizontal), and the height of the pile is restricted to 2m. A minimum distance of 1m is required between stockpiles of different materials.

In cases where the topsoil has to be preserved for more than a month, the stockpile is to be stabilised within 7 days of forming. The stabilisation shall be carried out through temporary seeding. It consists of planting rapid-growing annual grasses or small grains, to provide initial, temporary cover for erosion control.

After spreading the topsoil on disturbed areas, it must be ensured that topsoil is seeded, and mulched within 30 days of final grading. During construction, if erosion occurs from stockpiles due to their location in small drainage paths, the sediment-laden runoff should be prevented from entering nearby watercourses. The Contractor shall preserve the stockpile material for later use on slopes or shoulders as instructed by the Engineer.



5. POST CONSTRUCTION STAGE

The topsoil shall be re-laid on the area after taking the borrow earth to maintain fertility of the agricultural field, finishing it to the required levels and satisfaction of the farmer. The area to be covered with vegetation shall be prepared to the required levels and slope as detailed in the DPR. The stockpile material shall be spread evenly to a depth of 5-15cm to the designed slopes and watering the same as required. The growth of the vegetation shall be monitored at frequent intervals. All temporary arrangements made for stockpile preservation and erosion control are to be removed after reusing the stockpile material. The top soil can also be used for the following purposes:

a. Covering the borrow areas;
b. Embankment and turfing;
c. Median; and
d. Rehabilitation of construction and labour camp.

GUIDELINE-5: QUARRY MANAGEMENT

1. INTRODUCTION

This guideline pertains to the measures to be taken to address environmental concerns in quarry areas. The general practice adopted is to procure materials from existing quarries operating with the requisite permits. The measures to be taken for operation and management for quarries during all stages of construction have been discussed in this Guideline.

2. PROJECT PLANNING AND DESIGN STAGE

The PIU shall provide in the DPR / bid document, a list of licensed quarries operating within the district and adjoining districts. In addition, the DPR shall contain the following: (i) Quantity of materials available in quarries (ii) Lead from the various existing quarries and (iii) Adequacy of materials for the project in these quarries. **Table 1** and **2** give the format for preparing a list of quarries.

Table 1 Details of Sand Quarry

Sample No.	Source of sand	Name of quarry area	Site Identification/ Location			Approximate Quantity (cum)	Approximate basic cost of the material (Rs.)	Remarks
			Nearest Chainage (Km.)	Left/ Right	Offset from nearest chainage (km)			

Table 2 Details of Quarry Area for Aggregates

Sample No.	Chainages (Km.)	Left/ Right	Name of Quarry Area	Name of Crusher	Lead from nearest chaniage (Km.)	Basic cost of the material (Rs.)	Available land/ terrian	Surrounding land Terrian	Remarks

Only in the event of non-availability of existing quarries, the Contractor shall open a new quarry in accordance with Mines and Minerals (Development & Regulation) Act, 1957. The bid document shall include the exhaust quarry reclaim plan per needs of the landowner / community.

3. PRE-CONSTRUCTION STAGE

The Contractor shall select an existing licensed quarry identified in DPR for procuring materials. The Contractor shall establish a new quarry with the prior consent of the PIU only in cases when: (i) Lead from existing quarries is uneconomical and (ii) Alternative material sources are not available. The Contractor shall prepare a Redevelopment Plan for the quarry site and get it approved by the PIU.

The construction schedule and operations plans to be submitted to the PIU prior to commencement of work shall contain a detailed work plan for procuring materials that includes procurement, transportation and storage of quarry materials.

4. CONSTRUCTION STAGE

4.1 Development of Quarry Area

To minimize the adverse impact during excavation of material following measures are need to be undertaken:

- Adequate drainage system shall be provided to prevent the flooding of the excavated area
- At the stockpiling locations, the Contractor shall construct sediment barriers to prevent the erosion of excavated material due to runoff.
- Construction of offices, laboratory, workshop and rest places shall be done in the up-wind of the plant to minimize the adverse impact due to dust and noise.
- The access road to the plant shall be constructed taking into consideration location of units and also slope of the ground to regulate the vehicle movement within the plant.
- In case of storage of blasting material, all precautions shall be taken as per The Explosive Rules, 1983.

4.2 Setting up of Crushers and other equipment's

The following measures shall be undertaken for setting up of crushers are other equipment's.

- The contractor shall obtain "No Objection Certificate (NoC)" from the Tamil Nadu Pollution Control Board.
- All vehicles must possess Pollution Under Control (PUC) Certificate and shall be renewed accordingly
- All machinery, equipment's, and vehicles shall comply with existing CPCB noise and emission norms.
- The PIU must ensure that contractor shall submit the copy of NoC and PUC Certificate before the start of work.

4.3 Quarry operations

The followings precautions shall be undertaken during quarry operations. vii) Overburden shall be removed and disposed as per **Guideline 8** "Waste Management and Debris Disposal".

- During excavation slopes shall be flatter than 20 degrees Guideline 8 on to prevent their sliding
- In case of blasting, the procedure and safety measures shall be taken as per The Explosive Rules, 1983
- The Contractor shall ensure that all workers related safety measures shall be done as per measures for, "Labour & Workers Health & Safety" (Guideline 12).
- The Contractor shall ensure maintenance of crushers regularly as per manufacturer's recommendation.
- Stockpiling of the excavated material shall be done as per stockpiling of topsoil explained in Guideline 4, "Topsoil Salvage, Storage& Replacement."
- During transportation of the material, measures shall be taken as per Guideline 11 "Construction Plants and Equipment Management" to minimize the generation of dust and to prevent accidents
- The PIU and the concerned authority shall review the quarry site for the management measures during quarry operation, including the compliance to pollution norms.

5. POST CONSTRUCTION STAGE

A quarry redevelopment plan shall be prepared by the Contractor. All haul roads constructed for transporting the material from the quarries to construction site shall be restored to their original state.

- The PIU and the concerned authority shall be entrusted the responsibility of reviewing the quarry site for the progress of implementation of Redevelopment Plan.
- The plan shall include:

- Photograph of the quarry site prior to commencement
- The quarry boundaries as well as location of the materials deposits, working equipments, stockpiling, access roads and final shape of the pit.
- Drainage and erosion control measures at site
- Safety measures during quarry operation
- Design for redevelopment of exhaust site.

Two options for redevelopment of quarry areas are given below:

Option A: Revegetating the quarry to merge with surrounding landscape. This is done by conserving and reapplying the topsoil for the vegetative growth.

Option B: Developing exhausted quarries as water bodies. The pit shall be reshaped and developed into pond, for harvesting rainwater. This option shall only be considered where the location of quarry is at the lowest point, i.e. surrounding areas/natural drainage slopes towards it.

GUIDELINE-6: WATER FOR CONSTRUCTION

1. INTRODUCTION

The scope of this guideline includes the procurement of water required for construction of roads. Except bituminous works, water is required during all stages of road construction such as Embankment Sub-Grade; Granular sub-base (GSB) and Water Bound Macadam (WBM). Management of water in various stages of construction is given in the following sections.

2. PROJECT PLANNING & DESIGN STAGE

- The Detailed Project Report for both road constructions shall contain the following information:
- Estimate of water requirement during different seasons based on construction schedule of various stages of construction.
- Identification of potential sources of water for construction,
- Arrangements to be worked out by the contractor with individual owners, when water is obtained from private sources, and
- Whether scarcity of water would have any impact on schedule of construction.

In water-scarce regions, provide the following additional information in Project Reports…

- Exploring possibilities for use of existing perennial sources, through interactions with water user groups as the villagers, relevant Government Departments, keeping in view that the water extraction does not infringe upon the usufruct rights of the existing water users.
- Identification of potable water source for domestic use of workers and for use in cement - based construction such as cement concrete roads, culverts and other cross drainage works.
- Identification of alternate water sources, water-harvesting techniques will be explored to avoid water extraction from the existing community sources.

In water scarce regions, if water-harvesting structures are to be constructed, suitable locations and mechanism for siting these structures will be identified. These are envisaged to be permanent water tanks for collection of stream water. Detailed drawings of water harvesting structures based on site conditions will need to be worked out and presented in the DPR. No extra payment shall be generally made for these works and the Contractor has to include the cost of these items in his offer while quoting his tendered rate.

Scheduling Construction in Water Scarce Areas: As part of the project preparation, the PIU shall conduct an assessment of water requirement and availability in water scarce regions. As far as possible, schedule for construction in these water scarce areas shall be prepared such that earthwork for embankment is carried out just before monsoon, so that water requirement for subsequent construction works such as granular sub-base and water bound macadam are met in monsoon and post monsoon season. Carrying out these activities even during the monsoon is possible as the rainfall may not be high enough to disrupt construction.

3. PRE-CONSTRUCTION STAGE

Prior to commencement of extraction of water for construction, the contractor shall work out arrangements as specified in the DPR.

In water-scarce regions, provide the following additional information in Project Reports…
• Exploring possibilities for use of existing perennial sources, through interactions with water user groups as the villagers, relevant Government Departments, keeping in view that the water extraction does not infringe upon the usufruct rights of the existing water users. • Identification of potable water source for domestic use of workers and for use in cement - based construction such as cement concrete roads, culverts and other cross drainage works. • Identification of alternate water sources, water-harvesting techniques will be explored to avoid water extraction from the existing community sources.
from any septic tank/soak pit or other source of pollution. • **In case of water harvesting structures** (if required), the Contractor shall in consultation with the residents, identify suitable locations for siting the structure and construct the same. • **In case of perennial sources,** the Contractor shall adhere to all administrative procedures pertaining to procurement of water from such sources.

4. CONSTRUCTION STAGE

During construction, the Contractor shall be responsible to monitor the following:

- The arrangements worked out with the Panchayat/individual land owners for water extraction is adhered to;
- Extraction of water is restricted to construction requirement and domestic use of construction workers;
- Water requirement for curing of concrete shall be minimized by pooling of water over the concrete or by covering with wet gunny bags; and
- The potable water used for drinking purposes of construction workers shall be as per the Indian Standard for Drinking Water IS: 10500, 1991.

GUIDELINE-7: SLOPE STABILITY AND EROSION CONTROL

1. INTRODUCTION

Stability of slopes is a major concern in locations of high embankment. In cases of high embankment, water retention at the embankment base initially causes toe failure and subsequently failure of the whole embankment. Soil erosion is consequent to high runoff on hill slopes. Embankments made up of silty and sandy soils get eroded, in the absence of vegetative cover, when the slopes are steep say more than 20 Degree.

The scope of this guideline includes measures to minimize the adverse environmental impacts due to slope instability and soil erosion. The adverse environmental impact can be: (i) Damage to adjacent land, (ii) Silting of ponds and lakes disturbing the aquatic habitat (iii) Erosion of rich and top fertile top layer of soil (iv) Contaminationof surface water bodies and (v) Reduction in road formation width due to erosion of shoulders/berms.

2. PROJECT PLANNING AND DESIGN STAGE

During the detailed project preparation phase, the following investigations shall be carried out prior to finalisation of alignment.

- Topographical;
- Hydrological;
- Geo-technical; and
- Geological Investigation (in case of roads in hill areas and areas of high seismic activity)

In addition to the slope stability analysis the alignment should be such that (i) steep as well as heavy cuts are avoided, (ii) Flora and fauna of the area are not disturbed and (iii) Natural drainage pattern is not obstructed.

For high embankments, geo-technical investigations (determination of C, φ, density etc.) of the available material need to be done to check its suitability as fill material.

In case of the CD structures, measures for preventing siltation and scouring shall be undertaken as per Guideline on, “Drainage”.

Following guidelines shall be followed in desert areas while using cohesion-less soils for embankment construction.

- The alignment should follow the natural ground level to the extent possible and the embankment shall be restricted to minimum to achieve ruling grades.
- Slope of the embankment should be 3 (H): 1(V) or flatter.
- The corners of the embankment should be rounded for better aerodynamic performance.

3. PRE-CONSTRUCTION STAGE

Interceptor ditches are constructed along hilly slopes or areas with high rainfall to protect the road bench and hillside slope from erosion due to heavy rainfall and runoff. Interceptor ditches are very effective in the areas of high intensity rainfall and where the slopes are exposed. These are the structures designed to intercept and carry surface run-off away from erodible areas and slopes, thus reducing the potential surface erosion. The PIU must ensure that the layout and siting of ditches is as per specifications.

4. CONSTRUCTION STAGE

When alternative material such as fly ash is used for embankment formation, it needs to be ensured that sufficient filter bed is provided along with the top cap. All tests as per IS: 2720 (Parts: 4, 5, 8 & 40) and IRC: SP: 20-2002 are to be conducted on the embankment to keep a check

on the compaction achieved. Slope stabilisation techniques and erosion control measures such as vettiver grass, stone pitching, use of geotectile and turfing.

Box-1: Detailed specifications for Vegetative cover

Description:

The vegetative cover should be planted in the region where the soil has the capacity to support the plantation and at locations where meteorological conditions favours vegetative growth.

Site Preparation:

- To prevent the seeds from being washed away subsequent to sowing, the area should be protected with surface roughening and diversions.
- Soil samples should be taken from the site and analysed for fertiliser and lime requirements.

Seed Application:

- The seed should be sown uniformly as soon as preparation of the seedbed has been completed.
- No seed should be sown during windy weather. The best time for needing would be during monsoon.

Maintenance:

During first six weeks, the planting should be inspected by the PIC, to check if the growth is uniform and dense. Appropriate moisture levels shall be maintained. There may be requirement of watering the plantings regularly during the dry seasons.

5. POST CONSTRUCTION STAGE

All the exposed slopes shall preferably be covered with vegetation using grasses, brushes etc. Locally available species possessing the properties of (i) good growth (ii) dense ground cover and (iii) deep root shall be used for stabilization.

In case of steep and barren slopes, in order to retain the seedling to the ground asphalt mulch treatment shall be given. Seedling are covered with asphalt emulsion and spread into a thin layer. The asphalt film gradually disintegrates and a carpet of green vegetation and deep-rooted species of grass and clovers, takes its place. Anchoring shall be carried out as per IRC: SP: 48-1998.

Regular inspection of check dams and repositioning/replacement of dislodged or stolen stones need to be carried out.

Repair and maintenance of eroded side drain inverts is to be done in order to arrest retrogation of levels in side drains. Slopes of high embankment can give a fertile base for growth of vegetative cover / sodding.

In arid areas, in order to avoid the deposition of sand over or near the road surface, shrubs are to be planted at an appropriate distance from the formation. The shrubs should not be abutting the road and the distance for carrying out plantation shall be determined based on prevalent wind speeds as well as quantity of sand being carried amongst various other factors. There should be a clear gap between the roadway and shrubs to allow the wind to pick up its velocity and carry along with it any sand that is deposited.

GUIDELINE-8: WASTE MANAGEMENT AND DEBRIS DISPOSAL

1. INTRODUCTION

This guidance describes procedures for handling, reuse and disposal of waste materials during road construction. The Guideline describes waste management measures in all stages of construction. Also, the Guideline discusses the measures to be taken for debris disposal.

2. PROJECT PLANNING AND DESIGN STAGE

As part of DPR preparation, the PIU shall carry out the following measures

- Finalize road design and alignment to minimize waste generation through balancing of cut and fill operations and minimizing excess cuts requiring disposal.
- Identify the type of wastes as well as sources of waste during construction and suggest options for possible reuse
- Provide guidelines to the contractor for locating waste disposal sites for non-toxic wastes
- Identify existing landfill sites if available for disposal of toxic materials.
- Incase no existing landfill sites are available, identification of landfill site as well as identification of the clearance requirements.
- Identify sites of disposal of debris.

3. PRE-CONSTRUCTION STAGE

The contractor shall identify the activities during construction, that have the potential to generate waste and work out measures for reducing, reusing and proper disposing of the generated waste in the construction schedule to be submitted to the PIU. A sequential listing of the activities during road construction and the nature of wastes together with the possible options for reuse are specified in **Table-1**. For the disposal of excess cut and unsuitable (non-toxic) materials, the contractor shall identify the location for disposal in consultation with the community / concerned department. Any toxic materials shall be disposed in existing landfill sites that comply with legislative requirements. Prior to disposal of wastes onto private/community land, it shall be the responsibility of the Contractor to obtain a No-objection Certificate (NOC) from the land owner/community. The NOC shall be submitted to the PIU prior to commencement of disposal.

The Contractor shall educate his workforce on issues related to disposal of waste, the location of disposal site as well as the specific requirement for the management of these sites.

Practices to avoid - waste disposal …
• Tipping of waste into stream channels, water bodies, forests and vegetated slopes • Non-cleaning of wastes after day's work • Leaching of wastes • Littering in construction camps / sites • Storing wastes on private land

4. CONSTRUCTION STAGE

The contractor shall either reuse or dispose the waste generated during construction for roads depending upon the nature of waste, as specified in **Table 1**. The reuse of waste shall be carried out by the contractor only after carrying out the specific tests and ascertaining the quality of the waste materials used, and getting the same approved by the PIU. Wastes that were not reused shall be disposed off safely by the contractor. The contractor shall adopt the following precautions while disposing wastes:

- Bituminous wastes shall be disposed off in 60mm thick clay lined pits and covered with 30cm good earth at top, so as to facilitate growth of vegetation in long run.
- In case of filling of low-lying areas with wastes, it needs to be ensured that the level matches with the surrounding areas. In this case care should be taken that these low lying areas are not used for rainwater storage
- In case oil and grease are trapped for reuse in a lined pit, care shall be taken to ensure that the pit should be located at the lowest end of the site and away from the residential areas.

The waste management practices adopted by the Contractor, including the management of wastes at construction camps etc shall be reviewed by the PIU and the Pollution Control Board (PCB) during the progress of construction.

5. POST CONSTRUCTION STAGE

On decommissioning of construction sites, the Contractor shall hand over the site free of all debris/wastes to the satisfaction of PIU. In case of any temporary disposal of wastes on private land, certificate of Completion of Reclamation is to be obtained by the Contractor from the landowner that "the land is restored to his satisfaction". The same is to be submitted to the PIU before final payment is claimed.

Table 1: Type of wastes and scope for reuse- road construction

S. No	Activity	Type of waste	Scope for possible reuse	Disposal of waste
I	**CONSTRUCTION WASTES**			
1.	Site Clearance and grubbing	Vegetative cover and top soil	Vegetating embankment slopes	
		Unsuitable material in embankment foundation	Embankment Fill	Low lying areas Land fill sites
2.	Earthworks			
a)	Overburden of borrow areas	Vegetative cover and soil	Vegetating embankment slopes	
b)	Overburden of quarries	Vegetative cover and soil	Vegetating embankment slopes	
		Granular material	Embankment Fill, Pitching	
c)	Accidental spillages during handling	Dust		
d)	Embankment construction	Soil and Granular Material	Embankment Fill	
e)	Construction of earthen drains	Soil	Embankment Fill	
3.	Concrete structures Dust			
a)	Storage of material	Dust, Cement, Sand	Constructing temporary structure, embankment fill	
		Metal Scrap		Scrap Yard
b)	Handling of materials	Dust		
c)	Residual wastes	Organic matter	Manure, Re-vegetation	
		Cement, sand	Constructing temporary structure, embankment fill	
		Metal scrap	Diversion sign, Guard Rail	
4	Reconstruction works			
a)	Dismantling of existing pavement	Bitumen Mix, granular material	sub-base	
		Concrete	Road Sub-base, reuse in concrete, fill material and as rip rap on roads	
		Guard rail sign post, guard stone	Reuse for same	
b)	Dismantling of cross drainage structures	Granular material & bricks	Constructing temporary structure, embankment fill	
		Metal scrap	Diversion sign, Guard Rail Culvert	

S. No	Activity	Type of waste	Scope for possible reuse	Disposal of waste
		Pipes	Culvert	
5	Decommissioning of sites			
a)	Dismantling of temporary structures	Granular material and bricks	Constructing temporary structure, embankment fill	
6	Maintenance operation			
a)	Desilting of side drains	Organic matter and soil	Re-vegetation	
II	OIL AND FLUIDS			
1	Construction machinery - maintenance and refueling	Oil and Grease	Incineration, Cooking, Illumination	
2	Bituminous works			
a)	Storage	Bitumen	Low Grade Bitumen Mix	
b)	Mixing and handling	Bitumen	Low Grade Bitumen Mix	
		Bitumen Mix	Sub-base, Paving access & cross roads	
c)	Rejected bituminous mix	Bitumen Mix	Sub-base, Paving access & cross roads	
III	**DOMESTIC WASTES**			
1	Construction camps	Organic waste,	Manure	
		Plastic and metal scrap		Scrap Yard
		Domestic effluent	Irrigation	

6. DISPOSAL OF DEBRIS

For the purpose of disposal of debris, dumping sites need to be selected. The criteria for selection of dumping sites include:

- No residential areas are located downwind side of these locations;
- Dumping sites are located at least 1000 m away from sensitive locations;
- Dumping sites do not contaminate any water sources, rivers etc; and
- Dumping sites have adequate capacity equal to the amount of debris generated;
- Public perception about the location of debris disposal site has to be obtained before finalizing the location;
- Permission from the Village Panchayat is to be obtained for the dumping site selected;
- Productive lands are avoided; and
- Available waste lands shall be given preference

GUIDELINE-9: WATER BODIES

1. INTRODUCTION

Water bodies may be impacted when the road construction is adjacent to it or the runoff to the water body is affected by change of drainage pattern due to construction of embankment. The following activities are likely to have an adverse impact on the ecology of the area:

- Earth moving;
- Removal of vegetation;
- Vehicle/Machine operation and maintenance;
- Handling and laying of asphalt; and
- Waste disposal from construction camps.

Impacts on water bodies impairs ...

- Change in Catchment area of the water body
- Drainage system
- Flood level and water logging
- Flora and fauna dependant on the water body
- Ground water recharging
- Animal husbandry as water bodies are used by animals
- Water quality &
- Runoff (increase/decrease)

2. PROJECT PLANNING AND DESIGN STAGE

All efforts are to be taken to avoid the alignments passing adjacent or close to water bodies. Where possible, it should be realigned away from the water body without cutting its embankment, decreasing the storage area or impairing the catchment area. Adequate drainage arrangements as per IRC guidelines have to be provided. Stream bank characteristics and hydrology of the area are to be studied before finalizing the alignment, the profile and cross-drainage structures.

Complete filling of water body with soil is not contemplated in the project. The DPR and its cost estimates have to accommodate costs of rehabilitation (to be estimated as lump sum at DPR stage) of water bodies impacted by the project. Water body rehabilitation shall be as per the Rehabilitation Plan prepared by the Contractor which should have approval of the PIU. Details of the tasks to be performed as per the sequence of activities during the project planning and design are as follows:

- Consultations with the people regarding alternate routes that were devised to avoid the pond. If alternate routes are not available, consent of the villagers is to be sought for affecting the pond and also the measures that would be taken to mitigate the impacts.
- Final design is to be prepared indicating the pond location in the alignment drawings.
- If impacting the pond, the extent of impact is to be clearly indicated on a separate drawing showing blown up portion of the pond. The drawing should aid the contractor in setting up exact lines for cutting the pond.
- All necessary measures for mitigation of impacts and precautionary measures while working close to the water body are to be incorporated into the DPR and cost estimates. The measures to be incorporated shall be as per this guideline.

3. PRE-CONSTRUCTION STAGE

The Contractor after an assessment of the likely impacts on the water body and review of the provisions of this guideline shall prepare a detailed work plan at the pre-construction stage. The Contractor shall prepare a Rehabilitation Plan for rectifying the likely impact to be caused and approval of PIU shall be sought prior to commencement of work. The Rehabilitation Plan should include:

- Locations of erosion protection works and silt fencing to prevent sediment laden runoff entering the water body;
- Location of side drains (temporary or otherwise) to collect runoff from the embankment before entering the water body in accordance with IRC guidelines;
- Work program in relation to the anticipated season of flooding/overflowing of the water body;

- Obstructions likely to cause temporary flooding and information to seek clearance to remove the obstruction; and
- Drawings in Rehabilitation Plan should indicate the landscape details along with species to be planted in the surrounding environs of the water body.
- The rehabilitation of water body should be with the objective of restoring it to its original state or to a better state with necessary enhancement of its environs. Rehabilitation Plan shall include:
- Reconstruction and stabilization of embankment in case it is impacted;
- If storage area is lost, then the water body is to be deepened to regain an equivalent volume;
- Further enhancement of the water body as a focal point with place for seating and provision of shade; and
- Costs of rehabilitation

Concurrence of the community has to be sought on the Rehabilitation Plan prepared by the Contractor. Concerns of the community have to be incorporated into the plan before submitting it for approval of the PIU.

The PIU shall scrutinize the Rehabilitation Plan, verify the implementation on site and finally approve the plan. The Rehabilitation Plan should be implemented by the Contractor immediately after completion of construction at the stretch near the water body.

Working near Water Bodies – Precautions

- Avoid locating roads on pond embankment
- Collect road runoff before entering the water bodies
- Runoff to be filtered of sediments before letting into water bodies
- Avoid debris disposal into water bodies
- Avoid disposal of oil/grease/other contaminants into water bodies

When there is interruption to regular activities of villagers near water body due to construction or rehabilitation work, following are the Contractor's responsibilities:

- Restriction on use of water, if any, should be intimated to the community in advance;
- Alternate access to the water body is to be provided in case there is interruption to use of exiting access. The access provided should be convenient for use of all the existing users whether community or cattle; and
- If the water body affected is a drinking water source for a habitation, alternate sources of water are to be provided to the users during the period for which its use is affected.

4. CONSTRUCTION STAGE

It should be ensured by the contractor that the runoff entering the water body is free from sediments

Silt fencing and/or brush barrier shall be installed in the drainage channels for collecting the sediments before letting them into the water body Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated. Cutting of embankment reduces the water retention capacity and also weakens it, hence:

- The contractor should ensure that the decrease in water retention should not lead to flooding of the construction site and surroundings causing submergence and interruption to construction activities.
- Any perceived risks of embankment failure and consequent loss/damage to the property shall be assessed and the contractor should undertake necessary precautions as provision of toe protection, erosion protection, sealing of cracks in embankments. Failure to do so and consequences arising out of embankment failure shall be the responsibility of the contractor. The PIU shall monitor regularly whether safe construction practices near water bodies are being followed.

Alternate drain inlets and outlets shall be provided in the event of closure of existing drainage channels of the water body. Movement of machinery and workforce shall be restricted around the water body, and no waste from construction camps or sites shall be disposed into it.

5. POST CONSTRUCTION STAGE

With the completion of construction, the PIU has to ensure implementation of rehabilitation/restoration plan for the water body, as indicated by the Contractor in the bid submission. The precincts of the water body have to be left clean and tidy with the completion of construction. Drainage channels of adequate capacity shall be provided for the water body impacted.

GUIDELINE-10: DRAINAGE

1. INTRODUCTION

Inadequate and faulty drainage arrangements during road construction result in obstruction to natural drainage pattern. The problem is further aggravated in the low-lying areas and flood plains receiving high intensity rainfall, which can lead to the instability of embankment, damage to pavement, sinking of foundation, soil erosion, safety hazards and disruption in traffic. Provision of cross-drainage and longitudinal drainage increases the life of the road and consequently reduces water logging and related environmental impacts. The functioning of the drainage system is therefore a vital condition for a satisfactory road.

However, construction or upgradation of CD structures and longitudinal drains is likely to increase sediments, scour the banks, change water level and flow, and also affect the ecology of the surrounding area. The guideline shall address the environmental concerns related to drainage aspects during different stages of the project execution.

2. PROJECT PLANNING AND DESIGN

Drainage shall be broadly divided as (i) Cross-Drainage and (ii) Longitudinal Drainage both surface & subsurface drainage. The alignment shall be routed such that minimum drainage crossings are encountered. Also the geometric design criteria as per IRC 73, guidelines for effective surface drainage should be ensured.

All drains crossing the alignment shall be identified on site and marked on map while undertaking transect walk. Basic information on the width of channel, frequency of traffic holdup and flow would provide inputs into screening of alternate alignments as well as fixing the alignment. Consultations with the community shall provide information on the HFL in the area.

In areas of high and medium intensity rainfall (>400 mm/year), flood prone areas and hilly areas, detailed hydrological studies will need to be conducted. The studies shall be conducted as per IRC: SP-13: 1973 “Guidelines for the Design of Small Bridges & Culverts” and IRC: SP-33:1989 “Guidelines on Supplemental Measures for Design, Detailing & Durability of Important Bridge Structures”.

Design of cross-drainage structures shall be based on the inputs from the hydrological studies as per clause 12.2.3 and in other areas, the C-D structure design shall be as per IRC: SP-13. Design of C-D structure shall be such that:

- Normal alignment of the road is followed even if it results in a skew construction of culverts and stream bank protections are incorporated.
- Afflux generated is limited to 30 cm in plains with flat land slopes.
- It is fish friendly – fish passage is not interrupted either in upstream or downstream direction.
- Adequate scour protection measures for stream bank, roadway fill as head walls, wing walls and aprons are included.
- Reinforced road bed (of concrete or rock) for protection against overflow in case of low water crossing (floods/causeways) is included.
- The design of C-D structure (minor and major bridge) should have stairs leading to the bed of the drainage channel, for regular inspection of the sub-structure.
- Schedule of construction of C-D structures should be confined to dry months to avoid contamination of streams.

Longitudinal drains are to be designed to drain runoff from highest anticipated rainfall as per rainfall data for the past 20 years or 50 years as per hydrological analysis in high rainfall areas (annual rainfall >1000 mm) and hill areas. For design of longitudinal drains in other areas, the design shall be as per IRC: SP-20:2002.

Outfall of the roadside drains shall be into the nearby stream or culvert. The outfall should be at such a level that there would be no backflow into the roadside drain. Wherein pond/low lying areas exist in the vicinity, the flow may be diverted into them after removal of sediment for possible ground water recharge.

In case of high embankment (>1.0m) or bridge approaches, lined channels shall be provided to drain the surface runoff, prevent erosion from the slopes and avoid damage to shoulders and berms. Detailed specifications shall be as per IRC: SP-20:2002. The type of drains that can be constructed include bricklined, pucca with RCC, covered drain with RCC slabs and piped drain.

3. PRE-CONSTRUCTION STAGE

Following measures are to be undertaken by the contractor prior to the commencement of CD/Bridge construction:

- The downstream as well as upstream user shall be informed one month in advance
- The contractor shall schedule the activities based on the nature of flow in the stream.
- The contractor should inform the concerned departments about the scheduling of work. This shall form part of the overall scheduling of the civil works to be approved by PIU.
- Erosion and sediment control devises are to be installed prior to the start of the civil works.
- Interceptor drains to be dug prior to slope cutting to avoid high runoff from slopes entering construction sites in case of hill roads
- Runoff from temporary drains and interceptor drains to be directed into natural drains in hill roads
- In case of up-gradation of the existing CD Structures, temporary route / traffic control shall be made for the safe passage of the traffic, depending upon the nature of the stream
- All the safety/warning signs are to be installed by the contractor before start of construction

In case of utilization of water from the stream, for the construction of the CD structures, the contractor has to take the consent from the concerned department (refer Guideline on “Water for Construction”)

4. CONSTRUCTION PHASE

Drainage structures at construction site shall be provided at the earliest to ensure proper compaction at the bridge approach and at the junction of bridge span and bridge approach. Velocity of runoff to be controlled to avoid formation of rills/gullies as per guideline, “Slope stability & erosion control”

While working on drainage channels, sediment control measures shall be provided. Silt fencing (as per the detailed specifications of guideline, “Slope Stability & Erosion Control”) shall be provided across the stream that carries sediment.

The sediments collected behind the bunds shall be removed and after drying, can either be reused or disposed off as per guideline, “Waste Management and Debris Disposal”. Safety devises and flood warning signs to be erected while working over streams and canals.

5. POST CONSTRUCTION

Inspection and cleaning of drain shall be done regularly to remove any debris or vegetative growth that may interrupt the flow. HFL should be marked as per hydrological data on all drainage structure. Temporary structure constructed during construction shall be removed before handing over to ensure free flow through the channels. The piers and abutments should be examined for excessive scour and make good the same if required. The upstream and downstream areas should be cleared of all CD works.

In case of Causeway following aspect shall be taken into consideration:

- Dislocation of stones in stone set pavements, scouring of filler material due to eddy currents.

- Floating debris block the vents. Incase of large amount of floating material, debris arrestor shall be provided in upstream side.
- Damage to guide stones, information board shall be inspected and replaced accordingly.

Schedule of Inspection shall be drawn up for checking cracks, settlements and unusual backpressures. It must be ensured that all the rectification shall be undertaken as and when required. Following are broadly the items to be checked:

- Settlement of piers/abutments & settlement of approach slabs have to be checked;
- Cracks in C-D structures or RCC slabs;
- Drainage from shoulders to be ensured;
- Ditches & drains to be kept clean of debris or vegetation growth; and
- Repairs to parapet of culverts whenever required are to be undertaken.

GUIDELINE-11: CONSTRUCTION PLANTS & EQUIPMENT MANAGEMENT

1. GENERAL

During execution of the project, construction equipment's, machinery and plants are likely to cause adverse impact on the environment. The impact can be due to the emissions, dust, noise and oil spills that concern the safety and health of the workers, surrounding settlements and environment as a whole. This guideline describes the activities during the project stages where pollution control measures are required.

2. PROJECT PLANNING AND DESIGN STAGE

Selection criteria for setting up a plant area and parking lot for equipment's and vehicles shall be done as per siting criteria for construction camp specified in Guideline on "Construction and Labour Camps".

3. PRE-CONSTRUCTION STAGE

The Contractor must educate the workers to undertake safety precaution while working at the plant / site as well as around heavy equipment's. Before setting up the crusher, hot-mix plant and generator, the Contractor shall acquire "No Objection Certificate (NOC)" from the Tamil Nadu Pollution Control Board for the same. The Contractor shall ensure all vehicles must possess Pollution under Control (PUC) Certificate, which and shall be renewed regularly. The Contractor must ensure that all machinery, equipment's, and vehicles shall comply with the existing Central Pollution Control Board (CPCB) noise and emission norms. The PIU must ensure that the Contractor shall submit a copy of the NOC and PUC Certificates before the start of work. The Contractor shall design the service road with protection measures as black topping at vulnerable points as in low lying areas.

4. CONSTRUCTION STAGE

The Contractor shall undertake measures as per **Table 1** to minimize -the dust generation, emissions, noise, oil spills, residual waste and accidents at the plant site as well as during transportation of material to construction site.

Table 1: Measures at Plant Site

Concern	Causes	Measures
Dust Generation	Vehicle Movement	• Water sprinkling • Fine Materials shall be Transported in Bags or Covered by Tarpaulin during Transportation • Tail board shall be properly closed and sealed to be spill proof
	Crushers	• Regular Water Sprinkling to keep the dust below visibility level
	Concrete-Mix Plant	• Educate the workers to follow/adopt good engineering practices while material handling
Emissions	Hot-Mix Plant	• Site Selection as per Clause 6.5.2, Section 6.5, IRC's Manual for Construction & Supervision of Bitumen Work • Regular maintenance of Dust Collector as per manufacture's recommendations
	Vehicles	• Regular maintenance as per manufacture's recommendation
	Generators	• Exhaust vent of long length and emission to confirm to PCB norms.
	Heavy Load Vehicles	• Exhaust silencer, Regular maintenance as per manufacture schedule

Concern	Causes	Measures
Noise	Crushers	• Siting as per guideline, "Construction and Labour Camps"
	Generators	• All generators should have mandatorily acoustic enclosures and confirms to PCB norms.
Oil Spills	Storage and Handling	• Good practice, guideline, "Waste Management and Debris Disposal"
Residual waste	Dust Collector and Pits	• Guideline , "Waste Management and Debris Disposal"
Concrete waste	Concrete-Mix plant	• Guideline, "Waste Management and Debris Disposal"
Bitumen and bitumen mix	Hot-mix Plant	• Guideline, "Waste Management and Debris Disposal"
Stone chips	Crushers	• Guideline, "Waste Management and Debris Disposal"
Safety	Trajectory of Equipments	• No worker shall be present in the vicinity of the equipments
	Movable Parts of Equipments	• Caution Sign, awareness among workers
	Plant Area / Site	• Caution Sign, Safety Equipments
	Accidents /Health	• First Aid Box, Periodic Medical Checkup Break down of
	Break down of vehicles	• Arrangement for towing and bringing it to the workshop

During site clearance, all cut and grubbed materials shall be kept at a secured location so that it does not raise any safety concerns. During excavation, water sprinkling shall be done to minimize dust generation. Frequent water sprinkling shall be done on the haul roads to minimize dust generation. In case of loose soils, compaction shall be done prior to water sprinkling. Cautionary and informatory sign shall be provided at all locations specifying the type of operation in progress. The contractor must ensure that there is minimum generation of dust and waste while unloading the materials from trucks. The construction waste generated shall be disposed as per Guideline on, "Waste Management and Debris Disposal". The equipments, which are required to move forward and backward, shall be equipped with alarm for backward movement. It shall be ensure that the workers shall remain away from the working areas at such times. Also, equipments at construction camp should be barricaded and kept away from residential quarters of workers.

Safety Measures During Bitumen Construction Work…

- The Contractor shall ensure that bitumen storing, handling as well as mixing shall be done at hot-mix plant or designated areas[1] to prevent contamination of soil and ground water.
- Skilled labour shall be used while hand placing the pre-mixed bitumen material. The hand placing of pre-mixed bituminous material shall be done only in following circumstances:
  - For laying profile corrective courses of irregular shape and varying thickness
  - In confined spaces where it is impracticable for a paver to operate and
  - For filling potholes
- The Contractor shall provide safety equipments i.e. gumboots and gloves to the workers while handling bitumen.
- While applying Tack Coat, spraying of bitumen shall be done in the wind direction. The labour shall wear jacket while spraying the bitumen.
- All the bituminous work shall be done as per IRC's Manual for Construction and Supervision of Bituminous Works.

The PIU shall carry out periodic inspections to ensure that all the pollution control systems are appropriately installed and comply with existing emission and noise norms.

5. POST-CONSTRUCTION STAGE

The PIU shall ensure that all the haul roads are restored to their original state. Incase any inner village road is damaged while transporting the procured material; the contractor shall restore the

road to its original condition. The PIU must ensure that the decommissioning of plant shall be done in environmentally sound fashion and the area to bring its original state.

Designated area refers to paved surfaces and barren parcels of land, with adequate drainage and disposal system. It must be ensure that these are away from agriculture land, water body and other sensitive areas.

GUIDELINE-12: LABOUR AND WORKER'S HEALTH AND SAFETY

1. INTRODUCTION

The safety and health concerns of the workers and the community are impacted due to the hazards created during the construction of road. **Box: 1** gives the safety concerns during construction. This Guideline describes the hazards and measures that need to be taken to mitigate the impacts.

2. PROJECT PLANNING AND DESIGN STAGE

To address health and safety concerns, the DPR shall contain selection criteria for setting up:

- Construction Camps (as per guideline);
- Borrow Areas (as per guideline); and
- In case of opening new quarry areas (as per guideline).

To address the safety concerns to road user during operational phase, the DPR shall contain the following:

- Selection and location of regulatory as well as informatory signs as per IRC: 67-2001, depending upon the geometry of the road.

Box 1: Safety Concerns during Construction

Community due to:

- Improper scheduling of construction activities especially near the settlements and sensitive areas;
- Parking of equipments and vehicles at the end of the day likely to cause accidents to the general public especially during night hours;
- Transportation of uncovered loose material or spillage of material increases the chances of accidents to road users and surrounding settlements.

Workers due to:

- Improper handling of materials like bitumen, oil and other flammable material at construction sites, likely to cause safety concerns to the workers;
- Lack of safety measures such as alarm, awareness and safety equipment result in accidents, especially working with or around heavy machinery / equipments.

3. PRE-CONSTRUCTION STAGE

In order to incorporate public health and safety concerns, the PIU and the Contractor shall disseminate the following information to the community:

- Location of construction camps, borrow areas and new quarry areas;
- Extent of work;
- Time of construction;
- Diversions, if any;
- Precaution measures in sensitive areas;
- Involvement of local labours in the road construction;
- Health issues - water stagnation, exposure to dust, communicable disease; and
- Mechanism for grievances.

Health Concerns are adversely impacted.....

Public due to:

- Unhygienic conditions due to water logging (improper drainage of waste water), either by improper decommissioning of Construction Camps and parking lots, or improper disposal of construction wastes, leading to the breeding of vectors that are likely to impact the health of the general public
- Interaction between workers and host community is likely to increase the risk of spread of communicable diseases.

Workers due to:

- Low quality drinking water as well as inappropriate storage of drinking water likely to cause water borne diseases among workers.
- Absence of proper sanitary facility likely to act as a breeding ground for vectors raising health concerns among workers.

The information dissemination could be through the local newspaper, billboards, panchayats meetings, etc. The Contractor must educate the workers to undertake the health and safety precautions. The contractor shall educate the workers regarding:

- Awareness on HIV/AIDS awareness and usage of safety measures such as condoms;
- Awareness on hygienic sanitary practices;
- Personal safety measures and location of safety devices;
- Interaction with the host community;
- Protection of environment with respect to:
  - Trampling of vegetation and cutting of trees for cooking;
  - Restriction of activities in forest areas and also on hunting;
  - Water bodies protection;
  - Storage and handling of materials;
  - Disposal of construction waste.

4. CONSTRUCTION STAGE

During the progress of work, following are the safety requirements that need to be undertaken by the contractor at the construction site:

- Personal Protective Equipments (PPE) for the workers. Table 1 gives the safety gear to be used by the workers during each of the construction activities.
- All measures as per bidding document shall be strictly followed.
- Additional provisions need to be undertaken for safety at site:
  - Adequate lighting arrangement;
  - Adequate drainage system to avoid any stagnation of water;
  - Lined surface with slope 1:40 (V:H) and provision of lined pit at the bottom, at the storage and handling area of bitumen and oil, as well as at the location of generator (grease trap); and
  - Facilities for administering first aid.

FIRST AID FACILITIES

- First Aid Kit, distinctly marked with Red Cross on white back ground and shall contain minimum of following:
  - 6 small-sterilized dressings
  - 3 medium and large sterilized dressings
  - 1 (30 ml.) bottles containing 2 % alcoholic solution of iodine
  - 1(30 ml) bottle containing salvolatile
  - 1 snakebite lancet
  - 1 pair sterilized scissors
  - 1 copy of first-aid leaflet issued by the Director General, Factory Service & Labour Institute, Government of India
  - 100 tablets of aspirin
  - Ointment for burns
  - A suitable surgical antiseptic solution
- Adequate arrangement shall be made for immediate recoupment of the equipments, whenever necessary.
- A trained personnel incharge of first aid treatment to be readily available during working hours at construction site
- Suitable transport to the nearest approachable hospital should be made available.
- Tetanus injection must be made compulsory for all workers every 6 months.

Table 1: Worker Safety Measures

Sl. No.	Activity	Safety Requirement
1.	Setting out and levelling	• Luminous jackets; • Helmets; • Boots for protection against insect bite; and Dust Mask
2.	Tree cutting	• Helmet Boots • Luminous safety jackets
3	Reinforced yard/ carpentry/ reinforcement cutting/ bending work.	• Hand gloves
4.	Shuttering work	• Goggles Hand gloves
5.	Plant and Machinery	• Hand gloves • Boots • Helmets • Dust Mask
6.	Material handling	• Hand gloves • Dust mask

Sl. No.	Activity	Safety Requirement
7.	Batching plant	• Goggles • Hand gloves • Dust mask
8.	Weeding	• Goggles
9.	Binding reinforcement	• Safety belt • Boots
10.	Manual concrete laying	• Gum boots • Hand gloves • Helmet
11.	Piling	• Helmet • Hand gloves, gumboots.

The following measures need to be adopted by the contractor to address public safety concerns:

- The Contractor shall schedule the construction activities taking into consideration factors such as:
  - Sowing of crops;
  - Harvesting;
  - Local hindrances such as festivals etc.; and
  - Availability of labour during particular periods.
- All the cautionary signs as per IRC: 67-2001 and traffic control devices (such as barricades, etc) shall be placed as soon as construction activity get started and shall remain in place till the activities get completed.
- Following case specific measures need to be followed during the progress of the activity:
  - Incase of blasting, the Contractor must follow The Explosives Rules, 1983.
  - Incase of construction activity adjoining the water bodies, measures shall be taken as per measures suggested in Guideline on “Water Body”.
  - If construction of road is within the settlement, the contractor must ensure that there shall not be any unauthorized parking as well as storage of material, adjacent to road.
  - Approved chemicals should be sprayed to prevent breeding of mosquitoes and other disease-causing organisms, at all the water logging areas

The PIU shall carry out periodic inspections in order to ensure that all the measures are being undertaken as per the guideline.

5. POST-CONSTRUCTION STAGE

During this stage a major concern is on road user safety. Following are the measures that need to be undertaken by the PIU to ensure safer roads:

- Inspection and maintenance of installed regulatory and informatory signs.
- Ensure that the location of signage does not obstruct the visibility
- Incase of hill roads, maintenance of parapet wall as well as of overtaking zones.

The PIU must ensure that during the maintenance operation of road, road materials are stored at a location such that they shall not create any risk to road users.

The construction site shall be cleaned of all debris, scrap materials and machinery on completion of construction for the safety of public and road users, as per the measures given in Guideline on “Construction and labour Camp” and “Waste Management and Debris Disposal.”

GUIDELINE-13: CULTURAL PROPERTIES

1. INTRODUCTION

The cultural properties located close to the road are likely to be impacted by the road construction. Most of the properties are avoided in general during finalization of alignment. This Guideline discusses the mitigation measures for cultural properties.

2. PROJECT PLANNING AND DESIGN STAGE

Measures for mitigation of impacts on cultural properties during project preparation shall be as per the following steps:

- Identification of locally significant cultural properties should be done;
- Assessment of likely impacts on each cultural property due to project implementation;
- The extent of impact on the identified culture property should be assessed and possible measures for avoidance should be devised based on the site investigation. Incase impact is not avoidable, identification of alternative routes or possibility of relocation of the culture property shall be assessed in consultation with the local public, based on the economic feasibility.

Information to be collected...
• Location
• Direction (North/ South/East/West) With Respect to Road
• Distance of the structure from existing centerline of the road
• Type of Property eg: temple/mosque/shrine/dargah etc
• Plan of the structure
• Importance of the structure – historical/social/archeological
• Ownership of the property
• Probable loss to the property
• Specific periods/durations in which large congregations as festivals/mela take place causing hindrance to vehicular movement
• Choice of community, issue of relocation

Incase of relocation, relocated site should be suggested by the local people and the size of relocated structure should at least be equal to the original structure. A written consent letter is to be obtained from the community regarding the relocation site of the cultural property in the form of resolution on the letter pad of the sarpanch/gram panchayat or with the signatures of community members.

A detailed design of the relocated structure and its site plan along with the necessary BoQ are to be presented DPR. The relocation and other avoidance measures should be carried out before the start of the road work

It must be ensured by the PIU that the BoQ and rates are incorporated into the contract document.

3. CONSTRUCTION STAGE

Major impacts on the properties during this stage are mainly due to movement of construction machinery as well as due to construction activity in the vicinity of the cultural property. Following are precautionary measures that need to be undertaken by the contractor while working near these structures:

- Restrict movement of heavy machinery near the structure
- Avoid disposal or tipping of earth near the structure
- Access to these properties shall be kept clear from dirt and grit

During earth excavation, if any property is unearthed and seems to be culturally significant or likely to have archeological significance, the same shall be intimated to the Engineer. Work shall be suspended until further orders from PIU. The State Archeological Department shall be intimated of the chance find and the Engineer shall carry out a joint inspection with the department. Actions as appropriate shall be intimated to the Contractor along with the probable date for resuming the work.

The PIU must ensure that the contractor implements the precautionary measures as suggested. Also, the PIU must conduct monitoring for the enhancement of cultural property.

GUIDELINE-14: 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 at least three saplings for every tree cut is done.

The plantation/afforestation would be carried out by the forest department. 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: Endemic Species of Tamil Nadu

Sl.no	Local name	Botanical name
1.	Neem	*Azadirachtaindica*
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*
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*

Sl.no	Local name	Botanical name
20.	Mango	*Mangifera indica*
21.	Jamun	*Syzigium cumini*
22.	Indian Laural Fig	*Ficus retusa*

GUIDELINE-15: FORESTS AND OTHER NATURAL HABITATS

1. INTRODUCTION

This guideline envisages measures to be undertaken during blacktopping / widening of road sections passing through natural habitats. These measures shall be undertaken in addition to the measures laid down in the other Guidelines.

Natural Habitats means...
• National Park
• Reserve Forest
• Sanctuaries
• Notified Wetlands
• Fisheries and Aquatic Habitats

Conservation of natural habitats is essential for long-term sustainable development. A precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development has been adopted for the project.

2. PROJECT PLANNING AND DESIGN

To minimize the adverse impact on the ecology of the natural habitats, selection of alignment should be as per guideline. An officer of at least the rank of a forest ranger shall be deputed for detailed inventory of ecological features along the road. The nature and type of impact on natural habitats due to road construction shall be identified. Magnitude of the impact to the extent feasible on the ecological features shall also be assessed.

Ecological Features...	Adverse Impacts...
• Area of natural habitat; • Type and number of endangered species of flora and fauna; • Stream and water bodies; • Breeding ground and seasons; • Migration season of bird species; and • Animal crossing.	• Diversion of forest land; • Cutting of trees; • Trampling of vegetation; • Contamination of water due to the usage of water from the source within the natural habitat; • Loss of breeding grounds; and • Interruption to animal crossings during the construction.

Impacts identified on the natural habitats shall be minimized to the extent required. Minimization shall be through precautionary measures or through appropriate mitigation measures. Following are the measures should be undertaken along the road passing through natural habitats:

- Constricting the road width to 6.0 m and embankment height to 0.5 m to minimize the extent of diversion of forest land and cutting of trees
- Drainage Structures shall be designed strictly in accordance with guideline on “Drainage”.
- Rumble strips shall be provided at every kilometer along the length of the natural habitat and invariably at the start and end of the natural habitat
- Signage (viz. speed limit, animal crossing, switch of headlight etc) shall be provided as per IRC: 67-2001 Code of Practice for road sign (first revision)

In addition to the above measures, specific impacts identified on site shall be mitigated as per the recommendation of the forest department / officer in charge of the identified natural habitat.

In case proposed alignment falls within the catchments of a water body or a stream, a flush causeway shall be constructed without impacting the drainage system. The length of the causeway shall be as per the existing water spread. The causeway shall be strictly in compliance with IRC:SP-20:2002. In no circumstances a water body within the natural habitat shall be cut across or filled for the purpose of laying the road.

3. PRE-CONSTRUCTION STAGE

No Construction Camps, Stockyards, Concrete Batching or Hot Mix Plants shall be located within the natural habitat or within 500m from its boundary.

Contractor in consultation with forest ranger or any other concerned authority shall prepare a schedule of construction within the natural habitat. Due consideration shall be given to the time of migration, time of crossing, breeding habits and any other special phenomena taking place in the area for the concerned flora or fauna.

4. CONSTRUCTION STAGE

Procurement of any kind of construction material (as quarry or borrow material) from within the natural habitat shall be strictly prohibited. No water resources within the natural habitat shall be tapped for road construction. Use of mechanized equipment shall be kept minimum within the natural habitat. Contractor must ensure that there will be no parking of vehicles machine and equipment within the natural habitat. Disposal of construction waste within the natural habitat shall be strictly prohibited and as far as possible reuse shall be undertaken as per **Table -1** type of waste of guideline, “Waste Management and Debris Disposal”.

5. POST CONSTRUCTION STAGE

The road passing through the natural habitat shall be declared as a silence zone. Compensatory tree plantation within the available Right of Way shall be done in accordance with guideline, on “Tree Cutting and Afforestation”. The PIU must ensure maintenance of drainage structure shall be undertaken as per guideline, “Drainage”

GUIDELINE-16: AIR AND NOISE POLLUTION

1. INTRODUCTION

This guideline deals with the mitigation of adverse impacts due to air and noise pollution. Both of these have been discussed in the subsequent sections respectively.

2. AIR POLLUTION

The types of air pollution due to construction activities might include generation of dust, emission from hot mix plants and batching plants, odour from construction labour camps, emission from construction machinery/vehicles etc. The measures for mitigation of impacts from each of these are given below.

2.1 Generation of Dust

- All vehicles delivering materials to the site shall be covered to avoid spillage of materials.
- The Contractor shall take every precaution to reduce the level of dust emission from the hot mix plants and the batching plants up to the satisfaction of the Engineer in accordance with the relevant emission norms.
- All existing highways and roads used by vehicles of the contractor, or any of his sub-contractor or supplies of materials or plant 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 or their tyres.
- Spillage shall be cleared immediately by manual sweeping and removal of debris or if so directed by the Engineer, by mechanical sweeping and clearing equipment, and all dust, mud and other debris shall be removed completely. Additionally, if so directed by the Engineer, the road surfaces shall be hosed or watered using necessary equipments.
- Plants, machinery and equipment shall be so handled (including dismantling) so as to minimize generation dust.
- All earthwork shall be protected in a manner acceptable to the Engineer to minimise generation of dust.
- The hot mix plant is sited at least 1000m from the nearest habitation. The hot mix plants shall be fitted with dust extraction units in order that the exhausts comply with the requirements of the relevant current emission control legislation.
- Generation of dust should be suppressed during unloading of construction material and also during storage of the construction material.

2.2 Emission from Hot-Mix Plants and Batching Plants

- Hot mix plants and batching plants shall be located sufficiently away from habitation, agricultural operations or industrial establishments. Where possible such plants will be located at least 1000m away from the nearest habitation.
- The exhaust gases shall comply with the requirements of the relevant current emission control legislation. All operations at plants shall be undertaken in accordance with all current rules and regulations protecting the environment.

2.3 Odour from Construction Labour camps

- Construction labourers camp shall be located at least 500 m away from the nearest habitation.
- The waste disposal and sewerage system for the camp shall be properly designed, built and operated so that no odour is generated. Compliance with the Factory Act, the construction workers (regulation of employment and conditions of service) Act, 1996 and all other relevant legislation shall be strictly adhered to.

2.4 Emission from 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 used for construction shall conform to the relevant Indian Standard (IS) norms.

- All vehicles, equipment and machinery used for construction shall be regularly maintained to ensure that pollution emission levels\comply with the relevant requirements of SPCB & the Engineer.

2.5 Pollution from Crusher

- All crushers used in construction shall confirm to relevant dust emissions control as legislated. Clearance for siting shall be i obtained from the SPCB. Alternatively, only crushers already licensed by the SPCB shall be used.
- Dust screening vegetation will be planted on the edge of RoW for all existing roadside crushers.
- If crusher owned by contractor, the suspended particulate matter contribution value at a distance of 40m from a controlled isolated as well as from a unit located in a cluster should be less than 600 ug/Nm3. The monitoring is to be conducted at least twice a month for all the 12 months in a year during the crushing operation for the project.

3. NOISE POLLUTION

3.1 Noise from Vehicles, Plants and Equipment

- The plants and equipment used in construction (including the aggregate crushing plant) shall strictly conform to the GoI noise standards.
- All vehicles and equipment used in construction shall be fitted with exhaust silences. During routine servicing operations, the effectiveness of exhaust silencers shall be checked and if found to be defective shall be replaced. Notwithstanding any other conditions of contract, noise level from any item of plant(s) must comply with the relevant legislation for levels of sound emission. Non-compliant plant shall be removed from site.
- Noise limits for construction equipment used in this project (measured at one meter from the edge of the equipment in free field) such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB(A), as specified in the Environment (Protection) Rules, 1986.
- Maintenance of vehicles, equipment and machinery shall be regular and proper, to the satisfaction of the Engineer, to keep noise from these at a minimum.
- In construction sites within 150 m of the nearest habitation, noisy construction work such as crushing, concrete mixing and batching, mechanical compaction, etc., will be stopped between 2200 hours to 0600 hours. In silence zone (areas up to 100 m around such premises as hospitals, educational institutional and courts) no hot-mix, batching or aggregate crushing plant will be allowed. No construction shall take place within 100m around hospitals between 21.00 hours to 06.00 hours.
- Workers in vicinity of strong noise, and workers working with or in crushing, compaction, batching or concrete mixing operations shall wear earplugs.

3.2 Noise from Blasting (or) Pre splitting Operations.

- Blasting shall be carried out only with permission of the Engineer. All the statutory laws, regulators, rules, etc., pertaining to acquisition, transport, storage, handling and use of explosives shall be strictly followed.
- Blasting shall be carried out during fixed hours (preferably during mid-day), as permitted by the Engineer. The timing should be made known to all the people within 500m (200m for pre-splitting) from the blasting site in all directions. People, except those who actually light the fuse shall be excluded from the area of 200m (50m for pre-splitting) from the blasting site in all directions at least 10m minutes before the blasting.

GUIDELINE-17: ENVIRONMENTAL MONITORING

1. ENVIRONMENTAL MONITORING PLAN

The monitoring programme is devised to ensure that the envisaged purpose of the project is achieved and results in the desired benefit to the target population. To ensure the effective implementation of the EMP, it is essential that an effective monitoring programme be designed and carried out. Broad objectives of the monitoring programme are:

- 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

The monitoring programme contains monitoring plan for all performance indicators, reporting formats and necessary budgetary provisions. Monitoring plan for performance indicators and reporting system is presented in the following sections.

2. PERFORMANCE INDICATORS

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

The performance Indicators and monitoring plans prepared for project Implementation are presented in the following table **Table1.1**

Table 1.1: 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 as per the Monitoring Plan prepared **(Refer Table 1.5)**	Pre-Construction	Contractor through approved monitoring agency
			Construction	
			Operation	PIU through approved monitoring agency
2	Noise Levels		Pre-Construction	Contractor through approved monitoring agency
			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	Pre-construction	Contractor and CSC

Sl. No.	Indicator	Details	Stage	Responsibility
		in the area has to be reported		
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 CSC
3	Tree Cutting	Progress of tree removal marked for cutting is to be reported	Pre-construction	Revenue Department and Contractor (under the supervision of CSC)
4	Tree Plantation	Progress of measures suggested as part of the Strategy is to be reported	Construction	Forest Wing (Assisted by supervision of CSC)
5	Disposal Site	No. of locations Approved for Debris disposal; Quantity disposed off at each location; No. site Rehabilited and hand overed	Construction	Contractor and CSC
6	Reuse and recycle of waste	Quantity of waste reused/recycled; location and type of construction activity	Construction	Contractor and CSC
7	Sensitisation / awareness Training	No. and frequency of sensitisation training; No. and type of target audience trained	Construction	Contractor and CSC
8	Accidents/Incidents	No of accidents/incidents recorded	Construction	Contractor and CSC
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

3. MONITORING PARAMETERS AND STANDARDS

The Environmental monitoring of the parameters involved and the threshold limits specified are discussed below:

3.1 Ambient Air Quality Monitoring (AAQM)

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 1.2.

Table 1.2 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) -Chemiluminescence
3	Particulate Matter (size less than 10µm) or PM_{10} µg/m^3	Annual* 24 hours**	60 100	60 100	-Gravemetric -TOEM -Beta attenuation
4	Particulate Matter (size less than 2.5µm) or PM_{25}µg/m^3	Annual* 24 hours**	40 60	40 60	-Gravemetric -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.*

3.2 Noise Quality Monitoring

The noise levels shall be monitored at identified locations in accordance with the Ambient Noise Quality standards given in **Table 1.3**.

Table 1.3: National Ambient Noise Quality Standards

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

** Daytime shall mean from 6.00am 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.*

3.3 Water Quality Monitoring

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 1.4**.

Table 1.4: 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

4. MONITORING PLANS FOR ENVIRONMENT CONDITION

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 1.5**. Monitoring plan does not include the requirement of arising out of regulation provision such as obtaining NOC/ consent for plant site operation.

Table 1.5: Environmental Monitoring Plan

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
Air	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	Three seasons per year	24 hours Sampling	Along the project road, Hot mix / batching plant & crusher	Contractor under the supervision of CSC
	Operation				Two seasons in a year for three years		Along the project road	Contractor (till the DLP) and PIU
Water	Construction	All essential characteristics and some of desirable characteristics as decided by the Environmental Specialist of the CSC 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	Four seasons per year	Grab Sampling	Along the road Surface water sources	Contractor under the supervision of CSC
	Operation				Four seasons for three years			Contractor (till the DLP) and PIU
Noise	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 Noise Rules, 2000	Three seasons per year	Leq in dB(A) of day time and night time	Along the project road, Hot mix / batching plant & crusher	Contractor under the supervision of CSC
	Operation				Three seasons per year for three years.		Along the project road	Contractor (till the DLP) and PIU
Soil	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	Four seasons per year	Grab Sampling	Along the project road, Hot mix / batching plant	Contractor under the supervision of CSC
	Operation				Four seasons		Along the	Contractor (till

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
				standards are promulgated	for three years		project road	the DLP) and PIU
Borrow area	Construction	As per Guidelines	Visual Observation	-	Once in a month	-	Borrow area location	Contractor under the supervision of CSC
Tree plantation	Operation stage	As per Design			Quarterly	-	Areas where plantation is being done	Contractor (till the DLP) and then PIU will be responsible

5. REPORTING SYSTEM

Reporting system suggested for the Phase-1 Corridors 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

Contractor and Engineer - in charge operate the reporting system for environmental conditions and environmental management indicators (except tree cutting). The Environmental Management Cell of PIU will operate the reporting system for environmental management tree cutting indicators and operational performance indicators. The PIU will set the targets for each activity envisaged in the ESMP beforehand and all reports will be against these targets.

The Contractor will report to the Engineer - in-charge of the progress of the implementation of environmental conditions and management measures as per the ESMP. The Engineer- in-charge will in turn report to the PIU every quarter. Reporting formats have been prepared, which will form the basis of monitoring, by the Engineer- incharge and/or the Environmental Cell as required and presented as **Annexure 4**.

Table 1.6: Summary details of Reporting

Format No.	Item	Stage	Contractor	Environmental Cell	Supervision Consultant (CSC) / Concessionaire		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	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
OP2	Status Regarding Rehabilitation of Borrow Areas	Operation	-	-	-	-	Half Yearly

GUIDELINE-18: GUIDANCE FOR CONSTRUCTION WORKERS/ CONTRACTORS UNDER TNRSP-II (ADDITIONAL FINANCING) IN VIEW OF COVID-19

In view of COVID-19 outbreak, 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/---ed_emp/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 Tamil Nadu under TNRSP-II, Additional Financing. 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 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 checkups/ 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 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 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 handwashing facilities. Adequate provision for solid waste management needs to be provided. (a, b, d, f)
- Provide health and safety training/orientation on COVID19, 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)

GUIDELINE-19: SALIENT PROVISION FOR SAND MINING IN THE STATE OF TAMIL NADU

1. Site Selection and Legal Compliance

The contractor shall comply with requirements of TNMMC Rule 1959 and EIA notification 2006 on minor mineral. The identification of sand mining location shall be

- Area identified in the Comprehensive Mining Plan of the District.
- No mining shall be done in forest, protected areas, habitation.
- Distance of 500m from cross drainage structure like bridges, towers from outer edge of cutting.
- distance of 50 meter shall be measured in the case of railway, reservoir or canal from outer edge of the cutting.
- Preference to source of sand mining include desilting locations that could include Lake, dam reservoir, agriculture land etc.
- Distance between any two clusters of sand mining should be more than 2.5 km
- Sand mining at river only for channelization of rivers so as to avoid the possibility of flooding and to maintain the flow of the rivers.

2. Salient provision for sand mining in the state of Tamil Nadu

I. STEPS TO BE FOLLOWED BEFORE EXECUTION:

- The state as a policy should endeavour to have single authority/agency responsible for all river sand mining in the state with an objective to ease the gap in demand and supply and accordingly, take necessary measures including planning, monitoring of mined material and its transport, and to curb illegal mining and sale of materials.
- The prospective site for sand quarry may be identified based on the availability of adequate sand deposits along the river beds, which hinders the free flow of water and results in flooding during monsoon seasons. Emphasis may be given to such quarry sites which is more viable for replenishment.
- A detailed study may be conducted by engaging expert from reputed Institutions to identify prospective sand reaches, assessment of the impact of sand quarrying on the Ground Water Table and water availability, conduct bore log details and study the social and environmental aspects. The generic requirement for replenishment study is to be followed.
- Once the site is identified for prospective sand quarry site based on the detailed replenishment study, the concerned department shall submit the proposal with the geo-tagged boundary of the proposed mining Precise Area Proposal to the District Collector for approval.
- A joint inspection may be carried out by the RDO/Sub-Collector, Assistant/Deputy Director, Executive Engineer, TWAD Board and the PWD officials to consider the various factors before giving consent to the proposal.
- The RDO concerned along with Revenue officials may verify the revenue records of the proposed sand quarrying area and give the NOC.
- The AD/DD Mines may verify the presence of permanent structures such as tower line, bridge, monuments if any, in the vicinity of the proposed mining site as per Tamil Nadu Minor Mineral Concession Rules,1959 (As per Rule 36 " there shall be no quarrying of sand in any river bed or adjoining area or any other area which is located within 500 meter radial distance from the location of any bridge, water supply system, infiltration well or pumping installation of any of the local bodies or Central or State Government Department or the Tamil Nadu Water Supply and Drainage Board head works or any area identified for locating water supply schemes by any of the above mentioned Government Department or other bodies" and " The distance of 50 meter shall be measured in the case of railway, reservoir or canal horizontally from the outer toe of the bank or the outer edge of the cutting, as the case may be …. "). Also, the availability of minerals may be cross verified with the available DSR.
- The TWAD officials may verify the drinking water schemes located nearby the proposed quarry site and the minimum distance required as per statutory norms.

- Based on the feasibility report of the joint inspection by the Revenue, Tamil Nadu Water Supply and Drainage Board and Mining officials/experts, the District Collector may give consent for the Precise Area proposal.
- After getting Precise Area approval, a detailed Mining Plan and sketch shall be prepared by the Executive Engineer, PWD using the services of a NABET accredited consultant who holds the pivotal role in the preparation of mining plan. Due responsibility will be expected on the concerned consultant in the mining plan preparation taking care of adhering to all mining rules, existing as on date. The mining plan shall contain the details of quantity to be excavated, the period of mining, method of excavation, deployment of required machinery, Environment Management Plan (EMP), proposed number of laborers to be deployed and Conceptual Mining Plan, as per Rule 41 of TNMMC Rules 1959. It is also the duty of the consultant to give the safe distance of 50 m or twice the bank height from the toe of the riverbank, whichever is higher and fixing the Geo coordinates for boundaries using DGPS instruments.
- The concerned Executive Engineer, PWD shall submit the Mining Plan prepared by the NABET accredited consultant to the concerned Assistant/Deputy Director, Department of Geology and Mines for approval, as per Rule 42 of TNMMC 1959. After scrutiny, the Assistant/Deputy Director, Department of Geology will present the Mining plan before the State Level Environment Impact Assessment Authority (SEIAA) for granting Environmental Clearance.
- The Executive Engineer, PWD shall prepare Form I and Pre-feasibility report with the help of the consultant and submit to SEIAA for an area less than 50 Ha. or to the Ministry of Environment and Forest and Climate Change (MoEF&CC) for the area more than 50 Ha.
- The State Expert Appraisal Committee (SEAC) under SEIAA, consisting of experts from renowned fields such as Mines, Environment, Sociology etc. shall conduct a site inspection of the proposed sand quarry site and after intense scrutiny, may recommend the proposal to SEIAA for approval.
- SEIAA shall grant Environmental Clearance for the sand quarry proposal after analyzing all the statutory provisions and based on the recommendation of the SEAC.
- The Environmental Clearance shall be informed to the public with basic details through advertisement in at least two widely circulated local newspapers with at least one in the vernacular language of the locality, within 7 days of the receipt of the clearance.
- On receipt of the Environmental Clearance, the Executive Engineer, PWD shall apply for Consent to Establish (CTE), from the Tamil Nadu Pollution Control Board as per the Air and Water Act, to enter upon the sand quarry site and commence the preliminary works such as construction of temporary sheds, bio-toilets, formation of biodegradable road using sugar cane leaves etc., drilling of bore wells etc. as per the statutory requirements. After all the preliminary works are completed, the Executive Engineer, PWD shall apply for the Consent to Operate (CTO) from the Tamil Nadu Pollution Control Board. Earmarking boundary of the identified land site through the concrete posts along with red flags need to be established.
- On receipt of the CTO, the Executive Engineer, PWD shall request the consent of the District Collector to commence the quarries. The District Collector shall request the Taluk Level Task Force comprising of Tahsildar, Inspector of Police, Officials from the Departments of Geology and Mining, Transport and Forest, Assistant Engineer, PWD and the Village Administrative Officer concerned, to verify the compliance of all preconditions mentioned in the Environmental Clearance and grant necessary permission to start the functioning of new sand quarries.

II. STEPS TO BE FOLLOWED DURING EXECUTION:

- Before the commencement of mining operations, the depth of sand quarrying needs to be measured accurately using Advanced technology and new gadgets like Total Stations, Global Positioning System (GPS) instruments etc. The Total Station and GPS instruments also need to be calibrated before measurement. Both the traditional and modern techniques may be infused in the right blend to get an accurate measure of the depth. A clear contour map (0.25m interval) of the levels within 2Km (one Km U/s and one Km D/s) needs to be prepared

and submitted to both the Project Director, Sand Quarrying Operations and all the Monitoring Committee members. The depth of sand quarrying shall be restricted to 1 m from the theoretical/design bed level.

- The mining area must be demarcated at a minimum distance of at least 50 m away from the river embankment on either side. The boundaries of the quarries may be fixed with reference to the existing survey marks from the survey fields adjacent to the river. Sand quarrying lease area shall be demarcated on the ground with pucca stone or concrete pillars to show the present natural bed level and the depth of mining allowed.
- Modern techniques such as drone survey may be adopted to assess the depth and quantity of the mined area. Boundary pillars shall be erected at an interval of 50 m each on all four sides of the sand quarry site with red flags on every pillar and also in site pillars. The levels of shoal height, river bed height and depth to be excavated up to one meter downwards shall be marked in the pillars to avoid any deviation from the approved depth of excavation.
- It shall be ensured that no sand quarrying of any type is undertaken with 50m of the distance mentioned in the proposal (whichever is higher) from both the banks of the river to control and avoid erosion of river banks.
- Temporary access roads or Katcha roads shall be formed between the banks of the river and the mining area with locally available biodegradable materials such as sugarcane waste (bagasse), hay, etc.
- Proper entry and exit point for the movement of loading vehicles in and out of the sand quarry site shall be carefully located taking into consideration the habitations/settlements in the area.
- To monitor the groundwater level during sand quarrying operations, a network of existing wells may be established around the sand quarrying area and new piezometers must be installed at all sand quarry sites. Monitoring of Ground Water Quality in the vicinity (one Km radius from the sand quarrying site) shall be carried out once in two months.
- Periodic Monitoring (at least four times in a year – pre-monsoon, Monsoon, Post monsoon and winter) once in each season shall be carried out by PWD and the data thus collected may be sent regularly to SEIAA/TNPCB. If at any stage, it is observed that the groundwater table is getting depleted due to the mining activity; necessary corrective measures shall be carried out, which includes immediate stopping of mining.
- Similar to the Baseline studies for data on water, soil and air etc., that is being done before the sand quarrying operations, the air and water quality may be checked periodically by Tamil Nadu Pollution Control Board to ensure that no pollution is caused due to Sand Quarrying Operations. 10. Safety gadgets such as earplugs, goggles, respiratory devices, luminescent vests etc. may be provided to the workers at the sand quarry site.
- First aid kit with all essentials shall be kept ready at all quarry/depot site, in case of any emergency.
- To prevent air pollution due to the dust during sand quarrying operations and safeguard the persons in the sand quarry and depot site, constant water sprinkling on the pathways and dust prone areas may be done. The sand loaded vehicles are to be covered with a tarpaulin before moving out of the quarries/depots.
- Suitable depots shall be located in the vicinity of the sand quarry site to facilitate the sale of sand. While selecting the site for depots, it must be ensured that the site is within 25 km from the sand quarry site and has an area of around 10-15 Acres with parking facilities and proper entry and exit for smooth movement of the vehicles. The depot site shall preferably be a Government poramboke land, foreshore area of tank bund etc., near an NH/SH/MDR/ODR. In the absence of any Government land in the vicinity, private Patta land may be leased out and rent fixed as per the approved Government rates applicable therein.
- Permission must be obtained from the Electricity Board for power supply to operate the CCTV cameras at sand quarry site and depots.
- Minimum of two CCTV cameras, one each at the entry and exit point and one PTZ camera may be installed at all quarries/depots to monitor illegality if any taking place in the sand quarry/depot.

- To ensure uninterrupted seamless live streaming of videos from the surveillance cameras, a high-speed Internet Lease Line connection may be made available at all quarries/depots. Arrangements may also be made for online monitoring of the sand quarrying, Centre for Assessing Real-Time Sand Mining (CARS) that could be located at the office of the Project Director in Chennai.
- The live streaming of the videos shall be monitored at a Centralised control room and the data shall be stored in the Server for future references. A robust Customer Care may also be functional 24 x 7 at the Control Room, to redress the grievance of the public.
- Drop gates shall be installed at the entry and exit points of all quarries/depots.
- Display boards shall be erected in local vernacular language at sand quarry/depot site, in the nearest village by which sand transportation will be carried and at the entrance of the village road from the main road.
- The concerned authority of PWD shall call for e-tender to select the contractors for loading/raising of sand at the quarry site, transporting contractors to transport sand from the quarry site to depots and loading/maintenance contractors at depots.
- Sand shall be loaded in the quarries in the PWD tendered GPS fitted vehicles and online transmit permit shall be issued by the competent authorities in PWD to the transporting vehicles to transport sand from the quarry to depots.
- On the arrival of the sand shunting vehicles from quarry to the depot, an online authentication shall be done to confirm the arrival of the appropriate quantity of sand mentioned in the transport permit into the depot.
- The loading of sand from the depots shall be carried out by booking through the online portal "www.tnsand.in" as done presently. Online transit passes will also be issued to the loaded vehicles which could be verified by using an Android app "TNsand Investigator".
- During operation of the quarries, the PWD officers shall ensure that at no point in time, the depth of quarry exceeds 1 m depth from the river bed level and quarrying is done in a uniform manner over the entire mining area to avoid overexploitation and formation of pits at fixed places.
- Proper registers may be maintained at the entry and exit points of the sand quarry/depot sites and a Loading Register may be made available during inspection. An Inspection Register and a Complaint Register may be made available at the sand quarry/depot site.
- The functioning time of quarries/depots shall be from 7.00 AM to 6.00 PM. No sand transporting vehicles to be parked inside the quarry/depot site during night time.
- A copy of the approved mining plan may be kept at the quarry site for ready reference.
- Photographs and sketch showing the pit dimensions, depth etc. may be recorded every week and maintained in the sand quarry. The Executive Engineer, PWD may inspect each sand quarry on a weekly basis and ensure that mining activities are taking place within the approved boundaries/depth.
- The sand quarrying activity shall be stopped if the entire quantity is quarried even before the expiry of the sand quarry lease period and the same shall be mentioned by the PWD authorities.
- The Taluk Level Taskforce shall inspect the quarries every fortnight, as per G.O. (Ms) No. 135 of Industries Department, dated 13.11.2009 and record the status of the compliance in the registers maintained at the sand quarry site.
- The Taluk Level Task Force has to submit its inspection report to the District Level Task Force chaired by the District Collector. The District Level Task Force has to be convened every month to discuss cases of illegal quarrying. An Environmentalist from reputed State / Central Institution and a legal expert on environmental matters may be part of the District Level Task Force. The District Level Task Force shall also dispose of the petitions on illegal sand quarrying after due enquiry and scrutiny, and pass orders within a period of two months from the date of receipt of the complaint. If any person is aggrieved with the orders passed by the District Level Task Force, an appeal may be preferred before the Appellate Forum.
- The District Collector shall take necessary steps to strengthen the existing District and Taluk Level Committees and act on the complaints received, if any, on illegal sand quarrying and

take strict remedial measures to rectify the same in a time-bound manner. The District Level Task Force may send its monthly report to the Appellate Forum formed as per G.O. (Ms) No. 27 of Industries Dept. dated 17.02.2015.

- The Appellate Forum shall hear the appeals filed against the orders passed by the District Level Task Force. The Appellate Forum comprises of the Secretaries to Government from Industries Department, Public Works Department, Revenue Department, Environment and Forests Department, Commissioner of Geology and Mining and an Expert from a reputed Government Institution.
- The Appellate Forum may convene once in 2 months to deliberate on the reports from the District Level Task Force and shall dispose of the appeals made by the petitioners aggrieved with the orders passed by the District Level Task Force.
- Periodical Capacity building and sensitization of PWD officials on the environmental and legal aspects of sand quarrying may be made mandatory. Continuous training and awareness programs shall be scheduled and conducted by IIT/Anna University for the PWD staff to keep themselves aware of the best practices in this field. It may be ensured that the enforcement officials from the Departments of Revenue, Police, Geology and Mining and Transport in the districts where quarries are situated are given adequate training and capacity building on their duties and responsibilities with respect to inspection of sand quarries and sand transporting vehicles at specified time intervals.
- No blasting shall be carried out any point in time.
- It is the obligation of the Public Works Department to run the quarry in an environmentally friendly and ecologically sustainable manner.
- The Hon'ble High Court-appointed Monitoring Committee shall inspect the sand quarries periodically and submit a report to the Hon'ble High Court.
- The PWD should explore/take necessary steps to introduce Mining Surveillance System (MSS) in line with MSS evolved by the Indian Bureau of Mines and Bhaskaracharya Institute for Space Applications and Geoinformatics (BISAG).

III. STEPS TO BE FOLLOWED AFTER EXECUTION:

- A Judicious mine closure plan may be formulated once the quarry is closed after exhaustion of the quantity of sand.
- Reclamation works may be factored into the contract agreement and strict monitoring by the PWD officials may be initiated to scrupulously follow up the mine closure plan.
- It may be ensured that the total quantity of sand permitted in the EC shall not be exceeded in any case.
- After the exhaustion of the quantity of sand, the sheds constructed at the quarry site may be removed. All the roads and pathways may be levelled so that there is no obstruction for the normal flow in the river.
- All the records/registers may be carefully maintained by the PWD for future reference.