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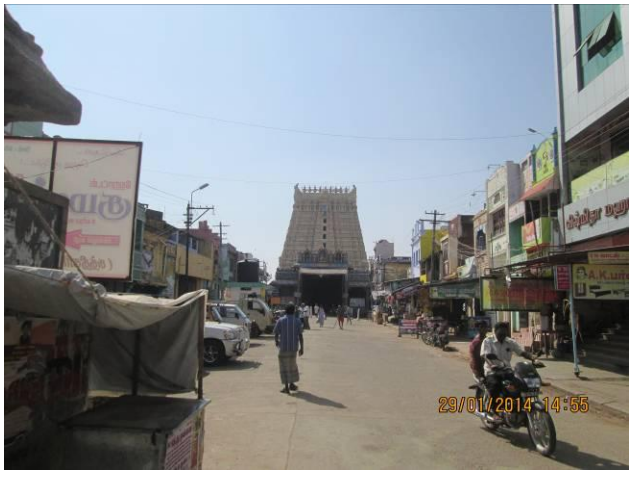
HIGHWAYS DEPARTMENT

Government of Tamil Nadu

SMEC

DETAILED PROJECT REPORT (DPR) FOR ROAD IMPROVEMENT WORKS UNDER TAMIL NADU ROAD SECTOR PROJECT II (TNRSP II)

VOLUME VII: PART A (II)
ENVIRONMENTAL MANAGEMENT PLAN FOR
UPGRADING RAJAPALAYAM - SANKARANKOIL - TIRUNELVELI ROAD (SH 41)
KM 1/800 TO KM 28/000 AND KM 33/800 TO KM 82/800



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ROAD IMPROVEMENT WORKS UNDER TAMIL NADU ROAD SECTOR PROJECT II (TNRSP II)

For

PD, PMU, WB(Transport), TNRSP, Chennai, Tamil Nadu

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ABBREVIATIONS

Abbreviation	Full Form
AIDS	Acquired Immunodeficiency Syndrome
BIS	Bureau of Indian Standards
BP	Bank Procedure
BOD	Biological Oxigen Demand
BOQ	Bill of Quantities
CD	Cross Drainage
CNG	Compressed Natural Gas
COD	Chemical Oxigen Demand
COI	Corridor of Impact
CRZ	Coastal Regulation Zone
CPCB	Central Pollution Control Board
CPR	Common Property Resource
CL	Centre Line
CO	Carbon Monoxide
CSC	Construction Supervision Consultant
CTE	Consent to Establish
CTO	Consent to Operate
DPR	Detailed Project Report
dB(A)	Decibel
DG	Disel Generator
EA	Environment Assessment
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EMP	Environmental Management Plan
EMAP	Environmental Management Action Plan
ERoW	Existing Right of Way
EMU	Environment Management Unit
EO	Environment Officer
EPC	Engineering Procurement Construction
ES	Environmental Specialist
ESE	Environment Safety Engineer
FIDIC	Fédération Internationale Des Ingénieurs-Conseils/ International Federation of Consulting Engineers
FMB	Field Measurement Book
GoI	Government of India

Abbreviation	Full Form
GoTN	Government of Tamil Nadu
GW	Ground Water
HD	Highway Department
HFL	High Flood Level
HIV	Humen Immunodeficicency Virus
IMD	Indian Meteorological Department
IRC	Indian Road Congress
IS	Indian Standard
ISO	International Organisation for Stanardization
KVA	Kilo Vatt Ampare
LHS	Left Hand Side
l/hr	Litre Per hour
LPG	Liquid Petroleum Gas
MoRTH	Ministry of Road Transport & Highways
MCW	Mother and Child fare
MoEF&CC	Ministry of Environment, Forests and Climate Change
NABL	National Accreditation Board for Testing and Calibration Laboratories
NBWL	National Board for WildLife
NAAQS	National Ambient Air Quality Standards
NH	National Highway
NGO	Non Governmental Organisation
NOx	Oxides of Nitrogen
NPV	Net Present Value
NQ	Noise Qauality
OB	Over Burder (Waste)
OFC	Optical Fibre Cable
OHSAS	Environmental Health & Safety Management System
OP	Operational Procedure
PAPs	Project Affected Persions
PPP	Public Private Partnership
PWD	Public Work Department
PIA	Project Influence Area
PIL	Public Information Cell
POL	Petroleum, Oil and Lubricant
PIU	Project Implementation Unit

Abbreviation	Full Form
PM	Particulate Matter
PPE	Persional Protective Equipment
PRoW	Proposed Right of Way
PD	Project Director
pH	Potencia of Hydrogenie
PUC	Pollution under Control Certificate
PVC	Poly Vinyl Chloride
QMS	Quality Management System
RAP	Resettlement Action Plan
RCC	Reinforced Cement Concrete
RHS	Right Hand Side
ROB	Railway Over Bridge
RoW	Right of Way
RUB	Railway Under Bridge
SAR	Sodium Adsorption Ration
SEIAA	State Environment Impact Assessment Authority
SC	Suppervision Consultant
SCRN	State Core Road Network
SCSS	Senior Construction Safety Specialist
SE	Superintendent Engineer
SH	State Highway
SO_2	Sulfer Dioxide
SOS	Save Our Souls/ Emergency Communication Telephone
SP	Superintedent of Police
SPCB	State Pollution Control Board
SQ	Soil Quality
TDS	Total Dissolved Solids
TNRSP	Tamil Nadu Road Sector Project
TNPCB	Tamil Nadu Pollution Control Board
TWAD	Tamil Nadu Water Supply and Drainage Board
USEPA	United State Environment Protection Agency
WB	World Bank
WBG	World Bank Group

CHAPTER 1

INTRODUCTION

1 INTRODUCTION

The Highway Department, Government of Tamil Nadu (GoTN) is undertaking road development in the State with World Bank assistance loan. The State Highways of length of about 1800km has already been improved under Tamil Nadu Road Sector Project Phase I (TNRSP I).

GoTN has now mooted to second phase of road improvement works, namely TNRSP II. A Strategic Options Study (SOS) on the State Core Road Network (SCRN) for selection of candidate roads for improvement was carried out by Tamil Nadu Road Sector Project I, HD in the year 2009-10 and the same was revalidated in 2011-12. State HD has prioritized about 2000km of State Roads for various improvement works under EPC +5 years maintenance/public private partnership (PPP) Contract/ bill of quantity (BOQ) Contract modes.

SMEC India Pvt. Ltd.-SMEC International Pty. Ltd., Australia (JV) has been appointed by Highways Department, GoTN as PPC 05 DPR Consultant vide agreement signed on 18thOctober 2013 to undertake work of second phase, TNRSP II.

To define the Environmental Management requirements, to ensure environmental safe guards during construction and operation, an Environmental Management Plan (EMP) has been prepared for the section Rajapalayam - Sankarankoil – Tirunelveli Road (km 1/800 to km 28/000 and km 33/800 to km 82/800), of SH-41 of length 75.2 km, (refer Figure 2.1) considered under Phase –I roads under TNRSP-II as follows:

1. Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (SH44) km 22/500 to km 38/750 and km 41/300 to km 56/700

2. Nanguneri - Bharatavaram - Ovari Road upto ECR Junction (SH89) km 0/000 to km 35/200)

3. Rajapalayam - Sankarankoil – Tirunelveli Road (SH41) km 1/800 to km 28/000 and km 33/800 to km 82/800

As a first step an Environmental Assessment (EA) has been prepared in accordance to the World Bank requirements for the roads considered under Phase –I roads under TNRSP-II.

This document provides the Environmental Management Action Plan (EMAP) comprising activity wise impacts and mitigation measures identified for each environmental attribute like land, water, air, noise, biological environment and social environment for the project road. A robust Monitoring and Reporting (M&R) system is in-built into it for various phases of the project and activities. This is supported by annexures, which provides (i) detailed guidelines to enable the contractor to implement the EMAP in an appropriate manner, (ii) monitoring formats for the contractor to report to CSC (Construction Supervision Consultant) and (iii) checklists for the CSC to monitor the implementation of EMAP.

The acquisition of land, which has already been identified under earlier design, is under process. RAP provides compensation and rehabilitation, for direct (private properties) social

impacts, while EMP provides other social impact mitigation and enhancement for direct (public properties) and indirect impacts.

1.1 ENVIRONMENTAL ASSESSMENT (EA) PROCESS

The EA has been carried out for the roads considered Phase –I roads under TNRSP-II implementation as mentioned above. The project/road specific issues are addressed in the Environmental Assessment reports and EMPs. This document addresses the corridor-specific Environmental Management Plan (EMP) for the 75.2 km of Rajapalayam - Sankarankoil – Tirunelveli Road Section of SH-41 included in the TNRSP Phase-II improvement programme. EA and EMP reports identifies the environmental impacts in the earlier stages of project preparation to incorporate necessary mitigation measures required to minimise those impacts as well as to enhance the positive factors. All environmental management/ mitigation costs including environmental monitoring and training budget have been included in the EMP Cost provided in **Chapter 6**.

The project's Social Impact Assessments resulted in the preparation of a Resettlement Action Plan (RAP) to address the land acquisition procedures and all associated social aspects such as compensation, resettlement and relocation for the project road. Similarly the environmental studies has led to the preparation of project specific EMP.

This document assists the Contractor and associated officials to mitigate or minimize the negative social and environmental impacts due to the construction and operation of the project and to enhance the positive impact of this project. The EMP has been prepared to meet the GOI requirements as specified by the Ministry of Environment, Forests and Climate Change (MoEF&CC) and meeting the requirements of the World Bank. Its purpose is to present an evaluation of potential impacts due to the proposed widening of the existing Rajapalayam- Sankarankoil -Tirunelveli Road Section of SH-41. The document has presented the impacts, mitigation measures and appropriate costs for the proposed mitigation measures. Institutional strengthening for environmental management is also an essential part of this document for implementing contract provisions and other environmental mitigation and enhancement provisions.

1.2 OBJECTIVES OF ENVIRONMENTAL MANAGEMENT PLAN (EMP)

The objectives of the Environmental Management Plan (EMP) are to

- Define the Environmental management principles and guidelines for the preconstruction, construction and post construction phases of the road improvement.
- Describe the practical mitigation measures that will be implemented on road improvement works and ancillary sites (quarry and borrow areas) to prevent or mitigate any negative environmental impacts and to enhance the positive issues.
- Establish the roles and responsibilities of all parties involved in the implementation of environmental controls;
- Establish monitoring and reporting system for facilitating appropriate implementation of EMP.

1.3 ENVIRONMENTAL REGULATIONS APPLICABLE TO THE PROJECT

Summary of environmental clearances/ permits/ approvals required for the sub-project is presented in **Table 1-1.** During the pre-construction stage, the responsibility of obtaining clearances from concerned authority lies with TNRSP. However, for such clearances which are required to be obtained during construction phase shall be obtained by the contractor.

Table 1-1: List of Environmental Regulations Applicable to the Project

S. No.	Type of Clearance / Permission	Statutory Authority	Applicability	Project stage	Responsibility
1.	Tree felling Permission	District Collector	For roadside tree cutting	Pre construction	TNRSP
2.	Consent to establish under The Air (Prevention & Control of Pollution) Act, 1981 and The Water (Prevention & Control of Pollution) Act, 1974	TNPCB	For establishment of construction camp, construction plant, crusher, batching plant etc	Pre Construction	Contractor
3.	Consent to Operate under The Air (Prevention & Control of Pollution) Act, 1981 and The Water (Prevention & Control of Pollution) Act, 1974	TNPCB	For operating construction plant, crusher, batching plant etc	Construction stage (Prior to initiation of any work)	Contractor
4.	Permission to withdraw water for construction from surface water sources such as Rivers/Ponds	TN Irrigation Department	Use of surface water for construction	Construction stage (Prior to initiation of any work)	Contractor
5.	Permission to withdraw ground water for construction from new sources	State and Central Ground Water Boards	Extraction of ground water	Construction stage (Prior to initiation of any work)	Contractor
6.	Permission for storage, handling and transport of hazardous materials	TNPCB	Manufacture storage and Import of Hazardous Chemical	Construction stage (Prior to initiation of any work)	Contractor
7.	Explosive License	Chief Controller of Explosives,	For storing fuel oil, lubricants, diesel etc. at	Construction stage (Prior to initiation	Contractor

S. No.	Type of Clearance / Permission	Statutory Authority	Applicability	Project stage	Responsibility
			construction camp	of any work)	
8.	Quarry Lease Deed and Quarry License from State Department of Mines and Geology	Dept. of Mining; Concerned District Administration; SEIAA; TNPCB	Quarry operation (for new quarry) Environmental Clearance from SEIAA and CTE/CTO from TNPCB.	Construction stage (Prior to initiation of any work)	Contractor
9.	PUC for vehicles forconstruction under Central Motor and Vehicle Act 1988	Motor Vehicle Department of Tamil Nadu State	For all construction vehicles	Construction stage (Prior to initiation of any work)	Contractor
10.	Labor license	Labor commissioner office	Engagement of Labor	Construction stage (Prior to initiation of any work)	Contractor

1.4 METHODOLOGY OF PREPARING EMP

Much of the environmental degradation that happens during the construction stage of a highway can be prevented or controlled, if there is an appropriate system in place. Hence, EMAP table has been specifically designed to capture all the impacts that take place during the entire life cycle of a project from design to operation stage. Accordingly, a thorough activity analysis was carried out listing out all the project activities, based on which an impact identification matrix was prepared to understand the impacts upon various environmental attributes such as land, water, air, noise, flora and fauna. Lastly, socio-economic impact upon people and solid waste generation was also considered as separate impacts.

Based on this exercise, an Environmental Management Plan (EMP) has been prepared suggesting various mitigation measures to avoid or minimize the impacts of the project on the environment during the pre-construction, construction and operation phases. Two sets of guidelines were prepared and incorporated in the EMAP table of EMP reports to enable the contractor to implement the project with least impact upon the environment– (i) Guidelines for entire project stretch including the project facilities like camps and sites and (ii) Guidelines exclusively for siting, management and restoration of project facilities like camps and sites. **Table 1.2** highlights the list of these guidelines:

Table 1.2: Guidelines in EMAP

Sl. No.	Title
A	**GUIDELINES FOR ENTIRE PROJECT STRETCH**
1	Guidelines for preparing comprehensive waste management plan

Sl. No.	Title
2	Guidelines for top soil conservation and reuse
3	Guidelines to ensure worker's safety during construction
4	Guidelines for preparation of traffic management plan
5	Guidelines for storage, handling, use and emergency response for hazardous substances
6	Environmental Monitoring Plan
B	**GUIDELINES FOR PROJECT FACILITIES**
1	Guidelines for siting, management and redevelopment of construction camps
2	Guidelines for siting, management and redevelopment of labour camps
3	Guidelines for siting, management and redevelopment of quarry and stone crusher
4	Guidelines for siting, management and redevelopment of borrow areas
5	Guidelines for siting and management of debris disposal site

The guidelines for project facilities have been structured with following objectives:

(i) It facilitates the selection of a site with least environmental impact,

(ii) It looks into the satisfaction of the land owner in case of leased out / rental out lands,

(iii) It guides the contractor with step by step measures in setting up of an efficient and environment friendly camp / site,

(iv) It ensure smooth, safe and efficient functioning of these camps and sites

(v) It guides the contractor in preparing a camp / site management and restoration plan to be submitted to CSC (prior to setting up of the camp/site)

(vi) It facilitates restoration of the site at the closure stage in a very environment friendly manner.

EMP assigns the responsibilities for various actions identified to limit the adverse impacts of the project. An environmental monitoring plan and an institutional framework have been proposed as part of the EMP for proper implementation and monitoring of mitigation measures. The cost for implementing the proposed environmental mitigation measures and

carrying out the environmental monitoring has been worked out and is presented as part of the EMP for necessary budgetary allocations as part of the project cost .In order to implement various environmental requirements during pre construction, construction and operational phases, all mitigation and enhancement measures have been clearly built in to the Environmental Management Plan (**Figure.1-1**) including cost. All necessary mitigation and enhancement costs have been part of the EMP cost in **Chapter 6**.

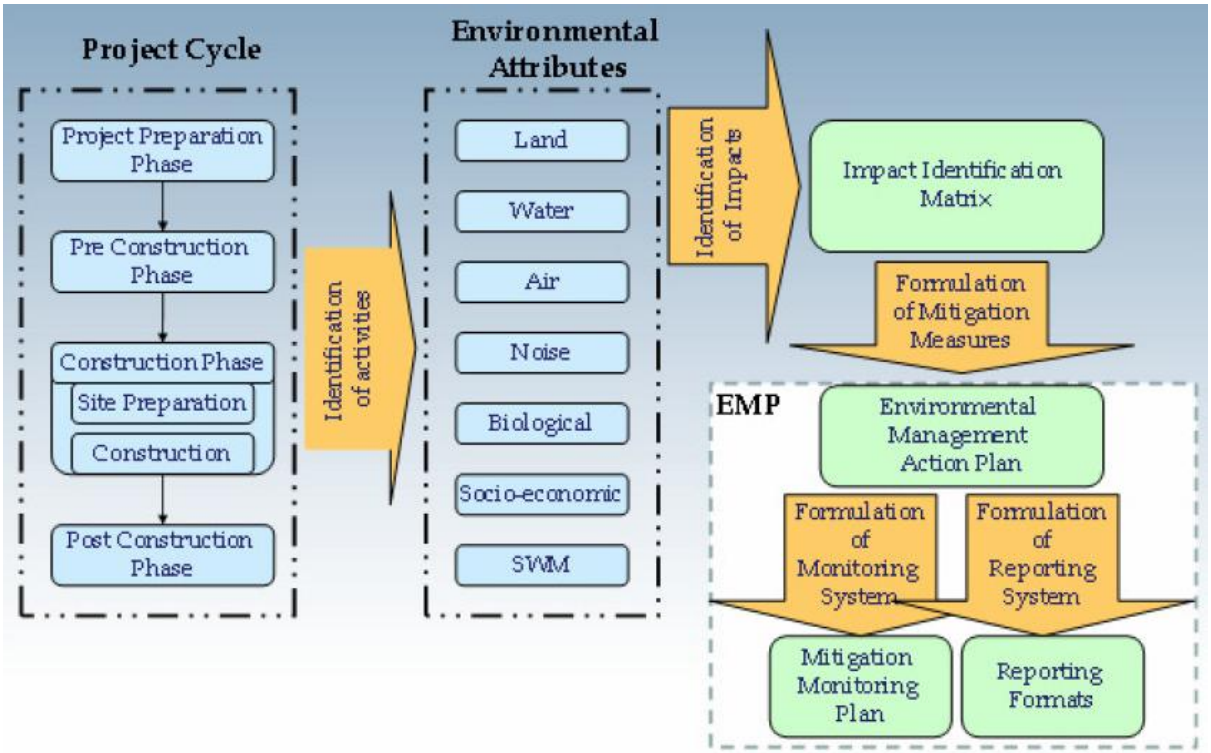


Figure 1-1: Approach to EMP Implementation

CHAPTER 2

PROJECT DESCRIPTION

2 PROJECT DESCRIPTION

2.1 REGIONAL SETTING OF THE PROJECT ROAD

Tamil Nadu lies in the southernmost part of the Indian Peninsula and is bordered by the union territory of Puducherry and the states of Kerala, Karnataka, and Andhra Pradesh. It is bounded by the Eastern Ghats on the north, by the Nilgiri, the Anamalai Hills, and Kerala on the west, by the Bay of Bengal in the east, by the Gulf of Mannar and the Palk Strait on the southeast, and by the Indian Ocean on the south.

Tamil Nadu is the eleventh largest state in India by area and the sixth most populous state in India. Presently there are 32 districts and 208 taluks in the State.

The project road is located in the Tirunelveli and Virudhnagar districts. Regional setting of the project road is shown in **Figure 2-1.**

2.2 DESCRIPTION OF PROJECT ROAD

Rajapalayam- Sankarankoil -Tirunelveli Road (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH-41

The project road stretch from km0/000 to km 10/500 falls in Virudhnagar district and rest of the project road from km 10/500 to km 85/730 falls in Tirunelveli district of Tamil Nadu state. The location map of the project road is shown in **Figure 2-2.**

SH No.	Description of Road link	Districts	Length (Km)
SH-41	Strengthening and widening of Rajapalayam- Sankarankoil -Tirunelveli Road, km 1/800 to km 28/000 and km 33/800 to km 82/800	Virudhnagar Tirunelveli	75.200

The project road starts at Km 0/000, intersection with NH 208, and ends at intersection with Tirunelveli-Tenkasi Road, SH-39 at Km 85/730. As per the contract, the project road length was 85.730 but after the feasibility study it is 75.2 km. There is commercial built up area at start and end points of project roads, thus the start and end chainages has been revised as km 1/800 and km 82/800 respectively. The total length of the project road is now 75.2 km.

The major congestion points identified along the project road stretch is at Sankrakovil, Tirunelveli District. A bypass is already proposed for Sankarankoil by C&M Highway Department (to avoid impact on Sankarankoil built up area) starting from km 28/000 to km 33/800 arriving a total length of 7/200 km on LHS of SH-41. Also, a ring road is proposed by C&M Highway Department crossing at ch.74/800 as shown in **Figure 2-2.**

The Project road passes through 46 villages, covering two districts namely Tirunelveli and Virudhnagar. About 53% and 30% of the road traverses through dry land and built-up area respectively.

Rajapalayam- Sankarankoil -Tirunelveli Road (km 1/800 to km 28/000 and km 33/800 to km 82/800) section of SH-41 is a two-lane road and proposed for two-lane up

gradation with paved shoulders (*except the stretch from km0/000 to km6/000, falling within 10 km buffer zone of Srivilliputtur Giant Grizzled Squirrel Wildlife Sanctuary, where it will be* 2-lane without paved shoulder*).*

Existing Features: There are 85 minor and 3 major junctions along the road. There is no truck lay bye, underpass, flyover and ROB/RUB. There are 29 nos. of minor bridges and 116 nos. of culverts. There are 71 nos. of bus bays/bus shelter along the road. There is no reserved / protected forest within RoW of project road. Srivilliputtur Giant Grizzled Squirrel Wildlife Sanctuary is located at about 6 km from Rajapalaym, start point of SH-41 (Stretch from km0/000 to Km 6/000 falls within 10km buffer of sanctuary). There is no archaeological site within 500m of project road.

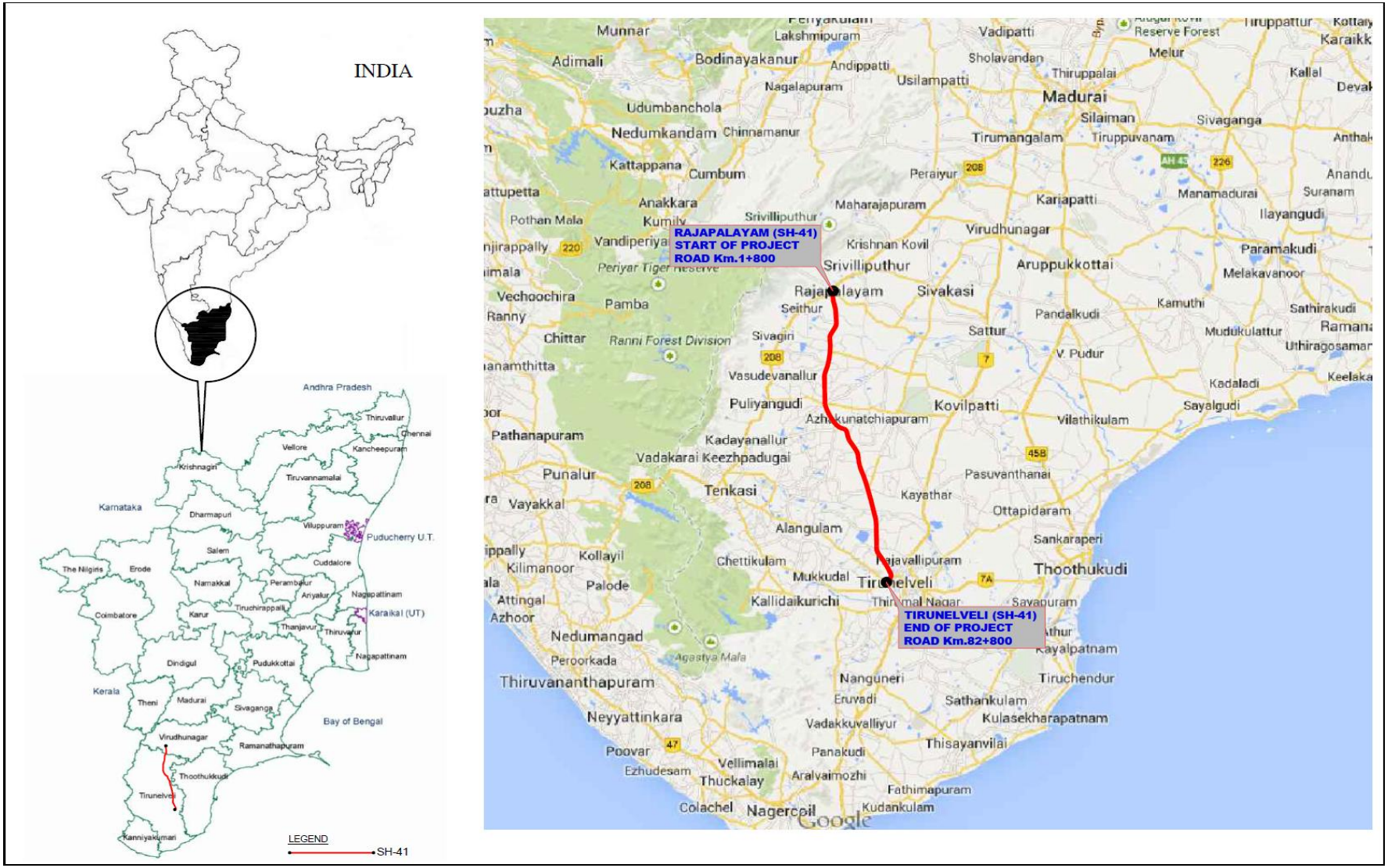


Figure 2-1: Regional Setting of the Rajapalayam - Sankarankoil - Tirunelveli Road Section of SH-41

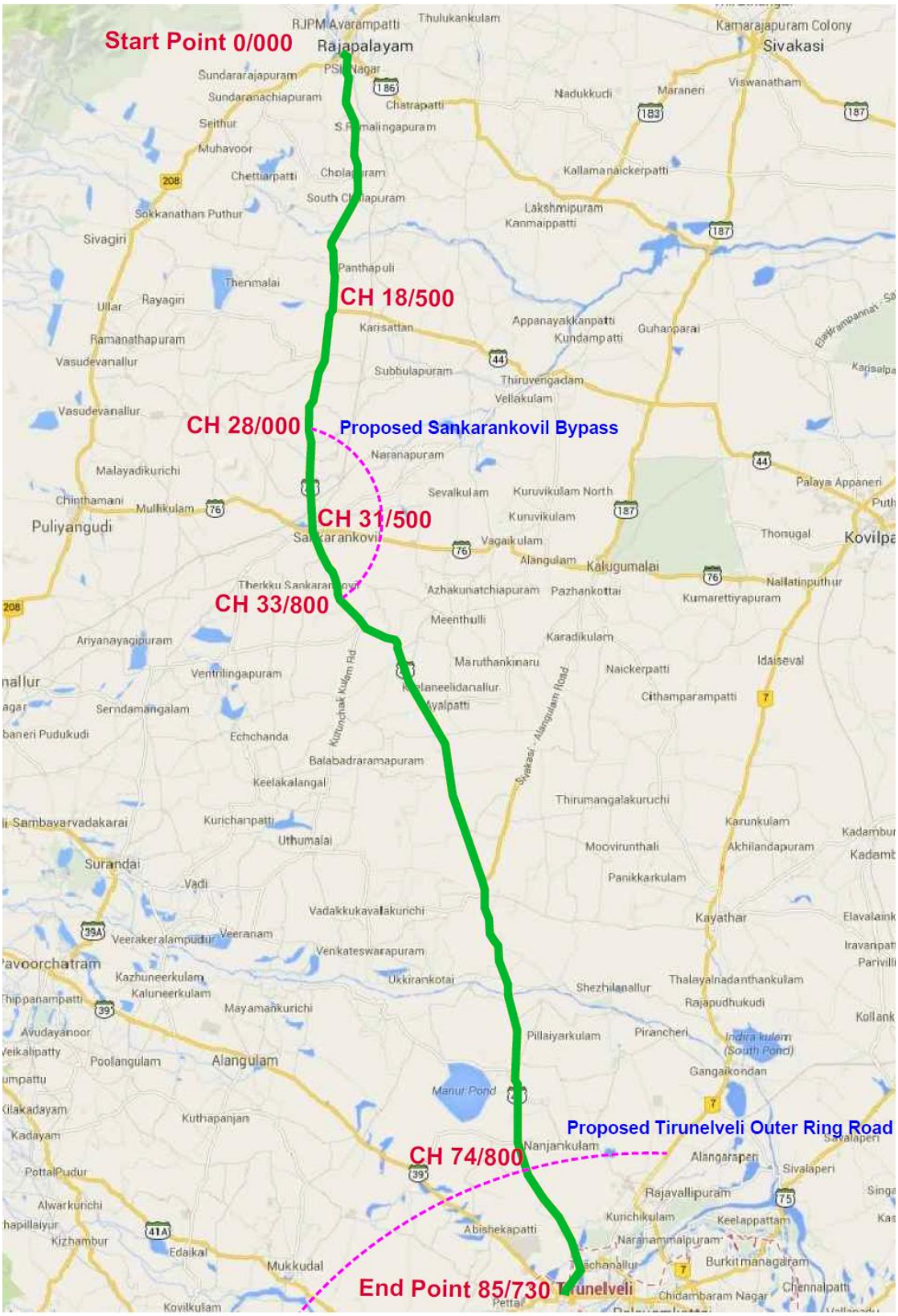


Figure 2-2: Location Map of Rajapalayam - Sankarankoil - Tirunelveli Road Section of SH-41

2.3 ENVIRONMENTAL DATA SHEET

Environmental data sheet comprises of chainage wise existing details of environmental and social features, road furniture details, and locations of cross drainage structures, water bodies and sensitive receptors along the project corridor. **Table 2-1** presents the environmental data sheet for Rajapalayam - Sankarankoil – Tirunelveli Road Section of SH-41.

Table 2-1: Environmental Data Sheet for Rajapalayam - Sankarankoil – Tirunelveli Road Section of SH-41

Chainage		Environmental and Social Features		
From (Km)	To (Km)	LHS	RHS	CD Structures
1.8	2.00	Built-Up Area	Pond/ Dry Area	
2.00	3.00	Built-up/Dry Land	Built-up/ Dry Land	
3.00	4.00	Built-up/Dry Land, Earthen Check Dam	Built-up/ Dry Land	Minor Bridge
4.00	5.00	Built-up/Dry/ wet Land, Pond	Built-up/ Dry Land	
5.00	6.00	Built-up/Dry Land	Built-up/ Dry Land, Church, Hand Pump, Ambedker statue	
6.00	7.00	Built-up/Dry Land, Bus Stop	Built-up/ Dry Land, Drain, Temple	Minor Bridge
7.00	8.00	Built-up/Dry Land, Earthen Check Dam	Built-up/ Grave yard/Dry Land, 3 Temples, Bus Stop	
8.00	9.00	Built-up/Dry Land	Built-up/ Dry Land, Check dam, Temple	Chozhapuram river, Minor Bridge
9.00	10.00	Built-up/Dry Land	Built-up/ Dry Land, Bus Stop, School	Drain, culvert
10.00	11.00	Built-up/Dry Land, Pond	Built-up/ Dry Land, Bus Stop	Minor Bridge
11.00	12.00	Built-up/Dry Land, Temple	Built-up/ Dry/ wet Land	Minor Bridge
12.00	13.00	Built-Up Area	Built-up/ Dry Land, Bus Stop	Drain, Minor Bridge
13.00	14.00	Dry Land	Built-up/ Dry Land, Check Dam, Temple, Bus Stop	
14.00	15.00	Dry Land, open bore well	Built-up/ Dry/ wet Land, Temple, Bus Stop	Minor Bridge
15.00	16.00	Dry/wet Land, open well	Dry Land	
16.00	17.00	Built-up/Dry Land, Bus Stop, College	Built-up/ Dry/ wet Land	
17.00	18.00	Dry Land, Bus Stop, Hand Pump	Pond/ Dry land, 2 Check Dams	
18.00	19.00	Dry Land, Bus Stop	Dry Land, 3 Hand Pumps, open bore well	Drain, 3 Minor Bridges

Chainage		Environmental and Social Features		
From (Km)	To (Km)	LHS	RHS	CD Structures
19.00	20.00	Built-up/Dry Land	Built-up/ Dry Land, Temple	Drain, Minor Bridge
20.00	21.00	Built-up/Dry Land, Check Dam, 2 Temples	Built-up/ Dry Land, 2 Temples, Bus Stop	Drain, Minor Bridge
21.00	22.00	Built-up/Dry Land, Panchyat office	Built-up/ Dry Land, Temple,2 Bus Stops, Hand Pump, Hospital	
22.00	23.00	Dry land	Built-up/ Dry Land	
23.00	24.00	Dry/wet Land	Dry Land, Pond	Drain, 3 Minor Bridges
24.00	25.00	Dry/wet Land, Pond, Temple	Dry/Wet Land	
25.00	26.00	Built-up/Dry Land, Temple, OHT TWAD	Built-up/Dry Land	2 Minor Bridges
26.00	27.00	Built-up/Dry Land, Check Dam, 2 Bus Stops, School	Dry Land, Check Dam	
27.00	28.00	Built-up/ Wet/Dry Land, 2 Bus Stops	Built-up/ Wet/ Dry Land, School	
28.00	29.00	Built-up/Dry Land	Built-up/ Wet/ Dry Land	
29.00	30.00	Built-up/Dry Land, School	Built-Up, Check Dam	
30.00	31.00	Built-Up Area	Built-Up Area	
31.00	32.00	Built-Up Area	Built-Up Area	
32.00	33.00	Built-Up Area/Wet/Grave Yard	Built-up/Wet Land	Drain
33.00	34.00	Wet/Dry Land, Pond	Wet/ Dry Land, Check Dam	
34.00	35.00	Dry/Temple	Wet/ Dry Land	
35.00	36.00	Dry land	Dry Land	
36.00	37.00	Built-up/Dry Land	Built-up/ Dry Land	
37.00	38.00	Built-up/Dry/Wet Land	Built-up/ Dry/ Wet Land	Drain, Minor Bridge
38.00	39.00	Built-up/Dry/Wet Land	Built-up /Dry/ Wet Land, Check Dam	Minor Bridge
39.00	40.00	Wet Land	Dry/ Cashew orchid	Drain
40.00	41.00			Drain
41.00	42.00	Built-up/Dry/Wet Land	Built-up/ Dry/ Wet Land	Minor Bridge
42.00	43.00	Built-up/Wet Land	Built-up/ Wet Land, Pond	Minor Bridge
43.00	44.00	Dry/wet Land	Dry/Wet Land	
44.00	45.00	Built-up/Dry/Wet Land, Check Dam, School	Built-up/ Dry/ Wet Land	
45.00	46.00	Built-up/Wet Land	Dry/Wet Land	
46.00	47.00	Built-up area	Built-up/ Dry/wet	
47.00	48.00	Built-up/Dry/wet	Dry/Wet Land, School	

Chainage		Environmental and Social Features		
From (Km)	To (Km)	LHS	RHS	CD Structures
48.00	49.00	Built-up Area	Built-Up Area	
49.00	50.00	Built-Up/ Dry Land, Drain	Built-up/Dry/Wet Land	
50.00	51.00	Dry Land	Dry/Wet Land	
51.00	52.00	Dry/wet Land	Dry/wet Land, Drain	Minor Bridge
52.00	53.00	Dry/wet Land	Dry/wet Land	
53.00	54.00	Built-Up/ Dry Land	Built-up/Dry/Wet Land, Check Dam	
54.00	55.00	Built-Up Area	Built-Up Area	
55.00	56.00	Built-Up/ Dry Land	Built-Up/ Dry Land, School	
56.00	57.00	Dry/wet Land	Built-up/Dry/Wet Land	
57.00	58.00	Built-Up/ Dry Land	Built-Up/ Dry Land, School	
58.00	59.00	Built-Up/ Dry Land	Built-up/Dry/Graveyard	Minor Bridge
59.00	60.00	Dry Land	Temple/Wet Land	
60.00	61.00	Dry/wet Land, Pond	Dry/Wet Land	
61.00	62.00	Dry/wet Land	Built-Up/ Dry Land, Check Dam with channels	
62.00	63.00	Dry Land, small river/Nala	Dry/wet Land, Check Dam with channels	Minor Bridge
63.00	64.00	Dry Land	Built-Up/ Dry Land	
64.00	65.00	Built-Up/ Dry Land, Pond	Built-Up/ Dry Land	
65.00	66.00	Dry Land	Dry Land	Sitraru River, Major Bridge, Minor Bridge
66.00	67.00	Dry Land	Dry Land	
67.00	68.00	Dry Land	Built-up/Dry Land	
68.00	69.00	Dry land	Built-up/Dry Land	Minor Bridge
69.00	70.00	Built-up/Dry Land	Dry land, Pond, Check Dam	
70.00	71.00	Dry Land	Dry land, Temple, Bus Stop, Water Tank(PWD)	
71.00	72.00	Built-up Area, Bus Stop	Built-up/Dry Land	
72.00	73.00	Built-up/Dry Land, Bus Stop	Dry Land, Temple	
73.00	74.00	Dry Land, Hand Pump	Dry Land, Bus Stop	
74.00	75.00	Built-up/Dry Land, open well	Built-up/Dry Land, 2 Temples, Bus Stop, Hand Pump, Water Tank(PWD)	
75.00	76.00	Built-up/Dry Land	Built-up/Dry Land	
76.00	77.00	Built-up/Dry Land	Built-up/Dry Land, Bus Stop	
77.00	78.00	Dry Land/Stone Querry	Dry Land/Stone Quarry, 2 Bus Stops	
78.00	79.00	Dry Land, Temple	Built-up/Dry Land, Water Tank(PWD)	
79.00	80.00	Built-up/Dry Land	Built-up/Dry Land, Check Dam,	

Chainage		Environmental and Social Features		
From (Km)	To (Km)	LHS	RHS	CD Structures
			Bus Stop	
80.00	81.00	Built-up/Dry Land	Built-up/Dry Land	
81.00	82.00	Built-up/Dry Land	Dry Land	Minor Bridge
82.00	83.00	Built-up/Dry Land	Built-up/Wet/Dry Land, Bus Stop	Canal/Nala, Minor Bridge

2.4 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. **However, no widening is proposed for the project road stretch from km0/000 to km 6/000 (falling within 10 km buffer zone of Srivilliputtur Giant Grizzled Squirrel Wildlife Sanctuary). This road stretch will be maintained as 2 lane without paved shoulder.**
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.
- 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 levels of improvements are proposed:

- Two lane with paved shoulder (16m PRoW in urban stretches and 23m in rural stretches) except the stretch from km0/000 to km6/000 (falling within 10 km buffer zone of Srivilliputtur Giant Grizzled Squirrel Wildlife Sanctuary)
- Reconstruction, widening and retaining of existing 9 nos., 6 nos. and 14 nos. of minor bridges respectively.
- Reconstruction of 11 nos. of pipe culverts to box culverts and 6 nos. of slab/cut stone culverts to box culverts. Retaining/widening of 57 nos. of pipe culverts, 32 nos. of slabculverts and construction of 5 addintional box culverts.
- Proposal for 68 nos. of bus bays/bus shelters
- Footpath of 1.5m width in built up areas
- Proposal for traffic control devices and road safety features
- Improvement of existing major junctions. 80 minor junctions proposed.

- No proposal for truck laybye, underpass, flyover and ROB/RUB.
- There is no proposal of bypass (except already proposed Sankarankoil Bypass by TNRSP). However, seven major horizontal curve improvements are proposed. (Refer Annexure 3.50, section E).

2.5 PUBLIC PARTICIPATION

To provide better and qualitative planning options; consultations with specific objectives, agenda were conducted in structured manner. For this purpose, much advance date and venue of consultation were fixed in coordination with the PRIs representatives at villages level and Tehsildar, Forest officials (range official) etc. **Structured Public Consultations (**PC) were conducted jointly by Technical, Social and Environment team members along Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 on 24.06.2014 at three locations (1) Kolapuram and (2) Gurukalpatti and (3) Manur. The major issues/concerns and their adopted mitigation measures are as follows:

- Identified the need for improved quality bridges along the road.The public highlighted the accident prone areas which need to be addressed.
- The compensation will usually cover the land compensation, structural value without depreciation, grant, assistance and allowance as per guidelines of World Bank. Compensation shall be paid as per the approved RAP. / Entitlements matrix.
- The survey numbers of land identified for acquisition and owners will be informed through public disclosure meetings and notified in the newspapers.
- Replacement of worship places with enhanced manner and public engagement shall be made.
- CPR relocation as per the approved RAP.

2.6 ENVIRONMENTAL ENHANCEMENT MEASURES ADOPTED IN THE PROJECT

Many environmental enhancement measures are proposed for the project viz.reconstruction of affected open well, construction of soak pit for open wells and hand pumps along the road to recharge water, recharge pits on both sides of roads in rural areas, planting trees on both sides of the road at places where land is available, plantation in realignment sections, landscaping of junctions etc., Apart from this, public utilities such as construction of bus shelters at bus bays locations.

The details of road specific environmental enhancement measures are presented in **Table 3-2.**

CHAPTER 3

ENVIRONMENTAL MANAGEMENT ACTION PLAN

3 ENVIRONMENTAL MANAGEMENT ACTION PLAN

Environmental Management Action Plan (EMAP) deals with the implementation procedure of the guidelines and measures recommended to avoid, minimize and mitigate environmental impacts of the project. It also includes management of measures suggested for enhancement of the environmental quality along the project coridor.

The institutional arrangement made under project will look into the implementation of project as well as EMAP as provided in this chapter. The various legal settings applicable to the project are briefly stated in **Chapter 1**.

The avoidance, mitigation & enhancement measures for protection of the environment along the project corridors have been discussed in detail in **Chapter 8** of EA report. Although the social environmental impacts, its mitigation and management are essential components of the EMAP, this chapter excludes them for the purpose of clarity and procedural requirements. Social elements have been separately dealt in separate volume namely, Resettlement and Rehabilitation Action Plan (RAP).

3.1 OBJECTIVE OF EMAP

The EMAP 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, timeframe, implementation and overseeing / supervision responsibilities are listed.

3.2 COMPONENTS OF EMAP

The components of the EMAP have been given in **Table 3-1** which explains the environmental issues and the avoidance/ mitigation/ minimization or enhancement measures adopted and/or to be adopted during different phases of the project. It also provides the references for the suggested measures, responsible agency for its implementation/ management as well as its timeframe.

Table 3-1: Environmental Management Action Plan (EMAP) for Rajapalayam - Sankarankoil – Tirunelveli Road Section of SH-41

Environmental Impact & Issues	Mitigation/Enhancement measures	Time frame	Implementing Organisation	Responsible Organisation	Reference
DESIGN PHASE					
General consideration of Cross section Alternatives	Standard cross section alternatives were used for the project road design depending on the traffic requirement and economic indicators like EIRR & NPV.	During Design	PIU – TNRSP	Design Consultant/ Contractor	Economic Analysis, DPR
Geometric Design	The Proposed alignment is selected/ adjusted (within IRC/ MoRTH specifications) • to minimize land disturbance • to avoid culturally & environmentally sensitive areas – cultural properties, water bodies etc.	During alignment design	PIU – TNRSP	Design Consultant/ Contractor	Geometric Design, Main Report, DPR
Issues from stakeholder Consultations	Various issues raised were examined & suitably incorporated based on merit & other road safety measures.	During Design	PIU - TNRSP	Design Consultants	Chapter 5: Stakeholder Consultation of Environmental Assessment (EA) Report
Avoidance of Cultural Properties	• Cultural properties along the alignment were identified. • Religious structures were avoided by adjustment of alignment. • 24 nos. of temples and 1 no. church will be impacted	During alignment design	PIU – TNRSP	PIU – EMU, Design Consultants/ Contractor	(Refer **Annexure 3.53**)
Preservation of tree	• About 28% of the existing trees have been saved during alignment design. • No trees to be cut beyond toe line.	During alignment design	TNRSP, District Collector of Tirunelveli	PIU – EMU, Design Consultants/	MoRTH clause 201.5 (Page42)

Environmental Impact & Issues	Mitigation/Enhancement measures	Time frame	Implementing Organisation	Responsible Organisation	Reference
	• Detailed Avenue plantation scheme is prepared, for plantation all along the project corridor, cost is considered in the budget.		and Toothukudi	Contractor	**Annexure 3.50**
Design discharge & drainage design	Bridges have been designed for 50-year flood frequency. All culverts have been designed for 25 years flood frequency. The fill height has been designed for 50-year flood.	During Design	TNRSP	Design Consultants/ Contractor	Hydrology report
Monitoring at critical locations	The monitoring of air, land, water and noise has been carried out at critical locations along the project corridor. This will serve as a benchmark for monitoring during construction and operational phases. (Refer Section 5.2 of Chapter 5)	During Design	TNRSP	Design Consultants	Section 4.2.2 (Air), section 4.3.3 (Soil) section 4.4.3 (Water), section 4.5.1 (Noise) of **Chapter 4**: Baseline Environment of EA Report
External Influence of construction camp	Location and basic facilities at site are suggested in a way to cause minimum interference with the local system, for details refer Annexure 3.1: Guidelines for siting, management and redevelopment of construction camp	During Design	TNRSP	Design Consultants/ Contractor	**Annexure 3.1**
Road safety issue due to poor geometrics.	Geometric improvement has been incorporated as per IRC codes and MoRTH specifications.	During alignment design	PIU - TNRSP	Design Consultants/ Contractor	Refer **section 2.8** (1) of **Chapter 2** of EA Report.
Diversion of Traffic	Appropriate diversion of traffic schemes to ensure smooth	During Design	PIU - TNRSP	Design	**Annexure 3.9**

Environmental Impact & Issues	Mitigation/Enhancement measures	Time frame	Implementing Organisation	Responsible Organisation	Reference
	traffic flow, minimize accidents during construction, design of diversionary signage.			Consultants/ Contractor	
Accident black spot	Improved road surface with improved road geometry, footpath and bus bays, are planned. Lining and signing are given a high priority for all road junctions. Safety Audits completed on the final design drawing and corrective measures undertaken.	During design Stage.	PIU - TNRSP Traffic Police	Design Consultants/ Contractor; Traffic Police	Refer **section 2.8** of **Chapter 2** of EA Report.
PRE-CONSTRUCTION PHASE					
Permissions/ Approvals	Tree felling permission to be obtained from District Collector of Tirunelveli and Virudhnagar Districts	After centerline marking at site.	TNRSP, District Collector of Tirunelveli and Toothukudi	PIU – EMU, Design Consultants/ Contractor	**Annexure 3.42**
Land Acquisition	The land acquisition will be done as per "The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013"	After proposed centerline marking at site	TNRSP, Revenue Department	PIU, Land Acquisition Officer (LAO-TNRSP) CSC	Resettlement Action Plan
Property Acquisition	Compensation to be paid to Project Affected People based on the Entitlement matrix as provided in Resettlement Action Plan.	Post design to Pre-construction.	TNRSP, Revenue Department, NGOs recommended in RAP	PIU R&R Officer (TNRSP), CSC	Resettlement Action Plan
Relocation of Utilities	All community underground and over head utilities are to be shifted as per utility shifting plan, prior permission will be	Post design to Pre-	TNRSP, Design Consultant	PIU – R&R officer, CSC	Resettlement

Environmental Impact & Issues	Mitigation/Enhancement measures	Time frame	Implementing Organisation	Responsible Organisation	Reference
	obtained from regional offices of Electricity, Telecommunications, OFC, Water works etc.	construction		Contractor	Action Plan
Loss of drinking water source	Drinking water source (41 nos. – 8 nos. hand pumps, 3 nos. open wells, 2 nos. borewell, 1 over head tank, 4 nos. water tank and 23 nos. water taps) to be relocated according to RAP.	Post design to Pre-construction.	TNRSP Ground Water Board /PHED	PIU, CSC, Contractor	**Annexure 3.44**
Tree Felling	A total of about 3923 trees of girth size > 30 cm will be felled. (Refer Annexure 3.49) Permission to be obtained from District Collector.	Post design to Pre-construction.	TNRSP, District Collector.	PIU – EMU, CSC Contractor	MoRTH clause 201.5 (Page 42)
Cultural Properties	Impact on 24 temples and 1 church	Pre Construction	PIU – TNRSP PIU – EMU,	CSC, Contractor	RAP
Bus Bays	A total of 68 nos. of bus bays are proposed.	During design stage.	PIU – TNRSP	Design Consultants/ Contractor	**Annexure 3.45**
CONSTRUCTION PHASE					
Clearances, Approvals and Permits	List of clearance required prior to start of construction activity is provided in **Annexure 3.42**. Provide a copy of all necessary clearances to the CSC / EMU • Adhere to all clearance terms and conditions • Obtain written permission from private landholders to conduct construction activities on their land prior to commencing works.	Construction stage (Prior to initiation of any work	PIU – TNRSP PIU – EMU Contractor District Collector	Contractor	General Conditions of Contract Clause 111.3, MoRTH
Environmental	Monitoring is to be carried out regularly as per the frequency	During and	SPCB, PIU -	Contractor	(Refer **Section**

Environmental Impact & Issues	Mitigation/Enhancement measures	Time frame	Implementing Organisation	Responsible Organisation	Reference
Management and Monitoring Facility Equipment for EMP (Meters, Vehicles and Buildings)	and locations mentioned in Section 5.2 of Chapter 5.	after construction (3.5 years construction and 2 years operation)	TNRSP		**5.2** of **Chapter 5** of EMP)
Asphalting	Asphalt mixing plants should be sited over 1000 m (refer CPCB/ SPCB guidelines) from any habilation area. Mixing equipment will be well sealed, and be equipped with a dust-removal device. Operators will wear dust masks, ear protection and hard hats.	During Construction	PIU- TNRSP, CSC, SPCB	Contractor	MORTH Specification 111, 111.5
AIR					
Gaseous Emissions	Vehicles and machinery are to be maintained so that emissions conform to National Ambient air quality standards (2009). All vehicles and machineries will obtain Pollution Under Control Certificates	Beginning with & throughout construction	PIU - TNRSP, SPCB	Contractor	MORTH Specification 111.1, 111.5
Dust Generation	• Vehicles delivering materials will be covered to reduce spills and dust blowing off the load. • Clearing and grubbing to be done, just before the start of next activity on that site. In case of time gap, water will be sprinkled regularly till the start of next activity. • Water to be sprayed during the construction phase, at mixing sites, approach roads & temporary roads. • In laying sub-base, water spraying is needed to aid	Beginning with & throughout construction until asphalting is completed and side slopes are covered.	PIU – TNRSP, EMU – TNRSP CSC	Contractor	MORTH Specification 111.1, 111.5, 111.8, 111.9, 111.10

Environmental Impact & Issues	Mitigation/Enhancement measures	Time frame	Implementing Organisation	Responsible Organisation	Reference
	compaction of the material. After the compaction, water spraying will be carried out at regular intervals to prevent dust generation. • Road surface should be cleaned with air compressor and vacuum cleaners prior to the construction works. Manual labour using brooms should be avoided, if used labour to be provided masks. Embankment slopes to be covered with turfing/stone pitching immediately after completion				
Equipment Selection maintenance and operation	Construction plant and equipment will meet recognized international standards for emissions and will be maintained and operated in a manner that ensures that relevant air, noise, and discharge regulations are met	During construction	PIU – TNRSP, EMU – TNRSP, CSC	Contractor	MORTH Spec 106, IRC: 72-1978; IRC: 90-1985, 111.5, 111.9, 111.10, 201.3
LAND					
Soil Erosion and Sedimentation control	Main reason of soil erosion is rains/monsoon, contractor will plan the activities so that no bare/ loose earth surface is left out before the onset of monsoon, for minimizing the soil erosion following preventive measures to be taken such as • Embankment slopes to be covered, soon after completion • Next layer/activity to be planned, soon after completion of, clearing and grubbing, laying of embankment layer, sub grade layer, sub-base layer, scarification etc.	Upon completion of construction activities at these sites during construction	PIU – TNRSP, EMU – TNRSP, CSC	Contractor	MoRTH Specification 306, 307, 308

Environmental Impact & Issues	Mitigation/Enhancement measures	Time frame	Implementing Organisation	Responsible Organisation	Reference
	• Top soil from borrow area, debris disposal sites; borrow area, construction site to be protected/covered for soil erosion. • Debris due to excavation of foundation, dismantling of existing cross drainage structure will be removed from the water course immediately. • Diversions for bridges will be removed from the water course before the onset of monsoon.				
Loss of agricultural topsoil	All areas of cutting and all areas to be permanently covered will be stripped to a depth of 150mm and stored in stockpile. Top soil will be safeguard from erosion and will be reused as follows. • Covering all borrow areas after excavation is over. • Dressing of slopes of road embankment • Agricultural field, acquired temporarily.	During construction	PIU – TNRSP EMU –TNRSP, CSC	Contractor	MoRTH Specification 301.3.2, 305.3.3
Compaction of Soil and Damage to Vegetation	Construction vehicles will operate within the Corridor of Impact avoiding damage to soil and vegetation. Diversions, access road used will be redeveloped by contractor, to the satisfaction of the owner/villagers.	During construction	PIU – TNRSP EMU –TNRSP, CSC	Contractor	MoRTH Specification 201.2
Contamination of soil	Guidelines of “Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008 will be enforced. • Plant to be setup 500m away from surface water body. • Oil interceptor will be installed at construction site.	During Construction	PIU – TNRSP EMU –TNRSP, CSC	Contractor	Refer **section 8.3.5**, **Chapter-8** of EA Report

Environmental Impact & Issues	Mitigation/Enhancement measures	Time frame	Implementing Organisation	Responsible Organisation	Reference
Borrow pits	A total of 6 borrow pits will be established/used. NO borrow pit will be opened without the permission of supervision consultant. • Written approval from owner to be submitted to EMU. • Borrow pits have been identified outside the ROW. Before opening additional borrow pits, operating pits will be closed according to IRC specification.	During Construction	PIU – TNRSP EMU –TNRSP, CSC	Contractor	IRC: 10 1961 MoRTH Spec. 111.2, 305.2.2 **Annexure 3.4**: guidelines for siting, management and redevelopment of borrow areas **Annexure 3.47:** Quarry and borrow areas for Project road
1) Quarrying 2) Material sources	1. Quarrying will be carried out at approved and licensed quarries only. Copy of licenses to be submitted to the EMU. 2. As far as possible contractor will use the material from the material sources as provided in Volume-III, Material Report of DPR. In case on new quarry the instruction of Annexure 3.3: Guidelines for siting, management and redevelopment of Quarry and stone crushers will be applicable.	During Construction	PIU – TNRSP EMU –TNRSP, CSC	Contractor	MORTH Specification 111.3, 302, 305.2.2

WATER					
Loss of water bodies (Surface/Ground)	• NO excavation from the bund of the water bodies. • NO debris disposal near, any water body. • Prior written permission from authorities for use of water for construction activity will be submitted to EMU. • Construction labours will be restricted from polluting the source or misusing the source. • Shifting of source to be completed prior to disruption of the actual source. • Source to be replaced immediately, in case of accidental loss. • Alternate measures to be taken/ ensured during disrupted period.	During Construction	PIU – TNRSP EMU –TNRSP, CSC	Contractor	MORTH Specification 111.4, 201.2, 301, 304, 306 Annexure 3.46 - Water bodies along the project road, impact, mitigation and enhancement.
Alteration of drainage	• Diversions will be constructed during dry season, with adequate drainage facility, and will be completely removed before the onset of monsoon. • Debris generated due to the excavation of foundation or due to the dismantling of existing structure will be removed from the water course. • Silt fencing has to be provided on the mouth of discharge into natural streams. • Side drains are provided on both sides of the road, obstruction if any to be removed immediately.	Whenever encountered during construction.	PIU – TNRSP EMU –TNRSP, CSC Irrigation Dept.	Contractor	MORTH Specification 201.2,301, 304, 306, 312 Section 8.4.3 and 8.4.4, **chapter 8** of EA Report
Runoff and drainage	• Lined drain is provided at builtup locations for quick drainage. • Increased runoff due to increased impervious surface is countered through increased pervious surface area through soak pits.	During Construction	PIU – TNRSP EMU –TNRSP, CSC	Contractor	Section 8.4.3 and 8.4.4, **chapter 8** of EA Report

Water requirement for project	• Contractor has to provide list of sources (surface/ground) for approval from EMU. • Prior to use of source contractor will obtain the written permission from authority, to use the water in construction activity, and submit a copy to EMU. • During construction only permitted quantity (permission taken) from approved sources will be used in construction activity. • Contractor to ensure optimum use of water; discourage labour from wastage of water.	During Construction	PIU – TNRSP EMU –TNRSP, CSC	Contractor	
Silting/ sedimentation	• Silt fencing will be provided near ponds at km 11.250 (LHS) and km 42.200 (LHS). Construction activities will be stopped near water bodies during monsoon.	Throughout construction period.	PIU – TNRSP, EMU –TNRSP, CSC Irrigation Dept.,	Contractor	MORTH Specification 111.4, 306 Refer section 8.4.6 of **Chapter 8** of EA Report
Contamination of water	• Measures suggested under "Contamination of soil" have to be enforced. • Construction work close to water bodies will be avoided during monsoon. • Labour camps are to be located away from water bodies. • Car washing/workshops near water bodies are to be avoided.	Throughout construction period.	PIU – TNRSP, EMU –TNRSP, CSC, SPCB, Irrigation Dept	Contractor	MORTH Specification 111.1, 111.4, 111.9, 111.13, 122, 201.2, 201.4, 301.1.3.10, 304.3.3, 306 Refer section 8.4.6 of **Chapter 8** of

					EA Report
NOISE					
Noise	• Noise standard at processing sites, e.g. aggregate crushing plants, batching plant, hot mix plant are to be strictly monitored to prevent exceeding of GOI noise standards. • Workers in the vicinity of strong noise to wear protectors and their working time will be limited as a safety measure. • In construction sites within 150 m of sensitive receptors construction to be stopped from 22:00 to 06:00. • Machinery and vehicles will be maintained to keep their noise to a minimum level. • Temporary noise barrier to be provided during construction at noise sensitive locations. • Other mitigation measures to be followed as per section 8.5 of Chapter 8 , EA Report	Beginning and throughout construction	PIU – TNRSP EMU –TNRSP, CSC , SPCB	Contractor	MORTH MoRTH Specification 111, 111.5
FLORA & FAUNA					
Loss of trees and mitigation measures	• Compensatory plantation and avenue plantation will be taken up soon after completion of civil works. • All the realignment sections are to be enhanced with tree plantation. • Plantation is also proposed at pond enhancement site Contractor has to make sure that no trees/branches to be felled by labourer for fuel, warmth during winter. Enough provision of fuel to be ensured.	After completion of construction activities	PIU – TNRSP EMU –TNRSP, CSC, District Collector	Contractor	MORTH MoRTH Specification, 111, 111.5, 201.5, 306, 308 Refer Annexure 3.50.

Vegetation clearance	• Clearing and grubbing will be avoided beyond that which is directly required for construction activities. • Next activity to be planned/ started immediately, to avoid dust generation and soil erosion during monsoon. • Turfing / re-vegetation to be started soon after completion of embankment.	During cleaning operations during construction	PIU – TNRSP EMU –TNRSP, CSC, District Collector	Contractor	MORTH MoRTH Specification 201.2
Fauna	• Construction workers wil protect natural resources & wild animals. • Hunting will be prohibited.	During construction	PIU – TNRSP EMU –TNRSP, CSC	Contractor	MORTH MoRTH Specification 111.1, 111.6
SOCIO-ECONOMIC ENVIRONMENT					
Fear of uncertainties regarding future	Public participation sessions are being/will be conducted in different stages of project construction. Initial consultations were held during environmental and social screening stage. Pre structured consultations and focused group discussions were also conducted during project design stage of the project road. Public consultations will also be conducted prior to review, clearance and disclosure of EMP, in order to solicit public concerns about environmental and social impacts and proposed mitigation measures.	During Construction	PIU – TNRSP EMU –TNRSP, CSC	Contractor	MORTH MoRTH Specification 111, 111.5, 111.6, 112, 201.2, 201.3 & 201, 302, 306
Public Health and Safety	Debris, so generated will be disposed to the satisfaction of Engineer. Monitoring of air, water, noise and land will be conducted during construction and operation phases.				
Labour camps can have clashes with the local population (Three labour	Contractor will be encouraged to recruit the local people as labourer at least for unskilled and semi-skilled jobs.				

camps/construction camps will be established for the project road) Pressure on basic facilities like medical services, power, water supply, etc Transmission of communicable diseases including aids. Sanitary conditions in the labour camps	Hygiene and basic facilities will be ensured at labour camp to prevent the spread of disease. Refer **Annexure 3.2**: Guidelines for Siting, Management and Redevelopment of Labour Camps and **Annexure 3.8** Guidelines to ensure Worker's Safety during construction				
Allied activities	Detailed traffic control plans shall be prepared and submitted to the engineer for approval 5 days prior to commencement of work on any section of road.				
Accidents and Safety	The contractor shall provide, erect and maintain barricades, including signs marking flags lights and flagmen as required by the Engineer.				
Sensitive Community Structures	• Contractor will implement the enhancement measures prepared for cultural & religious property and Govt. premises • Mitigation/enhancement plan is proposed for identified ponds (refer Annexure 3.46 and Annexure 3.51) • Precautions will be taken during construction, for accidental loss/damage of any communal property. • Any loss during construction will be the sole	During construction	PIU – TNRSP EMU –TNRSP, CSC	Contractor	RAP

	responsibility of contractor and the damage will be repaired immediately up to the satisfaction of people, at contractor's own cost. • Through access/identification will be maintained during construction.				
Enhancement measure	• Enhancement measures are porposed for four ponds along the road at km 4+980, Km11+250, Km 24+380 and Km 42+200.	During construction	PIU – TNRSP EMU –TNRSP, CSC	Contractor	Refer Annexure 3.51
Road side amenities	• The already existing bus stops will be shifted at suitable locations, where possible. A total of 68 bus bays/ stops with shelter will be provided. • Provision of Traffic lights, road markings, Zebra crossing, sign posts, speed breakers and foot paths in urban areas.	During construction	PIU – TNRSP EMU –TNRSP, CSC	Contractor	
Health and Safety issues in camp sites	• Safe drinking water and sanitation facilities comprising toilets, sewage collection system and septic tanks will be made available to the construction workers in all the camps sites. • Personal protective equipment such as ear plugs, helmets, goggles, gloves etc. will be made available to the workers in construction camp, quarry areas, stone crusher unit and borrow areas. • Labour camps will not be constructed with inflammable materials. Fire safety standards shall be followed in both construction camp and labour camp construction. • Firefighting equipment like fire extinguishers shall be provided in the camp as per fire safety standards. • Fencing will be provided for all the camps sites to	During construction	PIU – TNRSP EMU –TNRSP, CSC	Contractor	MoRTH Specification 111.6

	prevent trespassing of humans and animals into the camp. • Operation manuals and training shall be provided to machine operators. Warning signs shall be placed at accident prone areas. • Other provisions to ensure worker's safety shall be followed as per guidelines given in Annexure 3.8.				
Health and Safety issues in work sites	• Provide adequate signages and cordon off the activity area so as to ensure the safety of the pedestrians and passersby. • Temporary access shall be maintained throughout the course of the work unless the contractors make agreements with any affected frontages or legitimate road user. • Traffic Management Plan will be prepared to reduce the disruption of traffic. • Diversion roads to be paved, adequate traffic safety measures to be adopted. • All contractors' staff will wear high visibility purpose made overalls or trousers/a waist coat at all times All operators working with any materials above head height (even in trenches) will wear hard hats all at times on the worksite. • To the extent possible local people will be included in the labour force so that there are less incidence of crime. • Information dissemination will be undertaken to generate awareness among migrant labourers about the sensitivities of the local region with respect to rules,	During construction	PIU – TNRSP EMU –TNRSP, CSC	Contractor	MoRTH MoRTH Specification 111.6 Refer **Annexure 3.55** for EHS practices.

	laws, local customs and beliefs. • Other provisions to ensure worker's safety wil be followed as per guidelines given in Annexure 3.8. Follow guidelines in Annexure 3.10 to ensure safety in storage and handling of hazardous substances. • On occurrence of any accident or injury, the safety officer will submit an accident report to the CSC.				
ROAD SAFETY					
Accident with hazardous materials	COMPLIANCE with "Rules" as defined in Environmental (Protection) Act, 1986, including: • For delivery of hazardous substances, three certificates issued by transportation department are required permit license, driving license, and guarding license. • Vehicles delivering hazardous substances will be printed with standard signs. • Public security, transportation and fire fighting departments will designate a special route for these vehicles. • These vehicles can only be parked at designated parking lots. • In case of spill of hazardous materials, relevant departments will be informed at once & dealt with it in accordance with spill contingency plan. • Follow guidelines in **Annexure 3.10** to ensure safety in storage and handling of hazardous substances.	During Construction	TNRSP, State Police & Fire Station, SPCB, EMU	Contractor, local bodies	Annexure 3.10
OPERATIONAL PHASE					
Dust Generation	• Dust generation due to vehicle will be reduced due to	After	District Collector	Contractor/	EMP

	increased/widened paved surface. • Avenue plantation to be maintained, casualties to be replaced. • Avenue plantation includes species having dust absorption characteristic. (Annexure 3.50) • Community properties and realignment locations has been proposed for peripheral plantation and landscaping. • Maintenance of roads to be ensured.	completion of construction activity	EMU	Maintenance unit-TNRSP/ District Collector	Refer **section 8.2.2, Chapter 8** of EA Report
Air Pollution	• With the reduction in journey time, idle engine running time air pollution will reduce. • Avenues plantation is proposed throughout the corridor, casualties to be replaced. • Avenue plantation includes species having air purifying characteristic. • Enforce Pollution Under Control (PUC) Programs. The public will be informed about the regulations on air pollution of vehicles. • Air pollution monitoring program has been devised for checking pollution level and suggesting remedial measures.(Refer Section 5.2 of Chapter 5)	After completion of construction activity	EMU, SPCB District Collector, State Transport Dept., Police	Contractor/ Maintenance unit-TNRSP Forest Dept	Environmental Management Plan (EMP) Refer **section 8.2.2 & 8.2.3, Chapter 8** of EA Report
LAND					
Temporary land acquisition	• Borrow area redevelopment plan to be completed/ enforced. (Annexure 3.4) • All temporary acquired land for construction of diversion, transportation of material etc. will be redeveloped to the satisfaction of owner. • Affected productive area to be poured with top soil.	After completion of construction	EMU, SPCB,	Contractor/ Maintenance unit-TNRSP	EMP

Soil erosion	• Embankment slopes to be re-vegetated, casualties to be replaced.	After completion of construction	EMU, SPCB,	Contractor/ Maintenance unit-TNRSP	EMP
Soil Contamination	• Accidental spills are potentially disastrous, but its probability is quite low as one of the objectives of this project is to enhance road safety. • Monitoring of Land pollution to be done regularly as per frequency and location mentioned under Section 5.2 of Chapter 5 and suggesting remedial measures.	After completion of construction	EMU, SPCB, State Police, State Transport Dept.	Contractor/ Maintenance unit-TNRSP	EMP
WATER					
Silting/ sedimentation	• Measures suggested under “soil erosion” to be enforced. • De-silting of existing water bodies to be taken up. • Silt fencing to be provided.	After completion of construction	EMU, SPCB	Contractor/ Maintenance unit-TNRSP	EMP
Contamination of water	• Accidental spills are potentially disastrous, but its probability is quite low as one of the objective of this project is to enhance road safety. • Discouraging local people from establishing workshops and car wash near public drinking water source. • The public to be informed about the regulations on water pollution. • Monitoring of water pollution to be done regularly as per frequency and location mentioned in Section 5.2 of Chapter 5 and suggesting remedial measures.	After completion of construction	EMU, SPCB, State Police, State Transport Dept. respective Municipal Agency	Contractor/ Maintenance unit-TNRSP	EMP
Maintenance of Storm Water Drainage System	• The urban drainage systems will be maintained to accommodate storm water flow. • Cleaning/ removing of spoils will be ensured before/ during the monsoon rains.	Especially at the start & end of rains	EMU, respective Municipal Agency	Contractor/ Local municipal corporation	EMP

NOISE					
Noise	• "HORN PROHIBITED" sign posts will be enforced at sensitive receptors. • Discouraging local people from establishing sensitive receptor near the road. • The public to be informed about the regulations on noise pollution. • Monitoring of noise pollution to be done regularly as per frequency and location mentioned under section 5.2 of Chapter 5 and suggesting remedial measures.	After completion of construction	SPCB, State Police, Traffic Police, State Transport Dept.	Contractor/ Maintenance unit-TNRSP	EMP
FLORA & FAUNA					
Loss of trees and Avenue Plantation	• The avenue plantation will be completed, maintained, survival rate to be monitored and casualties to be replaced. • Discouraging local peoples from cutting tree/branches for fuel, cattle food etc. • Educating people about the usefulness of trees.	After completion of construction works		Contractor	
Fauna of Srivilliputtur Squirrel Sanctaury	• Provision of signboards (depicting sanctuary name and distance) to be displayed at start (km 0/000) and end location (km 6/000).	During construction	TNRSP	Contractor/ Maintenance unit-TNRSP	EMP
SOCIO-ECONOMIC ENVIRONMENT					
General issues	• Public consultation to be organized after completion of construction to access the people opinion/grievances from the project intervention. • Remedial measures to mitigate the impact due to project intervention, to be incorporated in the operation phase.	Operation phase	TNRSP, EMU	Contractor/ Maintenance unit - TNRSP	

ROAD SAFETY					
Protection of high road embankments	• Stabilization of altered (especially high) embankments • Although stone pitching is provided, vigilance to be maintained	Immediately after construction	TNRSP	Contractor / EMU	
Safety and noise disturbance	• New buildings are prohibited within 50 m from the edge of carriageway.	Throughout and after project development period	Local Bodies	Contractor / Local Bodies	IRC 35-1971 IRC 79-1981 IRC 93-1995
Accident black spot	• Road surface to be maintained, pot holes to be filled immediately. • Regular maintenance of sign post, painting/removal of bills. • Road marking to be maintained. • People to be educated about the safety in following traffic rules. • Speed limit to be enforced at sensitive locations. • Lighting of major junctions near settlements. • Mitigative /preventive measures for accident black spots, like traffic calming devises.	During Operational stage.	PIU – EMU, Local Bodies	Contractor/ PIU	EMP

All the guidelines, reporting formats, Checklists and other relevant project details are attached as Annexure with the EMP.

Table 3-2: Specific environmental enhancement measures for the project road

S. No.	Details of Enhancement Measures	Location (Chainage)		Side (LHS/ RHS)	Item	Length (m)	Width (m)	Height (m)	Materials to used (Specification)	Typical Drawing (refer Drawing No)	Additional details about site specific enhance measure
		From (km)	To (km)								
1	Pond	4/980	4/932	LHS	Pond wall	52	0.5	2.5	Stone	Drawing	1. New

S. No.	Details of Enhancement Measures	Location (Chainage)		Side (LHS/ RHS)	Item	Length (m)	Width (m)	Height (m)	Materials to used (Specification)	Typical Drawing (refer Drawing No)	Additional details about site specific enhance measure
		From (km)	To (km)								
	Enhancement at km 4/980								masonary	no.1 (Annexure 3.51)	construction of 2.5 m high pond wall
2.	Pond Enhancement at km 11/250	11/250	11/340	LHS	1. Pond wall 2. Benches for sitting 3. Turfing on earthen embankment of pond 4. Solar lights	90 - - -	0.5 - - -	3.0 -	- 3 nos. of benches - 3 nos. of solar lights	Drawing no.2 (Annexure 3.51)	1. New construction of 3.0m high pond wall 2. Benches for siting 3. Turfing on 1260sq.m area of earthen embankment of pond
3.	Pond Enhancement at km 24/380	24/380	24/440	LHS	Pond wall	55	0.5	3.0	-	Drawing no.3 (Annexure 3.51)	1. New construction of 3.0m high pond wall
4.	Pond Enhancement at km 42/200	42/200	42/225	RHS	1. Pond wall 2. Single beam metal crash barrier	24.5 52	0.5 -	2.0 1.1	- -	Drawing no.4 (Annexure 3.51)	1. New construction of 2.0m high pond wall 2. 52 m long single beam metal crash barrier along

S. No.	Details of Enhancement Measures	Location (Chainage)		Side (LHS/ RHS)	Item	Length (m)	Width (m)	Height (m)	Materials to used (Specification)	Typical Drawing (refer Drawing No)	Additional details about site specific enhance measure
		From (km)	To (km)								
											the pond for safety
5.	Ground water Recharging units	9/660	9/340	Both Side	Recharge Pits	1.0	1.5	2.0	1 no.		
		9/660	9/970	Both Side	Recharge pits	1.0	1.5	2.0	1 no.		
		20/505	20/260	Both Side	Recharge pits	1.0	1.5	2.0	1 no.		
		20/260	20/040	Both Side	Recharge pits	1.0	1.5	2.0	1 no.		
		40/900	41/210	Both Side	Recharge pits	1.0	1.5	2.0	1 no.		
		47/790	48/100	Both Side	Recharge pits	1.0	1.5	2.0	1 no.		
		54/490	54/235	Both Side	Recharge pits	1.0	1.5	2.0	1 no.		
		54/500	54/875	Both Side	Recharge pits	1.0	1.5	2.0	1 no.		
		57/700	58/440	Both Side	Recharge pits	1.0	1.5	2.0	2 nos.		
		63/950	64/650	Both Side	Recharge pits	1.0	1.5	2.0	2 nos.		
		70/480	70/085	Both Side	Recharge pits	1.0	1.5	2.0	1 no.		
		70/890	70/490	Both Side	Recharge pits	1.0	1.5	2.0	1 no.		
3.	Soak pits for Hand Pumps for saving water and recharging ground water	5/410		RHS	Soak pit for Hand Pump	1.5	0.250	1.0		Drawing 1 of Annexure 3. 44	Cost covered under RAP
		17/390		LHS	Soak pit for Hand Pump	1.5	0.250	1.0		Drawing 1 of Annexure 3. 44	
		18/060		RHS	Soak pit for Hand Pump	1.5	0.250	1.0		Drawing 1 of Annexure 3. 44	
		18/080		RHS	Soak pit for Hand Pump	1.5	0.250	1.0		Drawing 1 of Annexure 3. 44	
		18/100		RHS	Soak pit for Hand Pump	1.5	0.250	1.0		Drawing 1 of Annexure 3. 44	

S. No.	Details of Enhancement Measures	Location (Chainage)		Side (LHS/ RHS)	Item	Length (m)	Width (m)	Height (m)	Materials to used (Specification)	Typical Drawing (refer Drawing No)	Additional details about site specific enhance measure
		From (km)	To (km)								
		21/570		RHS	Soak pit for Hand Pump	1.5	0.250	1.0		Drawing 1 of Annexure 3. 44	
		74/680		RHS	Soak pit for Hand Pump	1.5	0.250	1.0		Drawing 1 of Annexure 3. 44	
		73/880		LHS	Soak pit for Hand Pump	1.5	0.250	1.0		Drawing 1 of Annexure 3. 44	
5.	Soak pits for wells	15/860	Open well	LHS	Soak pit for Open Well	1.5	0.250	1.0		Drawing 2 of Annexure 3. 44	Cost covered under RAP
		74/840	Bore well and hand pump	RHS	Soak pit for Bore Well and Hand Pump	1.5	0.250	1.0		Drawing 2 of Annexure 3. 44	
		74/580	open well	LHS	Soak pit for Open Well	1.5	0.250	1.0		Drawing 2 of Annexure 3. 44	
6.	Major Junctions Improvement	17/220 58/660 82/800			Landscaping						Dwarf shrubs plants will be planted near the locations of major junctions
7.	Informatory Sign Boards for Srivilliputtur Grizzled Squirrel Wild Life Sanctuary	One at 0/000	One at 6/000	LHS /RHS	Sign Boards	5	-	3.5	2 nos.		

3.3 PENALTY CLAUSE FOR NONCONFORMITY TO EMP

Clause No.	Description
Clause to be included in Bid document for Protection of the Environment	Contractor shall implement all mitigation measures for which responsibility is assigned to him as stipulated in the EMP report. Any lapse in implementing the same will attract the penalty clause as detailed below: 1. All lapse in obtaining clearances / permissions under statutory regulations and violations of any regulations with regard to eco-sensitive areas shall be treated as a major lapse. 2. Any complaints of public, within the scope of the contractor, formally registered with the CSC, or with the TNRSP complaint cell and communicated to the contractor, which is not properly addressed within the time period intimated by the CSC / PIU shall be treated as a major lapse. 3. Non-conformity to any of the mitigation measures stipulated in the EMP report (other than stated above) shall be considered as a minor lapse. 4. On observing any lapses, CSC shall issue a notice to the contractor, to rectify the same. 5. Any minor lapse for which notice was issued and not rectified, first and second reminders will be given after one month from the original notice date and first reminder date respectively. Any minor lapse, which is not rectified, shall be treated as a major lapse from the date of issuing the second reminder. 6. If a major lapse is not rectified upon receiving the notice, CSC shall invoke the penalty clause, in the subsequent interim payment certificate. 7. Penalty for major lapses shall be with-holding of 10% of the interim payment certificate, subject to a maximum limit of Rs. 30 lakhs. 8. If the lapse is not rectified within three months after withholding the payment, the amount withheld shall be forfeited.

CSC shall submit a monthly report to PIU on the progress of work. (Kindly refer Annexure 3.41). Point F & G provides details of major and minor lapses identified during this period; and details whether penalty clause is invoked and details of issue of notices. etc.

In case penalty clause is being invoked, CSC shall issue a notice in **Triplicate** to the contractor and provide him the details about such lapses as recorded during the monthly reporting. A copy of the notice shall also be marked to TNRSP for information and necessary actions. The contractor shall provide a receipt of the notice served and shall send back the signed copy of notice after affixing the date to CSC and TNRSP for record purpose.

CHAPTER 4

ARRANGEMENTS FOR IMPLEMENTATION OF EMAP

4 ARRANGEMENTS FOR IMPLEMENTATION OF EMAP

The Environmental Management Action Plan (EMAP) (Provided as **Table 3.1**), which is an integral part of the Environmental Management Plan, identify the detailed impacts, propose the mitigation actions, mention the implementing organization and monitoring organization. The responsibility for the implementation of EMP involves a number of parties, each with specific responsibilities. They are listed as follows:

- Project Implementation Unit (PIU), that represents TNRSP and is directly responsible for implementing the project
- Construction Supervising Consultant (CSC), who will be in charge of supervising the Contractor
- Construction Contractor, who is in charge of undertaking road construction work.

This section looks into the organisation and staffing of each of these stakeholders along with their responsibilities.

4.1 ORGANISATION, STAFFING AND RESPONSIBILITIES OF PIU

Project Implementation Unit (PIU) for the project under scrutiny of TNRSP, is responsible for the implementation of all road improvement works and environmental management activities. The TNRSP is executing the project work under the guidance of Project Director (PD) as its head. The Project Director is assisted on all technical issues by Superintending Engineer (H.O.), Executive Engineer (Environment) and sociologist and Assistant Executive Engineer and Assistant Engineers.

Each project activity at site will be distributed among groups to ensure the implementation of project work in the scheduled date. Superintending Engineer (H.O.) is in charge for review of the implementation of EMP with the assistance of one Environmental Specialist (ES), and 2 Assistant Environmental Scientist followed by environmental supporting team. The team will oversee the management activities of the project including the overall control of construction activities and implementation of contracts.

The implementation of mitigating measures requires supervision from adequately trained staff within the TNRSP. The institutional organisation for EMP implementation is shown in **Figure 4.1** and **Figure 4.2**, which shows a very flexible and practical Environmental Management Unit (EMU). The detailed structure of TNRSP is separately shown in **Figure 4.3.**

Roles and responsibilities of important officials are mentioned below.

Table 4-1: Roles and Responsibilities of Officers

Officers	Responsibility
Project Director	S/he is responsible for acquisition of all necessary right-of-way (R0W) land and buildings, review and approval of detailed road designs, obtaining all necessary clearances for construction and related activities, review and approval of the road realignments and road works (including retaining walls and excavation sites) and liasoning with supervision consultants. Suprintending Engineer and

Officers	Responsibility
	Environmental Specialist will assist Project Director to reporting various stakeholders (World Bank, Regulatory body etc.).
Superintending Engineer	The Environmental Specialist (ES) of Project Implementation Unit (PIU) assists the Superintending Engineer in the overseeing of environmental aspects of the construction contracts, including the enforcement of all monitoring provisions, and advice on the locations of construction and labour camps, etc.
Environmental Specialist	The Environmental Specialist (ES) of Project Implementation Unit (PIU) assists the Superintending Engineer in the overseeing of environmental aspects of the construction contracts, including the enforcement of all monitoring provisions, and advice on the locations of construction and labour camps, etc. He will review the periodic reports on EMP implementation and advise Project Director in taking corrective measure and conduct periodic field inspection of EMP implementation
Assistance Environmental Specialist	S/he is familiar with the Indian environmental legislation, environmental monitoring, EMP implementation aspects etc. The Environmental specialist will oversee day to day implementation of the environmental management plans pertaining to the construction contract for various road links and is also responsible for monitoring reports to World Bank. Additional recruitment if needed will be undertaken as necessary on contract basis. He will be responsible for obtaining regulatory clearances. He will coordinate with CSC to conduct necessary training program for the workers, engineers and office staffs.

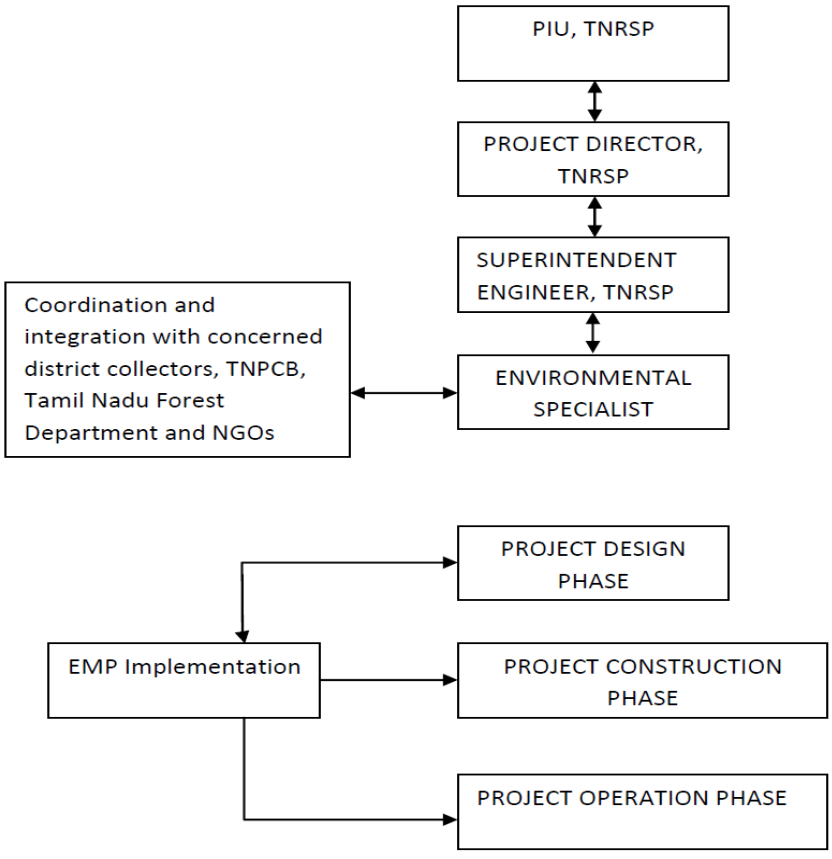


Figure 4-1: Institutional Organisation for TNRSP EMP Implementation

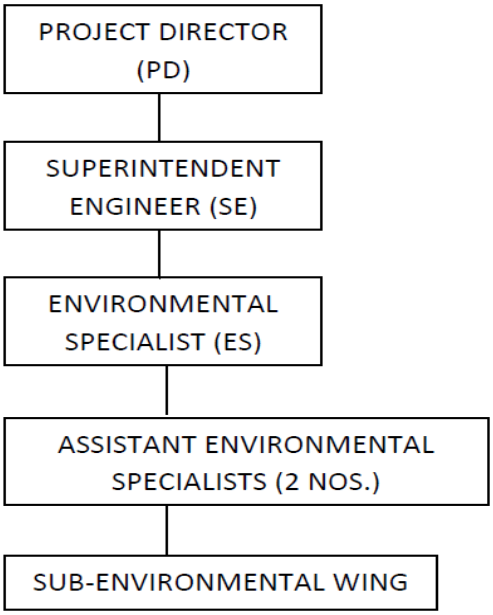


Figure 4-2: Environmental Management Unit (EMU)

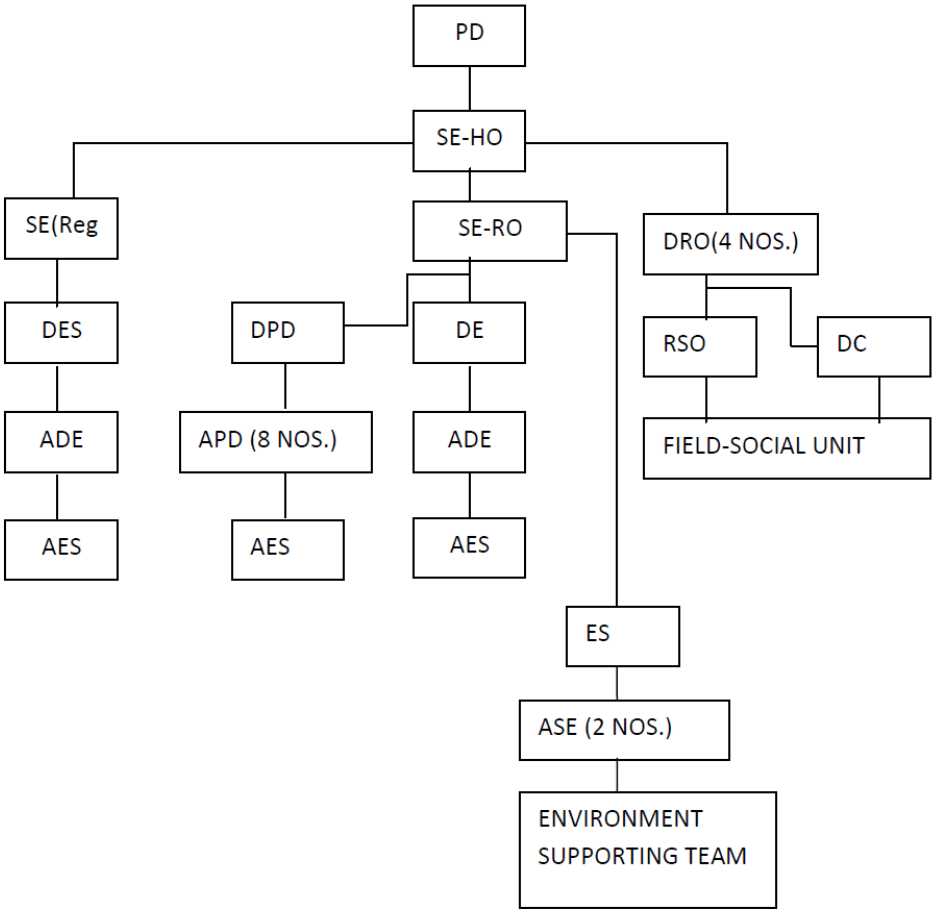


Figure 4-3: Organisation Structure, TNRSP

The main duties of the Assistant Environmental Engineers will include:

- Collection and dissemination of relevant environmental documents including amendments to environmental protection acts issued by the Government and various agencies such as the World Bank, Asian Development Bank (ADB) and other organisations.
- Co-ordination with non-government organisations (NGOs), community groups, government departments, etc. on environmental issues and obtaining the necessary clearances from the regulatory authorities.
- Monitoring the environmental aspects of the project during construction to ensure that the environmental requirements of the contract and the mitigation measures proposed in the EMP are implemented.
- Advising the Engineer and preparing the environmental input for the monthly progress report.
- Development of guidelines or a code of good practice on low-cost environmental measures that can be implemented in the road construction and maintenance programs for the Highway Dapartment.
- Development of environmental training activities for contractors and supervisory consultants staff.
- Assistance to local governments in the restoration of the environmentally degraded portions of any existing Right-of-Way, which may revert to their control due to the construction of realignments.
- Promotion of the policies adopted for the development of roadside amenities
- Assistance with the road safety components and issues related to the effects of roadside environment on road safety and non-motorised traffic.
- Laison with the EO of CSC and report to Superintending Engineer on all matters related to implementation of the Environmental Management Plan.
- Issuing completion certificate for constructed road works for payment.

4.2 ORGANISATION, STAFFING AND RESPONSIBILITIES OF CONSTRUCTION SUPERVISING CONSULTANT (CSC)

The Supervising Consultant will supervise the activities of the construction Contractor on behalf of Tamil Nadu State Sector Project (TNRSP) and will be reporting directly to the Superintending Engineer. The Supervising Consultant will be responsible for the technical supervision of road layout, overseeing contract implementation and certifying works for payment.

The roles of Construction Supervision Consultant are described below:

- Supervision of the Contractor to ensure that work is undertaken according to the construction contract.
- Inspection and reporting of Contractor activities to ensure effective implementation of the EMP.
- Auditing of Contractor works and activities against the conditions put forward in the

EMP.

- Issuing corrective action, requests and conduct follow up inspections and evaluation.
- Reporting any exceptions to the Project Director.
- Certifying completed constructed road works for payment.

The Construction Supervision consultants will have all the required specialists including an Environmental officer (EO) and a Senior Construction Safety Specialist. The brief description of qualifications, duties and responsibilities of the Team Leader, Senior Construction Safety Specialist and Environmental Officer of the Construction Supervision Consultants (CSC) are as follows:

Qualifications, roles and responsibilities of Team Leader: He will be at least a graduate in Civil Engineering, with atleast at least 20 years of professional experience out of which he should have worked as Team Leader/Project Manager or equivalent for minimum 4 years on supervision/construction of highway projects, preferably involving flexible pavements. Post Graduate qualification in civil engineering is desirable. His roles and responsibilities will be as follows:

- He will be overall in-charge of the project supervision team.
- He will be responsible for the overall implementation activities.
- He swill be assisted by key Professionals and other support Staff.
- He will coordinate with the subordinate team to ensure that the construction process is well controlled as per established Procedures.
- He will interact with the client.

Qualifications, roles and responsibilities of Senior Construction Safety Specialist (SCSS): The candidate will be at least a graduate in civil engineering and preferably with post graduate qualification in Industrial and Construction safety. S/he needs a minimum of 10 years of relevant professional experience, out of which, s/he should have worked for at least 5 years at a road / bridge construction site in the capacity of a safety engineer. Experience in working on height / deep foundations and live traffic situation and imparting safety training to construction managers and workers will be highly desirable.

- The SCSS will report to the Team leader of the Construction Supervision Team.
- S/he will be responsible for reviewing and approving the construction zone safety plans and traffic management including all temporary works/staging along with the structural or bridge engineer to confirm the safety point of view.
- The Safety Specialist shall be reponsible to guide the field supervision team and contractors site officers and should confirm whether safety measurements implemented in the field are complying with safety standards.
- The safety specialist must report any job accident or safety violation to the concerned officials through team leader. When an employee is injured on the job, the construction safety officer will investigate the accident and handle any workers' compensation claims.
- The safety specialist shall teach proper safety and health procedures to the entire

construction workers. Also, he shall take intiatives to conduct training programmes and mock safety drills which will help to update safety procedures as well as the importance of reporting a safety concern or injury.

Qualifications, roles and responsibilities of Environment Officer (EO) of CSC: The candidate will be M. Sc. in Environmental Science or graduate in Civil / Environmental Engineering. The candidate will have professional experience of at least 10 years relevant to environmental management in infrastructure road projects. Experience in implementation of EMP in externally aided/FIDIC based major highway projects is preferable. He should have adequate experience in implementing EMPs and organizing training to Contractor's and Employer's staff. He should be familiar with requisite procedures involved in obtaining and implementing environmental clearance requirements for project roads.

- The Environmental Officer (EO) shall report to the Team leader of the Construction Supervision Team. The EO will not instruct or direct the Contractor or Contractor's men but can discuss various issues and environmental mitigation measures with all concerned directly or indirectly.
- All matters related to environmental and social activities within the ROW such as latest EA, SEA, RAP and other related documents will be provided to EO immediately after mobilisation. Consent to Establish and Consent to Operate from Tamil Nadu State Pollution Control Board's and other applicable approvals will be taken. A status report prepared by PCC/ESMC of PIU will be provided to EO, to start the work.
- The Environmental Officer (EO) will be mobilised during the early stages of construction. This is to help the Contractor in identifying environmentally sound locations for construction camps, hot mix plant, WMM plant and all other issues according to the Environmental Management Action Plan (EMAP).
- The important role of EO during construction is to ensure the smooth implementation of EMAP and to address direct and indirect social issues arising out of implementation of the RAP.
- The EO will visit incomplete construction work sites where there are no contractor's current activities, active construction work sites and completed areas of the work sites and conduct regular meetings with the contractor in identifying gaps pertaining to both environment and contruction safety. The EO will also visit the hot mix plant; quarries and crushers, borrow areas and others as per the necessity. EO will ensure appropriate corrective and preventive action to the identified gaps in construction site in environmental aspects. Conduct regular meeting on environmental aspects with Environmental and Social Management Unit in TNRSP.
- The EO shall assist the Engineer to ensure environmentally sound engineering practices. In addition, other specialists of the engineers team may also act and report on road safety related issues.
- The EO shall carry out consultation with the Contractor, contractors men, local Project Affected Persons (PAPs) and interest groups. The EO shall also consult with NGOs to consider any problems (e.g. access problem to school, buildings, houses and business establishments) arising from construction activities.

- The EO shall assist in the compliance with various labour laws including the payment of minimum wages to the individual contract labourer's especially 'unskilled illiterate migrant labourers'. This has a direct bearing on the health and safety of the workers.
- The EO shall assist the Contractor, and the Public Works Department in all matters related to public contacts including consultation, training and public relations.
- The EO shall prepare standard formats (if available they may be obtained from other projects that are being implemented or are completed recently) for the compliance of the environmental and social requirements.
- The EO shall ensure the procurement of materials that are included in the Bill of Quantities relating to environmental and social mitigation costs.
- The EO shall assist the TNRSP and the Contractor in all training activities during construction supervision period.
- The EO shall prepare and submit a regular reports to the team leader of CSC.
- The EO shall assist the various Environmental monitoring activities of the Contractor / TNRSP.
- The EO shall be responsible to confirm whether the contractor has received all certifications in different sectors from the concerned authority to proceed the work.
- The EO in cooperation with the EO of PIU and Superintending Engineer will make sure the issuing of timely work order for the nurseries to be raised according to the '*Landscaping, Tree planting and Environmental Enhancement Plan'.* This will allow one year for the plants to attains the required size.

4.3 ORGANISATION, STAFFING AND RESPONSIBILITIES OF CONSTRUCTION CONTRACTOR

The Construction Contractor will be responsible for undertaking all duties and works assigned in the road construction contract, including all specified conditions in the EMAP. The Construction Contractor will prepare an implementation plan of mitigating actions specified in the EMP activity Table. The Contractor will work closely with the Supervision Consultant to ensure that works are constructed to standard. Throughout this EMP, the construction contractor is referred to as the 'Contractor' and the supervising Consultant is referred to as the 'Construction Supervising Consultant' (CSC). Detailed staffing pattern in the contractor's office is given below in **Table 4.2.**

Table 4-2: Staffing Pattern in Contractor's Office

Sl. No.	Designation	Nos.
1	Contract Manager	1
2	Construction Planning Engineer	1
3	Site Engineer	5
4	Quality Control/Material Engineer	1
5	Bridge Engineer	1
6	Earth Works Supervisor	6
7	Pavement Supervisor	2
8	Environmental Engineer	1

Roles and Responsibilities of Team Leader of Contractor: The Team Leader of the Contractor will be responsible for the timely implementation of EMP, as per the conditions stipulated in the Environmental Management Action Plan. S/he will prepare an implementation plan of mitigating actions specified in the EMP Activity Table. H/she will guide / supervise the ESE in ensuring that all construction work is undertaken in line with the requirements of EMP. The team leader will ensure that the reporting procedures mentioned in EMAP is adhered to and required reports and management plans are submitted to CSC on time. The corrective actions, as suggested by CSC will also be implemented and reported. S/he will have good understanding of the contractual clauses, especially the penalty clause given in the bid document as well as EMAP of this report. He will also ensure that the responsibilities stipulated in EMAP for Defect Liability period are carried out1.

Qualifications, Roles and Responsibilities of Environment and Safety Engineer (ESE) of Contractor: The candidate shall be M. Sc. in Environmental Science or B.Tech. in Civil / Environmental Engineering with minimum 7 years field experience in environmental management of transportation projects.

The duties and responsibilities of the Environment and Safety Engineer in the contractor's team2 are as follows:

1. To ensure that all the contractor activities are done in line with the EMP requirements.
2. To have good understanding of the contractual clauses, especially the penalty clause as given in the bid document as well as EMAP of this report.
3. To verify the appropriateness of all the EMP items.
4. To prepare a management and redevelopment plan for all the sites of identified project related ancillary facilities like (i) construction camp, (ii) labour camp, (iii) quarry and stone crusher unit, (iv) borrow area and (v) debris disposal site in line with detailed guidelines given in EMP.
5. To ensure that all the five sites and camps mentioned activity is operated, managed and closed in line with management and redevelopment plan.
6. To ensure that the top soil preservation is done wherever required as per the guidelines.
7. To ensure the adoption of proper waste management practices in the plant sites, labour camps, construction camps and along the road (also pertains to the proper disposal of bituminous / concrete waste generated during construction).
8. To ensure that the Contractor does not violate any social norms such as employment of child labour, children at work sites, providing creches, unhygienic working conditions and minimum wage considerations as per prevailing laws
9. To ensure that all the MoRTH specifications are available and followed in all the contractor activities.
10. To liaison with the Supervision Consultant and TNRSP on matters pertaining to the EMP.

[1] No full time engineer is required for this, any one in the Contractor's team will be given this responsibility.
[2] The Contractor will need a dedicated civil engineer to address EMF and safety-related issues for each contract package. This engineer will be given appropriate logistical support to carry out the various activities

11. To liaison with Government Agencies such as the Pollution Control Boards in order to obtain the required clearances, and to ensure that the Contractor activities are carried out in line with any conditions placed.
12. To ensure adoption of good construction-related safety practices and appropriate traffic management practices to ensure road safety during the construction phase.
13. To prepare and implement a plan for road safety, accidents and traffic management.
14. To demark the starting chainage & end chainage of the project as the construction zone, and provide sign boards as per accepted standards.
15. To inform and train all the contractor personnel on the IRC requirements on construction safety and on road safety.
16. To ensure the availability of first aid facilities.

Reporting requirements of Contractor: The Contractor will undertake regular reporting to CSC, comprising submission of reports as well as management and redevelopment plans to CSC.

4.4 INFORMATION DISSEMINATION

Information dissemination will be undertaken by TNRSP at a macro level and by the Contractor in the project site at micro level. The wider dissemination of information to public will be undertaken by TNRSP through the disclosure of EA / EMP reports in the website of TNRSP. At the project site, i.e. the direct impact zone, information boards will be displayed at critical and pre-identified locations to disseminate the project details. Such information boards will display project name, contractor's name, concerned official's name in Contractor's office with his designation and contact no., name and contact details of an authorized official in local TNRSP divisional office. These information boards will be approximately of size 5' x 5' and will be designed and put up in such a way that public can easily read it from a distance. Such boards will be setup, not only along active project stretches, but also at the sites of construction camps and labour camps and other project facilities like borrow area, quarry and stone crusher site and debris disposal site. These information boards will also mention the availability of a complaint register with ESE of the Contractor. Under the RTI Act, 2005, Contractor is also bound to share any information demanded by the public, pertaining to any aspect of the project, as and when it is demanded.

4.5 GRIEVANCE REDRESSAL MECHANISM

Public Complaint Cell in TNRSP: In order to create a responsive and transparent information landscape for the TNRSP, a Public Grievance Redressal Cell (GRC) cum Public Information Cell (PIL) will be established to serve as a point of contact to provide information to the public and the media about the goals, policies and activities of the TNRSP and to cater to the complaints received from public related to environmental issues due to the project. The GRC cum PIL will operate from TNRSP headquarters and will serve as an active link for gathering and disseminating information about the TNRSP. The GRC cum PIL shall be headed by Superintending Engineer (PIU - H.O.) and shall be assisted by Environmental Specialist and Social Specialist of TNRSP.

A complaint can be sent or information can be received by any means either by email, fax, phone, letter or in person at following address:

The Officer In charge,
Grievance Redressal Cell cum Public Information Cell,
Tamil Nadu Road Sector Project-II,
TNMB Building, Ist Floor,
No.171, South Kesavaperumalpuram,
Greenways Road, R.A.Puram,
Chennai 600 028.Tamil Nadu.
Ph.:044 24951072
Fax :044 24952414
E-mail: tnrsp1@gmail.com

The set up GRC shall have the system of records keeping, contact details of complainant, date of the complaint received, nature of grievance etc. for the project road and shall take necessary action against the complaint. The GRC will determine the merit of each grievance, and resolve grievances within an outer time limit of three months of receiving the complaint.

The dissemination of information on the availability of GRC shall be disclosed to public through either by uploading of EMP on TNRSP website or through circulation of print media by TNRSP along the project road.

Complaints register with Contractor: The contractor shall keep and maintain a complaint register report at his site office along the project road as well as project facilities like construction camp, labour camp etc., for public to register their complaints. The Contractor, after taking necessary action based on the complaint, will also incorporate the same in the complaint register. This report will also be part of the monthly report, for CSC to monitor and take necessary action, if needed. It has to be noted that, inaction upon the complaint of the public will be considered as a major lapse from the side of the contractor, leading to invoking of penalty clause which is given in bid document/EMP.

4.6 TRAINING PROGRAMME ON ENVIRONMENTAL ASPECTS

Training is an investment made on the human resource of the organization to provide and tone the competencies, required to do an existing job well and also to perform for future needs. Targeted and monitored training can set up an environment of good morale and productivity and contributes in creating a powerhouse of competencies for the organisation. The general awareness on environment and safety will be imparted to the educational institutes that are present in the project corridor by the contractor. This section deals with the training to be imparted to the Contrator's staff by the EO and Senior Construction Safety Specialist (SCSS) of CSC for ensuring effective implementation of EMP. The training requirements could be broadly identified as given in **Table 4.3** below.

Table 4-3: Training Programme to the Contractor's Staff

Programme	Particulars	Duration	Participants
Orientation Programme	Contactor's Responsibility as per bid document Reporting System in EMAP	One day each	Engineers including ESE

Programme	Particulars	Duration	Participants
Awareness programme	General Awareness on Environment General Awareness on Safety aspects	One day each	Skilled and unskilled labourers
			Engineers, supervisors and office staff
			Educational Institutes in the project line

The need for additional and specialised training will be examined and appropriate training will be undertaken as required.

CHAPTER 5

ENVIRONMENTAL MONITORING AND REPORTING REQUIREMENTS

5 ENVIRONMENTAL MONITORING AND REPORTING EQUIREMENTS

5.1 MONITORING AND REPORTING OF ENVIRONMENTAL MANAGEMENT MEASURES

A robust monitoring and reporting system is mandatory to ensure compliance to EMAP by the contractor. The monitoring and reporting system evolved for TNRSP-II is shown in **Table 5.1** and is integrated into EMAP table and its annexures. It comprises of following three parts:

A. Monitoring and reporting of environmental management measures for project related facilities like construction camp, labour camp, quarry area, borrow area and debris disposal site,
B. Monitoring and reporting of environmental management measures for overall project, and
C. Monitoring and reporting of quality of environmental attributes like air, water and noise.

This monitoring and reporting system attempts to pre-empt much of the environmental issues created during construction and post construction stages and provides the necessary feedback for CSC / PMU to make sure that EMAP is implemented in full spirit. Instead of a linear reporting system, this system works on a two way basis – initial reporting by contractor followed by monitoring by CSC based on contractor's reports. Responsibilities for monitoring will rest with the environmental officer of the supervising consultant reporting to the PMU and EMU at TNRSP.

The detailed procedure of reporting and monitoring system is as follows:

(A) Monitoring and Reporting of Environmental Management Measures for Project Related Facilities

Sage I – Site Identification: While initiating the project, the contractor needs to identify suitable sites for project related ancillary facilities like construction camp, labour camp, quarry and stone crusher units, borrow area, debris disposal sites and sources of water for construction. The same will be undertaken adhering to the criteria given in the respective guidelines for each of these sites given in **Annexures 3.1 to 3.5**. Once the site is identified by the contractor, s/he will prepare a site identification report furnishing all the details pertaining to the identified site using the reporting format given in **Annexures 3.12 to 3.17** and submit it to the CSC. Subsequently, the EO of CSC will require visit each site and approve / reject the site with reasons. The EO of CSC has to give a copy of this format to the contractor after his approval / rejection with remarks. This reporting procedure needs to be undertaken for each and every parcel of land identified for any of the project related ancillary facility.

Table 5-1: Monitoring and Reporting Plan for Entire Project

Reporting / Monitoring Format	Applicable Project site	Frequency of Reporting by Contractor	Frequency of reporting / action to be taken by CSC	Applicable Annexure no.
A. FOR PROJECT RELATED FACILITIES AND SITES				
STAGE-I. SITE IDENTIFICATION				
Reporting Formats for Identification of Sites	Construction camp	One time reporting to CSC for each site, when it is identified.	Visit each site and approve the site as and when it is reported	Annexure No. 3.12
	Labour camp			Annexure No. 3.13
	Quarry and stone crusher unit			Annexure No. 3.14
	Borrow area			Annexure No. 3.15
	Debris disposal site			Annexure No. 3.16
	Water Sources			Annexure No. 3.17
STAGE-II. SETTING UP OF SITES				
Management and Re-development Plans for Sites / Camps	Construction camp	One time reporting to CSC for each site, when it is required.	Visit each site and approve the management plans as and when it is submitted	Annexure No. 3.1
	Labour camp			Annexure No. 3.2
	Quarry and stone crusher unit			Annexure No. 3.3
	Borrow area			Annexure No. 3.4
	Debris disposal site			Annexure No. 3.5
Comprehensive Waste Management Plan	All Sites	One time reporting to CSC for all sites together	Visit each site and approve the management plan as and when it is submitted	Annexure No. 3.6
Occupational Health and Safety Management Plan	All Sites	One time reporting to CSC for all sites together	Visit each site and approve the management plan as and when it is submitted	Annexure No. 3.8
Traffic Management Plan	All Sites	One time reporting to CSC for all sites together	Visit each site and approve the management plan as and when it is submitted	Annexure No. 3.9
Hazardous Substances Management Plan	All Sites	One time reporting to CSC for all sites together	Visit each site and approve the management plan as and when it is submitted	Annexure No. 3.10

Reporting / Monitoring Format	Applicable Project site	Frequency of Reporting by Contractor	Frequency of reporting / action to be taken by CSC	Applicable Annexure no.
STAGE-III. OPERATION OF SITES				
Format for Register of sites opened and closed and its reporting	All sites / camps	**Details to be recorded in** chronological order when a site is opened / closed,to be submitted to CSC monthly.	Check the status of clearances and redevelopment status of each site and approve the report monthly.	Annexure No. 3.19
Checklists for Monitoring Environmental Management of Sites / Camps	Construction camp	Nil	Monitor the implementation of management plan monthly once, through site visits and checklists.	Annexure No. 3.20
	Labour camp			Annexure No. 3.21
	Quarry and stone crusher unit			Annexure No. 3.22
	Borrow area			Annexure No. 3.23
	Debris disposal site			Annexure No. 3.24
STAGE-IV. CLOSURE OF SITES				
Checklists for Monitoring Redevelopment of Sites / Camps	Construction camp	Nil	Monitor the implementation of redevelopment plan through site visits and checklists as and when a site is closed and reported through the register of sites.	Annexure No. 3.25
	Labour camp			Annexure No. 3.26
	Quarry and stone crusher unit			Annexure No. 3.27
	Borrow area			Annexure No. 3.28
	Debris disposal site			Annexure No. 3.29
B. FOR OVERALL PROJECT				
Format for Register of complaints and its reporting	All project sites	Monthly	Monitor the implementation of **m**anagement measures through site visits and approve the reports monthly.	Annexure No. 3.18
Reporting Format for Work Force Management	All project sites	Monthly		Annexure No. 3.30
Reporting Format for Occupational Health and Safety Measures	All project sites	Monthly		Annexure No. 3.31
Reporting Format for Top Soil Conservation	All project sites	Monthly		Annexure No. 3.32
Reporting Format for Water Sprinkling for Dust	All project sites	Monthly		Annexure No. 3.33

Reporting / Monitoring Format	Applicable Project site	Frequency of Reporting by Contractor	Frequency of reporting / action to be taken by CSC	Applicable Annexure no.
Suppression				
Reporting Format for Road Safety Measures During Construction	All project sites	Monthly		Annexure No. 3.34
Reporting Format for Register of Accidents and it's Reporting	All project sites	Monthly		Annexure No. 3.35
Reporting Format for Enhancement and Mitigation of Cultural Properties	All project sites	Monthly		Annexure No. 3.37
Reporting Format for Enhancement Measures Other than Cultural Properties	All project sites	Monthly		Annexure No. 3.39
Reporting Format for Tree Plantation	All project sites	Monthly		Annexure No. 3.39
Reporting Format for Monthly Report from Contractor to CSC	All project sites	Monthly		Annexure No. 3.40
Reporting Format for Monthly Report from CSC to PIU	All project sites	Nil	Monthly	Annexure No. 3.41
C. FOR ENVIRONMENTAL QUALITY MONITORING				
Reporting Format for Environmental Quality Monitoring	All project sites	Monitoring is to be conducted as per Environmental Quality Monitoring plan in Table 5.2. To be submitted to CSC along with the Monthly report.	Verify the details through site visits and approve the reports monthly	Annexure No. 3.36

Stage II – Setting up of Sites: On approval of a site, the contractor has to prepare the management and redevelopment plan for this site as per the relevant guidelines given in **Annexures 3.1 to 3.5** of EMP and submit to CSC for approval. In addition to the Management and Redevelopment Plans for sites, the Contractor has to prepare comprehensive waste management plan, occupational health and safety management plan, traffic management plan and hazardous substances management plan for all sites together, as per the guidelines given in EMP **Annexure 3.6, 3.8, 3.9 and 3.10 r**espectively. Subsequently, the EO of CSC needs to visit each site and approve the management plan. The EO of CSC has to give a copy of this management plan to the contractor after his approval with remarks / suggestions for additional mitigation measures. Any kind of activity could be initiated in a site only after getting approval from CSC for the Management and Redevelopment Plan for that site. These plans need to be prepared for each and every parcel of land identified as described above.

Stage III –Operation of Sites: Once the contractor receives approval for the Management and Redevelopment Plan, s/he can initiate activities on the site. All the activities will be undertaken strictly in line with the said plan. CSC will monitor the implementation of management plan monthly once, through site visits and the checklists for monitoring the environmental management of sites / camps given in **Annexures 3.20 to 3.24.** Corrective actions with specific timeframe should be proposed for each environmental management measure, which is not implemented satisfactorily. A copy of the filled up checklist should be given to the ESE of the Contractor. CSC has to attach this format to the monthly report to be submitted to PIU, with details of corrective action taken by the contractor.

A Register of sites opened and closed in the format given in **Annexure 3.19** should be maintained by the contractor (preferably in A3 size paper) for each road. Details of each site opened should be entered in this register in chronological order. When ever a site is closed, it should be recorded in this register with status of redevelopment. Clearances applicable for each site and the status of clearances should also be entered in this register. This same format will be used to report the details of sites opened and closed to the CSC along with the monthly report of the contractor. EO of CSC has to visit the sites, verify the details and approve the report with instruction to the contractor if any clearance is pending for any site or redevelopment is not done satisfactorily for any closed site. A copy of the approved report with CSC's remarks will be given to the ESE of the Contractor. The EO of CSC has to attach this format to the monthly report to be submitted to PMU, with details of corrective action taken by the contractor.

Stage IV – Closure of Sites: Upon completion of the operation in any particular project ancillary facility site, the contractor will undertake redevelopment of the same, in line with the redevelopment plan which was already approved by CSC and intimate to CSC through the format for register of sites opened and closed. The Environmental Officer of the CSC will monitor the same through site visit and the checklists for monitoring the redevelopment of sites / camps provided in **Annexures 3.25 to 3.29** as and when a site is closed and reported by the contractor. Corrective actions with specific timeframe will be proposed for each environmental management measure, which is not implemented satisfactorily. A copy of the filled up checklist will be given to the ESE of the contractor, to attach with monthly report to

be submitted to PMU, with details of corrective action taken by the contractor.

As described above, the reporting tasks for project facilities have been split and shared among contractor and CSC and its summary is given below:

- One time reporting by contractor to CSC during identification of sites and camps
- One time reporting by contractor to CSC through management and redevelopment plans before setting up of sites and camps.
- Monthly reporting of sites opened and closed by contractor to CSC
- Monthly monitoring by CSC during the operation stage of sites and camps
- One time monitoring by CSC after the closure of each site and camp

(B) Monitoring and Reporting of Environmental Management Measures for Overall Project

The Contractor will undertake regular monthly reporting to CSC using the format given in **Annexure 3.40,** and all other reporting formats will be attached to this monthly report as annexures. The Monthly Report captures the physical progress of the work, main issues / concerns, corrective actions taken, no. of workers in the reporting month etc. Further, CSC will report monthly to PIU, summarising the issues / concerns and actions taken. This report has to be prepared in the format given in **Annexure 3.41** and all other reports are to be attached to it as annexures. All the reporting formats given in **Annexures 3.30 to 3.39** will be used by the Contractor to report environmental management measures related to various aspects of the overall project. These reports are to be submitted monthly by the Contractor to the CSC. The EO of CSC will visit the sites and verify the implementation of management measures and approve the reports. EO of CSC will give a copy of the approved reports to the ESE of the Contractor with his remarks.

(C) Monitoring and Reporting of Environmental Quality

Environmental quality monitoring will be undertaken by the contractor through an NABL approved laboratory, based on the Environmental Quality Monitoring Plan presented in **Table 5.1.** The monitoring results will be reported by the contractor to the CSC in the reporting format for environmental quality monitoring given in **Annexure 3.36** along with the monthly report, if monitoring was due in that month. A copy of the monitoring report given by the Laboratory has to be attached to this format. The CSC has to visit the sites and verify the details. Additional mitigation measures, if required, can be suggested by the CSC. The EO of CSC has to give back a copy of this format to the contractor after his approval with remarks.

5.2 ENVIRONMENTAL QUALITY MONITORING PLAN FOR THE PROJECT

The environmental monitoring plan for the project is presented in **Table 5-2.** For each of the environmental components, the monitoring plan specifies the technical aspects of monitoring like locations of monitoring; frequency of monitoring and duration, sampling method, parameters to be monitored and standards to be compared. The monitoring plan also specifies the applicable standards, and implementation and supervising responsibilities. Baseline monitoring locations are also mentioned also mentioned in **Table 5-3**, serve as a reference for monitoring during construction and operation phases.

Table 5-2: Environmental Quality Monitoring Plan

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation	Supervision
Air	Construction	PM_{10} & $PM_{2.5}$, SO_2, NOx and CO	Sampler to be located 50 m from the plant in the downwind direction. Use method specified by CPCB for analysis	NAAQS, 2009	Three seasons per year for 3.5 years	24 hours Sampling	Along the road and at Hot mix / batching plant	Contractor through NABL approved monitoring agencies	CSC appointed by TNRSP
	Operation				Three seasons in a year for 2 years		Along the road	Contractor through NABL approved monitoring agencies	
Water	Construction	pH, BOD, COD, TDS, Pb, Oil & Grease, Detergents and Faecal Coliforms for Surface water. pH, TDS, Total hardness, Sulphate, Chloride, Fe, and Pb for groundwater.	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) and for Drinking Water (IS : 10500 - 2012)	Three seasons per year for 3.5 years	Grab Sampling	Along the road	Contractor through NABL approved monitoring agencies	CSC appointed by TNRSP
	Operation				Three seasons in a year for 2 years		Surface water sources	Contractor through NABL approved monitoring agencies	
Noise	Construction	Noise levels on dB (A) scale	Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from	Noise standards as per Noise Rules, 2000	Three seasons per year for 3.5 years	Leq in dB(A) of day time and night time	Along the road and near Hot mix / batching plant	Contractor through NABL approved monitoring agencies	CSC appointed by TNRSP

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation	Supervision
	Operation		edge of pavement		Three seasons in a year for 2 years		Along the road	Contractor through NABL approved monitoring agencies	
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 standards are promulgated	Three seasons per year for 3.5 years	Grab Sampling	Along the road Hot mix / batching plant	Contractor through NABL approved monitoring agencies	CSC appointed by TNRSP
	Operation				Three seasons in a year for 2 years		Along the road	Contractor through NABL approved monitoring agencies	

Environmental Standards for air, water and noise are provided in **Annexure 3.54.**

Baseline Monitoring Locations along Rajapalayam- Sankarankoil -Tirunelveli Road (SH41)

S.No.	Existing km	LHS/RHS	Name of Location and Village
1	1.10	RHS	College
2	13.00	Both Side	Mahatma Gandhi college of Art & Science for Women
3	21.150	RHS	Govt. Hospital and Bus Shelter
4	29.300	LHS	Vaiyapuri-School and Temple, Sankarankoil
5	43.000	Both Side	Mutharamalinga Thevar College and Hostel Canteen
6	55.400	RHS	Govt. Hospital and Govt. High School
7	61.800	RHS	Govt. High School
8	71.200	LHS/RHS	Manur Village
9	85.600	LHS/RHS	At Junction
Ambient Noise Levels			

S.No.	Existing km	LHS/RHS	Name of Location and Village
1	1.10	RHS	College
2	9.400	LHS	Vandimahali Aman Temple
3	13.000	Both Side	Mahatma Gandhi college of Art & Science for Women
4	16.000	LHS	Polytechnic college
5	21.150	RHS	Govt. Hospital and Bus Shelter
6	26.800	LHS/RHS	A.V.K. International School and PKR Cotton Mill, Sankarankoil
7	29.300	LHS	Vaiyapuri-School and Temple, Sankarankoil
8	43.000	Both Side	Mutharamalinga Thevar College and Hostel Canteen
9	55.400	RHS	Govt. Hospital and Govt. High School
10	57.050	LHS	Elisabetta Vitale Matriculation School and Church, Lodola Nagar, Devarkulam
11	61.800	RHS	Govt. High School
12	63.400	RHS	Eskiamanv Temple
13	71.200	LHS/ RHS	Manur Village
14	74.750	RHS	Govt. Middle School and Temple
15	77.600	RHS	Nanjankulam Regrouped Stone Mines, Indian Cement Ltd., Seduroyan Paddur
16	81.200	RHS	T.N., Vetenary College and Research Institute of Vetenary and Animal Science University, Tirunveli
17	84.990	RHS	Sudalai Temple, Tirunelveli
18	85.600	LHS/ RHS	At Junction
Surface and Ground Water Quality			
1	4.400	RHS, GW	Near Marriage Garden, Rajapallayam
2	4.950	LHS, SW	Madhukudy
3	12.800	LHS ,GW	Solaiseri
4	16.800	RHS, SW	K.R Naidu Nagar
5	25.600	LHS, GW	Ramalingapuram
6	38.200	RHS, GW	Muthukrishapuram
7	48.700	RHS, GW	Panavadalachathiram
8	65.300	Cross, SW	Alakiyapandiapuram
9	71.200	RHS, SW	Manur

S.No.	Existing km	LHS/RHS	Name of Location and Village
10	72.250	LHS, GW	Jami Nagar
Soil Quality			
1	9.4000	LHS	Ammanpuram and Sonaganvilai
2	20.000	LHS	Sivasubramaniyapuram and Thenthirupperai
3	33.000	LHS	Puliamkullam
4	64.400	RHS	Parancheri
5	82.00	RHS	Ramainpatti

CHAPTER 6

ENVIRONMENTAL BUDGET

6 ENVIRONMENTAL BUDGET

Mitigation measures proposed in the EMAP will be implemented by the Contractor. The works to be undertaken by the Contractor have been quantified and the quantities included in the respective BOQ items such as earth works, slope protection, road safety features and tree plantation.

More general environmental management measures to be followed by the contractor have been included in the specifications and this EMAP. The budgetary provisions for the implementation of the environmental management plan and enhancement measures for the Project road are presented in **Table 6.1**.

The EMP budget will be incorporated as BOQ no.11 in the total project cost estimates (DPR).

Table 6-1: Cost Estimates for Environmental Management along proposed Rajapalayam-Sankarankoil -Tirunelvel Road Section of SH-41

S. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)	Remarks
A	**PRE CONSTRUCTION PHASE**					
1	Tree Felling >30cm girth	Number		3923		Covered under Engineering Cost
2	Utility Shifting		Covered under regulatory clearance, Engineering cost.			
B	**CONSTRUCTION PHASE**					
1	**Mitigation Measures other than Good Engineering practices**					
1.1	Oil Interceptors	Number		4		
1.2	Silt Fencing	Length, m		200		
1.3	Recharge pits for urban drains	Number		28		In urban areas on both sides, where pucca drains are prposed
1.4	Soakpits for Hand Pump/Wells	Number		11		Refer Annexure 3.44. Cost considered under RAP
2	**Tree Plantation and Protection**					
2.1	**Avenue Plantation including Compensatory Plantation (including maintenance cost for 5 years)**					
2.1.1	Compensatory Plantation including Avenue Plantation*	Number		39,230		
2.1.3	Tree Fencing	Numbers		39,230		
2.2	**Plantation in Realignment Locations (including maintenance cost for 5 years)**					

S. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)	Remarks
2.2.1	Plantation of Saplings	Number		360		
2.2.2	Tree Fencing	Numbers		360		
2.3	**Plantation in Enhancement sites (including maintenance cost for 5 years)**					
2.3.1	Along pond at Km11+250	Numbers		90		
2.3.2	Turfing on earthern embankment on of 1260sq.m area around pond			1260		
3	**Landscaping**					
3.1	At major junction location	Numbers		3		
4	**Monitoring of Environmental Attributes during Construction Phase**					
4.1	Air Quality					
4.1.1	Monitoring of Air Quality near Hot mix plants	Per Samples		20		Three seasons in a year for 3.5 years
4.1.2	Monitoring of Air Quality at Critical Locations	Per Samples		80		Three seasons in a year for 3.5 years
4.2	Noise Levels					
4.2.1	Monitoring of Noise Level at Equipment Yards	Per Samples		20		Three seasons in a year for 3.5 years
4.2.2	Monitoring of Noise Levels at Critical Locations	Per Samples		160		Three seasons in a year for 3.5 years
4.3	Water Quality					
4.3.1	Monitoring of Water Quality (Surface & Ground)	Per Samples		100		Three seasons in a year for 3.5 years
4.4	Soil Quality					
4.4.1	Monitoring of Soil Quality	Per Samples		50		Three seasons in a year for 3.5 years
4.4.2	Additional Soil Monitoring during Spills	Per Samples		20		
5	**Mitigation/Enhancement Measures**					
5.1	**Cultural Properties (Covered under RAP Budget)**					
5.2	**Enhancement Measures at selected Ponds (Annexure 3.51)**					

S. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)	Remarks
5.2.1	Pond at Km 4+980					
	Provision of 52m long, 2.5 m high and 0.5m width stone wall along pond on road side	cum		65		
5.2.2	Pond at Km 11+250					
	Benches for sitting	Numbers		3		
	Solar Light along pond on road side	Numbers		3		
	Provision of 90m long, 3.0 m high and 0.5m width stone wall around pond on road side	sqm		135		
5.2.3	Pond at Km 24+380					
	Provision of 55m long, 3.0 m high and 0.5m width stone wall along pond on road side	cum		82.5		
5.2.4	Pond at Km 42+200					
	Provision of 24.5m long, 2.0 m high and 0.5m width stone wall along pond on road side	cum		24.5		
	Provision of 52m long metal beam crash barrier for safety in drainage area of pond along road side	m		52		
6	Provision of Signboards along Srivilliputtur Grizzled Squirrel Wildlife Sanctuary at start (km0/000) and end location (km 6/000) of 10km influence zone along SH-41	Numbers		2		
C	**GOOD ENGINEERING PRACTICES**					
1	Dust Suppression		**Covered under Engineering Costs**			

S. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)	Remarks
2	Erosion Control Measures (Turfing / Pitching / Seeding & Mulching)					
3	Provision of Cross drainage & side drainage structures					
4	General Borrow area management and maintenance of haul roads related to borrow areas					
5	Air/noise pollution control measures in construction equipments					
6	Management and disposal of scarified waste bituminous material					
7	Provision of Informatory Signs					
8	Bus shelters					
9	Construction of Speed Humps					
10	Cattle Crossings					
11	Management of quarries		**Will form a part of the Contractor's cost**			
12	Redevelopment of Borrow Areas					
13	Construction Camp Mangement Costs		**Will form a part of the Contractor's cost**			
14	Safety measures for workers					
D	**ITEMS COVERED UNDER THE RAP BUDGET**					
1	Relocation of private Properties		**Covered under RAP Budget**			
2	Relocation of Other Community Assets (private)					
E	**OPERATION PHASE**					
1	**Monitoring of Environmental Attributes during Operation Phase**					
1.1	Monitoring of Air Quality at Critical Locations	Per Sample		48		Three seasons in a year for 2 years
1.2	Monitoring of Noise Levels at Critical Locations	Per Sample		96		Three seasons in a year for 2 years
1.3	Monitoring of Water Quality	Per Sample		60		Three seasons in a year for 2 years
1.4	Monitoring of Soil Quality	Per Sample		30		Three seasons in a year for 2 years

S. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)	Remarks
1.5	Additional Soil Monitoring during Spills	Per Sample		12		Throughout operation phase.
2	**Information Dissemination**	-	-	-		Covered under RAP
	Environmental Budget During Operation Phase					
	Sub Total (A+B+E)			INR		
	GRAND TOTAL US$ @ INR 60.00/$			US$		
	*Note: 10 times for trees>30cm girth. Single row Plantation to be taken up on both sides of road in rural area and remaining within available space between EROW and PROW considering 1/2/3 row of plantation all along the corridor.					

ANNEXURES

ANNEXURE 3.1: GUIDELINES FOR SITING, MANAGEMENT AND REDEVELOPMENT OF CONSTRUCTION CAMPS

A. OVERVIEW

Construction camp accommodates a mix of activities, which are highly polluting in nature causing considerable environmental impact and its proper siting, management and redevelopment is crucial to avoid, minimize and mitigate those impacts. The EMAP clearly distinguishes between various impacts that may occur at various stages of the camp like (i) siting, (ii) setting up, (iii) operation and (iv) closure / redevelopment and provide respective mitigation measures to some extent. In addition to that, this guideline has been prepared to provide the Contractor with comprehensive and systematic information on various steps to be undertaken during these four stages, so that s/he can execute his/her role in an environmentally sound manner. Various mitigation measures have been synthesized into this guideline so that it serves as a single and stand alone document for the Contractor.

B. CRITERIA FOR SITING THE CAMP

To the extent, possible barren land or wastelands shall be preferred during site selection and fertile land and agricultural land shall be avoided. All such sites must be above the HFL with adequate drainage facility. In areas prone to floods, cyclones, cloudbursts or heavy rainfall, selection of the site should be made keeping in mind the safety of the camp and the workers. In addition, the Contractor should take care of the following criteria for locating the site:

- A minimum of 250 m away from any major settlement or village in downwind direction.
- A minimum of 200 m of any major surface water course or body[1]
- Not within 500 m from ecologically sensitive areas like wild life sanctuary, mangroves etc.
- Sufficiently wide access roads (at least 5.5 m Wide) for heavy vehicle movements

After identification of the site the Contractor should fill up the prescribed reporting format and submit the same for approval to the CSC without which any activity shouldn't be started on the site

C. FINALIZATION OF SELECTED SITE/S

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

[1] In the absence of site meeting the stipulated criteria, an alternate site can be selected specifying the reasons. In such a case, the construction camp management plan should incorporate additional measures specific to the site as suggested by the CSC.

D. DESIGNING OF CAMP / PREPARATION OF LAYOUT PLAN

The Contractor should design a layout plan of the camp with adequate space for (i) site office along with store room, rest area and sanitary facilities, (ii) plants, machineries, (iii) workshops, (iv) vehicle washing area, (v) fuel handling area, (vi) room for raw material unloading and stocking, (vii) space for storage and handling of solid wastes (viii) security cabin etc. The laying out of these should be undertaken in such a manner that it facilitates smooth functioning of both man and machine. Fuel pumps, storage facility for inflammable and hazardous chemicals/ materials shall be provided inside the camp, but at a safe distance from office. Electric safety practices shall be integrated/ incorporated during the lay-out plan preparation.

Prevailing wind direction shall be kept in mind while planning out the lay-out of internal facilities. Cutting of trees should be minimum and the existing ones need to be integrated into the lay-out plan with proper planning. The roads within the camp should be well planned with adequate space for movement of vehicles and their parking.

E. SETTING UP OF CONSTRUCTION CAMP

Site preparation: The stripping, stacking and preservation of top soil will be mandatory in case of farm lands and fertile areas and absolutely no material stacking or equipment installment or vehicle parking or any other activity should be allowed prior to the satisfactory completion of this activity as per guidelines in EMP. Thereafter, the site should be graded and rendered free from depressions such that the water does not get stagnant anywhere. A compound wall of 2.4 m height should be constructed all around the camp to prevent the trespassing of humans and animals. Green belt should be provided along the boundary and as detailed in the EMP, it should be integrated with storm water drain and sedimentation trenches as given in annexure in EMAP. No. of trees planted should not be less than three times the number of trees cut. The approved layout plan should be strictly adhered to while setting up the camp.

Setting up of plants and machineries: Adequate arrangements should be made for avoiding fugitive emissions from plants and camp premises. This will include (i) control of air pollution through provision of in-built dust extraction systems like bag filter, damper and cyclone filter for bitumen hot mix plant, (ii) a chimney of appropriate height (as per SPCB guideline) from ground level attached with dust extraction system and scrubber for the hot mix plant, (iii) a chimney of appropriate height for the DG set (iv) water sprinkling facilities for the concrete batching plant, wet mix macadam plant as well as in the camp premises and (v) garden net to prevent fugitive emissions from storage place of cement and aggregates.. It has to be also ensured that effluent from the sludge tank of the scrubber is recycled and reused and the sludge is used for land filling with top soil spread on it.

To ensure that noise levels are within the limit, all plants and machineries should have their own silencers or any other noise control devices. All pollution control devices should be provided with back up power. Following conditions should be complied regarding the sound level conditions:

- The sound level (Leq) measured at a distance of 1 m from the boundary of the site shall not exceed 55dB (A) during day time (6am - 6pm) and 45 dB(A) during night time (6 pm - 6am).
- The total sound power level of the DG set shall be less than 96+10 log 10(KVA) dB(A) where KVA is the nominal power rating of DG set.
- The DG set shall be provided with acoustic enclosure/acoustic treatment with an insertion loss of minimum 25 dB(A).
- The DG set shall be provided with proper exhaust muffler with insertion loss of minimum 25 dB(A).

- A proper, routine and preventive maintenance procedure for the DG set shall be set and followed in consultation with the DG set manufacturer.
- Concrete flooring with slope drains and oil interceptors should be proposed for hot mix plant area and workshop, vehicle washing and fuel handling area as per EMP, so that oil and lubricants that may spill on the floor does not contaminate any soil or water body. In case of any oil spills, it should be cleaned properly. There shall also be provisions for storage of used oil until it is disposed as per comprehensive waste management plan prepared by Contractor and approved by CSC.

Sanitation Facilities: Adequate no. of toilets shall be provided separately for males and females (depending on their strength), screened from those of men and provided with markings in vernacular language. All such facilities must have adequate water supply with proper drainage and effluent treatment system like septic tank with soak pit. Soak pit should have a sealed bottom, honey comb wall and 75 cm. thick, 2 mm sand envelope around that. The sewage system for the camp must be properly sited, designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place.

Portable toilets may be brought to use and the night soil from such units has to be disposed through designated septic tanks so as to prevent pollution of the surrounding areas. In the construction camp, no night soil or sewerage shall be disposed of at any place other than the septic tanks constructed at the site.

Waste Disposal: While preparing the layout plan, the Contractor should allocate adequate space for storage and handling of various wastes generated until they are disposed off in pre-identified disposal sites. The Contractor should provide separate garbage bins for biodegradable, non-biodegradable and domestic hazardous wastes in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner. No incineration or burning of wastes shall be carried out by the Contractor. The disposal of any biodegradable matter shall be carried out in pits covered with a layer of earth within the camp site. Discarded plastic bags, paper and paper products, bottles, packaging material, gunny bags, hessian, metal containers, strips and scraps of metal, PVC pipe scrubber and poly urethane foam, auto mobile spares, tubes, tires, belts, filters, waste oil, drums and other such materials shall be either reused or sold /given out for recycling. POL (petroleum, oil and lubricants) waste shall be disposed off by transfer only to recycler/ re-refiners possessing valid authorization from the State Pollution Control Board and valid registration from the Central Pollution Control Board. Used lead batteries, if any, should be disposed as per the Batteries (Management and Handling) Rules 2001.

First aid / safety facilities: At every camp site, a readily available first-aid unit including an adequate supply of sterilized dressing materials and appliances should be provided. Workplaces which are remote and far away from regular hospitals should have indoor health units with one bed for every 250 workers. Details of nearest clinics as well as major hospitals like their location, distance from camp, phone nos. facilities offered by the hospital should be displayed in the camp office at clearly visible location in a legible manner. Suitable transport should be provided to facilitate taking injured and ill persons to the nearest hospital. Adequate personal protective equipments and fire fighting equipments as detailed out in EMP should be made available in the camp and provided to the staff / workers. Operation manuals and training should be provided to machine operators. Warning signs should be placed at accident prone areas as well as at the entrance of the site.

Training to workers: Workers shall be trained in smooth operation of plants and machines, their regular maintenance and various safety measures to be followed as well as about the need for adherence to these measures.

Information dissemination: There should be a sign board of size 6' x 4' mentioning the project details and Contractor's details to disseminate the information to the public. There should be a second sign board displaying the latest air and noise monitoring data against the standards specified.

Warning signboards should be set up at the entrance gate for the public as well as at other required places for the workers to alert them about the nature of operation being undertaken at those respective places.

Once the construction camp is set up, the date of commissioning of the camp should be intimated to the Head Office and concerned District Office of the SPCB.

F. OPERATION OF CONSTRUCTION CAMP

During the operation phase of the camp it is important to ensure that all vehicles and machineries are maintained regularly and their PUC certificates are renewed at regular intervals. All pollution control devices should be monitored and maintained properly at regular intervals. In case of process disturbance/ failure of pollution control equipments, the respective units should be shut down and should not be restarted until the control measures are rectified to achieve the desired efficiency. All units should operate only between 6 am and 10 pm. or as specified by SPCB in the consent letter.

Oil and grease waste generated from garages in construction camps should be drained out through oil interceptors and they should be maintained properly. Necessary arrangements should be made for regular sprinkling of water for dust suppression. Raw materials and products should be transported with proper cover to prevent spreading of dust.

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

Environmental monitoring should be undertaken by the Contractor as stipulated in the EMP. If any standard is set by SPCB for hot mix plant emissions, the Contractor should collect samples of emission from all the chimneys and analyse for the parameters at least once in a month. The CTE certificate from SPCB should be renewed at regular intervals and the same should be intimated to CSC.

A register should be maintained at the site office which provides (i) a one page format for each migrant labourer which will give their personal profile (including name, age, sex, educational qualification, address, blood group and any major illness), along with a copy of any ID proof and an original photograph, (ii) a copy of the ID card of local labourers. A copy of the details of the migrant labourers should be submitted to the local police station.

G. PREPARATION OF CONSTRUCTION CAMP MANAGEMENT AND RE-DEVELOPMENT PLAN

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

Section–1: Details of site: Copy of approved site identification report along with location plan on a

village map or an FMB, showing the site, its survey no., access road, project stretch, distance form the project stretch, surrounding features and land use like residences, agricultural land, water bodies etc., photograph of the site showing the topography and other existing features.

Section-2: Site preparation: Activities that will be undertaken for preparing the site based on EMP and this guideline.

Section-3: Arrangements/ facilities within the camp: List of plants / machineries to be set up within the camp like hot mix plant, batching plant, DG set etc., including type and no of each equipment and machinery, list of other facilities to be provided like site office, store room, rest room, toilet room, material stocking yard etc, layout plan showing all these details along with vehicular movement path, green belt etc. Species wise no. of trees to be cut shall be provided.
Section-4: Mitigation measures that will be undertaken as per the EMP and this guideline while setting up of the camp and operation of the camp should be separately listed out here.
Sectoin-5: Other details: Any other relevant detail like list of trainings to be provided to workers, details of information dissemination, date of CTE certificate from SPCB, its validity, additional conditions laid down in it etc. should be included.

Section 6: Re-development plan, which should indicate the following points: (i) List of structures to be demolished and list of the clean up activities that needs to be undertaken, (ii) Proposed use of the land after de-mobilising and (iii) Presence of facilities that could be put in use by the land owner if it is a leased out private land or community in case of a public property.

Section-7: Annexure-(a) Working drawings: Electrical plan showing the electrical network planned for the site, location of plants, generators, master switch boards etc. and plumbing drawing showing the network of water supply lines, sewerage line and drainage line, (b) Copy of certificates / permissions obtained from regulatory authorities / local governing body / community etc. as applicable, (c) Copy of agreement entered with the owner of the site if it is a leased out land.

All the drawings should have north direction marked in it along with prevailing wind direction. Necessary dimensions and specifications should be provided where ever necessary. The construction camp management plan should be submitted to the CSC for a written approval before any physical work (includes storage of materials, equipment etc.) is undertaken on a particular site. The CSC shall carefully examine the proposals considering the specific conditions of each site as well as various EMP and regulatory provisions and provide suggestions, as necessary to the Contractor who shall incorporate it in the management plan.

Contractor needs to prepare this document for each different site identified and CSC shall undertake a thorough analysis of the said management and redevelopment plan through a site investigation and suggest additional mitigation measures depending on the site and as demanded by the features of the specific site.

H. DE-MOBILIZATION AND RE-DEVELOPMENT OF THE SITE

The Contractor should clear all temporary structures; dispose all building debris, garbage, night soils and POL waste as per the approved debris management plan. All disposal pits or trenches should be filled in, disinfected and effectively sealed off. All the areas within the camp site should be leveled and spread over with stored top soil. Residual topsoil, if any will be distributed or spread evenly in plantation sites, on adjoining/near-by barren land or affected agricultural land adjacent to the RoW that has been impacted on account of any accidental spillage. Entire camp area should be left clean and tidy, in a manner keeping the adjacent lands neat and clear, at the Contractor's expense, to the entire satisfaction of landowner and CSC.

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

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

CSC shall ensure, through site verification that all clean-up and restoration operations are completed satisfactorily and a written approval should be given to the Contractor mentioning the same before the 'works completion' certificate is issued/recommended. The PIU shall ensure through site inspection that the Contractor and CSC have complied with all these provisions. The site can then be handed over to the concerned owner or local bodies or for local communities as the case may be.

Certification/documentation pertaining to approval for clean-up and restoration operations and thereafter handing-over to the owner shall be properly maintained by the Contractor, Supervision Consultant and PIU

ANNEXURE 3. 2: GUIDELINES FOR SITING, MANAGEMENT AND REDEVELOPMENT OF LABOUR CAMPS

A. OVERVIEW

Staff-quarters include accommodation for Engineers / Supervisors and labour camp include accommodation for workers / labourers along with other basic amenities such as kitchen, potable water supply, sanitation (toilets, bathrooms, washing areas and water supply for such needs), first aid room as well as garbage collection and disposal facility. Staff quarters shall be provided with additional facilities of drawing room. The guidelines outlined here aims to facilitate the Contractor in implementing the measures in the EMP there by reducing the impact on the environment.

B. CRITERIA FOR LOCATING THE SITE/S

Following criteria should be followed in the siting of labour camps:

- To the extent possible, agricultural lands and fertile lands shall be avoided[1].
- Not within 500m of ecologically sensitive areas like wild life, sanctuary, mangroves, forest etc.
- Not to be located in CRZ area.

C. FINALIZATION OF SELECTED SITE/S

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

D. DESIGNING AND SETTING UP OF LABOUR CAMP

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

Site preparation: The site should be graded and rendered free from depressions such that the water does not get stagnant anywhere. Fencing should be constructed all around the camp to prevent the trespassing of humans and animals. Green belt should be provided along the boundary and as detailed in the EMP, it should be integrated with storm water drain and sedimentation trenches as given in annexure in EMAP. No. of trees planted should not be less than three times the number of trees cut. The approved layout plan should be strictly adhered to while setting up the camp.

Accommodation: Contractor will follow all relevant provisions of the Factories Act, 1948 and the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labour camp. The height of the worker's and labour accommodation shall not be less than 3mt. from floor level to the lowest part of the roof. The

[1] In the absence of site meeting the stipulated criteria, an alternate site can be selected specifying the reasons. In such a case, the construction camp management plan should incorporate additional measures specific to the site as suggested by the CSC.

camps shall be floored with concrete, shall be kept clean, with proper cross ventilation, and the space provided shall be on the basis of one sq.mt per head or as per the relevant regulation, whichever is higher. Fire and electrical safety pre-cautions shall be adhered to. Cooking, sanitation and washing areas shall be provided separately. The Contractor will maintain necessary living accommodation and ancillary facilities (including provision of clean fuel to prevent damage to forests and to prevent fuel wood cutting and burning by labour) in functional and hygienic manner.

The site must be graded and rendered free from depressions such that water does not get stagnant anywhere. The entire boundary of the site should be fenced all around with barbed wire so as to prevent the trespassing of humans and animals. Green belt should be provided along the boundary and it should be integrated with storm water drain and sedimentation trenches to reduce the surface run off as per clauses in EMAP. No. of trees planted should not be less than three times the number of trees cut.

Drinking Water: The Contractor should provide potable water within the precincts of every workplace in a cool and shaded area, which is easily accessible as per standards set by the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996. All potable water storage facilities will be on a safely raised platform that is at least 1m above the surrounding ground level. Such facilities shall be regularly maintained from health and hygiene point of view. If necessary water purifier units shall be installed for providing potable water.

As far as possible shallow wells should not be used as potable source of water. However, if water is drawn from any existing well, irrespective of its location from any polluting sources, regular disinfection of the water source (which may include application of lime, bleaching power and potassium permanganate solution) has to be ensured at weekly/fort nightly interval. All open wells will be entirely covered and will be provided with a trap door to prevent accidental fall and contamination from dust, litter etc. The trap door will be kept locked and opened only for cleaning or inspection, which will be done at least once in a month. A reliable pump will be fitted to each covered well. A drain shall be constructed around the well to prevent flow of contaminated water into the well from road, camp or other sources. Water quality testing of all potable water sources will be done every six months as per parameters prescribed in IS 10500:2012

Sanitation Facilities: Adequate no. of toilets shall be provided separately for males and females (depending on their strength), screened from those of men and provided with markings in vernacular language. All such facilities must have adequate water supply with proper drainage and disposal facility. They shall be maintained, cleaned and disinfected daily using proper disinfectants. Location and design of soak pit should be in such a way that it doesn't pollute the ground water. Drains and ditches should be treated with bleaching powder on a regular basis. The sewage system for the camp must be properly designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place.

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

Waste Disposal: The Contractor should provide garbage bins in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner. No incineration or burning of wastes shall be carried out by the Contractor. Separate bins shall be provided for biodegradable, non-biodegradable and domestic hazardous wastes. The disposal of kitchen waste and other biodegradable matter shall be carried out in pits covered with a layer of earth within the camp

site. The Contractor may use the compost from such wastes as manure in the plantation sites. Discarded plastic bags, paper and paper products, bottles, packaging material, gunny bags, hessian, metal containers, strips and scraps of metal, PVC pipe scrubber and poly urethane foam, auto mobile spares, tubes, tires, belts, filters, waste oil, drums and other such materials shall be either reused or sold /given out for recycling.

Day Crèche Facility: At every construction site, provision of a day crèche shall be made so as to enable women to leave behind their children while going to work. At least one attendant shall be provided to take care of the children at the crèche. At construction sites where 20 or more women are employed, there shall be at least one shelter for use of children under the age of 6 years belonging to such women.

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

Communicable Diseases

Communicable diseases pose a significant public health threat worldwide. Health hazards typically associated with large development projects are those relating to poor sanitation and living conditions, sexual transmission and vector-borne infections. Communicable diseases of most concern during the construction phase due to labor mobility are sexually-transmitted diseases (STDs), such as HIV/AIDS. Recognizing that no single measure is likely to be effective in the long term, successful initiatives typically involve a combination of behavioral and environmental modifications.

Recommended interventions at the project level include:

- Providing surveillance and active screening and treatment of workers
- Preventing illness among workers in local communities by:
    - Undertaking health awareness and education initiatives, for example, by implementing an information strategy to reinforce person-to-person counseling addressing systemic factors that can influence individual behavior as well as promoting individual protection, and protecting others from infection, by encouraging condom use
    - Training health workers in disease treatment
    - Conducting immunization programs for workers in local communities to improve health and guard against infection
    - Providing health services
- Providing treatment through standard case management in on-site or community health care facilities. Ensuring ready access to medical treatment, confidentiality and appropriate care, particularly with respect to migrant workers
- Promoting collaboration with local authorities to enhance access of workers families and the community to public health services and promote immunization

(i) Mess and Kitchen Facilities: The Contractor shall adhere to the sanitary/hygiene

requirements of local medical, health and municipal authorities at all times. Adopt such precautions as may be necessary to prevent soil and water pollution at the site while operating mess or kitchen facilities.

First aid facilities: At every workplace, a readily available first-aid unit including an adequate supply of sterilized dressing materials and appliances should be provided. Workplaces remote and far away from regular hospitals should have indoor health units with one bed for every 250 workers. Suitable transport should be provided to facilitate taking injured and ill persons to the nearest hospital. Adequate personal protective equipments and fire fighting equipments as detailed out in EMP should be made available in the camp and provided to the staff / workers.

Health Care Facilities: Health problems of the workers should be taken care of by providing basic health care facilities. If there is no hospital or clinic, which can be accessed in half an hour's time, then a temporary health center should be set up for the construction camp. The health centre should have at least a doctor and a nurse, duty staff, medicines and minimum medical facilities to tackle first aid requirements or minor accidental cases, linkage with nearest higher order hospital to refer patients of major illnesses or critical cases.

The health centre should have MCW (Mother and Child Welfare) units for treating mothers and children in the camp. Apart from this, the health centre should be provided with regular vaccinations required for children. The health centre should carryout quarterly awareness programme of HIV – AIDS with the help of AIDS control society as well as about community living and hygiene practices in day to day living. Posters should be exhibited in the health care clinic.

E. OPERATION OF LABOUR CAMP

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

F. PREPARATION OF LABOUR CAMP MANAGEMENT AND RE-DEVELOPMENT PLAN

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

Section–1: Details of site: Copy of approved site identification report along with location plan on a village map or an FMB, showing the site, its survey no., access road, project stretch, distance form the project stretch, surrounding features and land use like residences, agricultural land, water bodies etc., photograph of the site showing the topography and other existing features.

Section-2: Site preparation: Activities that should be undertaken for preparing the site based on EMP and this guideline.

Section-3: Arrangements/ facilities within the camp: List of facilities to be provided along with its details like area, no of people to be accommodated and a layout plan showing the plan of the site with all the facilities planned like quarters, labour camps, mess, common facilities, toilet facilities and the vehicular and pedestrian movement paths.

Section-4: Mitigation measures that should be undertaken as per the EMP and this guideline while

setting up of the camp and operation of the camp should be separately listed out here.

Sectoin-5: Other details: Any other relevant detail like list of awareness camps to be provided to workers, details of information dissemination etc. should be included.

Section 6: Re-development plan: which should indicate following points: (i) List of structures to be demolished and list of the clean up activities that needs to be undertaken, (ii) Proposed use of the land in the post construction phase, if it is a public property, (iii) Presence of existing facilities that could be put in use by the land owner if it is a leased out private land or by the community in case of a public property.

Section-7: Annexure-(a) Working drawings: Electrical plan showing the electrical network planned for the site, location of generators, master switch boards etc. and plumbing drawing showing the network of water supply lines, water tank, drainage facilities etc. (b) Copy of permissions obtained from local governing body / community etc. as applicable, (c) Copy of agreement entered with site owner, in case of leased out sites.

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

Contractor needs to prepare this document for each different site identified and CSC shall undertake a thorough analysis of the said management and redevelopment plan through a site investigation and suggest additional mitigation measures depending on the site and as demanded by the features of the specific site.

G. RE DEVELOPMENT OF THE LABOUR CAMP

The Contractor should clear all temporary structures; dispose all building debris, garbage, night soils and any other waste as per the approved debris management plan. All disposal pits or trenches should be filled in, disinfected and effectively sealed off. Residual topsoil, if any will be distributed or spread evenly in plantation sites, on adjoining/near-by barren land or affected agricultural land adjacent to the RoW that has been impacted on account of any accidental spillage. Entire camp area should be left clean and tidy, in a manner keeping the adjacent lands neat and clear, at the Contractor's expense, to the entire satisfaction of landowner and the CSC.

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

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

CSC shall ensure, through site verification that all clean-up and restoration operations are completed satisfactorily and a written approval should be given to the Contractor mentioning the same before the 'works completion' certificate is issued/recommended. The PIU shall ensure

through site inspection that the Contractor and CSC have complied with all these provisions. The site can then be handed over to the concerned owner or local bodies or for local communities as the case may be.

Certification/documentation pertaining to approval for clean-up and restoration operations and thereafter handing-over to the owner shall be properly maintained by the Contractor, Supervision Consultant and PIU.

ANNEXURE 3.3: GUIDELINES FOR SITING, MANAGEMENT AND REDEVELOPMENT OF QUARRY AND STONE CRUSHER

A. OVERVIEW

A quarry is a type of open-pit mine from which rock or minerals are extracted for building materials, such as dimension stone, construction aggregate, riprap, sand, and gravel. Quarrying causes lot of environmental damages like air and noise pollution, water logging etc. and requires permission from regulatory authorities like mining department. It requires a careful approach in the site selection process, scientific method of quarrying and appropriate measures to redevelop it.

B. CRITERIA FOR LOCATING THE SITE/S

The selection of a quarry is sole responsibility of the Contractor and should be undertaken in adherence to the rules & regulations of the authorities. Following criteria should be followed while selecting a quarry site:

- To the extent possible barren land or waste lands shall be preferred during site selection and fertile land and agricultural land shall be avoided.
- There shall be no quarrying of sand in any river bed or adjoining area or any other area which is located within 500 meters 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 any area identified for locating water supply schemes by any of the Government Department or other bodies.
- Quarry site shall be located at a minimum distance of: 500 m from any human settlements, public road, railway line, national highway, state highway or major district road.
- Stone quarry shall be located at a minimum distance of 50 m from any water body.
- Locate the quarry and crusher at a min. distance of 500 m. away from forests / wildlife habitats / mangroves / ecologically sensitive areas.
- The minimum distance between two stone crushers should be 1 km to avoid dust pollution influence of one over the other.
- Stone crushing unit should be distanced for 500 m from the NH or SH or residential area or places of public and religious interests.
- Access roads to quarry sites must be wide enough for heavy vehicle movement without inconvenience to local traffic.

After identification of the site, Contractor should fill up the prescribed reporting format and submit the same for approval to the CSC without which any activity shouldn't be started on the site.

C. FINALIZATION OF SELECTED SITE/S

After identification of the site, the Contractor should fill up the prescribed reporting format provided in EMAP and submit the same for approval to the CSC. The selected site/s shall be approved by Environmental Officer of CSC, after considering the compliance with the EMP clauses. No agreements or payments shall be made to the land owner/s (in case of a leased or rented out land) prior to receipt of a written approval from the CSC. Any consequence of rejection prior to the approval shall be the responsibility of the Contractor and shall be made good at his own cost. After obtaining a written approval from the CSC for the selected site, the Contractor has to enter into an agreement with the land owner to obtain his/her consent before commencing any operation /

activities in the land. The agreement should also mention its type, duration, amount and mode of payment as well as the preferences of the owner regarding site maintenance and redevelopment.

D. SETTING UP OF QUARRYING AND STONE CRUSHER

Quarrying involves not only extraction of material (rock) but also crushing and screening that makes the rock suitable for use as construction material. Following are the major parameters to be considered before the start of quarrying and stone crushing operations:

Site preparation: The stripping, stacking and preservation of top soil will be mandatory and absolutely no activity should be allowed prior to the satisfactory completion of this conservation measure as per guidelines in EMAP. The boundary of the quarry should be demarcated using barbed wire fencing in order to avoid the future dispute over land as well as to avoid accidental trespassing of people. There should be recorded documents of exact no of trees cut. Green belt should be provided all along the quarry site to function as both noise attenuators and dust collectors and number of trees planted should not be less than three times the number of trees cut. Contour trenches should be dug along the borrow area boundary and at any other appropriate places considering the topography to reduce the surface run off and conserve soil and water. Side slopes shall be constructed with slope drains at applicable locations, to provide drainage and avoid any landslides. All the drainage constructed should be linked to existing drainages in order to avoid flooding and water logging.

Setting up of a quarry site: The layout of a quarry should provide a gravity flow of material from the face to the crusher, from the crusher to the storage bin and from the bin to the hauling equipment. Adequate arrangements should be made for avoiding fugitive emissions from quarry and crusher premises. This will include (i) housing the noise and dust producing units of the crusher unit in a building with wall of minimum 23 cm thickness and with suitable roofing, (ii) control of air pollution through provision of in-built dust extraction systems in the crusher unit and all transfer points, (iii) a chimney of appropriate height for the DG set (as specified by SPCB), (iv) water sprinkling facilities for the camp premises, (v) facilities to store water required for 3 days use.

Consent to operate the crusher unit should be obtained from SPCB under Air (Prevention and Control of Pollution) Act, 1981 before starting the operation.

Safety aspects: Blasting timings in quarry should be fixed avoiding the rush hours and these timings should be adhered to in order to avoid the conflict between the surrounding communities or population. Provide warning sirens 10 before each explosion as a warning alarm to people in and outside the quarry. Damaged explosives must be disposed off in a safe manner away from the operational area. Speed of the vehicles around the quarry should be restricted to a low speed in order to reduce the noise pollution and dust generation. Workers should not be exposed to sound of more than 85 – 90 DB for more than eight hours a day and shall be provided with adequate safety wears and personal protective equipments like ear muffs / plugs etc. as detailed out in EMP. Fire extinguishers should be provided in the site office.

Traffic movements should be restricted along the access road around times that children walk to and from school. Proper first aid facilities should be provided within the site office and in case of an accident, quick access to nearby hospital /clinic should be provided.

Facilities for workers: Potable drinking water should be provided in the site office in a hygienic environment sufficient for all the people. Adequate no. of toilets shall be provided for the workers with adequate water supply, proper drainage and effluent treatment system like septic tank with soak pit. Soak pit should have a sealed bottom, honey comb wall and 75 cm. thick, 2mm sand envelope around that. The sewage system for the camp must be properly sited, designed, built and operated

so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place.

Waste Disposal: The Contractor should provide separate garbage bins for biodegradable, non-biodegradable and hazardous wastes in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner. No incineration or burning of wastes shall be carried out by the Contractor. The disposal of any biodegradable matter shall be carried out in pits covered with a layer of earth within the camp site. Discarded plastic bags, paper and paper products, bottles, packaging material, gunny bags, hessian, metal containers, strips and scraps of metal, PVC pipe scrubber and poly urethane foam, auto mobile spares, tubes, tires, belts, filters, waste oil, drums and other such materials shall be either reused or sold /given out for recycling. POL (petroleum, oil and lubricants) waste shall be disposed off by transfer only to recycler/ re-refiners possessing valid authorization from the State Pollution Control Board and valid registration from the Central Pollution Control Board. Used lead batteries, if any, should be disposed as per the Batteries (Management and Handling) Rules 2001.

Quarry areas should be protected from illegal dumping of waste by third parties. The overburden should be kept as minimum to maximize the commercial efficiency of the quarry, it can be utilized for creating earth bunds to mitigate the noise and visual impacts and also for the site rehabilitation process. No quarry waste shall be dumped within a 100 m on either side of the road. The overburden should be reused or disposed properly. Site for overburden disposal should be planned within the quarry site or any other appropriate site.

Training to workers: Workers shall be trained in smooth and safe operation of plants and equipments, their regular maintenance and various safety measures to be followed as well as about the need and importance for adherence to these measures. All the drivers should be trained about safe driving and should be made aware about the need to observe caution while plying through access roads, especially during the time when children walk to and from school. Conduct education programs with the locals regarding the potential impacts of blasting, blasting warning systems, schedules etc.

Information dissemination: There should be a sign board of size 6’ x 4’ mentioning the project details and Contractor’s details to disseminate the information to the public. There should be a second sign board displaying the latest air and noise monitoring date and data against the standards specified. Warning sign boards should be set up at the entrance gate for the public as well as at other required places for the workers to alert them about the nature of operation being undertaken.

Other mitigation measures: The quarry should not damage any building, work, property or rights of other persons. The quarry should not alter any right of way, well or tank. Roads inside the crusher premises should be tarred or concreted. Water course, if any, from a higher slope should be properly drained out. Strom water drainage shall be provided to prevent water logging and flooding in and around the area. The possibility of collecting the storm water in a pit or a tank should be explored so that it can be reused for dust suppression and the dependence on other water sources could be reduced. If this is not possible, the water should be safely channeled out of the quarry without disturbing any nearby human settlement. A register should be provided in the camp site for public to record their grievances if any. Environmental monitoring should be conducted as per suggested frequency.

The concerned authority – CSC/ PIU should regularly review the environmental, health and safety aspects. If any adverse effect on environment, habitat and concern of safety is noticed, appropriate measures should be taken as suggested by CSC or should arrange an alternative for

road construction materials. In the case of existing quarries and additional quarries, the Contractor has to ensure that all actions in these quarries are in compliance with EMP.

E. OPERATION OF QUARRY SITE AND STONE CRUSHING UNIT

No quarrying operation shall be done without the approval from the concerned authority. The equipment used in quarry should be wear faced, which extends the equipment life and reduce the demand for spare parts. Adopt controlled blasting techniques and conduct quarrying in a skillful, scientific and systematic manner. All units should operate only between 6 am and 10 pm. or as specified by SPCB in the consent letter.

Accessory facilities to be provided in the quarry includes sprinklers to spray water for dousing the dust generation, noise suppressers and rubberized mounting to reduce noise and vibration and tarpaulins or covers over material transporting vehicles. Provide sufficient water storage facility for 2 days' use. Measures have to be taken to reduce the dust generation during drilling operation. Deep wetting of drilling zones also to be done by water sprinkling and drilling machine shall be fitted with dust suppression, collection and disposal arrangements. In case of blasting, the storage and the operation should be as per the regulations. To avoid spillage of fuel and lubricants, the vehicles and equipment should be properly maintained and repaired. Maintenance should be carried out on impervious platforms with spill collection provisions.

Following conditions regarding sound generation should be complied with in a quarry / crusher unit:

- The sound level (Leq) measured at a distance of 1 m from the boundary of the site shall not exceed 55 dB(A) during day time (6am - 6pm) and 45 dB(A) during night time (6 pm - 6am).
- The DG set shall be provided with exhaust muffler /acoustic enclosure/acoustic treatment with an insertion loss of minimum 25 dB(A) and its emission levels should be within relevant SPCB guidelines.
- A proper, routine and preventive maintenance procedure for the DG set shall be set and followed in consultation with the DG set manufacturer.

F. PREPARATION OF QUARRY MANAGEMENT AND REDEVELOPMENT PLAN

The Contractor after getting approval from the competitive authority for the selected site should submit a detailed Quarry Management Plan comprising the following details:

Section–1: Details of site: Copy of approved site identification report along with location plan on a village map or an FMB, showing the site, its survey no., access road, project stretch, distance form the project stretch, surrounding features and land use like residences, agricultural land, water bodies etc., photograph of the site showing the topography and other existing features.

Section-2: Site preparation: Activities that should be undertaken for preparing the site based on EMP and this guideline.

Section-3: Arrangements/ facilities within the camp: List of facilities to be set up within the site like site office, store room, rest room, sanitation facilities etc. and a layout plan showing all these details along with vehicular movement path, green belt, locations were digging of contour trenches should be undertaken etc.

Section-4: Mitigation measures that will be undertaken as per the EMP and this guideline while setting up of the camp and operation of the camp should be separately listed out.

Sectoin-5: Other details: Any other relevant detail like list of awareness camps to be provided to workers, details of information dissemination etc. date of quarry licence obtained from Dept of Mines,

its validity, additional conditions laid down in it etc. should be included in the quarry management plan. Species wise no. of trees to be cut and the details of top soil to be removed and conserved like quantity, location of storing etc. shall also be provided.

Section 6: Re-development plan: which should indicate following points: (i) List of structures to be demolished and list of the clean up activities that needs to be undertaken, (ii) Proposed use of the land in the post construction phase, if it is a public property, (iii) Presence of existing facilities that could be put in use by the land owner if it is a leased out private land or by the community in case of a public property.

Section-7: Annexure-(a) Working drawings: Electrical plan showing the electrical network planned for the site, location of generators, master switch boards etc. (b) Copy of permissions obtained from local governing body / community etc. as applicable, (c) Copy of agreement entered with site owner, in case of leased out sites.

All the drawings should have north direction marked in it along with prevailing wind direction. Necessary dimensions and specifications should be provided where ever necessary. The quarry and crusher unit management plan should be submitted to the CSC for a written approval before any physical work (includes storage of materials, equipment etc.) is undertaken on a particular site. The CSC will carefully examine the proposals in light of the various EMP and regulatory provisions and provide suggestions, as necessary to the Contractor who will implement it within the stipulated time period.

Contractor needs to prepare this document for each different site identified and CSC shall undertake a thorough analysis of the said management and redevelopment plan through a site investigation and suggest additional mitigation measures depending on the site and as demanded by the features of the specific site.

G. REDEVELOPMENT OF QUARRY AREA

The main objective of the redevelopment of quarries is to make the area a safe and secure place and adapt it to a suitable land use like leisure place or fishing place etc. which is suitable for the physical environment as well as for the community around. Along with the preparation of quarry and crusher management plan the Contractor should also prepare a re-development plan, which will be submitted for approval to CSC who in turn will be responsible for approving and monitoring these plans. The redevelopment plan should indicate following points:

- List of structures to be demolished and list of the clean up activities that needs to be undertaken.
- Presence of existing facilities that could be put in use by the land owner if it is a leased out private land or community in case of a public property.
- The proposed use of the quarry site with a layout plan showing the proposed facilities / improvement measures, list of local plant species that could be planted etc.
- Photographs of the site before, during and after the quarrying process.
- Possible re-development options include the following:
- Re-vegetation of the quarry to merge with surrounding landscape with reuse of top soil mixed together with farm yard manure.
- Development of exhausted quarries as water bodies, where the quarry pit is developed into pond or a rainwater harvesting structure.
- Pits created as a result of blasting could be filled with over burden which are removed and

stockpiled in other areas or with construction debris. Top soil should be spread back and trees should be planted along the boundary.

Tree plantation where ever possible depending on the proposed use, erosion control measures etc should be taken up as part of the redevelopment plan.

The Contractor should clear all temporary structures; dispose all debris, garbage, night soils and any other waste as per the approved debris management plan. All disposal pits or trenches should be filled in, disinfected and effectively sealed off. Residual topsoil, if any will be distributed or spread evenly in plantation sites, on adjoining/near-by barren land or affected agricultural land adjacent to the RoW that has been impacted on account of any accidental spillage. Entire camp area should be left clean and tidy, in a manner keeping the adjacent lands neat and clear, at the Contractor's expense, to the entire satisfaction of land owner and the CSC.

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

- Copy of approved site identification report
- Photographs of the concerned site 'before' and 'after' setting up the camp.
- Certificate from the owner stating his/her satisfaction about status of re-development of the site, this is applicable only in the case of a site to be returned to the owner.

CSC shall ensure, through site verification that all clean-up and restoration operations are completed satisfactorily and a written approval should be given to the Contractor mentioning the same before the 'works completion' certificate is issued/recommended. The PIU shall ensure through site inspection that the Contractor and CSC have complied with all these provisions. The site can then be handed over to the concerned owner or local bodies or for local communities as the case may be.

Certification/documentation pertaining to approval for clean-up and restoration operations and thereafter handing-over to the owner shall be properly maintained by the Contractor, Supervision Consultant and PIU.

ANNEXURE 3.4: GUIDELINES FOR SITING, MANAGEMENT AND REDEVELOPMENT OF BORROW AREAS

A. BORROW AREA SELECTION

A borrow describes an area where material (usually soil or sand) has been dug for use at another location, for example, soil might be excavated to fill an embankment for a highway. In some cases, the borrow pits may become filled with ground water posing a danger to the surrounding community. If properly redeveloped, it can be turned into recreational areas or sustainable wildlife habitats. In other cases, borrow pits may be used for landfill and waste disposal also.

B. CRITERIA FOR SITE SELECTION

The contractor in addition to the established practices, rules and regulation shall also use the following criteria before finalizing the locations of borrow areas:

- The borrow area should not be located in agriculture areas especially in paddy fields unless unavoidable i.e. barren land is not available. In case borrowing needs to be done on an agricultural land, top-soil stripping, stacking and preservation is a must.
- Borrow pits shall not be located within a distance of 100 mts. from any NH, SH or other roads.
- Site shall be located 30m away from toe of the embankment along road side.
- Site should be located not less than 30m from the toe of the bank along the river side or irrigation tank bund.
- Borrow area shall be located at a minimum distance of 30m from the toe of the irrigation tank bund.
- Borrow site shall be located at a minimum distance of 500 m in down-wind direction of villages and settlements.
- No borrow pits shall be located within 250 m. from schools, colleges, playgrounds, religious structures and health centers.
- No borrow area shall be opened within 500 m. from a reserved or protected forest area/sites, wildlife movement zone and cultural heritage site.
- Loss of vegetation shall be almost nil or minimum.
- Borrow area near any surface water body will be at least 100mts. away from the toe of the bank or high flood level, whichever is maximum. After identification of borrow area location/s, the Contractor will fill the prescribed reporting format and submit the same for approval to the “Site Engineer” at least 7 working days before commencement of earth works. A written approval from SC shall be necessary before any activity/work is commenced.
- Borrow pit location shall be located at least 0.8 km from villages and settlements. If unavoidable, they should not be dug for more than 30 cm and should be drained.

C. FINALIZATION OF THE SELECTED AREA

After identification of the site, the Contractor should fill up the prescribed reporting format provided in EMAP and submit the same for approval to the CSC. The selected site/s shall be approved by Environmental Officer of CSC, after considering the compliance with the EMP clauses. No agreements or payments shall be made to the land owner/s (in case of a leased or rented out land)

prior to receipt of a written approval from the CSC. Any consequence of rejection prior to the approval shall be the responsibility of the Contractor and shall be made good at his own cost. After obtaining a written approval from the CSC for the selected site, the Contractor has to enter into an agreement with the land owner to obtain his/her consent before commencing any operation / activities in the land. The agreement should also mention its type, duration, amount and mode of payment as well as the preferences of the owner regarding site maintenance and redevelopment.

D. BORROW AREA MANAGEMENT

- Before the start of operations, the area to be borrowed shall be marked by the contractor with wooden or stone pegs to ensure that the land required for slope stabilization or bund creation is maintained. Supervision Consultant has to ensure that this marking is done on the ground to avoid issues at a later date. Any disregard of this condition shall be made good at the contractor's and/or consultant's own expense.
- After receiving the approval, the contractor will begin operations keeping in mind the following points.
- Top soil conservation is to be undertaken only if its reuse is envisaged for the proposed activity in the borrow area rehabilitation. Top soil that cannot be re-used in rehabilitation of borrow areas shall be used in the plantation belt/zone along the road.
- Damage to productive and fertile areas has to be minimum. This includes appropriate planning of haul roads.
- No excavated acceptable material other than surplus to requirements of the Contract shall be removed from the site. Contractor should be permitted to remove acceptable material form the site to suit his operational procedure, and then be shall make good any consequent deficit of material arising there from.
- Where the excavation reveals a combination of acceptable and un-acceptable materials, the Contractor shall, unless otherwise agreed by the Engineer, carryout the excavation in such a manner that the acceptable materials are excavated separately for use in the permanent works without contamination by the un-acceptable materials. The acceptable material shall be stockpiled separately.
- The Contractor shall ensure that he does not adversely affect the stability of excavation or fills by the methods of stockpiling materials, use of plants or siting of temporary buildings or structures.
- The following principles shall be adhered to during borrow area operations:
- A 15 cm topsoil layer will be stripped off from the borrow pit and this will be preserved in stockpiles in a designated area with a height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Borrowing of earth will be allowed up to a depth of 1.5 mtr from the existing ground level only.
- Ridges of not less than 8m width will be left at intervals not exceeding 300m.Small drains will be cut through the ridges, if necessary, to facilitate drainage.
- The slope of the edges will be maintained not steeper than 1:4 (vertical: Horizontal).
- Rehabilitation shall be satisfactorily undertaken immediately after the use has ceased and at least three weeks prior to monsoon.
- If the rehabilitation plan envisages re-use of top soil, then preserved top soil has to be spread uniformly over the land used as a borrow area.

- Bunds and temporary fencing (using barbed wire) along with plantation should be provided in case the borrow area is developed as a pond to ensure safety of the residents and the cattle. However, the depth shall not exceed 1.5 m.

E. PREPARATION OF BORROW AREA MANAGEMENT AND REDEVELOPMENT PLAN

The Contractor after getting approval from the competitive authority for the selected site should submit a detailed Borrow Area Management and Redevelopment Plan comprising the following details:

Section–1: Details of site: Copy of approved site identification report along with location plan on a village map or an FMB, showing the site, its survey no., access road, project stretch, distance from the project stretch, surrounding features and land use like residences, agricultural land, water bodies etc., photograph of the site showing the topography and other existing features.

Section-2: Site preparation: Activities that should be undertaken for preparing the site based on EMP and this guideline.

Section-3: Layout plan: A layout plan showing all these details along with vehicular movement path, green belt, locations where digging of contour trenches should be undertaken etc.

Section-4: Mitigation measures that will be undertaken as per the EMP and this guideline while setting up of the camp and operation of the camp should be separately listed out.

Sectoin-5: Other details: Any other relevant detail like list of awareness camps to be provided to workers, details of information dissemination etc. date of quarry licence obtained from Dept. of Mines, its validity, additional conditions laid down in it etc. should be included in the quarry management plan. Species wise no. of trees to be cut and the details of top soil to be removed and conserved like quantity, location of storing etc. shall also be provided.

Section 6: Re-development plan: which should indicate following points: (i)proposed use of the land in the post construction phase, (ii) preferences of land owner with respect to redevelopment, (iii) Presence of existing facilities that could be put in use by the land owner if it is a leased out private land or by the community in case of a public property, (iv) Extent of community involvement.

Section-7: Annexure-(a) Copy of permissions obtained from local governing body / community etc. as applicable, **(b) Copy of agreement entered with site owner**, in case of leased out sites.

All the drawings should have north direction marked in it along with prevailing wind direction. Necessary dimensions and specifications should be provided where ever necessary. The management plan should be submitted to the CSC for a written approval before any physical work (includes storage of materials, equipment etc.) is undertaken on a particular site. The CSC will carefully examine the proposals in light of the various EMP and regulatory provisions and provide suggestions, as necessary to the contractor who will implement it within the stipulated time period.

Contractor needs to prepare this document for each different site identified and CSC shall undertake a thorough analysis of the said management and redevelopment plan through a site investigation and suggest additional mitigation measures as demanded by the features of the specific site and its surroundings.

F. REHABILITATION OR RE-DEVELOPMENT OF BORROW AREAS

The objective of the borrow area rehabilitation is to return the borrowing sites to a safe and environmentally sound condition. The concept entails enhancing benefits (including those linked to livelihood) for the community and individuals. Top soil preservation (and its re-use) and proper stabilization of slopes are the fundamental requirements of the rehabilitation process. Re-development plan shall be prepared and submitted along with reporting format by the

contractor before the borrowing operation is permitted by the CSC. The redevelopment is to be prepared in consultation with land owner/s (whether public, private or institutional) and by within the environmental and safety requirements of the EMP. Some key points on borrow area rehabilitation are presented in the table provided below. However, the contractor is free to prepare other rehabilitation scheme/s subject to the approval by the Environmental Officer of the Supervision Consultant

Type/Form of Rehabilitation	Re-Use of Top Soil	Actions Required for Rehabilitation
Farm land	Yes	Leveling Slope Stabilization along the edges if there is a level difference
Ponds including creation of new ones and enhancing capacity of existing ones (for irrigation; pissiculture and general uses by people and/or cattle)	No	Slope Stabilization (angle/ benching) Access / Approach Ramp Bund creation and Temporary Fencing Plantation in the periphery
Water recharging areas/percolation tanks (depth up to one meter)	No	Slope Stabilization Small bund creation
Leveled lands that can be developed later for various uses (such as residential areas, parking lots, community grounds etc.)	Generally No	Leveling Top soil re-use depends on the type of developmental work envisaged
Construction waste disposal sites (for non-toxic/non-hazardous wastes) (reinstated with top-soil with plantation over the rehabilitated site)	No	Depression after filling-in of wastes to be leveled-up Top soil re-use depends on the type of developmental work envisaged
Plantation Zones	Yes	Leveling Selection of Species as per OSRP Project Guidelines
Water holes for animals and birds (outside forest and protected areas)	No	Gentle Slopes on all sides Plantation in the periphery Depth upto 1.5 m.

Rehabilitation works shall be undertaken immediately upon the exhaustion of the approved quantity and shall not be delayed. The Supervision Consultant shall take appropriate action in case delays are observed.

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

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

CSC shall ensure, through site verification that all clean-up and restoration operations are completed satisfactorily and a written approval should be given to the Contractor mentioning the same before the ‘works completion’ certificate is issued/recommended. The PIU shall ensure

through site inspection that the Contractor and CSC have complied with all these provisions. The site can then be handed over to the concerned owner or local bodies or for local communities as the case may be.

Certification/documentation pertaining to approval for clean-up and restoration operations and thereafter handing-over to the owner shall be properly maintained by the Contractor, Supervision Consultant and PIU.

ANNEXURE 3. 5: GUIDELINES FOR SITING AND MANAGEMENT OF DEBRIS DISPOSAL SITE

A. OVERVIEW

Construction of highways generates huge quantity of building debris, which needs to be disposed off in previously identified sites suitable for such an activity. This process entails close scrutiny of the sites with respect to their location and this section details out the criteria to be followed in doing so. Moreover, it also guides the Contractor as to how to prepare the site without causing much impact on the surrounding environment.

B. CRITERIA FOR LOCATING THE SITE/S

The locations of waste disposal have to be selected such that:

- The said site shall be selected preferably from barren, infertile lands. In case agricultural land needs to be selected, top-soil stripping, stacking and preservation should be undertaken prior to initiation of any activities.
- Debris disposal site shall be at least 200 m away from surface water bodies[2].
- No residential areas shall be located within 100 m downwind side of the site.
- The site is minimum 250 m. away from sensitive locations like settlements, ponds/lakes or other water bodies, wetlands, protected areas, forests, wildlife habitats / Mangroves / Ecologically sensitive areas, seasonal streams, rivers, canals, flood plains, educational institutions, medical centers, religious sites, cultural or heritage sites and play grounds.
- The local governing body and community shall be consulted while selecting the site.
- The selected site shall meet with the local regulatory requirements (including those of SPCB, Municipalities etc.).
- The site shall preferably be owned by government so that there is no need to acquire the land for the same.

  After identification of the site the Contractor should fill up the prescribed reporting format and submit the same for approval to the CSC. Any activity on the site can be initiated only after obtaining permission form the CSC.

C. FINALIZATION OF SELECTED SITE/S

The selected site/s shall be approved by CSC and PIU, after considering compliance with the EMP clauses and this guideline. No agreements or payments shall be made to the land owner/s prior to receipt of a written approval from the CSC and PIU. Any consequence of rejection prior to the approval shall be the responsibility of the Contractor and shall be made good at his own cost.

D. SETTING UP OF DEBRIS DISPOSAL SITE

Following steps has to be undertaken while setting up a debris disposal site:

- Top soil conservation has to be undertaken as per the guidelines given in EMP.

[2] In the absence of site meeting the stipulated criteria, an alternate site can be selected specifying the reasons. In such a case, the construction camp management plan should incorporate additional measures specific to the site as suggested by the CSC

- Considering the topography of the site contour trenches as detailed in EMP should be made along the site boundary to prevent soil erosion.
- Fencing should be provided for the debris disposal site to prevent trespassing of humans and animals into the area as well as to prevent spread of the waste material through action of wind, water, scavengers or rag pickers.
- No of trees cut should be recorded and three times the same should be planted as green belt development or elsewhere as part of the project.
- Provide proper drainage facility so that the run off from the site doesn't contaminate any near by water sources or rivers.

E. PREPARATION OF DEBRIS DISPOSAL SITE MANAGEMENT AND REDEVELOPMENT PLAN

The Contractor after getting approval from the competitive authority for the selected site should submit a detailed Debris Disposal Site Management and Redevelopment Plan comprising the following details:

Section–1: Details of site: Copy of approved site identification report along with location plan on a village map or an FMB, showing the site, its survey no., access road, project stretch, distance form the project stretch, surrounding features and land use like residences, agricultural land, water bodies etc., photograph of the site showing the topography and other existing features.

Section-2: Site preparation: Activities that should be undertaken for preparing the site based on EMP and this guideline.

Section-3: Arrangements within the site: A layout plan showing the existing trees, green belt, locations were contour trenches should be dug etc.

Section-4: Mitigation measures that will be undertaken as per the EMP while preparing the site and dumping the waste should be separately listed out.

Sectoin-5: Other details: Any other relevant details like copy of approvals / clearances obtained, species wise no. of trees to be cut and the details of top soil to be removed and conserved like quantity, location of storing etc. shall also be provided.

Section 6: Re-development plan: which should indicate following points: (i) species wise no of tree to be planted, (ii) Proposed use of the land in the post construction phase, if it is a public property, (iii) Presence of existing facilities that could be put in use by the land owner if it is a leased out private land or by the community in case of a public property and (iv) Other site specific mitigation measures to be undertaken as recommended by the CSC.

Section-7: Annexure-(a) Copy of permissions obtained from local governing body / community etc. as applicable, **(c) Copy of agreement entered with site owner**, in case of leased out sites.

All the drawings should have north direction marked in it along with prevailing wind direction. Necessary dimensions and specifications should be provided where ever necessary. The debris site management plan should be submitted to the CSC for a written approval before any physical work is undertaken. The CSC will carefully examine the proposals in light of the various EMP and regulatory provisions and provide suggestions, as necessary to the Contractor who will implement it within the stipulated time period.

Contractor needs to prepare this document for each different site identified and CSC shall undertake a thorough analysis of the said management and redevelopment plan through a site investigation and suggest additional mitigation measures as demanded by the features of the specific site and its

surroundings.

F. REDEVELOPMENT OF WASTE DISPOSAL SITES

Along with the format seeking permission/approval for the disposal site/location from the Engineer/Supervision Consultant, the Contractor shall also submit a rehabilitation plan for the area. Following points have to be kept in view while undertaking the rehabilitation measure:

- The dump sites shall be suitably rehabilitated by planting local species of shrubs and other plants.
- The species (region specific) shall be chosen from the list suggested in the EA/EMP. Local species of trees should be selected so that the landscape is coherent and is in harmony with the surrounding environment.
- Rehabilitation can also include conversion into farm land, playground, parking area, block plantation area etc.
- Some of the dumpsites could be used either for plantation or for growing agricultural products such as ginger, turmeric or oranges etc.
- Care should always be taken to maintain the hydrological flow in the area.

ANNEXURE 3.6: GUIDELINES FOR PREPARING COMPREHENSIVE WASTE MANAGEMENT PLAN

A. OVERVIEW

A comprehensive waste management plan shall be prepared by the Contractor prior to initiation of any works. The purpose of the plan is to provide standardized procedures for the clearance, removal and disposal of debris caused by major debris / waste generated during the construction work as well as to establish the most efficient and cost effective methods to resolve debris disposal issues.

B. PREPARATION OF COMPREHENSIVE WASTE MANAGEMENT PLAN

The Contractor should prepare a Comprehensive Waste Management Plan to be submitted to CSC for approval prior to setting up of construction and labour camp and it should comprise the following details:

- Categorization of waste into degradable, biodegradable and hazardous categories and list of different types of waste that falls in each of these categories.
- Estimates about the quantity of waste generated in each category and type of storage units required.
- Detail the provisions for storage and handling of waste until disposed. A plan of the respective camps / areas like construction camp, labour camp etc. to be attached indicating in it the space allocated for storage and handling of wastes.
- Detail the precautions to be taken while storing, handling and disposing each type of waste, trainings to be imparted to workers to create awareness about waste management.
- Details of each debris disposal site: Copy of approved site identification report along with location plan on a village map or an FMB, showing the debris disposal sites, site, its survey no., access road, project stretch, distance form the project stretch, surrounding features and land use like residences, agricultural land, water bodies etc., photograph of the site showing the topography and other existing features.

C. TRAINING FOR PROJECT STAFF AND WORKERS

All staff and workers involved in the highway construction should be imparted training about comprehensive waste management plan including the need for such a plan, its components and measures adopted by the Contractor for implementing it. In addition, all personnel involved should be made aware about various steps and measures each of them has to follow so as to ensure the compliance to the comprehensive waste management plan.

D. PRECAUTIONS TO BE ADOPTED DURING DISPOSAL OF DEBRIS/WASTE MATERIAL

The Contractor shall take the following precautions during transportation and disposal of debris/waste material:

- A register should be kept for recording the details of the waste generated and their disposal.
- The pre-designated disposal sites should be a part of Comprehensive Solid Waste Management Plan and should be identified as per the EMP clauses prior to initiation of any work on a particular section of the road.
- The Contractor will take full care to ensure that public or private properties are not damaged/

affected during the site clearance for disposal of debris and the traffic is not interrupted.

- All arrangements for transportation during dismantling and clearing debris, considered incidental to the work, will be implemented by the Contractor in a planned manner as approved and directed by the CSC.
- In the event of any accidental spill or spread of wastes onto adjacent parcels of land, the Contractor will immediately remove all such waste material/s and restore the affected area to its original state to the satisfaction of CSC.
- Contractor should ensure that any spoils/materials unsuitable for embankment fill shall not be disposed off near any water course; water body; agricultural land; natural habitats like grass lands, wet lands, flood plains, forests etc. pasture; eroded slopes; and in ditches, which may pollute the surrounding including water sources.
- Contractor should ensure effective water sprinkling during the handling and transportation of materials where dust is likely to be created.
- Materials having the potential to produce dust will not be loaded beyond the side and tail board level and will be covered with a tarpaulin in good condition.
- Any diversion required for traffic during disposal of debris shall be provided with traffic control signals and barriers after discussion with the local body and as approved by CSC.
- During the debris disposal, Contractor will take care of surrounding features and avoid any damage to trees and properties.
- Surplus fly ash, bottom ash and lime, if any, transported for use on this corridor shall not be left open and dumped at any disposal site. Contractor shall take care of such residual materials for use at any other location/s of new embankment construction wok with proper protection measures
- No hazardous and contagious waste material shall be disposed at such locations.

E. WASTE DISPOSAL IN CONSTRUCTION CAMP

- Concrete flooring and oil interceptors should be provided for hot mix plant area, workshops, vehicle washing and fuel handling area.
- POL (petroleum, oil and lubricants) waste shall be stored safely in separate containers and should be disposed off by transfer only to recycler/ re-refiners possessing valid authorization from the State Pollution Control Board and valid registration from the Central Pollution Control Board.
- Used lead batteries, if any, should be disposed as per the Batteries (Management and Handling) Rules 2001.
- Water separated and collected from oil interceptor should be reused for dust suppression.
- There should be a register to record the details of the oil wastes generated at the workshops and oil storage areas.
- The Contractor will provide separate garbage bins in the camps and ensure that these are regularly emptied and disposed off in safe and scientific manner as per the Comprehensive Solid Waste Management Plans approved by the CSC.
- No incineration or burning of wastes shall be carried out.
- Discarded plastic bags, paper and paper products, bottles, packaging material, gunny bags, hessian, metal containers, strips and scraps of metal, PVC pipes, rubber and poly urethane foam, auto mobile spares, tubes, tires, belts, filters, waste oil, drums and other such materials

shall be either reused or will be sold /given out for recycling.

- Septic tank must be provided for toilets and the sludge should be cleared by municipal exhausters.

F. WASTE DISPOSAL IN LABOUR CAMP

- The Contractor should provide separate garbage bins in the camps for bio-degradable, non-degradable and domestic hazardous waste and ensure that these are regularly emptied and disposed off in safe and scientific manner.
- The disposal of kitchen waste and other biodegradable matter shall be carried out in pits covered with a layer of earth within the camp site to avoid smell and pests. The Contractor may use the compost from such wastes as manure in the plantation sites.
- Noon-biodegradable waste like discarded plastic bags, paper and paper products, bottles, packaging material, gunny bags, hessian, metal containers, strips and scraps of metal, PVC pipes, rubber and poly urethane foam, auto mobile spares, tubes, tires, belts, filters, waste oil, drums and other such materials shall be either reused or should be sold /given out for recycling.
- No incineration or burning of wastes should be carried out.
- Effluent treatment system like septic tank with soak pits provided for toilets should be sited, designed, built and operated in such a way that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place.
- Soak pits must be provided to collect waste water from bathrooms and kitchen.

G. DISPOSAL OF BITUMINOUS WASTE

- The bituminous waste should be used for development of roads inside the construction camps, haul roads or for filling pot holes in rural roads.
- At locations identified for disposal of residual bituminous wastes, the disposal will be carried out over a 60 mm thick layer of rammed clay so as to eliminate the possibility of leaching of wastes into the ground water.
- The Contractor will suitably dispose off unutilized non-toxic debris either through filling up of borrows areas located in wasteland or at pre-designated disposal sites, subject to the approval of CSC.
- Debris generated from pile driving or other construction activities along the rivers and streams drainage channels shall be carefully disposed in such a manner that it does not flow into the surface water bodies or form puddles in the area.

H. DISPOSAL OF NON BITUMINOUS WASTE

- Non-bituminous wastes other than fly ash may be dumped in borrow pits (preferably located in barren lands) where such borrow pits are not suitable to be re-developed as an economic source like pisci-culture or a source of irrigation. Such borrow pits can be filled up with non-bitumen wastes and then covered with a minimum 30cm layer of the soil, where plantation of trees and shrubs will be taken-up by the Contractor as a part of site rehabilitation.
- Local tree species suitable for such re-habitation work shall be selected in consultation with local community.

I. REUSE OF DEBRIS GENERATED FROM DISMANTLING STRUCTURES AND ROAD SURFACE

Debris generated due to the dismantling of existing road will 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 addition of sand and suitable cementing material for qualitative up-gradation.
- The dismantled scraps of bitumen will be utilized for the paving of cross roads, access roads and paving works in construction sites and campus, temporary traffic diversions, haulage routes, parking areas along the corridor or in any other manner approved by the Environmental Officer of SC.

ANNEXURE 3.7: GUIDELINES FOR TOP SOIL CONSERVATION AND REUSE

The top soil from all sites including road side widening and working area, cutting areas, quarry sites, construction camps, labour camps, haul roads in agricultural fields (if any) and areas to be permanently covered shall be stripped to a specified depth of 15 cm and stored in stock piles for reuse. A portion of temporarily acquired area and/or RoW edges will be earmarked for storing top soil. The locations for stacking will be pre-identified in consultation and with approval of environmental officer of SC. The following precautionary measures will be taken by the Contractor to preserve the stock piles till they are re-used:

Stockpiles will be such that the slope doesn't exceed 1:2 (vertical to horizontal), and height is restricted to 2 m.

- To retain soil and allow percolation of water, the edges of pile will be protected by silt fencing.
- Multiple handling kept to a minimum to ensure that no compaction occurs.
- Such stockpiles shall be covered with empty gunny bags or will be planted with grasses to prevent the loss during rains.

Such stockpiled topsoil will be utilized for:

- Covering reclamation sites or other disturbed areas including quarry areas.
- Top dressing and raising turfs in embankment slopes
- Filling up of tree pits
- For developing compensatory plantation
- In the agricultural fields of farmers, acquired temporarily that needs to be restored.

Residual top soil, if there is any, shall be utilized for the plantations works along the road corridor. The utilization as far as possible shall be in the same area from where top soil was removed. The stripping, preservation and reuse shall be carefully inspected, closely supervised and properly recorded by the SC.

ANNEXURE 3.8: GUIDELINES TO ENSURE WORKER'S SAFETY DURING CONSTRUCTION

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

A. TREE FELLING

- Use hard hats during tree felling
- Ensure safe use and storage of tools such as axes, power chain saw, hand saw of different types, HDPE ropes of approved thickness to drag felled trees and logs.
- Keep the saw blades in proper lubrication and sharpened state for efficient workability.
- Determine proper foot and body position when using the implements for felling, cutting and dragging.
- Wear appropriate foot protection
- Avoid cutting branches overhead.
- Keep first aid kits ready at the site.
- Determine possible hazards in the area, e.g. electrical or telephone or other utility lines, buildings, vehicles and domestic cattle that may create unsafe work situations.
- Prior to felling, determine the safest direction of fall and orient fixing of ropes and
- Cutting positions accordingly.
- Determine the proper hinge size before directing the fall.
- Keep machineries and workers ready for speedy removal of the tree from the main traffic movement area.
- Keep flag men and warning signal signage at either end of felling area to control movement of traffic and warn passers-by.
- Use loud noise signals for warning by-standers and workmen about the impending fall, so as they move away from the direction of fall.

B. PLANT SITES, CONSTRUCTION CAMP AND QUARRY AREAS

- Install perimeter fencing.
- Ensure good visibility and safe access at site entrances.
- Provide adequate warning signs at the entrance and exit, as necessary.
- Provide adequate space/area for loading and unloading, storage of materials, plant and machinery.
- Display emergency procedure and statutory notices at conspicuous locations.
- Provide areas for collecting garbage and other waste material, and also arrange for their regular/periodic disposal.

- Arrange appropriate storage, transportation and use of fuel, other flammable materials and explosives in line with the license requirements obtained from concerned authorities.
- Provide defined access roads and movement areas within the site.
- Ensure availability of first aid facilities and display notices at various work places showing the location of first aid facilities and emergency contact numbers. Provide and enforce use of PPE at plant and quarry sites.

C. HOUSE KEEPING PRACTICES

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

D. TRAFFIC SAFETY AND ROADS WORKS

- Delineate advance warning zones, transition zones and construction zones at both ends of a work front. Use devices such as regulatory signs, delineators, barricades, cones, pavement markings, lanterns and traffic control lights, reflectors and signal men in appropriate manner round the clock.
- No work front should be ‘touched’ without putting appropriate safety measures in place. SC will be responsible to ensure that the permission for any activity is not given without the required safety plan and practices in place.
- Put signage at appropriate locations as per the road construction activity plan to warn the road users, construction vehicles/equipment operators, pedestrians and local residents about the work

in progress, speed controls, hindrances/ blockages, diversions, depressions etc. in lines with contract requirements and IRC guidelines.

- Express a regret signage for the inconvenience caused and alert about the dangers ahead on account of construction activity.
- Signage has to be: (i) simple, easy-to-understand and should convey only one message at a time;
- (ii) has florescent and reflective properties of the paints; iii) broad, prominent and with appropriate size of letters and figures; (iv) placed at the appropriate 'point/s' as specified in the IRC guidelines to allow proper stoppage/reaction time to approaching vehicles.
- Different sign boards shall have a mix of pictorial signs and messages in local language, Hindi and English.
- While using barricades, ensure that traffic is kept away from work areas and the road user is guided to the safe, alternative movement track.
- Ensure that excavation sites are provided with effective barriers and reflecting signage to prevent any accidental approach by vehicles during the day or night.
- Prevent entry of cattle and wildlife through proper fencing/barricading around the excavation sites.
- Provide proper uniform (light reflecting garments) to flagmen engaged in traffic control at diversions so that they can be singled out from the moving traffic.
- Provide wide red and green flags or red and green lights to flagmen for controlling traffic.
- In high traffic zones and congested areas, use of wireless communication devices with protective headgear and shoes by flagmen has to be ensured to prevent confusion and minimize the risk of accidents.

E. SAFETY DURING EXCAVATION

- The risk of accidents involving people and vehicles remains high in excavated sites. All pits or excavations shall to be barricaded to warn the road users and residents and to avoid any unauthorized entry of persons, children, domestic cattle or wildlife. For deep excavations and culvert construction sites, painted GI sheets, delineators, lamps (as required) and retro-reflective signage shall be used.
- For excavation in soft loose & slushy soil (above 2.00 m depth where sliding of earth or collapsing of sides may occur)
- Excavation more than 1.5 m. is to be done in steps of minimum 500 mm offsets with plank and stuttering support, as required under contract clauses.
- For excavation in slippery or water logged area (labour or machinery may slip or get caught in slush)
- Try to dewater the area and spread minimum 150 mm thick sand layer to avoid slipping.
- For excavation in rock where chiseling is involved (and hammer or stone pieces may fall and injure the hand, eyes or legs).
- Only experienced and skilled labour should be employed. Chisel should be held with a tight fitting grip. Goggles and leg cover should be provided to protect the labour.

- Excavation in rock where blasting is involved (risk of injury to workers and passer-by)
- Blasting is to be carried out where absolutely necessary following all explosive handling regulations with mines safety principles including use of hooters, signage, protective gear, safety fuse, detonators, ignition coils and wires, exploder dynamo etc. The danger zone has to be vacated at least 20 minutes before the actual firing. Sufficient warning through positioning of red flags, dander signs, painted drums and sirens for safety of men at work and for any passer-by is to be provided. After a lapse of minimum 15 minutes when a clear signal is given by the site-in-charge through use of whistle or horn or light, the blasting charge should be ignited. After blasting a minimum of 30 minutes gap is to be given for the rocks and earth or blocks of loose boulders to fall of so that safety and security of the staff at the operation zone is ensured. Heavy charges shall not be used in fragile rock systems, where rock disintegrating machinery could be brought to use.
- The entire operation shall be conducted under the strict supervision of qualified staff and in the presence of safety officers.
- For excavation for drain or manhole (risk of a passer-by falling into the excavated portion).
- The area should be properly barricaded with sign boards and illumination/lamps for night time safety. In congested stretches, watchmen/guards can also be placed for vigil.
- Snake bites or Scorpion Stings during excavation
- In areas with vegetation, tall grasses and forest cover, the contractor shall provide the labour with gum boots and gloves. He shall also make snake antidotes available on site. Emergency ve`hicles should also be kept ready to rush the patient to the nearest hospital.

F. SAFETY DURING SOME TYPICAL CONSTRUCTION WORK

Centering and scaffolding (risk of framework collapse while construction, concreting or just before concreting especially when wooden ballies are used).

Many a times ballies joined together give away due to weak joints. Use of metal scaffolding and centering plates with metal fasteners are the safest and highly recommended materials for use in all road construction works for ensuring safety, stability and casting of structures. All such scaffolding should be placed on a firm and a level base on the ground for ensuring stability. No wooden scaffolding or bamboo scaffolding is to be used for any casting of heavy (RCC) structural construction as the risk to safety of workers is higher.

Railings are to be provided along working platforms and ladders for better safety. Nets shall be hung below the scaffolding or structures where work is on-going to prevent fall of debris, stones, bricks, equipments and other heavy objects and even workmen, which could be fatal.

Form-work for small/light beams and slabs

The collapse of bottom of the beam that may bring down the slab as well is a risk in such operations, which may injure the labour or supervision staff. Slender ballies without bracing are not be allowed for such works. No concreting should be allowed without bracing at 300 mm above ground and at mid way for normal beams and slabs. The bracings should be for the support of beams as well as the slabs. Direct ballies support from the ground and the practice of tying planks with binding wire to the steel reinforcement shall not be allowed. A temporary railing and properly based working platforms along the periphery of slab reduces risk to the life of labour and supervision staff.

Dismantling of Scaffoldings

Dismantled materials may fall on passer-by and workers. Workers could also get injured during the

removal of such materials. Prior to dismantling of scaffoldings/working platforms, the area of operation should be closed for all outsiders. No one should be allowed within 50 mt. from the place of demolition. Helmets, safety belts and other PPE must be worn by all the workers engaged in such a work. This work requires careful handling by an experienced supervisor/work force and should be executed with utmost caution. Gradual dislodging and use of PPE is required.

Column Reinforcements

The tendency of bar-benders is to tie the vertical steel with coir rope or 8 mm steel rods as ties on all four sides of the column reinforcements. Reinforcement to columns shall be by welding MS rods with metal scaffolding to keep it in position till the final casting of RCC is done.

Fall of Objects or Debris from a Height

At bridges construction sites (or in work areas at a height above ground level) thick nylon net or hessian barriers shall be used to prevent any splinter, debris, mortar or concrete from falling onto the passers by or workmen around.

Water Storage Tanks (for General Use, Curing etc.)

A child of a worker or that of a near-by resident falling into the water tank is also a risk associated with construction sites. The water tanks therefore shall be provided with protective cover/lid with locking arrangement at every site of activity to prevent accidental drowning.

Site Cleaning

Throwing of waste materials, broken concrete pieces, brick bats, sand etc. straight from the top of a structure onto the ground can injure a worker or a passerby. Such materials should be brought to the ground with the help of lift or the use of rope over pully with a bucket.

G. OPERATION OF EXCAVATORS

- Ensure that excavators are operated by authorized persons who have been adequately trained. Prevent any unauthorized use of the excavators.
- Ensure that only experienced and competent persons are engaged in supervising all excavations and leveling activity.
- Check and maintain as per the manufacturer’s manual.
- Issue relevant information, including that related to instructions, training, supervision and safe system of work in writing and provide expert supervision for guidance.
- Ensure that the operation and maintenance manuals, manufacturer's specifications, inspection and maintenance log books are provided for the use of the mechanics, service engineers or other safety personnel during periodic maintenance, inspection and examination.
- During tipping or running alongside the trenches, excavators must be provided with stop blocks.
- Avoid operating the machine too close to an overhang, ditch or hole, potential carving in edges, falling rocks and landslides, rough terrain with undulating obstacles.
- Excavators must be rested on firm ground after field operation away from the road
- Locate and identify underground services including telephone cables, OFC cables, sewerage and drainage lines, water supply, electrical cables etc by checking with all concerned underground utility providers.

- When reversing or in cases where the operator's view is restricted, adequate supervision and signaling arrangements shall be provided.
- Ensure that the type and capacity of the excavator are properly chosen for the intended purposes and site conditions. Never use a machine for any purposes other than it is designed for.
- Check and report for excessive wear and any breakage of the bucket, blade, edge, tooth and other working tools of the excavator and ensure replacement/ repair to avoid mishap and break down.
- Check that all linkages/hinges are properly lubricated and ensure that the linkage pins are secured. Never use improper linkage pins.
- Never dismount from or mount on a moving machine.

H. OPERATION OF TRUCKS AND DUMPERS

- Ensure that only trained, authorized and licensed drivers operate the vehicles.
- Enlist help of another worker before reversing the vehicle.
- Switch-off the engine when not in use to save fuel, prevent accidents and unnecessary noise and air pollution.
- Lower the tipping bodies when the machine is unattended, but if it is necessary to leave them in the raised position they should be blocked to prevent their fall by fixing a sturdy support below.
- Carryout periodic servicing as per the manufacturer’s requirements. All records of maintenance and repairs should be in writing and available for verification.
- Keep the vehicle tidy and the cabin free from clumsy utilities, which mightobstruct the controls and create hazards.
- Follow safe driving principles including speed limits as per traffic signage.
- Avoid carrying additional passengers in the cabin or on the body of the dumper, while in field operation other than the connected workers.
- Provide stop blocks when the vehicle is tipping into or running alongside excavations or when it is parked.
- Do not overload the vehicle.
- Carry only well secured loads and use proper covers and fasteners.

I. MANUAL HANDLING AND LIFTING

- Avoid manual handling of heavy and hazardous objects and chemicals.
- Pre-assess the actual requirement of manpower in case of emergency situations.
- The hazardous and poisonous materials should not be manually handled without proper equipments/gears and prior declaration of the risks needs to be made to the involved workers.
- All concerned persons shall be trained in proper methods of lifting and carrying.
- In all manual operations where groups of workers are involved, a team leader with necessary training to handle the entire work force in unison has to be provided for.

- Watch and ward to control/supervise/guide movement of equipments and machineries, loading and unloading operations, stability of the stockpiled materials and irregularly shaped objects have to be provided for safety and security of workers.
- Carriageway used by the workers must be free from objects, which are dangerous.
- Loading and unloading from vehicles shall be under strict supervision.

J. ELECTRICAL HAZARDS IN CONSTRUCTION AREAS

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

K. USE AND STORAGE OF GAS (LPG)

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

L. GAS WELDING

- The welders and welding units should follow all the basic principles of welding for safety and security.

- Use face shield to protect the eyes.
- Use goggles, particularly when chipping slag and cutting strips.
- Use gloves long enough to protect wrists and forearms against heat, sparks, molten metal and radiation hazards.
- Use high-top boots/gum boots to prevent sparks, splinters, sharp edges of metal and hot welded strips, welding rods, electric cables etc. from injuring the legs.
- Avoid inhaling the noxious fumes and gasses from burning electrodes by using gas masks and screen of the work area to prevent the glair moving outside it.
- Keep the key hung from the regulator control for split seconds operations to stop the valve in case of any accidental damage or leakage to supply pipeline that may catch fire and cause accidents in case acetylene or LPG cylinder.
- The welding area should have sufficient openings with fixed exhaust ventilators or adequate air flow openings to remove poisonous fumes and gases.
- Take precautions of wearing hard hats or fiber helmets to prevent injury due to fall of any object and accidental injury from projections while welding.
- Welders operating above ground should have adequate safety belt secured to stable platform to prevent accidental fall or injury from the scaffold. All electrical and gas connection lines up tothe welder should be sufficiently insulated and protected from sharp edges and sharp objects.

These shall not come into contact with hot metal.

- Do not use gas cylinders for supporting work or as rollers.
- While using LPG or CNG cylinders for welding, follow all safety precautions as has been prescribed by the supplier company.
- Avoid fire hazards and accidents by posting safety supervisors to oversee the activities of workers.
- Do not store explosives, high inflammable materials, loose hanging overhead objects, hot welded strips etc. near gas cylinders.
- Close all valves, switches and circuits while leaving the work place under proper lock and key. In case of mobile units, proper carriage procedure have to be followed for safety and security of men and materials.

M. FIRE SAFETY PRACTICES

- Before fire breaks out
- Designate fire officers.
- Store flammable material in proper areas having adequate fire protection systems.
- Display sufficient warning signs.
- Install fire alarm wherever required and test regularly.
- Inspect fire extinguishers regularly and replace as necessary.

- Train selected personal on use of fire extinguishers
- Fire escape route should be kept clear at all times and clearly indicated
- Display escape route maps prominently on each side.
- Provide sufficient exit signs at prominent locations for directing people to the escape staircases and routes.
- Train workers about the escape route and assembly point/s.
- Carryout fire drill periodically.

When fire breaks out

- Alert all persons through fire alarms or other methods.
- Put off the fire with appropriate fire extinguishers only when you are sure that you are safe to do so.
- Escape if you are in danger through the fire escape route to assembly point.
- Call-up Fire Service.
- Fire officers to carryout head count at the assembly point.

N. NOISE HAZARDS AND ITS CONTROL

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

O. PERSONAL PROTECTIVE EQUIPMENT

General

- Provision of personal protective equipment has to be made over and above all measures taken for removing or controlling safety hazards on a work site.
- Ensure that sufficient personal protective equipments are provided and that they are readily available for every person who may need to use them.

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

Eye Protection

- Road construction work sites, quarries and crushers are full of dust particles, sand, splinter, harmful gases, bright light and welding arc lights, which are injurious for the eyes. Therefore, eye protection and adequate lighting in work areas is required. All workers, supervisors and inspection officers and dignitaries coming over for study of works should be compelled to weareye protecting glasses/goggles properly fitting the eye sockets to prevent damage due to dust, gases and other particles.
- Head Protection
- Hard hats are compulsory for all workers, supervisors and managers/officials while working and/or inspecting a work sites.
- Hard hat areas shall be demarcated clearly.
- Hearing Protection
- Provide ear plugs or ear muffs to the workers and to those who need to get in and out of a high noise area frequently. Use re-usable earplugs when the reduction required (15-25 dBA) is not excessive. Use earmuffs where a large attenuation of upto 40 dBA is demanded.
- Do not use dry cotton wool for hearing protection because it doesn't provide any such protection.
- Provide disposable ear plugs for infrequent visitors and ensure that these are never re-used.
- Replenish ear plugs from time to time for those who need to work continuously for a long period in a high noise area/s.
- Use ear muffs with replaceable ear cushions because they deteriorate with age or may be damaged in use.
- Avoid wearing spectacles with ear muffs.
- Use soap and water or the recommended solvent for cleaning ear muffs.
- Respiratory (Protective) Equipment
- Wear suitable masks for protection when there is a potential for small particles entering the lungs, e.g. emptying of cement bags, working at crusher sites etc.
- Provide training to all persons using the masks/respirators for their correct fitting, use, limitations and symptoms of exposure.

- Clean and inspect all respirators before and after use.
- Store respirators properly when not in use.
- Safety Footwear
- Wear suitable footwear for work
- Use safety footwear on site or in other dangerous areas.
- Wear suitable safety shoes or ankle boots when working anywhere where there is high risk of foot injuries from slippery or uneven ground, sharp objects, falling objects etc.
- All safety footwear, including safety shoes, ankle boots and rubber boots, should be fitted with steel toecaps.
- Avoid wearing flip flops, high heeled shoes, slippers, light sport shoes in situations where there is a risk of foot injury.
- Keep shoelace knots tight.
- Hand Protection
- Wear suitable gloves for selected activities such as welding, cutting and manual handling of materials and equipment.
- Do not wear gloves where there is a risk of them becoming entangled in moving parts of machinery.
- Wash hands properly with disinfectant soap and clean water before drinking or eating.
- Wash hands immediately after each operation on site when the situation warrants.

P. FIRST AID

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

Q. ACCIDENT INVESTIGATIONS

- Carryout the investigation/s as quickly as possible.
- Investigation should be carried out both internally as well as through third party.
- Conduct interviews with as many witnesses as necessary including the affected persons and supervising officials.
- Do not rely on any one/limited source of evidence.
- Check all the log books, stock registers, issue registers, movement registers on site

- safety regulations, traffic signals and signal men activities, signage, as well as other field positions and keep a record of all investigations through audio-visual and electronic medium for presenting an evaluation of the incident/s.
- After completion of the investigation/enquiry, a summary of the facts recorded, sequence of happenings, persons-in-charge, persons examined, equipments and machineries tested, follow-up of action as per legal requirements, copy of station diary entry, hospital entry, safety regulations etc. to be prepared with a comparative analysis for proper assessment.

ANNEXURE 3.9: GUIDELINES FOR PREPARATION OF TRAFFIC MANAGEMENT PLAN

The Contractor shall at all times carry out work on the road in manner creating least interference to the flow of traffic with the satisfactory execution. For all works involving improvements to the existing state highway, the Contractor shall, in accordance with the directives of the CSC, provide and maintain, during execution of the work, a passage for traffic either along a part of the existing carriageway under improvement, or along a temporary diversion constructed close to the state highway. The Contractor shall take prior approval of the CSC regarding traffic arrangements during construction.

A. ENSURING TRAFFIC SAFETY AND CONTROL

Where subject to the approval of the Engineer the execution of the works requires temporary closure of road traffic use, the Contractor shall provide and maintain temporary traffic diversions. The diversions shall generally consist of 200 mm thickness of gravel 4.5 meters wide laid directly upon natural ground and where any additional earthworks are required for this purpose that will be provided under the appropriate payment items.

Where the execution of the works requires single-lane operation on public road, the Contractor shall provide and maintain all necessary barriers, warning signs and traffic control signals to the approval of the Engineer.

With the exception of temporary traffic arrangements or diversions required within the first 4 weeks of the Contract, the Contractor shall submit details of his proposals to the Engineer for approval no less than 4 weeks prior to the temporary arrangement or diversion being required. Details of temporary arrangements or diversions for approval as soon possible after the date of the Letter of Acceptance.

The colour, configuration, size and location of all traffic signs shall be in accordance with the code of practice for road sign. In the absence of any detail or for any missing details, the signs shall be provided as directed by the Engineer (CSC).

The Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, marking, flags, lights and flagmen as may be required by the Engineer for the formation and protection of traffic approaching or passing through the section of the road under improvement. Before taking up any construction, an agreed phased programme for the diversion of traffic or closer of traffic on the road shall be drawn up in consultation with the SE.

At the points where traffic is to deviate form its normal path (whether on temporary diversion or part width of the Carriageway) the lane width path for traffic shall be clearly marked with the aid of pavement markings, painted drums or a similar device to the directions of the SE. At night, the passage shall be delineated with lanterns or other suitable light source.

One-way traffic operation shall be established whenever the traffic is to be passed over part of the carriageway inadequate for two-lane traffic. This shall be done with the help of temporary traffic signals or flagmen kept positioned on opposite sides during all hours. For regulation of traffic, the flagmen shall be equipped with red and green flags and lanterns/lights.

On both sides, suitable regulatory / warnings signs as approved by the SE shall be installed for

the guidance of road users. On each approach, at least two signs shall be put up, one close to the point

where transition of carriageway begins and the other 120 m away. The signs shall be of design and of reflectory type, if so directed by SE.

Upon completion of the works for which the temporary traffic arrangements or diversions have been made, the Contractor shall remove all temporary installations and signs and reinstate all affected roads and other structures or installations to the conditions that existed before the work started, as directed by the Engineer.

B. MAINTENANCE OF DIVERSIONS AND TRAFFIC CONTROL DEVICES

Signs, lights, barriers and other traffic control devices, as well as the riding surface of diversion shall be maintained in a satisfactory condition till such time they are required as directed by the SE. The temporary traveled way shall be kept free of dust by frequent applications of water, if necessary. The signages and devices required include the following:

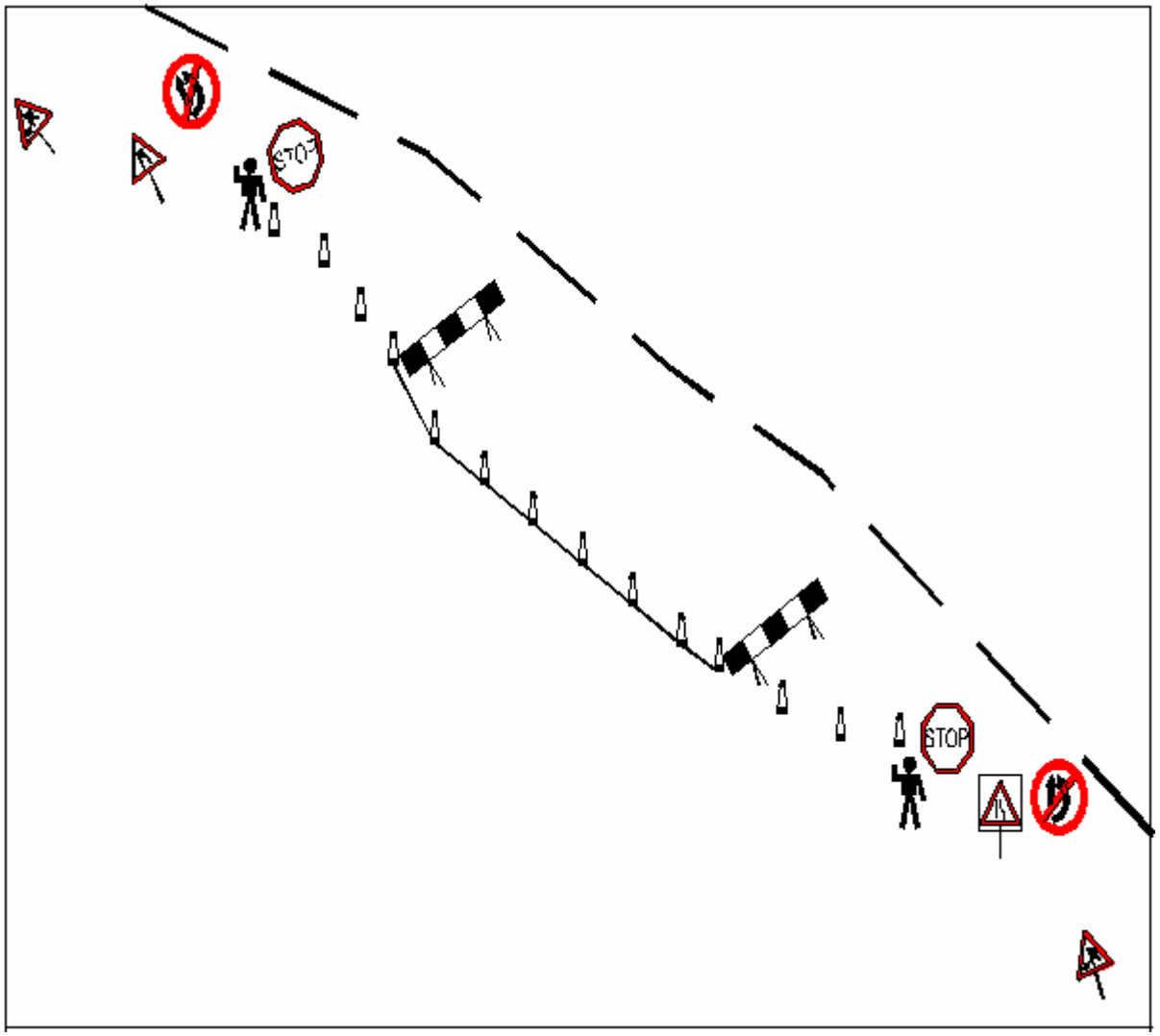
- Barricading
- Men at work
- Keep Left
- Go slow
- Flag men
- Narrow signs
- Lantern(Amber Blinker)
- Traffic control Lights
- Cones

Safety jackets and helmets should be provided to all the workers/ Engineers working on the road.

Fixed mobile solid barricades must be placed between the workmen and traffic or pedestrian and traffic.

All the safety signs should be according to IRC: 67 and IRC: SP: 55: 2001

Examples of some good practice in traffic control during construction are shown in the figures below.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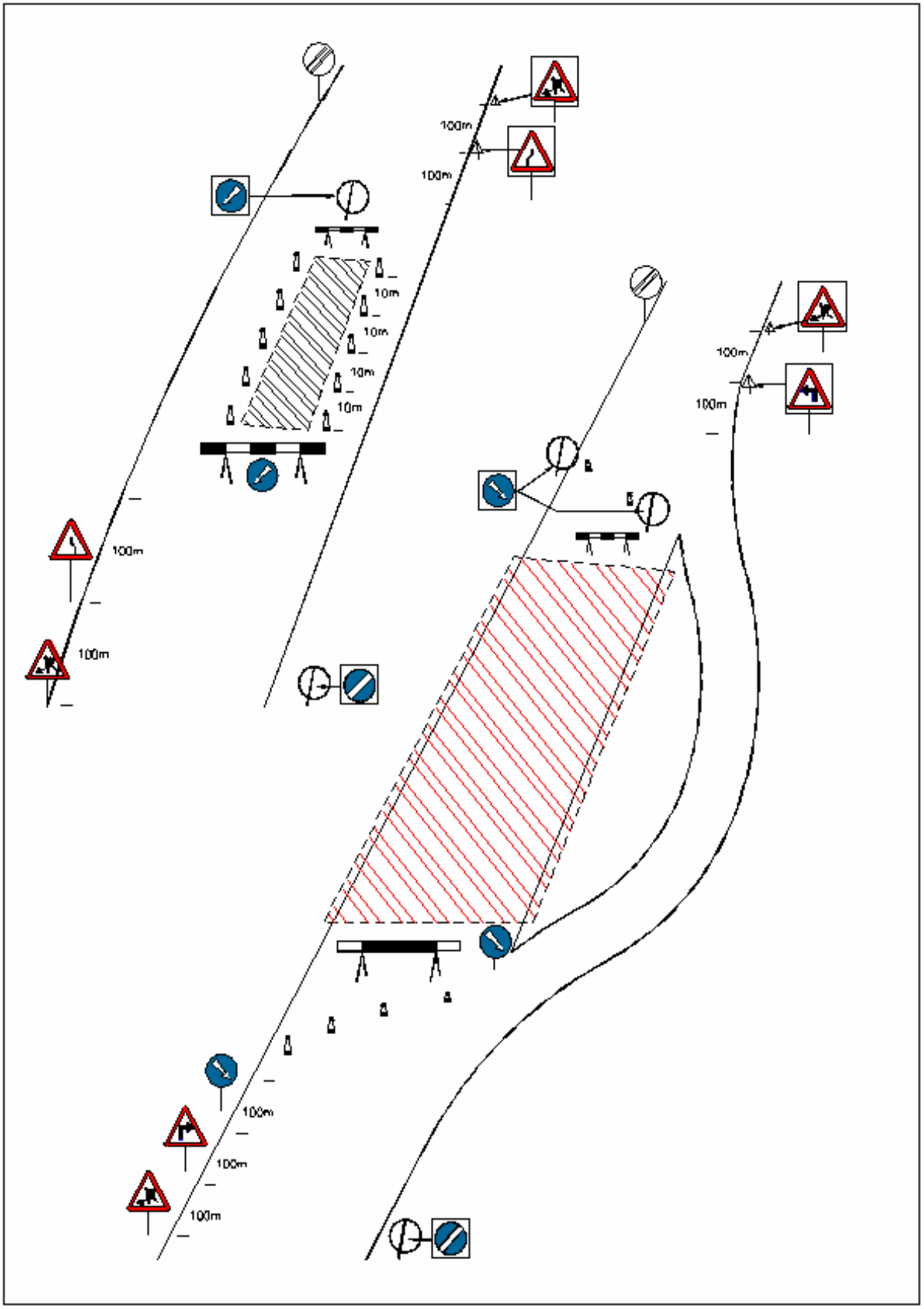
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ANNEXURE 3.10: GUIDELINES FOR STORAGE, HANDLING, USE AND EMERGENCY RESPONSE FOR HAZARDOUS SUBSTANCES

A. HANDLING HAZARDOUS SUBSTANCES (INCLUDING CHEMICALS)

- As far as practicable the hazardous materials will be stockpiled under proper mechanical loading, unloading and stacking aided by manual labour where necessary.
- Exercise great care in the storage and use of chemicals because they may be explosive, poisonous, corrosive or combustible.
- Separate different chemicals physically and store accordingly after proper labeling.
- Stock taking of all hazardous will be mandatory together with enforcement of manufacturer's or supplier's safety standard/s and drill exercises.
- New and less known chemicals and building materials, for which toxicological studies are wanted, need to be properly evaluated prior to their inclusion in the materials list.
- All containers should be clearly labeled to indicate contents.
- Maintain the Material Safety Data Sheet of all chemicals for reference on safety precautions to be taken and the use of suitable PPE.
- Ensure use of correct personal protective equipment before allowing workers to handle chemicals.
- When opening containers, ensure holding of a rag over the cap/lid or use of safety gloves, as some volatile liquids tend to spurt up when released.
- Eye fountain, emergency shower and breathing apparatus should be available near the workplace.
- Ensure immediate medical attention in case of spill/splash of a chemical.
- Safety instructions for handling emergency situations shall be displayed prominently at both the storage and use locations.

B. TRANSPORTATION, REFUELING AND MAINTENANCE PROCEDURE

- Truck or suitable containers will bring in all fuel and fluids.
- There will be no storage of fuel, oil or fluids within 200m of a water line.
- Prior to re-fueling or maintenance, drip pans and containment pans will be placed under the equipment.
- Absorbent blankets may also be required to be placed under the equipment and hoses where there is a possibility of spillage to occur.
- All used oils or fluids will be properly contained and transported to appropriately licensed (authorized) disposal facilities.
- Following re-fueling and maintenance, the absorbent blankets (if any) and spill pans will be picked up and the fuel truck or container moved outside of the 100m (or 50m) wide area.

C. EMERGENCY SPILL PROCEDURE

- Should a spill occur, either through accidental spillage or equipment failure, the applicable emergency spill procedure as outlined in sections below and/or as directed by the manufacturer/supplier shall be followed:

Spill Procedure (Inside a Stream)

- In the case of a spill, overflow or release of fluid into the stream waterway (whether water is flowing during the spill or not), do what is practical and safely possible to control the situation, while sending SOS for help from the technical wings and fire brigade or any other govt. agency.
- Stop the flow
- Stop the release into the waterway
- Shut down the equipments
- Close valves and pumps.
- Plug leaking of damage hosepipes or containers with suitable sealants or temporary plugs at the holes.

Remove Ignition Sources

- Cut off the supply sources and shut down the sources of power supply.
- Cordon up the area and salvage the spilled materials for recycling or disposal as would be suggested by the technical experts or as per the manufacturer's guidelines for the product. In case of inflammable materials, mobile phones, electrical switches and heat generating machines, sparking electrodes etc. shall not be operated.
- Portable fire extinguishers need to be kept handy in such vehicles for immediate use as a damage control measure.
- Clean-up and Disposal
- Emergency Services shall be engaged for the containment, clean-up and disposal of contaminants released into the environment.
- Reporting
- The Contractor's Environmental Officer will document the event and submit the reports to the Engineer, the Client and appropriate regulatory agencies like the Pollution Control Board.

Procedure Review

- The Engineer will review the report, determine if changes are required to be incorporated in the plan of activity under the revised guidelines and recommendation/s that have been suggested by the technicians/manufacturer/ supplier /fire brigade /SPCB /environment officer of the PIU, as the case may be.

Spill Procedure (On Land)

- All types of spills are hazardous - whether liquid or amorphous or solid and accordingly the spill has to be dealt with. For liquids, sealing the leakage or emptying the container into another empty vessel may be considered. For solid or semi-solid or viscous products, special salvage equipments are to be used. For fine particles and water soluble chemicals, neutralizing or scraping the affected soil from the area has to be resorted to with mechanical

removal and depositing at a safe site as would be recommended by experts.

Notification

- All legal authorities such as civil administration including the district Collector, the sub-divisional officer, Tehsildar, the local SHO of the police station, the SP, Divisional Forest Officer, the Inspector of Factories and Boiler, the SPCB authority monitoring the pollution in the area, site engineer/supervision consultant and environmental officer of OWD/PIU, local gram panchayat and people's representatives have to be informed about the incident, the probable damage, current and after effects, precautionary measures to be taken and already taken and restrictions imposed on movement of men, material, live stock etc in an around the site of spill.

Cleanup and Disposal

- The Engineer's Environmental Officer will ensure that a proper cleanup and disposal method is determined. Absorbent pads will soak up the spilled material. The pads will be contained and removed from site for disposal at a licensed (authorized) facility.

Reporting

- The Contractor's Environmental Officer will document the event and submit reports to the Engineer, the Client and appropriate regulatory agencies like the Pollution Control Board(s).

Procedure Review

- The Engineer will review the report; determine, if changes are required to procedures and; recommend implementation of all required changes.

ANNEXURE 3.11: GUIDELINE FOR ENVIRONMENT FRIENDLY CONSTRUCTION METHODOLOGY

The contractor shall be deemed to have acquainted himself with the requirements of all the current statutes, ordinances, by-laws, rules and regulations or their instruments having the force of law including without limitation those relating to protection of the environment, health and safety, importation of labour, demolition of houses, protection of environment and procurement, transportation, storage and use of explosives, etc.

1. PROTECTION OF ENVIRONMENT

(i) The contractor will take all necessary measures and precautions and ensure that the execution of the works and all associated operations on site or offsite are carried out in conformity with statutory and regulatory environmental requirements including those prescribed in EMP.

(ii) The contractor will take all measures and precautions to avoid any nuisance or disturbance to inhabitants arising from the execution of works.

(iii) All liquid waste products arising on the sites will be collected and disposed of at a location on or off the sites and in a manner that will not cause either nuisance or pollution.

(iv) The contractor will at all times ensure that all existing water courses and drains within and adjacent to the site are kept safe and free from any contamination.

(v) The contractor will submit details of his temporary drainage work system (including all surface channels, sediment traps, washing basins and discharge pits) to the Project Implementation Unit –TNRSP / Environment Officer for approval prior to commencing work on its construction.

(vi) The contractor will arrange all the equipment in good condition to minimize dust, gaseous or other air-borne emissions and carry out the works in such a manner as to minimize adverse impact on air.

(vii) Any vehicle with an open load-carrying area used for transporting potentially dust-producing material will have properly fitted side and tailboards. Materials having the potential to produce dust will not be loaded to a level higher than the side and tail boards and will be covered with a clean tarpaulin in good condition.

(viii) The contractor will take all necessary measures to ensure that the operation of all mechanical equipment and condition processes on and off the site will not cause any unnecessary or excessive noise, taking into account applicable environmental requirements.

(ix) The contractor will take necessary measures to maintain all plant and equipment in good condition.

(x) Where the execution of the works requires temporary closure of road to traffic, the contractor will provide and maintain temporary traffic diversions subject to the approval of the EO/Engineer.

(xi) Where the execution of the works requires single-lane operation on public road the contractor will provide and maintain all necessary barriers, warning signs and traffic control signals to the satisfaction of the EO/Engineer.

(xii) Wherever traffic diversions, warning signs, traffic control signals, barriers and the like are required, the contractor will install them to the satisfaction of EO/Engineer prior to commencing the work, in that area.

(xiii) Contractor will install asphalt plants and other machineries away from the populated areas as per laid down regulations.

(xiv) Permit for felling of trees will be obtained from the forest department before the execution of any work.

(xv) Trees and plants going to be uprooted will be duly compensated and maintained up to 3 years.

(xvi) Mist sprays should be provided at appropriate places for preventing dust pollution during handling and stockpiling of stones and loose earth.

(xvii) Over Burden (OB) waste dumps shall be sprayed with water, as they are the major source of air borne particulate matter.

(xviii) OB waste dumps shall be reclaimed / afforested to bind the loose soil and to prevent soil erosion. The frequency of sprinkling should be fixed as per the seasonal requirement and in consultation with engineer.

(xix) Regular water spraying on haulage roads during transportation of construction material by water sprinklers. The frequency of sprinkling should be fixed as per the seasonal requirements in consultation with engineer.

(xx) Transfer point for transporting construction material shall be provided with appropriate hoods/ chutes to prevent dust emissions.

(xxi) Dumping of construction material should be from an optimum height (preferably not too high), so as to reduce the dust blow.

(xxii) Innovative approaches of using improvised machinery designs, with in-built mechanism to reduce sound emission.

(xxiii) Procurement of drill loaders, dumbers and other equipment with noise proof system in operator's cabin.

(xxiv) Confining the equipment with heavy noise emissions in soundproof cabins, so that noise is not transmitted to other areas.

(xxv) Regular and proper maintenance of noise generating machinery including the transport vehicles to maintain noise levels.

(xxvi) Provisions should be made for noise absorbing pads at foundations of vibrating equipments to reduce noise emissions.

2. QUARRY OPERATIONS

The Contractor shall obtain materials from quarries only after the consent of the Forest Department or other concerned authorities and in consultation with the EO/Engineer. The quarry operations shall be undertaken within the purview of the rules and regulations in force and instructions as mentioned in **Annexure 3.3:** Guidelines for Quarry Management and **Annexure 3.4:** Guidelines for Borrow Area Management.

3. PREVENTION OF WATER COURSES FROM SOIL EROSION AND SEDIMENTATION SILTATION

The Contractor shall apply following mitigation measures to prevent sedimentation and pollution of watercourses.

- To prevent increased siltation, if need be existing bridges maybe widened downstream side of the water body;

- Cement and coal ash should be stacked together, fenced by bricks or earth wall, and kept away from water, to prevent leachate formation and contamination of surface and ground water;
- If need be, slope of the embankments leading to water bodies should be modified and rechannelised to prevent entry of contaminants into the water body;
- During construction silt fencing (consists of geo-textile with extremely small size supported by wire-mish mounted on a panel made up of angle frame) could be used along the road at all canals and rivers to prevent sediments from the construction site to enter into the watercourses.

3. POLLUTION FROM HOT-MIX PLANTS AND BATCHING PLANTS

Bituminous hot-mix plants and concrete batching plants shall be located sufficiently away from habitation, agricultural operations. The Contractor shall take every precaution to reduce the levels of noise, vibration, dust and emissions from his plants and shall be fully responsible for any claims for damages caused to the owners of property, fields and residents in the vicinity.

4. ARRANGEMENT FOR TRAFFIC DURING CONSTRUCTION

The Contractor shall at all times carry out work on the road in a manner creating least interference to the flow of traffic with the satisfactory execution. For all works involving improvements to the existing state highway, the Contractor shall, in accordance with the directives of the SE, provide and maintain, during execution of the work, a passage for traffic either along a part of the existing carriageway under improvement, or along a temporary diversion constructed close to the state highway. The Contractor shall take prior approval of the SE regarding traffic arrangements during construction.

5. TRAFFIC SAFETY AND CONTROL

(i) Where subject to the approval of the Engineer the execution of the works requires temporary closure of road to traffic use, the Contractor shall provide and maintain temporary traffic diversions. The diversion shall generally consist of 200 mm thickness of gravel 4.5 meters wide laid directly upon natural ground and where any additional earthworks are required for this purpose that will be provided under the appropriate payment items.

(ii) Where the execution of the works requires single-lane operation on public road, the Contractor shall provide and maintain all necessary barriers, warning signs and traffic control signals to the approval of the Engineer.

(iii) With the exception of temporary traffic arrangements or diversions required within the first 4 weeks of the Contract, the Contractor shall submit details of his proposals to the Engineer for approval not less than 4 weeks prior to the temporary arrangement or diversion being required. Details of temporary arrangements or diversions for approval as soon as possible after the date of the Letter of Acceptance.

(iv) The color, configuration, size and location of all traffic signs shall be in accordance with the code of practice for road sign. In the absence of any detail or for any missing details, the signs shall be provided as directed by the Supervising Engineer (SE).

(v) The Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, marking, flags, lights and flagmen as may be required by the Engineer for the information and protection of traffic approaching or passing through the section of the road under improvement. Before taking up any construction, an agreed phased programme for the diversion of traffic or closer of traffic on the road shall be drawn up in consultation with the SE.

(vi) At the points where traffic is to deviate from its normal path (whether on temporary diversion or part width of the carriageway) the lane width path for traffic shall be clearly marked with the aid of pavement markings, painted drums or a similar device to the directions of the SE. At night, the passage shall be delineated with lanterns or other suitable light source.

(vii) One-way traffic operation shall be established whenever the traffic is to be passed over part of the carriageway inadequate for two-lane traffic. This shall be done with the help of temporary traffic signals or flagmen kept positioned on opposite sides during all hours. For regulation of traffic, the flagmen shall be equipped with red and green flags and lanterns / lights.

(viii) On both sides, suitable regulatory / warnings signs as approved by the PIU-APRDC shall be installed for the guidance of road users. On each approach, at least two signs shall be put up, one close to the point where transition of carriageway begins and the other 120 m away. The signs shall be of design and of reflectory type, if so directed by the Engineer.

(ix) Upon completion of the works for which the temporary traffic arrangements or diversions have been made, the Contractor shall remove all temporary installations and signs and reinstate all affected roads and other structures or installations to the conditions that existed before the work started, as directed by the Engineer.

6. HEALTH AND SAFETY

The contractor shall take all measures and precautions necessary to ensure the health, safety and welfare of all persons entitled to be on the site. Such precautions shall include those that, in the opinion of the Engineer, are reasonable to prevent unauthorized entry upon the site and to protect members of the public from any activities under the control of the contractor. The contractor's responsibilities shall include but not be limited to:

(i) The provision and maintenance of the Contractor's Equipment in a safe working condition and the adoption of methods of work that are safe and without risks to the health of any person entitled to be on the site.

(ii) The execution of suitable arrangements for ensuring safety and absence of risks to health in connection with the use, handling, storage, transport and disposal of articles and substances,

(iii) The provision of lighting, including standby facilities in the event of failure that, in the opinion of the Engineer, is adequate to ensure the safe execution of any works that are to be carried out at right.

(iv) The provision of protective clothing and safety equipment, with such personnel and equipment and such information, instruction, training and supervision as are necessary to ensure the health and safety at work of all persons employed on or entering on the site in connection with the works, including the Engineer's supervisory staff, all in accordance with the laws.

(v) Near towns, villages and all frequented places, trenches and foundation pits shall be securely fenced provided with proper caution signs and marked with lights at night to avoid accidents. Contractor shall take adequate protective measures to see that the excavation operations do not affect or damage adjoining structures.

(vi) The contractor shall not use or generate any materials in the works, which are hazardous to the health of persons, animals or vegetation. Where it is necessary to use some substances, which can cause injury to the health of workers, the Contractor shall provide protective clothing or appliances to his workers.

(vii) The contractor will take all measures necessary to safeguard the health; safety and welfare of all persons entitled to be on site and will ensure that works are carried out in a safe and efficient manner.

(viii) The contractor will provide, and ensure the utilization of appropriate safety equipment for all workmen and staff employed directly or indirectly by the contractor. Such safety equipment will include but not be limited to the safety helmets, goggles and other eye protectors, hearing protectors, safety harnesses, safety equipment for working over water, rescue equipment, fire extinguishers and first-aid equipment. The personnel working at vulnerable locations at site will wear safety helmets and strong footwear.

(ix) The contractor will provide an adequate number of latrines and other sanitary arrangements at areas of the site where work is in progress and ensure that they are regularly cleaned and maintained in a hygienic condition.

7. FIRST AID

(i) The provision and maintenance of suitably equipped and staffed first aid stations throughout the extent of the works to the satisfaction of the Engineer. The contractor shall allow in his prices and the responsible for the costs of all such site welfare arrangements and requirements.

(ii) Injuries might occur during the construction period. It is therefore pertinent to provide first aid facilities for all the construction workers. At construction camps and at all workplaces first aid equipment and nursing staff must be provided. Since many of the workplaces may be far away from regular hospitals, an indoor health unit having one bed facility every 150 workers needs to be provided.

(iii) Adequate transport facilities for moving the injured persons to the nearest hospital must also be provided in ready to move condition.

(iv) The first-aid units apart from an adequate supply of sterilized dressing material should contain other necessary appliances as per the factory rules.

8. MAINTENANCE

(i) All buildings, rooms and equipment and the grounds surrounding them shall be maintained in a clean and operable condition and be protected from rubbish accumulation.

(ii) Each structure made available for occupancy shall be of sound construction, shall assure adequate protection against weather, and shall include essential facilities to permit maintenance in a clean and operable condition. Comfort and safety of occupants shall be provided for by adequate heating, lighting, ventilation or insulation when necessary to reduce excessive heat.

(iii) Each structure made available for occupancy shall comply with the requirements of the Uniform Building Code. This shall not apply to tent camps.

9. MAINTENANCE OF DIVERSIONS AND TRAFFIC CONTROL DEVICES

Signs, lights, barriers and other traffic control devices, as well as the riding surface of diversion shall be maintained in a satisfactory condition till such time they are required as directed by the EO/Engineer. The temporary traveled way shall be kept free of dust by frequent applications of water, if necessary.

ANNEXURE 3.12: REPORTING FORMAT FOR IDENTIFICATION OF CONSTRUCTION CAMP SITE

A	**Project Details**		**Date of reporting:**	
1.	Name of project stretch and SH no			
2.	Name and address of the Contractor			
3.	Contract date and duration			
4.	Status of completion of the project			
B	**Site Details**			
1.	Place Name		Landmark	
2.	Name of Panchayath / Municipality		Revenue Village	
3.	Taluk		District	
4.	Nearest Chainage (km) of the project road		Location w.r.t. project road	LHS/ RHS
5.	Area of site		Current land use	
6.	Ownership of the land	Owned / leased	Survey no.	
7.	If leased / rented, name, address and contact details of owner			
8.	Distance* from any major settlement or village			
9.	Distance from any major surface water course or body			
10.	Distance from ecologically sensitive areas			
11.	Distance from the Project road			
12.	Width and type (paved or unpaved) of access road			
13.	No of trees with girth> 0.3m			
14.	No of trees to be cut			
15.	Is top soil conservation required (Yes/ No)			
List of enclosures:	(a) Location map			
	(b) Layout plan			
	(c) Photographs of the site			
	(d) List of machinery, equipments and vehicles to be used			
	(e) List of schools and hospitals within 200 m distance from the boundary of the camp			
C. Submission Details	Submitted by (Environment & Safety Engineer of Contractor)		Approved / Rejected by (Environmental Officer of CSC)	
Signature & date				
Name				
Designation				
Remarks by CSC				

* *All distances are to be measured from the boundary of the site.*

Note: Contractor has to fill and submit this format to the CSC upon identification of each construction camp site. Subsequently, the EO of CSC has to visit the site and approve / reject the site with reasons. The EO of CSC has to give a copy of this format to the contractor after his approval / rejection with remarks. On approval of a site, the Contractor has to prepare the Management and Redevelopment Plan for this site as per the Guidelines given in EMP and submit to CSC for approval.

ANNEXURE 3.13: REPORTING FORMATS FOR IDENTIFICATION OF LABOUR CAMP SITE

A	**Project Details**		Date of reporting:	
1.	Name of project stretch and SH no.			
2.	Name and address of the Contractor			
3.	Contract date and duration			
4.	Status of completion of the project			
B	**Site Details**			
1.	Place Name		Landmark	
2.	Name of Panchayath / Municipality		Revenue Village	
3.	Taluk		District	
4.	Nearest Chainage (km) of the project road		Location w.r.t. project road	LHS/ RHS
5.	Area of site		Current land use	
6.	Ownership of the land	Owned /leased	Survey no.	
7.	If leased, name, address and contact details of owner			
8.	Distance* from any major settlement or village			
9.	Distance from any major surface water course or body			
10.	Distance from ecologically sensitive areas			
11.	Distance from the Project road			
12.	Width and type of access road			
13.	No of trees with girth> 0.3m			
14.	No of trees to be cut			
15.	Is top soil conservation required (Yes/ No)			
List of enclosure:		Location map		
		Layout Plan		
		Photographs of the site		

C. Submission Details	**Submitted by (Environment & Safety Engineer of Contractor)**	**Approved / Rejected by (Environmental Officer of CSC)**
Signature & date		
Name		
Designation		
Remarks by CSC		

* *All distances are to be measured from the boundary of the site.*

Note: Contractor has to fill and submit this format to the CSC upon identification of each Labour camp site. Subsequently, the EO of CSC has to visit the site and approve / reject the site with reasons. The EO of CSC has to give a copy of this format to the contractor after his approval / rejection with remarks. On approval of a site, the Contractor has to prepare the Management and Redevelopment Plan for this site as per the Guidelines given in EMP and submit to CSC for approval.

ANNEXURE 3.14: REPORTING FORMAT FOR IDENTIFICATION OF QUARRY AND STONE CRUSHER SITE

A	**Project Details**		Date of reporting:	
1.	Name of project stretch and SH no.			
2.	Name and address of the Contractor			
3.	Contract date and duration			
4.	Status of completion of the project			
B	**Site Details**			
1.	Place Name		Landmark	
2.	Name of Panchayath / Municipality		Revenue Village	
3.	Taluk		District	
4.	Nearest Chainage (km) of the project road		Location w.r.t. project road	LHS/ RHS
5.	Area of site		Current land use	
6.	Ownership of the land	Owned / leased	Survey no.	
7.	If leased, name, address and contact details of owner			
8.	Type of material available and its quantity			
9.	Distance* of the site from:			
	(i) any major settlement or village			
	(ii) any major surface water course or body			
	(iii) any bridge, water supply system, infiltration well or pumping installation			
	(iv) any public road			
	(v) ecologically sensitive areas			
	(vi) nearest quarry / stone crusher			
10.	Distance from project road			
11.	Width and type of access road			
12.	No of trees with grid >0.3m			
13.	No of trees to be cut			
14.	Is top soil conservation required: Yes/ No			
15.	Place identified for top soil conservation			
List of enclosure:	(a) Location map			
	(b) Layout plan			
	(c) Photographs of the site			
	(d) List of schools and hospitals with in 200 mts distance from the boundary of the site			

C. Submission Details	**Submitted by (Environment & Safety Engineer of Contractor)**	**Approved / Rejected by (Environmental Officer of CSC)**
Signature & date		
Name		
Designation		
Remarks by CSC		

* *All distances are to be measured from the boundary of the site.*

Note: Contractor has to fill and submit this format to the CSC upon identification of each quarry and stone crusher site. Subsequently, the EO of CSC has to visit the site and approve / reject the site with reasons. The EO of CSC has to give a copy of this format to the contractor after his approval / rejection with remarks. On approval of a site, the Contractor has to prepare the Management and Redevelopment Plan for this site as per the Guidelines given in EMP and submit to CSC for approval.

ANNEXURE 3.15: REPORTING FORMAT FOR IDENTIFICATION OF BORROW AREAS

A	**Project Details**		Date of Reporting:	
1.	Name of project stretch and SH no.			
2.	Name and address of the Contractor			
3.	Contract date and duration			
4.	Status of completion of the project			
B	Site Details			
1.	Place Name		Landmark	
2.	Name of Panchayath / Municipality		Revenue Village	
3.	Taluk		District	
4.	Nearest Chainage (km) of the project road		location w.r.t. project road	LHS/ RHS
5.	Area of site		Current land use	
6.	Ownership of the land	Owned / leased	Survey no.	
7.	If leased, name, address and contact details of owner			
8.	Distance* from any major settlement or village			
9.	Distance from any major surface water course or body			
10.	Distance from ecologically sensitive areas			
11.	Distance from the Project road			
12.	Width of and type of access road			
13.	No of trees with girth> 0.3m			
14.	No of trees to be cut			
15.	Is top soil conservation required (Yes/ No)			
List of enclosure:		Location map		
		Layout Plan		
		Photographs of the site		
C. Submission Details	Submitted by (Environment & Safety Engineer of Contractor)		Approved / Rejected by (Environmental Officer of CSC)	
Signature & date				
Name				
Designation				
Remarks by CSC				

* *All distances are to be measured from the boundary of the site.*

Note: Contractor has to fill and submit this format to the CSC upon identification of each borrow area. Subsequently, the EO of CSC has to visit the site and approve / reject the site with reasons. The EO of CSC has to give a copy of this format to the contractor after his approval / rejection with remarks. On approval of a site, the Contractor has to prepare the Management and Redevelopment Plan for this site as per the Guidelines given in EMP and submit to CSC for approval.

ANNEXURE 3.16: REPORTING FORMAT FOR IDENTIFICATION OF DEBRIS DISPOSAL SITE

A	**Project Details**		Date of Reporting:	
1.	Name of project stretch and SH no.			
2.	Name and address of the Contractor			
3.	Contract date and duration			
4.	Status of completion of the project			
B	**Site Details**			
1.	Place Name		Landmark	
2.	Name of Panchayath / Municipality		Revenue Village	
3.	Taluk		District	
4.	Nearest Chainage (km) of the project road		location w.r.t. project road	LHS/ RHS
5.	Area of site		Current land use	
6.	Ownership of the land	Owned / leased	Survey no.	
7.	If leased, name, address and contact details of owner			
8.	Distance* from any major settlement or village			
9.	Distance from any major surface water course or body			
10.	Distance from ecologically sensitive areas			
11.	Distance from the project road			
12.	Width and type of access road			
13.	No of trees with girth> 0.3m			
14.	No. of trees to be cut			
15.	Is top soil conservation required (Yes/ No)			
List of enclosure:	Location map			
	Layout Plan			
	Photographs of the site			
C. Submission Details	**Submitted by (Environment & Safety Engineer of Contractor)**		**Approved / Rejected by (Environmental Officer of CSC)**	
Signature & date				
Name				
Designation				
Remarks by CSC				

* *All distances are to be measured from the boundary of the site.*

Note: Contractor has to fill and submit this format to the CSC upon identification of each debris disposal site. Subsequently, the EO of CSC has to visit the site and approve / reject the site with reasons. The EO of CSC has to give a copy of this format to the contractor after his approval / rejection with remarks. On approval of a site, the Contractor has to prepare the Management and Redevelopment Plan for this site as per the Guidelines given in EMP and submit to CSC for approval.

ANNEXURE 3.17: REPORTING FORMAT FOR IDENTIFICATION OF SOURCES OF WATER FOR CONSTRUCTION

A	**Project Details**		Date of Reporting:	
1.	Name of project stretch and SH no.			
2.	Name and address of the Contractor			
3.	Contract date and duration			
4.	Status of completion of the project			
B	**Site Details**			
1.	Place Name		Landmark	
2.	Name of Panchayath / Municipality		Revenue Village	
3.	Taluk		District	
4.	Nearest Chainage (km) of the project road		Location w.r.t. project road	LHS/ RHS
5.	Type of water body (River / Canal / lake)			
6.	Existing users			
7.	Ownership of the water body			
8.	Authority responsible for giving permission			
9.	If private, name, address and contact details of owner			
10.	Distance from project road			
11.	Width and type of access road			
List of enclosure:		Location map		
		Photographs of the site		

C. Submission Details	**Submitted by (Environment & Safety Engineer of Contractor)**	**Approved / Rejected by (Environmental Officer of CSC)**
Signature & date		
Name		
Designation		
Remarks by CSC		

* *All distances are to be measured from the boundary of the site. Ground water should not be used for construction.*

Note: Contractor has to fill and submit this format to the CSC upon identification of each water source for construction. Subsequently, the EO of CSC has to visit the site and approve / reject the site with reasons. The EO of CSC has to give a copy of this format to the contractor after his approval / rejection with remarks.

ANNEXURE 3.18: FORMAT FOR REGISTER OF COMPLAINTS AND IT'S REPORTING

A	**Project Details**		**Information**		
1.	Name of project stretch and SH no.				
2.	Name and address of the Contractor				
3.	Contract date and duration				
B	**Details of Complaint Received**		**Site Name**		
Sl. No.	**Date of Complaint**	**Name and address of person with contact details**	**Complaint**	**Action taken with date**	**Signature of ESE of Contractor**
1					
2					
3					

A register in this format shall be maintained at each site office of the contractor. This same format shall be used to compile and report the details of complaints received at all sites to the CSC along with the Monthly Report of the Contractor. The EO of CSC has to give instruction to the Contractor, if any further action has to be taken on any complaint.

ANNEXURE 3.19: FORMAT FOR REGISTER OF SITES OPENED AND CLOSED AND IT'S REPORTING

A.	**Project Details**			**Information**							
1.	Name of project stretch and SH no.										
2.	Name and address of the Contractor										
3.	Contract date and duration										
B.	**Site Details**										
Sl. No.	**Site Opening Date**	**Type of Site***	**Address of Site (Place name, Landmark, Revenue Village, Survey No., Panchayath, Taluk and District)**	**Name And Address of the Owner**	**List of Clearance Required**	**Issue Date of each Clearance**	**Expiry Date of each Clearance**	**Site Closing Date**	**Redevelopment Status**	**Remarks**	**Signature of ESE of Contractor**
1											
2											

** Construction Camp / Labour camp / Quarry Area and Stone Crusher Unit / Borrow Area / Debris Disposal Site / Water Source.*

A site should be opened only after submitting the Management and Redevelopment Plan prepared as per the Guidelines given in EMP and got it approved by the EO of the CSC. A register in this format (preferably in A3 size paper) should be maintained by the contractor for each road. This same format shall be used to report the details of sites opened and closed to the CSC along with the Monthly Report of the Contractor. The EO of CSC has to give instruction to the contractor if any clearance is pending for any site.

ANNEXURE 3. 20. CHECKLIST FOR MONITORING OF CONSTRUCTION CAMP MANAGEMENT

A	**Project Details**		Date of Monitoring:	
1.	Name of project stretch and SH no.			
2.	Name and address of the Contractor			
3.	Contract date and duration			
4.	Status of completion of the project			
5.	Name of Construction Camp with sl. no. in Register of Sites			
B.	**Monitoring Details**			
Sl. No.	**Environmental Management Measures**	**CSC's observation (Yes / No / Not Applicable)**	**Corrective Actions Proposed**	**Remarks**
1.	Whether concrete flooring and oil interceptors are provided for hot mix plant area and work shop, vehicle washing and fuel handling area?			
2.	Are all the first aid facilities provided in the camp?			
3.	Whether the plant is located in such a way that there are no residences, public institutions or hospital within a radius of 250 M from the centre of the plant?			
4.	Whether the vehicle movement in and out of the camp is in a controlled manner?			
5.	Does water in cross drainage channels block?			
6.	Whether all the plant and machineries are well maintained and regularly serviced?			
7.	Whether all the drains and channels are covered?			
8.	Whether a green belt is provided along the periphery of camp?			
9.	Whether water is stored for dust suppression in the			

	camp?			
10.	Whether sanitation facilities are provided for male and female?			
11.	Whether separate garbage bins are provided to collect the garbage?			
12.	Whether septic tanks with soak pits are provided?			
13.	Whether the location of soak pit is in such a way that it does not pollute the ground water?			
14.	Whether a qualified safety officer is appointed for ensuring safety?			
15.	Whether noise barriers near sensitive receptors are provided?			
16.	Whether personal protective equipments are provided?			
17.	Whether warning sign boards are set up at the entrance gate for the public?			
18.	Whether all applicable clearances are obtained and valid till date?			
Signature of Environment and Safety Engineer (ESE) of the Contractor with date			Signature of Environmental Officer of the CSC with date	

Note: *The Environmental Officer of the CSC has to use this format to monitor the implementation of Environmental Management Measures for each Construction Camp Quarterly.*

Corrective actions with specific timeframe should be proposed for each Environmental Management Measure, which is not implemented satisfactorily. A copy of the filled up format should be given to the ESE of the Contractor. CSC has to attach this format to the Quarterly Report to be submitted to PIU, with details of corrective action taken by the Contractor.

ANNEXURE 3.21: CHECKLIST FOR MONITORING OF LABOUR CAMP MANAGEMENT

A	**Project Details**		Date of Monitoring:	
1.	Name of project stretch and SH no.			
2.	Name and address of the Contractor			
3.	Contract date and duration			
4.	Status of completion of the project			
5.	Name of Labour Camp with sl. no. in register of sites			
B	**Monitoring Details**			
Sl. No.	**Environmental Management Measures**	**CSC's observation (Yes / No / Not Applicable)**	**Corrective Actions Proposed**	**Remarks**
1.	Whether the camps are floored with concrete?			
2.	Are all the first aid facilities provided in the camp?			
3.	Whether the camp is located in such a way that there are no residences, public institutions or biosensitive area within a radius of 500 m from the camp?			
4.	Whether the vehicle movement in and out of the camp is in a controlled manner?			
5.	Whether LPG for cooking is provided?			
6.	Whether safe drinking water is provided?			
7.	Whether all the drains and channels are covered?			
8.	Whether a green belt is provided along the periphery of camp?			
9.	Whether day care centres are provided with in the camp?			
10.	Whether sanitation facilities are provided separately for male and female?			

11.	Whether separate garbage bins are provided to collect the garbage?			
12.	Whether septic tanks with soak pits are provided?			
13.	Whether the location of soak pit is in such a away that it does not pollute the ground water?			
14.	Whether a qualified safety officer is appointed for ensuring safety?			
15.	Whether proper fencing of the camp is done?			
16.	Whether the workers are well aware of cleanliness, hygiene, community livings, AIDS etc.?			
17.	Whether all applicable clearances are obtained and valid till date?			
Signature of Environment and Safety Engineer (ESE) of the Contractor with date			Signature of Environmental Officer of the CSC with date	

Note: *The Environmental Officer of the CSC has to use this format to monitor the implementation of Environmental Management Measures for each Labour Camp Quarterly. Corrective actions with specific timeframe should be proposed for each Environmental Management Measure, which is not implemented satisfactorily. A copy of the filled up format should be given to the ESE of the Contractor. CSC has to attach this format to the Quarterly Report to be submitted to PIU, with details of corrective action taken by the Contractor.*

ANNEXURE 3.22: CHECKLIST FOR MONITORING OF QUARRY AND STONE CRUSHER MANAGEMENT

A	**Project Details**			Date of Monitoring:
1.	Name of project stretch and SH no.			
2.	Name and address of the Contractor			
3.	Contract date and duration			
4.	Status of completion of the project			
5.	Name of Quarry & Crusher with sl. no. in register of sites			
B	**Monitoring Details**			
Sl. No.	**Environmental Management Measures**	**CSC's observation (Yes / No / Not Applicable)**	**Corrective Actions Proposed**	**Remarks**
1.	Whether the crusher units and/or other dust- producing units are housed in a building with a wall of minimum 23 cm thickness and with suitable roofing?			
2.	Whether quarry site is located at a distance of minimum 500 mts. from human settlement, railway line, national highway, state highway, eco-sensitive area or district road*?			
3.	Whether stone quarry is located at a minimum distance of 50mts. from a water body4?			
4.	Whether the vehicle movement in and out of the camp is in a controlled manner?			
5.	Whether a dust extraction with collection system is provided in the crusher unit and all transfer points?			
6.	Whether safe drinking water is provided for the workers?			
7.	Whether a dust extraction unit with collection system is provided in the crusher unit and all transfer points?			
8.	Whether a green belt is provided along the periphery of quarry?			
9.	Whether adequate systems with water spray and sprinkling is provided for dust suppression?			
10.	Whether the roads inside the crusher premises is tarred or concreted?			
11.	Whether separate garbage bins are provided to collect the garbage?			
12.	Whether the crusher, impactor and other connecting unit working time is restricted to day time (6 am to 6 pm)?			
13.	Whether dust sealing arrangement is provided in the impactor to avoid fugitive emission?			

14.	Whether the ambient sound level (Leq) at a distance of 1 m away from the boundary of the site is with in 55 dB(A)?			
15.	Whether the occupier is conducting air monitoring on the suggested frequency?			
16.	Whether contour trenches are made to control soil erosion?			
17.	Whether workers are properly trained?			
18.	Whether sign boards of size 6’ x 4’ mentioning the project details and Contractor’s details are placed for public?			
19.	Whether the stack height of the D.G set is adequate?			
20.	Whether arrangement made for avoiding fugitive emission from plants/ premises are adequate?			
21.	Whether natural drainage patterns are kept clear without not alteration or blockage?			
22.	Whether top soil conservation has been undertaken?			
23.	Whether all applicable clearances are obtained and valid till date?			
Signature of Environment and Safety Engineer (ESE) of the Contractor with date		Signature of Environmental Officer of the CSC with date		

Note: *The Environmental Officer of the CSC has to use this format to monitor the implementation of Environmental Management Measures for each Quarry & Crusher Quarterly.*
Corrective actions with specific timeframe should be proposed for each Environmental Management Measure, which is not implemented satisfactorily. A copy of the filled up format should be given to the ESE of the Contractor. CSC has to attach this format to the Quarterly Report to be submitted to PIU, with details of corrective action taken by the Contractor.

ANNEXURE 3.23: CHECKLIST FOR MONITORING OF BORROW AREA MANAGEMENT

A	**Project Details**	Date of Monitoring:		
1.	Name of project stretch and SH no.			
2.	Name and address of the Contractor			
3.	Contract date and duration			
4.	Status of completion of the project			
5.	Name of Borrow Area with sl. no. in register of sites			
B	**Monitoring Details**			
Sl. No.	**Environmental Management Measures**	**CSC's observation (Yes / No / Not Applicable)**	**Corrective Actions Proposed**	**Remarks**
1.	Whether the work at night is fully avoided?			
2.	Whether the approach road to the borrow area well maintained?			
3.	Whether the necessary traffic sign board is kept to control the traffic flow?			
4.	Whether any record is kept for the number of trees cut?			
5.	Whether a record on total quantity of earth evacuated is maintained?			
6.	Whether all waste materials from the borrow area is properly disposed?			
7.	Whether the relaying of the preserved top soil is carried out?			
8.	Whether required signages for the protection of the works or safety and convenience of public provided?			
9.	Whether effective measures are taken to control nuisance and disturbance arising from the execution work?			
10.	Whether the excavation is carried out in such a manner that the activity will not damage adjacent properties or cause contamination of nearby stream or other water bodies?			
11.	Whether the land is leveled after completion of work?			
12.	Whether the borrow pits are redeveloped?			
13.	Whether water logging is avoided?			
14.	Whether arrangements are made for regular sprinkling of water?			

15.	Whether all applicable clearances are obtained and valid till date?			
Signature of Environment and Safety Engineer (ESE) of the Contractor with date			Signature of Environmental Officer of the CSC with date	

Note: *The Environmental Officer of the CSC has to use this format to monitor the implementation of Environmental Management Measures for each Borrow Area Quarterly. Corrective actions with specific timeframe should be proposed for each Environmental Management Measure, which is not implemented satisfactorily. A copy of the filled up format should be given to the ESE of the Contractor. CSC has to attach this format to the Quarterly Report to be submitted to PIU, with details of corrective action taken by the Contractor.*

ANNEXURE 3.24: CHECKLIST FOR THE MONITORING OF DEBRIS DISPOSAL SITE MANAGEMENT

A	**Project Details**	Date of Monitoring:		
1.	Name of project stretch and SH no.			
2.	Name and address of the Contractor			
3.	Contract date and duration			
4.	Status of completion of the project			
5.	Name of Debris Disposal Site with sl. no. in register of sites			
B	**Monitoring Details**			
Sl. No.	**Environmental Management Measures**	**CSC's observation (Yes / No / Not Applicable)**	**Corrective Actions Proposed**	**Remarks**
1.	Whether the construction operations are carrying out in such a manner that no waste material is dumped or disposed off in an unhealthy manner that causes any environmental hazard?			
2.	Whether the debris forming work close to the streams and water bodies are generally avoided during the monsoon period?			
3.	Whether the debris disposal site is at least 200 meter away from the surface water body?			
4.	Whether the debris disposal site is at least 500 meter away from the ecologically sensitive are, residential area or main road?			
5.	Whether the debris disposal along the water courses and close to the drainage channels are in such a manner that it do not cause any blockage to the flow of water?			
6.	Whether the bituminous waste is used as a surfacing material to the access roads to base camps, quarries, borrow area, temporary diversion, haulage routes etc.?			
7.	Whether the waste disposal details are submitted to the CSC in the prescribed format?			
8.	Whether the spoils from excavation of the river bed are disposing off at specified area suggested by the engineers?			
9.	Whether the debris generated due to dismantling of existing permanent structure is reused in the temporary diversion?			

10.	Whether the preserved topsoil is used for redevelopment of the area?			
11.	Whether green belt is developed?			
12.	Whether all applicable clearances are obtained and valid till date?			
Signature of Environment and Safety Engineer (ESE) of the Contractor with date			Signature of Environmental Officer of the CSC with date	

Note: *The Environmental Officer of the CSC has to use this format to monitor the implementation of Environmental Management Measures for each Debris Disposal Site Quarterly.*

Corrective actions with specific timeframe should be proposed for each Environmental Management Measure, which is not implemented satisfactorily. A copy of the filled up format should be given to the ESE of the Contractor. CSC has to attach this format to the Quarterly Report to be submitted to PIU, with details of corrective action taken by the Contractor.

ANNEXURE 3.25: CHECK LIST FOR MONITORING OF REDEVELOPMENT OF CONSTRUCTION CAMP SITE

A	**Project Details**	Date of Monitoring:		
1.	Name of project stretch and SH no.			
2.	Name and address of the Contractor			
3.	Contract date and duration			
4.	Status of completion of the project			
5.	Name of Construction Camp with sl. no. in register of sites			
B	**Monitoring Details**			
Sl. No.	**Environmental Management Measures**	**CSC's observation (Yes/No/Not Applicable)**	**Corrective Actions Proposed**	**Remarks**
1.	Are all the temporary structures cleared as per the list in the redevelopment plan?			
2.	Are all building debris, garbage, night soils and POL waste disposed off safely?			
3.	Are all disposal pits or trenches filled, disinfected and effectively sealed off?			
4.	Are the facilities that could be put to re-use maintained well ?			
5.	Are all the spills within the camp site effectively disposed off from the site?			
6.	All the area within the camp site is leveled and spread over with stored top soil.			
7.	Has the residual top soil been utilized effectively ?			
8.	Has the entire camp area been made clean and tidy without disturbing the adjacent lands?			
9.	Are the plantations / green belt along the boundary of the camp maintained well ?			
10.	Are the ‘before’ and ‘after’ scenarios of the site documented through photographs and submitted to CSC?			
11	Are the conditions mentioned by the owner in the agreement adhered to ?			
12.	If not, mention details of the conditions that are not adhered to & further steps to be taken.			
13.	Can ‘works completion’ certificate be issued to this site ?			
Signature of Environment and Safety Engineer (ESE) of the Contractor with date		Signature of Environmental Officer of the CSC with date		

Note: *The Environmental Officer of the CSC has to use this format to monitor the implementation of Environmental Management Measures for the redevelopment of each Construction Camp Site as & when it is closed. Corrective actions with specific timeframe should be proposed for each Environmental Management Measure, which is not implemented satisfactorily. A copy of the filled up format should be given to the ESE of the Contractor. CSC has to attach this format to the Quarterly Report to be submitted to PIU, with details of corrective action taken by the Contractor.*

ANNEXURE 3.26: CHECK LIST FOR MONITORING OF REDEVELOPMENT OF LABOUR CAMP SITE

A	**Project Details**	Date of Monitoring:		
1.	Name of project stretch and SH no.			
2.	Name and address of the Contractor			
3.	Contract date and duration			
4.	Status of completion of the project			
5.	Name of Labour Camp with sl. no. in register of sites			
B	**Monitoring Details**			
Sl. No.	**Environmental Management Measures**	**CSC's observation (Yes/No/Not Applicable)**	**Corrective Actions Proposed**	**Remarks**
1.	Are all the temporary structures cleared as per the list in the redevelopment plan?			
2.	Are all building debris, garbage, night soils and POL waste disposed off safely?			
3.	Are all disposal pits or trenches filled, disinfected and effectively sealed off?			
4.	Are the facilities that could be put to re-use maintained well ?			
5.	Are all the spills within the camp site effectively disposed off from the site?			
6.	All the area within the camp site is leveled and spread over with stored top soil.			
7.	Has the residual top soil been utilized effectively ?			
8.	Has the entire camp area been made clean and tidy without disturbing the adjacent lands?			
9.	Are the plantations / green belt along the boundary of the camp maintained well ?			
10.	Are the ‘before’ and ‘after’ scenarios of the site documented through photographs and submitted to CSC?			
11	Are the conditions mentioned by the owner in the agreement adhered to ?			
12.	If not, mention the details of the conditions that are not adhered to and further steps to be taken.			
13.	Can ‘works completion’ certificate be issued to this site?			
Signature of Environment and Safety Engineer (ESE) of the Contractor with date			Signature of Environmental Officer of the CSC with date	

Note: *The Environmental Officer of the CSC has to use this format to monitor the implementation of Environmental Management Measures for the redevelopment of each Labour Camp Site as and when it is closed. Corrective actions with specific timeframe should be proposed for each Environmental Management Measure, which is not implemented satisfactorily. A copy of the filled up format should be given to the ESE of the Contractor. CSC has to attach this format to the Quarterly Report to be submitted to PIU, with details of corrective action taken by the Contractor.*

ANNEXURE 3.27: CHECK LIST FOR MONITORING OF REDEVELOPMENT OF QUARRY AND STONE CRUSHER SITE

A	**Project Details**	Date of Monitoring:		
1.	Name of project stretch and SH no.			
2.	Name and address of the Contractor			
3.	Contract date and duration			
4.	Status of completion of the project			
5.	Name of Quarry & Crusher with sl. no. in register of sites			
B	**Monitoring Details**			
Sl. No.	**Environmental Management Measures**	**CSC's observation (Yes / No / Not Applicable)**	**Corrective Actions Proposed**	**Remarks**
1.	Are all the temporary structures cleared as per the list in the redevelopment plan?			
2.	Are all debris, garbage, night soils and POL waste disposed off safely?			
3.	Are the facilities that could be put to re-use maintained well ?			
4.	Has the conserved top soil been reused ?			
5.	Are the improvement measures identified in the redevelopment plan implemented ?			
6.	If not, mention the measures yet to be implemented.			
7.	Has the residual top soil been utilized effectively?			
8.	Has the entire area been made clean and tidy without disturbing the adjacent lands?			
9.	Are the plantations / green belt along the boundary of the camp maintained well ?			
10.	Has additional tree plantation been undertaken as mentioned in the re-development plan ?			
11	Has erosion control measures and slope stabilization measures been undertaken ?			
12.	Whether pits created by blasting are filled with overburden soil.			
13.	Has the local community been involved in the implementation of redevelopment plan ?			
14.	Are the required photographs submitted to CSC?			
15.	Are the conditions mentioned by the owner in the agreement adhered to ?			

16.	If not, mention the details of the conditions that are not adhered to and further steps to be taken.			
17.	Can 'works completion' certificate be issued to this site ?			
Signature of Environment and Safety Engineer (ESE) of the Contractor with date			Signature of Environmental Officer of the CSC with date	

Note: *The Environmental Officer of the CSC has to use this format to monitor the implementation of Environmental Management Measures for the redevelopment of each Quarry and Crusher Site as and when it is closed. Corrective actions with specific timeframe should be proposed for each Environmental Management Measure, which is not implemented satisfactorily. A copy of the filled up format should be given to the ESE of the Contractor. CSC has to attach this format to the Quarterly Report to be submitted to PIU, with details of corrective action taken by the Contractor.*

ANNEXURE 3.28: CHECK LIST FOR MONITORING OF REDEVELOPMENT OF BORROW AREAS

A	**Project Details**	Date of Monitoring:		
1.	Name of project stretch and SH no.			
2.	Name and address of the Contractor			
3.	Contract date and duration			
4.	Status of completion of the project			
5.	Name of Borrow Area with sl. no. in register of sites			
B	**Monitoring Details**			
Sl. No.	**Environmental Management Measures**	**CSC's observation (Yes / No / Not Applicable)**	**Corrective Actions Proposed**	**Remarks**
1.	Has slope stabilization been undertaken along the edges (if there is a level difference) ?			
2.	Is all the waste material raised from the borrow area disposed off properly ?			
3.	Has the preserved top soil been used in redevelopment of site ?			
4.	Has the borrow areas been re-vegetated properly ?			
5.	Is the cross drainage system and the flood water drains managed properly to avoid occurrence of flooding ?			
6.	Are the borrow area pits re-developed ?			
7.	Is the leveling of depression after filling-in of wastes undertaken?			
8.	Selection of Species as per OSRP Project Guidelines for plantation.			
9.	Has bund creation and temporary fencing been undertaken?			
10.	Ponds including creation of new ones and enhancing capacity of existing ones (for irrigation; pissiculture and general uses by people and/or cattle)			
Signature of Environment and Safety Engineer (ESE) of the Contractor with date		Signature of Environmental Officer of the CSC with date		

Note: *The Environmental Officer of the CSC has to use this format to monitor the implementation of Environmental Management Measures for the redevelopment of each Borrow Area as and when it is closed. Corrective actions with specific timeframe should be proposed for each Environmental Management Measure, which is not implemented satisfactorily. A copy of the filled up format should be given to the ESE of the Contractor. CSC has to attach this format to the Quarterly Report to be submitted to PIU, with details of corrective action taken by the Contractor.*

ANNEXURE 3.29: CHECK LIST FOR MONITORING OF REDEVELOPMENT OF DEBRIS DISPOSAL SITE

A	**Project Details**	Date of Monitoring:		
1.	Name of project stretch and SH no.			
2.	Name and address of the Contractor			
3.	Contract date and duration			
4.	Status of completion of the project			
5.	Name of Borrow Area with sl. no. in register of sites			
B	**Monitoring Details**			
Sl. No.	**Environmental Management Measures**	**CSC's observation (Yes / No / Not Applicable)**	**Corrective Actions Proposed**	**Remarks**
1.	Rehabilitation of the dump site by planting local shrubs and other plant species.			
2.	Conversion of debris site into farm land, playground, parking area, block plantation area etc.			
3.	Maintenance of the hydrological flow in the area.			
Signature of Environment and Safety Engineer (ESE) of the Contractor with date			Signature of Environmental Officer of the CSC with date	

Note: *The Environmental Officer of the CSC has to use this format to monitor the implementation of Environmental Management Measures for the redevelopment of each Debris Disposal Site as and when it is closed. Corrective actions with specific timeframe should be proposed for each Environmental Management Measure, which is not implemented satisfactorily. A copy of the filled up format should be given to the ESE of the Contractor. CSC has to attach this format to the Quarterly Report to be submitted to PIU, with details of corrective action taken by the Contractor.*

ANNEXURE 3.30: REPORTING FORMAT FOR WORK FORCE MANAGEMENT

A	**Project Details**	Date of Reporting:
1.	Name of project stretch and SH no.	
2.	Name and address of the Contractor	
3.	Contract date and duration	
4.	Status of completion of the project	
5.	Name of Work Site with sl. no. in register of sites	

B.	**Status of work force**				
Sl.	**Category of work force**	**Work force in the Previous Month (No.)**	**Work force added in the reporting month (No.)**	**Work Force left in the reporting month (No.)**	**Total work force in the reporting month (No.)**
1.	Unskilled Labourers				
2.	Skilled labourers				
3.	Supervisors				
4.	Engineers				
5.	Office Staff				
	Sub Total				
	Grand Total				

C.	**Categorization of work force**										
Sl.	**Category of work force**	**Male**		**Female**		**Employment Status**		**Residential Status**		**Accommodation Status**	
		< 18 yrs.	**> 18 yrs.**	**< 18 yrs.**	**> 18 yrs.**	**Regular**	**Temporary**	**Migrant**	**Local**	**Staying in Labour Camp / Quarters**	**Others**
1.	Unskilled Labourers										
2.	Skilled labourers										
3.	Supervisors										

4.	Engineers										
5.	Office Staff										
	Sub Total										
	Grand Total										

D.	**Details of non-working migrated people, living in the Labour Camps / Staff Quarters as part of work force family**								
No. of children (0-6 yrs.)			**No. of children (7-18 yrs.)**			**No. of adults**			**Grand Total**
Male	**Female**	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**	

C.	**Submission Details**	
	Submitted by **(Environmental & Safety Engineer of Contractor)**	**Approved by** **(Environmental Officer of CSC)**
Signature & date		
Name		
Designation		
Remarks by CSC		

Note: Contractor has to fill and submit this format to the CSC along with the Monthly Report. In addition to that, the Contractor has to maintain the database of work force in the form of a register. An attendance register for the work force should also be maintained by the Contractor. Contractor has to report the details of migrant work force to the nearest police station. The CSC has to visit the sites and verify the details. The EO of CSC has to give back a copy of this format to the contractor after his approval with remarks.

ANNEXURE 3.31: REPORTING FORMAT FOR OCCUPATIONAL HEALTH AND SAFETY MEASURES

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

	condition		
11	Regular health checkup for labour/ Contractor's personnel		
12	Ensuring the sanitary conditions and all waste disposal procedures & methods in the camps.		
13	Provision for insurance coverage to the workers		
C.	**Submission Details**		

	Submitted by **(Environment & Safety Engineer of Contractor)**	**Approved by** **(Environmental Officer of CSC)**
Signature & date		
Name		
Designation		
Remarks by CSC		
Note: Contractor has to fill and submit this format to the CSC along with the Monthly Report. The CSC has to visit the sites and verify the details. Further mitigation measures, if required, can be suggested by the CSC. The EO of CSC has to give back a copy of this format to the contractor after his approval with remarks.		

ANNEXURE 3.32: REPORTING FORMAT FOR TOP SOIL CONSERVATION

A	**Project Details**	Date of Reporting:	
1.	Name of project stretch and SH no.		
2.	Name and address of the Contractor		
3.	Contract date and duration		
4.	Status of completion of the project		
5.	Name of Site with sl. no. in register of sites		
B	**Top Soil Conservation Details**		
Sl. No.	**List of Activities**	**Status (Yes / No)**	**Remarks**
1.	Whether the location was pre-identified?		
2.	Whether the slope is < 1:2 ?		
3.	Whether height is less than 2 mts ?		
4.	Whether edges of pile are protected by silt fencing ?		
5.	Whether multiple handling is kept to a minimum		
6.	Whether measures are taken to prevent the loss during rains.?		
7.	Whether any other measure are provided? If yes, What is it?		
C.	**Submission Details**		

	Submitted by (Environment & Safety Engineer of Contractor)	**Approved by (Environmental Officer of CSC)**
Signature & date		
Name		
Designation		
Remarks by CSC		

Note: Contractor has to fill and submit this format to the CSC along with the Monthly Report. This format is to be filled for each site, after opening the site. The CSC has to visit the sites and verify the details. Further mitigation measures, if required, can be suggested by the CSC. The EO of CSC has to give back a copy of this format to the contractor after his approval with remarks.

ANNEXURE 3.33: REPORTING FORMAT FOR WATER SPRINKLING FOR DUST SUPPRESSION

A	**Project Details**		Month and Year of reporting:
1.	Name of project stretch and SH no.		
2.	Name and address of the Contractor		
3.	Contract date and duration		
4.	Status of completion of the project		
5.	Location of water sprinkling		

B	**Water Sprinkling Details**	Days																														
Particulars		1	2	3	4	5	6	7	8	9	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3
No. of trips per day																																
Quantity of Water Sprinkled (KLD)																																
If not sprinkled, reason for the same																																

C.	**Submission Details**	
	Submitted by **(Environment & Safety Engineer of Contractor)**	**Approved by** **(Environmental Officer of CSC)**
Signature & date		
Name		
Designation		
Remarks by CSC		

Note: Contractor has to fill this format for each construction site (preferably in A3 size paper) and submit to the CSC along with the Monthly Report. The CSC has to visit the sites and verify the details. Additional water sprinkling, if required, can be suggested by the CSC. The EO of CSC has to give back a copy of this format to the contractor after his approval with remarks.

ANNEXURE 3.34: REPORTING FORMAT FOR ROAD SAFETY MEASURES DURING CONSTRUCTION

A	**Project Details**	Date of Reporting:	
1.	Name of project stretch and SH no.		
2.	Name and address of the Contractor		
3.	Contract date and duration		
4.	Status of completion of the project		
B	**Details of Safety Measures**		
S.No	**Safety Measures**	**Compliance Status (Yes / No)**	**Remarks**
a.	**General**		
1	A qualified Environment and Safety Engineer should be appointed		
2	A Traffic Management Plan should be prepared in accordance with IRC: SP: 55-2001 and got approved by the Engineer		
3	Maintenance of existing road stretches handed over to the Contractor should be carried out		
b.	**Details of Construction Zone**		
1	Length of transition sub zone should be min 50 m for a speed of 50km/hr		
2	Length of work sub zone in urban stretch should be<2 km		
3	Length of work sub zone in rural stretch should be 5-10 km		
c.	**Signages in construction zones**		
1	Sign saying ‘Men at Work’ should be kept 1 km ahead of Transition sub zone		
2	Supplementary sign saying Diversion 1 km should be provided		
3	Sign saying ‘Road Closed ahead’ should be provided		
4	Compulsory Tum Right/Left sign should be provided		
5	Detour sign should be placed		
6	Sharp Deviation sign should be placed at end of advance warning sub zone		
7	Signage should be provided in Transition Sub Work Zone		
8	Signage saying ‘Keep Right/Left should be provided		
9	Signage should be placed in work sub zone		
10	Hazard Marker should be placed where railing for CD structure on diversion starts		

11	Barricade should be provided on either side of work sub zone		
12	Flag persons should be provided for traffic control		
13	Flags and warning lights should be provided at Construction zones		
14	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 or Barricades/caution tapes should be provided in construction zones		
15	Plastic crash barriers should be provided		
16	Demarcations (fencing, guarding and watching) should be provided at bridge / culvert construction sites		
17	Arrangements should be made for controlled access and entry to Construction zones		
18	Regular Inspection of Work Zone Traffic Control Devices should be carried out by authorized contractor personnel		
19	All vehicles should be provided with reverse horns		
20	Speed of construction vehicles should be controlled through road safety training of drivers		
d.	**Signage in Termination sub zone**		
1	Sign for indication of end of work zone should be placed 120m from end of termination sub zone		
e.	**Road Delineators**		
1	Roadway indicators should be provided		
2	Hazard markers should be provided		
3	Object markers should be provided		

C.	**Submission Details**	
	Submitted by (Environment & Safety Engineer of Contractor)	**Approved by (Environmental Officer of CSC)**
Signature & date		
Name		
Designation		
Remarks by CSC		

Note: Contractor has to fill this format and submit to the CSC along with the Monthly Report. The CSC has to visit the sites & verify the details. Additional safety measures, if required, can be suggested by the CSC. The EO of CSC has to give back a copy of this format to the contractor after his approval with remarks.

ANNEXURE 3.35: FORMAT FOR REGISTER OF ACCIDENTS AND IT'S REPORTING

A	**Project Details**		Date of Reporting:	
1.	Name of project stretch and SH no.			
2.	Name and address of the Contractor			
3.	Contract date and duration			
4.	Status of completion of the project			
B	**Details of Accident and People Involved in Accident**			
	Name of site where accident happened			
	Name and address of people involved in the accident			
	Whether Contractor's personnel or General public			
	Details of Injury			
	Details of treatment given			
	Details of compensation given			
C	**Type of Accident (√)**			
	Fall of person from a height		Explosion	
	Slip, trip or fall on same level		Fire	
	Struck against fixed objects		Contact with hot or corrosive substance	
	Struck by flying or falling objects		Contact with poisonous gas or toxic substances.	
	Struck by moving objects		Contact with poisonous gas or toxic substances	
	Struck / caught by cable		Hand tool accident	
	Stepping on hail etc.		Vehicle / Mobile plant accident	
	Handling without machinery		Machinery operation accident	
	Crushing / burying		Other (please specify)	
	Drowning or asphyxiation			
D	**Agent Involved in Accident (√)**			
	Machinery		Stair edge	
	Portable power appliance		Excavation / underground working	
	Vehicle or associated equipment /machinery		Ladder	
	Material being handled, used or stored		Scaffolding /gondola	
	Gas, vapor, dust, fume or oxygen		Construction formwork, shuttering and false work.	
	Hand tools		Electricity supply cable, wiring switchboard and associated equipment	
	Floor edge		Nail, slinter or chipping	
	Floor opening		Other (Please specify)	
	Left shaft			

E	**Unsafe Action Relevant to the Accident (√)**			
	Operating without authority			Failure to use proper footwear
	Failure to secure objects			Failure to use eye protector
	Making safety devices inoperative			Failure to use respirator
	Working on moving or dangerous equipment			Failure to use proper clothing
	Using un-safety equipment			Failure to use warn others or given proper signals
	Adopting unsafe position or posture			Horseplay
	Operating or working at unsafe speed			No unsafe action
	Unsafe loading, Placing, mixing et			Others (please specify)
	Failure to use helmet			
F	**Lack of Safety Measures Relevant to the Accident (√)**			
	No protective gear			Unsafe layout of job, traffic etc.
	Defective protective gear			Unsafe process of job methods
	Improper dress / footwear			Poor housekeeping
	Improper guarding			Lack of warning system
	Improper ventilation			Defective tool, machinery or materials
	Improper illumination			No unsafe condition
	Improper procedure			Others (please specify)
G	**Personal Factor Relevant to the Accident (√)**			
	Incorrect attitude /motive			No unsafe personal factor.
	Unsafe act by another person			Other (please specify)
H	**Details of Corrective and Preventive action taken**			
1				
2				
3				
4				

I	Submission Details		
		Submitted by **(Environment & Safety Engineer of Contractor)**	**Approved by** **(Environmental Officer of CSC)**
Signature & date			
Name			
Designation			
Remarks by CSC			

Note: Contractor has to fill this format as and when an accident happens and submits to the CSC along with the Monthly Report. The CSC has to visit the sites and verify the details. Additional safety measures, if required, can be suggested by the CSC. The EO of CSC has to give back a copy of this format to the contractor after his approval with remarks.

ANNEXURE 3.36: REPORTING FORMAT FOR ENVIRONMENTAL QUALITY MONITORING

A	**Project Details**		Date of Reporting:			
1.	Name of project stretch and SH no.					
2.	Name and address of the Contractor					
3.	Contract date and duration					
4.	Status of completion of the project					
B	**Environmental Monitoring Details**					
Sl. No	**Details of Monitoring Location**	**Period of Monitoring**	**Details of values exceeding the relevant standards**	**Reasons for pollution**	**Details of Corrective actions taken**	**Remarks**
a.	**Air Monitoring**					
1.						
2.						
3.						
b.	**Water Monitoring**					
1.						
2.						
3.						
c.	**Noise Monitoring***					
1.						
2.						
3.						
C	**Submission Details**					

	Submitted by (Environment & Safety Engineer of Contractor)	**Approved by (Environmental Officer of CSC)**
Signature & date		
Name		

Designation		
Remarks by CSC		

** Noise monitoring along the road will be done by the CSC, using the Noise Meter of PIU. The CSC has to give the monitoring results to the Contractor for corrective actions, if any, required and including in this report.*

Note: The Contractor has to conduct Environmental Monitoring through a NABL approved Laboratory as per the Environmental Monitoring Plan given in the EMP, fill this format and submit to the CSC along with the Monthly Report, if monitoring was due in that month. A copy of the monitoring report given by the Laboratory has to be attached to this format. The CSC has to visit the sites and verify the details. Additional mitigation measures, if required, can be suggested by the CSC. The EO of CSC has to give back a copy of this format to the contractor after his approval with remarks.

ANNEXURE 3.37: REPORTING FORMAT FOR ENHANCEMENT AND MITIGATION OF CULTURAL PROPERTIES

A	**Project Details**		Date of reporting:
1.	Name of project stretch and SH no.		
2.	Name and address of the Contractor		
3.	Contract date and duration		
4.	Status of completion of the project		
B	**Details of Enhancement and Mitigation of Cultural Properties**		
Sl. No.	**Location with Chainage**	**% work completed**	**Remarks and reasons for delay, if any**
C	**Submission Details**		
	Submitted by (Environment & Safety Engineer of Contractor)		**Approved by (Environmental Officer of CSC)**
Signature & date			
Name			
Designation			
Remarks by CSC			

Note: The Contractor has to fill the details of cultural properties for which enhancement and mitigation measures were carried out during the reporting month in this format and submit to the CSC along with the Monthly Report. Overall progress in this activity for the entire project road is to be included in the Monthly Report. The CSC has to visit the sites and verify the details. Additional mitigation measures, if required, can be suggested by the CSC. The EO of CSC has to give back a copy of this format to the contractor after his approval with remarks.

ANNEXURE 3.38: REPORTING FORMAT FOR ENHANCEMENT MEASURES OTHER THAN CULTURAL PROPERTIES

A	**Project Details**		Date of reporting:
1.	Name of project stretch and SH no.		
2.	Name and address of the Contractor		
3.	Contract date and duration		
4.	Status of completion of the project		
B	**Details of Enhancement Measures**		
Sl. No.	**Location with Chainage**	**% work completed**	**Remarks and reasons for delay, if any.**
a	**Raising embankment height**		
b	**Ponds**		
c	**Bus stops and bus bays**		
f	**Sign Boards**		
h	**Any other measures**		
C	**Submission Details**		
		Submitted by (Environment & Safety Engineer of Contractor)	**Approved by (Environmental Officer of CSC)**
Signature & date			
Name			
Designation			
Remarks by CSC			

Note: The Contractor has to fill the details of enhancement measures carried out for amenities / facilities other than cultural properties during the reporting month in this format and submit to the CSC along with the Monthly Report. Overall progress in this activity for the entire project road is to be included in the Monthly Report. The CSC has to visit the sites and verify the details. Additional mitigation measures, if required, can be suggested by the CSC. The EO of CSC has to give back a copy of this format to the contractor after his approval with remarks.

ANNEXURE 3.39: REPORTING FORMAT FOR TREE PLANTATION

A	**Project Details**		Date of reporting:	
1.	Name of project stretch and SH no.			
2.	Name and address of the Contractor			
3.	Contract date and duration			
4.	Status of completion of the project			
B	**Details of Trees Planted**			
Sl. No.	**Location with Chainage**	**No. of Trees to be Planted**	**% work completed**	**Remarks and reasons for delay, if any**
C	**Submission Details**			

	Submitted by **(Environment & Safety Engineer of Contractor)**	**Approved by** **(Environmental Officer of CSC)**
Signature & date		
Name		
Designation		
Remarks by CSC		

Note: The Contractor has to fill the details of Trees planted during the reporting month in this format and submit to the CSC along with the Monthly Report. Overall progress in this activity for the entire project road is to be included in the Monthly Report. The CSC has to visit the sites and verify the details. The EO of CSC has to give back a copy of this format to the contractor after his approval with remarks.

ANNEXURE 3.40: REPORTING FORMAT FOR MONTHLY REPORT FROM CONTRACTOR TO CSC

A.	Project Details	Period of Reporting:
1.	Name of project stretch and SH no.	
2.	Name and address of the Contractor	
3.	Contract date and duration	
4.	Status of completion of the project	

B.	Physical Progress Report								
Sl. No.	**Enhancement Measure**	**Physical target (Nos.)**	**Units carried over from previous month**	**Units started in reporting month**	**Units completed in reporting month**	**Units carried over to next month**	**Cumulative units completed till end of reporting month**	**% target completed**	**Remarks / reasons for delay**
			(a)	(b)	(c)	(d=a+b-c)			
1.	Noise barrier								
2.	Hand pumps								
3.	Bus Shelter								
4.	Sign Boards								
5.	Preserving and landscaping cultural properties like								
6.	Constructing new well								
7.	providing new water taps								
8.	Parking space for auto rickshaws, cars and jeep								
9.	Landscaping of								

	type C oxbow lands								
10.	Planting trees along road side								
11.	Planting trees on inner side of sound insulating wall								
12.	Providing 1.2 mt. high fencing under via duct								
13.	Concrete flooring with slope drains and oil interceptors in construction camps								

C.	**Details of Sites for Project Ancillary facilities**					
Sl. No.	**Type of camp / site**	**Cumulative No of sites opened**	**No of sites operational**	**Cumulative No of sites redeveloped**	**Cumulative No of sites closed***	**Remarks**
1.	Construction camp					
2.	Labour camp					
3.	Quarry & stone crusher unit					
4.	Borrow Area					
5.	Debris disposal site					
6.	Water sources			NA		
** A site will be considered closed after redeveloping and obtaining closure certificate from CSC.*						

D.	Summary of machinery and equipment available			
Sl. No.	**Type of equipment / machinery / vehicles**	**Nos. available**	**Validity date of PUC certificate (as applicable)**	**Remarks**
1.				

E.	Details of lapses and notices					
Sl. No.	**Details of notices issued by CSC**	**Date of notice**	**Type of lapse (Major / Minor)**	**Notice No. ***	**Corrective actions taken**	**Remarks**

**In case of minor lapse, specify whether original notice, first reminder or second reminder.*

F.	REPORTING FORMATS TO BE ANNEXED WITH THIS MONTHLY REPORT BY THE CONTRACTOR				
SL. NO.	**REPORTING FORMAT**	**YES/NO**	**SL. NO**	**REPORTING FORMAT**	**YES/NO**
1	Format for Register of sites opened and closed and its reporting		8	Reporting Format for Register of Accidents and it's Reporting	
2	Format for Register of complaints and its reporting		9	Reporting Format for Enhancement and Mitigation of Cultural Properties	
3	Reporting Format for Work Force Management		10	Reporting Format for Noise Barrier Construction	
4	Reporting Format for Occupational Health and Safety Measures		11	Reporting Format for Enhancement Measures Other than Cultural Properties	
5	Reporting Format for Top Soil Conservation		12	Reporting Format for Tree Plantation	
6	Reporting Format for Water Sprinkling for Dust Suppression		13	Reporting Format for Environmental Quality Monitoring	
7	Reporting Format for Road Safety Measures During Construction		-	-	-

G. SUBMISSION DETAILS	SUBMITTED BY (ENVIRONMENT & SAFETY ENGINEER OF CONTRACTOR)	APPROVED BY (ENVIRONMENTAL OFFICER OF CSC)

Signature & date		
Name		
Designation		
Remarks by CSC		

ANNEXURE 3.41: REPORTING FORMAT FOR MONTHLY REPORT FROM CSC TO PIU

A	Project Details				Period of Reporting:				
1.	Name of project stretch and SH no.								
2.	Name and address of the Contractor								
3.	Contract date and duration								
4.	Status of completion of the project								
B.	Physical Progress Report								
Sl. No.	**Enhancement Measure**	**Physical target (Nos.)**	**Units carried over from previous month**	**Units started in reporting month**	**Units completed in reporting month**	**Units carried over to next month**	**Cumulative units completed till end of reporting month**	**% target completed**	**Remarks / reasons for delay**
			(a)	**(b)**	**(c)**	**(d=a+b-c)**			
1.	Noise barrier								
2.	Hand pumps								
3.	Bus Shelter								
4.	Sign Boards								
5.	Preserving and landscaping the cultural properties like shrines and hyundi								
6.	Constructing new well								
7.	providing new water taps								
8.	Parking space for auto rickshaws, cars and jeep								
9.	Landscaping of type C oxbow lands								

10.	Planting trees along road side								
11.	Planting trees on inner side of sound insulating wall								
12.	Providing 1.2 mt. high fencing under via duct								
13.	Concrete flooring with slope drains and oil interceptors								

C.	**Details of Sites for Project Ancillary facilities**					
Sl. No.	**Type of camp / site**	**Cumulative No of sites opened**	**No of sites operational**	**Cumulative No of sites redeveloped**	**Cumulative No of sites closed***	**Remarks**
1.	Construction camp					
2.	Labour camp					
3.	Quarry & stone crusher unit					
4.	Borrow Area					
5.	Debris disposal site					
6.	Water sources			NA		

** A site will be considered closed after redeveloping and obtaining closure certificate from CSC.*

D.	**Summary of machinery and equipment available**			
Sl. No.	**Type of equipment / machinery / vehicles**	**Nos. available**	**Validity date of PUC certificate (as applicable)**	**Remarks**
1.				
2.				
3.				

E.	**Details of lapses for which notices were issued during the previous reporting month**					
Sl. No.	**Details of notices issued by CSC**	**Date of notice**	**Type of lapse (Major / Minor)**	**Notice No. ***	**Corrective actions taken by Contractor**	**Remarks**
1.						
2.						

3.						

In case of minor lapse, specify whether original notice, first reminder or second reminder.

F.	**Details of major lapses for which notices were issued during the current reporting month**			
Sl. No.	**List of major lapses**	**Date of issuing notice**	**Whether invoking penalty clause from next interim payment certificate is recommended?**	**Remarks**
1.				
2.				
3.				

G.	**Details of minor lapses for which notices were issued during the current reporting month**					
Sl. No.	**List of minor lapses**	**Date of issuing notice**			**Whether invoking penalty clause from next interim payment certificate is recommended?**	**Remarks**
		Original notice	**First Reminder**	**Second Reminder**		
1.						
2.						
3.						

H.	**Reporting / Monitoring formats to be annexed with this monthly report by the CSC**				
Sl. No.	**Reporting / Monitoring format**	**Yes/ No**	**Sl. No**	**Reporting / Monitoring format**	**Yes/No**
1	Format for Register of sites opened and closed and its reporting		13	Reporting Format for Environmental Quality Monitoring	
2	Format for Register of complaints and its reporting		14	Checklist For Monitoring Of Construction Camp Management	
3	Reporting Format for Work Force Management		15	Checklist For Monitoring Of Labour Camp Management	
4	Reporting Format for Occupational Health and Safety Measures		16	Checklist For Monitoring Of Quarry and Stone Crusher Management	
5	Reporting Format for Top Soil Conservation		17	Checklist For Monitoring Of Borrow Area Management	
6	Reporting Format for Water Sprinkling for Dust Suppression		18	Checklist For The Monitoring Of Debris Disposal Site Management	

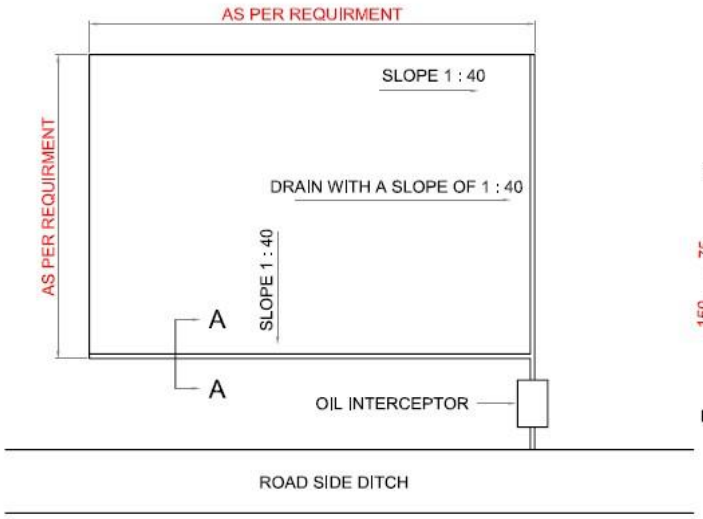
7	Reporting Format for Road Safety mseasures During Construction		19	Check List For Monitoring of Redevelopment Of Construction Camp Site	-
8	Reporting Format for Register of Accidents and it's Reporting		20	Check List For Monitoring Of Redevelopment Of Labour Camp Site	
9	Reporting Format for Enhancement and Mitigation of Cultural Properties		21	Check List For Monitoring Of Redevelopment Of Quarry And Stone Crusher Site	
10	Reporting Format for Noise Barrier Construction		22	Check List For Monitoring Of Redevelopment Of Borrow Areas	
11	Reporting Format for Enhancement Measures Other than Cultural Properties		23	Check List For Monitoring Of Redevelopment Of Debris Disposal Site	
12	Reporting Format for Tree Plantation				

I. Submission Details	**Submitted by** **(Environmental Officer of CSC)**	**Approved by** **(Environmental Engineer of PIU)**
Signature & date		
Name		
Designation		
Remarks by PIU		

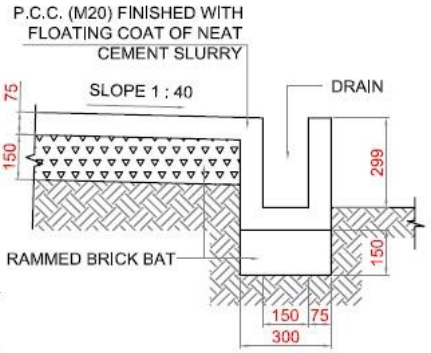
ANNEXURE 3.42: LIST OF PERMISSIONS TO BE OBTAINED BY THE CONTRACTOR

S. No.	Type of Clearance / Permission	Statutory Authority	Applicability	Project stage	Responsibility
1.	Consent to Establish under the Air (Prevention & Control of Pollution) Act, 1981 and the Water (Prevention &Control of Pollution) Act, 1974	TNPCB	For establishment of construction camp, construction plant, crusher, batching plant etc.	Pre construction	Contractor
2.	Consent to Operate under the Air (Prevention & Control of Pollution) Act, 1981 and the Water (Prevention &Control of Pollution) Act, 1974	TNPCB	For operating construction plant, crusher, batching plant etc.	Construction stage (Prior to initiation of any work	Contractor
3.	Permission to withdraw water for construction from surface water sources such as Rivers/Ponds	TN Irrigation Department	Use of surface water for construction	Construction stage (Prior to initiation of any work)	Contractor
4.	Permission to withdraw ground water for construction from new sources	State and Central Ground Water Boards	Extraction of ground water	Construction stage (Prior to initiation of any work)	Contractor
5.	Permission for storage, handling and transport of hazardous materials	TNPCB	Manufacture, storage and import of Hazardous Chemical	Construction stage (Prior to initiation of any work	Contractor
6.	Explosive License	Chief Controller of Explosives	For storing fuel oil, lubricants, diesel etc. at construction camp	Construction stage (Prior to initiation of any work)	Contractor
7.	Quarry Lease Deed and Quarry License from State Department of Mines and Geology	Dept. of Mining; Concerned District Administration; SEIAA;TNPCB	Quarry operation (for new quarry) Environmental Clearance from SEIAA and CTE/CTO from TNPCB.	Construction stage (Prior to initiation of any work)	Contractor
8.	PUC for vehicles for construction under Central Motor and Vehicle Act 1988	Motor Vehicle Department of Tamil Nadu State	For all construction vehicles	Construction stage (Prior to initiation of any work)	Contractor
9.	Labor license	Labor commissioner office	Engagement of Labor	Construction stage (Prior to initiation of any work)	Contractor

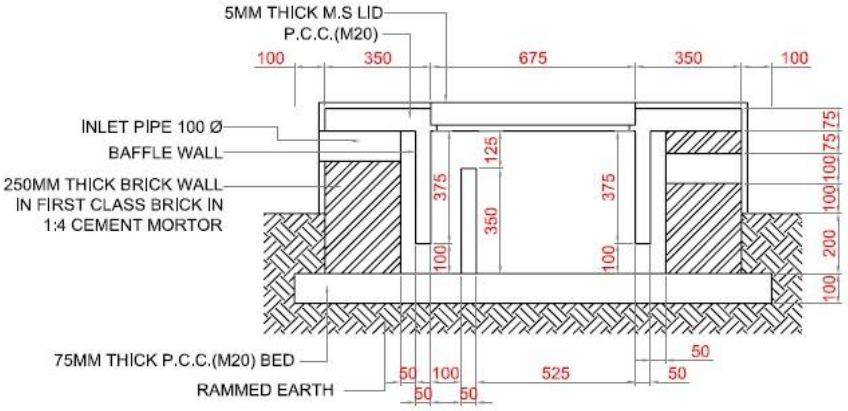
ANNEXURE 3.43: SCHEMATIC DIAGRAM OF CATCH DRAIN AND OIL INTERCEPTORS



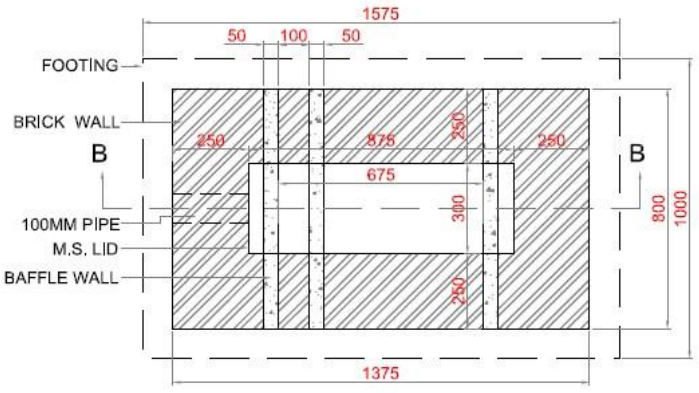
KEY PLAN



SECTION A - A



SECTION B - B



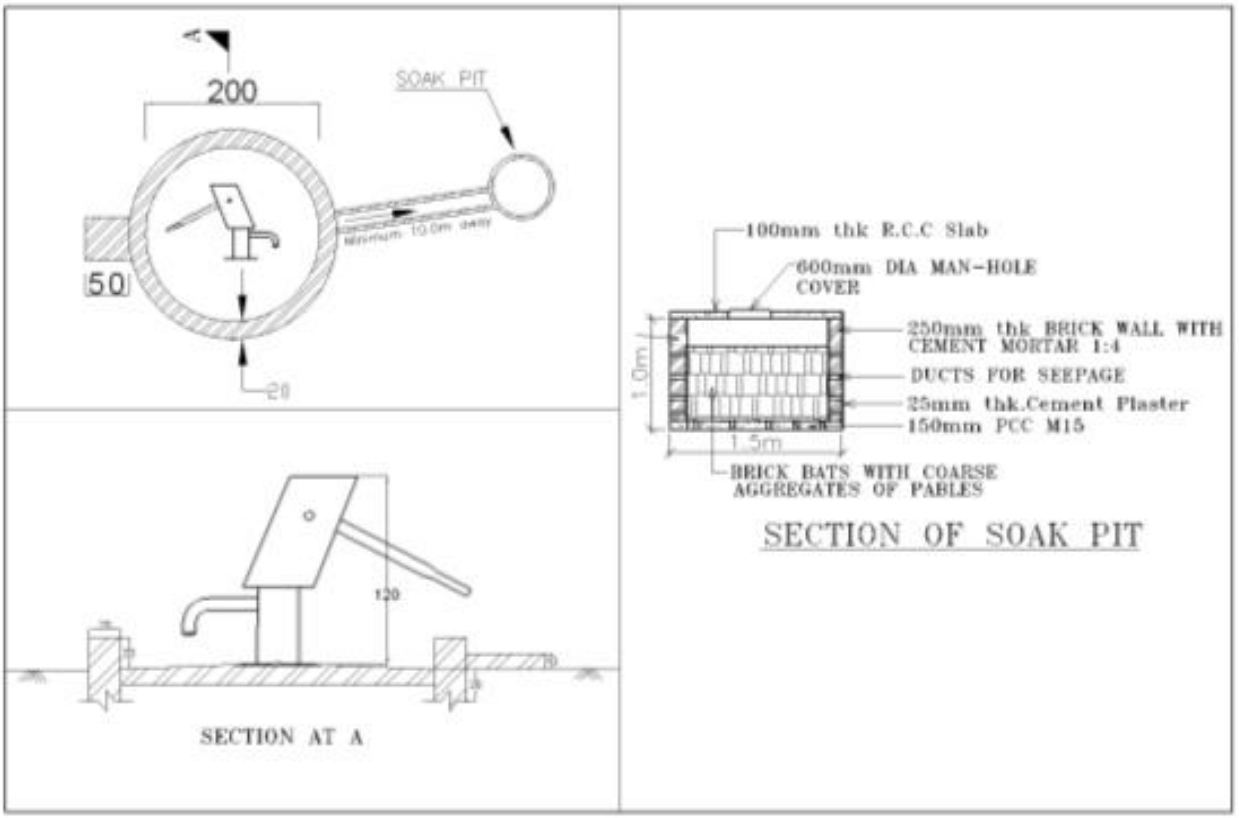
PLAN OF OIL INTERCEPTOR

ANNEXURE 3.44: PUBLIC WATER SOURCES ALONG PROJECT ROAD, IMPACT AND MITIGATION

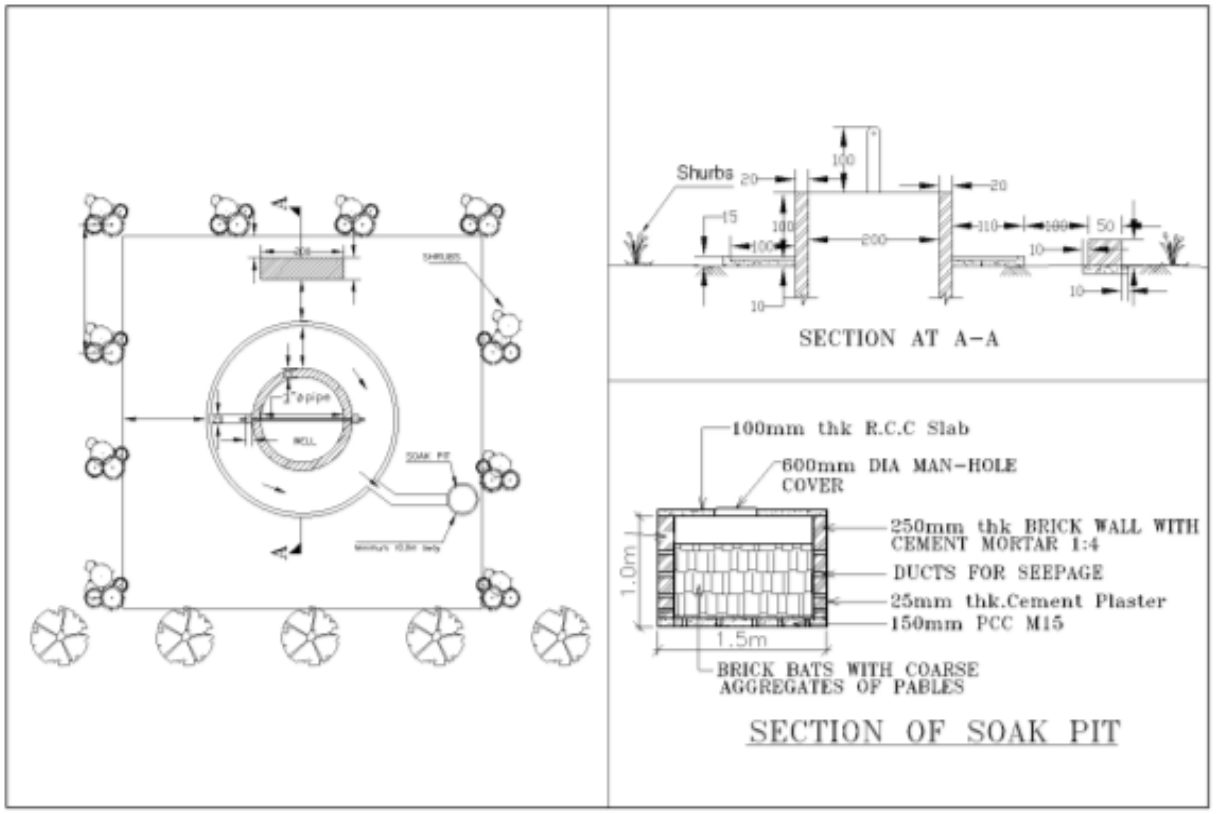
S.No	Chainage	Description	Category	Location	Mitigation/ Enhancement
1.	5/410	Hand Pump	Hand Pump	RHS	Will be relocated to the nearest place Drain and soak pit as per Drawing No. 1
2.	17/390	Hand Pump	Hand Pump	LHS	Will be relocated to the nearest place Drain and soak pit as per Drawing No. 1
3.	18/060	Hand Pump	Hand Pump	RHS	Will be relocated to the nearest place Drain and soak pit as per Drawing No. 1
4.	18/080	Hand Pump	Hand Pump	RHS	Will be relocated to the nearest place Drain and soak pit as per Drawing No. 1
5.	18/100	Hand Pump	Hand Pump	RHS	Will be relocated to the nearest place Drain and soak pit as per Drawing No. 1
6.	21/570	Hand Pump	Hand Pump	RHS	Will be relocated to the nearest place Drain and soak pit as per Drawing No. 1
7.	74/680	Hand Pump	Hand Pump	RHS	Will be relocated to the nearest place Drain and soak pit as per Drawing No. 1
8.	73/880	Hand Pump	Hand Pump	LHS	Will be relocated to the nearest place Drain and soak pit as per Drawing No. 1
9.	14/380	Borewell point	Borewell Point	LHS	Relocation
10.	18/050	Open bore well	Bore well	RHS	Relocation
11.	15/860	open well	Open Well	LHS	Will be relocated to the nearest place Drain and soak pit as per Drawing No. 1
12.	25/660	OHT TWAD	OHT	LHS	Will be relocated to the nearest place
13.	70/720	water tank(PWD)	Water Tank	RHS	Will be relocated to the nearest place
14.	74/760	water tank(PWD)	Water Tank	RHS	Will be relocated to the nearest place
15.	74/840	(PWD)open bore well and	Open Well	RHS	Will be relocated to the nearest place

S.No	Chainage	Description	Category	Location	Mitigation/ Enhancement
		hand pump			Drain and soak pit as per Drawing No. 1
16.	78/600	water tank(PWD)	Water Tank	RHS	Will be relocated to the nearest place
17.	74/580	open well	Open Well	LHS	Will be relocated to the nearest place Drain and soak pit as per Drawing No. 1
18.	16/290	TWAD	Water Tap	LHS	Relocation
19.	16/980	TWAD	Water Tap	LHS	Relocation
20.	17/030	TWAD	Water Tap	LHS	Relocation
21.	17/040	TWAD	Water Tap	LHS	Relocation
22.	17/290	TWAD	Water Tap	LHS	Relocation
23.	18/000	TWAD	Water Tap	LHS	Relocation
24.	18/060	TWAD	Water Tap	LHS	Relocation
25.	18/400	TWAD	Water Tap	LHS	Relocation
26.	23/890	TWAD	Water Tap	LHS	Relocation
27.	23/890	TWAD	Water Tap	LHS	Relocation
28.	24/600	TWAD	Water Tap	LHS	Relocation
29.	25/560	TWAD	Water Tap	LHS	Relocation
30.	25/920	TWAD	Water Tap	LHS	Relocation
31.	26/050	TWAD	Water Tap	LHS	Relocation
32.	26/220	TWAD	Water Tap	LHS	Relocation
33.	71/680	TWAD	Water Tap	LHS	Relocation
34.	72/280	TWAD	Water Tap	LHS	Relocation
35.	72/780	TWAD	Water Tap	LHS	Relocation
36.	72/980	TWAD	Water Tap	LHS	Relocation
37.	72/980	TWAD	Water Tap	LHS	Relocation
38.	73/550	TWAD	Water Tap	LHS	Relocation
39.	74/320	TWAD	Water Tap	LHS	Relocation
40.	79/890	TWAD	Water Tap	LHS	Relocation
41.	82/780	TWAD	Water Tap	LHS	Relocation

Source: Primary Survey at site



Drawing No. 1: Conceptual plan of Soak Pit for Hand Pump



Drawing No. 2: Conceptual Plan of Soak Pit for Open Well

ANNEXURE 3.45: LOCATION OF BUS BAYS/BUS SHELTER

S. No.	Existing Chainage (km)	Design Chainage (km)	Side	Village Name
1.	7+980	7+947	RHS	Cholapuram
2.	9+540	9+487	LHS	Cholapuram
3.	9+925	9+947	RHS	Cholapuram
4.	10+900	10+917	LHS	-
5.	11+690	11+697	LHS	-
6.	12+800	12+900	LHS	-
7.	13+025	13+017	RHS	-
8.	14+400	14+312	LHS	-
9.	14+540	14+397	RHS	-
10.	15+350	15+287	LHS	-
11.	15+565	15+507	RHS	-
12.	17+260	17+137	LHS	-
13.	18+140	18+132	LHS	-
14.	21+200	21+172	LHS	Kuvalaikanni
15.	21+950	21+207	RHS	Kuvalaikanni
16.	21+900	21+912	LHS	Kuvalaikanni
17.	22+100	22+192	RHS	Kuvalaikanni
18.	24+315	24+372	RHS	-
19.	24+450	24+512	LHS	-
20.	25+200	25+247	RHS	Perumbathor
21.	25+500	25+552	LHS	Perumbathor
22.	26+010	26+038	LHS	Perumbathor
23.	27+060	27+087	LHS	-
24.	27+740	27+787	LHS	-
25.	27+800	27+847	RHS	-
26.	38+360	38+387	LHS	Sanmuganallur
27.	38+470	38+652	RHS	Sanmuganallur
28.	40+115	40+117	RHS	Grukkalpatty
29.	41+120	41+167	RHS	Grukkalpatty
30.	41+430	41+482	LHS	Grukkalpatty
31.	42+985	42+997	LHS	-
32.	43+020	43+168	RHS	-
33.	44+400	44+452	RHS	-
34.	44+500	44+567	LHS	-
35.	45+600	45+646	RHS	-
36.	45+800	45+852	LHS	-
37.	47+930	47+997	LHS	Panavadalichathiram
38.	48+060	48+122	RHS	Panavadalichathiram
39.	48+700	48+747	RHS	Panavadalichathiram
40.	49+850	49+897	RHS	-
41.	50+670	50+707	LHS	-
42.	50+720	50+757	RHS	-
43.	54+425	54+450	LHS	Vannikonthal
44.	54+590	54+632	RHS	Vannikonthal
45.	56+320	56+322	RHS	Vannikonthal
46.	58+700	58+572	RHS	Devarkulam
47.	58+732	58+732	LHS	Devarkulam
48.	60+380	60+412	LHS	-
49.	61+655	61+692	RHS	-
50.	61+900	61+932	LHS	-
51.	64+280	64+252	LHS	Azhagiyapandi Puram

S. No.	Existing Chainage (km)	Design Chainage (km)	Side	Village Name
52.	66+960	66+947	LHS	-
53.	67+785	67+767	RHS	-
54.	70+570	70+553	RHS	Manur
55.	70+870	70+851	LHS	Manur
56.	71+775	71+752	LHS	-
57.	72+270	72+252	LHS	-
58.	73+100	73+092	RHS	-
59.	74+550	74+547	LHS	-
60.	74+815	74+807	RHS	-
61.	76+640	76+637	RHS	-
62.	76+730	76+782	LHS	-
63.	77+660	77+652	RHS	-
64.	78+285	78+287	RHS	-
65.	78+740	78+747	RHS	-
66.	78+890	78+902	LHS	-
67.	80+000	80+017	LHS	-
68.	80+175	80+192	RHS	-

ANNEXURE 3.46: WATER BODIES ALONG PROJECT ROAD, IMPACT, MITIGATION AND ENHANCEMENT

S. No.	Ch. (Km)	LHS/RHS	Name and Type of Water Bodies	Distance From Centerline (m)	Possible impacts from Project	Mitigation/Enhancement
1.	3.00	LHS	Earthen Check Dam	15-20m	No Impact	
2.	4.98	LHS	Pond	7m	No Impact	Enhancement measure proposed (Ref Drawing no. 1 of Annexure 3.51)
3.	7.00	LHS	Earthen Check Dam	9-12m	No Impact	
4.	8.050	Both side & crossing	Chozhapuram river and Check dam on RHS	RHS-along the Bridge LHS-along the Bridge approach	Siltation	
5.	11.250	LHS	Pond	5-6m	Directly Impacted Siltation and Encroachment of catchment area	Enhancement measure proposed (Ref Drawing no. 2 of Annexure 3.51)
6.	13.550	RHS	Check Dam	5-9m	Directly Impacted Damage to Bund wall at few locations	
7.	17.00	RHS	Check Dam	Along the road	Not impacted due to radius improvement	
8.	17.250	RHS	Check Dam	8-20m	Damage to Bund wall at few locations	
9.	20.600	LHS and Crossing	Nala and Check Dam/Pond	6-50m	Siltation during construction	
10.	23.100	RHS	Pond with stone stairs	20m	No Impact	
11.	23.700	RHS	Pond	20m	No Impact	
12.	24.380	LHS	Pond with cement concrete wall	8-9m	Pond wall impacted	Enhancement measure proposed (Ref Drawing no. 3 of Annexure 3.51)
13.	25.600	LHS	Pond	5-6m	Directly Impacted Pond wall damage	
14.	26.200	Both side	Check Dam	Along the road	Directly Impacted Encroachment of catchment area, bund wall damage	
15.	33.800	RHS	Check Dam	15-20m	Impact on bund wall from km 34.520 to km 34.570	
16.	40.200	RHS	Check Dam	30-50m	No Impact	

S. No.	Ch. (Km)	LHS/RHS	Name and Type of Water Bodies	Distance From Centerline (m)	Possible impacts from Project	Mitigation/Enhancement
17.	42.200	RHS	Pond	6-7m	Directly Impacted (earthen wall)	Enhancement measure proposed (Ref Drawing no. 4 of Annexure 3.51)
18.	44.00	LHS	Check Dam	15-30m	No Impact	
19.	53.400	RHS	Pond/Check Dam	5-10m	Directly Impacted Encroachment of catchment area Siltation	
20.	53.570	LHS	Check Dam	5-25m	Directly Impacted Damage to bund wall (15m)	
21.	60.400	LHS	Pond	25-30m	No Impact (check, not shown in design)	
22.	61.700	RHS	Check Dam with channels	5-100m	Directly Impacted Damage to bund wall (5m)	
23.	62.400	RHS and cross to LHS	Check Dam with steel channels/doors	40-60m	No Impact	
24.	66.400	LHS	Pond in rock trench	15-20m	No Impact	
25.	69.000	RHS	Pond in rock trench	25-30m	No Impact	
26.	69.600	RHS	Check Dam	6-8m	Directly Impacted Damage to bund wall (5m)	
27.	79.600	RHS	Check Dam	15-20m	No Impact	

ANNEXURE 3.47: QUARRY AND BORROW AREAS NEAR PROJECT ROAD

The details of aggregate and gravel quarry areas are

Table 1 Aggregate Quarry Details

S.No	Quarry Location	Side	Quarry Name	Lead	Quantity
1	4/400 V.K.Pudur Shanmuhanallur Road	R.H.S	M.M.A Blue Metals	19 Km from SH-39 km at 39+200 to this Quarry (Athiyuthu to V.K Pudur Road)	100 Tones Per Day
2	Vadikottai Hills at 27/200 of SH-41	R.H.S	Maruthi Blue Metals	5 Km	250 Tones Per day
3	66/400 of SH-41 Road	R.H.S	A.M.Blue metals	0.5 km	300 Tones per day

Table 2 Gravel Quarry Details

S. No.	Quarry Location	Side	Quarry Name	Lead	Quantity (cum)
1	15/000	L.H.S	Hill	1km away from road	25000
3	17/200	B.S	Lake	50m away from road	250000
4	69/600	R.H.S	Manur Kulam / Pond	1.7 km from Road	300000
5	76/000	L.H.S	Barren Land	1 km	30000
6	81/000	R.H.S	Megamudayar kulam / Pond	0.8 km	50000

ANNEXURE 3.48: MATERIAL SOURCES AVAILABLE NEAR PROJECT ROAD

Cement, bitumen, and Steel are the manufactured materials. Cement and steel with IS certification are available at Sankarankovil, at km 32/000 along the road. Bitumen is available at three different sources as below:

Kochi refinery, IOCL, average lead of 282.65 km

Chennai Depot (Hincol, Emulsion), average lead of 600.65 km

Chennai refinery, IOCL, average lead of 600.65 km

ANNEXURE 3.49: DETAILS OF LIKELY TREE REMOVAL ALONG PROJECT ROAD

Details of trees (>30cm girth size) falling within Corridor of Impact

30 - 60	60 - 90	90 - 120	120 - 150	150 - 180	180 - 210	>210	Total	Local Name	Scientific Name	30 - 60	60 - 90	90 - 120	120 - 150	150 - 180	180 - 210	>210	Total
1							1	Akatthi	*Sesbania grandiflora*								
	2	2	1	1	1	11	18	Ala Maram	*Ficus bengalensis*	2	2	0	3	1	2	18	28
1	1	1					3	Aarasamaram	*Ficusr eligiosa*	5	3	2	0	2	0	2	14
							0	Arjun	*Terminalia arjuna*						1	1	2
							0	Athi	*Ficus racemosa*						1		1
5							5	Badam	*Terminalia catappa*	2							2
							0	Chrismas tree	*Picea sp.*	1							1
	9						9	Thennai tree	*Cocos nucifera*		3	3	0	1	1	0	8
	5			1			6	Cotton tree	*Ceibapentandra*								
1							1	Guava	*Psidium guajava*	1							1
1							1	Itchu(Flus)									
	1		2				3	Kakaipalai	*Micromelum minutum*								
1							1	Kodukkapuli	*Murraya koenigii*	1	1	1	0	0	0	0	3
30	20	4	5	2		2	63	Malai Vembu	*Melia azedarach*	1	2						3
						3	3	Mamaram	*Mangifera indica*								
68	7	1		1		1	78	Manjanathi	*Morinda tomentosa*	36	15	4	2	0	1	1	59
7	2						9	Murungai	*Moringa oleifera Lank*	5	3	0	1	0	0	0	9
2							2	Naval	*Eugenia argentea*	4	2	0	0	0	0	0	6

30 - 60	60 - 90	90 - 120	120 - 150	150 - 180	180 - 210	>210	Total	Local Name	Scientific Name	30 - 60	60 - 90	90 - 120	120 - 150	150 - 180	180 - 210	>210	Total
2							2	Neerkaruvai	*Prosopis juliflora*	3	5	1	4	0	0	0	13
367	103	46	10	6	9	12	553	Neem	*Azadirachta indica*	408	186	72	37	17	11	25	756
						1	1	Neermarudhu	*Terminalia arjuna*								
1							1	nellikai	*Phyllanthus emblica*								
2							2	Nettalingam	*Polyalthial ongifolia*								
2	61	182	27	2	2	0	276	Palmyra palm	*Borassus flabellifer*	0	61	263	28	3	0	0	355
							0	Pinari	*Ailanthus excelsa*				1				1
		1					1	Puvarasu	*Thespesia populnea*	1							1
71	19	9	1	2	0	0	102	Pungan	*Pongamia pungan*	65	12	4	9	3	7	10	110
1							1	Savukku	*Casurina equisetifolia*								
20	9	6	6	0	2	3	46	Siridam/Vagai	*Albizia lebbeck*	22	37	23	10	4	5	3	104
37	61	66	50	22	36	101	373	Pulee	*Tamarindus indica*	35	33	54	40	36	38	104	340
2	1						3	Tekku	*Tectona grandis*	6	0	0	1	0	0	0	7
25	40	21	4	5	4	0	99	Udai /Odai	*Acacia planifrons*	7	33	35	18	10	3	2	108
11	8	46	46	15	15	32	173	Usil	*Albizia procera*	5	13	60	25	15	10	17	145
							0	Vathanarayanan	*Delonix elata*		2	0	1	0	2	0	5
	1						1	vilvam/Velvam	*Aegle marmelos*	2	2						4
658	**350**	**385**	**152**	**57**	**69**	**166**	**1837**			**612**	**415**	**522**	**180**	**92**	**82**	**183**	**2086**

A total of 3923 no. of trees >30cm girth size are likely to be impacted.

Details of trees (<30cm girth size) falling within Corridor of Impact

LHS		Local Name	Scientific Name	RHS	
<=10	10-30			10-30	<=10
1	2	Badam	*Terminalia kadappa*		
15	43	Manjanathi	*Morinda tomentosa*	18	8
125	142	Neem	*Azadirachta indica*	98	32
2		Padam			
19	49	Pungan	*Pongamia pungan*	28	3
12	10	Pulee	*Tamarindus indica*	5	
2	2	Vagai	*Albizia lebbeck*	1	
	1	Usil	*Albizia amara*		4
	1	Akatthi	*Sesbania grandiflora*		
	1	Kodukkapuli	*Murraya koenigii*	1	
	1	Kodukkapuli	*Murraya koenigii*		
	1	Mala Vagai			
	2	Naval	*Eugenia argentea*	1	
	2	Nettalingam	*Polyalthial ongifolia*		
	1	nellikai	*Phyllanthus emblica*		
	2	Palmyra palm	*Borassus flabellifer*	2	2
	2	Panna poo			
	3	Savukku	*Casurina equisetifolia*		
	1	Odai	*Acacia planiforns*	2	
		Teak			1
		Aarasamaram	*Ficusr eligiosa*	1	
		Avathi		3	
		Puvarasu	*Thespesia populnea*	1	
176	**266**			**161**	**50**

Summary of girth wise (>30cm) impacted trees along the project road

Rajapalayam - Sankarankovil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41								
Side	**30 - 60**	**60 - 90**	**90 - 120**	**120 - 150**	**150 - 180**	**180 - 210**	**>210**	**Total**
LHS	658	350	385	152	57	69	166	1837
RHS	612	415	522	180	92	82	183	2086
Total	**1270**	**765**	**907**	**332**	**149**	**151**	**349**	**3923**

ANNEXURE 3.50: LANDSCAPING, TREE PLANTING AND ENVIRONMENTAL ENHANCEMENT PLAN

Due to the proposed project, there will be direct and long term impacts on the flora, which is unavoidable. Therefore, to reduce the impact on flora, plantation of trees has been proposed.

The mitigation and enhancement measures taken along the project corridor includes,

a) Transplantation of trees (girth size up to 30 cm): to save the existing tree species
b) Compensatory Plantation: to compensate the felling of trees
c) Plantation at enhancement sites
d) Avenue Plantation
e) Plantation at realignment sections

A) TRANSPLANTATION OF TREES

362 trees (98-LHS and 264-RHS) have been identified for transplantation out of total 1013 no. of trees of girth size <30 cm. Major species, which can be transplanted, is Neem.

Details of trees for transplantation (<30cm)

Girth Size	Rajapalayam-Sankarankovil-Tirunelveli section of SH-41			
	Existing No. of Trees		Can be Transplanted	
	LHS	RHS	LHS	RHS
Upto 30 cm	546	467	98	264
Total	**1013**		**362**	

The Chainage and species wise details of trees <30 cm which can be transplanted are as tabulated below:

Trees <30cm girth size on LHS

S. No.	Tree No.	Chainage	Local Name	Scientific Name	Girth at (m)	Approx Height (m)
1	43	2.6-2.7	Neem	*Azadirachta indica*	0.16	2.5
2	3	3.0-3.1	Panna poo		0.14	2.5
3	5	3.0-3.1	Panna poo		0.1	2
4	6	3.0-3.1	Panna poo		0.12	2
5	8	3.0-3.1	Panna poo		0.12	2
6	11	3.0-3.1	Manjanathi	*Morinda tomentosa*	0.14	2.5
7	26	3.5-3.6	Neem	*Azadirachta indica*	0.12	2.5
8	27	3.5-3.6	Manjanathi	*Morinda tomentosa*	0.12	2.5
9	28	3.5-3.6	Manjanathi	*Morinda tomentosa*	0.1	2.5
10	8	5.1-5.2	Neem	*Azadirachta indica*	0.12	2
11	16	5.3-5.4	Malavaagai		0.1	2

S. No.	Tree No.	Chainage	Local Name	Scientific Name	Girth at (m)	Approx Height (m)
12	18	5.4-5.5	Pulee	*Tamarindus indica*	0.15	2
13	2	6.0-6.1	Manjanathi	*Morinda tomentosa*	0.09	1.5
14	4	7.2-7.3	Pungan	*Pongamia pungan*	0.25	2.5
15	7	7.2-7.3	Neem	*Azadirachta indica*	0.25	2.5
16	13	7.3-7.4	Neem	*Azadirachta indica*	0.2	2.5
17	22	7.4-7.5	Neem	*Azadirachta indica*	0.25	2
18	25	7.6-7.7	Neem	*Azadirachta indica*	0.2	2
19	33	7.7-7.8	Manjanathi	*Morinda tomentosa*	0.2	1.5
20	66	8.8-8.9	Neem	*Azadirachta indica*	0.1	1.5
21	74	8.9-9	Neem	*Azadirachta indica*	0.25	2
22	1	9.1-9.2	Neem	*Azadirachta indica*	0.1	1.5
23	19	10.5-10.6	Neem	*Azadirachta indica*	0.2	2
24	6	11.8-11.9	Neem	*Azadirachta indica*	0.15	2.5
25	10	12.7-12.8	Pungan	*Pongamia pungan*	0.2	1
26	1	13.0-13.1	Neem	*Azadirachta indica*	0.1	1
27	6	13.1-13.2	Neem	*Azadirachta indica*	0.1	1.5
28	17	17.9-18	Manjanathi	*Morinda tomentosa*	0.1	1
29	5	20.`-20.2	Neem	*Azadirachta indica*	0.1	2
30	18	20.5-20.6	Neem	*Azadirachta indica*	0.1	1
31	19	20.6-20.7	Neem	*Azadirachta indica*	0.1	1
32	20	20.6-20.7	Neem	*Azadirachta indica*	0.1	1
33	30	26.8-26.9	Neem	*Azadirachta indica*	0.1	1
34	34	39.3-39.4	Neem	*Azadirachta indica*	0.1	2
35	38	39.4-39.5	Neem	*Azadirachta indica*	0.1	2
36	44	39.4-39.5	Neem	*Azadirachta indica*	0.1	2
37	52	39.5-39.6	Neem	*Azadirachta indica*	0.15	2
38	58	39.6-39.7	Neem	*Azadirachta indica*	0.12	2
39	63	39.6-39.7	Pulee	*Tamarindus indica*	0.25	2
40	68	39.7-39.8	Pulee	*Tamarindus indica*	0.2	2
41	69	39.7-39.8	Neem	*Azadirachta indica*	0.18	2.5
42	82	39.9-40	Pulee	*Tamarindus indica*	0.2	2
43	13	40.0-40.1	Neem	*Azadirachta indica*	0.12	2
44	21	40.1-40.2	Neem	*Azadirachta indica*	0.2	2.5
45	29	40.3-40.4	Pulee	*Tamarindus indica*	0.2	2
46	30	40.3-40.4	Pulee	*Tamarindus indica*	0.22	2
47	33	40.3-40.4	Pulee	*Tamarindus indica*	0.25	2
48	34	40.4-40.5	Neem	*Azadirachta indica*	0.15	1.5

S. No.	Tree No.	Chainage	Local Name	Scientific Name	Girth at (m)	Approx Height (m)
49	38	40.4-40.5	Pulee	*Tamarindus indica*	0.12	1.5
50	40	40.4-40.5	Pulee	*Tamarindus indica*	0.24	2
51	41	40.4-40.5	Pulee	*Tamarindus indica*	0.2	2
52	25	42.8-42.9	Neem	*Azadirachta indica*	0.12	2
53	29	42.9-43.0	Neem	*Azadirachta indica*	0.12	1.5
54	34	42.9-43.0	Tekku	*Tectona grandis*	0.12	2.5
55	30	43.2-43.3	Neem	*Azadirachta indica*	0.15	2
56	31	43.2-43.3	Neem	*Azadirachta indica*	0.18	1.5
57	36	43.2-43.3	Neem	*Azadirachta indica*	0.13	1.5
58	53	43.6-43.7	Neem	*Azadirachta indica*	0.15	2
59	64	43.7-43.8	Neem	*Azadirachta indica*	0.1	2
60	85	43.9-44.0	Neem	*Azadirachta indica*	0.15	2
61	86	43.9-44.0	Neem	*Azadirachta indica*	0.1	2
62	1	44.0-44.1	Neem	*Azadirachta indica*	0.15	2.5
63	4	44.0-44.1	Neem	*Azadirachta indica*	0.1	2
64	5	44.0-44.1	Neem	*Azadirachta indica*	0.07	1.5
65	20	45.0-45.1	Neem	*Azadirachta indica*	0.1	2
66	9	49.1-49.2	Neem	*Azadirachta indica*	0.11	2
67	15	49.2-49.3	Neem	*Azadirachta indica*	0.15	2
68	16	49.2-49.3	Neem	*Azadirachta indica*	0.1	2
69	18	49.2-49.3	Neem	*Azadirachta indica*	0.14	2
70	19	49.3-49.4	Neem	*Azadirachta indica*	0.1	2
71	21	49.3-49.4	Neem	*Azadirachta indica*	0.12	2
72	22	49.4-49.5	Neem	*Azadirachta indica*	0.15	2.2
73	26	49.4-49.5	Neem	*Azadirachta indica*	0.09	1.5
74	32	49.5-49.6	Pulee	*Tamarindus indica*	0.12	2
75	34	49.6-49.7	Neem	*Azadirachta indica*	0.1	2
76	35	49.7-49.8	Neem	*Azadirachta indica*	0.1	1.5
77	37	49.7-49.8	Neem	*Azadirachta indica*	0.1	2
78	38	49.7-49.8	Neem	*Azadirachta indica*	0.1	1.5
79	47	49.8-49.9	Neem	*Azadirachta indica*	0.15	1.5
80	48	49.8-49.9	Neem	*Azadirachta indica*	0.2	2
81	1	50-50.1	Neem	*Azadirachta indica*	0.1	1
82	7	50.4-50.5	Neem	*Azadirachta indica*	0.1	1
83	8	50.4-50.5	Pungan	*Pongamia pungan*	0.1	1
84	18	54.1-54.2	Neem	*Azadirachta indica*	0.2	2
85	23	54.2-54.3	Neem	*Azadirachta indica*	0.15	2

S. No.	Tree No.	Chainage	Local Name	Scientific Name	Girth at (m)	Approx Height (m)
86	27	54.2-54.3	Neem	*Azadirachta indica*	0.2	2
87	5	55.1-55.2	Neem	*Azadirachta indica*	0.1	2
88	14	56.5-56.6	Neem	*Azadirachta indica*	0.1	2
89	15	56.6-56.7	Neem	*Azadirachta indica*	0.1	2
90	16	56.7-56.8	Neem	*Azadirachta indica*	0.12	2
91	16	59.7-59.8	Neem	*Azadirachta indica*	0.1	1
92	17	59.7-59.8	Neem	*Azadirachta indica*	0.15	1
93	4	61.0-61.1	Neem	*Azadirachta indica*	0.1	1.5
94	4	62.6-62.7	Neem	*Azadirachta indica*	0.1	1
95	5	62.6-62.7	Neem	*Azadirachta indica*	0.1	1
96	21	80.8-80.9	Manjanathi	*Morinda tomentosa*	0.07	1.5
97	3	80.9-81.0	Manjanathi	*Morinda tomentosa*	0.09	2
98	4	80.9-81.0	Manjanathi	*Morinda tomentosa*	0.12	2

Trees <30cm girth size on RHS

S. No.	Tree No.	Chainage	Local Name	Scientific Name	Girth (m)	Approx Height (m)
1	30	2.4-2.5	Neem	*Azadirachta indica*	0.1	1
2	34	2.5-2.6	Pungan	*Pongamia pungan*	0.18	1
3	35	2.5-2.6	Pungan	*Pongamia pungan*	0.12	1
4	37	2.5-2.6	Pungan	*Pongamia pungan*	0.11	1
5	44	2.7-2.8	Pungan	*Pongamia pungan*	0.23	1.5
6	4	3.0-3.1	Manjanathi	*Morinda tomentosa*	0.07	0.5
7	25	3.6-3.7	Manjanathi	*Morinda tomentosa*	0.09	1
8	35	3.7-3.8	Neem	*Azadirachta indica*	0.09	1.5
9	41	3.9-4.0	Neem	*Azadirachta indica*	0.09	1
10	5	4.0-4.1	Aalamaram	*Ficus bengalensis*	0.22	1
11	25	4.3-4.4	Pungan	*Pongamia pungan*	0.18	0.5
12	43	4.7-4.8	Neem	*Azadirachta indica*	0.21	3
13	18	5.2-5.3	Pungan	*Pongamia pungan*	0.2	1.8
14	26	5.4-5.5	Seetha		0.15	1.2
15	27	5.4-5.5	Seetha		0.11	1.2
16	31	5.4-5.5	Pungan	*Pongamia pungan*	0.1	1
17	33	5.4-5.5	Pungan	*Pongamia pungan*	0.26	0.6
18	37	5.5-5.6	Pungan	*Pongamia pungan*	0.14	0.2

S. No.	Tree No.	Chainage	Local Name	Scientific Name	Girth (m)	Approx Height (m)
19	38	5.5-5.6	Pungan	*Pongamia pungan*	0.23	0.1
20	74	5.9-6.0	nochi		0.11	2
21	19	6.1-6.2	Neem	*Azadirachta indica*	0.15	1.15
22	32	6.2-6.3	Neem	*Azadirachta indica*	0.2	0.8
23	41	6.3-6.4	Pungan	*Pongamia pungan*	0.25	3
24	49	6.3-6.4	Neem	*Azadirachta indica*	0.1	2.5
25	53	6.4-6.5	Pungan	*Pongamia pungan*	0.12	2.6
26	55	6.4-6.5	Neem	*Azadirachta indica*	0.1	1.5
27	56	6.4-6.5	Neem	*Azadirachta indica*	0.09	1.5
28	60	6.4-6.5	Neem	*Azadirachta indica*	0.2	2.5
29	63	6.4-6.5	Neem	*Azadirachta indica*	0.25	2.5
30	64	6.4-6.5	Manjanathi	*Morinda tomentosa*	0.1	2
31	73	6.5-6.6	Pungan	*Pongamia pungan*	0.2	2
32	75	6.5-6.6	Neem	*Azadirachta indica*	0.1	2.5
33	81	6.7-6.8	Neem	*Azadirachta indica*	0.12	2
34	82	6.7-6.8	Neem	*Azadirachta indica*	0.15	2.5
35	84	6.7-6.8	Neem	*Azadirachta indica*	0.15	2
36	85	6.8-6.9	Neem	*Azadirachta indica*	0.2	2.5
37	87	6.8-6.9	Neem	*Azadirachta indica*	0.15	2
38	88	6.8-6.9	Neem	*Azadirachta indica*	0.22	2
39	89	6.8-6.9	Neem	*Azadirachta indica*	0.18	2
40	93	6.9-7.0	Neem	*Azadirachta indica*	0.12	2
41	99	6.9-7.0	Neem	*Azadirachta indica*	0.12	2
42	5	7.0-7.1	Neem	*Azadirachta indica*	0.12	2
43	7	7.0-7.1	Neem	*Azadirachta indica*	0.25	2.5
44	8	7.1-7.2	Neem	*Azadirachta indica*	0.25	1
45	9	7.1-7.2	Manjanathi	*Morinda tomentosa*	0.15	2
46	10	7.1-7.2	Neem	*Azadirachta indica*	0.23	2.5
47	11	7.2-7.3	Neem	*Azadirachta indica*	0.15	3
48	14	7.2-7.3	Neem	*Azadirachta indica*	0.18	2.5
49	15	7.2-7.3	Neem	*Azadirachta indica*	0.15	2.5
50	32	7.3-7.4	Neem	*Azadirachta indica*	0.12	2
51	36	7.4-7.5	Manjanathi	*Morinda tomentosa*	0.14	2
52	39	7.4-7.5	Neem	*Azadirachta indica*	0.25	3.5
53	46	7.5-7.6	Naval	*Eugenia argentea*	0.12	1.5
54	47	7.5-7.6	Naval	*Eugenia argentea*	0.1	2
55	53	7.6-7.7	Neem	*Azadirachta indica*	0.15	2

S. No.	Tree No.	Chainage	Local Name	Scientific Name	Girth (m)	Approx Height (m)
56	56	7.7-7.8	Pulee	*Tamarindus indica*	0.09	1.5
57	58	7.7-7.8	Neem	*Azadirachta indica*	0.11	2
58	72	8.5-8.6	Murungai	*Moringa oleifera*	0.25	2
59	75	8.6-8.7	Neem	*Azadirachta indica*	0.1	2
60	76	8.6-8.7	Neem	*Azadirachta indica*	0.13	2.5
61	77	8.6-8.7	Neem	*Azadirachta indica*	0.2	2.5
62	78	8.6-8.7	Manjanathi	*Morinda tomentosa*	0.25	2.5
63	1	9.0-9.1	Pungan	*Pongamia pungan*	0.12	2
64	10	10.2-10.3	Manjanathi	*Morinda tomentosa*	0.13	2
65	13	10.3-10.4	Neem	*Azadirachta indica*	0.18	2
66	18	10.4-10.5	Neem	*Azadirachta indica*	0.12	2.5
67	31	10.8-10.9	Naval	*Eugenia argentea*	0.25	2
68	3	11.2-11.3	Neem	*Azadirachta indica*	0.1	2
69	10	11.7-11.8	Neem	*Azadirachta indica*	0.12	2
70	2	12.3-12.4	Neem	*Azadirachta indica*	0.1	2
71	3	12.3-12.4	Neem	*Azadirachta indica*	0.07	1.5
72	6	13.1-13.2	Pungan	*Pongamia pungan*	0.07	1.5
73	7	13.2-13.3	Neem	*Azadirachta indica*	0.12	2
74	8	13.2-13.3	Neem	*Azadirachta indica*	0.13	2
75	9	13.3-13.4	Neem	*Azadirachta indica*	0.12	2
76	12	13.7-13.8	Neem	*Azadirachta indica*	0.11	2
77	14	13.8-13.9	Pungan	*Pongamia pungan*	0.15	2
78	16	13.9-14.0	Neem	*Azadirachta indica*	0.12	2
79	2	14.0-14.1	Neem	*Azadirachta indica*	0.12	2
80	7	14.1-14.2	Neem	*Azadirachta indica*	0.12	1.5
81	8	14.3-14.4	Vagai	*Albizia labbeck*	0.12	2
82	13	14.4-14.5	Neem	*Azadirachta indica*	0.15	2
83	16	14.4-14.5	Neem	*Azadirachta indica*	0.12	2
84	17	14.4-14.5	Neem	*Azadirachta indica*	0.15	2
85	18	14.4-14.5	Neem	*Azadirachta indica*	0.12	2
86	19	14.5-14.6	Neem	*Azadirachta indica*	0.09	2
87	23	14.8-14.9	Manjanathi	*Morinda tomentosa*	0.25	2
88	5	15.3-15.4	Manjanathi	*Morinda tomentosa*	0.25	2
89	20	15.9-16.0	Manjanathi	*Morinda tomentosa*	0.25	2
90	14	16.2-16.3	Pulee	*Tamarindus indica*	0.15	2
91	16	16.2-16.3	Pulee	*Tamarindus indica*	0.15	2
92	41	16.7-16.8	Neem	*Azadirachta indica*	0.15	2

S. No.	Tree No.	Chainage	Local Name	Scientific Name	Girth (m)	Approx Height (m)
93	52	16.8-16.9	Pulee	*Tamarindus indica*	0.25	2.5
94	4	17.2-17.3	Pulee	*Tamarindus indica*	0.1	2
95	4	18.0-18.1	Manjanathi	*Morinda tomentosa*	0.12	2
96	6	18.0-18.1	Aarasamaram	*Ficusr eligiosa*	0.25	2
97	8	18.0-18.1	Neem	*Azadirachta indica*	0.15	2
98	9	18.0-18.1	Neem	*Azadirachta indica*	0.15	2
99	7	20.1-20.2	Neem	*Azadirachta indica*	0.15	2.5
100	8	20.1-20.2	Pungan	*Pongamia pungan*	0.25	2
101	27	20.8-20.9	Neem	*Azadirachta indica*	0.12	2
102	3	22.0-22.1	Neem	*Azadirachta indica*	0.22	2
103	6	26.6-26.7	Neem	*Azadirachta indica*	0.14	2
104	8	26.7-26.8	Neem	*Azadirachta indica*	0.1	2
105	2	27.1-27.2	Pungan	*Pongamia pungan*	0.27	2.5
106	5	27.1-27.2	Pungan	*Pongamia pungan*	0.16	1
107	31	35.9-36.0	Pungan	*Pongamia pungan*	0.26	1
108	34	35.9-36.0	Pungan	*Pongamia pungan*	0.25	1.5
109	36	35.9-36.0	Pungan	*Pongamia pungan*	0.25	1
110	37	35.9-36.0	Pungan	*Pongamia pungan*	0.2	1.6
111	2	36.0-36.1	Neem	*Azadirachta indica*	0.25	1.5
112	3	36.0-36.1	Neem	*Azadirachta indica*	0.2	1.5
113	6	36.0-36.1	Neem	*Azadirachta indica*	0.1	1.5
114	7	36.0-36.1	Neem	*Azadirachta indica*	0.15	1.53
115	8	36.0-36.1	Pungan	*Pongamia pungan*	0.25	1
116	31	36.4-36.5	Neem	*Azadirachta indica*	0.08	1.5
117	33	36.5-36.6	Neem	*Azadirachta indica*	0.29	2.2
118	34	36.5-36.6	Neem	*Azadirachta indica*	0.09	2
119	43	36.6-36.7	Neem	*Azadirachta indica*	0.22	1.5
120	71	36.9-37.0	Neem	*Azadirachta indica*	0.09	1.5
121	74	36.9-37.0	Neem	*Azadirachta indica*	0.07	1
122	6	37.0-37.1	Neem	*Azadirachta indica*	0.2	2.2
123	51	37.8-37.9	Neem	*Azadirachta indica*	0.1	2
124	25	39.4-39.5	Pulee	*Tamarindus indica*	0.29	2
125	29	39.5-39.6	Neem	*Azadirachta indica*	0.1	1
126	30	39.5-39.6	Neem	*Azadirachta indica*	0.15	1.2
127	35	39.6-39.7	Neem	*Azadirachta indica*	0.25	2
128	38	39.6-39.7	Pulee	*Tamarindus indica*	0.09	1
129	39	39.7-39.8	Neem	*Azadirachta indica*	0.1	1.5

S. No.	Tree No.	Chainage	Local Name	Scientific Name	Girth (m)	Approx Height (m)
130	40	39.8-39.9	Neem	*Azadirachta indica*	0.29	1
131	41	39.8-39.9	Neem	*Azadirachta indica*	0.29	1
132	42	39.8-39.9	Neem	*Azadirachta indica*	0.29	1.5
133	1	40.0-40.1	Neem	*Azadirachta indica*	0.25	0.5
134	2	40.0-40.1	Neem	*Azadirachta indica*	0.2	0.5
135	3	40.0-40.1	Neem	*Azadirachta indica*	0.2	0.3
136	6	40.0-40.1	Neem	*Azadirachta indica*	0.2	2
137	10	40.1-40.2	Neem	*Azadirachta indica*	0.25	2
138	12	40.1-40.2	Neem	*Azadirachta indica*	0.25	1.5
139	17	40.2-40.3	Neem	*Azadirachta indica*	0.29	1
140	21	40.3-40.4	Pulee	*Tamarindus indica*	0.07	1
141	24	40.4-40.5	Pulee	*Tamarindus indica*	0.29	1
142	30	40.7-40.8	Neem	*Azadirachta indica*	0.1	0.5
143	31	40.7-40.8	Neem	*Azadirachta indica*	0.05	0.5
144	33	42.9-43.0	Teak		0.2	1.5
145	37	42.9-43.0	Teak		0.25	2.5
146	6	43.1-43.2	Neem	*Azadirachta indica*	0.2	1
147	2	44.0-44.1	Neem	*Azadirachta indica*	0.22	1.5
148	118	44.9-45.0	Neem	*Azadirachta indica*	0.25	2
149	85	45.4-45.6	Neem	*Azadirachta indica*	0.12	2
150	87	45.4-45.6	Neem	*Azadirachta indica*	0.12	2.5
151	90	45.4-45.6	Neem	*Azadirachta indica*	0.18	2.5
152	100	45.4-45.6	Neem	*Azadirachta indica*	0.2	2.5
153	111	45.4-45.6	Neem	*Azadirachta indica*	0.1	2
154	113	45.4-45.6	Neem	*Azadirachta indica*	0.09	2
155	4	46.8-46.9	Neem	*Azadirachta indica*	0.25	2
156	19	46.9-47.0	Neem	*Azadirachta indica*	0.09	2.5
157	20	46.9-47.0	Neem	*Azadirachta indica*	0.1	0.5
158	12	47.1-47.2	Neem	*Azadirachta indica*	0.08	1
159	30	47.3-47.4	Neem	*Azadirachta indica*	0.08	0.5
160	19	48.2-48.3	Neem	*Azadirachta indica*	0.18	1.5
161	23	48.3-48.4	Neem	*Azadirachta indica*	0.18	1.8
162	24	48.3-48.4	Neem	*Azadirachta indica*	0.25	1
163	25	48.4-48.5	Neem	*Azadirachta indica*	0.28	1.5
164	29	48.5-48.6	Neem	*Azadirachta indica*	0.13	1.5
165	30	48.5-48.6	Neem	*Azadirachta indica*	0.09	1.5
166	35	48.6-48.7	Pulee	*Tamarindus indica*	0.25	1.5

S. No.	Tree No.	Chainage	Local Name	Scientific Name	Girth (m)	Approx Height (m)
167	36	48.6-48.7	Neem	*Azadirachta indica*	0.2	1.5
168	37	48.6-48.7	Neem	*Azadirachta indica*	0.27	2
169	1	49.0-49.1	Neem	*Azadirachta indica*	0.1	2
170	6	49.2-49.3	Neem	*Azadirachta indica*	0.15	2
171	9	49.3-49.4	Neem	*Azadirachta indica*	0.1	2
172	10	49.3-49.4	Neem	*Azadirachta indica*	0.09	1.5
173	11	49.3-49.4	Neem	*Azadirachta indica*	0.09	1.5
174	14	49.4-49.5	Neem	*Azadirachta indica*	0.1	2
175	16	49.4-49.5	Neem	*Azadirachta indica*	0.18	2.5
176	20	49.5-49.6	Neem	*Azadirachta indica*	0.1	1.5
177	34	49.6-49.7	Neem	*Azadirachta indica*	0.12	2
178	36	49.8-49.9	Neem	*Azadirachta indica*	0.15	2.5
179	46	49.9-50	Neem	*Azadirachta indica*	0.15	2
180	47	49.9-50	Pulee	*Tamarindus indica*	0.2	2
181	1	50.0-50.1	Neem	*Azadirachta indica*	0.08	1.5
182	2	50.0-50.1	Neem	*Azadirachta indica*	0.08	1
183	3	50.0-50.1	Pulee	*Tamarindus indica*	0.23	1
184	4	50.0-50.1	Neem	*Azadirachta indica*	0.09	2
185	5	50.0-50.1	Neem	*Azadirachta indica*	0.05	1.8
186	7	50.1-50.2	Neem	*Azadirachta indica*	0.05	1
187	28	52.5-52.6	Neem	*Azadirachta indica*	0.08	1.5
188	29	52.6-52.7	Neem	*Azadirachta indica*	0.08	1
189	29	53.5-53.6	Neem	*Azadirachta indica*	0.25	1.5
190	31	53.6-53.7	Neem	*Azadirachta indica*	0.18	0.5
191	32	53.6-53.7	Neem	*Azadirachta indica*	0.22	1.5
192	35	53.8-53.9	Neem	*Azadirachta indica*	0.1	1.5
193	1	57.0-57.1	Neem	*Azadirachta indica*	0.08	0.5
194	25	57.4-57.5	Neem	*Azadirachta indica*	0.2	2
195	26	57.4-57.5	Neem	*Azadirachta indica*	0.23	2
196	27	57.4-57.5	Neem	*Azadirachta indica*	0.23	2.5
197	28	57.4-57.5	Neem	*Azadirachta indica*	0.2	1.5
198	9	58.1-58.2	Vagai	*Albizia labbeck*	0.29	2.2
199	27	58.6-58.7	Neem	*Azadirachta indica*	0.2	1.58
200	42	58.9-59.0	Neem	*Azadirachta indica*	0.1	1.5
201	1	59.0-59.1	Neem	*Azadirachta indica*	0.2	2.7
202	9	59.4-59.5	Neem	*Azadirachta indica*	0.15	1.5
203	13	59.4-59.5	Neem	*Azadirachta indica*	0.1	1

S. No.	Tree No.	Chainage	Local Name	Scientific Name	Girth (m)	Approx Height (m)
204	18	59.7-59.8	Neem	*Azadirachta indica*	0.1	1.5
205	23	59.9-60	Neem	*Azadirachta indica*	0.2	1.5
206	4	60.6-60.1	Neem	*Azadirachta indica*	0.25	2.5
207	15	60.5-60.6	arasamaram		0.25	0.7
208	5	61-61.1	Neem	*Azadirachta indica*	0.29	3.5
209	6	61.4-61.5	Neem	*Azadirachta indica*	0.1	1.5
210	7	61.4-61.5	Neem	*Azadirachta indica*	0.1	1.5
211	8	61.4-61.5	Neem	*Azadirachta indica*	0.1	1
212	9	61.4-61.5	Neem	*Azadirachta indica*	0.2	1.8
213	10	61.5-61.6	Neem	*Azadirachta indica*	0.1	1
214	13	65.1-65.2	Neem	*Azadirachta indica*	0.2	2
215	19	65.2-65.3	Neem	*Azadirachta indica*	0.25	2
216	3	67.1-67.2	Neem	*Azadirachta indica*	0.2	1
217	4	67.1-67.2	Neem	*Azadirachta indica*	0.15	2
218	5	67.8-67.9	Neem	*Azadirachta indica*	0.15	2
219	19	68.8-68.9	Neem	*Azadirachta indica*	0.25	1.5
220	21	68.8-68.9	Neem	*Azadirachta indica*	0.2	1.7
221	23	68.9-69	Neem	*Azadirachta indica*	0.2	1.5
222	1	69.0-69.1	Neem	*Azadirachta indica*	0.25	1.5
223	2	71.1-71.2	Neem	*Azadirachta indica*	0.21	1.5
224	21	72.3-72.4	Manjanathi	*Morinda tomentosa*	0.29	2.5
225	22	72.3-72.4	Manjanathi	*Morinda tomentosa*	0.29	2.5
226	23	72.3-72.4	Neem	*Azadirachta indica*	0.2	2
227		72.3-72.4	Pungan	*Pongamia pungan*	0.29	1
228	24	72.3-72.4	Manjanathi	*Morinda tomentosa*	0.25	0.5
229	25	72.4-72.5	Manjanathi	*Morinda tomentosa*	0.29	2
230	26	72.4-72.5	Pungan	*Pongamia pungan*	0.29	2
231	28	72.4-72.5	Pungan	*Pongamia pungan*	0.15	1.5
232	32	72.5-72.6	Pungan	*Pongamia pungan*	0.2	1.5
233	37	72.5-72.6	Manjanathi	*Morinda tomentosa*	0.25	2
234	48	72.7-72.8	Pungan	*Pongamia pungan*	0.29	1.5
235	51	72.7-72.8	Manjanathi	*Morinda tomentosa*	0.23	2
236	52	72.7-72.8	Manjanathi	*Morinda tomentosa*	0.23	2
237	54	72.7-72.8	Pungan	*Pongamia pungan*	0.25	1.5
238	55	72.7-72.8	Manjanathi	*Morinda tomentosa*	0.29	1.5
239	60	72.8-72.9	Manjanathi	*Morinda tomentosa*	0.29	1.5
240	61	72.8-72.9	Pungan	*Pongamia pungan*	0.1	0.5

S. No.	Tree No.	Chainage	Local Name	Scientific Name	Girth (m)	Approx Height (m)
241	63	72.8-72.9	Akatthi	*Sesbania grandiflora*	0.1	1
242	64	72.8-72.9	arasamaram		0.1	0.5
243	65	72.8-72.9	Pungan	*Pongamia pungan*	0.2	1
244	68	72.9-73	Manjanathi	*Morinda tomentosa*	0.2	1.5
245	1	73.0-73.1	Neem	*Azadirachta indica*	0.12	2
246	4	73.0-73.1	Vagai	*Albizia labbeck*	0.12	2
247	8	73.1-73.2	Neem	*Azadirachta indica*	0.11	2
248	13	73.2-73.3	Vagai	*Albizia labbeck*	0.14	2
249	15	73.3-73.4	Neem	*Azadirachta indica*	0.15	2
250	18	73.4-73.5	Neem	*Azadirachta indica*	0.12	1.5
251	27	73.6-73.7	Neem	*Azadirachta indica*	0.12	1.5
252	7	74.1-74.2	Neem	*Azadirachta indica*	0.12	1.5
253	8	74.2-74.3	Neem	*Azadirachta indica*	0.1	1.5
254	15	74.4-74.5	Neem	*Azadirachta indica*	0.24	2.5
255	19	74.5-74.6	Neem	*Azadirachta indica*	0.12	2.5
256	4	75.1-75.2	Neem	*Azadirachta indica*	0.15	1.5
257	4	76.3-76.4	Neem	*Azadirachta indica*	0.13	2
258	6	76.4-76.5	Neem	*Azadirachta indica*	0.12	1.5
259	19	80.8-80.9	Manjanathi	*Morinda tomentosa*	0.15	4.5
260	14	81.1-81.2	Manjanathi	*Morinda tomentosa*	0.12	2
261	49	81.5-81.6	Manjanathi	*Morinda tomentosa*	0.1	1.5
262	52	81.6-81.7	Manjanathi	*Morinda tomentosa*	0.1	1.5
263	53	81.6-81.7	Manjanathi	*Morinda tomentosa*	0.1	1.5
264	54	81.6-81.7	Manjanathi	*Morinda tomentosa*	0.1	1.5

Note: Above trees have been identified for transplantation. However, contractor in consultation with CSC/TNRSP can transplant trees based upon the land availability and site assessment during execution. It is preferred that trees ranging between girth size 20cm-30cm should be given preference for transplantation.

Transplantation will be done as per below GUIDELINES FOR TRANSPLANTATION OF TREES

GUIDELINES FOR TRANSPLANTATION OF TREES

If trees are not very old, they can be transplanted easily. The percentage of survival can be hundred percent if the work is done properly and during the rainy season. The following steps are involved:

1. The sites where the trees are to be shifted should be selected first. The sites should be free of overhead telephone or power lines. Large pits should be dug at these sites to comfortably accommodate the 'tree roots' ball of earth.
2. Distance between pits depends on the variety. Since less than 30 cm girth size trees are proposed to be transplanted, the distance of 3 m should be considered.
3. When pits are dug at the selected sites, their sizes would depend on the dimensions/ age of the tree. For trees of medium size the pit size will be around 8 feet in diameter and 5 feet deep. The actual pit size for different trees can be adjusted with experience. The point to be kept sight of is

that 'trees roots' ball of earth should fit in comfortably with at least 6 to 12 inches clearance all around. Usually the pit size in feet should be directly proportional to the girth of the trees in inches.

4. Adequate quantity of soil and manure mixture @ 4:1 is necessary for each pit. A little bone meal can also be added. To start with only about 60cm soil mixture is to be filled in each pit and watered well to form a puddle before the actual transplantation. The total quantity of soil and manure required for all the pits should be mixed and arrange before the start of the actual operation.
5. Before transplantation, the trees should be 'extensively pruned'. That is, the foliage should be completely removed and all the branches should be cut off with a pruning saw. The cut surfaces should be painted with non-synthetic white paint to anaesthetize these portions. 'Extensive pruning ' helps in easier 'replanting balance' and handling, thereby reducing the shock effect. This also aids the plant roots in recovering and adhering to the new soil and reduces transpiration and/or loss of moisture.
6. The trees are now ready for lifting or uprooting. A deep trench of at least up to 5 feet in depth is to be dug around the base of the tree at least 2 to 3 feet away from the trunk in the case of trees with a girth of up to 60cm. The depth of the trench and its distance from the trunk would therefore vary with the size of the tree. The trench should be dug to gradually converge towards the base of the tree so that 'tree roots' ball of earth can ultimately be detached from the ground.
7. The trees are then to be lifted with the help of a suitable size crane. Before lifting, a piece of gunny should be wound round the trunk, with a few wooden batons secured around the gunny pack on the outside by a steel wire rope. This will facilitate lifting without injuring the bark. Immediately the 'trees roots' ball should be sprayed with potassium phosphate solution and then wrapped and tied with a piece of very wet gunny.
8. Before replanting, the soil at the base of the pit should be watered heavily after which the uprooted tree along with the 'tree roots' ball should be lowered carefully into the new pit with the help of the crane.
9. The empty space in this pit is to be filled with the previous prepared mixture of soil, bone meal and manure and thoroughly rammed in tightly, so that no air gaps are left inside the soil. Air gaps could result in fungal infection to the roots. Sand can also be added which will fill up the air gaps when watered.
10. The trunk can now be sprayed with Blytox, a copper sulphate compound whose action is anti-fungicidal in nature.
11. The transplanted tree should be watered heavily at the base.
12. Guy ropes, angle iron or bamboos should be used for a few days to secure the tree till the soil hardens around the transplanted tree to hold it erect.
13. Four to five days after transplantation the trunk can be sprayed with potassium nitrate solution for facilitating the initiation of new shoots.
14. If rains are inadequate watering should continue for three months.

    The heavily pruned transplanted tree is not a pretty sight, but this should not deter the optimist, as the chances of survival are maximum without the branches and foliage.

B) COMPENSATORY PLANTATION

As per the recent High Court order, ten saplings should be planted against each tree felled. The TNRSP will bear the cost of such plantation. To minimise loss of trees, clearance of only those trees identified from the design will be removed. Endangered species, if found during construction, will be transplanted as detailed in above section. For compensatory plantation, 10-times plantation against each felled tree of >30 cm girth size has been considered. Tree fencing will be provided.

3923 trees of girth size > 30 cm need to be uprooted along the alignment of SH-41 because of project

intervention. Following the above guideline, 39,230 trees are recommended for plantation against felled trees..

A provision of 1 m along both side of the road has been kept in the design in rural stretches for avenue plantation along with utilities. Since the area available will be used for plantation and utilities, 5m spacing will be maintained.

Compensatory plantation: Out of total length, 56.14 km is rural stretch, where 22,429 nos. of saplings can be planted covering both side of this stretch. Remaining 16,801 saplings will be planted in the space between PRoW and ERoW (considering 3 m c/c spacing, Refer Drawing 8.4), wherever available.

GUIDELINES FOR SELECTION OF TREE SPECIES

Road side plantation may be of various species, some of which are not appropriate. There may be giant trees with strong stems and horizontally spreading roots or trees which branch out early and have short stems or trees without deep roots system overturn when old in rain or wind.

1. **TREES TO BE AVOIDED**: On all account, the following trees should be avoided along the roadside:

S. No.	Trees Name	Characteristics
1	Eucalyptus (all species)	All these tree species have very weak wood and consequently break easily in windstorm. After a heavy storm, roads become blocked and traffic is stopped for a considerable length of time. During a storm, these trees are threats to vehicles plying and pedestrians on the road. Besides the *eucalyptus* has a few other negative environmental impacts.
2	*Acacia (all species)*	They are thorny trees to be avoided close to urban stretches. Their thorns are nuisances for the pneumatic tyres of small vehicles.
3	*Ficus bengalensis, Ficus religiosa*	The *Ficus* species are of tap root system but flowing type (average depth of root system is 1.5m). Therefore, these, when mature, may overturn in strong-wind, storm, etc. Even the existing trees may be recommended for removal from safety points of view

2. **TREES TO BE SELECTED**: On the other hand, some trees are appropriate for highway landscaping. These include trees, which have thinner stem but dense foliage; that absorb/ retain dust and other atmospheric pollutants; those, which erosion resistant species, etc. Moreover, the species, which are native to this area, should be preferred for replanting. These trees include:

S. No.	Trees Name	Characteristics	Remarks
1	*Azardiracta indica* (Neem)	The leaves, barks are used for medicinal purposes, and the seeds yield valuable oil. It can grow on alkaline usar soil	Recommended for plantation in the 2nd / 3rd row
2	*Tamarindus indica* (Pulee)	A beautiful tree, which stands the dust of roads very well. Its fruit and timber are also valuable; suitable for dry area	Recommended for plantation in the 2nd / 3rd row
3	*Mangifera indica* (Mango)	Yield valuable fruit	Recommended for plantation in the 2nd / 3rd row
4	*Albizia amara (Usil)*	Small tree with a wide, dense, round or umbrella-shaped canopy. Bark greyish and creviced, twigs dark yellowish-grey, with lenticels.	Recommended for plantation in the 1st row

S. No.	Trees Name	Characteristics	Remarks
5	*Delonix elata* (Vatha narayanam), *Delonix regia (Konrai)*	Flowering species	Recommended for plantation in the 1st / 2nd row
6	*Morinda tomentosa*	Flowering species with medicinal values. Root, Leaves, Fruits are used	Recommended for plantation in the 1st row

3. **DUST RESISTANCE:** Many of the species resists pollution. Almost all trees have capability to absorb dust. Available data (from CPCB) shows that different species have different dust collection efficiency, although dust collection depends on the total leaf area.

S. No.	Species	Dust Collection Efficiency (g/m^2-d)	Total leaf Area (m^2/tree)	Mean Dust Collection (g/tree-d)
1	Ficus bengalensis	3.59	107-125	416.44
2	Ficus religiosa	4.15	55-62	242.76
3	Magnifera indica	1.05	60-76	275.40
4	Polyalthia longifolia	4.56	8-12	45.60
5	Tectona grandis	5.35	35-38	195.26
6	Terminalia arjuna	4.49	48-52	224.50

4. CHARACTERISTICS OF MAJOR TREE SPECIES FOUND ALONG PROJECT CORRIDOR

S No.	Species	Characteristics
1	***Tamarindus indica*** (Pulee)	Category of wood is E. Seed yields fellose, which is used as a sizing agent. It is dust resistant, gas absorbent. Controls erosion, is drought resistant and supports wildlife.
2	***Azadirachta indica*** (Neem)	Category of wood is E. It is dust resistant, gas absorbent. Controls erosion, is drought resistant and supports wildlife. Seeds yield *margosa* oil, which has medicinal properties including being extremely effective in treatment of leprosy and skin diseases.
3	***Pongamia pungan*** (Pungan)	Category of wood is E. Dust resistant, gas resistant. Controls erosion. Drought resistant. Seeds are effective in treating bronchitis. Seeds/oil have antiseptic/antiparasitic properties.
4	***Morinda tomentosa*** (Manjanathi)	Deciduous trees, bark pale brown, thick, vertically fissured and irregularly cracked; blaze turmeric yellow.

S No.	Species	Characteristics
5	***Prosopis juliflora*** (Neer karuvai)	The tree has a trunk with a diameter of up to 1.2 metres (3.9 ft). Its leaves are deciduous, bi-pinnate, light green. Flowers shortly after leaf development. A mature plant can produce hundreds of thousands of seeds. The tree reproduces by way of seeds, not vegetative. Seeds are spread by cattle and other animals that consume the seed pods and spread the seeds in their droppings. Its roots are able to grow to a great depth in search of water. This species has thorns in pairs at the nodes but thornless internodes. It may also be almost thornless.
6	***Albizia lebbeck*** *(Vagai)*	A nitrogen-fixing tree, with value for shade, quality hardwood (cabinet, veneer, construction), fuel-wood and charcoal, and honey (source of nectar and pollen); various parts of the tree are used in folk remedies for many ailments. It is also used as an ornamental and avenue tree, and sometimes as a shade tree in coffee and tea.
7	***Thespesia populnea*** (Puvarasu)	It is a flowering plant. It is a small tree or arborescent shrub that has a pantropical distribution, found on coasts around the world The heartwood of the Portia Tree is dark reddish brown to chocolate brown. It is used to make the thavil, a Carnatic musical instrument of South India.

C) PLANTATION AT ENHANCEMENT SITES

A number of cultural/ community properties exist along the project corridors. Landscape design has been worked out to enhance the aesthetic beauty of selected sites, wherever possible. A total of around 90 saplings can be planted as an enhancement, details are as below:

- As part of the enhancement measure, 90 nos. of saplings (two row plantation with 5m c/c spacing) will be planted on the outer slope of earthern embankment of existing pond (Chainage 11+250).(Refer Drawing no. 2 of Annexure 3.51)

Ornamental and fruit bearing trees like *Sesbania grandiflora, Delonix elata, Morinda tomentosa, Psidium guajava* may be planted in such places.

D) AVENUE PLANTATION

Avenue plantations will be initiated once the construction is complete. The objective behind such plantation is to cover/ re-vegetate the areas within the RoW that are presently barren. Avenue plantation will be considered as compensatory plantation for the impacted trees. The selection of the plants for greenery development is to be made as per the following criteria:

- Plants should be fast growing & have dense canopy cover
- Preferably with large leaf area
- Indigenous species
- Species resistant to air pollutants
- Should help to maintain the ecological and hydrological balance of the region

GUIDELINE FOR AVENUE PLANTATION

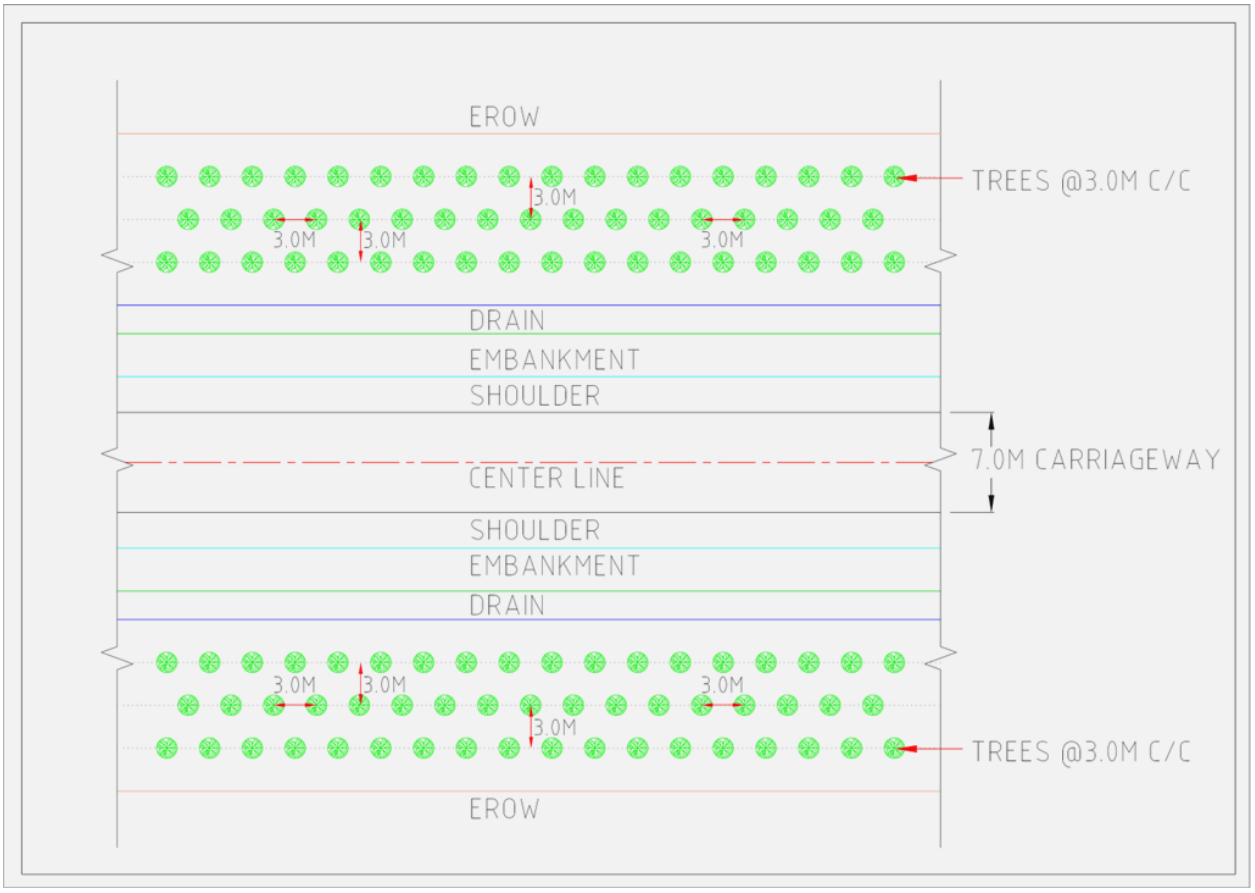
1 GENERAL DESCRIPTION

1.1 Avenue plantation is suggested all along the rural stretches of the project corridor.

1.2 Planting should generally be done at the height of the monsoons in the month of July.

1.3 It is felt that a weighted emphasis should be paid to protection, maintenance and safety of the planted trees. Suitable full-timers should be employed for this purpose.

1.4 The species to be planted would be to enhance the visual experience of the road corridor. One/ two / three rows of trees are recommended in accordance to the varying width available of different sections. Tree spacing should not be less than 3m (Refer Figure below.)



Conceptual Plan for Avenue Plantation

1.5 The plants will be at spacing of 3 meters and size of the pits for planting will be 0.6m /0.6m dia and deep. Plantation will be done within the EROW in those stretches, where barren land is available.

1.6 The species recommended for avenue plantation should be able to withstand extreme temperature and climate conditions and also has low requirements of water. These species have been proposed considering the climatic conditions, requirements of water and future management. However, other species may also be used, after approval from EO/Engineer.

1.7 The surface for the avenue plantation should be well prepared. The masses of loose debris and any convexities will be removed and similarly and concavities are to be filled by good soil. The surface should have sufficient layer of good quality of soil so as to have a better growth and survival of trees, grasses and saplings.

1.8 The height of the plants will not be less than 1.5m. and need to be in polythene bags until the planting.

1.9 All plants supplied must be planted within three days of removal from the nursery.

1.10 The contractor/ agency hired will be required to water the area in case of sufficient rains water after planting.

1.11 Size of the pits for planting saplings - 60x60x60 cm

1.12 Use of compost of manure - 1/3 of volume of pit mixed with soil, and refilled

1.13 The total no. tree saplings to be planted along the corridor

S. No.	Description	No. of sapling Required	Area for Landscaping (sqm)
1	Avenue Plantation		
2	Realignment Sections		
3	Cultural Properties		

Table-1: Activities schedule for Plantation along the Road

Year	Month	Sl No.	Activities to be done
1st Year	Jan to Mar	1	Surveying & Clearing of the area
		2	Digging of Pits
		3	Procurement of Angles Iron and Barbed wire (or other fencing material), and erecting the fence
2nd Year	April to June	1	Purchase of Farm yard manure
		2	Brick/Iron etc. guard for 1st row
		3.	Plantation along the road
		4	Filling up of pits with Farm yard manure and soil
	July to August	1	Transportation of Plants
		2	Planting of Sapling
		3	Watering
		4	Weeding and Hoeing
	Sept to Nov	1	Weeding of Hoeing
		2	Watering 4 times a month
	Dec to Feb	1	Weeding of Hoeing
		2	Maintenance
	March	1	Watering 4 times a month
3rd Years	April to June	1	Watering 6 times a month
	July to August	1	Casualty Replacement (20% of the total plants)
		2	Weeding
		3	Maintenance by Mali
	Sep to Nov	1	Watering 2 times a month
		2	Maintenance by Mali
	Dec to Feb	1	Maintenance by Mali
	March	1	Watering 4 times a month
		2	Maintenance by Mali
4th Year	April to March	1	Watering
		2	Casualty Replacement (10% of the total plants)
		3	Maintenance by Mali

2 PLANTATION

Scope

Contractor/ agency hired to furnish all materials, labor and related items necessary to complete the work indicated on drawing and specified herein.

2.1 MATERIALS

SAPLINGS

- Saplings/ Seedlings shall be well-formed and free from defects such as knots, sun-scaled, windburn, injuries, abrasion or disfigurement. All saplings shall be healthy, sound, free from plant diseases, insect's pests, of their egg and well-developed root systems.
- No plant will be accepted, if branches are damaged or broken. All the plant material must be protected from the sun and weather until planted.
- Any nursery stock shall have been inspected and approved by the EO-TNRSP.
- All saplings will be delivered with legible identification labels.
- The root system shall be conducive to successful transplantation. While necessary, the root-ball shall be preserved by suitable material. On soils where retention of a good ball is not possible, the roots should be suitably protected in some other way, which should cause any damage to roots.

TOPSOIL/GOOD EARTH

- Topsoil or good earth shall be a friable loam, typical of cultivated topsoil of the locality containing at least 2% of decayed organic matter (humus).
- Stored topsoil will be used for plantation at median and also for roadside plantation. Otherwise it could be taken from a well-drained arable site.
- It shall be free of subsoil, stones, earth skids, sticks, roots or any other objectionable extraneous matter or debris.
- It shall contain no toxic material.
- No topsoil shall be delivered in a muddy condition.

MANURE

- Only organic manure will be used for plantation. Composts from municipal solid wastes and distillery waste may be used.
- Manure shall be free from extraneous matter, harmful bacteria insects or chemicals (Subjected to safety norms).

GENERAL CONDITION

- Saplings shall be substantially free from pests and diseases, and shall be materially undamaged. Torn or lacerated roots shall be pruned before dispatch.
- No roots shall be subjected to adverse conditions such as prolonged exposure to drying winds or subjection to water logging, between lifting and delivery.

SUPPLY AND SUBSTITUTION

Upon submission of evidence that certain materials including plant materials are not available at time of contract, the contractor shall be permitted to substitute other and plants, with an equitable adjustment of price. All substitutions shall be of the nearest equivalent species and variety to the original specified and shall be subjected to the approval of the Landscape Architect. Packaging shall be adequate for the protection of the plants and such as to avoid heating or drying out.

Each specimen of tree, or each bundle, shall be legibly labeled with the following particulars:

- Its name (Both common and Scientific)
- The name of the supplier, unless otherwise agreed.
- The date of dispatch from the nursery.

2.2 PLANTING

Plants and Saplings

All saplings should be supplied with adequate protection as approved. After delivery, if planting is not to be carried out immediately, balled plants should be placed and the ball covered with sand to prevent drying out. Bare rooted plants can be heeled in by placing the roots in prepared trench and covering them with earth, which should be watered into, avoid air pockets round the roots. Saplings shall be planted as suggested by Environment officer.

Digging of Pits

- Tree pits shall be dug a minimum of three weeks prior to backfilling.
- The pits shall be 60 in diameter and 60 cms deep.
- While digging the pits, the topsoil up to a depth of 30cms may be kept aside, if found good (depending upon site conditions), and mixed with the rest of the soil.
- If the soil is normal it shall be mixed with manure.
- The bottom of the pit shall be forked to break up the subsoil.

Back Filling

The soil back filled watered through end gently pressed down, a day previous to planting, to make sure that it may not further settle down after planting. The soil shall be pressed down firmly by treading it down, leaving a shallow depression all round for watering.

Planting

- No pits shall be dug until final position has been pegged out for approval.
- Care shall be taken that the plant sapling when planted is not be buried deeper than in the nursery, or in the pot.
- Planting should not be carried out in waterlogged soil.
- Plant saplings at the original soil depth; soil marks on the stem is an indication of this and should be maintained on the finished level, allowing for setting of the soil after planting.
- All plastic and other imperishable containers should be removed before planting.
- Any broken or damage roots should be cut back to sound for healthy growth.
- The bottom of the planting pit should be covered with 50mm to 75mm of soil.
- Bare roots should be spread evenly in the planting pit; and small mound in the center of the pits on which the roots are well aid on and evenly spread.
- Soil should be placed around the roots, gently shaking the saplings to allow the soil particles to shift into the root system to ensure close contact with all roots and prevent air pockets.
- Back fill soil should be firmed as filling proceeds, layer by layer, care being taken to avoid damaging the roots.

Staking

Newly planted saplings must be held firmly although not rigidly by staking to prevent a pocket forming around the stem and newly formed fibrous roots being broken by mechanical pulling as the tree rocks.

Methods:

The main methods of staking shall be:

- A single vertical shake, 900mm longer than the clear stem of the saplings driven 600mm into the soil.
- Two stakes as above driven firmly on either side of the saplings with a cross bar to which the stem is attached. Suitable for bare- rooted or Ball material.
- A single stake driven in at an angle at 45 degrees and leaning towards the prevailing wind, the stem just below the lowest branch being attached to the stake. Suitable for small bare- rooted or Ball material
- For plant material 3m to 4.5m high with a single stem a three- wire adjustable guy system may be used in exposed situations.

The end of stake should be pointed and the lower 1m to 1.2m should be coated with a non-injurious wood preservative allowing at least 150mm above ground level.

Tying

Each sapling should be firmly secured to the stake so as to prevent excessive movement. Abrasion must be avoided by using a buffer, rubber or Hessian, between the saplings and stake. The saplings should be secured at a point just below its lowest branch, and also just above ground level; normally two ties should be used for saplings. These should be adjusted or replaced to allow for growth.

Watering

The Landscape Contractor should allow for the adequate watering in of all newly planted trees and saplings immediately after planting and during the growing season, keep the plant material well watered.

Manure/ Fertilizer usage

The fertilizers/manure usage should be such that the turn of all the fertilizers comes after, every 15 days from the beginning of the monsoon till the end of winter:

Organic well-rotted dry farm yard manure: 0.05 cum or tussle.

1. Urea 25gm.
2. Ammonium sulphate 25gm.
3. Potassium sulphate 25gm.

All saplings, which are supplied pot grown, shall be well soaked prior to planting.

Watering in and subsequent frequent watering of summer planted container- grown plants is essential.

Application of inorganic manure should as for possible be avoided. Form yard manure as biofertilizer with for better option.

4. COMPLETION

On completion, the ground shall be formed over and left tidy.

Special Conditions and Particular Specifications:

1. Wherever applicable, work shall be done according to P.W.D. specifications

2. At the time of invitation of tender.

3. Water shall be made available, near the tube well at one point. Contractors shall make their own arrangement for drawing water from there. Water charges as per the value of work done shall be deducted from the contractors Bills.

4. If electricity is required for the works, the same shall be made available at one point within the site of works, for which recovery at the prevailing rate per unit shall be deducted from the contractors' bill.

5. The work mentioned in the schedule of Quantities include grassing as well as planting of trees and saplings. 'Contractors' quoted rates shall include execution of these works at different levels. No extra cost shall be paid for any item, for working at these levels.

6. The Contractor shall provide all facilities to subcontractor (plantation) / Environment Officer / or his authorized representatives to make frequent inspection of their Nursery and ascertain the process / quality of various categories of trees/plants etc., grown by them.

7. The safe custody and up-keep of various categories of plants brought to site is the sole responsibility of the contractor and he shall employ sufficient supervisory personnel to ensure the safety of these items.

8. The site of work may be handed over to the contractors for execution of work in phases, as soon as the same are available. Nothing extra shall be payable for such phased execution of work.

9. While excavating / executing the work the contractors shall ensure that existing cables / pipe lines / structures / fittings are not damaged.

10. The Contractor shall co-ordinate his work with other agencies employed by the Clients and ensures that the work of other agencies is not hampered in any way during the duration of contract.

11. The Contractor shall keep the site of works neat and clean during the execution of the work. Any debris found at or near the site of work shall be rescued immediately as and when so required by the Contractor.

12. On completion of the work, the site of work shall be thoroughly cleaned and all debris removed before the work is handed over satisfactorily.

13. The Contractors shall, without any additional charge to the clients, renew or replace any dead or defective plants/grass and shall fully maintain the whole landscape for a period of 12 months after the certified date of completion.

14. Saplings/small tree shall be of minimum length straight and symmetrical with a crown and having a persistent main stem. The size of crown shall be in good over all proportion to the height of the tree.

15. Small trees and saplings shall be well formed with the crown typical of the species or variety.

16. General Requirements of Plants:

- Plants shall be typical of their species and variety, well-developed branches, and well foliated with fibrous root system. Plants shall be free from defects and injuries. Plants shall not be pruned before planting.

- Plants shall be free from defects and injuries.
- Plants shall not be pruned before planting.
- Plants shall not be freshly dug and nursery grown.
- Nursery grown plants shall have been at least once transplanted.
- Bark shall be free from abrasion.
- All trees, soon after planting, shall be properly supported with bamboo stocks to ensure their safety against winds or any other factor, which may affect it adversely.

E) PLANTATION AT REALIGNMENT SECTION

Provision of tree plantation is proposed for the road sections abandoned due to realignments

Chainage		Length in (km)	Total no of Rows of trees	Total no of trees
From	To			
16/850	17/250	0.40	Not feasible	-
25/050	25/400	0.35	1 row @ 3m c/c on both sides (150m LHS and 250m RHS)	133
34/450	34/600	0.15	Not feasible	-
41/380	41/780	0.40	Not feasible	-
50/620	50/880	0.26	1 row @ 3m c/c on both sides (100m LHS and 150m RHS)	167
50/980	51/300	0.32	Not feasible	-
70/950	71/150	0.20	1 row @ 3m c/c on one side (180m)	60
Total				**360**

F) LANDSCAPING

It is proposed to plant dwarf shrubs along the major Junctions.

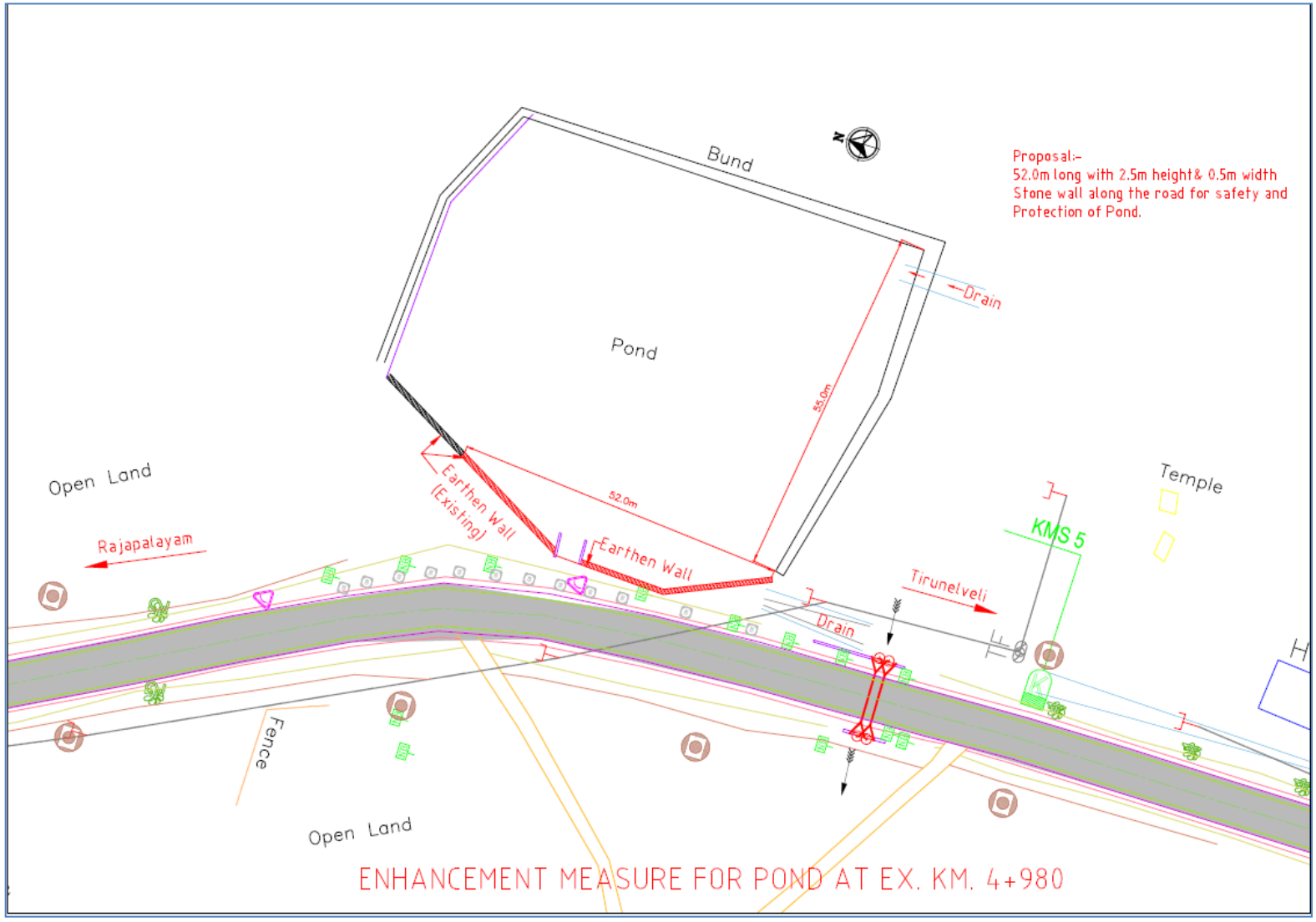
List of Major Junctions

S. No.	Existing Chainage (km)	Design Chainage (km)	Type of Junction (+,T,Y)	Category of Cross Road	Cross Road leads to
1	17+260	17+220	T	SH-44	Paruvakkudi
2	57+670	58+660	T	ODR	Devarkulam
3	82+790	82+800	Y	SH-U41	To Madurai

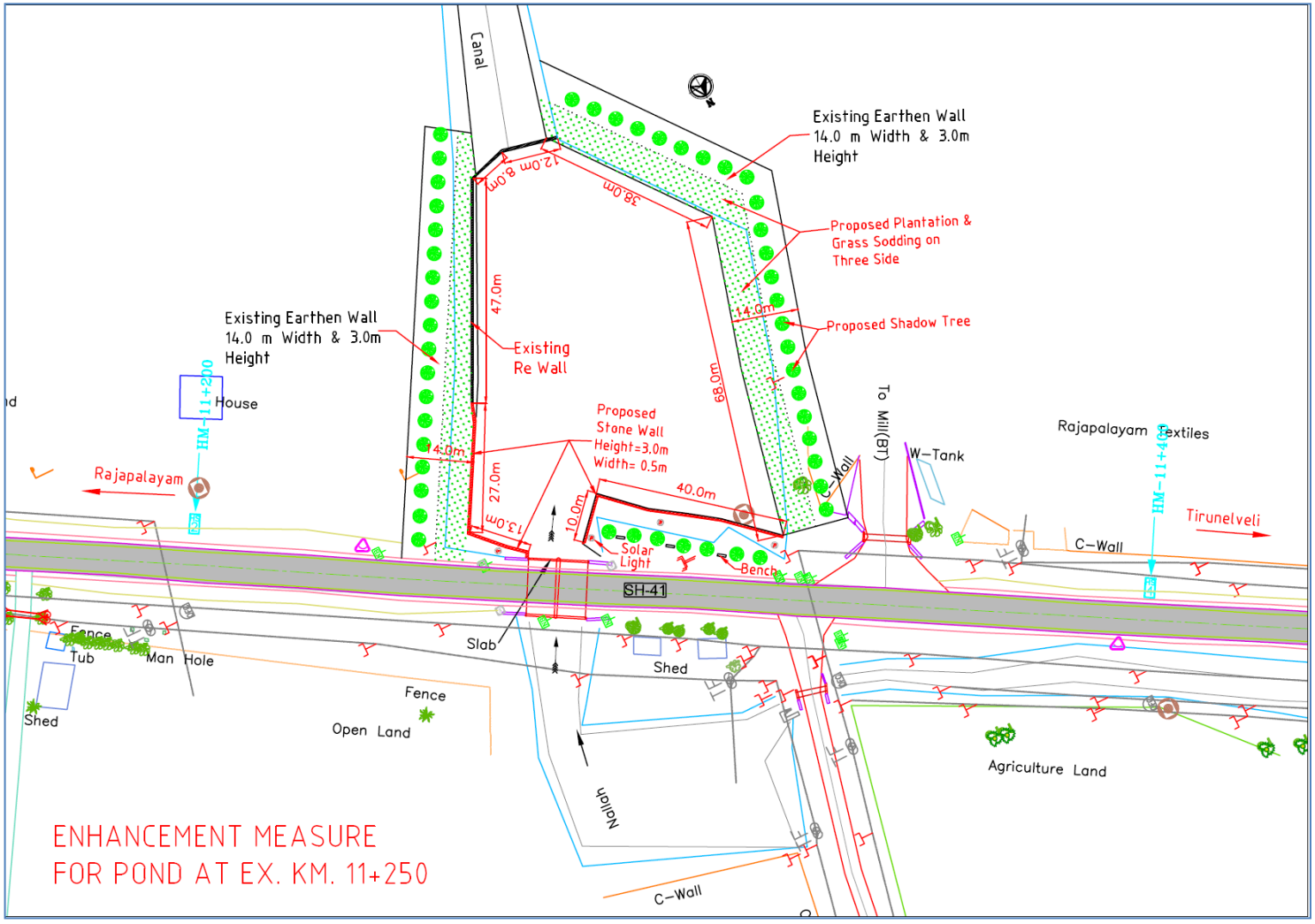
ANNEXURE 3.51: ENVIRONMENTAL ENHANCEMENT DRAWING

The details of road specific environmental enhancement measures for ponds are as follows:

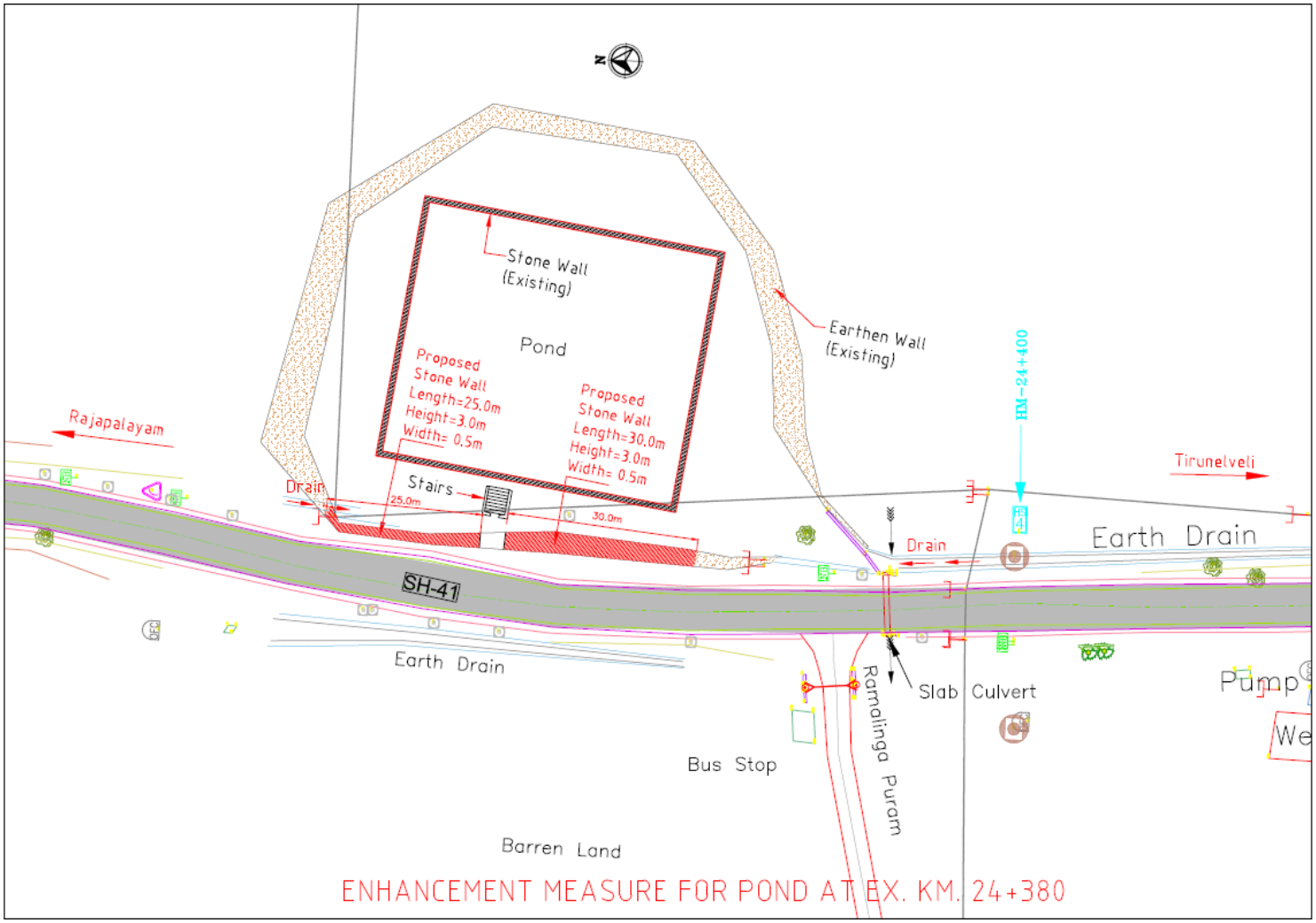
S. No.	Ch. (Km)	Impacted	Enhancement measures	Reference Drawing for Enhancement
1.	4/980 (LHS)	No impact	• Provision of 52m long, 2.5 m high and 0.5m width stone wall along pond on road side	Annexure 3.51 (Drawing no.1)
2.	11/250 (LHS)	Directly Impacted Siltation and Encroachment of catchment area-	• Provision of 90m long, 3.0 m high and 0.5m width stone wall around pond on road side • Tree plantation on earthen wall and road side of pond • Benches for sitting • Turfing on earthen embankment on 1260sq.m area around pond • Solar Street Light along pond on road side	Annexure 3.51 (Drawing no.2)
3	24/380 (LHS)	Earthen wall impacted	• Provision of 55m long, 3.0 m high and 0.5m width stone wall along pond on road side	Annexure 3.51 (Drawing no.3)
4	42/200 (RHS)	Earthen wall impacted	• Provision of 24.5m long, 2.0 m high and 0.5m width stone wall along pond on road side • Provision of 52m long metal beam crash barrier for safety in drainage area of pond along road side	Annexure 3.51 (Drawing no.4)


Bund
Pond
Proposal:-
52.0m long with 2.5m height& 0.5m width
Stone wall along the road for safety and
Protection of Pond.
Drain
55.0m
52.0m
Earthen Wall
(Existing)
Earthen Wall
Open Land
Rajapalayam
Tirunelveli
KMS 5
Temple
Drain
Fence
Open Land
ENHANCEMENT MEASURE FOR POND AT EX. KM. 4+980

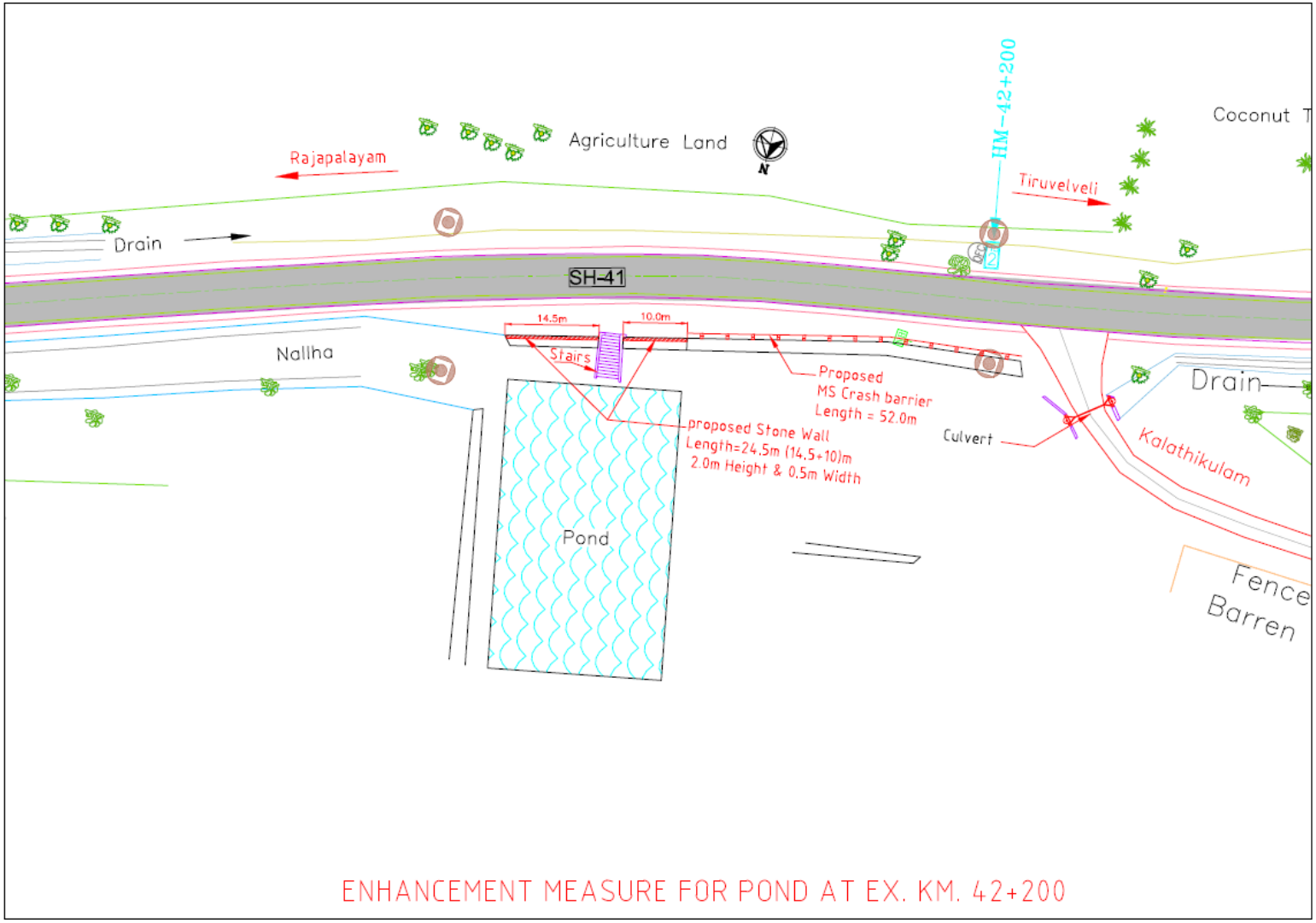
Drawing No. 1


Canal
Existing Earthen Wall
14.0 m Width & 3.0m
Height
12.0m 8.0m
38.0m
Proposed Plantation &
Grass Sodding on
Three Side
47.0m
14.0m
Proposed Shadow Tree
Existing Earthen Wall
14.0 m Width & 3.0m
Height
Existing
Re Wall
68.0m
To Mill(BT)
HM-11+200
House
Proposed
Stone Wall
Height=3.0m
Width= 0.5m
14.0m
27.0m
13.0m
10.0m
40.0m
C-Wall
W-Tank
Rajapalayam Textiles
HM-11+400
Rajapalayam
Solar
Light
Bench
Tirunelveli
C-Wall
SH-41
Fence
Tub
Man Hole
Slab
Shed
Shed
Fence
Open Land
Agriculture Land
Nallah
C-Wall
ENHANCEMENT MEASURE
FOR POND AT EX. KM. 11+250

Drawing No. 2


N
Stone Wall
(Existing)
Pond
Earthen Wall
(Existing)
HM-24+400
Proposed
Stone Wall
Length=25.0m
Height=3.0m
Width= 0.5m
Proposed
Stone Wall
Length=30.0m
Height=3.0m
Width= 0.5m
Rajapalayam
Tirunelveli
Drain
Stairs
25.0m
30.0m
Drain
Earth Drain
SH-41
Earth Drain
Slab Culvert
Ramalinga Puram
Pump
Bus Stop
Barren Land
ENHANCEMENT MEASURE FOR POND AT EX. KM. 24+380

Drawing No. 3


Rajapalayam
Agriculture Land
N
HM-42+200
Tiruvelveli
Coconut T
Drain
SH-41
14.5m
10.0m
Stairs
Nallha
Proposed
MS Crash barrier
Length = 52.0m
proposed Stone Wall
Length=24.5m (14.5+10)m
2.0m Height & 0.5m Width
Culvert
Drain
Kalathikulam
Pond
Fence
Barren
ENHANCEMENT MEASURE FOR POND AT EX. KM. 42+200

Drawing No. 4

ANNEXURE 3.52: SPOIL AND SCARIFIED MATERIAL DISPOSAL PLAN FOR PROJECT ROAD

The total estimated quantity of scarified material for SH41 is about 12050 cu.m (considering 7m of average width of scarification and 0.050m of average thickness of scarification)

The entire material will be required for base filling of the corridor. The topsoil in all cases is about 50 cm. This will be removed and heaped to use for productive purposes. The total fill material required would be 50cm pit developed after the topsoil removal and additional 50 cm new scarified material would also be filled in the case of new alignments.

The mass balance would be achieved by filling along the construction alignments for access roads etc. The detailed plan should be in conformity with the Construction scheduling prepared by the PIU . The Contractor will have to obtain approval from the Engineer regarding Contractors plan to use the material.

ANNEXURE 3.53: CULTURAL PROPERTIES REHABILITATION MEASURES

The project needs to develop measures for the rehabilitation of cultural properties that will be affected by the road improvement programme.

WHAT DOES CULTURAL PROPERTY MEAN?

The United Nations term “Cultural Property” includes sites having archaeological (prehistoric), palaeontological, historical, religious, and unique natural values. Cultural Property, therefore, encompasses remains left by previous inhabitants, for example, middens, shrines, and battlegrounds) and unique natural environmental features such as canyons and waterfalls. The rapid loss of cultural property in many countries is irreversible and often unnecessary. Detailed background information on all aspects of this note are contained in the technical paper of the same title, available from the office of Environmental and Scientific Affairs, Project Policy Department of UN, which is ready to provide assistance on request.

Source: World Bank Draft OP 4.11

TYPES OF RELIGIOUS PROPERTIES IDENTIFIED IN THE PROJECT LOCATION

The environmental and social surveys and the detailed social impact studies have identified all cultural properties (24 temples and 1 church) that will be affected by the Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41 road improvement. These are presented as below.

S.No	Chainage	Description	Category	Locaton
1	5+460	Church	Church	RHS
2	6+800	Isaki Amman Kovil	Temple	RHS
3	7+000	Udai Pahi Kovil	Temple	RHS
4	8+180	Adaikalam Katha Ayyanal Kovil	Temple	RHS
5	11+900	Sri Vandima Kalimman Kovil(Aasilapuram	Temple	LHS
6	7+000	Temple	Temple	RHS
7	7+320	Temple	Temple	RHS
8	13+200	Vinaiger Temple	Temple	RHS
9	14+410	Vinaiger Temple	Temple	RHS
10	20+150	Muthallamman Kovil	Temple	LHS
11	20+220	Raja Ganapathi Kovil	Temple	LHS
12	20+280	Karupu Samy Kovil	Temple	LHS
13	20+400	Karupu Samy Kovil	Temple	LHS
14	24+980	Temple	Temple	LHS
15	25+580	Kovil	Temple	LHS
16	19+850	Vinaiger Temple	Temple	RHS
17	20+340	Vinaiger Temple	Temple	RHS
18	20+580	Vinaiger Temple	Temple	RHS
19	21+800	Vinaiger Temple	Temple	RHS
20	70+800	Vinaiger Temple	Temple	RHS

S.No	Chainage	Description	Category	Locaton
21	72+200	Amman Temple	Temple	RHS
22	74+780	Temple	Temple	RHS
23	74+860	Temple	Temple	RHS
24	76+420	Temple	Temple	RHS
25	78+860	Temple	Temple	LHS

Focused group discussions were held regarding the relocation of above e impacted cultural properties. Details are provided in RAP (section 6.2).

ANNEXURE 3.54: ENVIORNMENTAL STANDARDS FOR AIR, WATER AND NOISE

NATIONAL AMBIENT AIR QUALITY STANDARDS (CPCB 2009)

Concentration in Ambient Air				
Pollutant	**Time Weighted Average**	**Industrial, Residential, Rural and Other Area**	**Ecologically Sensitive Area (notified by Central Government)**	**Method of Measurement**
Sulphur Dioxide (SO_2) $\mu g/m^3$	Annual*	50	20	Improved West and Geake Method Ultraviolet Fluorescence
	24 hours**	80	80	
Oxides of Nitrogen (NO_x) $\mu g/m^3$	Annual*	40	30	Jacob & Hochheiser Modified (Na-Arsenite) Method Chemiluminescence
	24 hours**	80	80	Gas Phase Chemiluminescence
Particulate Matter (Size less than 10 µm) or PM_{10} $\mu g/m^3$	Annual*	60	60	Gravimetric TOEM Beta attenuation
	24 hours**	100	100	
Particulate Matter (Size less than 2.5 µm) or $PM_{2.5}$ $\mu g/m^3$	Annual*	40	40	Gravimetric TOEM Beta attenuation
	24 hours**	60	60	
Ozone (O_3) $\mu g/m^3$	8 hours**	100	100	UV Photometric Chemiluminescence Chemical Method
	1 hour**	180	180	
Lead (Pb) $\mu g/m^3$	Annual*	0.5	0.5	ASS/ ICP Method after sampling on EPM 2000 or equivalent Filter paper ED – XRF using Teflon filter
	24 hours**	1.0	1.0	
Carbon Monoxide (CO) mg/m^3	8 hours**	02	02	Non Dispersive Infra Red (NDIR) Spectroscopy
	1 hour**	04	04	
Ammonia (NH_3) $\mu g/m^3$	Annual*	100	100	Chemiluminescence Indophenol blue method
	24 hours**	400	400	

Concentration in Ambient Air				
Pollutant	**Time Weighted Average**	**Industrial, Residential, Rural and Other Area**	**Ecologically Sensitive Area (notified by Central Government)**	**Method of Measurement**
Benzene (C_6H_6) $\mu g/m^3$	Annual*	05	05	Gas Chromatography based continuous analyzer Adsorption and Desorption followed by GC analysis
Benzo (a) pyrene (BaP) – Particulate phase only, ng/m^3	Annual*	01	01	Solvent extraction followed by HPLC/GC analysis
Arsenic (As) ng/m^3	Annual*	06	06	AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
Nickel (Ni) ng/m^3	Annual*	20	20	AAS/ICP method after sampling on EPM 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 interval.
**24 hourly or 08 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.

USE BASED CLASSIFICATION OF SURFACE WATERS IN INDIA

Designated-Best-Use	Class of water	Criteria
Drinking Water Source without conventional treatment but after disinfections	A	i. Total Coliforms Organism MPN/100ml shall be 50 or less ii. pH between 6.5 and 8.5 iii. Dissolved Oxygen 6mg/l or more iv. Biochemical Oxygen Demand 5 days 20^{o}C 2mg/l or less
Outdoor bathing (Organized)	B	i. Total Coliforms Organism MPN/100ml shall be 500 or less ii. pH between 6.5 and 8.5 iii. Dissolved Oxygen 5mg/l or more iv. Biochemical Oxygen Demand 5 days 20^{o}C 3mg/l or less
Drinking water source after conventional treatment and disinfections	C	i. Total Coliforms Organism MPN/100ml shall be 5000 or less ii. pH between 6 to 9 iii. Dissolved Oxygen 4mg/l or more iv. Biochemical Oxygen Demand 5 days 20^{o}C 3mg/l or less
Propagation of Wild life and Fisheries	D	i. pH between 6.5 to 8.5 ii. Dissolved Oxygen 4mg/l or more iii. Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	i. pH between 6.0 to 8.5 ii. Electrical Conductivity at 25^{o}C micro mhos/cm Max.2250 iii. Sodium absorption Ratio Max. 26 iv. Boron Max. 2mg/l

Source: Guidelines for Water Quality Management – CPCB 2008.

WATER QUALITY STANDARD AS PER BIS (IS: 10500:2012)

S. No.	Parameters	Desirable Limit	Max. Permissible Limits in the absence of alternate source
Essential Characteristics:			
1.	Colour	5	25
2.	Odour	Unobjectionable	Unobjectionable
3.	Taste	Agreeable	Agreeable
4.	Turbidity, NTU	5	10
5.	pH Value	6.5 to 8.5	No relaxation
6.	Total Hardness (as $CaCO_3$), mg/l	300	600
7.	Iron as Fe, mg/l	0.3	1.0
8.	Chloride as Cl, mg/l	250	1000
9.	Residual free Chlorine, mg/l	0.2	-
Desirable Characteristics			
10.	Dissolved Solids, mg/l	500	2000
11.	Calcium as Ca, mg/l	75	200
12.	Copper as Cu, mg/l	0.05	1.5
13.	Manganese as Mn, mg/l	0.10	0.3
14.	Sulphate as SO_4, mg/l	200	400
15.	Nitrate as NO_3, mg/l	45	100
16.	Fluoride as F, mg/l	1.0	1.5
17.	Phenolic Compounds as C_6H_5OH, mg/l	0.001	0.002
18.	Mercury as Hg, mg/l	0.001	No relaxation
19.	Cadmium as Cd, mg/l	0.01	No relaxation
20.	Selenium as Se, mg/l	0.01	No relaxation
21.	Arsenic as As, mg/l	0.05	No relaxation
22.	Cyanide as CN, mg/l	0.05	No relaxation
23.	Lead as Pb, mg/l	0.05	No relaxation
24.	Zinc as Zn, mg/l	5.0	15.0
25.	Anionic detergent as MBAS, mg/l	0.2	1.0
26.	Chromium as Cr^{6+}, mg/l	0.05	No relaxation
27.	Polynuclear aromatic hydro carbon as PAH, g/l	-	-
28.	Mineral Oil, mg/l	0.01	0.03
29.	Pesticide, mg/l	Absent	0.001
30.	Radioactive materials: i. Alpha Emitters, Bq/l ii. Beta Emitters, Bq/l	 - -	 0.1 1.0
31.	Alkalinity, mg/l	200	600
32.	Aluminum as Al, mg/l	0.03	0.2
33.	Boron, mg/l	1.0	5.0

NATIONAL AMBIENT NOISE MONITORING STANDARDS, 2000

Area/Class	Noise Level (Leq dB (A))*	
	Day Time	Night Time
Industrial	75	70
Commercial/Mixed	65	55
Residential/Rural	55	45
Sensitive	50	40

Note-:

1. Day time shall mean from 6 a.m. to 10 p.m.

2. Night time shall mean from 10 p.m. to 6 a.m.

3. Silence Zone is an area comprising not less than 100 meters around hospitals, education institutions, courts, religious places or any other area, which is declared as such by Competent Authority.

4. Mixed categories of areas may be declared as one of the four above-mentioned categories by the Competent Authority.

*dB(A) Leq denotes the time weighted average of the level of decibels on scale A which is related to Human Beings

A “decibel” is the unit in which noise is measured

“A” in dB(A) Leq, denotes the frequency weighted in the measurement of the noise corresponds to frequency response characteristics of the human ear.

Leq: It is an energy means of the noise level over a specified period.

ANNEXURE 3.55: REFERENCE ENVIRONMENTAL, HEALTH AND SAFETY INTERNATIONAL PRACTICES

The following section provides a summary of EHS issues associated with road projects, which occur during the construction and operation phase, along with recommendations for their management.

i. Environment

Environmental issues during the construction and operation of roads are similar to those of other large infrastructure projects involving significant earth moving and civil works. These impacts include, among others, construction site waste generation; soil erosion and sediment control from materials sourcing areas and site preparation activities; fugitive dust and other emissions (e.g. from vehicle traffic, land clearing and movement, and materials

stockpiles); noise from heavy equipment and truck traffic; and potential hazardous materials and oil spills associated with heavy equipment operation and fuelling activities. Environmental issues specific to construction and operation of roads include the following:

- Stormwater
- Waste
- Noise
- Air emissions
- Wastewater

Stormwater

Construction or widening of sealed roads increases the amount of impermeable surface area, which increases the rate of surface water runoff. High stormwater flow rates can lead to stream erosion and flooding. Stormwater may be contaminated with oil and grease, metals (e.g. lead, zinc, copper, cadmium, chromium, and nickel), particulate matter and other pollutants released by vehicles on the roadway, in addition to deicing salts (e.g. sodium chloride and magnesium chloride) and their substitutes (e.g. calcium magnesium acetate and potassium acetate) from road maintenance facilities in colder climates. Storm water may also contain nutrients and herbicides used for management of vegetation in the rights-of-way. Practices applicable to roadways include the following:

General Storm water Management

- Use of stormwater management practices that slow peak runoff flow, reduce sediment load, and increase infiltration, including vegetated swales (planted with salt-resistant vegetation); filter strips; terracing; check dams; detention ponds or basins; infiltration trenches; infiltration basins; and constructed wetlands;
- Where significant oil and grease is expected, using oil / water separators in the treatment activities;
- Regular inspection and maintenance of permanent erosion and runoff control features;

Road Paving

- Paving in dry weather to prevent runoff of asphalt or cement materials;
- Use of proper staging techniques to reduce the spillage of paving materials during the repair of potholes and worn pavement. This may include covering storm drain inlets and manholes during paving operations; using erosion and sediment control measures to decrease runoff from repair sites; and utilizing pollution prevention materials (e.g. drip pans and absorbent material on paving machines) to limit leaks and spills of paving

materials and fluids;

- Reducing the amount of water used to control dust, and using sweeping practices rather than washing. Collecting and returning swept material to aggregate base or disposing as solid waste
- Avoiding the generation of contaminated runoff from cleaning of asphalt equipment by substituting diesel with vegetable oil as a release and cleaning agent; containing cleaning products and contaminated asphalt residues; scraping before cleaning; and conducting cleaning activities away from surface water features or drainage structures.

Waste

Solid waste may be generated during construction and maintenance of roads and associated structures. Significant quantities of rock and soil materials may be generated from earth moving during construction activities. Solid waste generation during operation and maintenance activities may include road resurfacing waste (e.g. removal of the old road surface material); road litter, illegally dumped waste, or general solid waste from rest areas; animal carcasses; vegetation waste from right-of-way maintenance; and sediment and sludge from storm water drainage system maintenance (including sediment traps and oil / water separation systems). Paint waste may also be generated from road and bridge maintenance (e.g. due to removal of old paint from road stripping and bridges prior to re-painting). Waste management strategies include:

Road Resurfacing

- Maximizing the rate of recycling of road resurfacing waste either in the aggregate (e.g. reclaimed asphalt pavement or reclaimed concrete material) or as a base;
- Incorporating recyclable materials (e.g. glass, scrap tires, certain types of slag and ashes) to reduce the volume and cost of new asphalt and concrete mixes.

Miscellaneous Wastes

- Collecting animal carcasses in a timely manner and disposing through prompt burial or other environmentally safe methods;
- Composting of vegetation waste for reuse as a landscaping fertilizer;

Painting Activities

- Grinding of removed, old road surface material and re-use in paving, or stockpiling the reclaim for road bed or other uses. Old, removed asphalt may contain tar and polycyclic aromatic hydrocarbons and may require management as a hazardous waste.

Noise

Management practices to prevent, minimize, and control noise include:

- Consideration of noise impacts during road design to prevent adverse impacts at nearby properties through the placement of the road right-of-way and / or through the design and implementation of noise control measures discussed below.
- Design and implementation of noise control measures may include the following:
    - Construction of the road below the level of the surrounding land
    - Noise barriers along the border of the right-of way (e.g. earthen mounds, walls, and vegetation)
    - Insulation of nearby building structures (typically consisting of window replacements)

- Use of road surfaces that generate less pavement / tire noise such as stone-matrix asphalt

Air Emissions

Air emissions are typically related to dust during construction and exhaust from vehicles. Management practices for air emissions include:

- Use of dust control methods, such as covers, water suppression, or increased moisture content for open materials storage piles, or controls, including air extraction and treatment through a baghouse or cyclone for material handling sources, such as conveyors and bins;
- Use of water suppression for control of loose materials on paved or unpaved road surfaces. Oil and oil by-products is not a recommended method to control road dust.
- **Operation** and maintenance of maintenance vehicle fleets
- Consideration of design options for the reduction of traffic congestion, including:
    - Minimizing grade changes, at-grade crossings, and sharp curves which can promote congestion
    - Design of roadway to shed water, and prompt removal of snow to minimize rolling resistance, as well as to enhance safety
    - Maintenance of the road surface to preserve surface characteristics (e.g. texture and roughness)

Wastewater

Wastewater discharges from maintenance facilities should be managed properly, and may include connection to centralized wastewater collection and treatment systems and / or use of properly designed and operated septic systems.

ii. Occupational Health and Safety

Occupational health and safety issues associated with the construction and operation of roads primarily include the following:

- Physical hazards
- Chemical hazards
- Noise

Physical Hazards

Road construction and maintenance personnel, as well as landscaping workers maintaining vegetation in the rights-of-way, can be exposed to a variety of physical hazards, principally from operating machinery and moving vehicles but also working at elevation on bridges and overpasses.

Management practices to prevent and control physical hazards include:

Moving Equipment and Traffic Safety

• Development of a transportation management plan for road repairs that includes measures to ensure work zone safety for construction workers and the traveling public;

· Establishment of work zones to separate workers on foot from traffic and equipment by:

o Routing of traffic to alternative roads when possible

o Closure of lanes and diversion of traffic to the remaining lanes if the road is wide enough (e.g. rerouting of all traffic to one side of a multi-lane highway)

o Where worker exposure to traffic cannot be completely eliminated, use of protective barriers to shield workers from traffic vehicles, or installation of channeling devices(e.g. traffic cones and barrels) to delineate the work zone

o Regulation of traffic flow by warning lights, avoiding the use of flaggers if possible

o Design of the work space to eliminate or decrease blind spots

- Reduction of maximum vehicle speeds in work zones;
- Training of workers in safety issues related to their activities, such as the hazards of working on foot around equipment and vehicles; and safe practices for work at night and in other low-visibility conditions, including use of high-visibility safety apparel and proper illumination for the work space (while controlling glare so as not to blind workers and passing motorists).

Elevated and Overhead Work

- The area around which elevated work is taking place should be barricaded to prevent unauthorized access. Working under personnel on elevated structures should be avoided;
- Hoisting and lifting equipment should be rated and properly maintained, and operators trained in their use. Elevating platforms should be maintained and operated according to established safety procedures including use of fall protection measures (e.g. railings); equipment movement protocols (e.g. movement only when the lift is in a retracted position); repair by qualified individuals; and installation of locks to avoid unauthorized use by untrained individuals;
- Ladders should be used according to pre-established safety procedures for proper placement, climbing, standing, as well as the use of extensions.

Fall Protection

- Implementation of a fall protection program that includes training in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers, among others;
- Establishment of criteria for use of 100 percent fall protection (typically when working over 2 meters above the working surface, but sometimes extended to 7 meters, depending on the activity). The fall protection system should be appropriate for the structure and necessary movements, including ascent, descent, and moving from point to point;
- Installation of fixtures on bridge components to facilitate the use of fall protection systems;
- Safety belts should be not less than 16 millimeters (mm) (5/8 inch) two-in-one nylon or material of equivalent strength.
- Rope safety belts should be replaced before signs of aging or fraying of fibers become evident;
- When operating power tools at height, workers should use a second (backup) safety strap.

Chemical Hazards

Chemical hazards in road construction, operations, and maintenance activities may be principally associated with exposures to dust during construction and paving activities; exhaust emissions from heavy equipment and motor vehicle during all construction and maintenance activities; potentially hazardous dust generated during bridge paint removal; and diesel fuel used as a release and cleaning agent for paving equipment. Recommendations are as follows:

- Use of millers and pavers with exhaust ventilation systems and proper maintenance of such systems to maintain worker exposure to crystalline silica (millers and grinders) and asphalt fumes (pavers) below applicable occupational exposure levels;
- Use of the correct asphalt product for each specific application, and ensuring application at the correct temperature to reduce the fuming of bitumen during normal handling;
- Maintenance of work vehicles and machinery to minimize air emissions;
- Reduction of engine idling time in construction sites;
- Use of extenders or other means to direct diesel exhaust away from the operator;
- Ventilation of indoor areas where vehicles or engines are operated, or use of exhaust extractor hose attachments to divert exhaust outside;
- Provision of adequate ventilation in tunnels or other areas with limited natural air circulation;
- Use of protective clothing when working with cutbacks (a mixture of asphalt and solvents for the repair of pavement), diesel fuel, or other solvents;
- Avoiding the use of lead-containing paint and using appropriate respiratory protection when removing paints (including those containing lead in older installations) or when cutting galvanized steel.

Noise

Construction and maintenance personnel may be potentially exposed to extremely high levels of noise from heavy equipment operation and from working in proximity to vehicular traffic. As most of these noise sources cannot be prevented, control measures should include the use of personal hearing protection by exposed personnel and implementation of work rotation programs to reduce cumulative exposure.

iii. Community Health and Safety

Significant community health and safety issues associated with road projects may also include:

- Pedestrian safety
- Traffic safety
- Emergency preparedness

Pedestrian Safety

Pedestrians and bicyclists are at greatest risk of serious injury from collisions with moving vehicles. Children are generally the most vulnerable due to lack of experience and knowledge of traffic related hazards, their behavior while at play, and their small size making them less visible to motorists. Recommended pedestrian safety management strategies include the following:

- Provision of safe corridors along the road alignment and construction areas, including bridges (e.g. paths separated from the roadway), and safe crossings (preferably over or

under the roadway) for pedestrians and bicyclists during construction and operation. Crossing locations should take into account community preferences, including those related to convenience or personal safety (e.g. the prevalence of crime at potential crossing point locations).

- Installation of barriers (e.g. fencing, plantings) to deter pedestrian access to the roadway except at designated crossing points;
- Installation and maintenance of speed control and traffic calming devices at pedestrian crossing areas;
- Installation and maintenance of all signs, signals, markings, and other devices used to regulate traffic, specifically those related to pedestrian facilities or bikeways.

Traffic Safety

Collisions and accidents can involve a single or multiple vehicles, pedestrians or bicyclists, and animals. Many factors contribute to traffic accidents. Some are associated with the behavior of the driver or the quality of the vehicle, while others are linked to the road design, or construction and maintenance issues. Recommendations to prevent, minimize, and control risks to the community from traffic accidents include:

- Installation and maintenance of all signs, signals, markings, and other devices used to regulate traffic, including posted speed limits, warnings of sharp turns, or other special road conditions;
- Setting of speed limits appropriate to the road and traffic conditions;
- Design of roadways to accommodate anticipated traffic volume and flow;
- Maintenance of the road to prevent mechanical failure of vehicles due to road conditions;
- Installation of measures to reduce collisions between animals and vehicles (e.g. use of signs to alert drivers on road segments where animals frequently cross; construction of animal crossing structures; installation of fencing along the roadway to direct animals toward crossing structures; and use of reflectors along the roadside to deter animal crossings at night when vehicles are approaching);
- Targeting elimination of at-grade rail crossings;
- Targeting the use of a real-time warning system with signage to warn drivers of congestion, accidents, adverse weather or road conditions, and other potential hazards ahead.

Emergency Preparedness

Emergency situations most commonly associated with road operations include accidents involving single or multiple vehicles, pedestrians, and / or the release of oil or hazardous materials. Road operators should prepare an emergency preparedness and response plan in coordination with the local community and local emergency responders to provide timely first aid response in the event of accidents and hazardous materials response in the event of spills.