



## HIGHWAYS DEPARTMENT

Government of Tamil Nadu



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

#### VOLUME VII: PART A (I) ENVIRONMENTAL ASSESSMENT REPORT FOR

#### UPGRADING

**PARUVAKUDI - KOVILPATTI - ETTAYAPURAM - VILATHIKULAM - VEMBAR  
ROAD (SH44) KM 22/500 TO KM 38/750 AND KM 41/300 TO KM 56/700**

**NANGUNERI - BHARATAVARAM OVARI ROAD (SH89) UPTO ECR JUNCTION  
KM 0/000 TO KM 35/200**

**RAJAPALAYAM - SANKARANKOIL – TIRUNELVELI ROAD (SH41)  
KM 1/800 TO KM 28/000 AND KM 33/800 TO KM 82/800**



**October 2014**

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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**



ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

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## ABBREVIATIONS

Abbreviation	Full Form
AADT	Annual Average Daily Traffic
ADT	Average Daily Traffic
AAQ	Ambient Air Quality
AMSL	Above Mean Sea Level
BDL	Below Detection Limit
BIS	Bureau of Indian Standards
BOD	Biological Oxygen Demand
BOQ	Bill of Quantities
BP	Bank Procedure
CD	Cross Drainage
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
COI	Corridor of Impact
CRZ	Coastal Regulation Zone
CPCB	Central Pollution Control Board
CPR	Common Property Resource
CL	Centre Line
CSC	Construction Supervision Consultant
CW	Carriageway
CTE	Consent to Establish
CTO	Consent to Operate
dB	Decibel
DG	Diesel Generator
DPR	Detailed Project Report
EA	Environmental Assessment
EC	Environmental Clearance
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EMP	Environmental Management Plan
EMAP	Environmental Management Action Plan
EMU	Environment Management Unit
EO	Environment Officer
EPC	Engineering Procurement Construction
EROW	Existing Right of Way
ES	Environmental Specialist
ESZ	Eco Sensitive Zone
GoI	Government of India
GoTN	Government of Tamil Nadu
GW	Ground Water
HD	Highway Department
HFL	High Flood Level





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Abbreviation	Full Form
HP	Hand Pump
IMD	Indian Meteorological Department
IRC	Indian Road Congress
IS	Indian Standard
IUCN	International Union for Conservation of Nature,
LHS	Left Hand Side
LED	Light-Emitting Diode
LPG	Liquid Petroleum Gas
Leq	Equivalent Sound Pressure Level
LOS	Level of Service
MoRTH	Ministry of Road Transport & Highways
MoEF & CC	Ministry of Environment, Forests & Climate Change
NABL	National Accreditation Board for Testing and Calibration Laboratories
NBWL	National Board for Wildlife
NAAQS	National Ambient Air Quality Standards
NGO	Non-Governmental Organization
NH	National Highway
NOC	No Objection Certificate
NOx	Oxides of Nitrogen
NQ	Noise Quality
OHT	Over Head Tank
OP	Operational Procedure
PIA	Project Influence Area
PIU	Project Implementation Unit
PAPs	Project Affected Persons
PC	Public Consultation
PCU	Passenger Car Unit
PF	Protected Forest
PROW	Proposed Right of Way
PWD	Public Works Department
PM	Particulate Matter
PUC	Pollution under Control Certificate
RAP	Resettlement Action Plan
RF	Reserved Forest
ROB	Railway Over Bridge
RUB	Railway Under Bridge
RHS	Right Hand Side
ROW	Right of Way
SH	State Highway
SQ	Soil Quality
SCZMA	State Coastal Zone Management Authority
SOX	Sulphur oxide
SPCB	State Pollution Control Board



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<b>Abbreviation</b>	<b>Full Form</b>
TDS	Total Dissolved Solids
TNRSP	Tamil Nadu Road Sector Project
TNPCB	Tamil Nadu Pollution Control Board
TWT	Tap Water Tank
TWAD	Tamil Nadu Water Supply and Drainage Board
USEPA	United State Environment Protection Agency
VEC	Valued Environment Components
WB	World Bank
WBG	World Bank Group
WPA	Wildlife Protection Act
WQ	Water Quality



## **EXECUTIVE SUMMARY**



ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

## EXECUTIVE SUMMARY

### A.1 BACKGROUND

The Highway Department, Government of Tamil Nadu (GoTN) under Tamil Nadu Road Sector Project (TNRSP) has undertaken the State Highways (SHs) improvement work with World Bank assistance loan. About 1800km of SH has already been improved under Phase I (TNRSP I). GoTN has now mooted to second phase of road improvement works, namely TNRSP II, considering 9 roads, having length of 425.65 km. Out of which, 3 roads (*Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44, Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89 and Rajapalayam - Sankarankoil – Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41* having total length of 142.05 km have been considered as Phase-I roads under TNRSP-II.

### A.2 OBJECTIVES OF THE ASSIGNMENT

The main objective would be to alleviate the current congested conditions of the identified road network connecting the villages and towns by providing better quality and safe roads to the users in a sustainable and environment friendly manner.

Environmental Assessment (EA) has been conceived as an integral part of developing the project roads as Green Highways, so that the project can facilitate economic stimulation and improvement to community and cultural assets by integrating environmental enhancement measures along the project corridors through community partnering.

### A.3 SCOPE OF ENVIRONMENTAL ASSESSMENT (EA)

The environmental assessment scope includes screening and scoping, environmental assessment and preparation of environmental management plans for the individual project roads as required. The EA process also envisages developing a comprehensive environmental management framework for the entire project, which will be adopted as part of the corporate environmental policy for TNRSP.

### A.4 DESCRIPTION OF PROJECT ROADS

Three road corridors have been considered in this report:

**(1) Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road, section of SH44:** The project road starts from Naduvapatti at Km 22/500 and ends at Ettayapuram at Km 56/700, junction with NH-45B, covering a design length of 31.650 km. The road is passing through 16 villages, covering three districts namely Tirunelveli, Toothukudi and Virudhnagar. About 12.32 km stretch (39%) of the road traverses through built-up area.

**Existing Features:** The existing road stretch has 54 minor and 2 major junctions. There is no truck lay bye, underpass, flyover and ROB/RUB. There is no major bridge, 5 nos. of minor bridges, 1 causeway and 48 nos. of culverts. There are 7 nos. of bus bays/bus shelters along the road.



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There is no Protected Area (National Park, Wildlife Sanctuary, Bird Sanctuary, Bio-reserve, Eco sensitive Zone), archaeological site within 10km distance from either side of road. Also, there is no reserved/ protected forest within RoW of project road.

**Proposed Features:** The road improvement is proposed from existing 2 lane to 2-lane with paved shoulder with ROW varying from 16m to 23m, including 4-lane for a small urban stretch at Thittangulam from km 41/300 to km 45/355 of SH44 (4.065 km) with ROW 28 m. Also, Kovilpatti (km38/850 to km 41/300) is not in scope. No truck laybye, underpass, flyover and ROB/RUB are proposed. It is proposed to reconstruct existing 5 minor bridges and conversion of causeway to minor bridge, reconstruction of 3 nos. of pipe culverts to box culverts, 13 nos. of slab/cut stone culverts to box culverts and widening/ retaining of 21 nos. of pipe culverts and 10 nos. of slab culverts. It is also proposed to construct 2 additional box culverts. A total of 19 nos. of bus bays are proposed to be built. Footpath of 1.5m width is proposed in urban sections. There is no proposal of bypass, however, four major horizontal curve improvements are proposed.

**(2) Nanguneri – Bharatavaram – Ovari Road upto ECR Junction, section of SH89:** The project road starts from Nanguneri, NH-7 junction at Km 0/000 and ends at Ovari at Km 35/200, covering a design length of 35.200 km. The road is passing through 13 villages, covering only Tirunelveli district. About 11.02 km stretch (31%) of the road traverses through built-up area.

**Existing Features:** The existing road stretch has 42 minor and 5 major junctions. There is no truck lay bye, underpass, flyover and ROB/RUB. There is no major bridge and minor bridges, 4 causeways and 30 nos. of culverts. There are 37 nos. of bus stops along the road. There is no reserve/protected forest within RoW of project road. Koonthakulam Bird Sanctuary is located at about 7.5km distance from road (Stretch from km0/000 to Km15/500 falls within 10km buffer of sanctuary). There is no archaeological site within 500m of project road.

**Proposed Features:** The road improvement is proposed from 2 lane to 2-lane with paved shoulder, with ROW varying from 16m to 23m (*Except the stretch from km0/000 to km15/500 falling within 10 km buffer zone of Koonthakulam Bird Sanctuary, where it will be 2-lane without paved shoulder*). No truck laybye, underpass, flyover and ROB/RUB are proposed. It is proposed to convert existing 4 nos. of causeways to minor bridge, reconstruction of 6 nos. of pipe culverts to box culverts, 6 nos. of slab/cut stone culverts to box culverts, retaining/widening of 11 nos. of pipe culverts and 6 nos. of slab culverts. It is also proposed to construct 9 additional box culverts and 4 additional pipe culverts. About 18 nos. of bus bays are proposed to be built. Footpath of 1.5m width is proposed in urban sections. There is no proposal of bypass. One major realignment is proposed at Tisaiyanvillai (km26/800 to km 29/672). Apart from that, three major horizontal curve improvements are also proposed.

**(3) Rajapalayam - Sankarankoil - Tirunelveli Road, section of SH41:** The project road starts from intersection of NH 208, at Km 00/000 and ends at intersection of Tirunelveli-Tenkasi Road, SH39 at Km 85/730. The start and end points of project roads is thickly built up, thus the start and end chainages has been revised as km 1/800 and km 82/800





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respectively. The total length of the project road is now 75.2km. The Project road passes through 46 villages, covering two districts namely Tirunelveli, and Virudhnagar. About 53% of the road traverses through dry land and 30% through built-up area.

**Existing Features:** About 70% of project road length has earthen shoulder with width varying between 0.5m to 1.0m. There are 85 minor and 3 major junctions along the road. There is no truck lay by, 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 Rajapalayam, 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.

**Proposed Features:** The road improvement is proposed from 2 lane to 2-lane with paved shoulder, with ROW varying from 16m to 23m (*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*). No truck layby, underpass, flyover and ROB/RUB are proposed. It is proposed to reconstruct, widen and retaining of existing 9 nos., 6 nos. and 14 nos. of minor bridges respectively. There is proposal for 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 additional box culverts. A total of 68 nos. of bus bays will be constructed. It is proposed to provide footpath of 1.5m width in urban sections. There is no proposal of bypass (except already proposed Sankarankoil Bypass by TNRSP). However, seven major horizontal curve improvements are proposed.

## A.5 PROJECT BENEFITS

Widening and up-gradation of the project roads will lead to better road connectivity, significant economic benefits to the State. Installation of proper road safety system on project roads will further enhance the road safety on these project roads.

The project will help in changing socio-economic conditions of the people living in the region by generating employment. The indirect benefits include savings in vehicle operating costs, less fuel consumption and decreased cost of passenger travel. Also environmental enhancement measures such as the pond beautification, landscaping, solar lighting, tree plantation, and cultural property rehabilitation will also benefit the communities.

## A.6 ENVIRONMENTAL REGULATORY FRAMEWORK

Existing acts, legislations relevant to the environmental issues in this project has been followed at the National and State levels, viz. Govt. of India, Govt. of Tamilnadu and World Bank Operational Policies. Other guidelines, which have been followed, are MoRTH specifications for Road and Bridge works and guidelines of Indian Roads Congress (IRC).



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Key applicable environmental regulations for the project are as follows:

Sl. No	Act/Rules	Year	Objective	Reason for applicability	Authority
1.	Environmental (Protection) Act	1986	To protect and improve overall environment	As all environmental notifications, rules and schedules are issued under this act.	MoEF & CC, GoI; DoE, State Govt. CPCB; TNPCCB
2.	Water (Prevention and Control of Pollution) Act and Cess Act of 1977 as amended in 1988	1974	To control water pollution by controlling emission & water pollutants as per the prescribed standards	This act will be applicable during construction for (establishment and Operation of hot mix plant, stone crusher plants, construction camp, workers' camp, etc.	TNPCCB
3.	Air (Prevention and Control of Pollution) Act as amended in 1987	1981	To control air pollution by controlling emission and air pollutants according to prescribed standards	This act will be applicable during construction; for obtaining Consent to Establish & Consent to Operate for hot mix plant, stone crusher plants, workers' camp, construction camp, etc.	TNPCCB
4.	Noise Pollution (Regulation and Control) rules 2000	2000	Noise pollution regulation and controls	This act will be applicable as vehicular noise on project roads required to assess for future years and necessary protection measure need to be considered in design.	TNPCCB
5.	Hazardous Wastes (Management, Handling and Trans boundary Movement) Rules	2008	Storage, handling, transportation and disposal of hazardous waste	Storage and handling of hazardous waste during construction	TNPCCB



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Sl. No	Act/Rules	Year	Objective	Reason for applicability	Authority
6.	Municipal Solid Wastes (Management & Handling) Rules	2000	Management and handling of solid waste	For disposal of solid waste generated during construction	TNPCB
7.	The Mining Act	1952	The mining act has been notified for safe and sound mining activity.	The construction of project road will require aggregates. These will be procured through mining from quarries	Department of mining, GoTN
8.	The Right to Fair Compensation & Transparency in Land Acquisition, Rehabilitation & Resettlement Act	2013	Sets out rules for fair compensation and acquisition of land	This act will be applicable as there will be acquisition of land for widening, geometric improvements and realignments.	Revenue Department State Government.

### Environmental Legal Framework of Tamil Nadu State

Sl. No	Applicable GOI Acts	Year	Objective
1	Tamil Nadu State Environment Policy (Draft)	2012	Sustainable development of the State
2	Tamil Nadu State Water Policy	1994	To protect and conserve water resources
3	Tamil Nadu Water (Prevention and Control of Pollution) Rules	1983	To control water pollution by controlling emission and water pollutants according to prescribed standards
4	Tamil Nadu Air (Prevention and Control of Pollution) Rules	1983	To control air pollution by controlling emission & air pollutants as per the prescribed standards
5	Tamil Nadu Groundwater (Development and Management) Bill	2000	To protect groundwater resources, to provide safeguards against hazards of its over exploitation and to ensure its planned development and management in the State of TN and for matters connected therewith or incidental thereto
6	Tamil Nadu Forest Act	1882	Protection of wildlife (wild animals, defined plants and birds) and to control poaching, smuggling and illegal trade in wildlife and its derivatives.



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### Applicability of WB Safeguard Policies

WB Safeguard Policy	Subject Category	Reason for Applicability	Mitigation Measures	Documentation
OP 4.01	Environment Assessment	Umbrella Policy	All necessary mitigation measures incorporated.	EA and EMP required.
OP 4.02	Environmental Action Plan		Environmental mitigation plan formulated for each identified negative impact.	Covered under EMP
OP 4.04	Natural Habitats	Eco-sensitive Forestry and wildlife related issues along Nanguneri - Bharatavaram Ovari Road upto ECR Junction, section of SH89 <sup>1</sup> and Rajapalayam - Sankarankoil – Tirunelveli Road, Section of SH41 <sup>2</sup> .	No widening is proposed in road stretches falling within 10km buffer zone from sanctuary. Only 2 lane without paved shoulder is proposed in these stretches. (km 0/000 to km 15/500 on SH89 and km0/000 to km 6/000 on SH41)	Covered under EA/ EMP
OP 4.11	Cultural Property	A no. of religious structures is located within ROW. A cultural property rehabilitation plan to be developed.	Adequate mitigation measures provided for affected structures.	Covered under RAP & EMP and to minimise any adverse effect on the cultural properties.
OP/BP 4.12	Involuntary Resettlement	Road widening will lead to loss of livelihoods, loss of land and buildings etc.	Adequate mitigation measures provided in RAP	Resettlement Action Plan

The project road sections (Two lane up-gradation with paved shoulders of Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH 44, Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89 and Rajapalayam - Sankarankoil – Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41) are State Highways, and not attracting the conditions of MoEF & CC EIA Notification 2006 and amendments thereafter. The project roads have been categorised as '**Category A**' as per World Bank Guidelines as the project roads have adverse environmental impacts for which comprehensive Environmental Assessment has been carried out.

<sup>1</sup> Koonthakulam Bird Sanctuary is located at about 7.5km from Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89.

<sup>2</sup> Srivilliputtur Giant Grizzled Squirrel Wildlife Sanctuary is located at about 6 km from start point of Rajapalayam-Sankarankoil-Tirunelveli section of SH-41



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## A.7 BASE LINE ENVIRONMENT

Baseline data on environmental attributes has been collected from primary and secondary sources. The baseline environmental conditions will help in comparing and monitoring of the predicted negative and positive impacts resulting from the project during construction and operation phases. Accordingly, mitigation measures / management plan can be suggested for the project. The baseline monitoring of air, water, noise and soil was undertaken by NABL accredited agency, M/S Green Chem Solutions Pvt. Ltd. during 26.02.2014 to 26.03.2014 along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44 and Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89. The baseline monitoring along Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 was carried out during 24.06.2014 and 20.07.2014.

### **Air environment:**

**Climate:** The climate of the project influence area (PIA) is tropical, with distinct wet and dry seasons. The climate may be classified into four distinct seasons: winter (January – February), summer (March – May), southwest monsoons (June – September) and northeast monsoon (October – December).

**Rainfall:** Tamil Nadu state is the only part of the country that receives rainfall during winter months. The annual average rainfall for the last five years (2008-2012) is 949mm in Tirunelveli district, 759mm in Toothukudi district and 756mm in Virudhnagar district.

**Temperature:** Project region fall in hyper thermic to strong mega thermic zone as per temperature distribution map of Tamil Nadu State. The weather is quite hot in May & June where maximum temperature reaches as high as 45 degree Celsius. The period from November to January is the coolest period of the year with the mean daily maximum temperature of about 30 to 31 degree Celsius.

**Relative Humidity:** The PIA has arid and semi-arid climate. The relative humidity in Tirunelveli, Toothukudi and Virudhnagar districts varies between 79% - 84%, 60% - 75% and 65% - 85% respectively.

**Winds:** In PIA, when north-east monsoon sets in during October-December the winds blow from north and northwest direction towards east. In January/ February, winds blow steadily from northeast direction. During the period between June to September, the winds reverse their direction and blow mostly from southwest direction. The wind speed is highest in the month of June and lowest in the month of March.

**Ambient Air Quality:** Ambient air quality monitoring has been undertaken at four locations each along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road section of SH-44 and Nanguneri - Bharatavaram Ovari Road upto ECR Junction section of SH-89 during the months of February-March 2014 and at nine locations along Rajapalayam - Sankarankoil – Tirunelveli Road section of SH41 during the months of June-July 2014 as per National Ambient Air Quality Standards (NAAQS) for particulate & gaseous pollutants, laid down by Central Pollution Control Board (CPCB) in 2009. The monitoring frequency was taken as twice a week for 4 weeks. The parameters which were monitored are PM<sub>10</sub>, PM<sub>2.5</sub>,



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SO<sub>x</sub>, NO<sub>x</sub> & CO. The ambient air quality was found to be well within the permissible limits of CPCB along all 3 project roads.

Along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road section of SH44, the concentration of PM<sub>10</sub> varied between 35.8 µg/m<sup>3</sup> and 44.2 µg/m<sup>3</sup> and PM<sub>2.5</sub> varied between 14.6 µg/m<sup>3</sup> and 20.1 µg/m<sup>3</sup>. SO<sub>x</sub> concentration varied between 5.8 µg/m<sup>3</sup> and 7.5 µg/m<sup>3</sup> while NO<sub>x</sub> value varied between 14.4 µg/m<sup>3</sup> and 17.3 µg/m<sup>3</sup>. CO levels were found between 0.80 mg/m<sup>3</sup> and 0.95 mg/m<sup>3</sup>.

Along Nanguneri - Bharatavaram Ovari Road upto ECR Junction section of SH-89, the concentration of PM<sub>10</sub> varied between 34.5 µg/m<sup>3</sup> and 40.4 µg/m<sup>3</sup> and PM<sub>2.5</sub> varied between 15.8 µg/m<sup>3</sup> and 19.6 µg/m<sup>3</sup>. SO<sub>x</sub> concentration varied between 6.1 µg/m<sup>3</sup> and 7.8 µg/m<sup>3</sup> while NO<sub>x</sub> value varied between 15.3 µg/m<sup>3</sup> and 17.1 µg/m<sup>3</sup>. CO levels were found between 0.80 mg/m<sup>3</sup> and 0.95 mg/m<sup>3</sup>.

Along Rajapalayam - Sankarankoil – Tirunelveli Road section of SH41, the concentration of PM<sub>10</sub> varied between 36.3 µg/m<sup>3</sup> and 48.5 µg/m<sup>3</sup> and PM<sub>2.5</sub> varied between 16.5 µg/m<sup>3</sup> and 22.6 µg/m<sup>3</sup>. SO<sub>x</sub> concentration varied between 5.8 µg/m<sup>3</sup> and 8.8 µg/m<sup>3</sup> while NO<sub>x</sub> value varied between 16.2 - 18.5 µg/m<sup>3</sup>. The concentration of CO varied between 0.8 mg/m<sup>3</sup> - 1.0 mg/m<sup>3</sup>.

The concentration of all the parameters along all the three project roads is below the prescribed CPCB standards.

#### **Land Environment:**

**Geography and Topography:** The road stretch of Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar of SH-44 fall in Tirunelveli, Toothukudi and Virudhnagar Districts (only a small stretch of 600m length fall in Virudhnagar district). While the entire road stretches of Nanguneri - Bharatavaram - Ovari of SH-89 falls entirely in Tirunelveli district. The major project road length of Rajapalayam - Sankarankoil – Tirunelveli Road section of SH41 fall in Tirunelveli district. Geomorphologically from west to east, three major units are recognised in Tamil Nadu viz. the Western Ghats, the Central Region and the Coastal Plains. The general elevation of Tirunelveli district varies from less than 10m to 1408m above MSL (Tulukkaparai hill range). The project region has plain topography having an altitude in the range of 1-150m above MSL. The prominent geomorphic units of the district are Structural Hill, Bazada Zone, Valley Fill, Flood Plain, Pediment and Coastal Plain. The prominent geomorphic units identified in the Toothukudi district are 1) Fluvial, 2) Marine, 3) Fluvio-marine, 4) Aeolian and 5) Erosional landforms depending on the environment of formation.

**Geology and Mineralogy:** Geologically, the entire state can be broadly classified into hard rock or crystalline formation and sedimentary formations. Crystalline rocks of Archean metamorphic complex comprising of granite, charnockites, gneisses, schists etc. underlie nearly 73% of the state. Geological formation in the project region comprises mainly of granite gneiss rocks with some patches of alluvium and dharwar rocks. No minerals were found along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road section of SH-44, while limestone is found along Nanguneri - Bharatavaram Ovari Road upto ECR





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Junction section of SH-89. Limestone is found in project districts of Rajapalayam - Sankarankoil – Tirunelveli Road section of SH41.

**Seismicity:** According to seismic zoning map of India, the state of Tamil Nadu fall in Zone II and Zone III, least active to moderate zone of seismic hazard. All the three project roads fall in Zone II, i.e. least active zone.

**Soil:** The soil types along the project roads include inceptisols, alfisols, vertisols and red gravel. Based on water retention characteristics, project region found to have soils that have high water retention characteristic except in the end stretch of Nanguneri - Bharatavaram Ovari Road upto ECR Junction section of SH-89 where water retention is low. Soil samples were collected from 2 locations along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road section of SH-44, 3 locations along Nanguneri - Bharatavaram Ovari Road upto ECR Junction section of SH-89 and 5 locations along Rajapalayam - Sankarankoil – Tirunelveli Road section of SH41. The soil texture is sandy along SH44 and SH89, while along SH41, it is sandy and clayey. Along all the three road sections, the soil is alkaline in nature, has good electrical conductivity and has good amount of primary nutrients i.e., Nitrogen (N), Phosphorus (P) and Potassium (K) content. The soil in the project area is fertile with high agricultural productivity

**Land use:** Agriculture is the major land use pattern in Tirunelveli as well as Toothukudi districts. The major land use along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road section of SH-44 is Agricultural land (87%) while along Nanguneri - Bharatavaram Ovari Road upto ECR Junction section of SH-89, the major land use is open land (39%) followed by agricultural land (33%). The major land use along Rajapalayam - Sankarankoil – Tirunelveli Road section of SH41 is dry land (53%) followed by built up (30%) and wet land (17%)

**Landslide/ Landslip:** There is no issue of landslide/ landslip in the project area as the project roads fall in plain terrain.

**Agriculture:** Millets-rice is the major crops grown in the project area. Cash crops such as cotton, groundnut, pulses and vegetables are also grown in the project region. The important food crops are Paddy, Bajra, Ragi, Maize and other minor millets.

#### **Water Environment:**

**Hydrology:** Tirunelveli, Toothukudi and Virudhnagar districts are underlain by porous and fissured formations. The important aquifer systems in the Tirunelveli district are constituted by weathered & fractured hard rock formations of Archaean age; and Porous sedimentary formations ranging in age from Tertiary and Recent. The important aquifer systems in the Toothukudi and Virudhnagar districts are constituted by unconsolidated & semi-consolidated formations and weathered and fractured crystalline rocks.

Ground water is over exploited throughout the stretch of Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road section of SH-44 except along a small stretch in sattur block of Virudhnagar district. Around 60% of Nanguneri - Bharatavaram Ovari Road upto ECR Junction section of SH-89 fall in Nanguneri block which is under safe category of





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ground water resources while there is over exploitation of ground water resources along the remaining stretch of road in Radhapuram block. Along Rajapalayam - Sankarankoil – Tirunelveli Road section of SH41, ground water is over exploited throughout the stretch except along a small stretch in Manur block of Tirunelveli district. The depth to ground water level in project region during pre-monsoon varies from 2m to 10 m and during post-monsoon varies from 0 m to 10m

**Surface Water Resource:** Thamarabarani, Nambiar, Chittar and Karamanar are the important rivers flowing in Tirunelveli district. While the river originating from the Western Ghats and from uplands control the drainage network of the Toothukudi district. The major part of Virudhunagar district fall in Vaippar - Gundar river basin. Vaippar, Arjuna, Gundar and Deviar are the important rivers. There is no major river/stream crossing road sections of SH44 and SH89. However, there are many river/stream crossing the project road section of Rajapalayam - Sankarankoil – Tirunelveli, SH41. Chozhapuram and Sitaru rivers are the major ones crossing the project road. There are few nalas and drains along/crossing the roads, presently, most of them are in dry condition. Ponds are the major water bodies observed along the roads (11 nos. along SH-44 and 14 nos. along SH-89). Check dams/ponds are the major water bodies observed along road section of SH41. Water samples were collected from 4 locations along road section of SH-44 and from 6 locations along road section of SH-89 during February-March 2014. Water samples were collected from 4 surface water locations and 6 ground water locations along road section of SH41 during June-July 2014.

**Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road section of SH-44:** All monitored parameters meets the standards IS 2296 Class C (Drinking water source after conventional treatment and after disinfections), except the BOD. All monitored parameters of ground water samples are well within the limits stipulated by IS 10500 desirable limits for drinking purposes. However, levels of TDS, Total Hardness, Calcium, Chloride, Sulphate & Boron are high in ground water sample collected at Ettayapuram, the same is not fit for drinking.

**Nanguneri - Bharatavaram Ovari Road upto ECR Junction section of SH-89:** Surface water collected from two locations, meet the standards IS 2296 Class C surface water. All parameters of ground water samples are well within the limits stipulated by IS 10500 for drinking purposes.

**Rajapalayam - Sankarankoil – Tirunelveli Road section of SH41:** All monitored parameters for surface water locations meets the standards of IS 2296 Class C (Drinking water source after conventional treatment and after disinfections), except the DO and BOD at one location. All monitored parameters of ground water samples are well within the limits stipulated by IS 10500 desirable limits for drinking purposes at three locations. However, levels of TDS, Ca, Cl and Sulphate are high in ground water sample collected at other three locations making the ground water unfit for drinking.



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### **Noise Environment:**

Hourly noise levels were recorded at 6 locations identified along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road section of SH-44, 8 locations identified along Nanguneri - Bharatavaram Ovari Road upto ECR Junction section of SH-89 and at 18 identified locations along Rajapalayam - Sankarankoil – Tirunelveli Road section of SH41 using sound level meter. The hourly noise values were used to calculate daytime (6.00 am – 10.00 pm) and night time (10.00 pm – 6.00 am) equivalent noise levels. The monitored noise levels were ranging from 59.8 dB(A) to 35.4 dB(A) along Rajapalayam - Sankarankoil – Tirunelveli Road section of SH41.

Noise levels at all the locations along all the three roads have been found well below the permissible limits of CPCB. Along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road section of SH-44, the monitored noise levels were ranging from 61.4 dB(A) to 37.4 dB(A), whereas on Nanguneri - Bharatavaram Ovari Road upto ECR Junction section of SH-89, the noise levels were ranging from 58.7 dB(A) to 36.4 dB(A).

### **Forest:**

The recorded forest area in Tamil Nadu is 22,877 km<sup>2</sup> which constitutes 17.59% of the geographical area of the state. Reserved Forests comprise 84.75%, Protected Forests 9.54% and Unclassified Forests constitute 5.71%.

There is no reserved or protected forest within ROW of the project roads. Kurumalai RF exists on RHS along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road section of SH-44 at an aerial distance of about 9.5km. Along Nanguneri - Bharatavaram Ovari Road upto ECR Junction section of SH-89, Sathankulam RF and Kalakadu RF exist at an aerial distance of 6.5km (on LHS) and 12.5km (on RHS) respectively. However, 12 nos. of reserved forests exist within the 10 km radius of Rajapalayam - Sankarankoil – Tirunelveli Road section of SH41.

### **Protected Area:**

There is no protected area (National Park, Wildlife Sanctuary, reserved forest, biosphere reserve and wetland) within the ROW of project roads considered under Phase-I, TNRSP. In Tirunelveli district, Koonthakulam Kadankulam bird sanctuary exists at a distance of about 7.5 Km from km 13/000 of Nanguneri - Bharatavaram Ovari Road upto ECR Junction section of SH-89. The nearest distance of proposed Eco Sensitive Zone around Koonthakulam Bird Sanctaury is 5.25 km. Also, Srivilliputtur Grizzled Squirrel Wildlife Sanctuary is located between 09<sup>o</sup>23'38" to 09<sup>o</sup>49'51" N latitude and between 77<sup>o</sup>21'51" to 77<sup>o</sup>47'20" E longitude in Virudhnagar district (256.20sq.km) and Madurai district (220.42sq.km). The nearest distance of sanctuary from Rajapalayam - Sankarankoil – Tirunelveli Road section of SH41 (start point) is about 6km. However, MoEF & CC has not yet notified the proposed Eco Sensitive Zone around both the sanctuaries. Till the ESZ is notified by MoEF & CC, a default area of 10 km distance shall be considered as ESZ around both the sanctuaries.



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**Flora:**

The roadside trees are continuous throughout the corridor except some stretches where open land/agricultural land are observed. There is no green tunnel along the project roads.

A total of 1190 trees >30cm girth size are present within Col of Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road section of SH-44. The dominant tree species along SH-44 is Tamarind, Odai and Neem. A total of 773 trees girth size > 30 cm are present within Col of Nanguneri - Bharatavaram Ovari Road upto ECR Junction section of SH-89. The dominant tree species along SH-89 are Neem and Coconut. A total of 3923 trees of girth size > 30 cm are present within Col of Rajapalayam - Sankarankoil – Tirunelveli Road section of SH41. The dominant tree species along SH-41 is Neem, Tamarind and Palm.

**Fauna:**

The major terrestrial fauna observed and recorded during the site visit including livestock along the project corridor are monkey, snake, grey headed bulbul, buffalo, sheep, goat, pig etc.

Apart from above, faunal diversity in PIA includes fauna found in Koonthakulam Bird Sanctuary and Srivilliputtur Grizzled Squirrel Wildlife Sanctuary.

**Coastal Ecology:**

The project roads do not attract Coastal Regulation Zone (CRZ) Notification.

**Socio-economic Environment:**

Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road section of SH-44 fall in three districts of Tamil Nadu state, Tirunelveli (Taluk- Sankarankoil), Thoothukudi (Taluk- Kovilpatti and Ettayapuram) and Virudhnagar (Taluk- Sattur) and passes through 16 villages. The road section of Nanguneri - Bharatavaram – Ovari, SH-89 passes entirely through Tirunelveli (Taluk- Nanguneri and Radhapuram) district and passes through 13 villages. Rajapalayam - Sankarankoil – Tirunelveli Road section of SH41 fall in two districts of Tamil Nadu state, Tirunelveli (Sankarankoil and Tirunelveli Taluks) and Virudhnagar (Rajapalayam Taluk) and passes through 46 villages

The area of Tirunelveli district is 6,693sq.km. As per census 2011, Tirunelveli has population of 3,077,233 of which male and female are 1,520,912 and 1,556,321 respectively. Average literacy rate is 82.50%. The area of Thoothukkudi district is 4,745sq.km. As per census 2011, Thoothukkudi has population of 1,750,176 of which male and female are 865,021 and 885,155 respectively. Average literacy rate is 86.16%. The area of Virudhnagar district is 4,241sq.km. As per census 2011, Virudhnagar has population of 19, 42,288 of which male and female are 9, 67,709 and 9, 74,579 respectively. Average literacy rate is 80.15%

**Socio-Cultural Properties and Land Acquisition:** The proposed development of project roads will have some impact on residential, commercial as well as on other community's properties. About 183 structures along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road section of SH-44, about 127 structures along Nanguneri - Bharatavaram –



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Ovari Road section of SH-89 and about 392 structures along Rajapalayam - Sankarankoil – Tirunelveli Road section of SH41 will be impacted. The proposed project also requires land for road widening, junction improvement, geometric improvement etc. About 2.020 hectare of land is required on SH-44, 7.256 hectare of land is required on SH-89 and 4.692 hectare land is required on SH41.

**Common Property Resources (CPRs) and Sensitive receptors:** There are important community structures along the project road, which has cultural and sociological importance.

CPRs	Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44	Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89	Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41
Hand pumps	9 nos.	7nos.	8 nos.
Open Wells	14 nos.	10 nos.	3 nos
Tube wells and Tap Water Tank (TWT) and Over Head Tanks (OHT):	9 nos.	30 nos.	<ul style="list-style-type: none"> <li>▪ Water Tank (TWT) and Over Head Tanks (OHT): 9 nos.</li> <li>▪ Water taps: 23 nos.</li> <li>▪ Bore well : 2 nos.</li> </ul>
Religious Structures (Sensitive Receptors):	18 nos.	30 nos.	50 nos.
Educational Institutes (Sensitive Receptors):	23 nos.	15 nos.	9 nos.
Hospital/Health Centres (Sensitive Receptors):	3 nos.	-	1 no.
Graveyards	-	7 nos.	3 nos.

#### **Cultural heritage sites:**

Tamil Nadu has a rich cultural heritage. Based on the consultations and review of secondary literature, it is observed that there are no archaeological and historical sites of importance in proximity to the project sites.

### **A.8 STAKEHOLDER CONSULTATION**

Environmental and social experts conducted informal public consultations with local community during site visit along the project roads. Main objective of the public consultation was to aware the community regarding the proposed development and to obtain their views and suggestions on the likely impacts due to the project and their mitigations. To further



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strengthen this, formal Public Consultations were conducted for every 15-20km stretch. Two (2) consultations were conducted for each road, along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44 on 13.05.2014 and Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89 on 15.05.2014. Three (3) consultations were conducted along Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41 on 24.06.2014. All technical, social and environmental issues pertaining to the stretch were briefed and discussed. Potential PAPs, District level Govt. officials, MLAs/ MPs/ Panchayat Members, TNRSP Officials, Village representatives, PRIs, Village level health workers, Patwaris, Local voluntary organizations like CBOs and NGOs attended the consultations.

Major issues related to provision of bye pass for Tisaiyanvillai town, bye pass for Idayankudi village; road extension up to the ECR junction; road connectivity with temple/ tourist places; provision of cross drainage structures, road side facilities and road safety; impacts on water source, CPRs, utilities and local tree species; compensation and enhancement measures were discussed. Probable solutions were also shared with the stakeholders.

Focused Group discussions were also conducted at impacted community structures along project roads.

## **A.9 ANALYSIS OF ALTERNATIVES**

There are few sharp and blind curves along project roads for which horizontal curve improvements have been proposed to improve the geometry so that the homogeneous speed can be maintained. All the realignments have been designed taking into account technical, social, environmental and safety issues.

**Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44:**  
On this road, following major horizontal curve improvements are proposed:

**a) Km 24/430 to Km 24/605**

The stretch is passing through Mukkuttumalai village. Straight realignment is proposed to improve the curve radius. One well is being impacted due to this realignment. There is no major environmental impact.

**b) Km 26/200 to km 26/350**

- The stretch from km 26/200 to km 26/350 is passing through sippiparai village. The existing alignment has a continuous sharp curve with the poor sight distance. So, to improve the geometry of the road, realignment is proposed.
- There is no major environmental and social impact in this realignment.

**c) Km 30/100 to km 30/200**

- The stretch is passing through Elayarasanenedal village. To improve the curve radius, realignment is proposed for a length of 100m.
- There is no major environmental and social impact in this realignment.

**d) Km 35/220 to km 35/600**

- The stretch from km 35/220 to km 35/600 is passing through Ayyaneri village.





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The existing alignment has a continuous sharp reverse curve with the poor sight distance.

- Also, a major causeway exists across the project road with pipe vents which are in poor condition. So to improve the geometry of the road, realignment with a curve radius of 240m is proposed and a minor bridge is proposed.
- There is no major environmental and social impact in this realignment.

**Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89:** On this road, following horizontal curve improvements are proposed as below:

- Major Realignment has been proposed from km 26/200 to km 26/700 as the existing road has a continuous sharp reverse curve with the poor sight distance
- Major Realignment has been proposed between km 26/800 to km 29/672 (Tisaiyanvillai village) to avoid very congested stretch along SH89, for which three alternative options has been studied and best suitable option has been selected based on technical aspect, environmental & social impact and economic feasibility.
- Minor Realignment has been proposed from km 0/550 to km 0/800 at village Nanguneri
- Minor Realignment has been proposed from km 24/100 to km 24/600 at village Mamnapuram

**Rajapalayam - Sankarankoil – Tirunelveli Road, Section of SH41:** Bypass proposed at Sankarankoil from Km 28/000 to Km 33/800 is not under Consultant's scope as it is proposed by C&M Highways Department.

Seven major horizontal curve improvements are proposed (1) Km 16/850 to Km 17/250 (2) Km 25/050 to Km 25/400 (3) km 34/450 to km 34/600 (4) km 41/380 to km 41/780 (5) km 50/620 to km 50/880 (6) km 50/980 to km 51/300 (7) km 70/950 to km 71/150.

## A.10 POTENTIAL IMPACT AND MITIGATION

The improvement proposal envisages 2-lane roads with paved/ earthen shoulder as a result a direct impact zone up to towline is in the range of 16-23 meters of corridors and magnitude of indirect impact varies depending upon location of environmental receptors and type of impact.

Environmental Attributes	Anticipated Impacts	Management Measures
<b>Project Pre-construction Phase</b>		
Land	<ul style="list-style-type: none"> <li>▪ Loss of productive Land</li> <li>▪ Generation of debris due to demolition of structures</li> <li>▪ Erosion and loss of top soil</li> <li>▪ Quarry and borrow area</li> </ul>	<ul style="list-style-type: none"> <li>✓ Land acquisition to be minimized with provision of Retaining walls</li> <li>✓ Disposed properly to avoid contamination</li> <li>✓ Silt Fencing need to be provided.</li> <li>✓ Quarries need to be reclaimed</li> </ul>
Water	<ul style="list-style-type: none"> <li>▪ Loss of drinking water sources (8 nos. along SH-44, 18 nos. along SH-89 and 41 nos. along SH41)</li> <li>▪ Siltation due to loose earth</li> </ul>	<ul style="list-style-type: none"> <li>✓ Relocation of ground/surface water sources</li> <li>✓ provision of Retaining walls in the periphery of the pond</li> </ul>



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Environmental Attributes	Anticipated Impacts	Management Measures
Air Quality	<ul style="list-style-type: none"> <li>▪ Dust generation during dis-mantling</li> <li>▪ Emission from construction equipment &amp; vehicular movement</li> </ul>	<ul style="list-style-type: none"> <li>✓ Water sprinkling &amp; dust sweeping</li> <li>✓ Fine materials to be completely covered, during transport &amp; stocking</li> <li>✓ Air pollution Norms will be enforced</li> </ul>
Noise	<ul style="list-style-type: none"> <li>▪ Increase in ambient noise level due to movement of machinery</li> </ul>	<ul style="list-style-type: none"> <li>✓ Machinery to be checked &amp; complied with noise pollution regulations</li> </ul>
Flora & Fauna	<ul style="list-style-type: none"> <li>▪ Loss of trees (&gt;30cm girthsize): 1190 trees along SH-44, 773 trees along SH-89 and 3923 trees along SH41 falling within PROW</li> <li>▪ Removal of vegetation</li> <li>▪ Disturbance Habitat loss</li> </ul>	<ul style="list-style-type: none"> <li>✓ Compensatory plantation will be taken up in the ration of 1:10 for trees &gt;30 cm girth size</li> <li>✓ Avenue plantation will be done as additional plantation</li> <li>✓ Plantation in realignment sections</li> </ul>
Socio-economic	<ul style="list-style-type: none"> <li>▪ Land acquisition: 2.020 ha in SH-44, 7.256 ha in SH-89 (except Tisaiyanvillai Bypass) and 4.692 ha in SH41</li> <li>▪ Loss of Structures – Along SH-44: 183 structures Along SH-89: 127 structures Along SH41: 392 structures</li> <li>▪ loss of utilities</li> <li>▪ loss of livelihood</li> <li>▪ Loss of standing crops</li> <li>▪ Loss of shade &amp; community trees</li> <li>▪ Loss of fuel wood and fodder</li> </ul>	<ul style="list-style-type: none"> <li>✓ Compensation will be paid to the PAPs</li> <li>✓ Market Value Assessment Committee will decide the actual cost of land</li> <li>✓ Relocation of utilities will be completed prior to start of project work</li> <li>✓ Compensatory plantation and avenue plantation will be done</li> <li>✓ Public participation sessions were/will be conducted in different stages of project.</li> </ul>
<b>Project Construction Phase</b>		
Air Quality	<ul style="list-style-type: none"> <li>▪ Dust generation from construction zone during clearing and grubbing, materials dumping, drying of materials, brushing of the surface, including quarrying and Vehicle operation &amp; maintenance</li> <li>▪ Operation of construction plants such as Crushers, hot mix, WMM and Concrete Batching Plants</li> <li>▪ Asphalt odour during Laying of pavement</li> </ul>	<ul style="list-style-type: none"> <li>✓ Water sprinkling &amp; dust sweeping</li> <li>✓ CPCB emission limits for DG set up to 800 KW will be followed by the contractor</li> <li>✓ Fine materials to be completely covered, during transport &amp; stocking</li> <li>✓ Crusher &amp; Hot Mix Plants to be installed in downwind direction from nearby settlement</li> <li>✓ Air pollution Norms will be enforced</li> <li>✓ Labourers will be provided mask</li> <li>✓ Local people will be educated on safety and precaution on access roads, newly constructed embankment etc.</li> </ul>





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Environmental Attributes	Anticipated Impacts	Management Measures
	<ul style="list-style-type: none"> <li>▪ Fuel combustion in various equipment</li> <li>▪ Odour / smoke from labour camp</li> </ul>	
Water	<ul style="list-style-type: none"> <li>▪ Alteration of drainage</li> <li>▪ Break in continuity of ditches Siltation, Stagnant water pools in quarries</li> <li>▪ Contamination by asphalt leakage or fuel &amp; lubricants</li> <li>▪ Contamination from wastes overuse</li> </ul>	<ul style="list-style-type: none"> <li>✓ Widening of minor bridges and bridging of existing causeways, will lead to improvement in the drainage</li> <li>✓ Provision of silt fencing and recharge well</li> <li>✓ Unlined drain in rural area and lined drain in urban areas</li> <li>✓ Oil Interceptor will be provided for accidental spill of oil and diesel</li> <li>✓ Provision of septic tank</li> </ul>
Noise	<p>Increase in noise levels due to the following:</p> <ul style="list-style-type: none"> <li>▪ movement and operation of various construction equipment</li> <li>▪ construction activities</li> </ul>	<ul style="list-style-type: none"> <li>✓ Noise level at processing sites, will be strictly enforced as per standards of CPCB</li> <li>✓ Construction will be done during day time only (6 am – 10 pm)</li> <li>✓ Workers in vicinity of strong noise will be provided with personal protective equipment for limited exposure to noise levels</li> <li>✓ 2-3 ROWs of trees are recommended around sensitive receptors, which will act as vegetative barrier.</li> <li>✓ NO Horn Zone sign Boards.</li> </ul>
Land / Soil Environment	<ul style="list-style-type: none"> <li>▪ Erosion and loss of top soil due to extraction of material from quarry site</li> <li>▪ Road slopes and spoils</li> <li>▪ Contamination of land / soil by fuel, lubricants and waste</li> <li>▪ Compaction of soil</li> <li>▪ Generation of solid waste from labour camps</li> </ul>	<ul style="list-style-type: none"> <li>✓ Proper treatment of quarry site, rehabilitation and vegetation</li> <li>✓ Land used for temporary purpose will be redeveloped after use</li> <li>✓ Embankment protection - For Embankment height &gt;3m Stone pitching and for Embankment height &lt;3m Turfing</li> <li>✓ Provision of oil interceptor</li> <li>✓ Proper collection and disposal of solid waste/ construction spoils at identified disposal sites</li> </ul>
Flora & Fauna	<ul style="list-style-type: none"> <li>▪ Cutting of trees to meet fuel requirements by labour</li> <li>▪ Poaching</li> </ul>	<ul style="list-style-type: none"> <li>✓ Adequate supply of kerosene/ LPG in labour camp to avoid dependency on firewood</li> <li>✓ Contractual agreements will include penalties for poaching</li> </ul>
Wildlife	<ul style="list-style-type: none"> <li>▪ Koonthakulam Bird Sanctuary is located at a distance of 7.5 km from project road section of SH-89 (km 13.000) (km 0/000 to km 15/500 falling within 10km radius of eco sensitivity zone of sanctuary)</li> </ul>	<ul style="list-style-type: none"> <li>✓ Proposal includes two lane without paved shoulder in these stretches of project roads</li> <li>✓ Appropriate signboards (depicting sanctuary name and distance) shall be displayed at two locations (at km 0.000 and at km 15.500 on project road section of SH89).</li> <li>✓ Appropriate signboards (depicting sanctuary</li> </ul>



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Environmental Attributes	Anticipated Impacts	Management Measures
	<ul style="list-style-type: none"> <li>▪ Srivilliputtur Giant Grizzled Squirrel Wildlife Sanctuary is located at a distance of 6 km from project road section of SH41 (from Rajapalayam, Start point of project road) (km0/000 to km 6/000 is falling within 10km radius of eco sensitive zone of the sanctuary)</li> </ul>	<p>name and distance) shall be displayed at two locations (at km 0.000 and at km 6.000 on project road section of SH41).</p> <ul style="list-style-type: none"> <li>✓ Speed limit of vehicles should be kept within 40 km/hr.</li> <li>✓ Strict vigil during construction stage to be maintained that sand, stones pebbles and other material to be used in widening of the road should be brought from outside of the sanctuary area</li> </ul>
Public Health - water related diseases	<ul style="list-style-type: none"> <li>▪ Increased water-borne diseases as a result of lack of sewage treatment &amp; disposal facilities in labour camps and improper maintenance of drainage</li> <li>▪ Asphalt odour and dust</li> <li>▪ Collisions with vehicles, pedestrians &amp; livestock</li> <li>▪ Increase in communicable diseases</li> <li>▪ Increase in dust and ambient noise level and discomfort</li> </ul>	<ul style="list-style-type: none"> <li>✓ Health check-ups and provision of medical facilities</li> <li>✓ Maintenance of good drainage throughout the roads/ construction areas to avoid creation of stagnant water bodies</li> <li>✓ Insecticide sprays</li> <li>✓ Provision of septic tanks</li> <li>✓ Provision of safety measures</li> </ul>
Socio-economic	<ul style="list-style-type: none"> <li>▪ Dust on agricultural land reduce in productivity</li> </ul> <p>Positive impacts:</p> <ul style="list-style-type: none"> <li>▪ Increase in employment potential</li> <li>▪ Development of infrastructures</li> </ul>	<ul style="list-style-type: none"> <li>✓ Water sprinkling &amp; dust sweeping</li> <li>✓ Fine materials to be completely covered, during transport &amp; stocking</li> </ul>
<b>Project Operation Phase</b>		
Land / Water	<ul style="list-style-type: none"> <li>▪ Spill Contamination by fuel, lubricants and washing of vehicles</li> </ul>	<ul style="list-style-type: none"> <li>✓ Oil Interceptor will be provided for accidental spill of oil and diesel</li> </ul>
Air / Noise	<ul style="list-style-type: none"> <li>▪ Air pollutants from traffic</li> <li>▪ Dust emission from tyres</li> <li>▪ Predicted CO concentration within CPCB limits for future years -2020, 2030 and 2040</li> <li>▪ Noise from increased traffic</li> <li>▪ Predicted noise levels above CPCB limits for future years - 2020, 2030 and 2040</li> </ul>	<ul style="list-style-type: none"> <li>✓ Compliance with future statutory regulatory requirements w.r.t Air/ Noise</li> <li>✓ Auto-technology, vehicular fuel quality-improvement</li> <li>✓ Avenue plantation will act as noise barrier</li> </ul>
Flora	<p>Impact of pollution on vegetation</p> <ul style="list-style-type: none"> <li>▪ Lowered productivity</li> </ul>	<ul style="list-style-type: none"> <li>✓ Provision of 1/2/3 ROW plantation will act as dust absorbent and will lower the impact on vegetation</li> </ul>



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Environmental Attributes	Anticipated Impacts	Management Measures
Fauna	Increased chances of collision with traffic	<ul style="list-style-type: none"> <li>✓ Provision of Traffic safety measures</li> <li>✓ Strict compliance of the traffic rules</li> </ul>
Socio-economic	<b>Positive impacts:</b> <ul style="list-style-type: none"> <li>▪ Improved road with supporting infrastructure</li> <li>▪ Employment opportunities</li> <li>▪ Local area development</li> </ul>	

### A.11 ENVIRONMENTAL MONITORING PLAN

Environmental monitoring plan has been planned for SH44 and SH89 project road sections considering 2.5 years construction phase and initial 2 years operation phase. For SH41 project road stretch, construction and operation period has been considered as 3 years and 2 years respectively. It includes location, parameters to be monitored with frequency and institutional requirements for environmental monitoring (Air Quality, Ambient Noise, Water Quality and Soil Quality). The tentative budget of environmental monitoring for Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road, Section of SH44, Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 and Rajapalayam - Sankarankoil – Tirunelveli, Section of SH 41 is approximately INR 62.0 Lakhs (during construction phase and operation phase).

### A.12 ENHANCEMENT MEASURES

Enhancement measures related to technical, environmental, social and safety issues have been incorporated in the design:

- Technical Enhancement: The bridges and culverts proposed throughout the alignment are an automatic enhancement to minimize flooding, stagnation, scour, torrent run-off velocity
- Environmental enhancement: Pond beautification, landscaping, solar lighting, tree plantation, etc. at selected locations:

#### **Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road, Section of SH44**

- Pond at km 24/650 - Increase of pond wall height and provision of stone wall to replace earthen wall
- Pond at km 54/500 - Tree plantation (local species), solar street light, benches, increase of pond wall height, repairing of existing footpath around the pond and provision of shed for nearby small temple
- Available open land in front of Late Maha Kavi Bharthiyar's (Freedom fighter) House between chainage 55/600 and 55/700 along SH-44 - Tree plantation (local species), benches and solar light



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### **Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH89**

- Pond at Chainage 15/000 along SH-89 - Retaining wall has been proposed

### **Rajapalayam - Sankarankoil – Tirunelveli, Section of SH41**

- Pond at Km 4/980 (LHS)- Provision of 52m long, 2.5 m high and 0.5m width stone wall along pond on road side
- Pond at Km 11/250 (LHS): 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 and Solar Street Light along pond on road side
- Pond at Km 24/380(LHS)- Provision of 55m long, 3.0 m high and 0.5m width stone wall along pond on road side
- Pond at 42/200 (RHS) - 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
- Social Enhancement: Cultural property/ Religious Properties rehabilitation, Community properties, Private properties, CPRs, Utilities, etc. on impacted structures
- Safety Enhancement: Curve improvement, Road marking, Traffic signal, Signage, etc. throughout the alignment

## **A.13 ENVIRONMENTAL MANAGEMENT PLAN**

Environmental management plan has been prepared for mitigation/ management/avoidance of the potential adverse impacts and enhancement of various environmental components along the project roads. For each mitigation measure to be carried out with its location, time frame, implementation and overseeing/ supervising responsibilities have been identified. It also includes organisational framework to implement the EMP effectively. The EMP will be part of the contract document.

The total estimated project cost for **Naduvapatti - Kovilpatti - Ettayapuram Road (Km 22/400 to Km 56/100), SH44** is about INR 182.7 Crore (Cr), for **Nanguneri - Bharatavaram -Ovari Road (Km 0/000 to Km 36/030) upto ECR Junction, SH89** is INR 163.9 Cr and for **Rajapalayam - Sankarankoil – Tirunelveli, SH 41** is INR 354.2 Crores. The tentative EMP budget which includes the mitigation and enhancement measures for all three project roads is approximately INR 15.0 Cr.



# CHAPTER 1

## INTRODUCTION



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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## 1 INTRODUCTION

### 1.1 PROJECT BACKGROUND

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 (CRN) 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/ PPP Contract/ BOQ Contract modes.

The road network identified under TNRSP II (Contract PPC05) as per TNRSP letter no. 2360/2013/TNRSP II-5 dated 24.12.2013 is as follows (**Ref. Table 1-1**). The study will be carried out for the project roads under two phases:

- 1) Phase-I Roads under TNRSP-II
- 2) Phase-II Roads under TNRSP-II

**Table 1-1: Details of Project road length**

S.No.	SH No.	Road Stretches	Districts	Length (km)
<b>Phase-I Roads under TNRSP-II</b>				
1	SH44	Strengthening and widening of Naduvapatti - Kovilpatti - Ettayapuram Road (SH44) Km 22/500 to Km 56/700.	Tirunelveli, Virudhnagar Thoothukudi	31.650
2	SH89	Strengthening and widening of SH 89 (Nanguneri to Ovari) start point (NH 7 intersection) Km. 0/000 and End point Km. 35/200.	Tirunelveli	35.200
3	SH41	Strengthening and widening of Rajapalayam - Sankarankoil - Tirunelveli Road (SH41) Km 1/800 to Km 82/800	Virudunagar, Tirunelveli	75.200
<b>Sub Total Length</b>				<b>142.05</b>
<b>Phase-II Roads under TNRSP-II</b>				
4	SH39	Strengthening and widening of Tirunelveli - Tenkasi Road (SH39) Km 5/000 to Km 50/600	Tirunelveli	45.600
5	SH66	Strengthening and widening of Kumbakonam - Mannargudy - (SH66) Km 3/600 to Km 38/000	Thanjavur, Thiruvarur	34.400



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S.No.	SH No.	Road Stretches	Districts	Length (km)
6	SH40	Strengthening and widening of SH 40 (Tiruchendur to Tenkasi) Start Km. 0/00 to End Km. 84/000. Tirunelveli Township is excluded in between Km. 54/150 to km 63/00.	Tirunelveli, Thoothukudi	73.500
7	SH63	Strengthening and widening of Thanjavur – Mannargudi – Thiruthuraiipoondi – Vedaranyam – Kodiyakarai Road (SH63) Km 0/000 to Km 27/600 (upto Mannargudi Ring Road)	Thanjavur, Thiruvarur	27.600
8	SH191	Strengthening and widening of Melur – Thirupathur upto Karaikudi (SH191).	Madurai, Sivaganga	48.800
9	SH45	Strengthening and widening of Rajakamangalam – Pazhaya Uchakadai road (SH45).	Kanyakumari, Tirunelveli	53.700
<b>Sub Total Length</b>				<b>283.60</b>
<b>Total Road Length</b>				<b>425.65</b>

Source: Detailed Project Report, Volume I

SMEC India Pvt. Ltd.-SMEC International Pty. Ltd., Australia (JV) has been appointed by Highways Department, GoTN as DPR Consultant vide agreement signed on 18<sup>th</sup> October 2013 to undertake work of second phase, TNRSP II. The improvement works will essentially consist of widening and strengthening from 2 lanes to either 2 lane with paved shoulder or to 4 lanes; pavement strengthening with/without paved shoulders; improved drainage facility, road furniture and accessories.

A total of 9 roads having length of 425.65 km have been identified under PPC05, TNRSP-II, out of which 3 roads (**Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44, Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89 and Rajapalayam - Sankarankoil – Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41**) having total length of 142.05 km have been considered under Phase-I, TNRSP-II. The screening and scoping exercise has been carried out for these roads. This environmental assessment report provides the details of these three project roads.

## 1.2 THE PROJECT

### 1.2.1 Project Description

The road corridors selected as Phase-I under TNRSP-II are as follows:

1. Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44
2. Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89





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3. Rajapalayam - Sankarankoil – Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

The present report on Environmental Assessment (EA) deals with the environmental analysis of these three roads selected as Phase-I under TNRSP-II in accordance with the World Bank's guidelines on Environmental Assessment. The index map showing the project roads considered as Phase-I under TNRSP-II is shown in **Figure 1-1**.



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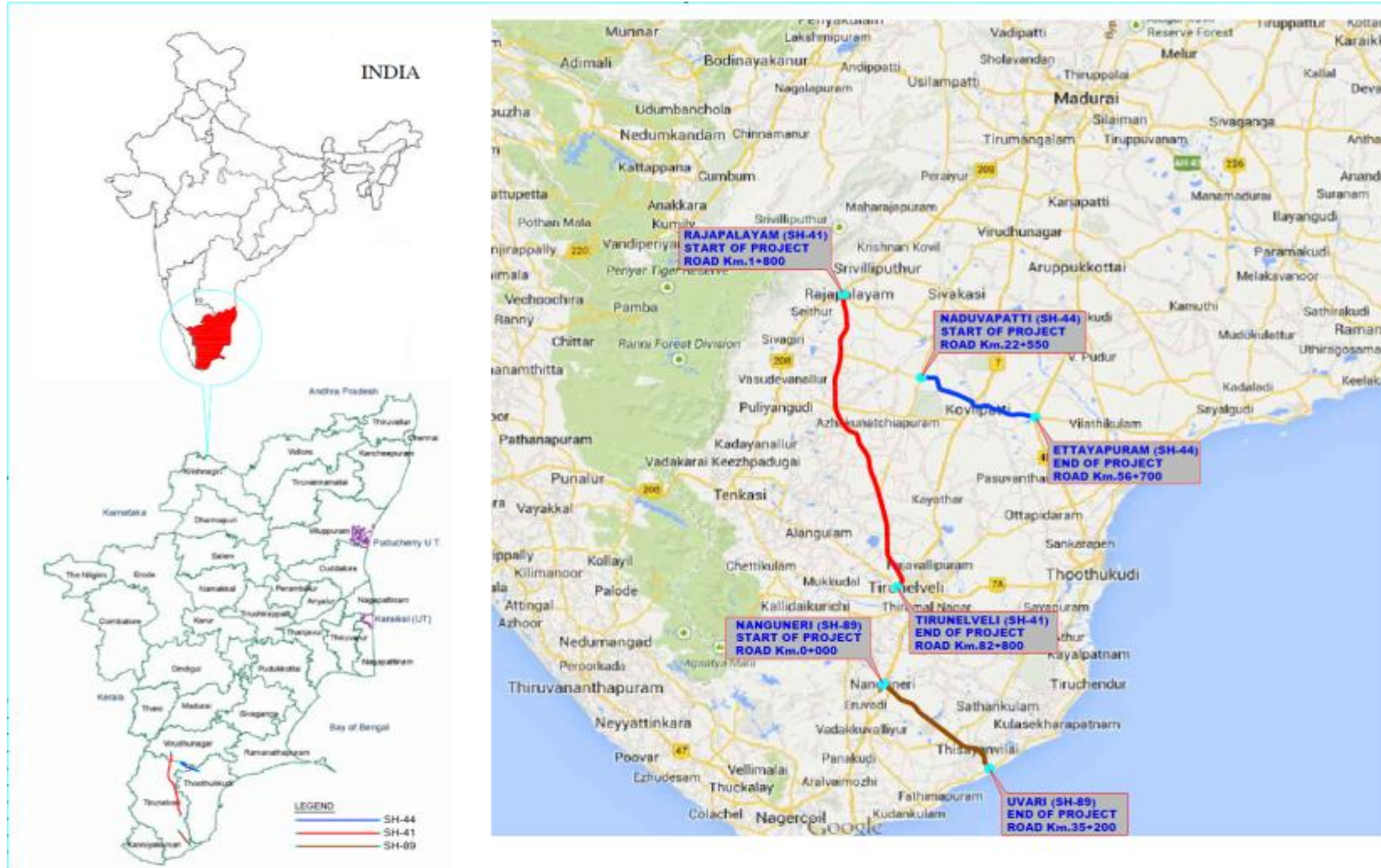


Figure 1-1: Key Map Showing the Project Roads Considered as Phase-I Roads under TNRSP-II



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## 1.2.2 Objectives of the Project

Surface transport plays a vital role in the transportation of goods and agricultural products in this state. To achieve the Government's development objectives, the existing road infrastructure requires up-gradation, improvement and maintenance. The main objective would be to alleviate the current unsafe and congested conditions of the identified road network connecting the villages and towns by providing better quality and safe roads to the users in a sustainable and environment friendly manner.

The improvement works will essentially consist of widening and strengthening of two lane with paved shoulder from existing two lane, from two lane to 4 lane and pavement strengthening with/without paved shoulders and all required drainage facility, road furniture and accessories. In some cases new alignments and /or re-alignments may also be required.

The environmental, social, economical, technical, and financial viability of the project for rehabilitation and upgrading of the existing road to 2-lane/4 lane with paved shoulders configuration and/ or its strengthening is to be established.

The Environmental Assessment (EA) has been conceived as an integral part of developing the project roads as Green Highways with below core objectives:

- Road up-gradation and improvements that are sustainable and ensures road safety
- Facilitate economic stimulation and improvement to community and cultural assets by integrating environmental enhancement measures along the project corridors through community partnering
- Energy and environmental stewardship through appropriate intervention in design and construction

The report in hand is prepared in accordance with the World Bank's operational policies<sup>3</sup> guidelines on Environmental Assessment and to meet the statutory requirement of Ministry of Environment, Forests and Climate Change (MoEF & CC), GoI. The major objectives of this assessment study are stated below:

- To present to decision makers a clear assessment of potential impact associated with the proposed project intervention,
- To apply a methodology which assesses and predict potential impacts and provides a) the means for impact prevention and mitigation, b) the enhancement of project benefits, and c) the minimization of long-term impacts;
- To provide a specific forum in which consultation is systematically undertaken in a manner that allows stakeholders to have direct input to the environmental management process.

<sup>3</sup> Applicable safeguards instruments are prepared based on Bank guidelines like environmental assessment (O.P. 4.01), Natural Habitat(O.P. 4.04), Forests(O.P. 4.06), Involuntary Resettlement(O.P.4.10) and Indigenous Peoples(O.P. 4.12)



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- To assess the analysis of alternatives to bring environmental considerations into the upstream stages of development planning as well as the later stage of site selection, design and implementation, and
- To recommend the environmental management measures to reduce adverse impacts.

In order to achieve these objectives, detailed surveys and other studies have been carried out along the project roads to identify Valued Ecosystem Components (VEC) and corridor specific significant environmental issues (SEI). For investigation/ monitoring purpose the study area has been defined as under.

- Corridor of Impact, Col: PROW of 16m and 23m in urban and rural areas respectively for two laning along SH44, SH89 and SH41 and 28m in urban area for four laning along SH44
- Project Influence Area, PIA: is the 10km area on either side along the existing road alignment.
- Project District, PD: is/ are the district/ districts through which project road is passing.

### 1.2.3 Scope of Environmental Assessment (EA)

The environmental assessment scope includes screening and scoping, environmental assessment and preparation of environmental management plans for the individual project roads as required. The EA process also envisages developing a comprehensive environmental management frame work for the entire project which will be adopted as part of the corporate environmental policy for TNRSP.

#### 1.2.3.1 Environmental Screening and Scoping

Environmental screening exercise of the project roads were undertaken to facilitate inputs on environmental considerations, apart from social, economic, and traffic & transport considerations. Further, screening exercise also provided scoping inputs in determining the major environmental issues and defined the scope of work for conducting environmental assessment. As per the recommendation of the environmental screening report, detailed environmental assessment has been carried out for the project roads. The scoping exercise defines geographical boundaries for the project roads for impact assessment as well as defining the project influence area to assess the impacts due to project activities.

#### 1.2.3.2 Environmental Assessment

The EA for project roads considered under phase-I roads of TNRSP-II includes establishing environmental baseline in the study area, identify the range of environmental impacts, specify the measures to avoid, minimize, and mitigate negative impacts and maximize positive impacts and integrate possible environmental enhancement measures. The proposed measures have been formulated in the form of an environmental management plan with necessary budget and institutional roles for effective implementation. The EMPs for individual projects and integration of the same into project implementation agreements, including construction contract documents.



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### 1.2.3.3 Environmental Management Framework

An Environmental Management Framework will be designed for the implementation of the project. The environmental management framework shall consist of an overall framework which will be developed as a guidance document providing environmental planning and design criteria for the current as well as future project roads, generic environmental management measures, institutional mechanism for implementation, capacity building & training process, and resource material for TNRSP to function adequately to mainstream the environmental management.

### 1.2.4 Project Benefits

The project will give significant economic benefits to the State. Widening and up gradation of the project roads will lead to better connectivity and will also play a significant role in changing the socio-economic condition of the people living in the region. Installation of proper road safety system through signage, barricades, crash barriers and by providing adequate bus bays, truck lay bys, underpasses, service roads etc. on project roads will further enhance the road safety on these project roads.

The project will also generate direct and indirect employment to the local people of the State. The indirect benefits include savings in vehicle operating costs, less fuel consumption and decreased cost of passenger travel. Also environmental enhancement measures such as the pond beautification, rain shelters, landscaping, solar lighting, tree plantation, and cultural property rehabilitation will also benefit the communities.

### 1.2.5 Structure of the EA

Environmental assessment process in the project involved assessment of natural environment, social and cultural aspects of the project. For the anticipated impacts, management measures are incorporated in the EMP and RAP. The present report is structured to present the environmental assessment with a holistic approach incorporating social and cultural aspects. However, the social aspects are presented in detail in the RAP separately. Structure of the EA Report is as follows:

Chapter No.	Chapter Name	Contents
	Executive Summary	Summary of the EA report providing overall justification for project implementation along with explaining how the adverse effects are proposed to be mitigated.
Chapter 1:	Introduction:	This chapter includes the project background, project objectives and benefits, scope of EA study and structure of EA report.
Chapter 2:	Project Description	This chapter covers details of the project, such as, the type of project, project location, details of major features of the existing project road, details of the proposed improvements of corridor. Details about right of way, roadway improvements, cross drainage structures, community facilities, traffic projections etc.





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Chapter No.	Chapter Name	Contents
Chapter 3:	Environmental Regulatory Framework	This chapter presents the legal and administrative framework of World Bank, Government of India and Government of Tamil Nadu. This section underlines various clearances involved for the project corridor at the State level and at the Central level
Chapter 4:	Baseline Environment	This chapter describes the Baseline Environmental features in details. It includes details about. Land Environment viz., geography, topography, geology, soil, land use, water environment viz., hydrology, drainage, surface and ground water quality, coastal and marine resources, air environment viz., meteorology, air quality, noise environment, biological environment and socio economic environment aspects along the project road corridor. The data presented in the chapter is collected from primary and secondary sources. The methodology was strictly adhered to the Central Pollution Control Board's stipulated guidelines.
Chapter 5:	Stakeholder Consultation	This chapter details the public consultation carried out in order to know the reactions of local population and the project affected people. Meetings were held with the stake holders to record their views on the impacts caused and the suggested remedies to be adopted for the proposed project corridor.
Chapter 6:	Analysis of Alternatives	This chapter details about the integration of environmental considerations in the alternatives and analysis of alternatives with respect of 'with project' or 'without project' scenario in terms of potential environmental impacts.
Chapter 7:	Project Impacts and Issues	This chapter details out the anticipated project impacts on the environmental and social parameters based on baseline environmental features of the project during design, construction and operation phases. The chapter also includes air and noise modeling results and interpretation based on projected traffic volumes.
Chapter 8:	Impact Mitigation and Enhancement	This chapter suggests the mitigation & enhancement measures for identified impacts caused due to various activities.



## CHAPTER 2

### PROJECT DESCRIPTION





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

## 2 PROJECT DESCRIPTION

### 2.1 GENERAL

The detailed description of the project roads is as follows:

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

The project road fall in three districts namely Tirunelveli, Toothukudi and Virudhnagar. (km 22/500-km 23/150 – Tirunelveli, km23/150 - km25/800- Toothukudi (Mukkutumalai village), km25/800-km27/200- Virudhnagar (Sippiparai Village), km27/200-km38/747-Tirunelveli and km38/747-km 56/700- Toothukudi)

Road No.	SH No.	Description of Road link	Districts	Length (Km)	Urban Area being excluded	Revised Length (Km)
1	SH44	Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44  Km 22/500 to 38/750 (up to NH7) & 41/300 to 56/700 (connecting NH45B)	Tirunelveli, Virudhnagar Thoothukudi	34.200	Kovilpatti Km 38/750 to Km 41/300	31.650

The key map of the project road is shown in **Figure 2-1**. Also, the project road marked on toposheet is shown in **Appendix 1.1**.

The project road starts from Naduvapatti at Km 22/400 and was originally proposed to end at Ettayapuram at intersection with SH 32, Km 56/100. During the site visit in December 2013 of the consultant team with TNRSP officials it was decided that the existing start point will be extended upto Km 22/500. This was decided to avoid impacting a pond and a temple at the very beginning of the road. Also in order to have a better connectivity, the road length has been increased by an additional 600m along SH32 and would now end at NH45B.

Presently the road is of 2 lane configuration with existing carriageway width of 7m. Based on traffic demand, it is proposed to widen it to 2 lane with paved shoulder configuration with proposed road width of 10m.

The total length of the project road is now 31.650 km. Other stretches of built up areas along the road are Sippiparai (at km 27 for length of 200m) Nakkalamuthanpatty (at km 28 for length of 400m), Ilayarasendal (at km 31 for length of 900m) and Ettayapuram (at km 54 for length of 2000m). The road traverses through plain terrain.



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

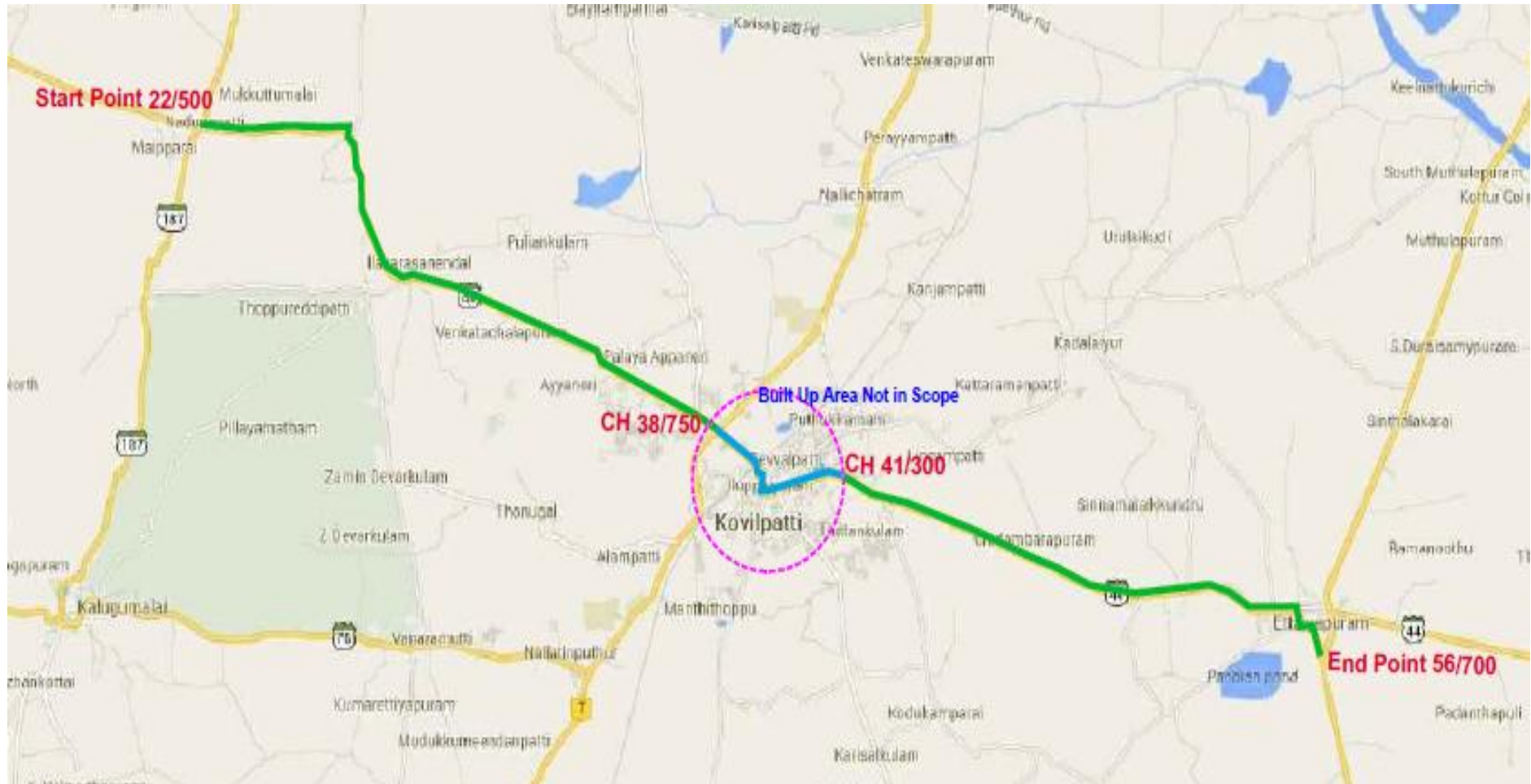


Figure 2-1: Key map showing Project Road Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

## 2) Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89

The entire length of project road stretch passes through Tirunelveli District of Tamil Nadu State. The key map of the project road is shown in **Figure 2-2**. Also, the project road marked on toposheet is shown in **Appendix 1.1**.

Road No.	SH No.	Description of Road link	Districts	Length (Km)
2	SH89	Strengthening and widening of Nanguneri – Bharatavaram – Ovari Road upto ECR Junction, Km 0/000 to Km 35/200	Tirunelveli	35.200

The project road starts at Nanguneri, NH7 junction, at Km 0/000 and now ends at Idaiyangudi, intersection with SH 176, Toothukudi-Tiruchendur-Kanyakumari (TTK) Road at Km 35/200. It is proposed after the site visit of the consultant team with TNRSP Officials in December 2013, to reduce the original length by 830m ( from end point) to avoid applicability of the CRZ notification.

Presently the road is of 2 lane configuration with existing carriageway width of 7m. It is proposed to widen it to 2 lane with paved shoulder configuration with proposed road width of 10m.

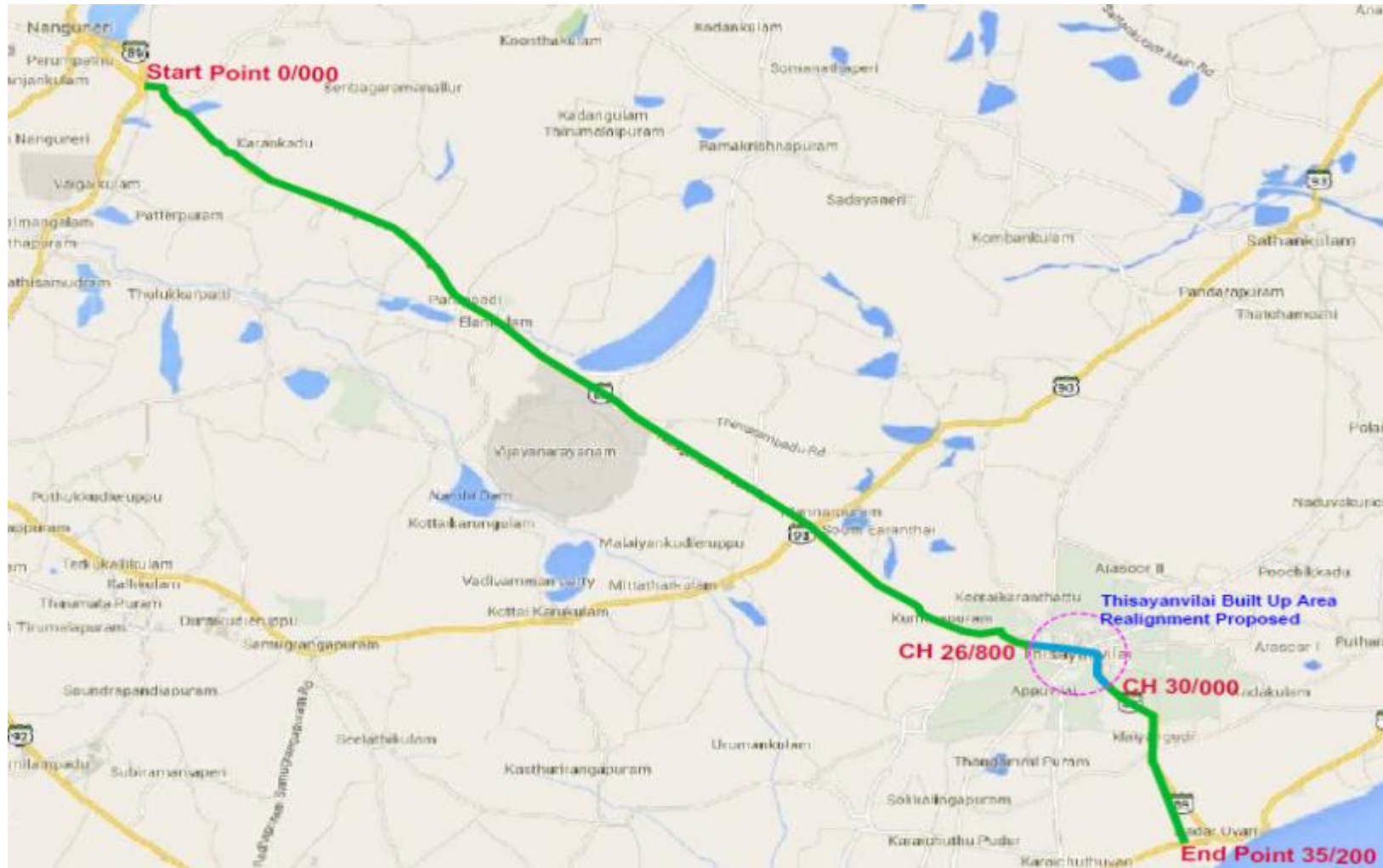
The major congestion point is at Tisaiyanvilai village between km 26/885 to km 30/000 along the project road with available ROW of 10m-22m and has been excluded from the road stretch being taken up as phase-I roads under TNRSP-II. Realignment at Tisaiyanvilai village has been proposed by TNRSP. Another major congestion point was observed at Idaiyangudi (km 31/600 to km 32/600) where it is proposed to have only edge to edge improvement in order to minimize impacts.

The road traverses through plain terrain.

There is an Indian Navy Establishment Kattabomman (Naval Base), on the RHS from Km 12/800 to Km 16/000. The available ROW at this location varies between 17m to 30 m. Hence, there may not be any impact on the compound wall of Indian Navy establishment. However, the widening is proposed on LHS of Road along this stretch.



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41



**Figure 2-2: Key map showing Project Road Nanguneri - Bharatavaram -Ovari Road Section of SH89**





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

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

The project road stretch from km0/000 to km 10/500 fall in Virudhnagar district and rest of the project road from km 10/500 to km 85/730 fall in Tirunelveli district of Tamil Nadu State.

Road No.	SH No.	Description of Road link	Districts	Length
3	SH-41	Strengthening and widening of Rajapalayam - Sankarankoil - Tirunelveli Road, Km 0/000 to Km 85/730 (as per contract)  Km 1/800 to Km 82/800 (as per reconnaissance)	Virudunagar, Tirunelveli	85.730 km  75.20 km (excluding bypass length also)

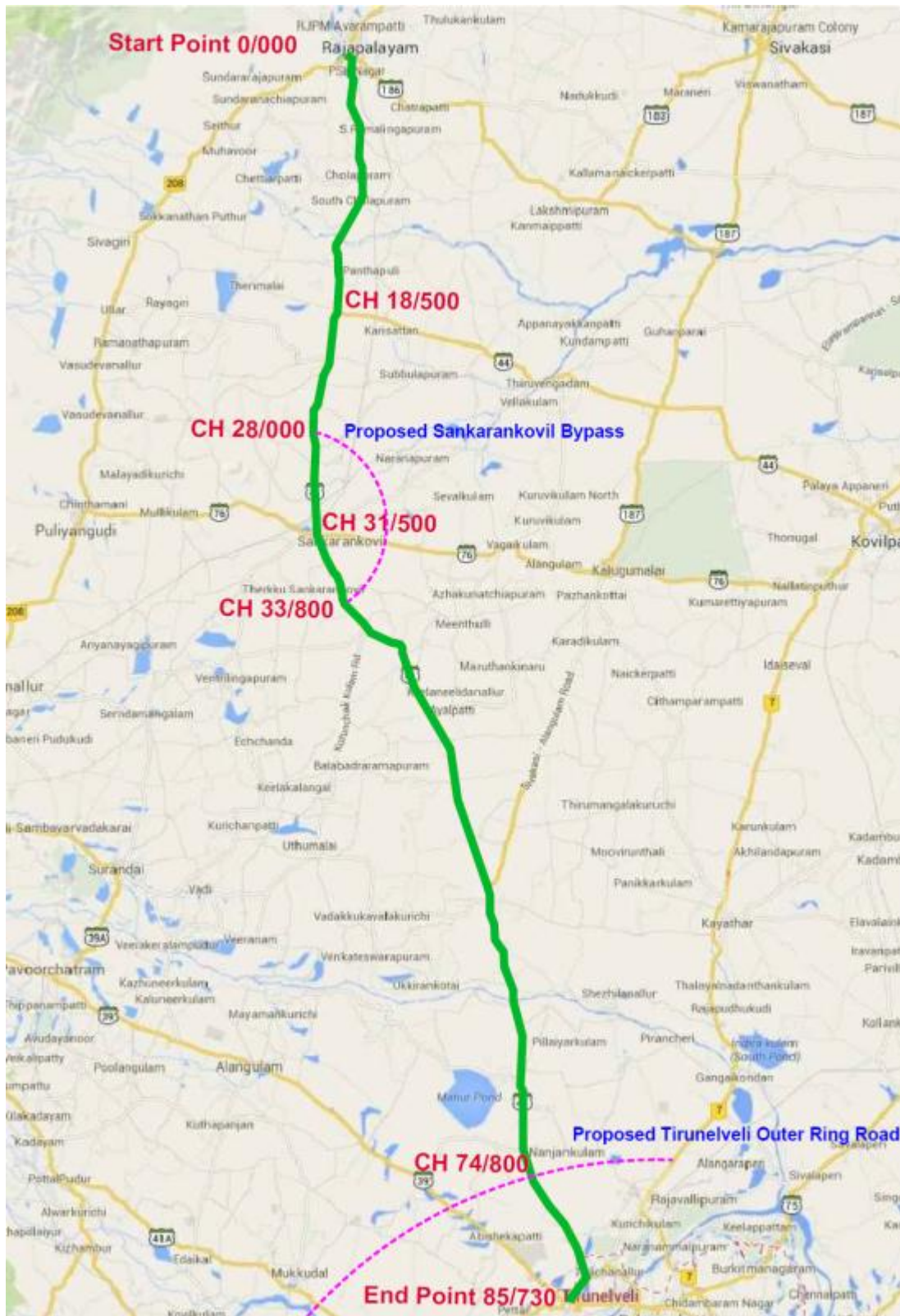
The key map of the project road is shown in **Figure 2-1**. Also, the project road marked on toposheet is shown in **Appendix 1.1**.

The project road starts from intersection with NH 208, at Km 00/000 and ends at intersection with Tirunelveli-Tenkasi Road, SH39 at Km 85/730. 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 75.2km.

The congestion points along the project road are Rajapalayam, Karivandanaru, Sankarankoil, Gurukulpatti, Tirumalapuram Deverkulam, Manur, Ramaianpatti and Rajajipuram.

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 SH41. Also, a ring road is proposed by C&M Highway Department crossing at ch.74/800 as shown in **Figure 2-3**.

**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41



**Figure 2-3: Key map showing Project Road Rajapalayam - Sankarankoil – Tirunelveli Section of SH41**





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

The following sections of this chapter provide details of the present characteristics and proposed improvements of project roads.

## 2.2 PRESENT CHARACTERISTICS

### 2.2.1 Right of Way (ROW)

Width of ROW is not uniform along the project roads. The information on existing ROW at every km has been compiled for project roads and attached as **Appendix 2.1**. Following table gives the distribution of length of project roads and %age length with respect to ROW width.

**Table 2-1: Summary of Right of Way**

	Width of Existing ROW					Total Length
	<16m	16 – 20m	20 – 25m	25 – 30m	> 30m	
<b>Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44</b>						
Length (km)	0.6	2.45	9.55	7.4	10.7	30.7*
%	2%	8%	31%	24%	35%	100%
<b>Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89</b>						
Length (km)	4.75	3.7	10.95	7.2	3.7	30.3*
%	16%	12%	36%	24%	12%	100%
<b>Rajapalayam - Sankarankoil – Tirunelveli Road (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41</b>						
Length (km)	2.2	2.85	8.15	55.43	6.55	75.18*
%	3%	4%	11%	74%	9%	100%

\*Total length excluding Realignment /bypass length

From the above table it has been found that 2% of SH44 road section, 16% of SH89 road section and 3% of SH41 road section has insufficient ROW for upgrading of the road to 2 lane standards in urban areas. This calls for land acquisition along the project roads.

### 2.2.2 Traffic Scenario

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

**Present traffic scenario** - The vehicle-wise average daily traffic (ADT) figures were estimated by classified count survey. **Table 2-2** presents a summary of the vehicle-wise ADT on project road for each homogenous section.

**Table 2-2: ADT observed on Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road Section of SH44**

Vehicle Category	Km 31+000*	Km 47+000**	Km 55+000*	Km 31+000*	Km 47+000**	Km 55+000*
	ADT			ADT (PCU)		
Car	392	1169	1209	392	1169	1209



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Vehicle Category	Km 31+000*	Km 47+000**	Km 55+000*	Km 31+000*	Km 47+000**	Km 55+000*
	ADT			ADT (PCU)		
Auto Rick.	51	104	365	51	104	365
Two Wheeler	2103	1874	3242	1052	937	1621
LMV (pickups and other less than 3T)	227	493	594	340	739	891
Mini Bus	15	43	49	23	64	74
Bus	157	560	530	470	1681	1591
LCV	50	147	135	75	221	202
2-A Truck	173	482	590	519	1445	1770
3-A Truck	87	362	316	260	1086	948
MAV / Heavy construction machinery (4 - 6 axle)	32	128	124	143	577	557
Oversized vehicles (7 axle / more)	0	0	0	0	0	0
Tractor	4	8	5	5	12	8
Tractor + Trailer	22	22	46	100	100	209
Cycle	107	53	502	53	27	251
Cycle Riksha	0	0	0	0	0	0
Animal drawn	0	0	0	0	0	0
<b>Total</b>	<b>3420</b>	<b>5446</b>	<b>7707</b>	<b>3484</b>	<b>8162</b>	<b>9695</b>

Note: Traffic Survey Conducted In \*December 2013 and \*\*February 2014

### Projected traffic:

Based on the base year traffic as presented above, traffic projections have been done to derive the traffic demand at horizon years.

**Table 2-3** presents the projected annual average traffic data (AADT) for five years gap on homogeneous sections of project road.

### Table 2-3: Projected Traffic (AADT) on Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road Section of SH44

S. no.	year	Km 31+000		Km 47+000		Km 55+000	
		Total AADT	Total AADT PCU	Total AADT	Total AADT PCU	Total AADT	Total AADT PCU
1.	2013	3426	3534	5492	8337	7745	9871
2.	2014	3718	3786	5927	8889	8350	10523
3.	2015	4031	4040	6377	9420	8985	11161
4.	2020	5967	5628	9180	12780	12906	15167



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S. no.	year	Km 31+000		Km 47+000		Km 55+000	
		Total AADT	Total AADT PCU	Total AADT	Total AADT PCU	Total AADT	Total AADT PCU
5.	2025	8561	7689	12870	17037	18083	20267
6.	2030	11906	10255	17541	22193	24665	26491
7.	2035	16091	13385	23306	28355	32813	33968
8.	2040	21192	17118	30243	35558	42656	42760
9.	2042	23571	18835	33453	38828	47221	46769

Source: Detailed Project Report, Volume I

## 2) Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89

**Present traffic scenario-** The vehicle-wise average daily traffic (ADT) figures were estimated by classified count survey. Table 2-4 presents a summary of the vehicle-wise ADT on SH89 for each homogenous section.

**Table 2-4: ADT observed on Nanguneri - Bharatavaram -Ovari Road, Section of SH 89**

Vehicle Category	Km 4+000**	Km 11+500*	Km 23+000*	Km 4+000**	Km 11+500*	Km 23+000*
	ADT			ADT (PCU)		
Car	944	760	958	944	760	958
Auto Rick.	144	97	116	144	97	116
Two Wheeler	1334	1901	1574	667	951	787
LMV (pickups and other less than 3T)	264	232	300	396	349	450
Mini Bus	26	74	14	40	110	20
Bus	184	152	204	551	457	613
LCV	60	87	94	90	131	141
2-A Truck	74	69	131	222	208	392
3-A Truck	32	20	51	96	59	152
MAV / Heavy construction machinery (4 - 6 axle)	16	7	21	72	33	95
Oversized vehicles (7 axle / more)	0	0	0	0	0	0
Tractor	7	5	4	10	8	6
Tractor + Trailer	11	2	4	49	10	17
Cycle	103	386	77	51	193	38
Cycle Rickshaw	1	0	1	0	0	0
Animal drawn	0	0	0	0	0	0
<b>Total</b>	<b>3199</b>	<b>3794</b>	<b>3547</b>	<b>3332</b>	<b>3366</b>	<b>3786</b>

Source: Traffic Survey Conducted In December 2013

**Projected traffic-** Based on the base year traffic as presented above, traffic projections have been done to derive the traffic demand at horizon years.



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Table 2-5 presents the projected annual average traffic data (AADT) for five years gap on homogeneous sections of project road.

**Table 2-5: Projected Traffic (AADT) on Nanguneri - Bharatavaram -Ovari Road, Section of SH89**

S. no.	Year	Km 4+000		Km 11+500		Km 23+000	
		Total AADT	Total AADT PCU	Total AADT	Total AADT PCU	Total AADT	Total AADT PCU
1.	2013	3137	3306	3724	3336	3482	3765
2.	2014	3405	3559	4031	3591	3780	4049
3.	2015	3693	3823	4361	3859	4100	4341
4.	2020	5459	5441	6386	5497	6066	6147
5.	2025	7813	7545	9089	7636	8689	8492
6.	2030	10837	10185	12567	10331	12060	11426
7.	2035	14606	13412	16908	13639	16264	15009
8.	2040	19180	17264	22189	17604	21367	19281
9.	2042	21307	19037	24650	19434	23741	21247

Source: Detailed Project Report, Volume I

### 3) Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41

**Present traffic scenario-** The vehicle-wise average daily traffic (ADT) figures were estimated by classified count survey. Table 2-6 presents a summary of the vehicle-wise ADT on Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 for each homogenous section.

**Table 2-6: ADT observed on Rajapalayam-Sankarankoil-Tirunelveli Road, Section of SH-41**

ADT	Km 15+000*	Km 40+000**	Km 70+000*	ADT PCU	Km 15+000	Km 40+000	Km 70+000
Car	876	1851	1561	Car	876	1851	1561
Auto Rick.	190	244	477	Auto Rick.	190	244	477
Two Wheeler	2014	2045	4060	Two Wheeler	1007	1022	2030
LMV (pickups and other less than 3T)	468	222	453	LMV (pickups and other less than 3T)	702	333	679
Mini Bus	277	119	105	Mini Bus	416	179	157
Bus	496	458	426	Bus	1488	1373	1278
LCV	176	176	108	LCV	264	264	161
2-A Truck	386	335	204	2-A Truck	1159	1004	612
3-A Truck	197	185	81	3-A Truck	591	555	242
MAV / Heavy construction machinery (4 - 6	42	85	19	MAV / Heavy construction machinery (4 - 6	190	382	87



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

ADT	Km 15+000*	Km 40+000**	Km 70+000*	ADT PCU	Km 15+000	Km 40+000	Km 70+000
axle)				axle)			
Oversized vehicles (7 axle / more)	0	0	0	Oversized vehicles (7 axle / more)	0	0	0
Tractor	8	38	10	Tractor	12	57	14
Tractor + Trailer	44	26	13	Tractor + Trailer	198	115	60
Cycle	141	122	231	Cycle	70	61	116
Cycle Riksha	0	5	0	Cycle Riksha	0	2	0
Animal drawn	0	1	0	Animal drawn	0	7	0
<b>Total</b>	<b>5316</b>	<b>5909</b>	<b>7748</b>	<b>Total</b>	<b>7164</b>	<b>7448</b>	<b>7475</b>

Note: Traffic Survey Conducted in \*December 2013 and \*\*May 2014

**Projected traffic** - Based on the base year traffic as presented above, traffic projections have been done to derive the traffic demand at horizon years.

**Table 2-7** presents the projected annual average traffic data (AADT) for five years gap on homogeneous sections of Rajapalayam-Sankarankoil-Tirunelveli section of SH-41.

**Table 2-7: Projected Traffic (AADT) on Rajapalayam-Sankarankoil-Tirunelveli Road, Section of SH-41**

Sl. no.	Year	Km 15+000		Km 40+000		Km 70+000	
		Total AADT	Total AADT PCU	Total AADT	Total AADT PCU	Total AADT	Total AADT PCU
1.	2013	11177	17353	10508	13078	7991	9897
2.	2018	16735	24684	16243	19112	12405	14471
3.	2023	23574	33553	23418	26502	17958	20119
4.	2028	32185	44258	32639	35644	25119	27124
5.	2033	42842	57153	44210	46834	34133	35724
6.	2038	55662	72313	58301	60173	45134	45998
7.	2042	67681	86241	71640	72577	55565	55567

Source: Detailed Project Report, Volume I

### 2.2.3 Road Width

The carriageway/ roadway width of the project roads is not uniform. The following table gives the distribution of %age length with respect to carriageway width (single lane, intermediate lane, double lane, double lane with paved shoulder)

From the road inventory, it can be summarised that around 95% of the project road length of SH-44 and SH89 sections is two lanes and about 5% of road length is having earthen shoulder with width varying between 0.5m to 1.0m. However, 70% of project road length of SH41 section is having two lane with earthen shoulder of width varying between 0.5m-1.0m.



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**Table 2-8: Distribution of Road Width along Project Roads**

Type of Carriageway Configuration and Length				
SL	IL	2L	2L(Shoulders )	4L
<b>Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44</b>				
0	0	95%	5%	0
<b>Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89</b>				
0	0	95%	5%	0
<b>Rajapalayam - Sankarankoil – Tirunelveli ((km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41</b>				
0	0	100%	70%	0

Based on the traffic figures and existing lane configurations, the existing Level of Service at which the sections of project roads are experiencing is provided in **Table 2-9**.

**Table 2-9: Section wise AADT and LOS**

Section	Description	AADT (PCU)	Existing CW Configuration	Existing LOS
Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44	km 22/500 to km 31/000	3534	2L	A
	Km 31/000 to km 47/000	8337	2L	A
	Km 47/000 to km 55/000	9871	2L	A
Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89	Km 0/000 to km 4/000	3306	2L	A
	Km 4/000 to km 11/500	3336	2L	A
	Km 11/500 to km 23/000	3765	2L	A
Rajapalayam-Sankarankoil-Tirunelveli Section of SH-41	km 0/000 to km 15/000	7164	2L	A
	Km 15/000 to km 40/000	7448	2L	A
	Km 40/000 to km 70/000	7475	2L	A

Source: Detailed Project Report, Volume I

LOS A: Represents a condition of **free flow**.

LOS B: Represents a condition of stable flow with **restricted freedom** for selection of speed.

LOS C: Represents a condition of stable flow with **little freedom** for selection of speed.

LOS D: Represents a condition of **limit of stable flow** with condition approaching unstable flow.

LOS E: Represents a condition of **unstable flow** with volumes close to capacity.

LOS F: Represents a condition of **breakdown flow** with long queues and delays.

**(Refer IRC 106: 1990)**

## 2.2.4 Land Use and Roadside Environments

The land use distribution along the project roads is as follows:



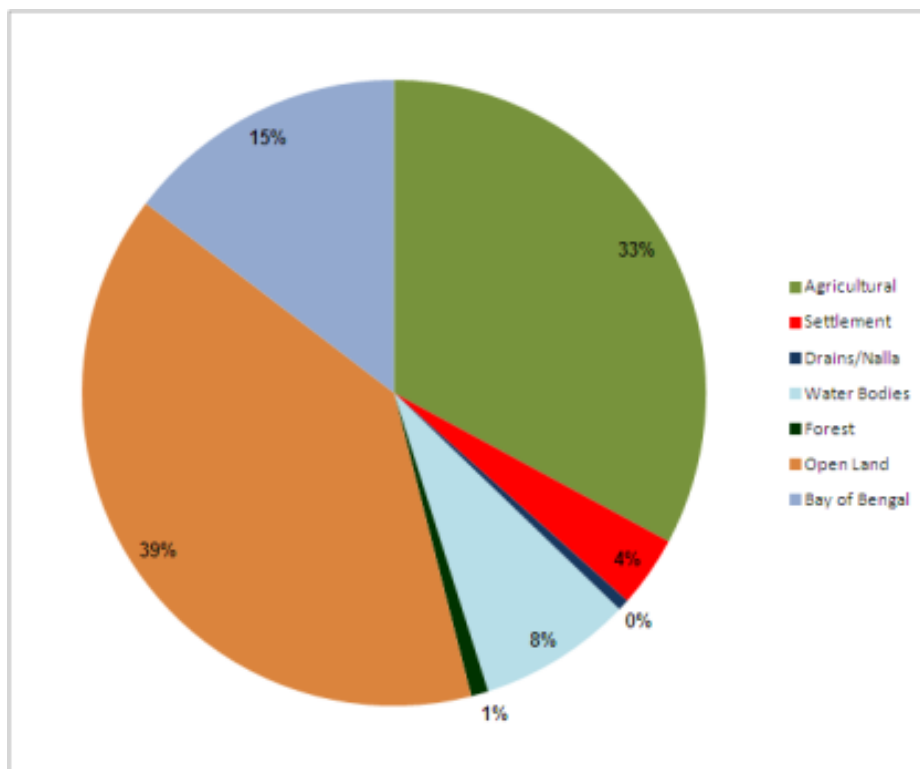


**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Project Road	Land Use Distribution within EROW	Land use beyond EROW
Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road Section of SH44	Open area with road side plantation : 61% Built Up : 39%	Predominantly Open Area followed by agricultural in some stretches
Nanguneri - Bharatavaram Ovari Road upto ECR Junction Section of SH 89	Open Area: 69% Built Up : 31%	Predominantly Open Area/Open Land followed by built up area. Cashew plantation observed in end changes of Idaiyangudi village.
Rajapalayam-Sankarankoil-Tirunelveli section of SH-41	Built Up – around 30% Dry Land – 53% Wet Land – 16%	Dry and Open Land

Also, land use map of project influence area (10km from either side of project roads) has been prepared based on toposheets, AutoCAD and ArcGIS 9.1. The land use maps prepared for project roads are attached as **Appendix 2.2**.

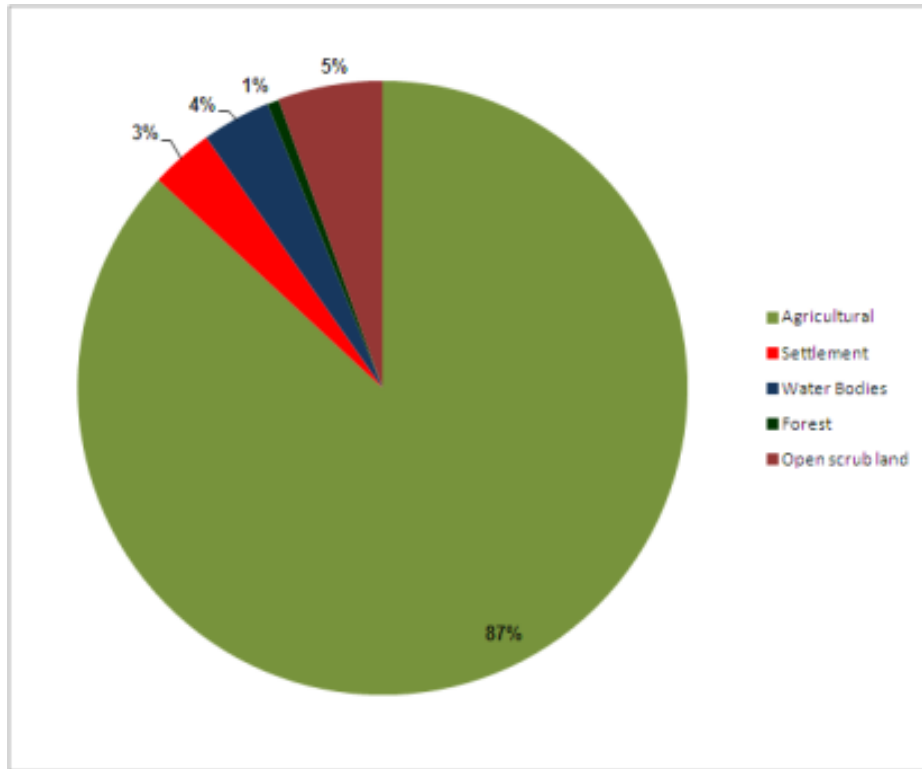
**Figure 2-4** indicates the % distribution of land use within Project influence area of project roads.



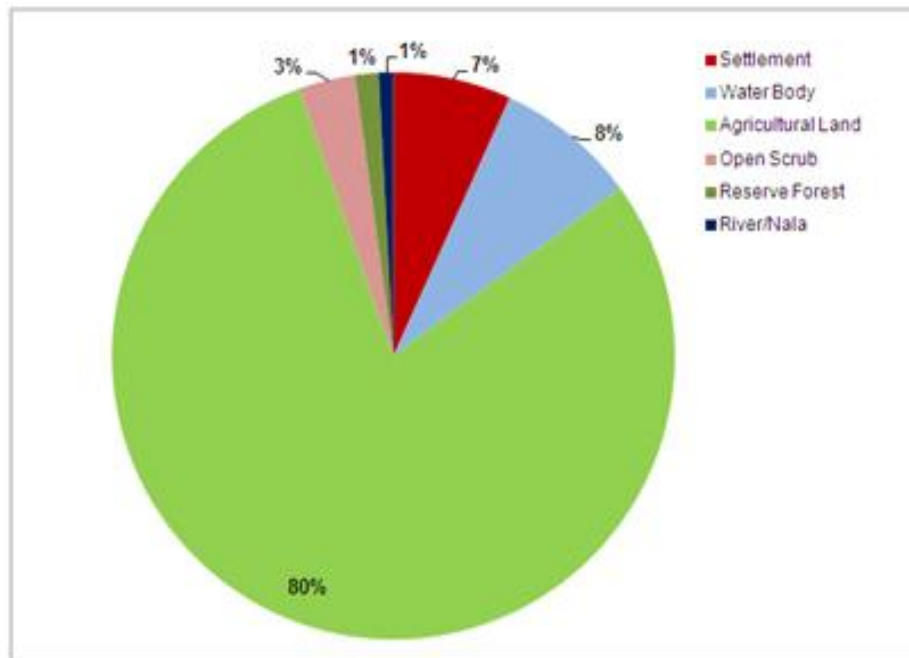
**Land Use Pattern within PIA- Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44**



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41



**Land Use Pattern within PIA- Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89**



**Land Use Pattern- Rajapalayam - Sankarankoil - Tirunelveli Road, Section of SH41**

**Figure 2-4: Land Use Pattern within PIA (within 10km buffer of project roads)**



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

As observed from Figure 2-4, major land use within PIA of Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44 is open land (39%) followed by agricultural (33%) and agricultural (87%) within PIA of Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89. Within PIA of Rajapalayam - Sankarankoil – Tirunelveli Road, Section of SH41, major land use is agricultural (80%).

### 2.2.5 Villages and Urban-Built Up Sections

Around 61% length of the Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road Section of SH44 passes through non-built up area; remaining 39% length traverses through inhabited area. There are a number of villages and settlements located along the project road as tabulated below:

**Table 2-10: Inhabitation along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44**

Chainage		Length (m)	Name of Village/Settlement
Start (km)	End (km)		
22/500	22/600	100	Naduvappatti
24/390	24/910	520	Mukkuttumalai
27/170	28/100	930	Nakkal muttampatti
30/020	31/090	1070	Ilaiyarsanendal
35/900	36/820	920	Appaneri
38/510	38/750	240	Kovilpatti
41/300	45/160	3860	Kovilpatti
50/890	52/820	1930	Kumaragiri
53/950	56/700	2750	Ilampuvanam, Ettayapuram

Source: Detailed Project Report, Volume I

Around 69% length of the Nanguneri - Bharatavaram -Ovari Road Section of SH 89 passes through non-built up area; remaining 31% length traverses through inhabited area. There are a number of villages and settlements located along the project road, the details are tabulated below:

**Table 2-11: Inhabitation along Nanguneri - Bharatavaram -Ovari Road (km 0/000 to km 35/200), Section of SH 89**

Chainage		Length(m)	Name of Village/ Settlement
Start (km)	End (km)		
0/000	2/140	2140	Nanguneri
2/140	2/810	670	IraippOvari
3/250	41/00	850	karunkadu
5/395	5/995	600	Iraipubari
7/800	11/600	3800	Alangulam
12/100	12/695	595	Alangulam
14/695	16/795	2100	Vijayanarayanam
20/500	21/000	500	Vijayanarayanam
24/670	25/270	600	Kumarapuram
26/800	30/000	3200	Tisaiyanvilai



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Chainage		Length(m)	Name of Village/ Settlement
Start (km)	End (km)		
31/100	32/400	1300	Idaiyangudi

Source: Detailed Project Report, Volume I

Around 25% length of the Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 passes through built up area; remaining 75% length traverses through non built up area. There are a number of villages and settlements located along the project road as tabulated below:

**Table 2-12: Inhabitation along Rajapalayam- Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41**

Chainage		Length (m)	Name of Village/ Settlement
Start (km)	End (km)		
1/800	2/700	900	INTUC Nagar
4/200	5/600	1400	Madhukudy
7/780	8/260	480	Cholapuram
8/400	10/100	1700	Cholapuram
10/600	11/100	500	Perumalpatti
12.600	13/100	500	Solaiseri
19/000	22/400	3400	Karivalamvanthanallur, Kulalaikanni
25/400	25/800	400	Ramalingapuram
38/100	38/700	600	Muthukrishapuram
40/600	41/700	1100	Gurukulpatti
47/700	49/100	1400	Panavadalachathiram, Marukkalankulam
54/000	56/000	2000	Vennikonendhal
57/700	58/800	1100	Devarkulam
64/000	64/700	700	Alakiyapandiapuram
70/000	71/200	1200	Manur
74/600	74/900	300	Rastha
81/600	82/820	1220	Ramainpatti

Source: Detailed Project Report, Volume I

## 2.3 PROPOSED IMPROVEMENT

### 2.3.1 Proposed CW Configuration and Cross Sections

The existing SHs are proposed to be upgraded to 2/4 lane paved shoulder configuration, the details of which are presented as follows:

**Table 2-13: Proposed Improvements for Project Roads**

Project Road	Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44	Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89	Rajapalayam-Sankarankoil-Tirunelveli Section of SH-41
Proposed Lane Configuration	2 Lane +PS	2 Lane +PS	2 Lane +PS



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Project Road		Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44	Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89	Rajapalayam-Sankarankoil-Tirunelveli Section of SH-41
Carriageway width (m)		7	7	7
Paved Shoulder (m)	Rural	1.5*2	1.5*2	1.5*2
	Urban	1.5*2	1.5*2	1.5*2
Earthen shoulder (m)		1*2	1*2	1*2
Median (m)	Rural	-	-	-
	Urban	0.625 <sup>#</sup>	-	-
Footpath/Drain (m)	Unlined	1.5*2	1.5*2	1.5*2
	Lined	1.5*2	1.5*2	1.5*2
Utility Corridor (m)	Rural	1.0*2	1.0*2	1.0*2
	Urban	1.5*2	1.5*2	1.5*2

# Median has been proposed only in stretch (41+170 – 44+100 of SH-44), where 4-lane is proposed

Source: Detailed Project Report, Volume I

**Table 2-14: Widening proposal for the existing highway**

Sl. No.	Existing Chainage (km)		Design Chainage (km)		Length (m)	Widening
	From	To	From	To		
<b>Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44</b>						
1	22/500	38/850	22/500	38/745	16245	2-lane with paved shoulder
2	38/850	41/300	38/745	41/170	2425	Kovilpatti (Not in Scope)
3	41/300	45/355	41/170	45/235	4065	4-lane with paved shoulder
4	45/355	56/800	45/235	56/825	11590	2-lane with paved shoulder
<b>Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89</b>						
1	0/000	14/955	0/000	15/500	15500	2-lane without paved shoulder
2	14/955	26/885	15/000	26/800	11800	2-lane with paved shoulder
3	26/885	30/000	26/800	29/672	2872	Thisayanvilai Bypass
4	30/000	35/200	*30/000	34/940	4940	2-lane with paved shoulder
<b>Rajapalayam-Sankarankoil-Tirunelveli Section of SH-41</b>						
1	1/800	6/045	1/800	6/000	4200	2-lane without paved shoulder
2	6/045	28/000	6/000	28/048	22048	2-lane with paved shoulder
3	28/000	33/800	28/048	33/895	5847	Sankarankoil (Not in scope)
4	33/800	82/900	33/895	82/935	49040	2-lane with paved shoulder

Source: Detailed Project Report, Volume I



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**Table 2-15: Proposed ROW Details**

Project Road	2 Lane Road		4 Lane Road	
	Rural	Urban / Village	Rural	Urban / Village
Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44	23	16	-	28*
Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89	23	16	-	-
Rajapalayam-Sankarankoil-Tirunelveli section of SH-41	23	16	-	-

\*4 lane + slow moving lane in Thittangulam (Urban stretch) from 41+170 – 44+100 of SH-44

Source: Detailed Project Report, Volume I

**Table 2-16: Details of typical cross sections adopted for proposed roads**

Type of Cross Section	Description
<b>Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44</b>	
TCS 1	Two lane Rural section (New Construction)
TCS 2	Two lane Rural section (Concentric widening)
TCS 3	Two lane Rural section (Eccentric widening RHS)
TCS 4	Two lane Rural section (Eccentric widening LHS)
TCS 5	Two lane Urban section (Concentric widening)
TCS 5A	Two lane Urban section (Concentric widening)
TCS 6	Two lane Urban section (Eccentric widening RHS)
TCS 7	Two lane Urban section (Eccentric widening LHS)
TCS 8	Four lane Urban / Village section (Concentric widening)
TCS 9	Four lane Urban / Village section (Eccentric widening RHS)
TCS 10	Four lane Urban / Village section (Eccentric widening LHS)
<b>Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89</b>	
TCS 1	Two lane Rural section (New Construction)
TCS 2	Two lane Rural section (Concentric widening)
TCS 2A	Two lane Rural section (Concentric widening)
TCS 3	Two lane Rural section (Eccentric widening RHS)
TCS 4	Two lane Rural section (Eccentric widening LHS)
TCS 5	Two lane Urban section (Concentric widening)
TCS 5A	Two lane Urban section (Concentric widening)
<b>Rajapalayam-Sankarankoil-Tirunelveli Section of SH-41</b>	
TCS 1	Two lane Urban section (New Construction)
TCS 1A	Two lane Urban section (New Construction)
TCS 1B	Two lane Urban section (New Construction)
TCS 2	Two lane Rural section (Concentric widening)
TCS 2A	Two lane Rural section (Concentric widening)
TCS 3	Two lane Rural section (Eccentric widening RHS)
TCS 4	Two lane Rural section (Eccentric widening LHS)
TCS 5	Two lane Urban section (Concentric widening)





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Type of Cross Section	Description
TCS 5A	Two lane Urban section (Concentric widening)
TCS 6	Two lane Urban section (Eccentric widening RHS)
TCS 7	Two lane Urban section (Eccentric widening LHS)

**Table 2-17: Chainage wise Cross Sections adopted for two lane up-gradation with paved shoulders of Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44**

Design Chainage (Km)		Length (m)	Type
From	To		
22/500	23/860	1360	TCS 2
23/860	23/960	100	TCS 4
23/960	24/100	140	TCS 3
24/100	24/390	290	TCS 2
24/390	24/600	210	TCS 4
24/600	25/800	1200	TCS 2
25/800	25/900	100	TCS 3
25/900	26/470	570	TCS 2
26/470	26/600	130	TCS 3
26/600	26/800	200	TCS 2
26/800	26/930	130	TCS 3
26/930	27/230	300	TCS 2
27/230	27/270	40	TCS 5A
27/270	27/500	230	TCS 5
27/500	27/530	30	TCS 7
27/530	27/650	120	TCS 4
27/650	28/600	950	TCS 2
28/600	28/800	200	TCS 4
28/800	29/450	650	TCS 2
29/450	29/750	300	TCS 4
29/750	29/900	150	TCS 3
29/900	30/075	175	TCS 2
30/075	30/110	35	TCS 3
30/110	30/200	90	TCS 6
30/200	30/290	90	TCS 5A
30/290	30/510	220	TCS 5
30/510	33/600	3090	TCS 2
33/600	33/700	100	TCS 3
33/700	34/050	350	TCS 2
34/050	34/200	150	TCS 3
34/200	34/320	120	TCS 4
34/320	35/220	900	TCS 2
35/220	35/600	380	TCS 1
35/600	36/490	890	TCS 2
36/490	36/600	110	TCS 3



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Design Chainage (Km)		Length (m)	Type
From	To		
36/600	37/050	450	TCS 2
37/050	38/000	950	TCS 3
38/000	38/745	745	TCS 2
38/745	41/170	2425	NOT IN SCOPE
41/170	42/470	1300	TCS 8
42/470	42/900	430	TCS 9
42/900	44/100	1200	TCS 8
44/100	44/560	460	TCS 5A
44/560	48/840	4280	TCS 2
48/840	48/950	110	TCS 3
48/950	54/035	5085	TCS 2
54/035	54/160	125	TCS 4
54/160	54/250	90	TCS 3
54/250	54/440	190	TCS 2
54/440	56/100	1660	TCS 5A

Source: Detailed Project Report, Volume I

**Table 2-18: Chainage wise Cross Sections adopted for two lane up-gradation with paved shoulders of Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89**

Design Chainage (km)		Length (m)	Type
From	To		
0/000	15/000	15000	TCS 2A
15/100	19/500	4400	TCS 2
19/500	19/730	230	TCS 3
19/730	20/660	930	TCS 2
20/660	20/780	120	TCS 5A
20/780	20/840	60	TCS 5
20/840	20/970	130	TCS 5A
20/970	21/600	630	TCS 2
21/600	22/900	1300	TCS 3
22/900	23/000	100	TCS 2
23/000	23/100	100	TCS 3
23/100	23/300	200	TCS 2
23/300	23/400	100	TCS 4
23/400	24/140	740	TCS 2
24/140	24/520	380	TCS 1
24/520	24/660	140	TCS 3
24/660	25/000	340	TCS 2
25/000	25/100	100	TCS 4
25/100	25/260	160	TCS 2
25/260	25/340	80	TCS 4
25/340	25/800	460	TCS 2



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Design Chainage (km)		Length (m)	Type
From	To		
25/800	25/900	100	TCS 3
25/900	26/000	100	TCS 4
26/000	26/250	250	TCS 2
26/250	26/700	450	TCS 1
26/700	26/800	100	TCS 4
26/800	30/000	3200	TCS 1
30/000	30/400	400	TCS 2
30/400	30/510	110	TCS 4
30/510	31/960	1450	TCS 2
31/960	32/750	790	TCS 3
32/750	33/400	650	TCS 2
33/400	34/500	1100	TCS 3
34/500	34/940	440	TCS 2

Source: Detailed Project Report, Volume I

**Table 2-19: Chainage wise Cross Sections adopted for two lane up-gradation with paved shoulders of Rajapalayam-Sankarankoil-Tirunelveli section of SH-41**

Design Chainage (km)		Length (m)	Type
From	To		
1/800	6/000	4200	TCS - 2A
6/000	6/680	680	TCS - 2
6/680	6/780	100	TCS - 3
6/780	6/880	100	TCS - 4
6/880	6/980	100	TCS - 3
6/980	7/140	160	TCS - 4
7/140	8/260	1120	TCS - 2
8/260	8/400	140	TCS - 3
8/400	8/900	500	TCS - 2
8/900	9/060	160	TCS - 3
9/060	9/220	160	TCS - 4
9/220	9/340	120	TCS - 3
9/340	9/500	160	TCS - 6
9/500	9/640	140	TCS - 7
9/640	9/970	330	TCS - 5A
9/970	10/660	690	TCS - 2
10/660	10/740	80	TCS - 4
10/740	12/500	1760	TCS - 2
12/500	12/600	100	TCS - 4
12/600	12/840	240	TCS - 2
12/840	12/940	100	TCS - 3
12/940	13/600	660	TCS - 2
13/600	13/660	60	TCS - 3
13/660	14/300	640	TCS - 2



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Design Chainage (km)		Length (m)	Type
From	To		
14/300	14/420	120	TCS - 4
14/420	15/720	1300	TCS - 2
15/720	16/100	380	TCS - 3
16/100	16/900	800	TCS - 2
16/900	17/260	360	TCS - 1
17/260	17/360	100	TCS - 4
17/360	17/460	100	TCS - 3
17/460	17/700	240	TCS - 4
17/700	17/800	100	TCS - 3
17/800	19/080	1280	TCS - 2
19/080	19/160	80	TCS - 4
19/160	19/640	480	TCS - 2
19/640	19/740	100	TCS - 4
19/740	19/880	140	TCS - 2
19/880	19/940	60	TCS - 4
19/940	20/020	80	TCS - 6
19/940	20/330	390	TCS - 5
20/330	20/380	50	TCS - 5A
20/380	20/428	48	TCS-5
20/428	20/590	162	TCS - 5A
20/590	21/380	790	TCS - 2
21/380	21/620	240	TCS - 3
21/620	23/080	1460	TCS - 2
23/080	23/160	80	TCS - 3
23/160	23/220	60	TCS - 2
23/220	23/520	300	TCS - 4
23/520	23/600	80	TCS - 2
23/600	23/680	80	TCS - 3
23/680	23/940	260	TCS - 2
23/940	24/140	200	TCS - 4
24/140	24/360	220	TCS - 3
24/360	24/420	60	TCS - 4
24/420	24/480	60	TCS - 2
24/440	24/660	220	TCS - 3
24/660	24/820	160	TCS - 2
24/820	25/040	220	TCS - 4
25/040	25/400	360	TCS - 1
25/400	25/580	180	TCS - 2
25/580	25/660	80	TCS - 4
25/660	27/540	1880	TCS - 2
27/540	27/620	80	TCS - 3
27/620	27/740	120	TCS - 2
27/740	27/820	80	TCS - 3



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Design Chainage (km)		Length (m)	Type
From	To		
27/820	28/048	228	TCS - 2
28/048	33/895	5847	Not In Scope
33/895	34/320	425	TCS - 2
34/320	34/460	140	TCS - 4
34/460	34/600	140	TCS - 3
34/600	34/940	340	TCS - 2
34/940	35/120	180	TCS - 4
35/120	37/480	2360	TCS - 2
37/480	37/780	300	TCS - 4
37/780	38/100	320	TCS - 2
38/100	38/200	100	TCS - 3
38/200	38/280	80	TCS - 4
38/280	40/900	2620	TCS - 2
40/900	41/131	231	TCS - 5A
41/131	41/187	56	TCS-5
41/187	41/292	105	TCS - 5A
41/292	41/380	88	TCS-5
41/380	41/400	20	TCS - 1A
41/400	41/450	50	TCS -1B
41/450	41/800	350	TCS - 1
41/800	42/140	340	TCS - 2
42/140	42/240	100	TCS - 3
42/240	42/720	480	TCS - 2
42/720	43/040	320	TCS - 4
43/040	43/140	100	TCS - 2
43/140	43/220	80	TCS - 4
43/220	43/820	600	TCS - 2
43/820	43/920	100	TCS - 4
43/920	44/580	660	TCS - 2
44/580	44/640	60	TCS - 3
44/640	45/660	1020	TCS - 2
45/660	46/820	1160	TCS - 4
46/820	47/560	740	TCS - 2
47/560	47/700	140	TCS - 3
47/700	47/765	65	TCS-5
47/765	48/100	335	TCS - 5A
48/100	48/540	440	TCS - 2
48/540	48/940	400	TCS - 3
48/940	49/980	1040	TCS - 2
49/980	50/100	120	TCS - 3
50/100	50/320	220	TCS - 2
50/320	50/420	100	TCS - 4
50/420	50/580	160	TCS - 2



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Design Chainage (km)		Length (m)	Type
From	To		
50/580	50/640	60	TCS - 4
50/640	50/900	260	TCS - 1
50/900	50/940	40	TCS - 2
50/940	51/280	340	TCS - 1
51/280	51/340	60	TCS - 2
51/340	51/700	360	TCS - 3
51/700	51/900	200	TCS - 2
51/900	52/000	100	TCS - 4
52/000	52/100	100	TCS - 3
52/100	52/220	120	TCS - 4
52/220	52/340	120	TCS - 3
52/340	53/660	1320	TCS - 2
53/660	53/820	160	TCS - 4
53/820	53/900	80	TCS - 2
53/900	54/355	455	TCS - 5A
54/335	54/540	205	TCS-5
54/540	54/480	40	TCS - 5A
54/480	54/672	20	TCS-5
54/672	54/900	228	TCS - 5A
54/900	55/720	820	TCS - 2
55/720	56/420	700	TCS - 4
56/420	57/620	1200	TCS - 2
57/620	57/960	340	TCS - 5A
57/960	58/225	265	TCS-5
58/225	58/394	169	TCS - 5A
58/394	58/500	106	TCS-5
58/500	58/532	32	TCS - 5A
58/532	58/596	64	TCS-5
58/596	58/650	54	TCS - 5A
58/650	59/260	610	TCS - 2
59/260	59/900	640	TCS - 4
59/900	60/380	480	TCS - 2
60/380	60/440	60	TCS - 3
60/440	61/240	800	TCS - 4
61/240	61/480	240	TCS - 3
61/480	61/960	480	TCS - 2
61/960	62/380	420	TCS - 1
62/380	62/680	300	TCS - 2
62/680	63/260	580	TCS - 4
63/260	63/950	690	TCS - 2
63/950	64/650	700	TCS - 5A
64/650	65/560	910	TCS - 2
65/560	65/760	200	TCS - 4





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

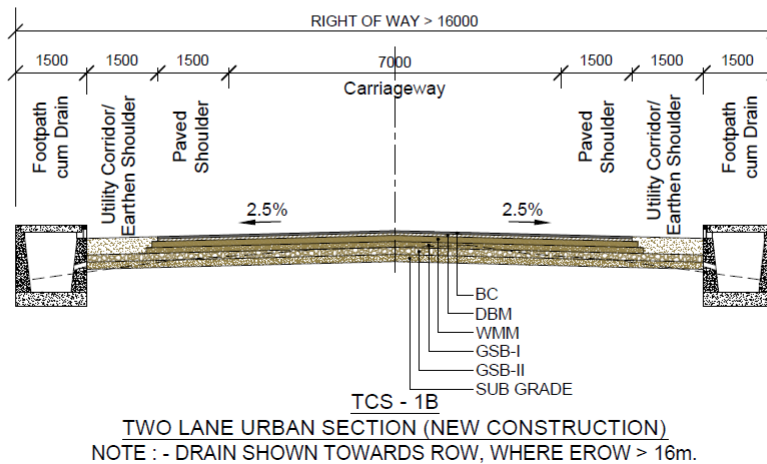
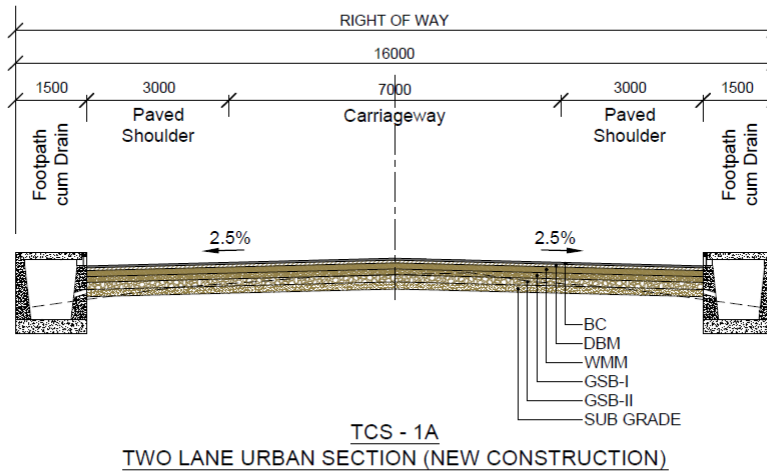
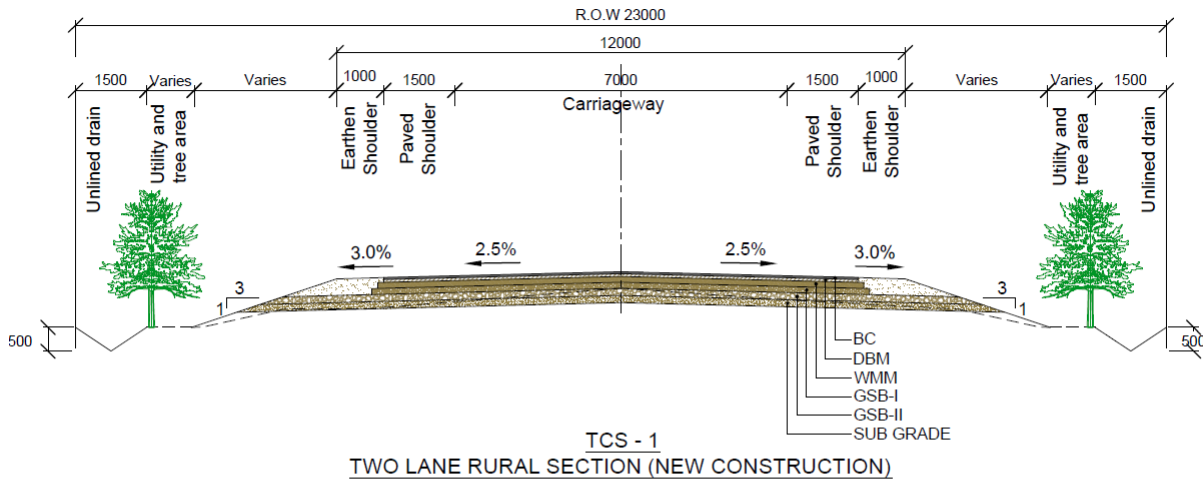
Design Chainage (km)		Length (m)	Type
From	To		
65/760	67/240	1480	TCS - 2
67/240	67/700	460	TCS - 4
67/700	68/720	1020	TCS - 2
68/720	68/960	240	TCS - 3
68/960	69/080	120	TCS - 2
69/080	69/300	220	TCS - 3
69/300	69/800	500	TCS - 2
69/800	69/880	80	TCS - 3
69/880	70/000	120	TCS - 4
70/000	70/020	20	TCS - 7
70/020	70/500	480	TCS - 5A
70/500	70/580	80	TCS-5
70/580	70/720	140	TCS - 5A
70/720	70/875	155	TCS-5
70/875	70/965	90	TCS - 5A
70/965	71/148	183	TCS - 5
70/960	70/980	20	TCS - 1A
70/980	71/030	50	TCS - 1B
71/030	71/140	110	TCS - 1
71/140	71/460	320	TCS - 2
71/460	71/600	140	TCS - 4
71/600	71/760	160	TCS - 3
71/760	75/080	3320	TCS - 2
75/080	75/200	120	TCS - 3
75/200	75/720	520	TCS - 4
75/720	75/820	100	TCS - 2
75/820	75/900	80	TCS - 3
75/900	76/000	100	TCS - 2
76/000	76/640	640	TCS - 3
76/640	76/800	160	TCS - 4
76/800	76/960	160	TCS - 3
76/960	77/160	200	TCS - 4
77/160	77/280	120	TCS - 2
77/280	77/460	180	TCS - 3
77/460	82/000	4540	TCS - 2
82/000	82/100	100	TCS - 3
82/100	82/837	737	TCS - 2

Source: Detailed Project Report, Volume I

The typical cross sections of project roads are depicted in **Figures 2-5**.

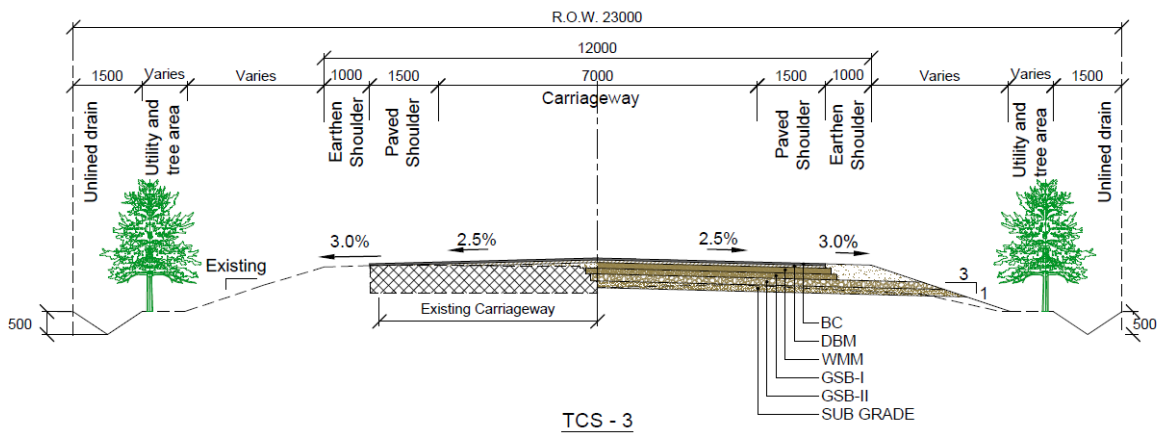
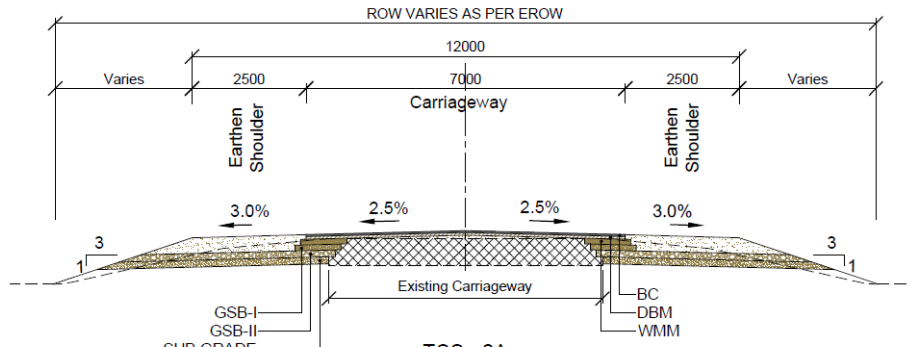
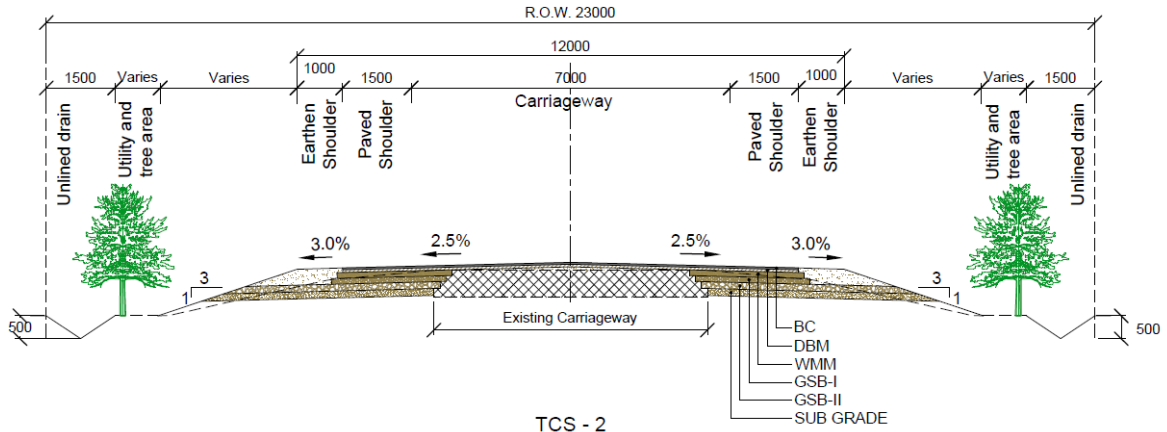


ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41



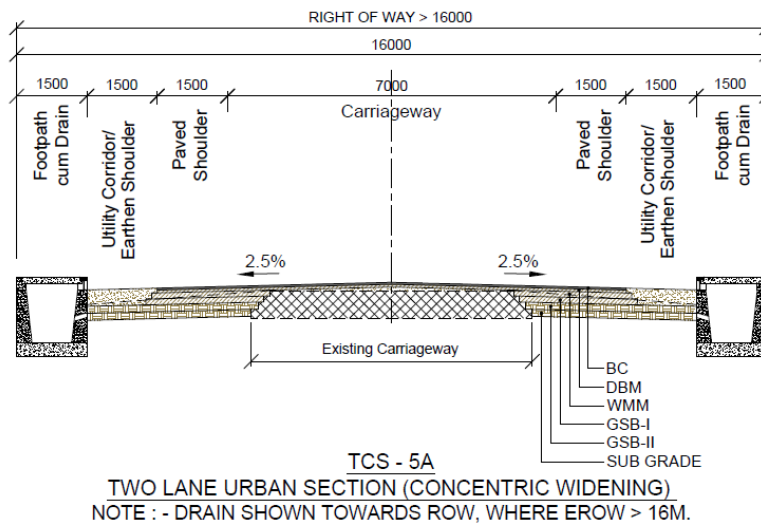
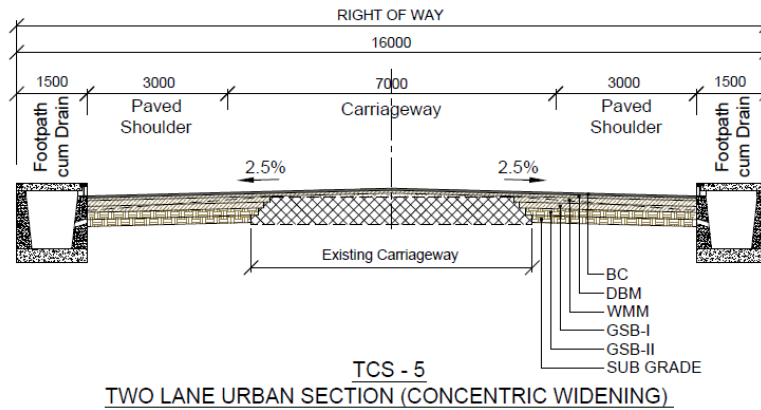
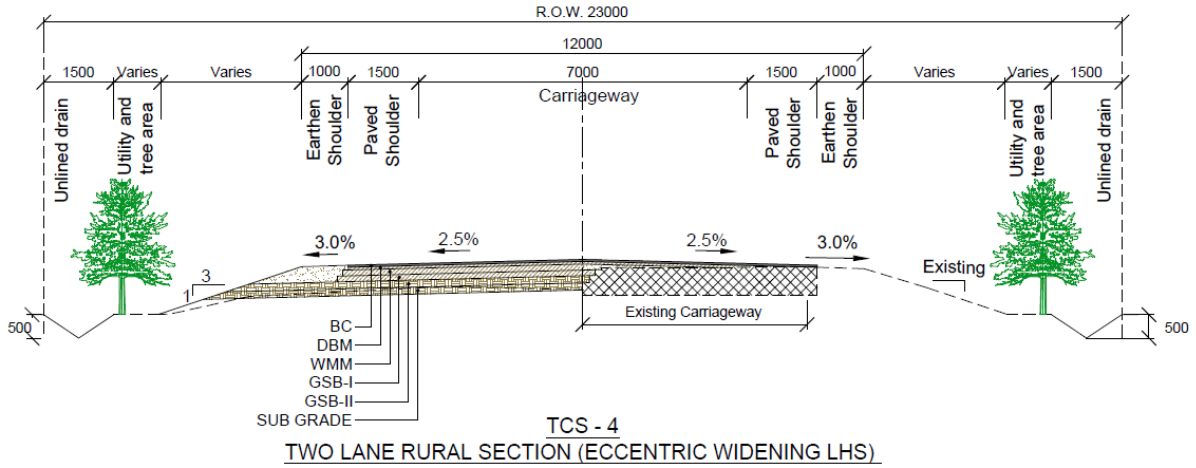


ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41



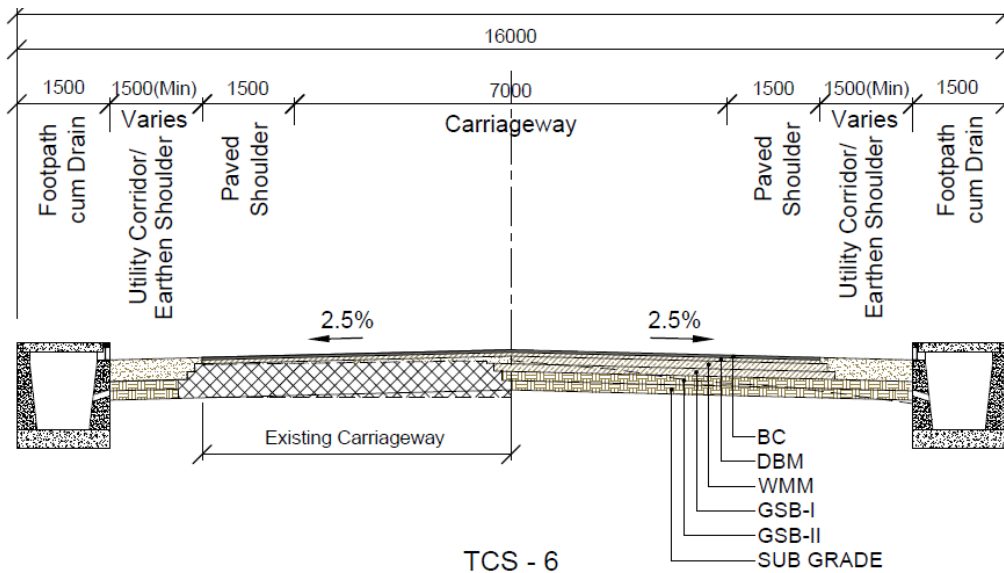


ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

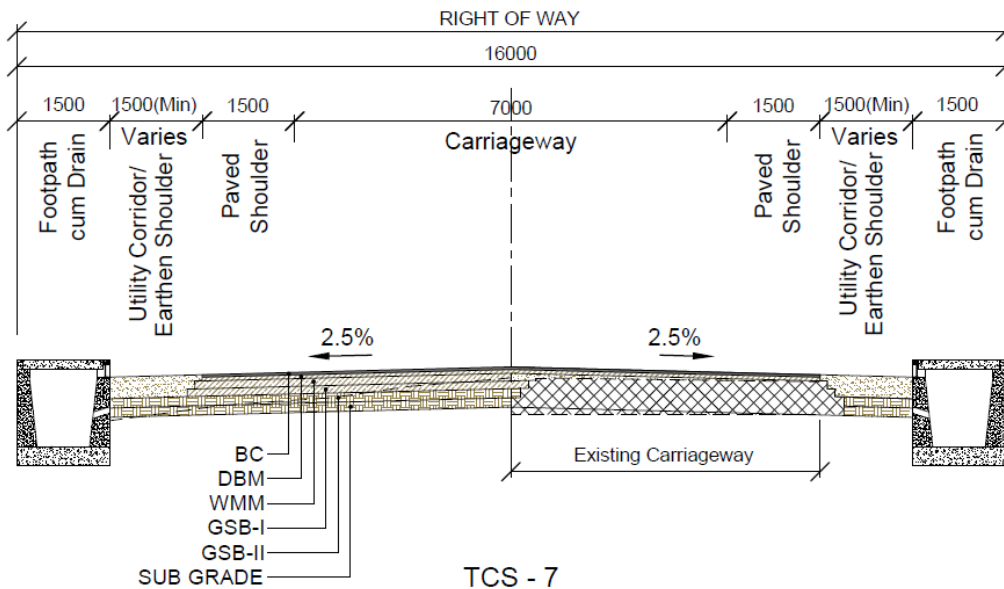




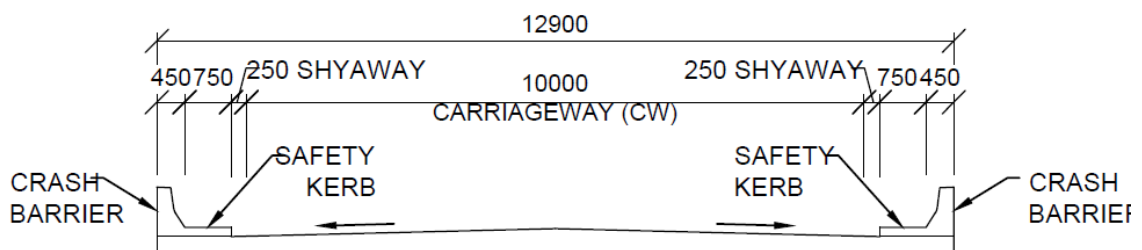
ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41



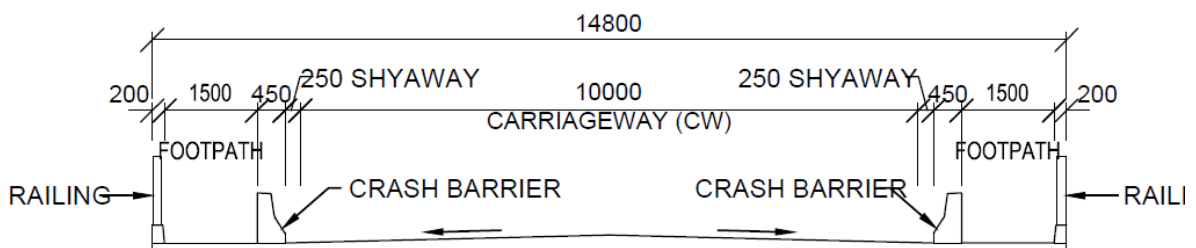
**TWO LANE URBAN SECTION (ECCENTRIC WIDENING RHS)**  
NOTE : - DRAIN SHOWN TOWARDS ROW, WHERE EROW > PROW



**TWO LANE URBAN SECTION (ECCENTRIC WIDENING LHS)**  
NOTE : - DRAIN SHOWN TOWARDS ROW, WHERE EROW > PROW



**TYPICAL CROSS SECTION OF BRIDGE IN RURAL AREA WITHOUT FOOTPATH**  
(APPROACH ROAD WITH PAVED SHOULDER)





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

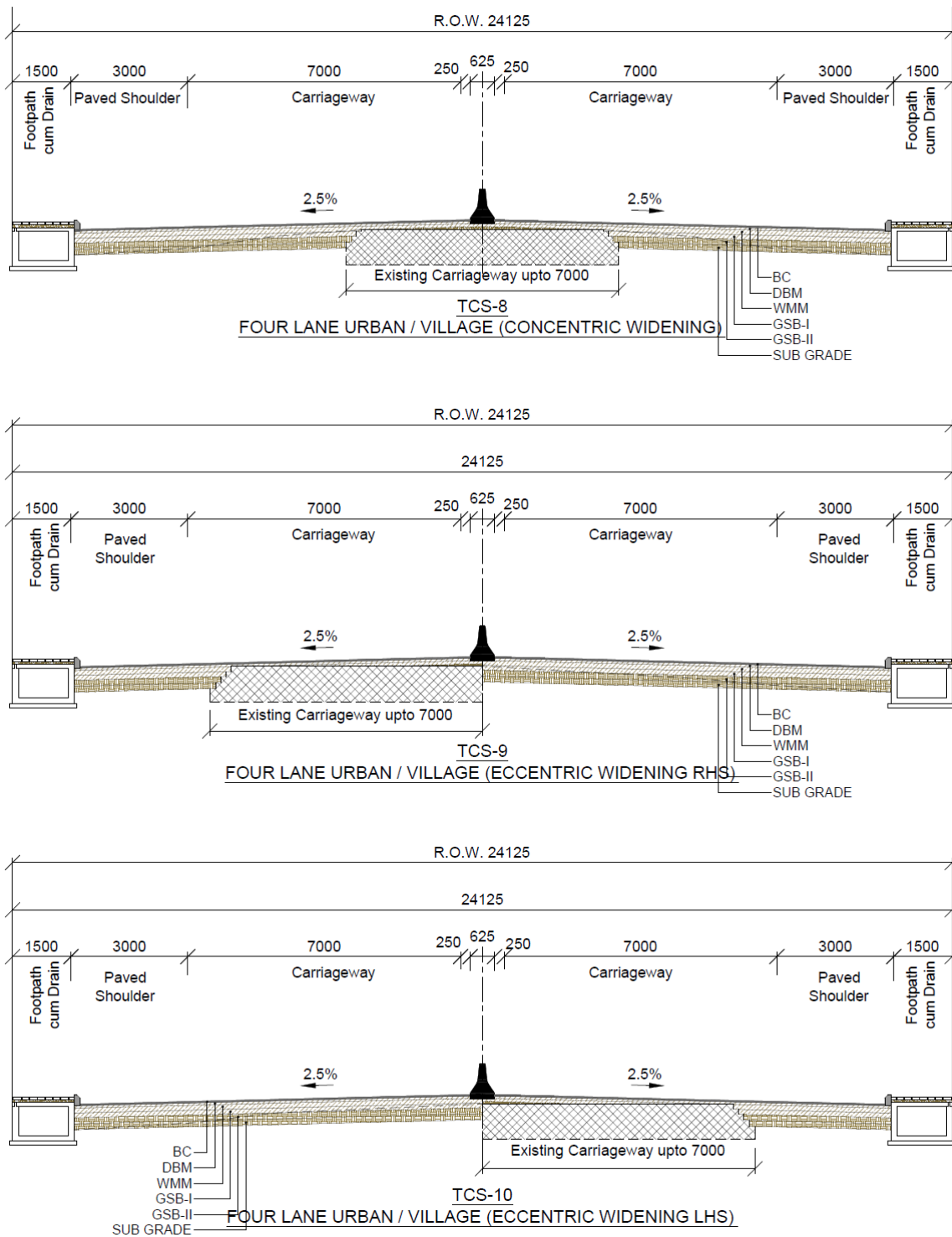


Figure 2-5: Typical Cross Sections of project roads





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

The following tables represent the urban and rural sections along project roads:

**Table 2-20: Details of Urban/ Rural sections along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44**

Chainage		Urban/ Rural	Length (m)
Start (km)	End (km)		
22/500	22/600	Urban	100
22/600	24/390	Rural	1790
24/390	24/910	Urban	520
24/910	27/170	Rural	2260
27/170	28/100	Urban	930
28/100	30/020	Rural	1920
30/020	31/090	Urban	1070
31/090	35/900	Rural	4810
35/900	36/820	Urban	920
36/820	38/510	Rural	1690
38/510	38/750	Urban	240
41/300	45/160	Urban	3860
45/160	50/890	Rural	5730
50/890	52/820	Urban	1930
52/820	53/950	Rural	1130
53/950	56/700	Urban	2750
<b>Total Length (km)</b>		<b>Rural</b>	<b>19.33 km</b>
		<b>Urban</b>	<b>12.32 km</b>

Source: Detailed Project Report, Volume I

**Table 2-21: Details of Urban/Rural sections along Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89**

Chainage		Urban/ Rural	Length (m)
Start (km)	End (km)		
0/000	2/140	Rural	2140
2/140	2/810	Urban	670
2810	3/250	Rural	440
3/250	4/100	Urban	850
4/100	5/395	Rural	1295
5/395	5/995	Urban	600
5/995	7/800	Rural	1805
7/800	11/600	Urban	3800
11/600	12/100	Rural	500
12/100	12/695	Urban	595
12/695	14/695	Rural	2000
14/695	16/795	Urban	2100
16/795	20/500	Rural	3705



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Chainage		Urban/ Rural	Length (m)
Start (km)	End (km)		
20/500	21/000	Urban	500
21/000	24/670	Rural	3670
24/670	25/270	Urban	600
25/270	31/100	Rural	5830
31/100	32/400	Urban	1300
32/400	35/200	Rural	2800
<b>Total Length (km)</b>		<b>Rural</b>	<b>24.185 km</b>
		<b>Urban</b>	<b>11.015 km</b>

Source: Detailed Project Report, Volume I

**Table 2-22: Details of Urban/Rural sections along Rajapalayam - Sankarankoil - Tirunelveli, Section of SH41**

Chainage		Urban/ Rural	Length (m)
Start (km)	Start (km)		
1/800	2/700	Urban	900
2/700	4/200	Rural	1500
4/200	5/600	Urban	1400
5/600	7/780	Rural	2180
7/780	8/260	Urban	480
8/260	8/400	Rural	140
8/400	10/100	Urban	1700
10/100	10/600	Rural	500
10/600	11/100	Urban	500
11/100	12/600	Rural	1500
12/600	13/100	Urban	500
13/100	19/000	Rural	5900
19/000	22/400	Urban	3400
22/400	25/400	Rural	3000
25/400	25/800	Urban	400
25/800	28/000	Rural	2200
33/985	38/100	Rural	4115
38/100	38/700	Urban	600
38/700	40/600	Rural	1900
40/600	41/700	Urban	1100
41/700	47/700	Rural	6000
47/700	49/100	Urban	1400
49/100	54/000	Rural	4900
54/000	56/000	Urban	2000
56/000	57/700	Rural	1700
57/700	58/800	Urban	1100
58/800	64/000	Rural	5200
64/000	64/700	Urban	700
64/700	70/000	Rural	5300



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Chainage		Urban/ Rural	Length (m)
Start (km)	Start (km)		
70/000	71/200	Urban	1200
71/200	74/600	Rural	3400
74/600	74/900	Urban	300
74/900	81/600	Rural	6700
81/600	82/820	Urban	1220
<b>Total Length (km)</b>			<b>75.04 Km</b>
		<b>Urban length</b>	<b>18.9 Km</b>
		<b>Rural length</b>	<b>56.2 Km</b>

Source: Detailed Project Report, Volume I

### 2.3.2 Identification of Realignment/ Bypass

#### ➤ Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44

No bypass is proposed in this project road. Following major horizontal curve improvements have been proposed along project road.

##### a) Km 24/430 to Km 24/605

The stretch is passing through Mukkuttumalai village. Straight realignment is proposed to improve the curve radius. One well is being impacted due to this realignment. There is no major environmental impact.

##### b) Km 26/200 to km 26/350

- The stretch from km 26/200 to km 26/350 is passing through sippiparai village. The existing alignment has a continuous sharp curve with the poor sight distance. So, to improve the geometry of the road, realignment is proposed.
- There is no major environmental and social impact in this realignment.

##### c) Km 30/100 to km 30/200

- The stretch is passing through Elayarasanenedal village. To improve the curve radius, realignment is proposed for a length of 100m.
- There is no major environmental and social impact in this realignment.

##### d) Km 35/220 to km 35/600

- The stretch from km 35/220 to km 35/600 is passing through Ayyaneri village. The existing alignment has a continuous sharp reverse curve with the poor sight distance.
- Also, a major causeway exists across the project road with pipe vents which are in poor condition. So to improve the geometry of the road, realignment with a curve radius of 240m is proposed and a minor bridge is proposed.
- There is no major environmental and social impact in this realignment.



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Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

➤ **Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89**

No bypass is proposed in this project road. Following realignments have been proposed along project road:

- a) Major Realignment has been proposed from km 26/200 to km 26/700 as the existing road has a continuous sharp reverse curve with the poor sight distance
- b) Major Realignment has been proposed between km 26/800 to km 29/672 (Tisaiyanvillai village) to avoid very congested stretch along SH89, for which three alternative options has been studied and best suitable option has been selected based on technical aspect, environmental & social impact and economic feasibility.
- c) Minor Realignment has been proposed from km 0/550 to km 0/800 at village Nanguneri
- d) Minor Realignment has been proposed from km 24/100 to km 24/600 at village Mamnapuram

➤ **Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41**

There is no major realignment along the project road. Only seven horizontal curve improvements are proposed.

A bypass is already proposed for Sankarakovil 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 SH41.

Details of major realignments is presented in Chapter 6: Analysis of Alternatives

## 2.4 CULVERTS AND BRIDGES

The Bridge and culvert inventory of project roads was carried out to assess the existing condition and the hydrological adequacy. There are 48 culverts, 5 minor bridges and 1 causeway on Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44, 30 culverts and 4 causeways on Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 and 116 culverts, 0 major and 29 minor bridges on Rajapalayam - Sankarankoil – Tirunelveli, Section of SH41. Some additional culverts have been proposed depending on the hydrological requirements along project roads. A summary of improvement proposals for cross-drainage structures along project roads are given in Table 2-23, Table 2-24 and Table 2-25. Details of existing bridges and proposal along project roads are presented in Table 2-26, Table 2-27 and Table 2-28.



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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**Table 2-23: Improvement proposal for Cross Drainage structures along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44**

S. No.	Description	Number of Existing Structures	Number of retained and widened	Number of structures reconstructed	Number of new Structures Proposed
1	Pipe culverts < 900	1	-	-	-
2	Pipe culverts >= 900	24	21	-	-
3	Slab/arch culverts	21	10	16	-
4	Cut stone culverts	2	-	2	-
5	Additional Culvert				2 Box culvert
5	Causeway	1	-	-	1 (causeway converted into minor bridge)
6	Minor bridges	5	-	5	

Source: Detailed Project Report, Volume I

**Table 2-24: Improvement proposal for Cross Drainage structures along Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89**

S. No.	Description	Number of Existing Structures	Number of retained and widened	Number of structures reconstructed	Number of new Structures Proposed
1	Pipe culverts < 900	-	-	-	-
2	Pipe culverts >= 900	17	11	2	9
3	Slab/arch culverts *	12	6	5	2
4	Cut stone culverts	1	-	1	-
5	Additional Culverts				9 nos. box culverts 4 nos. pipe culverts
5	Causeway	4	-	-	4 (causeway converted into minor bridge)
6	Minor bridges	-	-	-	-

Source: Detailed Project Report, Volume I

**Table 2-25: Improvement proposal for Cross Drainage structures along Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41**

S. No.	Description	Number of Existing Structures	Number of retained and widened	Number of structures reconstructed	Number of new Structures Proposed
1	Pipe culverts < 900	13	-	12	-



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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

2	Pipe culverts >= 900	60	57	1	2
3	Slab/arch culverts *	34	32	1	1
4	Cut stone culverts	9	-	5	2
5	Additional culverts				5 nos. box culverts
<b>Total</b>		<b>116</b>		<b>113</b>	

Source: Detailed Project Report, Volume I

**Table 2-26: Details of Existing Bridges and Proposal along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44**

S. No	Existing Pwd. No.	Existing Chainage	Design Chainage	Existing Arrangement of span (No. x Span)	Proposed Arrangement of span (No. x Span)	Recommendation
1	24/2	23/982	24/036	8x1.6	3x6.0	Reconstruction
2	-	35/200	35/458	10x0.9	1x36.0 (c/c Brg.)	Reconstruction due Vented Causeway (New minor bridge)
3	49/1	48/313	48/214	6x 2.5	2x6.0	Reconstruction
4	49/3	48/886	48/811	3 x 2.5	2x4.0	Reconstruction
5	53/2	52/200	52/162	3x6.5	3x6.0	Reconstruction
6	55/1	54/200	54/256	2x3.3	2x6.0	Reconstruction

Source: Detailed Project Report, Volume I

**Table 2-27: Details of Existing Bridges and Proposal along Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89**

S. No	Existing Pwd. No.	Existing Chainage	Design Chainage	Existing Arrangement No. x Span (m)	Proposed Arrangement No. x Span (m)	Recommendation
1	-	4/500	4/451	-	3x6.0	New Minor Bridge (Existing Causeway)
2	-	11/121	11/165	4x1.6	3x6.0	New Minor Bridge (Existing Vented Causeway)
3	-	13/610	13/607	-	2x6.0	New Minor Bridge (Existing Causeway)
4	-	26/300	26/287		1x 36.0 c/c Brg.	New Minor Bridge (Existing Causeway)

Source: Detailed Project Report, Volume I





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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**Table 2-28: Details of Existing Bridges and Proposal along Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41**

S. No	Existing Chainage (km)	Design Chainage (km)	Proposed Outer to Outer width (m)	Proposed minimum Water Way (m)	Proposed Span No x Span (m)	Remarks
1.	3/750	3/701	12	12.0	2 x 6	Reconstruction
2.	6/580	6/538	12	12.0	2 x 6	Reconstruction
3.	19/800	19/810	12	53.6	2 x 28 c/c Brg.	Reconstruction
4.	20/493	20/512	12	12.0	2 x 6	Reconstruction
5.	23/165	23/199	12	18.0	3 x 6	Reconstruction
6.	25/980	25/971	12	12.0	2 x 6	Reconstruction
7.	41/358	41/422	14.8	18.0	3 x 6	Reconstruction
8.	58/416	58/442	14.8	12.0	2 x 6	Reconstruction
9.	82/253	82/280	14.8	12.0	2 x 6	Reconstruction
10.	12/500	12/453	12.0	47.1	3x7.4+3 x 8.3	Retained and widening
11.	14/270	14/225	12.0	6.2	1 x 6.2	Retained and widening
12.	18/275	18/275	12.0	8.2	1 x 8.2	Retained and widening
13.	18/410	18/423	12.0	25.2	3 x 8.4	Retained and widening
14.	18/590	18/580	12.0	14.6	2 x 7.3	Retained and widening
15.	38/440	38.500	14.8	8	1 x 8.0	Retained and widening

Source: Detailed Project Report, Volume I

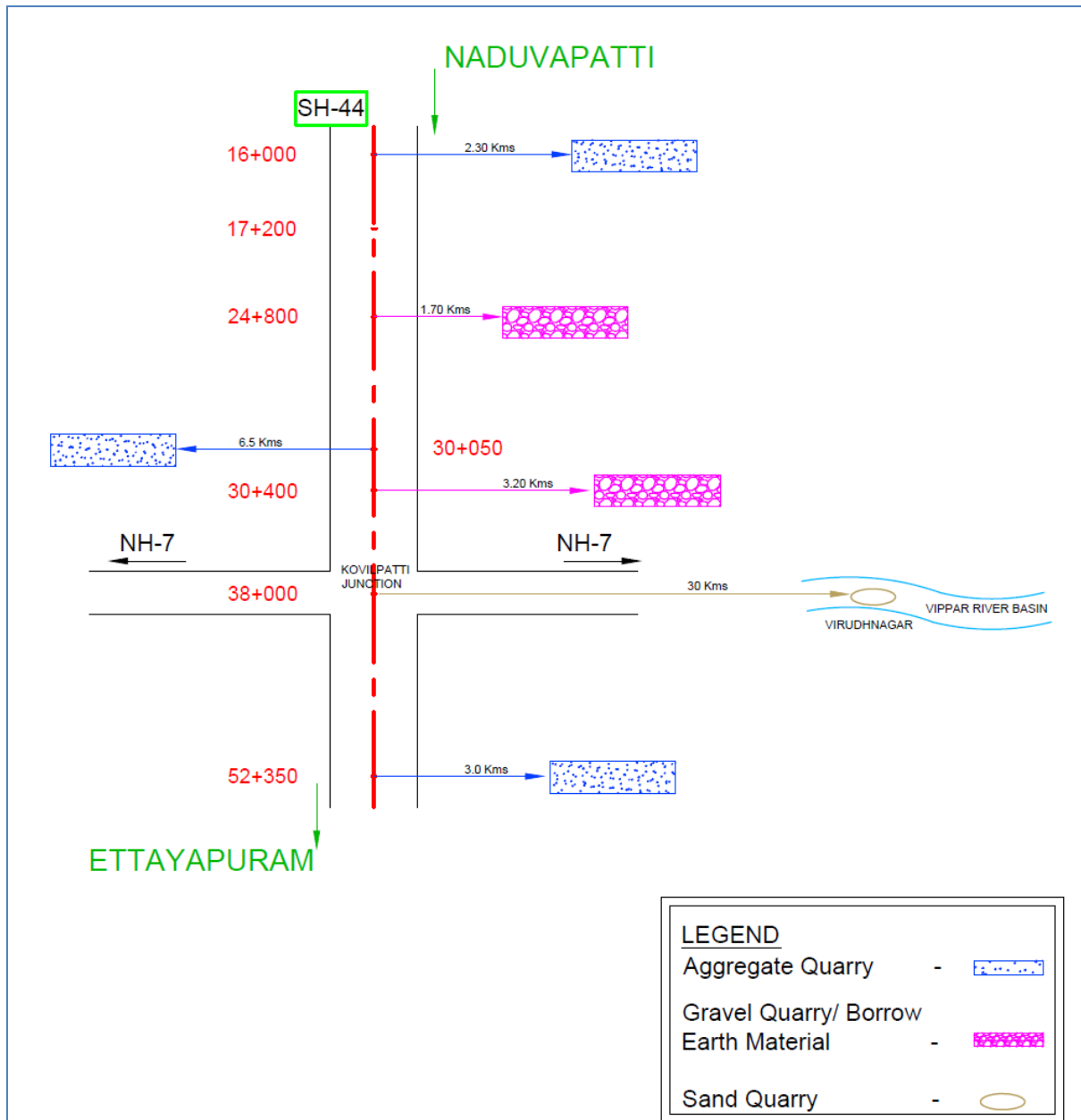
## 2.5 IDENTIFICATION OF BORROW AREAS

The information about existing stone Quarries, Moorum Quarries/ Borrow pits, Sand Quarries was collected from local PWD Divisional Offices and Sub divisional Offices, local construction contractors and local material suppliers throughout the project area, from other sources and from direct observation and by site visits. Location maps and type of material available in each project road were also collected and produced. The suitability of the materials sources is evaluated based on laboratory testing. After analysing the suitability of those material sources quantitatively and qualitatively, the lead chart is prepared.

The location details of borrow area, sand and stone quarry map along project roads are shown in lead chart in Figure 2-6, Figure 2-7 and Figure 2-8.



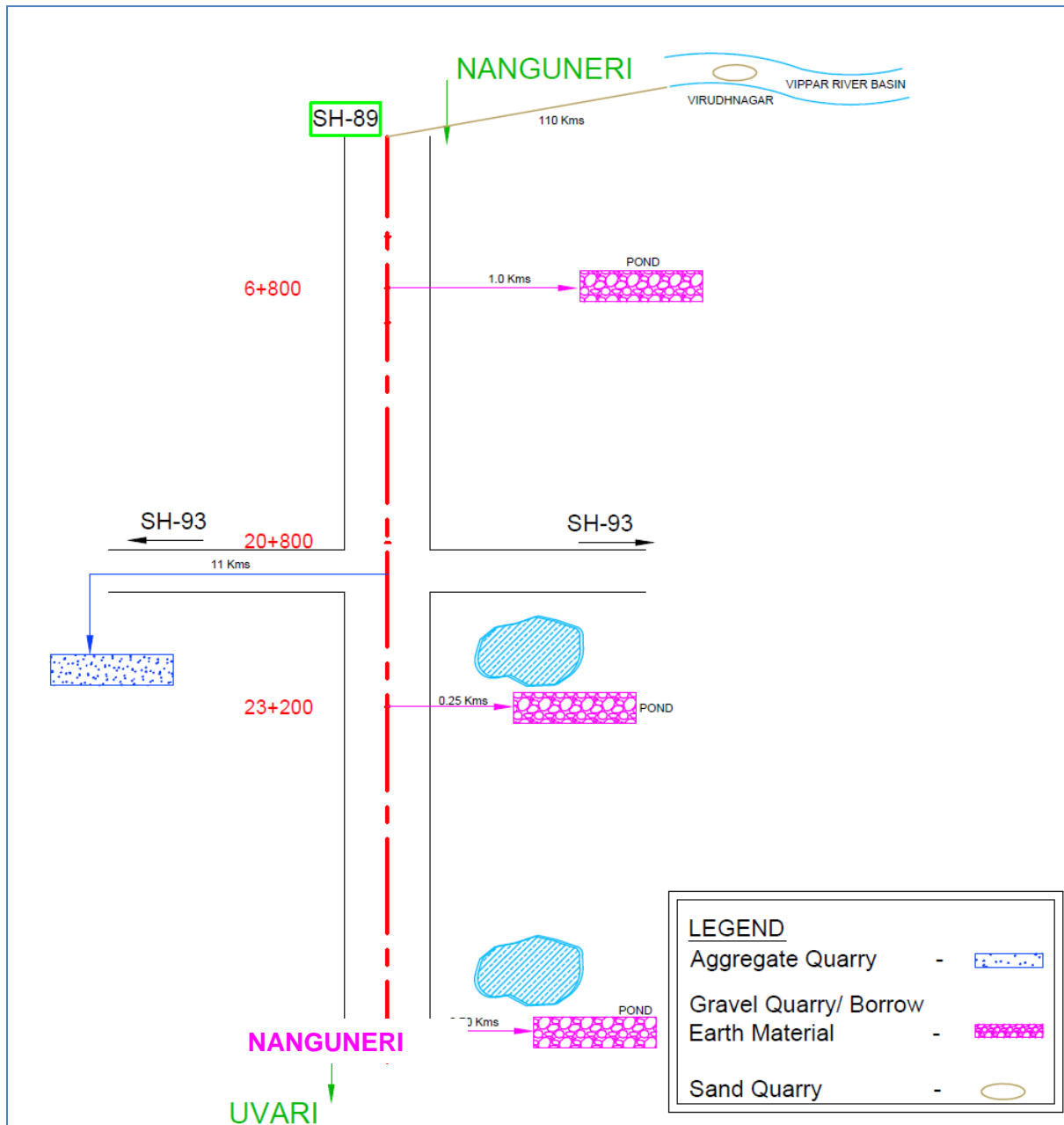
**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41**



**Figure 2-6: Location of Borrow area for gravel and Stone quarry on Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44**

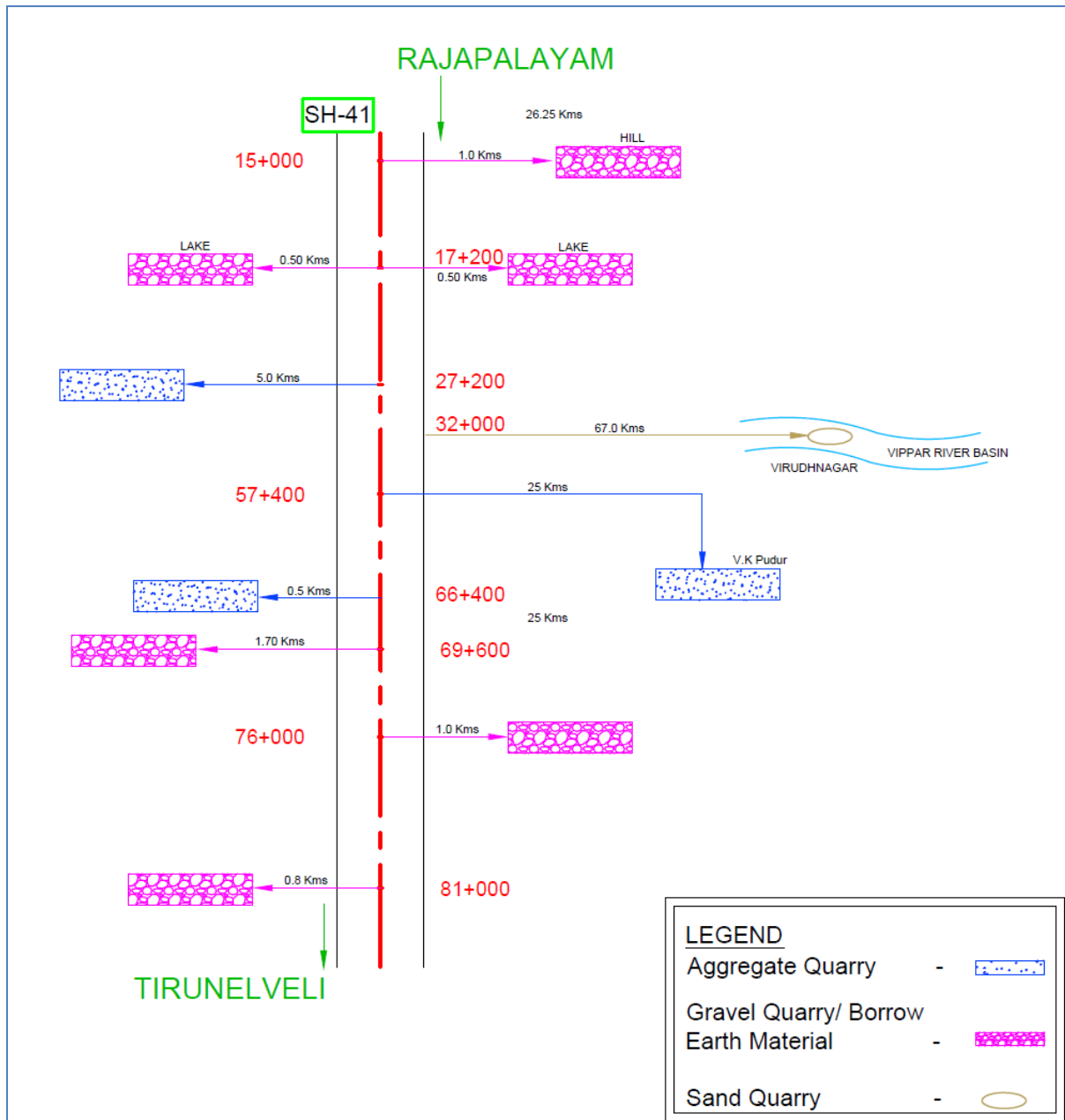


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**Figure 2-7: Location of Borrowarea for gravel and Stone quarry on Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89**

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**Figure 2-8: Quarry and Borrow Lead Chart for Rajapalayam-Sankarankoil-Tirunelveli section of SH-41**

The management of above mentioned aggregate and quarries will be done as per guidelines for aggregate quarry management provided in Appendix 8.2. Also, it is to be noted that no child labor will be involved in road works. (Refer Appendix 8.15: Worker’s Safety during construction)

**2.6 GEOTECHNICAL INVESTIGATIONS**

Geotechnical investigations are carried out at all bridge locations along project roads to explore subsurface conditions by drilling boreholes to different depths in order to identify the



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thickness and sequences of various strata and to ascertain the sub surface profile of soils and bed rock to determine the most suitable foundation levels of structures.

## 2.7 HYDRAULIC AND HYDROLOGICAL INVESTIGATIONS

All the hydraulic data for bridges has been collected from the field and it has been analyzed and studies carried out to determine the adequacy of waterway of the existing bridges proposed to be retained and new bridges to be constructed as per provisions of IRC:5-1998 and IRC: SP-13. 50 year return flood was considered.

## 2.8 ROAD SAFETY REVIEW

The basic aim for road safety review is to identify areas of major concern, including black spots and accident-prone stretches on project road and to propose measures to be taken for improving the engineering design with respect to road safety aspects.

Consultant have carried out a detailed reconnaissance along the project roads and identified areas of major concern, including black spots and accident-prone stretches on each project roads.

Following measures have been taken up for improve the traffic safety:

- i. Geometric Design Aspects
- ii. Design of Intersections
- iii. Traffic Control Devices and Road Safety Features
- iv. Roadside furniture
- v. Roadside facilities
- vi. Traffic management during construction

### 1. Geometric Design Aspects

All geometric design elements have been carried out as per design standards stipulated for project in consonance with IRC codal provisions. Comprehensive design standards, which link individual design elements to best estimates of actual speed have been utilised. The emphasis has been given on maintaining continuity or giving adequate warning where it could not be made.

Following realignment locations have been identified to improve the horizontal geometrics of the project road.

**Table 2-29: Realignment Sections along Project Roads**

Project road	Chainage		Length (km)	Reason for Realignment
	From (km)	To (km)		
Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44	24/430	24/605	0.18	Curve Improvement
	26/200	26/350	0.15	To avoid impact on built up area
	30/100	30/200	0.10	Curve Improvement
	35/220	35/600	0.38	Passing through Ayyaneri village. The



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

Project road	Chainage		Length (km)	Reason for Realignment
	From (km)	To (km)		
				existing alignment has a continuous sharp reverse curve with the poor sight distance.
Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89	0/550	0/800	0.25	Curve Improvement
	24/100	24/600	0.5	Curve Improvement
	26/200	26/700	0.5	This stretch has continuous sharp reverse curve with the poor sight distance.
	26/800	29/672	2.872	Passing through built up area in Tisaiyanvilai village
Rajapalayam-Sankarankoil-Tirunelveli section of SH-41	16/850	17/250	0.40	Curve Improvement
	25/050	25/400	0.35	Curve Improvement
	34/450	34/600	0.15	Curve Improvement
	41/380	41/780	0.40	Curve Improvement
	50/620	50/880	0.26	Curve Improvement
	50/980	51/300	0.32	Curve Improvement
	70/950	71/150	0.20	Curve Improvement

Source: Detailed Project Report, Volume I

Following embankment raising locations have been identified to improve the vertical geometrics and submergence locations along the project road.

**Table 2-30: Stretches requiring Embankment raising along the Project Roads**

Start Chainage (km)	End Chainage (km)	Approx. Length (m)	Raising Height (m)	Reason/ remarks
<b>Road: Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44</b>				
23/960	24/100	140	0.6	Dip portion, to be raised
25/900	25/960	60	0.6	Dip portion, to be raised
26/320	26/480	160	1	Water on road during rain
27/520	27/620	100	0.6	Road flushing with ground levels
29/560	29/760	200	0.6	Road flushing with ground levels
35/280	35/520	240	2	Causeway location
48/720	48/820	100	0.6	Dip portion, to be raised
<b>Road: Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89</b>				
0/700	0/800	100	0.6	Road level almost flushing with ground and water flow above road
5/880	5/960	80	0.6	Road at ground level and water from hills come to the road
8/200	8/600	400	0.6	Water gets accumulated near to the road
12/700	13/300	600		Water gets stagnated all the time on left





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Start Chainage (km)	End Chainage (km)	Approx. Length (m)	Raising Height (m)	Reason/ remarks
			0.6	side
26260	26/500	240	2.0	Causeway location
32/600	33/060	460	0.6	Road flushes with the ground and water stagnant on the side
16/100	16/200	100	0.6	Road flushing with ground levels and dip portion
18/400	18/650	250	0.6	Road flushing with ground levels and dip portion
<b>Road: Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41</b>				
19/500	19/700	200	0.6	Dip portion, to be raised
72/100	72/600	500	0.6	Road flushing with ground levels
74/000	74/300	300	0.6	Road flushing with ground levels

Source: Detailed Project Report

## Design Speed

Design speed is the basic parameter, which governs the geometric characteristics of the road. It is related to the function of the road and terrain conditions. Design speeds, based on the function of the road and terrain condition, as per IRC: 73-1980 for urban areas is followed. The speed adopted for the project roads are given in Table 2-30.

**Table 2-31: Adopted Design Speed**

Project Road	Design Speed (km/h)	
	Rural (Maximum)	Urban (Maximum)
Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44	80	65
Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89	80	65
Rajapalayam-Sankarankoil-Tirunelveli section of SH-41	80	65

Source: Detailed Project Report, Volume I

## 2. Design of Intersections

Accident data reveals number of accidents at intersection account for almost 30 -40% of all reported road accidents in India. During the detailed design proposal, all major and minor junctions have been studied thoroughly with respect to traffic volume and geometric. The important minor junctions leading to villages and major settlements have been identified and proper junction layouts (including road markings and traffic signs) have been applied as per



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IRC-SP: 41-1994. The major and minor junction proposal along the project roads are as follows:

**Table 2-32: Junction proposals along Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44**

Sl. No.	Existing Chainage (km)	Design Chainage (km)	Type of Junction (+,T,Y)	Cross Road leads to
<b>MAJOR JUNCTIONS</b>				
1	22/530	22/535	T	Sivakasi (MDR)
2	56/750	56/770	Y	Madurai (NH)
<b>MINOR JUNCTIONS</b>				
1	29/940	29/850	T(RHS)	Renugadeviellammalkovil
2	30/070	30/000	X(BOTH)	Panyauthu,Aandipatty
3	31/500	31/405	T(RHS)	Vengadachalapuram
4	31/775	31/690	T(LHS)	Vinayaka Nagar
5	31/855	31/770	T(LHS)	Layoutarea
6	33/155	34/090	T(LHS)	Puliyangudi
7	36/140	36/020	Y(RHS)	Aiyyaneri
8	36/290	36/170	T(RHS)	Supanagar
9	36/525	36/405	T(LHS)	Pudu Appalari
10	37/370	37/275	T(RHS)	House
11	37/415	37/310	T(LHS)	House
12	38/260	38/155	T(LHS)	Appanery
13	41/770	41/657	X(BOTH)	To Railway Station, To Jothinagar
14	41/915	41/800	T(LHS)	Kovilpatti
15	43/690	43/570	X(BOTH)	Pallakknagar
16	44/410	44/300	T(LHS)	To Pond
17	46/875	46/765	T(RHS)	Local
18	46/945	46/835	T(LHS)	Kalugsala Puram
19	48/100	48/000	T(LHS)	Sidhambarapuram
20	51/155	51/125	T(RHS)	Kulathuvapatti
21	51/745	51/705	X(RHS)	Matha Puram
22	52/190	52/180	X(BOTH)	To Jamin Usilampatti,To Kelamwalam
23	52/340	52/335	T(LHS)	To Ragul Plant
24	53/725	53/750	T(LHS)	To Ladies Hostel
25	54/245	54/280	X(RHS)	Street Road
26	54/320	54/360	T(RHS)	Iraatchi
27	54/400	54/440	T(RHS)	Iraatchi
28	54/660	54/700	Staggered(BOTH)	To Kadalayuar,To Bazaar
29	54/975	55/040	T(LHS)	To Govt Office
30	55/730	55/780	T(RHS)	Street
31	56/060	56/020	T(LHS)	To Madhurai



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Sl. No.	Existing Chainage (km)	Design Chainage (km)	Type of Junction (+,T,Y)	Cross Road leads to
32	56/330	56/385	T(RHS)	Street Road
33	56/360	56/415	T(RHS)	Street Road

Source: Detailed Project Report, Volume I

**Table 2-33: Junction proposals along Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89**

Sl. No.	Existing Chainage (km)	Design Chainage (km)	Type of Junction (+,T,Y)	Cross Road leads to
<b>MAJOR JUNCTIONS</b>				
1	0/280	0/350	Y (MDR – 292)	Moolakaraipati
2	20/735	20/720	X (SH – 93)	Saathangulam, Valliyur
3	26/884	26/800	Y (SH -Start of Bypass)	Thisayanvilai
4	30/295	29/672	Y (SH-End of Bypass)	Thisayanvilai
5	35/160	34/880	X (SH – 176)	Thirusanthuir, Kaniyakumari
<b>MINOR JUNCTIONS</b>				
1	0/000	0/000	T(BOTH SIDE)	Nanguneri, Kanniakumari
2	2/225	2/200	T(LHS)	Thattankulam
3	2/680	2/640	Y(LHS)	Eraippuvare
4	2/724	2/680	Y(LHS)	Eraippuvare
5	2/810	2/780	Y(LHS)	Eraippuvare
6	3/258	3/300	Y(LHS)	Melekaranagar
7	3/646	3/700	T(LHS)	Perumal Nagar
8	4/060	4/020	T(RHS)	Perumal Nagar
9	4/560	4/530	T(LHS)	Karangardh
10	4/820	4/800	T(RHS)	Pattarpuram
11	5/227	5/200	Y(RHS)	Kamarajar
12	5/725	5/700	T(RHS)	Pudhukulam
13	5/825	5/800	T(LHS)	Aamankulam
14	6/802	6/800	T(LHS)	Poteyer
15	8/086	8/100	Y(RHS)	Therkkukariyakulam
16	8/185	8/400	T(LHS)	Aalangulam
17	9/084	9/100	T(RHS)	Parpanathapuram
18	9/652	9/680	Y(LHS)	Sivagurunadar
19	9/797	9/815	Y(LHS)	Post Office
20	10/165	10/200	STAGGERED	Paapankulam, Veppankulam
21	11/448	11/200	T(RHS)	SITUR VILL.
22	12/515	12/575	Y(RHS)	Kakan Nagar
23	12/615	12/650	T(LHS)	Andu Nagar



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 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Sl. No.	Existing Chainage (km)	Design Chainage (km)	Type of Junction (+,T,Y)	Cross Road leads to
24	13/603	13/650	T(LHS)	Wadakuvijay Nagar
25	14/920	14/980	Y(LHS)	Vijayanagaram
26	15/104	15/150	Y(LHS)	Vijayanarayanam
27	15/320	15/350	Y(LHS)	Santhanamkulam
28	16/628	16/650	Y(LHS)	Malayankudiyiruppu
29	19/012	19/000	X(BOTH SIDE)	Sanganagulam, Temple
30	22/725	22/700	Y(LHS)	Rajivgandhinagar
31	23/495	23/500	STAGGERED	Nallandhala,Vazhithootam
32	24/837	24/800	Y(LHS)	Kumarapuram
33	25/600	25/500	T(RHS)	Ratha Nagar
34	26/085	26/050	T(RHS)	NanthanKulam
35	26/348	26/300	Y(LHS)	MahathevanKulam
36	30/300	30/000	Y(RHS)	Silver city
37	30/354	32/150	Y(RHS)	Silver city
38	31/421	31/110	Y(LHS)	Edeychi Village
39	31/850	31/550	T(LHS)	Upachambad
40	31/932	31/610	T(RHS)	Street
41	32/389	32/100	X(RHS)	Kuttam,Aanikudi
42	33/000	32/700	Y(LHS)	Local

Source: Detailed Project Report, Volume I

**Table 2-34: Junction proposals along Rajapalayam-Sankarankoil-Tirunelveli section of SH-41**

Sl. No.	Existing Chainage (km)	Design Chainage (km)	Type of Junction (+,T,Y)	Cross Road leads to
<b>MAJOR JUNCTIONS</b>				
1	17/260	17/220	T (SH-44)	Paruvakkudi
2	57/670	58/660	T (ODR)	Devarkulam
3	82/790	82/800	Y (SH-U 41)	To Madurai
<b>MINOR JUNCTIONS</b>				
1	2/025	2/000	Staggered(BOTH)	Karunkulam,Anna Nagar
2	4/210	4/160	T(LHS)	Kothainachiarapuram
3	4/520	4/480	T(RHS)	Street
4	5/274	5/200	T(LHS)	Ramalingapuram
5	5/474	5/420	T(RHS)	Mudukudi
6	6/594	6/540	T(RHS)	Desigapuram
7	7/436	7/400	T(RHS)	Local
8	9/828	9/800	X(BOTH)	Murambu, Asaipuram
9	10/920	10/860	T(LHS)	Street



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 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Sl. No.	Existing Chainage (km)	Design Chainage (km)	Type of Junction (+,T,Y)	Cross Road leads to
10	11/325	11/260	T(RHS)	Mangudi
11	11/702	11/640	T(RHS)	Permalpatti
12	12/152	12/080	T(RHS)	Street
13	12/205	12/140	Y(LHS)	Street
14	12/810	12/700	T(LHS)	Street
15	12/830	12/740	T(RHS)	Panthappuli
16	13/0005	12/960	T(RHS)	To College
17	14/409	14/360	T(RHS)	Senthattayar Puram
18	15/424	15/360	T(LHS)	Rettiyapatti
19	17/020	16/980	T(RHS)	Shivagiri
20	17/258	17/220	T(LHS)	Paruvakuddi
21	18/068	18/060	T(LHS)	Paruvakkudi
22	19/578	19/580	T(LHS)	Pacheri
23	20/338	20/340	T(RHS)	Rajagiri
24	20/795	20/800	T(LHS)	Street
25	21/400	21/400	Y(RHS)	Paniyur
26	22/047	22/080	T(LHS)	Sennikulam
27	23/507	23/580	Y(LHS)	Alagunachiya
28	24/367	24/440	T(RHS)	Ramalinga Puram
29	26/078	26/100	T(LHS)	Manalour
30	27/115	27/160	X(BOTH)	Oppanaiyal Puram,Vadikottai
31	35/876	35/960	T(LHS)	Nedunkulam
32	37/325	37/380	Y(RHS)	Street
33	38/480	38/540	Staggered(BOTH)	Reddiarpatty,Alankulam
34	40/195	40/260	T(RHS)	Street
35	40/570	40/640	T(LHS)	Reddiyapaati
36	41/170	41/220	Y(LHS)	Ilanthaikulam
37	40/590	41/640	T(LHS)	Melaneelithanallur
38	42/210	42/260	Y(RHS)	Kalathikulam
39	45/665	45/710	T(RHS)	To Thirumalapuram
40	45/990	46/030	Y(LHS)	To Ayalpatti
41	47/475	47/920	T(RHS)	To Annaimalai Pudur
42	48/037	48/080	Y(LHS)	To Kazhugu Malai
43	48/320	48/340	T(RHS)	To Panavadali Chathiram
44	49/200	49/210	T(RHS)	Local
45	49/915	49/965	T(RHS)	To Panavadali Chathiram
46	50/495	50/470	T(LHS)	To Narikutty Vilakku
47	52/980	52/995	T(RHS)	To Mesiya Puram
48	54/480	54/500	T(LHS)	To Kazhugu Malai



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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Sl. No.	Existing Chainage (km)	Design Chainage (km)	Type of Junction (+,T,Y)	Cross Road leads to
49	54/575	54/600	T(LHS)	Street
50	56/250	56/260	T(RHS)	To Adaikalapuram
51	57/667	57/695	T(LHS)	To Devar Kulam
52	58/200	58/227	T(RHS)	Local
53	54/408	58/435	T(RHS)	To Muthu Malai
54	60/340	60/370	T(RHS)	To Suppaiya Puram
55	61/805	61/840	Staggered(BOTH)	To Maruthapuram
56	62/035	62/060	Y(LHS)	To Kanthaswamipuram
57	63/800	63/780	T(LHS)	To Erandam Sollan
58	64/285	64/260	Y(RHS)	To Ukkiram Kottai
59	64/695	64/670	T(LHS)	To Vadakku Slinganallur
60	65/790	65/770	Y(RHS)	Ayyanar Temple
61	67/027	67/010	Y(LHS)	Keela Pilaiyar Kulam
62	67/845	67/820	T(LHS)	Kanarpatti
63	69/600	69/600	T(RHS)	Sri Mahalakshmi Nagar
64	69/715	69/720	Y(LHS)	Pallikottai
65	69/758	69/760	T(LHS)	Local
66	69/990	69/980	T(RHS)	Manur
67	70/680	70/670	T(RHS)	To Thalanguadi
68	71/700	71/680	Staggered(BOTH)	To Kumthalaperi/ Ramaswamy Puram
69	72/180	72/160	T(LHS)	To Mavadi
70	73/035	73/025	T(RHS)	To Karambai
71	74/800	74/780	T(LHS)	To Thaalai
72	74/890	78/885	T(RHS)	To Madhavakuruchi
73	75/650	75/650	Y(LHS)	Local
74	76/710	76/710	T(RHS)	To Nariyuthu
75	78/805	78/820	Y(RHS)	To Sethurayan Pudur
76	80/230	80/245	Y(LHS)	Local
77	80/600	80/620	Y(RHS)	To Poorvika Nagar
78	81/100	81/120	Y(LHS)	To Thamarabharani Eng College
79	81/935	81/950	Y(RHS)	Local
80	82/217	82/240	Staggered(BOTH)	To Ramayan Patti

Source: Detailed Project Report, Volume I

### 3. Traffic Control Devices and Road Safety Features

Traffic control devices and road safety works shall be provided in accordance with Section 9 of the Manual.

**Traffic Sign Material:** High Intensity Micro-Prismatic Grade Sheeting (HIP) (Type IV) shall be provided





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

**Crash Barrier:** W-beam crash barrier shall be provided along the Project Highway at the identified road side ponds as per Section 9 of the Manual as a minimum.

**Transverse Rumble strip** shall be provided at the sensitive receptors (schools) as a minimum.

#### 4. Roadside Furniture

Roadside furniture shall be provided in accordance with the provisions of Section 11 of the Manual.

**Pedestrian Crossings** shall be provided at the junctions along the project roads as a minimum.

**Overhead traffic signs** shall be provided at start and end of project roads.

**Street Lighting** shall be provided as per the Manual at the locations of built-up areas as a minimum provision. If any other locations warrants provision of lighting it shall be provided in consultation with Authority's Engineer.

#### 5. Roadside Facilities

Following roadside facilities shall be provided along project roads:

- Bus Lay-byes
- Footpath

Bus Bays are provided at places where the bus stoppages are more (Near Urban areas). Bus stops are generally provided at road intersections and minor urban areas where the number of stoppages is minimum

Based on the ROW availability, a total of 19 bus bays are proposed along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44.

**Table 2-35: Bus Bay location for Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44**

S.No.	Existing Chainage (km)	Design Chainage (km)	Side	Village Name
1	22/630	22/625	LHS	Naduvapatti
2	24/620	24/620	LHS	Mukkutumalai
3	26/220	26/190	LHS	Sippiparai
4	26/290	26/350	RHS	Sippiparai
5	30/143	30/150	LHS	Ilayarasanendhal
6	30/350	30/450	RHS	Ilayarasanendhal
7	36/204	36/085	LHS	College
8	36/395	36/275	RHS	College
9	44/790	44/675	RHS	Thittangulam
10	46/810	46/700	RHS	Kazhukasalapuram
11	47/010	46/910	LHS	Kazhukasalapuram
12	48/010	47/910	RHS	Chidambarapuram



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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S.No.	Existing Chainage (km)	Design Chainage (km)	Side	Village Name
13	48/186	48/090	LHS	Chidambarapuram
14	51/014	50/970	RHS	Kumaragiri
15	51/245	51/210	LHS	Kumaragiri
16	52/417	52/410	LHS	Ilambuvanam
17	52/742	52/735	RHS	Ilambuvanam
18	53/230	53/250	LHS	Ettaiyapuram (Polytec. College)
19	53/387	53/410	RHS	Ettaiyapuram (Polytec. College)

Source: Detailed Project Report, Volume I

A total of 18 bus bays are proposed along Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89

**Table 2-36: Bus Bay location for Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89**

S. No.	Existing Chainage (km)	Design Chainage (km)	Side	Village Name
1	0/216	0/230	LHS	Tattankulam
2	2/138	2/110	LHS	Eraippuvare
3	3/962	3/925	LHS	Perumalnagar
4	4/150	4/110	RHS	Perumalnagar
5	5/910	5/890	LHS	Ammankulam
6	8/207	8/205	LHS	Supramanyapuram
7	9/090	9/105	LHS	Parapanathapuram
8	10/704	10/740	LHS	Parapadi
9	10/774	10/810	RHS	Parapadi
10	11/995	12/035	LHS	Kamarajnagar
11	12/170	12/210	RHS	Kamarajnagar
12	13/365	13/410	LHS	INS Kattabomman
13	13/415	13/460	RHS	INS Kattabomman
14	22/430	22/410	RHS	Ariel Nagar
15	23/575	23/555	RHS	Nalandala Junction
16	23/590	23/570	LHS	Nalandala Junction
17	25/097	25/055	LHS	Indranagar
18	25/150	25/110	RHS	Indranagar

Source: Detailed Project Report, Volume I

Along the project road section of SH41, 68 no. of bus bays are proposed.

**Table 2-37: Bus Bay location for Rajapalayam-Sankarankoil-Tirunelveli Road section of SH-41**

S. No.	Existing Chainage (km)	Design Chainage (km)	Side	Village Name
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 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

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



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

S. No.	Existing Chainage (km)	Design Chainage (km)	Side	Village Name
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
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	-

Source: Detailed Project Report, Volume I

### Truck Lay-bye

The following procedure was adopted in locating the truck lay-bye:

- Surveys were carried out to identify the places where the trucks are regularly parked along the project roads. These places are usually near check posts, petrol bunks, town approaches, major Industries and restaurants/dhabas and at locations where truck repair facilities were available. Rural sections of highway merely have any such locations.
- There were no specific parking places for trucks along the project roads. This situation makes the truck drivers park vehicles at various locations in disorder which causes congestion for smooth flow of traffic particularly at town approaches.
- Local consultations were held at the places of petty repair shops, restaurants/dhaba etc. and subjective opinion of the drivers regarding necessity of truck lay-bay was gathered.



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The scenario of existing truck traffic on State Highways is entirely different from that on National Highways as only limited number of vehicles ply on the project roads from time to time and this trend changes during different seasons.

Survey details reveal that there is no existing truck lay bye along project roads. Also, no truck lay bye is proposed along project roads.

### Proposal for Underpasses

There is no proposal for pedestrian, cattle and vehicular underpass.along the project roads

### Footpath Locations:

Footpath has been proposed in on both sides in built up areas along the project roads. The location details are as follows:

**Table 2-38 : Footpath Locations along Project roads**

S. No.	Existing Chainage (km)		Proposed Chainage (km)		Length (m)	Location of Builtup area
	From	To	From	To		
<b>Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44</b>						
1.	27/404	27/715	27/230	27/530	300	Nakkalamuthanpatty
2.	30/202	30/606	30/110	30/510	400	Ilayarasendal
3.	41/312	42/600	41/170	42/470	1300	Kovilpatti
4.	42/600	43/020	42/470	42/900	430	Kovilpatti
5.	43/020	44/675	42/900	44/560	1660	Thittangulam
6.	54/600	56/048	54/440	56/100	1660	Ettayapuram
<b>Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89</b>						
1.	20/665	20/990	20/660	20/970	310	Mannarpuram
<b>Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41</b>						
1.	9/390	9/550	9/340	9/500	160	-
2.	9/550	9/700	9/500	9/640	140	-
3.	9/700	10/040	9/640	9/970	330	-
4.	19/890	19/980	19/940	20/020	80	Karivalmvanthanallur
5.	20/000	20/590	20/020	20/590	570	Karivalmvanthanallur
6.	40/835	41/370	40/900	41/380	480	Grukkalpatty
7.	41/370	41/400	41/380	41/450	70	Grukkalpatty
8.	47/650	48/035	47/700	48/100	400	Panavadalichathiram
9.	53/855	54/855	53/900	54/900	1000	Vannikonthal
10.	57/593	58/620	57/620	58/650	1030	Devarkulam
11.	63/987	64/675	63/950	64/650	700	Azhagiypandipuram
12.	70/010	70/030	70/000	70/020	20	Manur
13.	70/030	70/970	70/020	70/960	940	Manur
14.	70/970	71/040	70/960	71/030	70	Manur



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Source: Detailed Project Report, Volume I

**6. Traffic management during reconstruction:** The stretches where the existing road is proposed to be re-graded up-to 1m depth by cutting the existing road, the existing road shall be used partly for traffic during construction with required improvement and safety measures as per the Manual.

All other stretches, where the re-grading of existing profile involves more than 1m cutting, diversion shall be provided as per the Manual

## 2.9 ROAD CONSTRUCTION STANDARDS, NORMS AND GUIDELINES

The design standards and specifications were evolved at the commencement of the project preparation. IRC and MoRTH standards and specifications used in the detailed design are listed in the Table 2.39. Modification of IRC design guidelines has been attempted to better tailor the design to specific site conditions in areas such as the application of super elevation for reverse curves, back to back curves in adapting minimum and longitudinal gradients, etc.

**Table 2-39: List of Design Standards and Specifications**

S.No.	Number designation	Title of Standards
1.	IRC: 73-1980	Geometric Design Standard for Rural (Non-urban) Highways
2.	IRC SP:23-1983	Vertical curves for Highways
3.	IRC SP: 41-1994	Guidelines on Design of At-grade intersections in Rural and Urban Areas
4.	IRC: 64-1990	Guidelines for capacity of Roads in Rural Areas
5.	IRC: 106 – 1990	Guidelines for capacity of urban roads in plain areas
6.	IRC SP:15 – 1996	Ribbon Development along Highways and its prevention.
7.	IRC: 62-1976	Guidelines for control of Access on Highways
8.	IRC:35-1997	Code of Practice for Road Markings (First Revision)
9.	IRC: 52-2001	Recommendations about the Alignment Survey and Geometric Design of Hill Roads (Second Revision).
10.	IRC: 66-1976	Recommended Practice for Sight Distance on Rural Highways
11.	IRC: 38-1988	Guidelines for Design of Horizontal curves for Highways and Design Tables (First Revision)
12.	IRC:25-1967	Typical Design for Boundary Stones
13.	IRC:79-1981	Recommended Practice for Road Delineators
14.	MOST- 1992	Typical Designs for Intersections on National Highways
15.	IRC: 80 – 1981	Typical Designs for Bus stops on Rural (i.e., Non-urban) Highways.
16.	IRC: 67 – 2001	Code of Practice for Road Signs (First Revision)
17.	IRC: 31 – 1969	Route Marker Signs for State Routes
18.	IRC: 26 – 1967	Typical Design for 200 metre Stones
19.	IRC: 8 – 1980	Typical Designs for Highway Kilometre Stones (Second Revision)
20.	MoRTH 2001	MoRTH Specifications for Roads & Bridge works (2001) (Fourth Revision)
21.	IRC: 39 – 1986	Standard for Road Rail level crossings (First Revision)
22.	IRC: 99 – 1988	Tentative Guide lines on the provision of speed breakers for control of vehicles speeds on minor roads.
23.	IRC: 30 – 1968	Standard letters and numerals of different heights for use on Highway Signs.





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S.No.	Number designation	Title of Standards
24.	IRC: 54 – 1974	Lateral and vertical clearance at underpasses for vehicular traffic.
25.	MOST – Sep 1998	Manual for Safety in Road Design.
26.	IRC: 58 – 2002	Guideline for Design of Rigid Pavement
27	IRC: 101 – 1988	Guideline for Design of Continuous Reinforced Concrete Pavement (CRCP)

## 2.10 PROJECT COST

The total estimated project cost for **Naduvapatti - Kovilpatti - Ettayapuram Road (Km 22/400 to Km 56/100), SH44** is about INR 182.7 Crore (Cr), for **Nanguneri - Bharatavaram -Ovari Road (Km 0/000 to Km 36/030) upto ECR Junction, SH89** is INR 163.9 Cr and for **Rajapalayam-Sankarankoil – Tirunelveli, SH 41** is INR 354.2 Crores. The tentative EMP budget which includes the mitigation and enhancement measures for all three project roads is approximately INR 15.0 Cr.



## **CHAPTER 3**

### **ENVIRONMENTAL REGULATORY FRAMEWORK**



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### 3 ENVIRONMENTAL REGULATORY FRAME WORK

#### 3.1 APPLICABLE REGULATIONS

This chapter presents the review of the existing institutions and legislations relevant to the environmental issues in this project at the national and state levels. The various statutory clearances from various state and central government authorities and the institutional and legal frameworks are discussed in the following paragraphs.

##### 3.1.1 Legal Framework of Government of India

The Government of India has laid out various policy guidelines, acts and regulations pertaining to sustenance of environment. The Environment (Protection) Act, 1986 provides umbrella legislation for the protection of environment. As per this Act, the responsibility to administer the legislation has been jointly entrusted to the Central Ministry of Environment, Forests and Climate Change (MoEF & CC) and the Central Pollution Control Board (CPCB) / State Pollution Control Board (SPCB). More details on the legal framework of Government of India and State Government regulations and clearance procedures are envisaged in the following paragraphs.

##### 3.1.2 Key Environmental Laws and Regulations

The lists of most relevant Government of India regulations are provided in the **Table 3-1**.

**Table 3-1 : Environmental Legal Framework as per GoI**

Sl.No	Act/Rules	Year	Objective	Applicable Yes/No	Reason for applicability	Authority
1.	Environmental (Protection) Act	1986	To protect and improve overall environment	Yes	As all environmental notifications, rules and schedules are issued under this act.	MoEF & CC. GoI; DoE, State Gov. CPCB; SPCB
2.	Environmental Impact Assessment (EIA) Notification	2006	To provide environmental clearance to new development activities following environmental impact assessment	No	This notification is NOT applicable to all the three Project roads, as they do not attract the conditions of obtaining prior environmental clearance as per the Notification.	MoEF & CC. SEIAA



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SI.No	Act/Rules	Year	Objective	Applicable Yes/No	Reason for applicability	Authority
3.	Forest (Conservation) Act	1980	To check deforestation by restricting conversion of forested areas into non-forested areas	No	The project roads do not pass through forest land.	Forest Department, GoTN
4.	MoEF & CC circular on linear Plantation on roadside, canals and railway lines modifying the applicability of provisions of forest (Conversation) Act, to linear Plantation	1998	Protection / planting roadside strip as avenue/strip plantations as these are declared protected forest areas.	No	Roadside tree plantation in Tamil Nadu does not come under the forest act.	MoEF & CC
5.	Water (Prevention and Control of Pollution) Act and Cess Act of 1977 as amended in 1988	1974	To control water pollution by controlling emission & Water pollutants as per the prescribed standards	Yes	This act will be applicable during construction for (establishments of hot mix plant, construction camp, workers' camp, etc.	SPCB
6.	Air (Prevention and Control of Pollution) Act as amended in 1987	1981	To control air pollution by controlling emission and air pollutants according to prescribed standards	Yes	This act will be applicable during construction; for obtaining NOC for establishment of hot mix plant, workers' camp, construction camp, etc.	SPCB



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SI.No	Act/Rules	Year	Objective	Applicable Yes/No	Reason for applicability	Authority
7.	Noise Pollution (Regulation and Control) rules 2000	2000	Noise pollution regulation and controls	Yes	This act will be applicable as vehicular noise on project routes required to assess for future years and necessary protection measure need to be considered in design.	SPCB
8.	Biological Diversity Act	2002	To provide mechanism for equitable sharing of benefits arising out use of traditional biological resources and knowledge		Preserve Biological resources	
9.	Environmental (Protection) Act	1986	Eco sensitive zone around sanctaury	Yes	This act is applicable as Wildlife sanctuary fall within 10km radius from SH 89 and SH41 project road sections	Chief Conservator Wildlife, Wildlife Wing, Forest Department, GoTN
10.	Ancient Monuments and Archaeological sites & Remains Act	1959	Conservation of Cultural and Historical remains found in India	No	This act not applicable as the project routes are not close to any Ancient Monument, declared protected under the act.	Archaeological Dept. Gol, Indian Heritage Society and Indian National Trust for Art and Culture Heritage (INTACH).



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SI.No	Act/Rules	Year	Objective	Applicable Yes/No	Reason for applicability	Authority
11.	Notification for use of fly ash	2009	Promoting the utilization of fly ash in the manufacture of building materials and in construction activity within a specified radius of one hundred kilometers from coal or lignite based thermal power plants	Yes	Coal based Tuticorin Thermal Power Plant (2X500MW) located at Harbour Estate, Tuticorin fall within 100km radius of all the three project roads.	
12.	The Explosives Act (& Rules)	1884	An Act to regulate the manufacture, possession, use, sale, transport, import and export of Explosives	Yes	For transporting and storing diesel, bitumen etc.	SPCB
13.	Public Liability Insurance Act	1991	Protection form hazardous materials and accidents.	Yes	Contractor need to stock hazardous material like diesel, Bitumen, Emulsions etc.	SPCB
14.	Coastal Regulation Zone	2011	To regulate activities in the coastal zone to protect ecologically sensitive areas.	No	All the three project roads are far away from coast line	SCZMA, MoEF & CC
15.	Hazardous Wastes (Management, Handling and Transboundary Movement) Rules	2008.	Storage, handling, transportation and disposal of hazardous waste	Yes	Storage and handling of hazardous waste during construction	SPCB





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SI.No	Act/Rules	Year	Objective	Applicable Yes/No	Reason for applicability	Authority
16.	Municipal Solid Wastes (Management & Handling) Rules	2000	Management and handling of solid waste	Yes	For disposal of solid waste generated during construction	SPCB
17.	Batteries (Management & Handling) Amendment Rules	2010	Management and handling of used lead batteries	Yes	Safe disposal of used lead batteries	SPCB
18.	E-Waste (Management & Handling) Rules	2011	Effective mechanism to regulate generation, collection, storage, transport, import, export, recycling, treatment and disposal of e-wastes.	Yes	Handling of e-waste	SPCB
19.	Central Motor Vehicles Act Tamil Nadu Motor Vehicle Rules	1988	To control vehicular air and noise pollution.	Yes	This rule will be applicable to road users and construction machinery.	Motor Vehicle Department
20.	Minor Mineral and concession Rules	1960	For opening new quarry.	Yes	Regulate use of minor minerals like stone, soil, river sand etc.	District Collector
21.	The Mining Act	1952	The mining act has been notified for safe and sound mining activity.	Yes	The construction of project road will require aggregates. These will be procured through mining from quarries	Department of mining, GoTN



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Sl.No	Act/Rules	Year	Objective	Applicable Yes/No	Reason for applicability	Authority
22.	National Forest Policy 1952 National Forest Policy(Revised)	1988	To maintain ecological stability through preservation and restoration of biological diversity.	NO	This policy will not be applicable as NO eco sensitive feature exists along the project corridor.	Forest Department, Gol and GoTN
23.	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act	2013	Set out rules for fair compensation and acquisition of land	Yes	This act will be applicable as there will be acquisition of land for widening, geometric improvements and realignments.	Revenue Department State Government.

### 3.1.2.1 Environment (Protection) Act, 1986

The Environment (Protection) Act was enacted in 1986 with the objective of providing for the protection and improvement of the environment. It empowers the Central Government to establish authorities [under section 3(3)] charged with the mandate of preventing environmental pollution in all its forms and to tackle specific environmental problems that are peculiar to different parts of the country. The Act was last amended in 1991.

Under this act specified rules for discharge/emission of effluents and different standards for environmental quality. These include Ambient Noise Standard, Emission from Motor Vehicles, Mass Emission Standard for Petrol Driven Vehicles, General Effluent Standards etc. especially important for road project. This act will be applicable during all three phases of project namely Pre-construction, Construction and Operational phase.

The following rules, notifications and standards under the Environment (Protection) Act, 1986 are particularly relevant in this case:

- i. Noise Pollution (Regulation & Control) Rules, 2003 and its amendments
- ii. EIA Notification, 14<sup>th</sup> September 2006 and its amendments
- iii. Ash Utilization Notification, 1999 and its amendments
- iv. National Ambient Air Quality Standards and its amendments

### 3.1.2.2 Environmental Impact Assessment Notification 2006:

The primary responsibility for administration and implementation of the GoI policy with respect to conservation, ecologically sustainable development and pollution control rests with the Ministry of Environment, Forests and Climate Change (MoEF & CC). The MoEF & CC is responsible to enforce the regulations established pursuant to the National



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Conservation Strategy, National Forest Policy, the Policy for Abatement of Pollution (1992) and the Indian Environmental Protection Act 1986, revised in 1994 and amendments thereafter.

The GoI EIA Notification on Environmental Clearances (September 14, 2006) replacing the EIA Notification of 1994, sets out the requirement for Environmental Assessment in India. This states that Environmental Clearance (EC) is required for specified activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence. Projects are categorized as A or B depending on the scale of the project and the nature of its impacts. The categorisation for highways and roads projects is as below:

Project or Activity	Category with threshold limit		Conditions if any
	A	B	
7(f) Highways	i) New National Highways and ii) Expansion of National Highways greater than 100 km involving additional right of way or land acquisition greater than 40m on existing alignments and 60m on re-alignments or by-passes.	i) All New State Highway projects ii) State Highway expansion projects in hilly terrain (above 1,000m AMSL) and or ecologically sensitive areas	General Condition shall apply <b>Note:</b> Highway include expressways

Source: MoEF & CC Notification 2006 and amendments thereafter

**Category A** projects requires EC from the national Ministry of Environment, Forests and Climate Change (MoEF & CC).

**Category B** projects require environmental clearance from the State Environment Impact Assessment Authority (SEIAA).

**General Condition (GC):** Any project or activity specified in Category 'B' will be treated as Category A, if located in whole or in part within 10 km from the boundary of: (i) Protected Areas notified under the Wild Life (Protection) Act, 1972, (ii) Critically Polluted areas as notified by the Central Pollution Control Board from time to time, (iii) Notified Eco-sensitive areas, (iv) inter-State boundaries and international boundaries.

**The project roads (Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700) Section of SH44, Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200) Section of SH 89 and Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41) considered as Phase-I roads under TNRSP-II are State Highways and do not attract the conditions of obtaining prior environmental clearance as per EIA Notification 2006 and amendments thereafter.**

### 3.1.2.3 Forest (Conservation) Act, 1980:

The Forest Conservation Act 1980 was enacted to help conserve the country's forests. It strictly restricts and regulates the de-reservation of forests or use of forest land for non-forest



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purposes without the prior approval of Central Government. The Act lays down the pre-requisites for the diversion of forest land for non-forest purposes. At the state level, the government was empowered to declare Reserved and Protected Forests and was also given the authority to acquire land for extension and preservation of the forests.

The process of obtaining forest clearance under this varies with the area of the forestland to be diverted.

- If the area of forests to be cleared or diverted exceeds 40 hectares, the State Government/Union Territory Forest Department would forward the proposal with recommendations to MoEF & CC, Delhi.
- If the forest land is between 5 and 40 hectares, the State Government/Union Territory Forest Department processes the proposal, but the permission is issued by MoEF & CC Regional Office.
- If the forest land is less than or equal to 5 hectare the State Government/Union Territory Forest Department can give permission.
- Restrictions and clearance procedure proposed in the Forest (Conservation) Act applies wholly to the natural forest areas, even in case the protected/designated forest area does not have any vegetation cover.

***No forest land diversion is involved in 'Upgrading of Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700) Section of SH44, Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200) Section of SH 89 and Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800) Section of SH41'.***

#### **3.1.2.4 The Water (Prevention and Control of Pollution) Act, 1974**

This act resulted in the establishment of the Central and State level Pollution Control Boards whose responsibilities include managing water quality and effluent standards, as well as monitoring water quality, prosecuting offenders and issuing licenses for construction and operation of any facility. This will include generation of liquid effluent during construction of road from Civil Engineering activities or from domestic activities in workers colony. There are specific penalties for violation, which include imprisonment for responsible officials.

#### **3.1.2.5 The Air (Prevention and Control of Pollution) Act, 1981**

This act empowers Central and State Pollution Control Boards for managing air quality and emission standards, as well as monitoring air quality, prosecuting offenders and issuing licenses for construction and operation of any facility. There are specific penalties for violation, which include imprisonment for responsible officials. This Act has notified National Ambient Air Quality Standard for different regions e.g. Industrial, Residential and Sensitive. Air quality during construction and operation phases will be guided by this specific act.

#### **3.1.2.6 Noise Pollution (Regulation and Control) rules 2000**

These rules provide ambient air quality standards in respect of noise for different areas/zones. It also provides responsibility of concerned authority as to enforcement of



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Noise Pollution Control Measures, restrictions on the use of loud speakers/public address system, horns, sound emitting construction equipment and bursting of fire crackers, consequences of any violations in silence zone/area, complaints to be made to the authority and power to prohibit continuance of music sound or noise.

### **3.1.2.7 Biological Diversity Act, 2002**

Biological Diversity Act, 2002 is a federal legislation enacted by the Parliament of India for preservation of biological diversity in India, and provides mechanism for equitable sharing of benefits arising out use of traditional biological resources and knowledge. The Act was enacted to meet the obligations under Convention on Biological Diversity (CBD), to which India is a party.

The act also includes setting up of National Biodiversity Authority (NBA), State Biodiversity Board (SBB) and Biodiversity Management Committee's. (BMC's).

### **3.1.2.8 Wild Life Protection Act, 1972**

The Wild Life (Protection) Act 1972 was enacted with the objective of effectively protecting the wildlife of this country and to control poaching, smuggling and illegal trade in wildlife and its derivatives. The Act was amended in January 2003 and punishment and penalty for offences under the Act have been made more stringent. The Ministry has proposed further amendments in the law by introducing more rigid measures to strengthen the Act. The objective is to provide protection to the listed endangered flora and fauna and ecologically important protected areas.

It has allowed the government to establish a number of National Parks and Sanctuaries over the past 25 years, to protect and conserve the flora and fauna of the State. National Board for Wildlife is the apex body constituted under the Act. The Chief Wildlife Warden is the authority who shall control, manage and maintain all sanctuaries and for that purpose, within the limits of any sanctuary.

The Act states that no construction of commercial tourist lodges, hotels, zoos and safari parks shall be undertaken inside a sanctuary except with the prior approval of the National Board.

### **3.1.2.9 The Ancient Monuments and Archaeological Sites and Remains Act, 1958**

According to this Act, area within radius of 100m and 200m from the "protected property" are designated as "prohibited area" and "regulated area" respectively. No development activity (including building, mining, excavation, blasting) is permitted in the "prohibited area" and development activities likely to damage the protected property are not permitted in the "regulated area" without prior permission of the Archaeological Survey of India (ASI) if the site/remains/monuments are protected by ASI or the State Department of Archaeology if these are protected by the State.

### **3.1.2.10 Fly Ash Notification, 2009**

According to the Notification No. S.O. 763(E), dated 14.09.1999 and its amendment on 27.08.2003 and notification S.O. 2804(E) dated 3<sup>rd</sup> November 2009 by MoEF & CC, it is



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mandatory to use fly ash within a radius of 100 kilometers of Thermal Power Plant. Agency, person or organization shall within a radius of 100 kilometer of Thermal Power Plant undertake construction or approve design for construction of roads of flyover embankments in contravention of the guidelines/ specification issued by the Indian Road Congress (IRC) as contained in IRC specification No. SP: 56 of 2001. Any deviation from this direction can only be agreed to technical reasons if the same is approved by Chief Engineer (Design) or Engineer-in-chief of the concerned agency or organization or on production of certificate of "Pond ash not available" from the Thermal Power Plant(s) located within 100 kilometers of the site construction. This certificate shall be provided by TPP within two working days from the date of making request for fly ash.

Soil required for top or side cover of embankment of roads or flyovers shall be excavated from the embankment site and it is not possible to do so, only the minimum quantity of the soil required for the purpose shall be excavated from soil borrow area. In either case, the topsoil should be kept or stored separately. Voids created due to soil borROW area shall be filled up with ash with proper compaction and covered with top soil kept separately as mentioned above.

No agency, person or organization shall within a radius of 100 kilometers of coal or lignite based Thermal Power Plant is allowed for reclamation and compaction of low lying areas with soil. Only pond ash shall be used for compaction. They shall also ensure that such reclamation and compaction is done in accordance with the bye-laws, regulation and specification laid down by authorities.

#### **3.1.2.11 The Explosives Act (& Rules), 1884**

This Act regulates the manufacture, possession, use, sale (transport, import and export) of Explosives.

#### **3.1.2.12 Public Liability Insurance Act, 1991**

An Act to provide for public liability insurance for the purpose of providing immediate relief to the persons affected by accident occurring while handling any hazardous substance and for matters connected therewith or incidental thereto.

#### **3.1.2.13 Coastal Regulation Zone Notification, 2011**

This Act classifies the Coastal Regulation Zones in four categories i.e., CRZ I, II, III and IV for the purpose of conserving and protecting the coastal areas and marine waters. This act also specifies the activities prohibited and allowed in these CRZs. CRZ clearance is sought from MoEF & CC, Delhi Office.

#### **3.1.2.14 Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008**

These rules classified hazardous waste into 18 categories in its Schedule-I based on the constituents present. The Government of India amended the Rules in the year 2000 (principally to bring them in compliance with the Basel Convention) and further in the year





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2003 (to include Environmentally Sound Technologies for recycling of Hazardous Waste) and year 2008 (to include Trans boundary movement of Hazardous Waste)

### **3.1.2.15 Municipal Solid Wastes (Management & Handling) Rules 2000**

The Central Government notified the rules under Sections 3, 6 and 25 of the Environment (Protection) Act 1986 for the purpose of managing municipal and urban wastes/garbage in an environmentally sound manner. Every municipal authority is responsible to develop a system for scientific disposal of garbage through composting and engineered landfill.

### **3.1.2.16 Batteries (Management & Handling) Amendment Rules, 2010**

These rules are applicable to every manufacturer, importer, re-conditioner, assembler, dealer, recycler, auctioneer, consumer and bulk consumer involved in manufacture, processing, sale, purchase and use of batteries or components thereof for proper management and handling of used lead batteries.

### **3.1.2.17 E-Waste (Management & Handling) Rules, 2011**

This law mandates producers of electronic equipment to ensure that e-waste is collected, transported to specific collection, dismantling and processing units, and safely disposed under the principle of Extended Producer Responsibility or EPR.

Sale of electronic scrap under Schedule 1 (governing most commonly used electronics) to any unauthorized or unlicensed vendors or dealers (including "kabadiwalas") is strictly illegal.

### **3.1.2.18 The Motor Vehicles Act, 1988**

In 1988, the Indian Motor Vehicles empowered the State Transport Authority to enforce standards for vehicular pollution and prevention control. The Authority also checks emission standards of registered vehicles, collects road taxes and issues licenses. In August 1997, the Pollution Under Control Certificate (PUC) programme was launched in an attempt to crackdown on the vehicular emissions in the states.

### **3.1.2.19 National Environment Policy, 2006**

This policy widely covers all the major environmental issues including but not limiting to the 'Forests of India, Forest Policy, Legal Framework, Ecological Security, Emerging Needs and Goals of Forestry Sector, Constraints and Threats, Forest Conservation, Wildlife and Nature Conservation, Forests of the North-East, Forests, Local Communities and Peoples' Participation, Agro-forestry and Social Forestry, Research and Applications, Forestry institutions, Forest Administration, Personnel Management, Forests and industries, international Forest-related instruments, Forests in National Resource Accounting, Centre-State Relation, Financial Support, implementation and aftermath and the Recommendations.

### **3.1.2.20 National Green Tribunal Act, 2010**

An Act to provide for the establishment of a National Green Tribunal for effective and expeditious disposal of cases relating to environmental protection and conservation of forests and other natural resources including enforcement of any legal right relating to



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environment and giving relief and compensation for damages to persons, property and for matters connected therewith or incidental thereto.

### 3.1.2.21 The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013

In India, a new bill, Land Acquisition and Rehabilitation and Resettlement Bill has been passed by the Parliament in 2013 to repeal the Land Acquisition Act of 1894. This is the first National/ Central Law on the subject of Rehabilitation & Resettlement of families affected and displaced as a result of land acquisition. Only R&R provisions will apply when private companies purchase land for a project, and the same exceeds the area thresholds set by the State Governments for such purchase.

As per this Act, compensation will be given within a period of three months from the date of the award. Where an award has been made but the affected individuals have not accepted compensation or have not yet given up possession, and the proceedings have been pending for 5 years or more, provisions of the new law will apply. This Act stipulates mandatory consent of at least 70% of affected people for acquiring land for Public Private Partnership (PPP) projects and 80% for acquiring land for private companies. Under the new legislation, compensation for the owners of the acquired land will be four times the market value in rural areas and twice in urban areas. It also stipulates that the land cannot be vacated until the entire compensation is awarded to the affected parties.

### 3.1.3 Environmental Legislation Framework of the State

Table 3-2 provides the specific laws and policies that are formulated by Tamil Nadu State government for achieving certain level of sustainability in the human actions.

**Table 3-2 : Environmental Legal Framework of Tamil Nadu State**

Sl.No	Applicable GOI Acts	Year	Objective	Applicability
1	Tamil Nadu State Environment Policy (Draft)	2012	Sustainable development of the State	Direct
2	Tamil Nadu State Water Policy	1994	To protect and conserve water resources	Direct
3	Tamil Nadu Water (Prevention and Control of Pollution) Rules	1983	To control water pollution by controlling emission & Water pollutants as per the prescribed standards	Direct
4	Tamil Nadu Air (Prevention and Control of pollution) Rules	1983	To control air pollution by controlling emission and air pollutants according to prescribed standards	Direct
5	Tamil Nadu Groundwater (Development and Management) Bill	2000	To protect groundwater resources, to provide safeguards against hazards of its over exploitation and to ensure its planned development and	Direct



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SI.No	Applicable GOI Acts	Year	Objective	Applicability
			management in the State of TN and for matters connected therewith or incidental thereto	
6	Tamil Nadu Aquaculture (Regulation) Act	1995	For regulation of coastal aquaculture in the State	Indirect
7	Tamil Nadu Ancient and Historical monuments and Archaeological sites and remains Rule	1971	Provides procedure for moving antiquities	Direct
8	Costal Regulation Zone in Tamil Nadu	2011	Identifying and categorizing the coastal areas up to 500 meters from the high tide line	Indirect
9	EIA Notification by MOEF & CC	2006	Establishment of the State level environmental impact assessment authority for environmental clearance of Category B projects.	Not Applicable
10	Fly Ash Notification	2009	Promoting the utilization of fly ash in the manufacture of building materials and in construction activity within a specified radius of one hundred kilometers from coal or lignite based thermal power plants	Direct
11	Tamil Nadu Forest Act	1882	Protection of wildlife (wild animals, defined plants and birds) and to control poaching, smuggling and illegal trade in wildlife and its derivatives.	Direct

### 3.1.3.1 The Tamil Nadu Highways Bill, 2000

The Tamil Nadu Highways Bill, 2000 was introduced in the Legislative Assembly of the state on 13-11-2000. Objective of the bill is stated as:

*“To provide for the declaration of certain highways to be State Highways, restriction of ribbon development along such highways, prevention and removal of encroachment thereon, construction, maintenance and development of highways and levy of betterment charges and for matters connected therewith or incidental thereto”*

It provides for a legal status to the assets and premises of the highways along with functions and powers with the highways authorities to protect and maintain them. It specifically empowers highways authority towards restriction of Ribbon development, acquisition of property, prevention and removal of encroachments, restriction of heavy traffic and also the road safety. Penalties can be levied under the provisions of the bill for causing damage to highways properties and unauthorised occupation of the highways land.



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### 3.1.3.2 Tamil Nadu Groundwater (Development and Management) Act, 2003

The Tamil Nadu legislature passed the Ground Water (Development and Management) Act and the Act came into force after receiving the assent of the President in March 2003. The Act is applicable to the whole State of Tamil Nadu except the Chennai Metropolitan Area which is governed by a separate Act.

*“An Act to protect groundwater resources to provide safeguards against hazards of its over exploitation and to ensure its planned development and proper management in the State of Tamil Nadu and for matters connected therewith or incidental thereto.”*

The act empowers the government through the Tamil Nadu Groundwater Authority to develop, control, regulate and administer the groundwater in the state by ensuring its optimal and efficient utilization. The act also provides for conjunctive use of surface and groundwater. The act also provides for registration of new users of wells and also prohibition of sinking wells in notified areas without permit. It empowers the authority penalize the activities not in accordance with the act regarded as offences.

### 3.1.3.3 The Tamil Nadu Town and Country Planning Act, 1971:

*“An Act to provide for planning the development and use of rural and urban land in the State of Tamil Nadu and for purposes connected therewith”.*

The Act provides for the preparation and implementation of Regional Plans, Master Plans, New Town Development Plans and Detailed Development Plans and other various spatial plans. The act ensures implementation through various developmental controls and polices that would be incorporated in the spatial plans. The developmental plan is being implemented at various levels through the Directorate of Town and Country planning. These plans form the basis for land use regulations within the planned area.

### 3.1.3.4 Tamil Nadu Panchayats Act 1994

The Tamil Nadu Panchayats Act, 1994 is an act to repeal and re-enact the Tamil Nadu Panchayats Act 1958 for establishing a three tier panchayat raj system in keeping with the seventy –third amendment Act, 1992. It relates to the panchayats for greater participation of the people so as to make them institutions of self government and more effective implementation of rural development programmes.

The Act provides for preparation and implementation of District Development Plans. Plan preparation is enforced from the Panchayat level, Panchayat union, Panchayat council, village panchayats, town panchayats, municipal councils and the municipal corporation towards overall development plans. District Planning Committee is responsible for the overall coordination of plan preparation. The act also provides for avoidance of encroachment of public lands and protection of roadside properties (including trees) belonging to the respective government departments. The act is designed to monitor the industrial land use through the following clause under section 160:

*No person shall, without the permission of the panchayat union council in panchayat villages and except in accordance with the conditions specified in such permission, construct or*



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*establish any factory, workshop or workplace in which it is proposed to employ steam power, water power or other mechanical power or electrical power.*

### **3.1.3.5 Tamil Nadu Aquaculture (Regulation) Act, 1995**

The act is meant for regulation of coastal aquaculture in Tamil Nadu. It is administered through the Directorate of Fisheries at state level and District committee at the district level. The act provides for issue of licenses for setting up of any new aquaculture farm or expansion of the same. Aquaculture farms setup before the existence of the act is also to be registered with the District Committee setup for the purpose.

The act prohibits setting up of aquaculture farms in areas (termed as prohibited area) as:

*“Wetlands including biodiversity rich areas mangrove swamps, migratory bird routes, breeding grounds, sanctuaries, national parks, biosphere reserves designated as protected areas or areas committed to community conservation or protection forestry, place of heritage or place of worship, grey or dark areas in the map prepared by the Public Work Department (Groundwater).”*

Certain minimum distances as 300m for villages with population less than 500, 500m for villages with population more than 500 and 2 km from any place of heritage. A buffer zone of 50 to 100m is to be maintained between aquaculture zone and non-aquaculture zone in case of sea-based aquafarms and 25 to 50m, in case of estuarine based farms. No aquaculture farm is envisaged to extract ground water for culture purpose. The act empowers Directorate of Fisheries to penalize the offenders of provisions of the act by cancellation of licenses and/or levying of fines.

### **3.1.3.6 Tamil Nadu State Environment Policy (Draft), 2012:**

The State environment policy will strive to look at the regulatory framework, its adequacy, the awareness levels among the stakeholders, the recent judicial pronouncements and participation of technical institutions/industries in furthering the cause of environment.

The Thrust Areas: Key Issues and Major Interventions are as follows:

- a. Air Quality: local pollution hot spots and status of current actions
- b. Water Quality: domestic and industrial pollution flow into water bodies and status of various interventions.
- c. Pollution abatement in rivers, lakes and water bodies.
- d. Waste Management: Municipal Solid Waste and status of adherence to MSW 2000 rules; bio-medical waste; plastic waste; hazardous waste; electronic waste,
- e. Coastal Zone Management : Impact on coastal regulation zone of various economic activities; progress on integrated coastal zone management.

### **3.1.3.7 Tamil Nadu State Water Policy, 1994**

Tamil Nadu adopted a State Water Policy in 1994 along the lines of the National Water Policy of 1987. Subsequently, the National Water Policy was revised in 2002. Some of the major aspects of the policy are the following:

- Importance of water resources in the development of the State.
- Need for considering socio-economic aspects of water resource projects.





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- Need for basin wide planning for equitable water use.
- Priorities for water use in the State.
- Management and development of ground water resources.
- Watershed management in rainfed areas.
- Increase in demand for non-agricultural uses.
- Management of water quality and environmental aspects.
- Need for a hydrological database for planning and management.
- Stakeholder participation in management e.g. water user associations.
- Need for proper pricing of water in different sectors

The apex institution in the State at the policy level is the Water Resources Control and Review Council chaired by the Chief Minister. The primary agency charged with implementation of the policy is the Water Resources Organisation. The Institute of Water Studies is the nodal agency responsible for water planning while the Irrigation Management Training Institute imparts training to farmers and officials. Domestic water supply (urban and rural) schemes are executed by the Tamil Nadu Water Supply and Drainage Board (TWAD) for the entire State except Chennai Metropolitan Area where MetROWater is the implementing agency. TWAD executes capital projects which are handed over to the concerned local bodies for operation and maintenance. Industrial water pollution is regulated by the Tamil Nadu Pollution Control Board. Management of water quality and environmental aspects of rivers and water bodies is being monitored and coordinated by the Department of Environment.

### 3.1.4 Other Legislation Applicable to Road Construction Projects

Environmental issues during road construction stage generally involve equity, safety and public health issues. The road construction agencies require complying with laws of the land, which include *inter alia*, the following:

- ✚ **Workmen's Compensation Act 1923** (the Act provides for compensation in case of injury by accident arising out of and during the course of employment);
- ✚ **Payment of Gratuity Act, 1972** (gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years);
- ✚ **Employees PF and Miscellaneous Provision Act 1952** (the Act provides for monthly contributions by the employer plus workers);
- ✚ **Maternity Benefit Act, 1951** (the Act provides for leave and some other benefits to women employees in case of confinement or miscarriage, etc.);
- ✚ **Contact Labor (Regulation and Abolition) Act, 1970** (the Act provides for certain welfare measures to be provided by the contractor to contract labour);
- ✚ **Minimum Wages Act, 1948** (the employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the);





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- ✚ **Payment of Wages Act, 1936** (it lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers);
- ✚ **Equal Remuneration Act, 1979** (the Act provides for payment of equal wages for work of equal nature to Male and Female workers and not for making discrimination against Female employees);
- ✚ **Payment of Bonus Act, 1965** (the Act provides for payments of annual bonus subject to a minimum of 83.3% of wages and maximum of 20% of wages);
- ✚ **Industrial Disputes Act, 1947** (the Act lays down the machinery and procedure for resolution of industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment);
- ✚ **Industrial Employment (Standing Orders) Act; 1946** (the Act provides for laying down rules governing the conditions of employment);
- ✚ **Trade Unions Act, 1926** (the Act lays down the procedure for registration of trade unions of workers and employers. The trade unions registered under the Act have been given certain immunities from civil and criminal liabilities);
- ✚ **Child Labour (Prohibition and Regulation) A; 1986** (the Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of child labour is prohibited in Building and Construction Industry);
- ✚ **Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act, 1979** (the inter-state migrant workers, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, traveling expenses from home to the establishment and back, etc.);
- ✚ **The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and the Cess Act of 1996** (all the establishments who carry on any building or other construction work and employs 10 or more workers are covered under this Act; the employer of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as canteens, first-aid facilities, ambulance, housing accommodation for Workers near the workplace, etc.);
- ✚ **The Factories Act, 1948** (the Act lays down the procedure for approval of plans before setting up a factory, health and safety provisions, welfare provisions, working hours and rendering information-regarding accidents or dangerous occurrences to designated authorities);
- ✚ **Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996.**



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### 3.1.5 World Bank Requirements

The World Bank's environmental and social safeguard policies are a cornerstone of its support to sustainable poverty reduction. The objective of these policies is to prevent and mitigate undue harm to people and the environment in the development process. These policies provide guidelines for the identification, preparation, and implementation of programs and projects.

The World Bank has ten safeguard policies; the details and applicability of the safe guard policies to the Project road are provided in the **Table 3.3**.

**Table 3-3: Applicability of WB Safeguard Policies**

WB Safeguard Policy	Subject Category	Triggered or Not	Reason for Applicability	Mitigation Measures	Documentation
OP 4.01	Environment Assessment	Triggered	Umbrella Policy	All necessary mitigation measures incorporated.	EA and EMP
OP 4.02	Environmental Action Plan	Triggered	For the mitigation of identified impacts	Environmental mitigation plan formulated for each identified negative impact.	Covered under EMP
OP 4.04	Natural Habitats	Triggered	Eco-sensitive Forestry and wildlife related issues along Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 <sup>4</sup> . and Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 <sup>5</sup> .	No widening is proposed in road stretches falling within 10km buffer zone from sanctuary. Only 2 lane without paved shoulder is proposed in these stretches. (km 0/000 to km 15/500 on SH89 and km0/000 to km 6/000 on SH41)	Covered under EIA/ EMP
OP/BP 4.36	Forests	Not Triggered	No Reserved or Protected forest within ROW of	Not Applicable	Not Applicable

<sup>4</sup> Koonthakulam Bird Sanctuary is located at about 7.5km from Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89.

<sup>5</sup> Srivilliputtur Giant Grizzled Squirrel Wildlife Sanctuary is located at about 6 km from start point of Rajapalayam-Sankarankoil-Tirunelveli section of SH-41



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WB Safeguard Policy	Subject Category	Triggered or Not	Reason for Applicability	Mitigation Measures	Documentation
			project roads		
OP 4.11	Cultural Property	Triggered	A no. of religious structures is located within ROW. A cultural property rehabilitation plan to be developed.	Adequate mitigation measures provided for affected structures.	Details covered under RAP & to minimise any adverse effect on the cultural properties.
OP 4.09	Pest Management	Not triggered	Not Applicable	Not Applicable	Not Applicable
OP 4.20	Indigenous People	Not triggered	No separate Indigenous people development plan is required for the Project	Not Applicable	Not Applicable
OP/BP 4.12	Involuntary Resettlement	Triggered	Road widening will lead to loss of livelihoods, loss of land and buildings etc.	Adequate mitigation measures provided in RAP	Resettlement Action Plan

### 3.1.5.1 Environmental Assessment (OP 4.01)

Environmental Assessment is used in the World Bank to identify, avoid, and mitigate the potential negative environmental impacts associated with Bank's lending operations early-on in the project cycle. The policy states that Environment Assessment (EA) and mitigation plans are required for all projects having significant adverse environmental impacts or involuntary resettlement. Assessment should include analysis of alternative designs and sites, or consideration of "no option" and require public participation and information disclosure before the Bank approves the project.

In World Bank operations, the purpose of Environmental Assessment is to improve decision making, to ensure that project options under consideration are sound and sustainable, and that potentially affected people have been properly consulted and their concerns addressed.

The World Bank's environmental assessment policy and recommended processing are described in Operational Policy (OP)/Bank Procedure (BP) 4.01: Environmental Assessment.

The World Bank environment assessment (EA) requirements are based on a four-part classification system as defined by the WB OP4.01 Environment Assessment.



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Based on type, location, sensitivity, and scale of the project and the nature and magnitude of project's potential environmental impacts, the classification is as follows:

- Category A : Adverse environmental impacts that are sensitive, diverse, or unprecedented, comprehensive EA is required
- Category B : Potential adverse environmental impacts on human populations or environmentally important areas including wetlands, forests, grasslands, and other natural habitats, less adverse than those of Category A projects, EA narrower than Category A Projects
- Category C: Minimal or no adverse environmental impacts. Beyond screening, no further EA action is required
- Category FI: Investment of Bank funds through a financial intermediary, in subprojects that may result in adverse environmental impacts.

***The project roads 'Upgrading of Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700) Section of SH44, Nanguneri – Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200) Section of SH 89 and Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800) Section of SH41' have been categorised as "Category A" as project has few adverse environmental impacts for which comprehensive EA has been prepared.***

In addition to OP 4.01, other WB safeguard policies triggered by the project are given as follows:

The Project is being complied with the requirements of BP 17.50 on Public Disclosure. Initial consultations were held during environmental and social screening stage. Pre structured Consultations and focussed group discussions were also conducted during project design stage for all the three project roads. Post design follow up consultations are also planned. In addition, environmental and social reports of the TNRSP will be displayed at various district libraries, HD headquarters and other pre determined locations.

### **3.1.5.2 Natural Habitat (OP 4.04)**

The policy implementation ensures that Bank-supported development projects give proper consideration to the conservation of natural habitats, in order to safeguard their unique biodiversity and ensure the sustainability of the environmental services and products which natural habitats provide to human society.

This policy is applicable when a project (including any subproject under a sector investment or financial intermediary loan) with the potential to cause significant conversion (loss) or degradation of natural habitats, whether directly (through construction) or indirectly (through human activities induced by the project).



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### 3.1.5.3 Forest Policy (OP 4.36)

The implementation of the policy ensures that envisaged forest sector activities and other Bank sponsored interventions which have the potential to impact significantly upon forested areas:

- (a) Do not encroach upon significant natural forest areas that serve important social, environmental or local economic purposes.
- (b) Do not compromise the rights of local communities to continue their traditional use of forests in a sustainable fashion.
- (c) Do not finance commercial logging operations, in the case of primary tropical moist forest, nor any purchase of equipment for this purpose.

### 3.1.5.4 Cultural Property (OP 4.11)

The World Bank Policy OP/BP 4.11 defines physical cultural resources as movable or immovable objects, sites, structures, groups of structures, natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources may be located in urban or rural settings, and may be above or below ground, or under water. Their cultural interest may be at the local, provincial or national level, or within the international community.

The Bank assists countries to avoid or mitigate adverse impacts on physical cultural resources from development projects that it finances. The impacts on physical cultural resources resulting from project activities, including mitigating measures, may not contravene either the borrower's national legislation, or its obligations under relevant international environmental treaties and agreements.

The borrower addresses impacts on physical cultural resources in projects proposed for Bank financing, as an integral part of the environmental assessment (EA) process.

## 3.1.6 MoRTH and IRC Specifications

### 3.1.6.1 Specifications for Road and Bridge Works, Published by IRC

All road works in India are to be in accordance with the MoRTH specifications for Road and Bridge works and guidelines of Indian Roads Congress (IRC). The MoRTH specifications have special provisions towards protection of environment under clause 501, Annexure A and the contractor is to satisfy the provisions for control of erosion, drainage, dust suppression, borrow area and haul road management under relevant sections. Provision of Clause 501 Annexure A, cover the environmental aspects as:

#### General:

- The contractor shall take all necessary measures and precautions to carry out the work in conformity with the statutory and regulatory environmental requirements.
- The contractor shall take all measures and precautions to avoid nuisance or disturbances from the work. It shall be precautionary measures than abatement measures taken after generation of nuisance.



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- In the event of any spoil, debris, waste or any deleterious material from site being deposited on adjacent land, the same shall be removed and affected areas shall be restored to its original state

**Water:**

- The contractor shall prevent any interference with supply/abstraction of water resources
- Water used for dust suppression shall be reused after settlement of material in collected water
- Liquid waste products to be disposed off such that it does not cause pollution
- No debris is to be deposited or disposed into/adjacent to water courses

**Air:**

- The contractor to devise and arrange methods to control dust, gaseous or other airborne emissions in such a way that adverse impacts on air quality is minimized
- Dust shall be minimised from stored material and stockpiles by spraying water
- Covering of material likely to rise dust during transport is to be covered with tarpaulin
- Spraying of water on haul roads if found necessary

**Noise:**

- The contractor shall use all necessary measures to reduce noise from construction equipment and maintain all silencing equipment in good condition

**Control of waste:**

- No uncontrolled disposal of wastes shall be permitted. The contractor shall make specific provisions for disposal of all forms of fuel and engine oil, all types of bitumen, cement, surplus aggregate, gravels, bituminous mixtures etc. conforming to local regulations and acceptance of the engineer.

**Emergency Responses:**

The contractor shall plan and provide for remedial measures in case of occurrence of emergencies as spillage of oil, bitumen or chemicals.

In addition to the above conditions, avoidance measures and control of activities having potential for generation of environmental impacts are devised. These include:

Section 111	Precautions for safeguarding environment
Clause 201.2	Preservation of property/amenities during clearing and grubbing
Clause 301.3.2	Stripping and storing of topsoil for reuse during excavation for roadway and drains
Clause 302.4	Restriction on timings for blasting operations
Clause 304.3.6	Public safety near towns and villages where excavation is carried out
Clause 305.2.2	Locations of borrowing and relevant regulations
Clause 305.3.3	Stripping and storing of topsoil at borrow locations
Clause 306	Soil erosion and sedimentation control
Clause 407.4.2	Provisions for tiring on medians and islands
Clause 517	Recycling of bituminous pavement and excavated material





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Clause 701.2.1	Use of geotextiles for control of soil erosion
Clause 810	Use of metal beam crash barriers for safety, relevant regulations and specifications
Clause 1010	Quality of water for curing and construction
Clause 2501	Precaution during river training works

### 3.1.7 Clearances and Permissions required for the Project

The clearances and permissions required to implement the project roads are summarised below in **Table 3-4**.

**Table 3-4: Clearances and Permissions Required for the Project**

Sl. 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	TNPCB	Manufacture, storage and import of Hazardous	Construction stage (Prior to	Contractor



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Sl. No.	Type of Clearance / Permission	Statutory Authority	Applicability	Project stage	Responsibility
	hazardous materials		Chemical	initiation of any work	
7.	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
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 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
10.	Labour license	Labour commissioner office	Engagement of Labour	Construction stage (Prior to initiation of any work)	Contractor

In addition to above, for all the three project roads No Objection Certificate is to be obtained from concerned district forest officer stating that there is no forest land is involved in the proposed ROW.



## **CHAPTER 4**

### **BASELINE ENVIRONMENT**



ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

## 4 BASELINE ENVIRONMENT

### 4.1 BACKGROUND

Previous chapters have highlighted scope of environmental assessment, existing features of the project roads and proposed improvement, methodology and regulations applicable to environmental assessment. In this chapter an attempt has been made to prepare a baseline environmental setting so that applicability of Government of India (GoI) regulatory requirements as well as environmental management practices of operational procedure of World Bank could be envisioned. Based on the existing environmental scenario potential impacts of road improvement will be identified and accordingly management plan will be proposed in forthcoming sections. The baseline environmental conditions will help in comparing and to monitor the predicted negative and positive impacts resulting from the project during construction and operation phases.

Data was collected from secondary sources for the macro-environmental setting like climate, physiography (Geology and slope), biological and socio-economic environment. First hand information have been collected to record the micro-environmental features within and adjacent to the project road corridors. Collection of first hand (Primary) information includes preparation of base maps, extrapolating environmental features on proposed road design, tree enumeration, location and measurement of socio-cultural features abutting project road.

Data was also recorded at sites used for extraction of materials for construction but generally outside the project corridor e.g. borrows areas and quarries. Ambient air, noise, soil and water quality samples were collected at important locations in terms of environment quality to prepare a baseline database. The baseline environmental monitoring of air, water, noise and soil along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44 and Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 was undertaken by NABL accredited agency, M/S Green Chem Solutions Pvt. Ltd. between 26.02.2014 and 26.03.2014. The baseline environmental monitoring along Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 was undertaken between 24.06.2014 and 20.07.2014. The baseline environmental monitoring Report is attached as **Appendix 4.1**.

Following section describes the nature, type and characteristics of the physical, biological, cultural and socioeconomic components along the project roads.

### 4.2 AIR ENVIRONMENT –BASELINE

Air quality is relatively free from pollution along the project roads traversing through agrarian rural and small semi urban areas. As a part of the Environmental Assessment (EA), climatic component has been studied to establish the benchmarks to understand air quality in the project influence area.

#### 4.2.1 Meteorological Factors and Climate

**Climate:** Among all other physical factors, Climate is the most important factor-influencing environment because it plays a vital role in determining the evolution of landforms (erosion, soil characteristics), types of flora and fauna (ecological diversity), the productivity of



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ecosystems as well it has an influence on the pollution loads on the environment. rainfall, temperature, and winds are the principal climatic components that serve to transport, disperse various forms of pollution into the atmosphere and on the ground.

The climate of the project influence area (PIA) is tropical, with distinct wet and dry seasons. The climate may be classified into four distinct seasons: winter (January – February), summer (March – May), southwest monsoons (June – September) and northeast monsoon (October – December).

The various climatic factors such as temperature, humidity and rainfall pattern in the project area have been discussed in detail in the following sections.

### a) Rainfall

The project districts receive the rain under the influence of both southwest and northeast monsoons. The northeast monsoon chiefly contributes to the rainfall in the districts. Tamil Nadu state is the only part of the India that receives rainfall during winter months.

The actual rainfall in Tirunelveli, Toothukudi and Virudhnagar districts for the last five years (2008-2012) as provided by the Hydro-met division of the India Meteorological Department is given in Table 4-1, Table 4-2 and **Table 4-3**.

**Table 4-1: Rainfall for Tirunelveli District (mm)**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2008	9.4	53.2	400.5	106.4	2.9	11	41.4	74	21.3	322	171.3	77.5	1290.9
2009	8.2	0	28.2	69.9	25.8	15.3	54.1	30	27.9	115	405.4	133	912.8
2010	35.9	0.1	4.6	43.2	36.6	26.0	63.4	15.6	84.6	111.9	291.7	152.2	865.8
2011	21.9	52.6	44.7	78.0	5.0	49.1	21.2	22.0	15.4	307.5	253.6	78.8	949.8
2012	40.8	29.9	30.4	61.8	8.5	1.0	16.0	12.6	7.3	302.7	139.1	74.0	724.1
<b>Average</b>													<b>948.68</b>

Source: Indian Meteorological Department

**Table 4-2: Rainfall for Toothukudi District (mm)**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2008	3.8	91.1	264.6	58.9	0.4	3.3	9.0	49.9	3.5	357.9	180.0	54.5	1076.9
2009	6.8	0.2	16.8	79.5	17.0	1.2	0.7	18.7	33.9	56.0	386.6	47.9	665.3
2010	23.3	0.0	0.0	18.9	47.5	4.4	7.9	29.3	124.5	102.5	300.9	125.6	784.8
2011	2.3	11.4	1.9	39.8	4.3	0.0	2.7	15.2	12.4	305.6	196.0	49.3	640.9
2012	2.9	0.0	0.2	46.2	79.7	24.5	28.3	82.3	68.9	218.6	69.5	5.8	626.9
<b>Average</b>													<b>758.96</b>

Source: Indian Meteorological Department

**Table 4-3 : Rainfall for Virudhnagar District (mm)**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2008	0.8	37.5	270	50.1	37.1	7.2	40.4	108.1	19.8	338.4	139.6	21.4	1070.4
2009	2.2	0.0	35.3	39.8	49.3	1.7	0.0	16.5	60.1	38.8	264.1	28.2	536.0
2010	0.1	0.0	0.0	20.6	73.1	44.0	21.6	43.8	97.9	173.5	305.0	77.3	856.9
2011	1.7	46.7	34.8	50.7	19.2	11.4	14.4	61.8	58.3	265.9	215.6	23.5	804.0
2012	23.0	0.9	1.1	71.4	70.0	0.2	20.6	34.5	24.8	221.9	38.6	4.1	511.1
<b>Average</b>													<b>755.7</b>

Source: Indian Meteorological Department

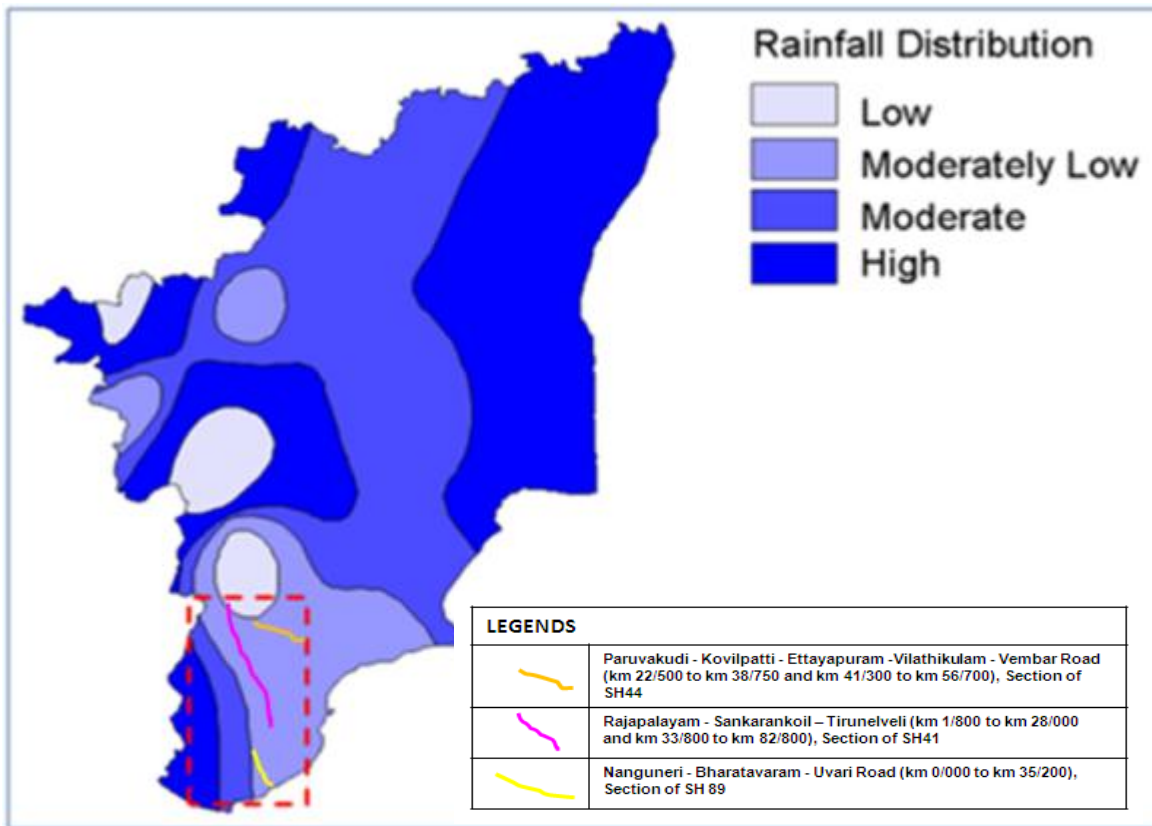
Above rainfall data shows that project districts received maximum rainfall during months of



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October and November i.e., in winter season. Tirunelveli district receives the highest rainfall among the project districts. The average rainfall in Tirunelveli is around 950 mm.

In the State of Tamil Nadu, the project region is located in moderate to moderately low rainfall receiving region. The rainfall distribution map for the State of Tamil Nadu presented in **Figure 4-1** highlights this aspect very clearly.

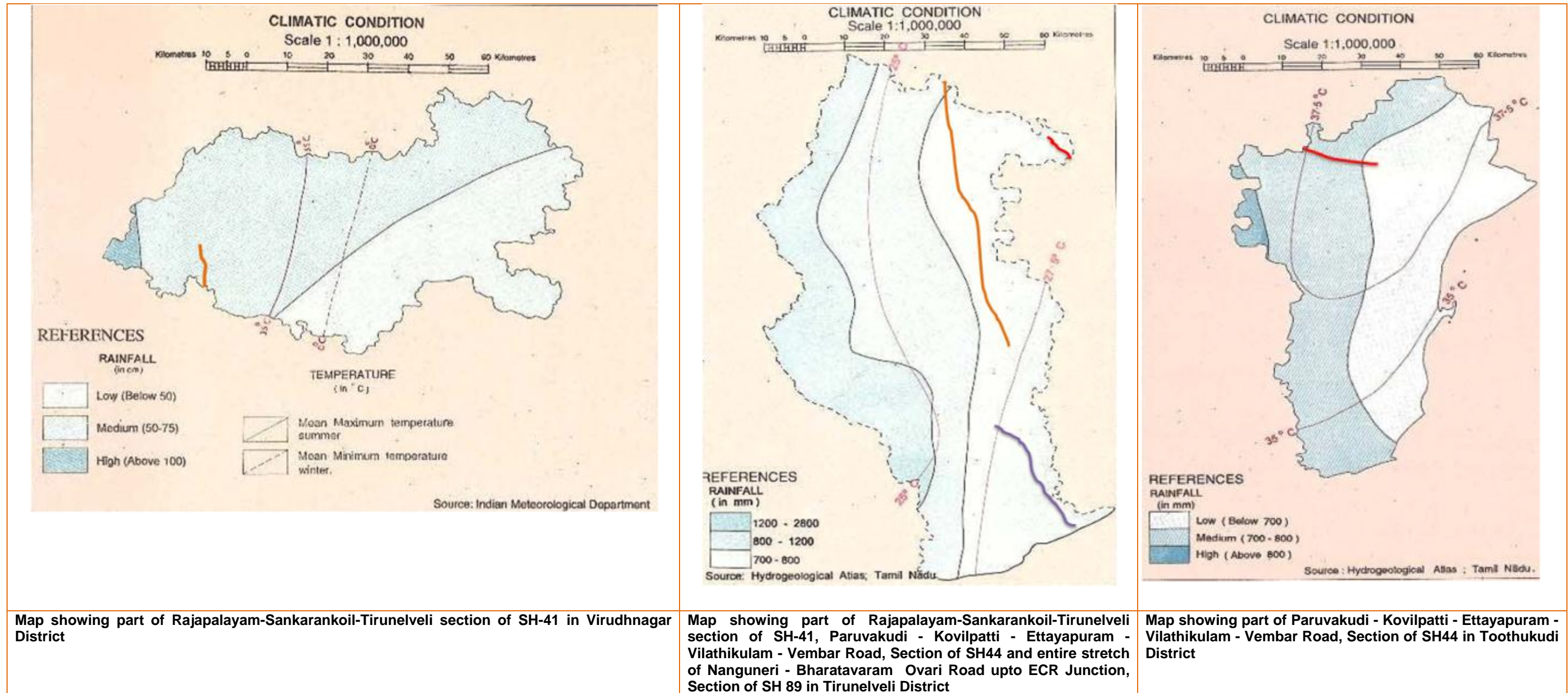


Source: <http://mapsof.net>

**Figure 4-1 : Rainfall Distribution in the State of Tamil Nadu (Project Region Highlighted in red dotted line)**



Maps showing the climatic conditions of project districts are presented in **Figure 4-2**. They show that the annual rainfall in project region varies between 500 mm to 800mm.



Map showing part of Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 in Virudhnagar District

Map showing part of Rajapalayam-Sankarankoil-Tirunelveli section of SH-41, Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44 and entire stretch of Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 in Tirunelveli District

Map showing part of Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44 in Toothukudi District

Source: District Planning Map Series

Figure 4-2 : Climatic Conditions in Project Districts

LEGENDS	
	Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44
	Rajapalayam - Sankarankoil - Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41
	Nanguneri - Bharatavaram - Uvari Road (km 0/000 to km 35/200), Section of SH 89



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## b) Temperature

In the day time the coastal regions are cooler than the interior parts by about a degree in summer and southwest monsoon seasons and warmer by one to two degrees during the rest of the year. From about the middle of February, temperature increases steadily. In May, which is usually the hottest month in the interior, the mean daily maximum temperature is 37.1 degree Celsius. The weather is quite hot in May & June and maximum temperature sometimes reaches as high as 45 degree Celsius. With the onset of the southwest monsoon by the end of May or beginning of June, there is some drop in temperature. By about the middle of October, both day and night temperatures decrease appreciably. The period from November to January is the coolest period of the year with the mean daily maximum temperature of about 30 to 31 degree Celsius in the interior parts. The mean daily minimum temperatures in these months are about 22 to 23 degree Celsius in the Tirunelveli district.

The maximum and minimum temperature in Tirunelveli district (Palaykottai) is as follows:

**Table 4-4 : Temperature of Tirunelveli District (Degree Celsius), Year 2011-12**

Month	Maximum Temperature	Minimum Temperature
June - 2011	39.6	24.4
July	39.4	33.8
August	39.4	24.6
September	40.1	25.1
October	39.5	23.3
November	34.0	24.0
December	32.8	19.5
January - 2012	33.4	18.4
February	36.2	19.4
March	38.2	22.4
April	39.5	23.5
May	41.0	24.5

Source: District Statistical Handbook 2011-2012- Tamil Nadu

The maximum and minimum temperature in Toothukudi district is as follows:

**Table 4-5 : Temperature of Toothukudi District (Degree Celsius), Year 2011-12**

Month	Maximum Temperature	Minimum Temperature
June - 2011	38.5	25.1
July	37.8	26.8
August	38.5	27.2
September	37.9	26.6
October	34.8	23.7
November	32.8	23.4
December	31.3	21.9
January - 2012	31.6	20.4
February	32.8	23.2
March	34.1	24.1



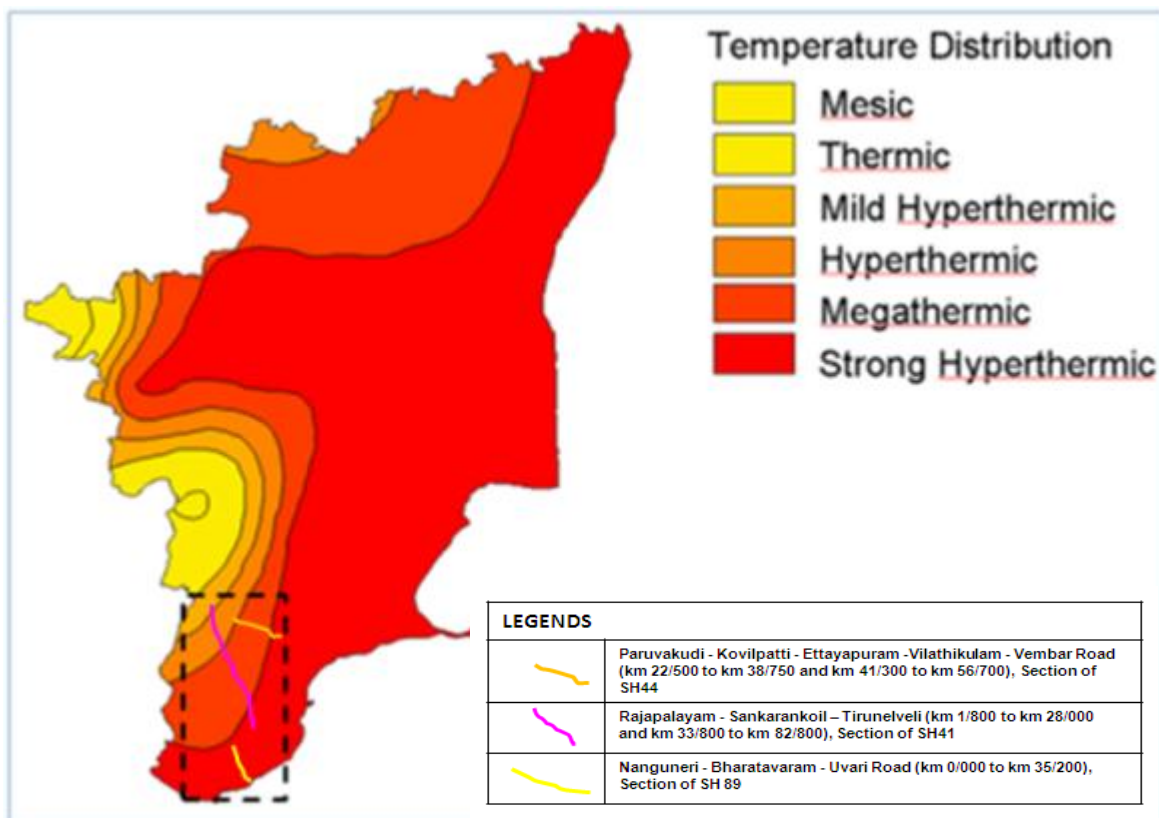
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Month	Maximum Temperature	Minimum Temperature
April	35.3	25.3
May	35.3	25.3

Source: District Statistical Handbook 2011-2012- Toothukudi

Also, as observed from **Figure 4-2**, the average temperature in project region varies between 25°C to 37.5°C.

Project region fall in hyperthermic to strong megathermic zone as per temperature distribution map of Tamil Nadu State (**Figure 4-3**).



Source: <http://mapsof.net>

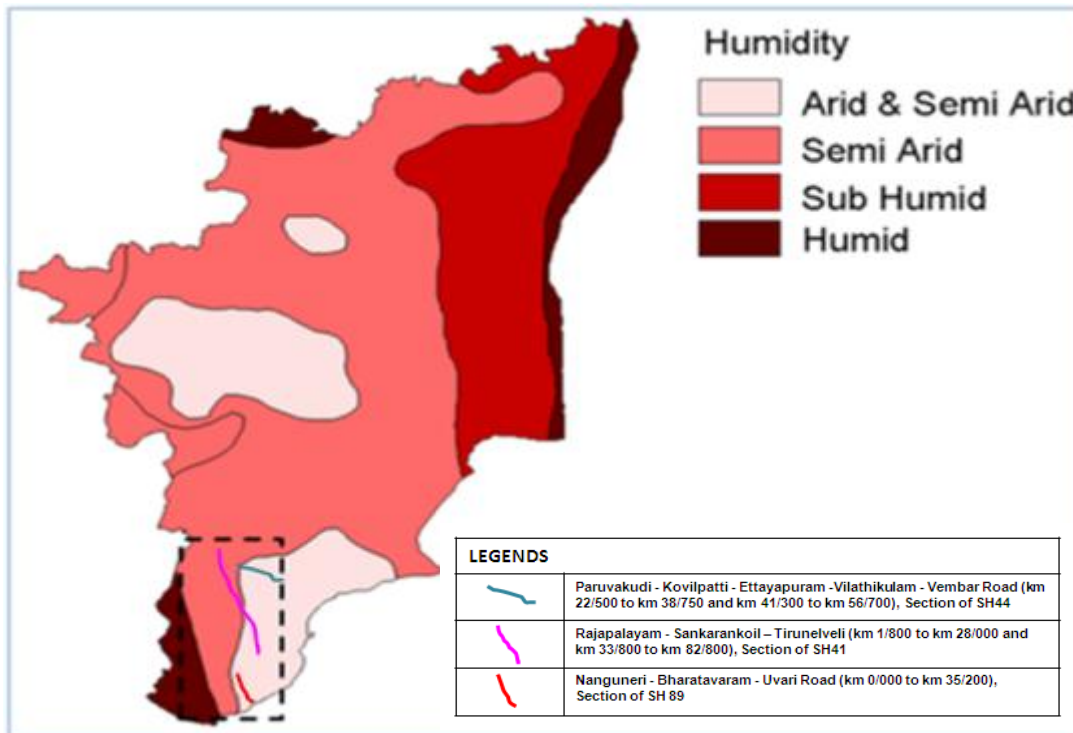
**Figure 4-3: Temperature distribution map of Tamil Nadu State (Project Region marked in black dotted line)**

### c) Relative Humidity

The PIA has arid and semi arid climate (**Figure 4-4**). The average relative humidity in Tirunelveli district varies between 79% and 84%, in Virudhnagar district varies between 65% and 85% and in Toothkundi district varies between 60% and 75%.



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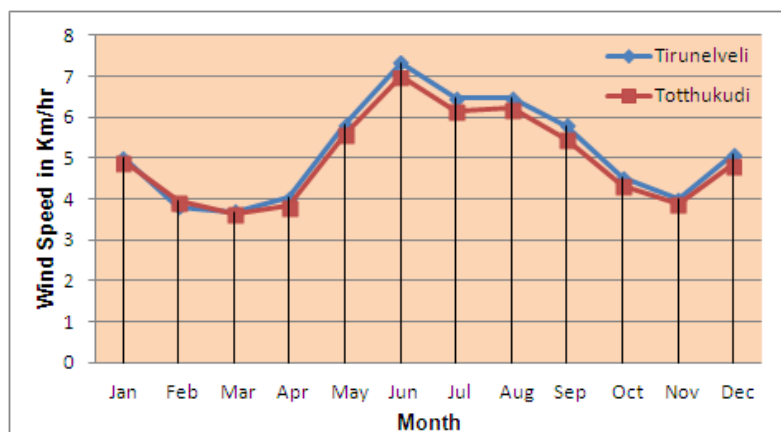


Source: <http://mapsof.net>

**Figure 4-4: Humidity map of Tamil Nadu State (Project Region marked)**

**d) Winds**

Wind speed and wind direction have a significant role on the dispersion of atmospheric pollutants and therefore, the air quality of the area. Ground level concentrations for the pollutants are inversely proportional to the wind speed in the down wind direction, while in upwind direction no effect will be observed and in cross wind direction partial effect due to the emission sources is observed.



source: [www.svneravenvirom.com](http://www.svneravenvirom.com)

**Figure 4-5: Wind Speed in Major Project Districts**

In PIA, Winds blow from north and northwest towards the east

between October and December, when north-east monsoon sets in.

In January and February, winds blow steadily from northeast, occasionally from the north and northwest. Between June and September, the winds reverse their direction and blow mostly from southwest direction.



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

The wind speed in Tirunelveli and Toothukudi is shown in **Figure 4-5**. As observed in the figure, wind speed is highest in the month of June and lowest in the month of March. The maximum and minimum wind speed in Tirunelveli and Toothukudi district is around 7.0 km/hr and 3.8km/hr respectively.

#### 4.2.2 Ambient Air Quality

Ambient air quality refers to the background air quality levels in a region, characterised by concentrations of various pollutants in the atmosphere. The presence of air pollutants and their concentrations depends on the type of polluting sources, and other factors that influence their flow and dispersion. In most cases vehicular emissions are the predominant source of air pollution. Existing ambient air quality data on various sections of the project corridors was collected to establish a baseline database. The aim was to identify areas that already have high pollution levels or are expected to experience so, on account of the road project, and to design adequate mitigation measures, as applicable.

The activities, which modify atmospheric air quality, are transportation (i.e., motor vehicle emissions, which are addressed in this study); industry; domestic and construction. The principal sources of air pollution due to road projects are hot mix plants and machineries used during construction phase and the vehicles that ply over it during the operation phase.

Dispersal of pollutants depends upon factors like prevailing wind direction and other weather conditions, height of the source, and characteristics of roadside plantation and presence of other sinks along the project corridor.

**Ambient air quality standards:** GoI Air Pollution Control standards, formulated by MoEF & CC, were set in 1981. The statutory bodies that regulate these standards at the central and state levels are the CPCB and the SPCB, respectively. National Ambient Air Quality Standards (NAAQS) for particulate and gaseous pollutants as laid down by the CPCB in year 2009 are given in **Appendix 4.2a**.

#### Sample Selection & Monitoring locations

The baseline status of the ambient air quality has been established through a scientifically designed ambient air quality monitoring network and is based on the following considerations:

- Meteorological conditions prevailing in the area;
- Topography of the study area;
- Representatives of background air quality for obtaining baseline status; and
- Representatives of likely impact areas

Ambient air quality monitoring has been undertaken at four locations each along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44 and Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 during February- March 2014 and at nine locations along Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 during June- July 2014 with due consideration to the above mentioned points. The



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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

monitoring frequency considered was twice a week 24 hourly continuous monitoring for four weeks.

Following parameters has been measured to prepare the baseline condition:

- i. Particulate Matter (<math>PM\_{10}</math>)
- ii. Particulate Matter (<math>PM\_{2.5}</math>)
- iii. Sulphur dioxide (<math>SO\_2</math>)
- iv. Nitrogen oxide (<math>NO\_x</math>)
- v. Carbon monoxide (CO)

Details of the ambient air quality monitoring locations along project roads are provided in **Table 4-6** and are shown in Baseline Environmental Monitoring Report of project roads (Appendix 4.1).

**Table 4-6 Ambient Air Quality Monitoring Locations**

Station Code	Location	Ex Ch.	Land Use	Co-ordinates of monitoring location
<b>Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44</b>				
AAQ01	School and temple at Naduvapatti	Km 23.00	Sensitive	E-0800589; N-1022966
AAQ02	Temple at Nakkalamuttampatti Village	Km 27.30	Sensitive	E-0804713; N-1021714
AAQ03	Cross junction of NH-7 at Kovilpatti Municipal Area	Km 40.41	Commercial	E-0814234; N-1016308
AAQ04	Near Mahakavi bharathiyar memorial near Ettayapuram	Km 55.20	Commercial	E-0828853; N-1012769
<b>Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89</b>				
AAQ12	School near Elankulam Village	Km 11.00	Sensitive	E-0801670; N-0931779
AAQ13	RECT College Vijayanarayanam	Km 14.20	Sensitive	E-0804526; N-0929543
AAQ14	College near cross junction of SH-93 (Vallure to Turchun)	Km 22.20	Commercial	E-0809188; N-0925979
AAQ15	School and Church Ovari	Km 35.90	Sensitive	E-0818520; N-0916343
<b>Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41</b>				
AAQ1	College	Km 1.100	Sensitive	E:0780738 N:1043165
AAQ2	Mahatma Gandhi college of Art & Science for Women	Km 13.00	Sensitive	E:0779689 N:1033014
AAQ3	Govt. Hospital and Bus Shelter	Km 21.15	Sensitive	E:0779040 N:1025009
AAQ4	Vaiyapuri-School and Temple, Sankarankoil	Km 29.30	Sensitive	E:0778530 N:1016955
AAQ5	Mutharamalinga Thevar College and Hostel Canteen	Km 43.00	Sensitive	E:0778530 N:1016955
AAQ6	Govt. Hospital and Govt. High School	Km 55.40	Sensitive	E:0788914 N:0994554





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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Station Code	Location	Ex Ch.	Land Use	Co-ordinates of monitoring location
AAQ7	Govt. High School	Km 61.80	Educational Area	E:0790580 N:0988370
AAQ8	Manur Village	Km 71.20	Residential	E:0791979 N:0980497
AAQ9	At Junction	Km 85.60	Commercial	E:0795478 N:0966063

Source: Baseline Monitoring undertaken by M/S Green Chem Solutions Pvt. Ltd.

**Monitoring Results:** The average ambient air quality monitoring results for project roads are provided in **Table 4-7** and also presented in **Figure 4-6**, **Figure 4-7** and **Figure 4-8**. Photographs taken during ambient air quality monitoring are given in Annexure 1 of Appendix 4.1.

**Table 4-7 Average Ambient Air Quality Monitoring Results**

Location	Classification of area	PM10 ( $\mu\text{g}/\text{m}^3$ )	PM2.5 ( $\mu\text{g}/\text{m}^3$ )	SO <sub>2</sub> ( $\mu\text{g}/\text{m}^3$ )	NO <sub>x</sub> ( $\mu\text{g}/\text{m}^3$ )	CO ( $\text{mg}/\text{m}^3$ )
<b>Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44</b>						
AAQ01	Sensitive	35.8	14.6	5.8	14.4	0.80
AAQ02	Sensitive	39.5	17.3	6.7	16.1	0.85
AAQ03	Commercial	44.2	20.1	7.5	17.3	0.95
AAQ04	Commercial	41.4	18.8	7.1	16.9	0.90
<b>Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89</b>						
AAQ12	Sensitive	34.5	15.8	6.8	15.3	0.85
AAQ13	Sensitive	36.2	17.1	6.1	15.8	0.80
AAQ14	Commercial	40.4	19.6	7.8	17.1	0.95
AAQ15	Sensitive	39.6	18.3	6.4	16.5	0.80
<b>Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41</b>						
AAQ1	Sensitive	39.7	18.4	6.6	17.3	0.80
AAQ2	Sensitive	36.9	16.8	5.8	16.4	0.85
AAQ3	Sensitive	38.5	17.3	6.1	16.8	0.85
AAQ4	Sensitive	37.8	17.2	6.3	16.6	0.95
AAQ5	Sensitive	36.3	16.5	6.0	16.2	0.80
AAQ6	Sensitive	37.6	17.0	6.5	16.7	0.80
AAQ7	Sensitive	38.1	17.7	6.9	17.0	0.80
AAQ8	Residential	42.0	20.2	7.4	17.8	0.90
AAQ9	Commercial	48.5	22.6	8.8	18.5	1.00
NAAQS CPCB Standards		100	60	80	80	02 (8 Hourly)

Source: Baseline Monitoring undertaken by M/S Green Chem Solutions Pvt. Ltd.

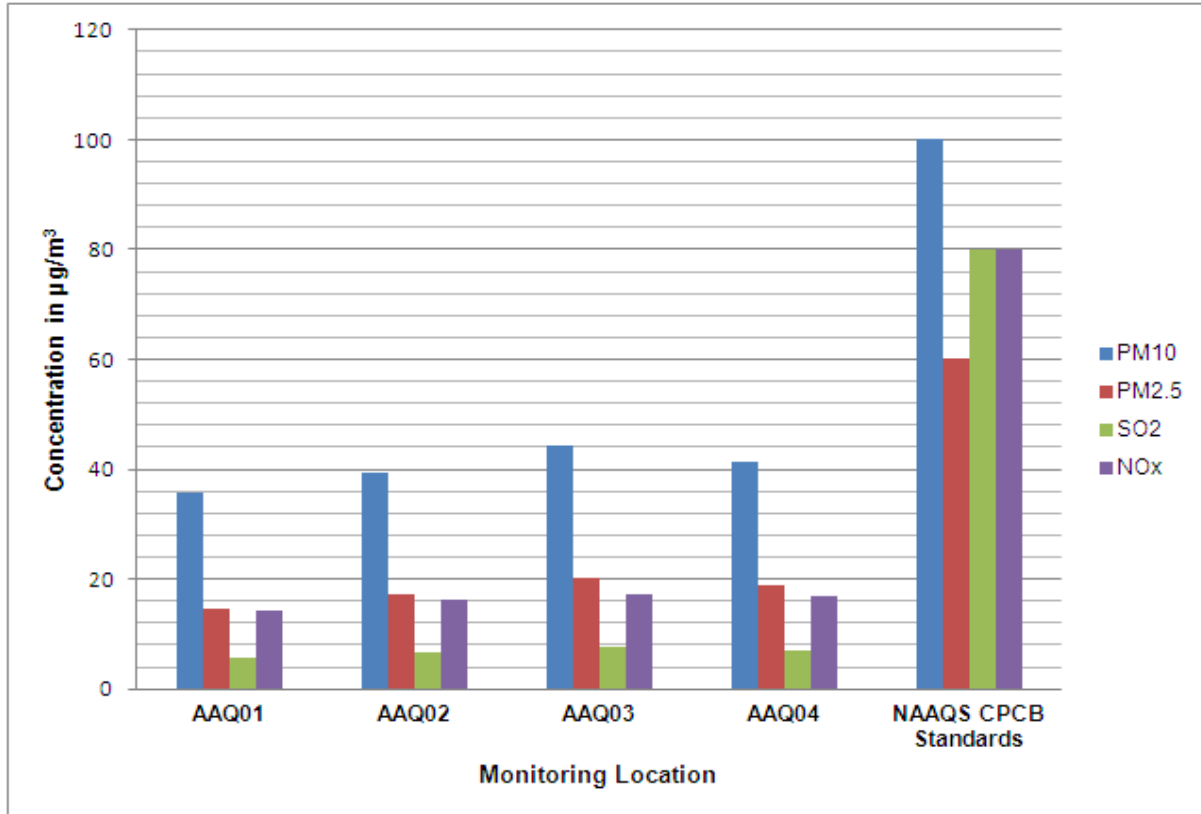
## Results Analysis

### 1) Paruvakudi- Kovilpatti- Ettayapuram-Vilathikulam-Vembar Road Section of SH44

The ambient air quality is well within the limits stipulated by CPCB. It is observed from Table 4-7 that concentration of PM<sub>10</sub> varies between 35.8  $\mu\text{g}/\text{m}^3$  and 44.2  $\mu\text{g}/\text{m}^3$  and that of PM<sub>2.5</sub> varies between 14.6  $\mu\text{g}/\text{m}^3$  and 20.1  $\mu\text{g}/\text{m}^3$ . SO<sub>2</sub> concentration ranges between 5.8  $\mu\text{g}/\text{m}^3$  and 7.5  $\mu\text{g}/\text{m}^3$  and NO<sub>x</sub> value ranges between 14.4  $\mu\text{g}/\text{m}^3$  and 17.3  $\mu\text{g}/\text{m}^3$ . CO levels are

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

found to be varying between  $0.8 \text{ mg/m}^3$  and  $0.95 \text{ mg/m}^3$ . The results are also presented in **Figure 4-6**.

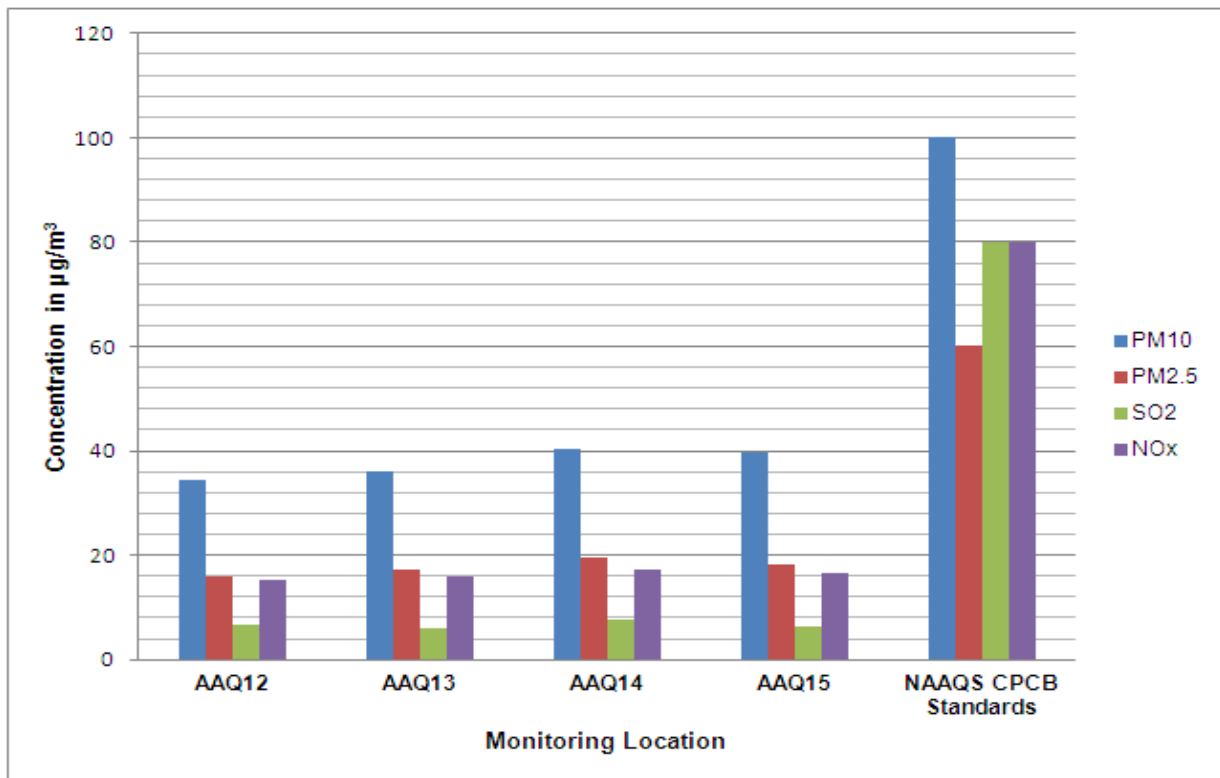


**Figure 4-6: Ambient Air Quality Monitoring Results along Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road Section of SH44**

## 2) Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89

The ambient air quality is well within limits stipulated by CPCB. It is observed from Table 4-5 that concentration of  $\text{PM}_{10}$  varies between  $34.5 \text{ µg/m}^3$  and  $40.4 \text{ µg/m}^3$  and that of  $\text{PM}_{2.5}$  varies between  $15.8 \text{ µg/m}^3$  and  $19.6 \text{ µg/m}^3$ .  $\text{SO}_2$  concentration ranges between  $6.1 \text{ µg/m}^3$  and  $7.8 \text{ µg/m}^3$  and  $\text{NO}_x$  value ranges between  $15.3 \text{ µg/m}^3$  and  $17.1 \text{ µg/m}^3$ . CO levels are found to be varying between  $0.8 \text{ mg/m}^3$  and  $0.95 \text{ mg/m}^3$ . The results are also presented in **Figure 4-7**.

**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

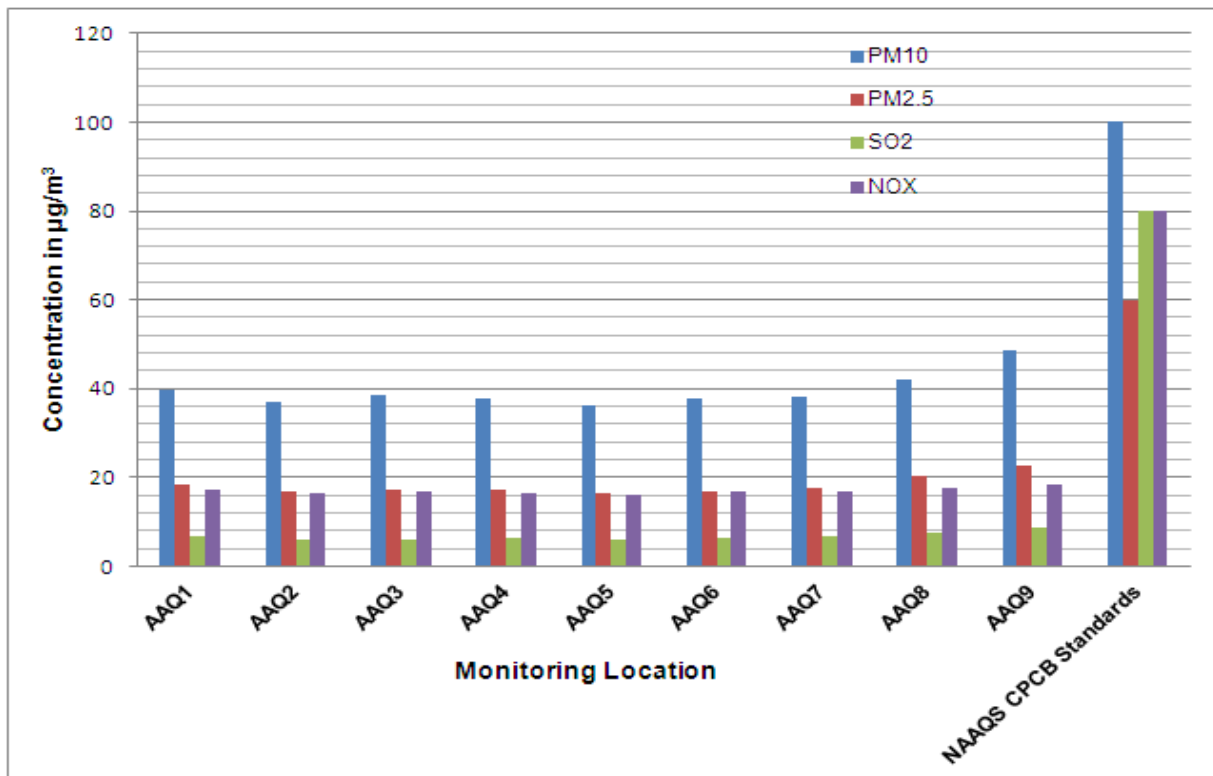


**Figure 4-7: Ambient Air Quality Monitoring Results along Nanguneri - Bharatavaram Ovari Road upto ECR Junction Section of SH 89**

### 3) Rajapalayam-Sankarankoil-Tirunelveli Road section of SH-41

The ambient air quality is well within limits stipulated by CPCB. It is observed that the concentration of PM<sub>10</sub> at all location varies between 36.3 µg/m<sup>3</sup> and 48.5 µg/m<sup>3</sup>. Concentration of PM<sub>2.5</sub> varies between 16.5 µg/m<sup>3</sup> and 22.6 µg/m<sup>3</sup>, SO<sub>2</sub> content ranges between 5.8 µg/m<sup>3</sup> and 8.8 µg/m<sup>3</sup> and NO<sub>x</sub> values ranges between 16.2 µg/m<sup>3</sup> and 18.5 µg/m<sup>3</sup>. The concentration of CO varies between 0.8 mg/m<sup>3</sup> and 1.00 mg/m<sup>3</sup>. The results are presented in **Figure 4-6**.

**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41



**Figure 4-8: Ambient Air Quality Monitoring Results along Rajapalayam-Sankarankoil-Tirunelveli Road Section of SH-41**

### 4.3 LAND ENVIRONMENT

The land environment describes the baseline aspects of the nature and geomorphic features, soil conditions and quality, borrow and material resources and land use characteristics.

#### 4.3.1 Geography and Topography

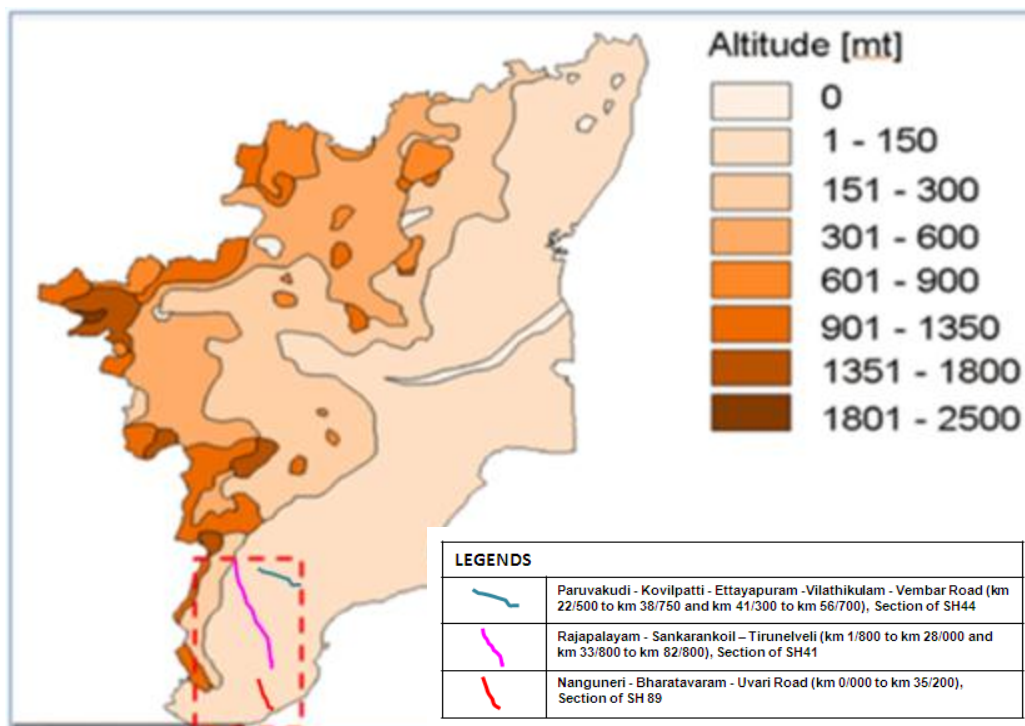
Geomorphologically from west to east, three major units are recognised in Tamil Nadu viz. the Western Ghats, the Central Region and the Coastal Plains. Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44 fall in Tirunelveli, Toothukudi and Virudhnagar Districts (only a small stretch of 600m length fall in Virudhnagar district). Entire stretch of Nanguneri - Bharatavaram -Ovari Road, section of SH89 falls in Tirunelveli district only. About 90% length of Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 fall in Tirunelveli and remaining in Virudhnagar District.

**Tirunelveli district** is surrounded by Western Ghats (Ridge and valley complex) in the West. A major part of the district constitutes a plain terrain with a gentle slope toward East and Southeast, except for the hilly terrain in the West. The general elevation of the area varies from less than 10m to 1408 m above MSL (Tulukkarparai hill range). The prominent geomorphic units are Structural Hill, Bazada Zone, Valley Fill, Flood Plain, Pediment, Shallow buried pediment, Deep buried pediment and Coastal Plain.

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The prominent geomorphic units identified in the **Toothukudi district** are 1) Fluvial, 2) Marine, 3) Fluvio-marine, 4) Aeolian and 5) Erosional landforms depending on the environment of formation. Taruvaikulam- Tuticorin surface, Kulattur surface, Vaippar surface, Nagalapuram-Vedanattham surface and Volinokkam-Vembar surface are some of the erosional geomorphic units in the northern part of the district. Karamaniyar surface, Tambraparni surface, Tiruchendur-Kayapattinam surface and Vallanadu surface are the geomorphic units in the southern part of the district.

The topography (altitude) map for the State of Tamil Nadu is presented in **Figure 4-9** wherein project roads have also been highlighted. As can be inferred from the map, the project region has plain topography having an altitude in the range of 1-150m above MSL.



Source: <http://mapsof.net>

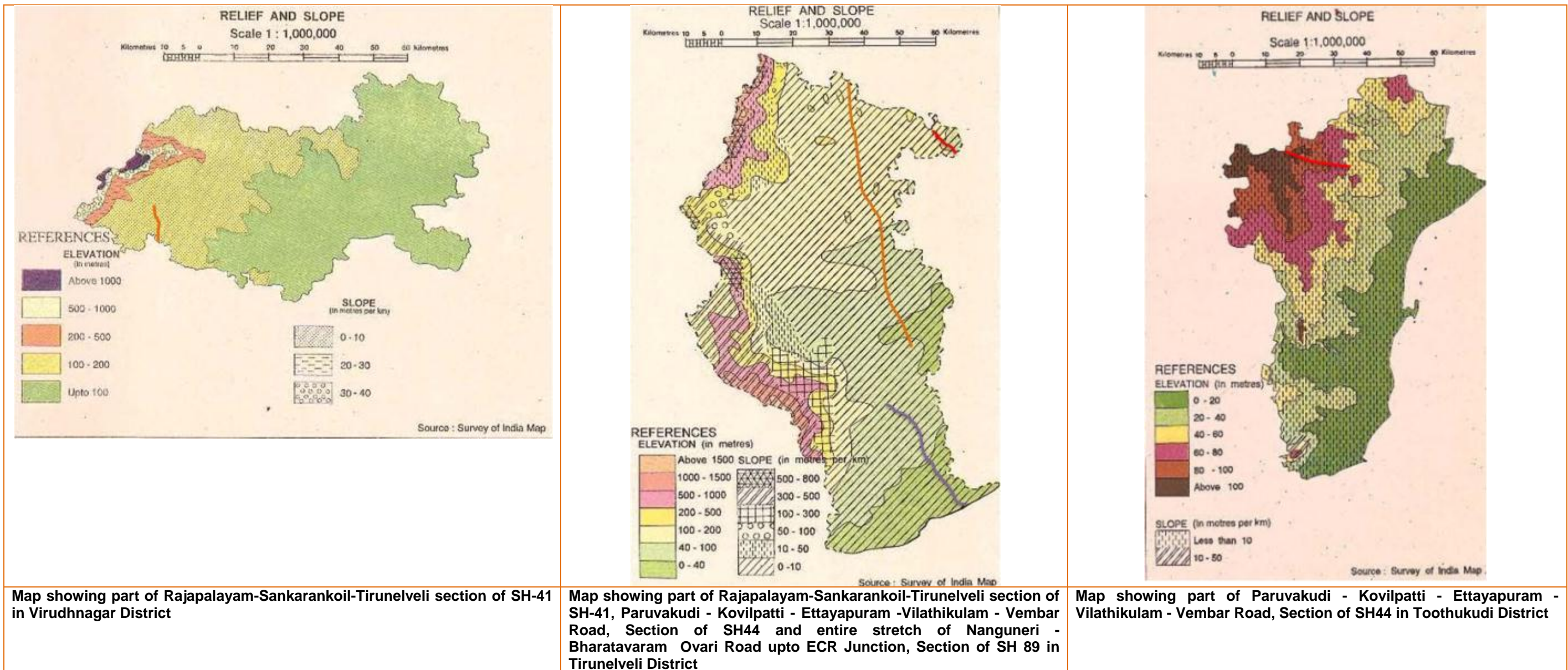
**Figure 4-9: Topographic Feature of Tamil Nadu State  
(Project Region marked in red dotted line)**

Also, the relief and slope map of project districts with marked project roads is shown in **Figure 4-10**. As observed from figure, the land slope along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44 ranges between 0-10m/km with elevation ranging from 0-200m in Tirunelveli district and 60m to above 100m in Toothukudi district.

The land slope along Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 ranges between 0-10m/km with elevation ranging from 0-100m.

As observed from figure, the land slope along Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 ranges between 0-10m/km with elevation ranging between 100m-200m in Virudhnagar district and 0m-200m in Tirunelveli district.





Source: District Planning Map Series

Figure 4-10: Relief and Slope map of Project Districts

LEGENDS	
	Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44
	Rajapalayam - Sankarankoil - Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41
	Nanguneri - Bharatavaram - Uvari Road (km 0/000 to km 35/200), Section of SH 89





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### 4.3.2 Geology and Mineralogy

Geologically, the entire state can be broadly classified into hard Rock or Crystalline Formation and Sedimentary Formations. Nearly 73% of the state is underlain by crystalline rocks of Archean metamorphic complex comprising of granite, charnockites, gneisses, schists etc. They are further intruded at many places by quartz veins, pegmatites and other ultra-basics like dolomites. The sedimentary rocks occur along the coast, flanking the crystalline mass in the west. This sedimentary formation mainly comprises of recent alluvial deposits, tertiary sandstone, lignite, cretaceous limestone, argillaceous sandstone etc. Besides these, sporadic occurrences of upper Gondwana formations consisting of compact sandstone, shale deltaic deposits cover the entire state.

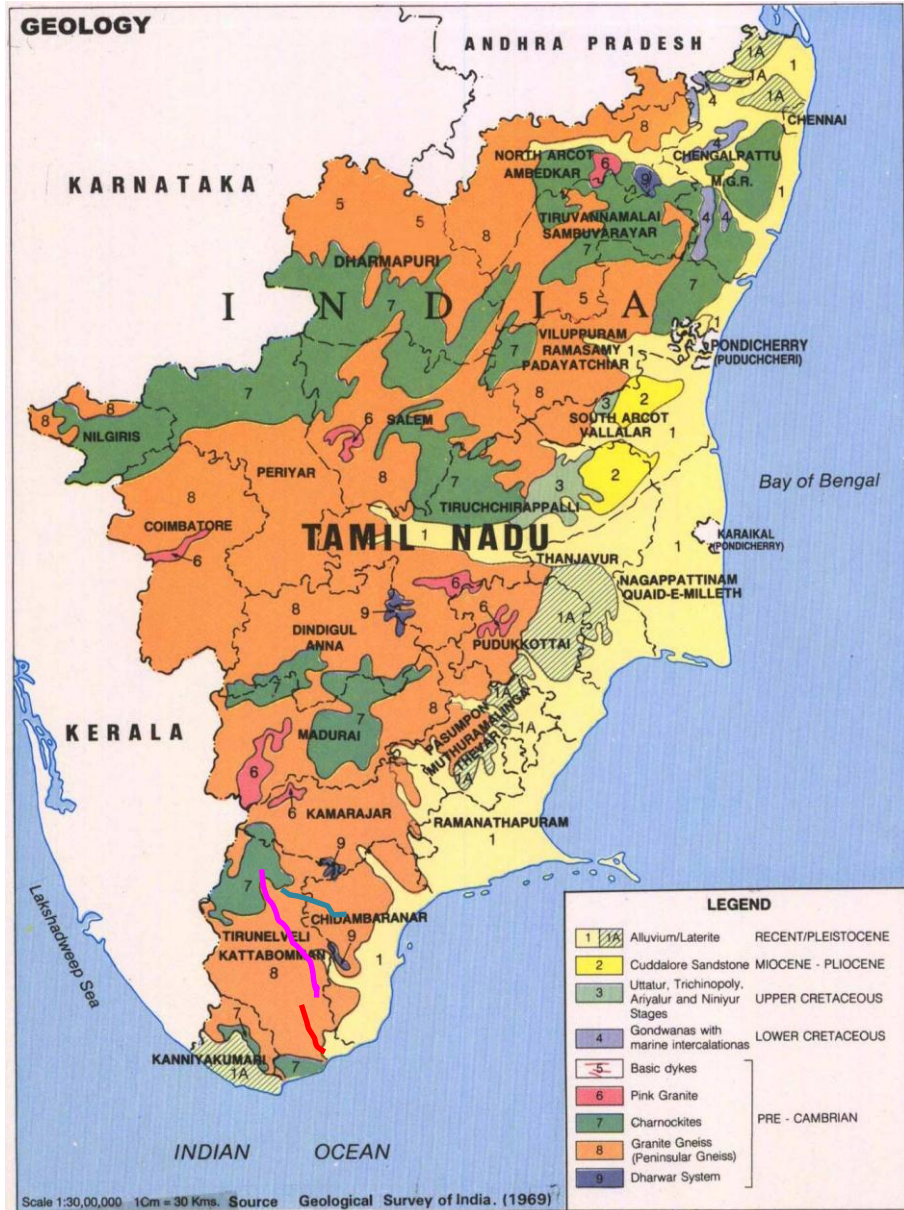


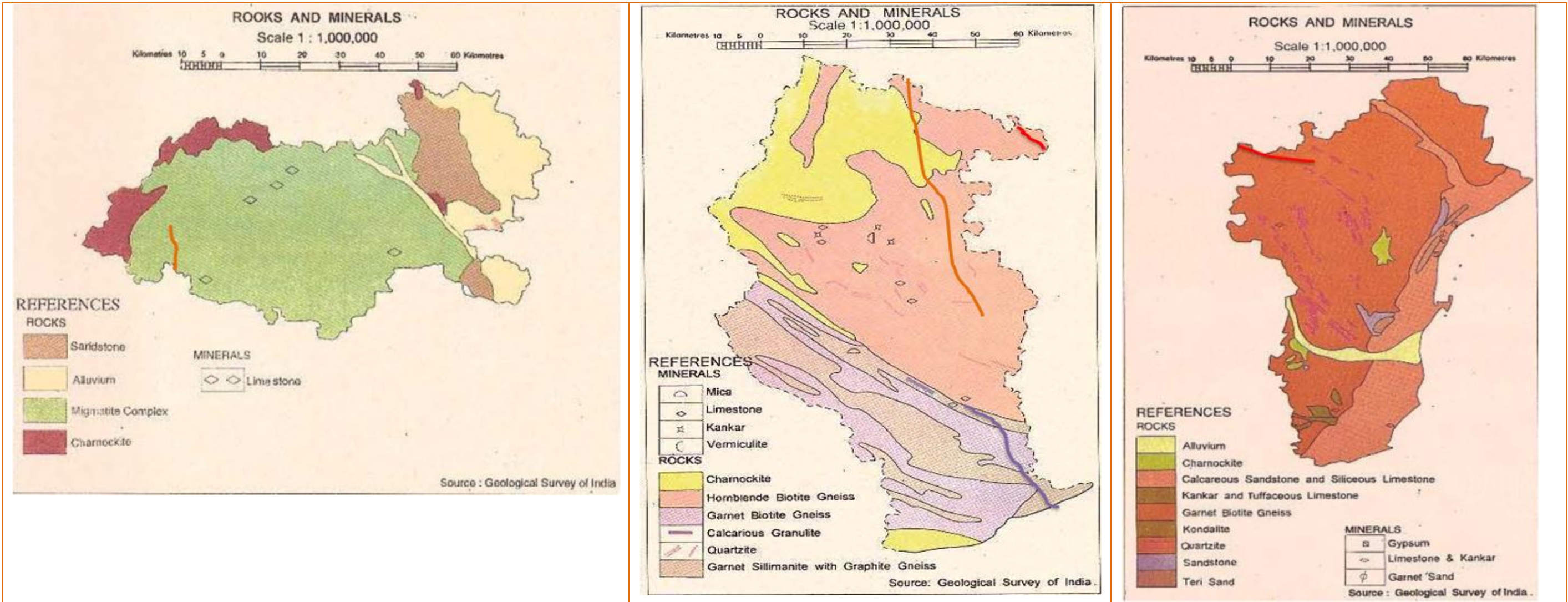
Figure 4-11: Geology of State of Tamil Nadu (Project roads marked)

The geological map of Tamil Nadu state with project roads marked is presented in Figure 4-11. As observed, geological formation in the project region comprises mainly of granite gneiss rocks with some patches of Charnockites.

LEGENDS	
	Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44
	Rajapalayam - Sankarankoil - Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41
	Nanguneri - Bharatavaram - Uvari Road (km 0/000 to km 35/200), Section of SH 89



Figure 4-12 shows the rocks and minerals map of project districts with marked project roads. As observed from map, no minerals are found along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44 and Rajapalayam-Sankarankoil-Tirunelveli section of SH-41. Limestone is found along Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89. However, lime stone is majorly found in the project districts.



Map showing part of Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 in Virudhnagar District

Map showing part of Rajapalayam-Sankarankoil-Tirunelveli section of SH-41, Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44 and entire stretch of Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 in Tirunelveli District

Map showing part of Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44 in Toothukudi District

Source: District Planning Map Series

Figure 4-12: Rocks and Minerals Map of Project Districts

LEGENDS	
	Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44
	Rajapalayam - Sankarankoil - Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41
	Nanguneri - Bharatavaram - Uvari Road (km 0/000 to km 35/200), Section of SH 89



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Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

### 4.3.3 Soil Characteristics

In Tamil Nadu soils are classified into six orders, 12 sub-orders, 20 great groups, 44 subgroups and 94 soil families in the hierarchy. The six orders are Entisols, Inceptisols, Alfisols, Mollisols, Ultisols, Vertisols. Inceptisols cover about 50% of the State's total geographical area followed by Alfisols (30%), Vertisols (7%), Entisols (6%), Ultisols (1%) and negligible area by Mollisols. About 5% of the areas are miscellaneous land types, which includes rocklands, marshes, urban areas and water bodies.



Figure 4-13 shows the soil map of the project districts with the marked project roads. As observed, the soil types along the project roads include inceptisols, alfisols, vertisols and red gravel.

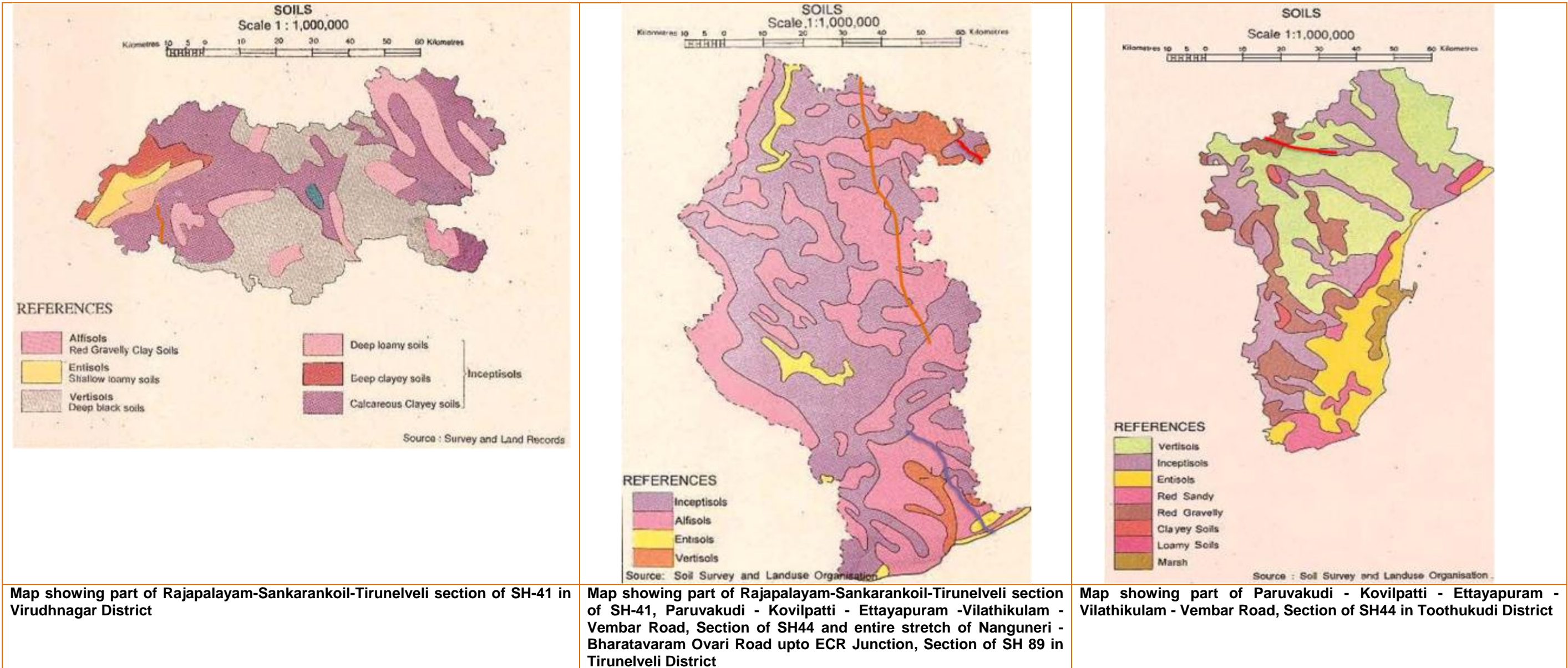
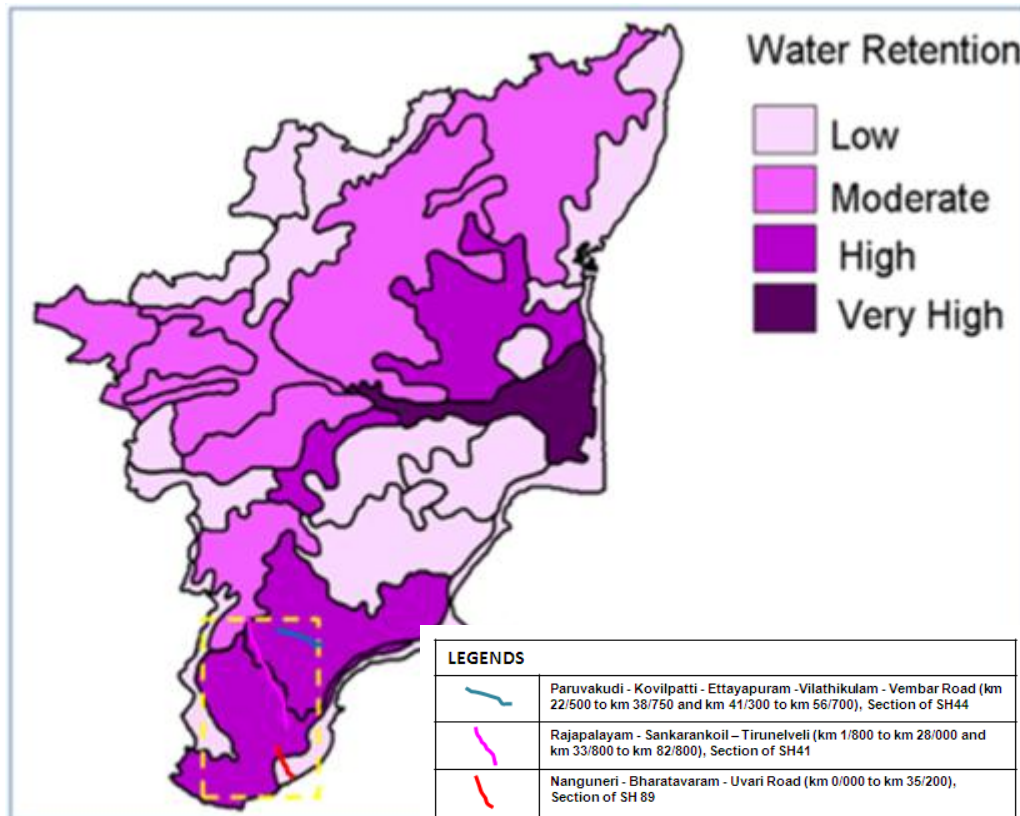


Figure 4-13 : Soil types in Project Districts

LEGENDS	
	Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44
	Rajapalayam - Sankarankoil - Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41
	Nanguneri - Bharatavaram - Uvari Road (km 0/000 to km 35/200), Section of SH 89

**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Based on water retention characteristics, project region found to have soils that have high water retention characteristic except in the end stretch of Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 where water retention is low (see **Figure 4-14**).



Source: <http://mapsof.net>

**Figure 4-14 : Soil Type Based on Water Retention Characteristics  
for the State of Tamil Nadu  
(Project Region is marked with yellow dotted line)**

#### 4.3.3.1 Soil Quality

Soil samples were collected from two locations along Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44, three locations along Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 and five locations along Rajapalayam-Sankarankoil-Tirunelveli section of SH-4. The details of soil sampling locations are provided in **Table 4-8** and presented in Baseline Environmental Monitoring Report of project roads (Appendix 4.1). The analytical results for each location are provided in **Table 4-9**. Field photographs taken during soil sample collection are provided in Annexure 1 of Appendix 4.1.



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**Table 4-8 Description of Soil Sampling Locations**

Location Code	Name of Location and Village	Existing km	Land Use	GPS Point (Zone 43)
<b>Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44</b>				
SQ1	Naduvapatti	Km 24.600	Agriculture and Open Land	E-0801187; N-1022885
SQ2	Mathupuram	Km 51.500	Agriculture land	E-0825722; N-1012709
<b>Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89</b>				
SQ6	Subramanyapuram	Km 7.5	Agriculture land	E-0799648; N-0934023
SQ7	Sevandiapuram	Km 17.4	Agriculture land	E-0806051; N-0928278
SQ8	Idaiyangudi	Km 34.5	Agriculture land	E-0817478; N-0919425
<b>Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41</b>				
SQ1	Ammanpuram and Sonaganvilai	9.4000	Rice Paddy Land	E:0781390 N:1036199
SQ2	Sivasubramaniyapuram and Thenthirupperai	20.000	Rice Paddy Land	E:0779386 N:1026424
SQ3	Puliamkullam	33.000	Open Agriculture and Rice Paddy Land	E:0778954 N:1013876
SQ4	Parancheri	64.400	Agriculture	E:0791397 N:0985629
SQ5	Ramainpatti	82.00	Agriculture	E:0796070 N:0968172

Source: Baseline Monitoring undertaken by M/S Green Chem Solutions Pvt. Ltd.





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**Table 4-9 Analytical results of Soil sampling of the study area**

Sl. No.	Parameters	Unit	SQ1	SQ2	SQ6	SQ7	SQ8	SQ1	SQ2	SQ3	SQ4	SQ5
	<b>Road Name</b>		<b>Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44</b>		<b>Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89</b>			<b>Rajapalayam-Sankarankoil-Tirunelveli section of SH-41</b>				
1	pH ( 10% solution )	--	7.65	7.91	7.91	7.84	7.67	7.28	7.81	7.76	7.79	7.18
2	Conductivity	mmhos/cm	0.254	0.229	0.274	0.269	0.416	0.224	0.432	0.447	0.280	0.374
3	Sand	%	90	60	80	70	60	80	30	35	30	65
	Silt	%	10	40	20	20	40	15	20	15	10	10
	Clay	%	--	--	--	10	--	5.0	50	50	60	25
4	Texture		Sand Soil	Sand Soil	Sand Soil	Sand Soil	Sand Soil	Sand Soil	Clay Soil	Clay Soil	Clay Soil	Sandy Soil
5	Moisture Retention capacity	%	2.12	1.2	1.76	0.45	0.036	1.05	0.84	6.07	1.46	1.39
6	Moisture	%	7.64	3.61	5.29	1.34	0.108	3.16	2.58	8.22	4.37	4.20
7	Infiltration rate	mm/hr	1.7	1.6	1.9	1.8	1.8	1.7	1.5	1.6	1.7	1.6
8	Organic matter	%	0.1012	0.014	0.1014	0.1043	0.1019	0.1023	0.1156	0.1127	0.1143	0.087
9	Nitrogen	%	0.0169	0.0172	0.0121	0.0138	0.0185	0.0164	0.0148	0.0157	0.0136	0.0172
10	Potassium	%	0.0142	0.0114	0.0148	0.0154	0.0172	0.013	0.0102	0.0105	0.0102	0.0128



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Sl. No.	Parameters	Unit	SQ1	SQ2	SQ6	SQ7	SQ8	SQ1	SQ2	SQ3	SQ4	SQ5
	<b>Road Name</b>		<b>Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44</b>		<b>Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89</b>			<b>Rajapalayam-Sankarankoil-Tirunelveli section of SH-41</b>				
11	Phosphorous	%	0.0034	0.0029	0.0041	0.0039	0.0053	0.0018	0.0021	0.0014	0.0018	0.0027
12	Sulphates	%	0.0084	0.0262	0.0135	0.0081	0.0189	0.0014	0.0029	0.0023	0.0016	0.0018
13	Sodium Sulphate	%	0.0119	0.0302	0.0188	0.0141	0.0222	0.0145	0.01090	0.0116	0.0032	0.0082
14	Calcium Sulphate	%	0.0141	0.0386	0.0217	0.0163	0.2714	0.0304	0.0234	0.0564	0.035	0.0642
15	Oil and grease	%	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Note : NPK:1%=10000mg/kg

Source: Baseline Monitoring undertaken by M/S Green Chem Solutions Pvt. Ltd.



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

### Results Analysis:

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

The soil samples do not show much variation in characteristics. The pH levels of the soils show that soils are alkaline in nature. The soil type is sandy. The nutrient status of soil is also a key element in agriculture. Above results also shows that the soils of the study area have good amount of primary nutrients i.e., Nitrogen (N), Phosphorus (P) and Potassium (K) content. From the results it can be observed that the soil in the project area is fertile with high agricultural productivity with appropriate use of fertilizer. The soil has good electrical conductivity.

#### 2) Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89

The pH levels (varies between 7.67-7.91) of the soils show that soil is alkaline in nature. The soil type is sandy. The nutrient status of soil is also a key element in agriculture. Above results also shows that the soils of the study area have good amount of primary nutrients i.e., Nitrogen (N), Phosphorus (P) and Potassium (K) content. From the results it can be observed that the soil in the project area is fertile with high agricultural productivity with appropriate use of fertilizer. The soil has good electrical conductivity.

#### 3) Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41

The pH levels of the soils show that soils are alkaline in nature. The soil type is sandy and clayey. The nutrient status of soil is also a key element in agriculture. Above results also shows that the soils of the study area have good amount of primary nutrients i.e., Nitrogen (N), Phosphorus (P) and Potassium (K) content. From the results it can be observed that the soil in the project area is fertile with high agricultural productivity with appropriate use of fertilizer. The soil has good electrical conductivity.

### 4.3.4 Land-Use

Land use of the major project districts is presented in **Table 4-10**. As observed, agriculture is the major land use pattern in both the districts. However, in Tirunelveli, proportion of other fallow land is almost same as agricultural.

**Table 4-10 : Land Use Pattern of Project Districts**

S.No.	Description	Year 2011 - 12			
		Tirunelveli District		Toothukudi District	
		Area in ha	%	Area in ha	%
1	Total Reported Area	675850		470723	
2	Forest Area	127758	18.9%	11010	2.3%
3	Cultivable Waste Land	36214	5.4%	47963	10.2%
4	Fallow Land				
i	Current Fallow	35525	5.3%	15002	3.2%
ii	Fallow land other than current	174126	25.8%	78698	16.7%



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S.No.	Description	Tirunelveli District		Toothukudi District	
		Area in ha	%	Area in ha	%
	fallow				
5	Barren & Unculturable Land	29682	4.4%	19878	4.2%
6	Land under Non-agricultural uses	103136	15.3%	76477	16.2%
7	Permanent pasture & other grazing land	5156	0.8%	5132	1.1%
8	Land under misc., Tree, cops and groves not included in net sown area	8595	1.3%	37940	8.1%
9	Net Area Sown	155658	23.0%	178623	37.9%

Source: District Statistical Hand Book

**Figure 4-15** shows the general land use pattern of the project districts with marked project roads. As observed, the land use along all the three project roads is mostly arable land. However, in Toothukudi district, the land use along small stretch of Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44 is non-agricultural.

The details of land use along the project roads are as follows:

Project Road	Land Use Distribution within EROW	Major Built Up Areas/Congestion Points	Land use beyond EROW
Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44	Open area with road side plantation : 65% Built Up : 35%	Major built up and congestion area: Kolvilpatti Municipal Area  Other built up areas: Titthankulam and Ettayapuram.	Predominantly Open Area followed by agricultural in some stretches
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89	Open Area: 69% Built Up : 31%	Major built up area: Tisaiyanvillai Congestion points: Tisaiyanvilai and Idaiyangudi Urban Areas are congested habitation centers with limited ROW	Predominantly Open Area/Open Land followed by built up area. Cashew plantation observed in end changes of Idaiyangudi village.
Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41	Built Up – around 30% Dry Land – 53% Wet Land – 16%	Rajapalayam, Sankarankoil and Rajajipuram are the major congestion points. Others are Karivalamvanthanallur and Manur	Predominantly Dry and Open Land



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Map showing the land use pattern within 10km distance from either side of project road (PIA) is shown in **Appendix 2.2**. The major land use within PIA of Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44 is open land (39%) followed by agricultural (33%). Within PIA of Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89, major land use is agricultural (87%). The major land use within PIA of Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 is agricultural (80%).



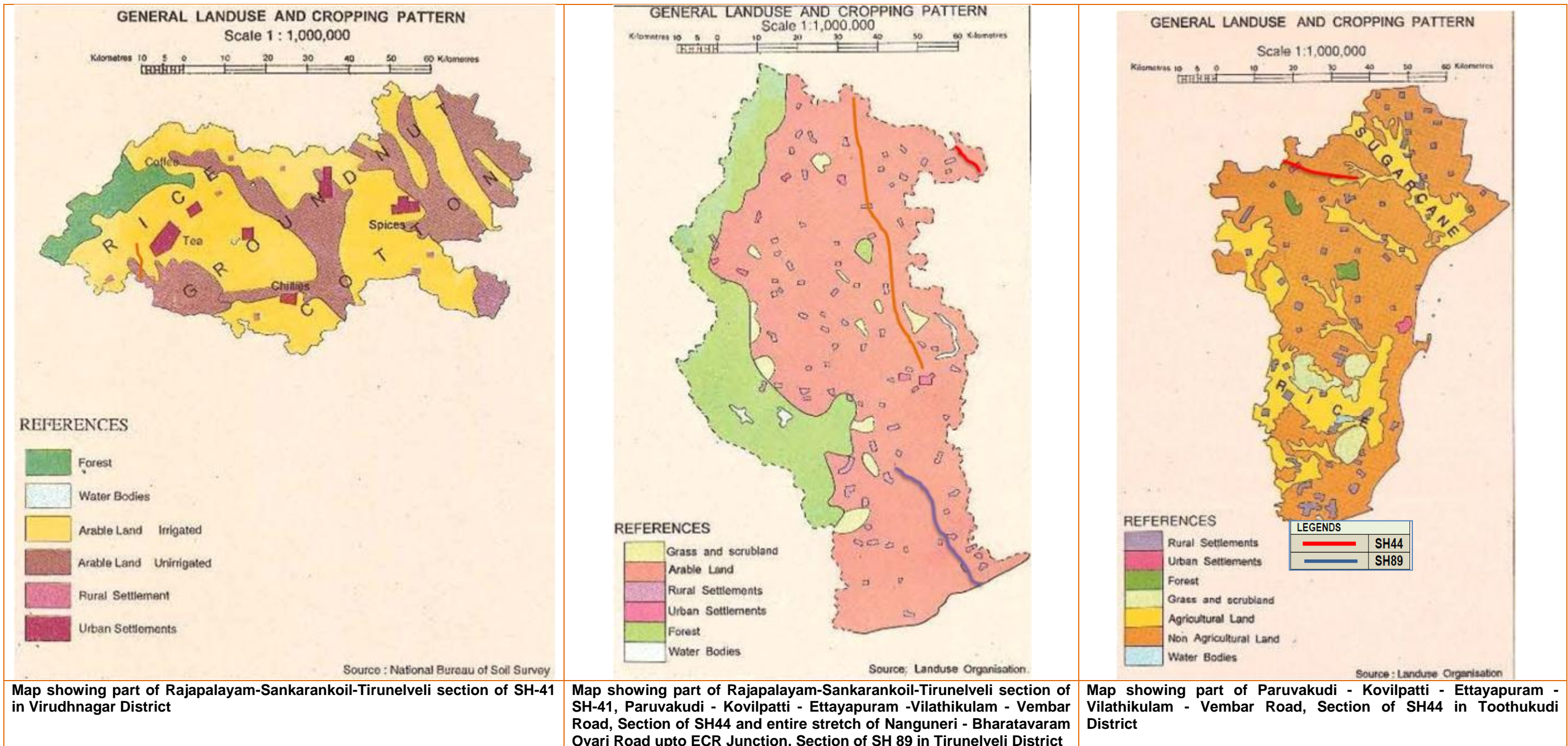


Figure 4-15 : General Land Use pattern in Project Districts

LEGENDS	
	Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44
	Rajapalayam - Sankarankoil - Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41
	Nanguneri - Bharatavaram - Uvari Road (km 0/000 to km 35/200), Section of SH 89





ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Photographs showing land use along the Project Roads

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



Road side Plantation



Open Land at Km 24.000



Road side structure



Market Area At km 43.400



Agricultural Area At km 53.200



Match Industry at Km 51.000



ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89**



**Built Up Area**



**Open area with road side plantation**



**Congested area at Tisayanvilai Village**



**Cashew Plantation in Idaiyangudi, Km 34/000**



**INS Kottabomman , Boundary wall along SH89 on RHS from Km 12/600 to Km 16/00**



**End point Junction, Km 35/200**





ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**Rajapalayam-Sankarankoil-Tirunelveli section of SH-41**



Wind mills along SH 41 in starting chainages



Open land along road



Agriculture land at Km 3.600



Lime Stone Industrial Area at km 75.980

**4.3.5 Landslide/landslip Problems**

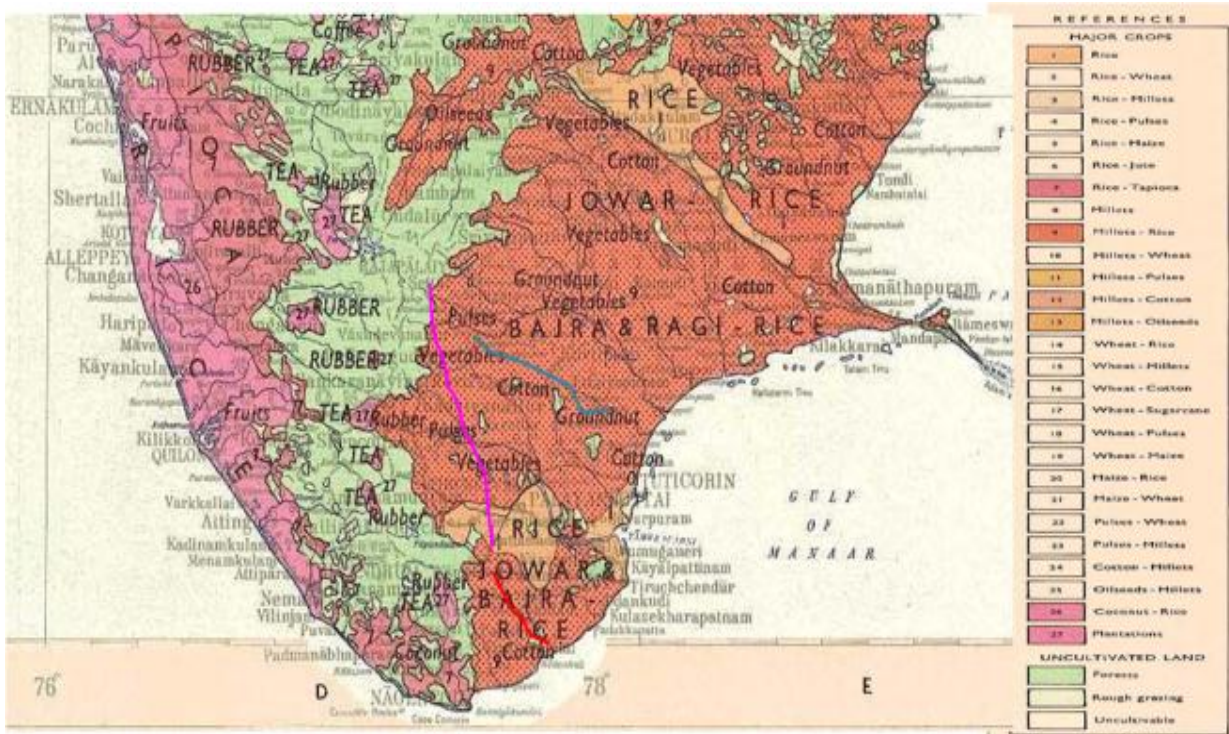
As the project road fall in plain terrain, so there is no issue of land slide/landslip in the project area.

**4.3.6 Agriculture**

Agriculture plays a vital role in the State's economy. The major source of economy along the project roads are agriculture and livestock.

**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**Figure 4-16** shows the major crops grown in project region. As observed, millets-rice are the major crops grown in the project area. Cash crops such as cotton, groundnut, pulses and vegetables are also grown in the project region. The important food crops are paddy, bajra, ragi, maize and other minor millets.



Source: National Atlas of India, Crops Region, Southern India Plate

LEGENDS	
	Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44
	Rajapalayam - Sankarankoil - Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41
	Nanguneri - Bharatavaram - Uvari Road (km 0/000 to km 35/200), Section of SH 89

**Figure 4-16 : Major Crops in the Project Region (Project Roads marked)**

## 4.4 WATER ENVIRONMENT

### 4.4.1 Hydrogeology

**Tirunelveli district** is underlain by both porous and fissured formations. The important aquifer systems in the district are constituted by (See **Figure 4-17**):

- Weathered and fractured hard rock formations of Archaean age;
- Porous sedimentary formations ranging in age from Tertiary and Recent.

The porous formations are found as small patch in the south-eastern part of the district and include sandstones, limestone's, Laterite and Clays from Tertiary to Quaternary. The yield of bore wells varies from 1.0 - 4.5 litres per second. The aquifer at the shallow depth is under unconfined condition and aquifer at depth is under semi-confined to confined condition. The



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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shallow aquifer is developed through dug wells and deeper aquifer through tube wells. The dug well can sustain a pumping of 4 to 6 hours while the tube wells can sustain a pumping of 6 to 8 hours.

**Toothukudi district** is underlain by both porous and fissured formations. The important aquifer systems in the district are constituted by (See **Figure 4-17**):

- unconsolidated & semi-consolidated formations and
- weathered and fractured crystalline rocks

The porous formations in the district include sandstones and clays of recent to sub recent and tertiary age (Quaternary). Ground water occurs under water table and confined conditions in these formations and is being developed by means of dug wells and filter points. The yield of large diameter wells in the district, tapping the weathered mantle of crystalline rocks ranges from 40 to 110 lpm and are able to sustain pumping for 2 to 6 hours per day.

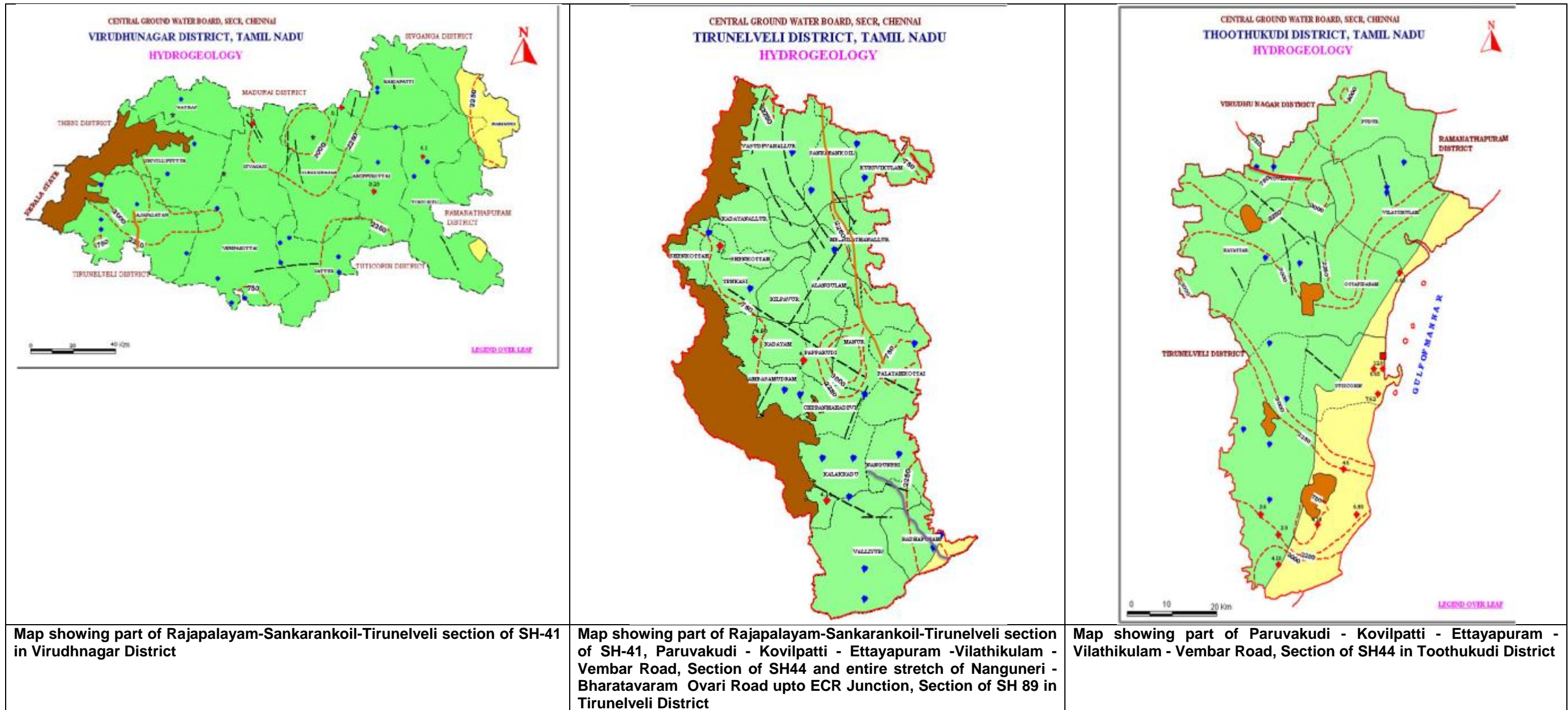
**Virudhnagar district** is underlain by both porous and fissured formations. The important aquifer systems in the district are constituted by (See **Figure 4-17**):

- unconsolidated & semi-consolidated formations and
- weathered, fissured and fractured crystalline rocks

The porous formations in the district include sandstones and clays of Recent to subrecent and Tertiary age (Quaternary). The alluvial formations comprising mainly sands, clays and gravels are confined to major drainage courses in the district. The maximum thickness of alluvium is 35.0 m. whereas the average thickness is about 25.0 m. Ground water occurs under phreatic to semi-confined conditions in these formations and is being developed by means of dug wells and filter points. Alluvium, which forms a good aquifer system along the Vaippar and Gundar river bed, which is one of the major sources of water supply to the villages. The thickness of weathered zone in the district is in the range of 4 to 15 m. The depth of dug wells ranged from 10 to 15 m bgl. The yield of large diameter wells in the district, tapping the weathered mantle of crystalline rocks ranges from 40 to 110 lpm and are able to sustain pumping for 2 to 6 hours per day.



ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

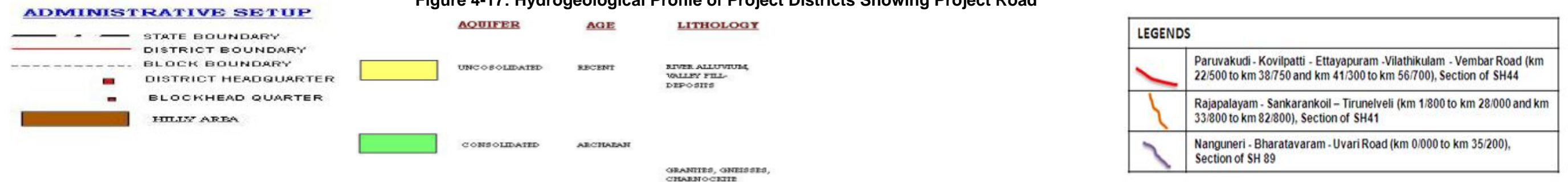


Map showing part of Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 in Virudhnagar District

Map showing part of Rajapalayam-Sankarankoil-Tirunelveli section of SH-41, Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44 and entire stretch of Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 in Tirunelveli District

Map showing part of Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44 in Thoothukudi District

Figure 4-17: Hydrogeological Profile of Project Districts Showing Project Road







**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

The project roads fall in consolidated aquifer of Archaean age except a small stretch of project road near the end chainage of Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 which fall in unconsolidated aquifer of recent age. The project roads fall under following blocks of project districts. The categorisation of blocks based on ground water resources is as follows:

Road	District	Block	Category of Block
Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44	Tirunelveli	Sankarankoil	Over-Exploited
	Toothukudi	Kovilpatti	Over-Exploited
		Ettayapuram	Over-Exploited
	Virudhnagar	Sattur	Safe
Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89	Tirunelveli	Nanguneri	Safe
		Radhapuram	Over-Exploited
Rajapalayam-Sankarankoil-Tirunelveli section of SH-41	Virudhnagar	Rajapalayam	Over-Exploited
	Tirunelveli	Sankarankoil	Over-Exploited
		Melaneelithanallur	Over-Exploited
		Manur	Safe

Source: District Groundwater Brochure, Tirunelveli District, Virudhnagar District & Toothukudi District, Tamil Nadu, 2009

As observed from above data, ground water is over exploited throughout the stretch of Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44 except along a small stretch in sattur block of Virudhnagar district. Also, around 60% of Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89 fall in Nanguneri block which is under safe category of ground water resources while there is over exploitation of ground water resources along the remaining stretch of road in Radhapuram block.

About 70% of Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41 passes through over exploited region.

The depth to ground water level of project region during pre-monsoon and post monsoon seasons varies from 2m to 10m and 0m to 10 m respectively. (Source: District Groundwater Brochure, Tirunelveli District, Virudhnagar District & Toothukudi District, Tamil Nadu, 2009)

### Ground Water Resources along the Road:

Ground water is the major source of water in the project region. The ground water resources along the project roads include hand pumps, open wells, tubewells, water tank with tap and over head tank. There are around 46 nos., 32 nos. and 41 nos. of these ground water resources along Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89, Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44 and Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 respectively.

## 4.4.2 Surface Water Resource

### 4.4.2.1 Drainage conditions/Issues

Thamarabarani, Nambiar, Chittar and Karamaniar are the important rivers flowing in Tirunelveli district.



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Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Tamarabarani originates from Papanasam and flows thorough the district. The Nambiyar river originates in the eastern slopes of the Western ghats near Nellikalmottai about 9.6 km west of Tirukkurugundi village at an altitude of about 1060 m above msl. At the foot hills, the river is divided into two arms. The main arm is joined by Tamarabarani at the foothills. Chittar originates near Courtallam and flows through Tenkasi and confluences with Tamarabarani. The hilly terrains have resulted in number of water fall in the district. There are three major water falls in Manimuttar Reservoir catchments area and there are few water falls in the Tamarabarani river also. A series of fall in Chittar River in Courtallam comprising Five Falls, Honey Falls, Main Falls and Old Courtallm Falls are some of the important falls in the area. The drainage pattern in general is dendritic.

The river originating from the Western Ghats and Tamil Nadu uplands control the drainage network of the Toothukudi district. A few streams originate in the hillocks within the district and confluences directly with the sea after flowing 10 to 20 km. Vaipar, Tambraparani and Karamanaiyar are the major rivers draining the district. All the rivers are ephemeral in nature and run off is generated in heavy rainfall period only.

The major part of Virudhunagar district fall in Vaippar - Gundar river basin. Vaippar, Arjuna River, Gundar and Deviar are the important rivers. The drainage pattern, in general, is dendritic. All the rivers are seasonal and carry substantial flows during monsoon period. Vaippar, which is one of the important rivers of the district, flow and drain in the Vembakkam and Sattur blocks. The Arjuna river, flowing in the central part of the district, has its origin from the Sattur Watrap Hills and is formed by Kovillar, periyar and Chittar rivers. The Gundar river originates at an altitude of 500 m amsl near Kottaimalai of Saptur reserved forest in Varushanadu hills in Madurai District.

#### Drainage along the project roads

There are few nalas and drains along/crossing the project roads. The details of nalas/drains along project roads are presented in **Table 4-11**, **Table 4-12** and **Table 4-13** respectively. Presently, most of the drains/nalas are in dry condition.

**Table 4-11 : Details of Water Bodies along Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44**

Existing Ch. (km)	LHS/RHS	Drain/Nala	Length of Water body along road (m)	Present Condition	Distance from CL (m)
22.700 to 23.400	LHS	Road side drain	700	Dry	7-8
23.800 to 24.000	LHS	Road side drain	700	Running	7-8
24.000	RHS	Nala	40	Running	10-12
25.400	LHS	Nala/Drain	-	Dry	Crossing
27.800	RHS	Drain	200	Dry	5-10
28.600	Crossing	Nala	-	Dry	-
29.400	Crossing	Nala	-	Dry	-



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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Existing Ch. (km)	LHS/RHS	Drain/Nala	Length of Water body along road (m)	Present Condition	Distance from CL (m)
29.900	Crossing	Nala	-	Dry	-
30.580	Crossing	Drain	100	Dry	5-8
35.000	LHS	Drain and Check Dam	500	Dry	6-20
35.500	LHS & Crossing	Drain/Nala	-	Dry	-
43.800	LHS	Drain along the road		Dry	Along the road
48.600	Crossing	Drain	-	Dry	-
51.800	Crossing	Drain	-	Dry	-
52.200	Crossing	Drain	-	Dry	-

Source: Primary Survey, March 2014

**Table 4-12 : Details of Water Bodies along Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89**

Existing Ch. (km)	LHS/RHS	Drain/Nala	Length of Water body along road (m)	Present condition	Distance From CL (m)
2.800	LHS	Drain/ Nala along the road	400	-	5-10
13.500	Cross	Rainy Water Nala	15	Running	-
16.580	LHS	Pond and Drain	20	Running	12
23.400 to 24.00	RHS	Road side drain/Nala	600	Dry	6-7
24.600 to 26.050	RHS	Road side drain/Nala	1450	Dry	5-8
26.050	Cross	Nala	10	Dry	-
26.0250	Cross	Nala	20	Dry	-
29.800	Cross	Nala	20	Dry	-
30.00	Cross	Nala	20	Dry	-

Source: Primary Survey, March 2014

**Table 4-13 : Details of drainage along Rajapalayam-Sankarankoil-Tirunelveli section of SH-41**

Existing Ch. (km)	LHS/RHS	River/Drain/Nala	Length of water body along road (m)	Present Condition	Distance From CL (m)
0.400	LHS	City Waste water drain/Nala	900	Running	5-8



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Existing Ch. (km)	LHS/RHS	River/Drain/Nala	Length of water body along road (m)	Present Condition	Distance From CL (m)
6.800	RHS	Drain	200	Dry	20-25
8.050	Both side & crossing	Chozhapuram river and Check dam on RHS	50m RHS 200m LHS	Dry	-
12.600	crossing	Small river/Nala	50	Dry	-
18.420	crossing	Nala/Drain	30	Dry	-
18.600	crossing	Nala/Drain	15	Dry	-
19.800	crossing	Small River	40	Dry	-
20.600	LHS and Crossing	Nala and Check Dam	10 and 20	Dry	-
23.400	crossing	Drain/Nala	15	Dry	-
32.300	crossing	Drain/Nala	20-30	Static and polluted water	-
37.750	Crossing	Drain/Nala	10	Dry	-
38.400	Crossing	Drain/Nala	10	Dry	-
39.450	Crossing	Drain/Nala	30	Dry	-
40.000	Crossing	Drain/Nala	10	Dry	-
40.200	Crossing	Drain/Nala	7	Dry	-
50.00	LHS	Earthen drain along the road	4400	Dry	8.5 to 12
52.220	RHS	Earthen drain and cross to LHS	600	Dry	7-8
62.400	LHS	Small river/Nala	400	Dry	6-10
65.300	Crossing	Sitaru River	100	Dry	-
82.230	Crossing	Canal/Nala	3	Static water	-

Source: Primary Survey, April 2014

#### 4.4.2.2 Surface water bodies along the project roads

There is no major river/stream crossing the project roads- Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44 and Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89. Ponds are the major water bodies observed along these project roads. However, there are many river/stream crossing Rajapalayam-Sankarankoil-Tirunelveli section of SH-41. Chozhapuram and Sitaru rivers are the major ones crossing this project road. Check dams/ponds are the major water bodies observed along this road. Details of the water bodies along the project roads are presented in **Table 4-14**, **Table 4-15** and **Table 4-16**. These surface water bodies are used for bathing and washing by the nearby locals.



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**Table 4-14 : Details of Water Bodies along Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44**

S. No.	Existing Ch (km)	LHS/RHS	Type of Water Body	Present condition	Length of Water body along road (m)	Distance From CL (m)
1.	22.500	LHS	Pond	Dry	20	5.4
2.	24.350	RHS	Pond	Wet	40	10-12
3.	24.650	RHS	Pond	Wet	150	5
4.	26.500	LHS	Pond/coffer dam	Wet	100 (along the road)	Crossing
5.	27.220	LHS	Pond with stone wall	Wet	50	9-10
6.	35.000	LHS	Drain and Check Dam	Dry	500	6-20
7.	42.400	LHS	Pond	Wet	200	20
8.	54.300	RHS	Pond with stone wall	Dry	30	7-10
9.	55.270	RHS	Pond	--	200	25
10.	55.300	LHS	Pond	Dry	20-25	6-7
11.	55.740	RHS	Pond	--	8	8-10

Source: Primary Survey, March 2014

**Table 4-15 : Details of Water Bodies along Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89**

S. No.	Existing Ch (km)	LHS/RHS	Type of Water Body	Present condition	Length of Water body along road (m)	Distance From CL (m)
1	0.350	LHS	Pond on rocky surface	Dry	150	8.0
2	1.100	RHS	Pond	Wet	50	40
3	1.300	LHS	Check dam/ Bund	Wet	150	Bund Wall is 5-7m from centerline
4	1.500	RHS	Water Pond on Rocky Pit	Dry	200	15-20
5	2.650	RHS	Small earthen Check dam\Bund	Wet	300	5-30
6	5.000	LHS	Check dam/ Bund	Dry	200	200
7	8.400	RHS	Check dam / Bund	Wet	40	10-30
8	9.3	Both sides	Check dam /	Wet	300	Adjoining on





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S. No.	Existing Ch (km)	LHS/RHS	Type of Water Body	Present condition	Length of Water body along road (m)	Distance From CL (m)
			Bund			both side
9	13.00	LHS	Coffer dam	Wet	500	50-60
10	15.00	LHS	Pond	Wet	40	8.2
11	16.580	LHS	Pond and Drain	Wet	20	12
12	21.750	RHS and crossing	Canal	Dry	1.30 km along the road on RHS	10-12 and crossing at 22.800
13	23.400	LHS	Pond	Dry	100	8-9
14	24.450	RHS	Check dam\Bund	Dry	60	7-8

Source: Primary Survey, March 2014

**Table 4-16 : Details of Water Bodies along Rajapalayam-Sankarankoil-Tirunelveli section of SH-41**

S.No.	Existing Ch (km)	LHS/RHS	Type of Water Body	Present Condition	Length of water body along road (m)	Distance From Centerline (m)
1.	3.00	LHS	Earthen Check Dam	Dry	400	15-20
2.	7.00	LHS	Earthen Check Dam	Dry	20	9-12
3.	4.980	LHS	Pond	Dry	52	7
4.	8.050	Both side & crossing	Chozhapuram river and Check dam on RHS	Dry	50m RHS 200m LHS	RHS-along the Bridge LHS-along the Bridge approach
5.	11.250	LHS	Pond	Wet	30	5-6
6.	13.550	RHS	Check Dam	Dry	1000	5-9
7.	17.00	RHS	Check Dam	Dry	200	Along the road
8.	17.250	RHS	Check Dam	Dry	700	8-20
9.	20.600	LHS and Crossing	Nala and Check Dam/Pond	Dry	10 and 20	6-50
10.	23.100	RHS	Pond with stone stairs	Dry	20	20
11.	23.700	RHS	Pond	Dry	30	20
12.	24.380	LHS	Pond with cement concrete wall	Dry	30	8-9



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S.No.	Existing Ch (km)	LHS/RHS	Type of Water Body	Present Condition	Length of water body along road (m)	Distance From Centerline (m)
13.	25.600	LHS	Pond	Dry	20	5-6
14.	26.200	Both side	Check Dam	Dry	50	Along the road
15.	29.00	RHS	Check Dam	Dry	500	20-25
16.	33.400	LHS	Pond with stone wall	Dry	20	4-5
17.	33.800	RHS	Check Dam	Dry	1200	15-20
18.	40.200	RHS	Check Dam	Dry	400	30-50
19.	42.200	RHS	Pond	Wet	20	6-7
20.	44.00	LHS	Check Dam	Dry	40	15-30
21.	50.00	LHS	Earthen drain along the road	Dry	4400	8.5-12
22.	52.220	RHS	Earthen drain and cross to LHS	Dry	600	7-8
23.	53.400	RHS	Pond/Check Dam	Dry	100	5-10
24.	53.570	LHS	Check Dam	Dry	350	5-25
25.	60.400	LHS	Pond	Dry	40	25-30
26.	61.700	RHS	Check Dam with channels	Dry	500	5-100
27.	62.400	RHS and cross to LHS	Check Dam with steel channels/doors	Dry	150	40-60
28.	64.400	LHS	Pond in rock trench	Static water	40	15-20
29.	69.000	RHS	Pond in rock trench	Static water	20	25-30
30.	69.600	RHS	Check Dam	Some Static water quantity is present	300	6-8
31.	79.600	RHS	Check Dam	Dry	40	15-20

Source: Primary Survey, March-April 2014

#### 4.4.3 Surface and Ground Water Quality

As mentioned in earlier section, there are many ponds and check dams along the project roads. Also, many groundwater sources such as wells and hand pumps are located on both sides of the existing road ROW. The proposed project may contaminate the surface and ground water during the construction, operation as well as maintenance phases. A plan for



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monitoring and mitigation will, therefore, be required to avoid the pollution or deterioration of the water sources.

Various surface and ground water samples have been collected along the project roads to ascertain the baseline conditions of water quality.

The details of locations of surface and ground water samples are provided in **Table 4-17** and are presented in Baseline Environmental Monitoring Report (Appendix 4.1). The analytical results of surface and ground water are given in **Table 4-15**. Surface water samples were analysed based on CPCB classification and the ground water samples were analyzed for all essential characteristics and for most of the desirable characteristics specified in IS 10500: 2012. These standards are provided in **Appendix 4.2b**. Field Photographs taken during the sample collection time are enclosed in Annexure 1 of Appendix 4.1.

**Table 4-17 Details of Surface and Ground Water Sampling Locations**

Location code	Name of the location and Village	Source of water	SW/GW	GPS Point (Zone 43)
<b>Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44</b>				
WQ01	Near Naduvapatti village	Pond water	SW	E-0800474; N-1022900
WQ02	Near Naduvapatti Village	Community open well	GW	E-0800520; N-1022963
WQ03	Kovilpatti	Hand Pump	GW	E-0814860; N-1015862
WQ04	Near Sri Ram Match industries, Ettayapuram	Water Tank	GW	E-0829707; N-1012900
<b>Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89</b>				
WQ12	Elankulam village	Pond/ Coffe dam	SW	E-0801698; N-0931806
WQ13	Vijayanarayanam village	Water supply Tank	GW	E-0805011; N-0929083
WQ14	Tisaiyanvilai Village	Water supply Tank	GW	E-0815605; N-0922587
WQ15	Km 10.80	Water over head Tank	GW	E-0802390; N-0931129
WQ16	Km 12.20	Water over head Tank	GW	E-0804439; N-0929556
WQ17	Km 16.6	Pond	SW	E-0805853; N-0928425
<b>Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41</b>				
WQ01	Near Marriage Garden, Rajapallayam	Hand Pump	GW	E:0781070 N:1040952
WQ02	Madhukudy	Pond	SW	E:0781261 N:1040555



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Location code	Name of the location and Village	Source of water	SW/GW	GPS Point (Zone 43)
WQ03	Solaiseri	Over Head Water Tank	GW	E:0779772 N:1033153
WQ04	K.R Naidu Nagar	Check Dam	SW	E:0779857 N:1028826
WQ5	Ramalingapuram	Hand pump	GW	E:0778441 N:1020695
WQ6	Muthukrishapuram	Over Head Water Tank	GW	E:0778161 N:1009058
WQ7	Panavadalachathiram	Over Head Water Tank	GW	E:0786968 N:1001727
WQ8	Alakiyapandiapuram	Sitaru River	SW	E:0791444 N:0985010
WQ9	Manur Village	Pond	SW	E:0791998 N:0980405
WQ10	Jami Nagar	Handpump	GW	E:0792102 N:0978493

**Table 4-18 Water Quality along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44**

S. No	Parameters	Units	WQ01 (SW)	WQ02 (GW)	WQ03 (GW)	WQ04 (GW)	IS:10500	IS:2296
							Desirable limits	Class C limits
1	Temperature	°C	29	28	29	29	--	--
2	pH @ 25°C	-	7.63	7.72	7.83	7.72	6.5 - 8.5	6.5 - 8.5
3	Turbidity	NTU	183	<0.5	<0.5	<0.5	1	--
4	Conductivity 25 °C	µmhos/cm	256	727	173	6390	--	--
5	Colour	Hazen	23	<1.0	<1.0	<1.0	5	300
6	Odour		Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	--
7	Total Suspended Solids	mg/L	30	<1.0	<1.0	<1.0	--	--
8	Dissolved Solids [inorganic]	mg/L	161	458	109	4026	500	1500
9	Dissolved Oxygen	mg/L	7.3	7.6	7.8	7.7	--	Min 4.0
10	COD	mg/L	18	10	BDL (DL:4.0)	8	--	--
11	BOD @ 27°C for 3 days	mg/L	5.4	3	BDL (DL:2.0)	2.4	--	3
12	TKN	mg/L	BDL (DL:1.0)	1.12	BDL (DL:1.0)	3.82	--	--



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 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S. No	Parameters	Units	WQ01	WQ02	WQ03	WQ04	IS:10500	IS:2296
			(SW)	(GW)	(GW)	(GW)	Desirable limits	Class C limits
13	Total Hardness as CaCO <sub>3</sub> ,	mg/L	120	253	72	1452	200	--
14	Sodium	mg/L	4.7	20	3.75	228	--	--
15	Potassium	mg/L	1.64	5.1	1.25	51	--	--
16	Calcium as Ca	mg/L	38	73	19	396	75	--
17	Magnesium as Mg	mg/L	6	17	6	111	30	--
18	Ammonia as NH <sub>3</sub>	mg/L	BDL (DL :0.1)	BDL (DL:1.0)	BDL (DL:1.0)	BDL (DL:1.0)	0.5	--
19	Chloride as Cl	mg/L	14	60	15	913	250	600
20	Sulphate as SO <sub>4</sub>	mg/L	20	34	4	1975	200	400
21	Phosphate as P	mg/L	0.16	0.27	0.12	0.24	--	--
22	Nitrate as NO <sub>3</sub>	mg/L	2.64	1.04	BDL	32	45	50
23	Fluoride as F	mg/L	BDL (DL:0.1)	BDL (DL:0.1)	BDL (DL:0.1)	0.33	1	1.5
24	Surfactants	mg/L	Absent	Absent	Absent	Absent	0.2	1
25	Total Iron as Fe	mg/L	1.23	0.09	0.06	0.08	0.3	50
26	Copper as Cu	mg/L	BDL (DL : 0.01)	BDL (DL : 0.01)	BDL (DL : 0.01)	BDL (DL : 0.01)	0.05	1.5
27	Zinc as Zn	mg/L	BDL (DL : .005)	BDL (DL : .005)	BDL (DL :0.005)	BDL (DL : .005)	5	15
28	Arsenic as As	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	0.01	0.2
29	Mercury as Hg	mg/L	BDL (DL : .001)	BDL (DL : .001)	BDL (DL : .001)	BDL (DL :0.001)	0.001	--
30	Lead as Pb	mg/L	BDL (DL : 0.01)	BDL (DL : 0.01)	BDL (DL : 0.01)	BDL (DL : 0.01)	0.01	0.1
31	Manganese as Mn	mg/L	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	0.1	--
32	Boron as B	mg/L	2.08	0.87	0.28	8.46	0.5	--





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S. No	Parameters	Units	WQ01	WQ02	WQ03	WQ04	IS:10500	IS:2296
			(SW)	(GW)	(GW)	(GW)	Desirable limits	Class C limits
33	Chromium as Cr	mg/L	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	0.05	0.05
34	Phenolic compounds as C <sub>6</sub> H <sub>5</sub> OH	mg/L	BDL (DL : .001)	BDL (DL : .001)	BDL (DL : .001)	BDL (DL : .001)	0.001	0.005
35	Cadmium as Cd	mg/L	BDL (DL: 0.005)	BDL (DL: 0.005)	BDL (DL: 0.005)	BDL (DL :0.005)	0.003	0.01
36	Total Coliform	MPN/10 Oml	350	Absence	Absence	Absence	Absence	5000
37	Fecal Coliform	MPN/10 Oml	48	Absence	Absence	Absence	Absence	--

Source: Baseline Monitoring done by M/S Green Chem Solutions Pvt. Ltd., February-March 2014

### Results Analysis:

Surface water sample was collected from one location, WQ 01. All monitored parameters meets the standards IS 2296 Class C (Drinking water source after conventional treatment and after disinfections), except the BOD. Ground water samples were collected from three locations WQ 02, WQ 03, & WQ 04. All monitored parameters of ground water samples, WQ2 and WQ3 are well within the limits stipulated by IS 10500 desirable limits for drinking purposes. However, levels of TDS, Total Hardness, Calcium, Chloride, Sulphate & Boron are high in ground water sample location of WQ 04. Hence, ground water sample WQ 04 is not fit for drinking.



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**Table 4-19 Water Quality along Nanguneri - Bharatavaram Ovari Road upto ECR Junction Section of SH 89**

S. No.	Parameters	Units	WQ12	WQ13	WQ14	WQ15	WQ16	WQ17	IS:10500	IS:2296
			(SW)	(GW)	(GW)	(GW)	(GW)	(SW)	Desirable limits	Class C limits
1	Temperature	°C	29	29	28	29	28	29	--	--
2	pH @ 25°C	-	7.96	7.95	7.84	8.01	7.57	7.96	6.5 - 8.5	6.5 - 8.5
3	Turbidity	NTU	5.3	4.4	2.9	<0.5	<0.5	5.4	1	--
4	Conductivity 25 °C	µmhos/cm	178	181	195	1038	851	187	--	--
5	Colour	Hazen	3	4	<1.0	<1.0	<1.0	6	5	300
6	Odour		Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	--
7	Total Suspended Solids	mg/L	2.8	2.9	1.7	<1.0	<1.0	2.4	--	--
8	Dissolved Solids [inorganic]	mg/L	112	114	123	484	478	118	500	1500
9	Dissolved Oxygen	mg/L	7.4	7.5	7.3	7.1	7.4	6.9	--	Min 4.0
10	COD	mg/L	BDL (DL :4.0)	BDL (DL : 4.0)	BDL (DL : 4.0)	BDL (DL : 4.0)	BDL (DL : 4.0)	BDL (DL : 4.0)	--	--
11	BOD @ 27°C for 3 days	mg/L	BDL (DL :2.0)	BDL (DL : 2.0)	BDL (DL : 2.0)	BDL (DL : 2.0)	BDL (DL : 2.0)	BDL (DL : 2.0)	--	3
12	TKN	mg/L	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	--	--
13	Total Hardness as CaCO3	mg/L	70	78	82	293	288	82	200	--
14	Sodium	mg/L	4.67	4	5	63	68	5	--	--
15	Potassium	mg/L	1.62	2.9	1.42	22	23	1.6	--	--



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S. No.	Parameters	Units	WQ12	WQ13	WQ14	WQ15	WQ16	WQ17	IS:10500	IS:2296
			(SW)	(GW)	(GW)	(GW)	(GW)	(SW)	Desirable limits	Class C limits
16	Calcium as Ca	mg/L	21	21	23	63	99	20	75	--
17	Magnesium as Mg	mg/L	4.32	6.5	5.86	33	19	7.92	30	--
18	Ammonia as NH3	mg/L	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	0.5	--
19	Chloride as Cl	mg/L	14	13	15	189	203	15		600
20	Sulphate as SO4	mg/L	1.5	1.4	2.6	53	25	3.8	250	400
21	Phosphate as P	mg/L	BDL (DL : 0.01)	0.08	0.09	0.14	0.06	0.05	200	--
22	Nitrate as NO3	mg/L	0.53	0.55	0.65	2.2	2.64	0.53	--	50
23	Fluoride as F	mg/L	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	0.13	0.12	BDL (DL : 0.1)	45	1.5
24	Surfactants	mg/L	Absent	Absent	Absent	Absent	Absent	Absent	1	1
25	Total Iron as Fe	mg/L	0.1	0.28	0.09	0.07	0.09	0.12	0.2	50
26	Copper as Cu	mg/L	BDL (DL : .01)	BDL (DL : .01)	BDL (DL : .01)	BDL (DL : .01)	BDL (DL : .01)	BDL (DL : .01)	0.3	1.5
27	Zinc as Zn	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	0.05	15
28	Arsenic as As	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	5	0.2
29	Mercury as Hg	mg/L	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	0.01	--
30	Lead as Pb	mg/L	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	0.001	0.1
31	Manganese as Mn	mg/L	BDL (DL : .03)	BDL (DL : .03)	BDL (DL : .03)	BDL (DL : .03)	BDL (DL : .03)	BDL (DL : .03)	0.01	--



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S. No.	Parameters	Units	WQ12	WQ13	WQ14	WQ15	WQ16	WQ17	IS:10500	IS:2296
			(SW)	(GW)	(GW)	(GW)	(GW)	(SW)	Desirable limits	Class C limits
32	Boron as B	mg/L	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	0.54	0.86	BDL (DL : 0.1)	0.1	--
33	Chromium as Cr	mg/L	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	0.5	0.05
34	Phenolic compounds as C6H5OH	mg/L	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	0.05	0.005
35	Cadmium as Cd	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	0.001	0.01
36	Total Coliform	MPN/100ml	326	Absence	Absence	Absence	Absence	862	0.003	5000
37	Fecal Coliform	MPN/100ml	38	Absence	Absence	Absence	Absence	134	Absence	--

Source: Baseline Monitoring done by M/S Green Chem Solutions Pvt. Ltd., February-March 2014

### Results Analysis:

Surface water collected from two locations (WQ12 & WQ17) meets the standards IS 2296 Class C surface water. All parameters of ground water samples, WQ13, WQ14, WQ15 & WQ16 are well within the limits stipulated by IS 10500 for drinking purposes.

**Table 4-20 Water Quality along Rajapalayam-Sankarankoil-Tirunelveli Road Section of SH-41**

S. No	Parameters	Units	WQ01	WQ02	WQ03	WQ04	IS:10500	IS:2296
			(GW)	(SW)	(GW)	(SW)	Desirable limits	Class C limits
1	Temperature	°C	28	29	29	28	--	--
2	pH @ 25°C	-	7.80	7.86	7.99	8.15	6.5 - 8.5	6.5 - 8.5
3	Turbidity	NTU	4.6	120	3.0	58	1	--
4	Conductivity 25°C	µmhos/cm	4337	131	121	366	--	--



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S. No	Parameters	Units	WQ01 (GW)	WQ02 (SW)	WQ03 (GW)	WQ04 (SW)	IS:10500	IS:2296
							Desirable limits	Class C limits
5	Colour	Hazen	<1.0	90	4.0	35	5	300
6	Odour		Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	--
7	Total Suspended Solids	mg/L	4.0	180	2.0	94	--	--
8	Dissolved Solids [inorganic]	mg/L	2689	76	68	216	500	1500
9	Dissolved Oxygen	mg/L	7.5	6.8	7.2	BDL (DL:0.2)	--	Min 4.0
10	COD	mg/L	BDL (DL:4.0)	10	BDL (DL:4.0)	28	--	--
11	BOD @ 27°C for 3 days	mg/L	BDL (DL:2.0)	2.0	BDL (DL:2.0)	10	--	3.0
12	TKN	mg/L	BDL (DL:1.0)	BDL (DL:1.0)	BDL (DL:1.0)	BDL (DL:1.0)	--	--
13	Total Hardness as CaCO3	mg/L	130	52	40	89	200	--
14	Sodium	mg/L	410	1.98	4.41	10	--	--
15	Potassium	mg/L	108	0.62	1.38	2.8	--	--
16	Calcium as Ca	mg/L	258	12.4	10	25	75	--
17	Magnesium as Mg	mg/L	92	5.0	3.6	6.48	30	--
18	Ammonia as NH3	mg/L	BDL (DL :0.1)	BDL (DL:1.0)	BDL (DL:1.0)	BDL (DL:1.0)	0.5	--
19	Chloride as Cl	mg/L	1229	5.8	15	34.7		600
20	Sulphate as SO4	mg/L	413	3.0	2.95	49	250	400
21	Phosphate as P	mg/L	0.15	BDL (DL:0.01)	BDL	BDL (DL:0.01)	200	--





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S. No	Parameters	Units	WQ01 (GW)	WQ02 (SW)	WQ03 (GW)	WQ04 (SW)	IS:10500	IS:2296
							Desirable limits	Class C limits
					(DL:0.01)			
22	Nitrate as NO <sub>3</sub>	mg/L	2.70	0.68	BDL (DL:0.5)	0.9	--	50
23	Fluoride as F	mg/L	0.23	BDL (DL:0.1)	BDL (DL:0.1)	0.14	45	1.5
24	Surfactants	mg/L	Absent	Absent	Absent	Absent	1	1.0
25	Total Iron as Fe	mg/L	0.73	17.5	0.07	8.82	0.2	50
26	Copper as Cu	mg/L	BDL (DL : 0.01)	BDL (DL : 0.01)	BDL (DL : 0.01)	BDL (DL : 0.01)	0.3	1.5
27	Zinc as Zn	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	0.05	15
28	Arsenic as As	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	5	0.2
29	Mercury as Hg	mg/L	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	0.01	--
30	Lead as Pb	mg/L	BDL (DL : 0.1)	BDL (DL : 0.01)	BDL (DL : 0.1)	BDL (DL : 0.1)	0.001	0.1
31	Manganese as Mn	mg/L	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	0.01	--
32	Boron as B	mg/L	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	0.1	--
33	Chromium as Cr	mg/L	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	0.5	0.05



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S. No	Parameters	Units	WQ01 (GW)	WQ02 (SW)	WQ03 (GW)	WQ04 (SW)	IS:10500	IS:2296
							Desirable limits	Class C limits
34	Phenolic compounds as C6H5OH	mg/L	BDL (DL : .001)	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	0.05	0.005
35	Cadmium as Cd	mg/L	BDL (DL : .005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	0.001	0.01
36	Total Coliform	MPN/100ml	Absence	Absence	Absence	Absence	0.003	5000
37	Fecal Coliform	MPN/100ml	Absence	Absence	Absence	Absence	Absence	--

Source: Baseline Monitoring done by M/S Green Chem Solutions Pvt. Ltd., June-July 2014

S. No	Parameters	Units	SH-41: Rajapalayam to Tirunelveli					IS:10500	IS:2296
			WQ05 (GW)	WQ06 (GW)	WQ07 (GW)	WQ09 (SW)	WQ 10 (GW)	Desirable limits	Class C limits
1	Temperature	°C	28	29	28	28	29	--	--
2	pH @ 25°C	-	8.41	7.84	7.97	8.03	8.07	6.5 - 8.5	6.5-8.5
3	Turbidity	NTU	3.8	2.5	4.1	148	<0.5	1	--
4	Conductivity 25°C	µmhos/cm	1428	2516	245	259	842	--	--
5	Colour	Hazen	<1.0	<1.0	<1.0	65	<1.0	5	300
6	Odour		Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	--
7	Total Suspended Solids	mg/L	4.0	2.0	3.0	200	BDL (D.L:1.0)	--	--
8	Dissolved Solids [inorganic]	mg/L	814	1536	142	153	487	500	1500
9	Dissolved Oxygen	mg/L	6.8	7.0	7.4	6.7	7.1	--	Min 4.0
10	COD	mg/L	BDL (DL:4.0)	BDL (DL:4.0)	BDL (DL:4.0)	8.0	BDL (DL:4.0)	--	--



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S. No	Parameters	Units	SH-41: Rajapalayam to Tirunelveli					IS:10500	IS:2296
			WQ05 (GW)	WQ06 (GW)	WQ07 (GW)	WQ09 (SW)	WQ 10 (GW)	Desirable limits	Class C limits
11	BOD @ 27°C for 3 days	mg/L	BDL (DL:2.0)	BDL (DL:2.0)	BDL (DL:2.0)	2.0	BDL (DL:2.0)	--	3.0
12	TKN	mg/L	BDL (DL:1.0)	BDL (DL:1.0)	BDL (DL:1.0)	BDL (DL:1.0)	BDL (DL:1.0)	--	--
13	Total Hardness as CaCO <sub>3</sub>	mg/L	557	541	85	92	291	200	--
14	Sodium	mg/L	65	183	6.3	3.43	30	--	--
15	Potassium	mg/L	19	54	1.8	1.1	8.6	--	--
16	Calcium as Ca	mg/L	142	120	24	25	69	75	--
17	Magnesium as Mg	mg/L	49	58	6.0	6.96	28	30	--
18	Ammonia as NH <sub>3</sub>	mg/L	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	0.5	--
19	Chloride as Cl	mg/L	246	641	19	12	96		600
20	Sulphate as SO <sub>4</sub>	mg/L	35	189	8.0	10	45	250	400
21	Phosphate as P	mg/L	0.12	0.14	BDL (DL:0.01)	BDL (DL:0.01)	0.09	200	--
22	Nitrate as NO <sub>3</sub>	mg/L	1.30	1.80	0.76	0.80	1.1	--	50
23	Fluoride as F	mg/L	0.16	0.21	BDL (DL : 0.1)	BDL (DL : 0.1)	0.12	45	1.5
24	Surfactants	mg/L	Absent	Absent	Absent	Absent	Absent	1	1.0
25	Total Iron as Fe	mg/L	0.18	0.10	0.09	21.2	0.06	0.2	50
26	Copper as Cu	mg/L	BDL (DL:0.01)	BDL (DL : 0.01)	BDL (DL:0.01)	BDL (DL:0.01)	BDL (DL:0.01)	0.3	1.5
27	Zinc as Zn	mg/L	BDL (DL:0.005)	BDL (DL:0.005)	BDL (DL:0.005)	BDL (DL:0.005)	BDL (DL:0.005)	0.05	15
28	Arsenic as As	mg/L	BDL	BDL	BDL	BDL	BDL	5	0.2



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S. No	Parameters	Units	SH-41: Rajapalayam to Tirunelveli					IS:10500	IS:2296
			WQ05 (GW)	WQ06 (GW)	WQ07 (GW)	WQ09 (SW)	WQ 10 (GW)	Desirable limits	Class C limits
			(DL:0.005)	(DL:0.005)	(DL:0.005)	(DL:0.005)	(DL:0.005)		
29	Mercury as Hg	mg/L	BDL (DL:0.001)	BDL (DL:0.001)	BDL (DL:0.001)	BDL (DL:0.001)	BDL (DL:0.001)	0.01	--
30	Lead as Pb	mg/L	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL:0.1)	BDL (DL:0.1)	0.001	0.1
31	Manganese as Mn	mg/L	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL:0.03)	BDL (DL:0.03)	BDL (DL:0.03)	0.01	--
32	Boron as B	mg/L	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	0.1	--
33	Chromium as Cr	mg/L	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL:0.03)	BDL (DL:0.03)	BDL (DL : 0.03)	0.5	0.05
34	Phenolic compounds as C <sub>6</sub> H <sub>5</sub> OH	mg/L	BDL (DL:0.001)	BDL (DL:0.001)	BDL (DL:0.001)	BDL (DL:0.001)	BDL (DL:0.001)	0.05	0.005
35	Cadmium as Cd	mg/L	BDL (DL:0.005)	BDL (DL:0.005)	BDL (DL:0.005)	BDL (DL:0.005)	BDL (DL:0.005)	0.001	0.01
36	Total Coliform	MPN/100ml	Absence	Absence	Absence	Absence	Absence	0.003	5000
37	Fecal Coliform	MPN/100m	Absence	Absence	Absence	Absence	Absence	Absence	--

Source: Baseline Monitoring done by M/S Green Chem Solutions Pvt. Ltd., June-July 2014



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

## Results Analysis:

Surface water samples were collected from four locations of WQ 02, WQ 04, WQ 08, & WQ 09. No river water was available from WQ 08. All the parameters monitored for WQ2 and WQ4 meet the standards of IS 2296 Class C. The concentration of all parameters for WQ 04 meet the standards IS 2296 Class C, except the DO & BOD. Ground water samples were collected from six locations WQ 01, WQ 03, WQ 05, WQ 06, WQ 07, & WQ 10. The concentration of all the parameters monitored samples collected from locations WQ 03, WQ 07 & WQ 10 are within the limits stipulated by IS 10500 desirable limits. At Ground water sample location of WQ01, WQ 05, & WQ 06, all parameters are within the limits stipulated by IS 10500 desirable limits, except parameters TDS, Total Hardness, Ca, Cl and Sulphate. Thus, ground water samples WQ01, WQ 05, & WQ6 do not meet the desirable limits of IS 10500 standards for drinking purposes.

## 4.5 NOISE ENVIRONMENT

### 4.5.1 Ambient Noise Quality

Road construction results in increase in noise levels due to movement and operation of machinery, heavy vehicles, loading and unloading of construction materials, apart from high noise levels at the asphalt plants (90 - 100 dB(A)). These activities are intermittent and localised. During the operation phase, noise is generated from vehicle movement in three ways, namely from the vehicle body parts, from the tyre-roadway system (also known as the rolling noise) and from the driver behaviour, such as use of horns.

Noise from the vehicle body parts includes engine, inlet, exhaust, transmission, suspension, gearbox, cooling fan, during acceleration and chassis, etc. Vehicle condition is very important to this noise source. The rolling noise/frictional noise (noise from the tyre-roadway system) includes aerodynamic noise, noise from tyre-road interaction, brakes, etc. The noise level depends upon the type and condition of tyres and pavement. At higher speed, these types of noise increase at same rate. At lower speeds in urban areas, where lower gears are used, noise from the vehicle body parts tends to be independent of vehicle speed whereas noise from the tyre-roadway system becomes less important. Driver behaviour contributes to road noise by using vehicle's horns, sudden breaking on vehicle speed, depending on the road surface and whether the surface is wet or dry.

The level of noise generated by road traffic depends on the type of vehicle flow, the volume of traffic, the speed and composition of the traffic, the road gradient and the type of road surface. Different types of travel patterns indicate the mode of operation of the vehicles. As the flow rate increases, traffic noise increases to a maximum, thereafter the effect of reducing vehicle speed on noise predominates. Interrupted traffic flow occurs with lot of interaction between the vehicles and vehicles are caused to stop or slow down. For decelerating vehicles, the level of noise decreases due to fall in power output of the vehicle. For accelerating vehicle, initially the noise level increases and then drops as the speed increases. In the low speed range, noise is independent of vehicle speed. However in free speed range, i.e., more than 50 km/h a strong relationship prevails between noise generated and vehicle speeds.





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

## Factors and parameters

The noise from a traffic stream is not constant but varies from moment to moment and it is necessary to use an index to arrive at a single figure estimate of the overall noise level for assessment purposes. Variation in traffic volume, vehicle composition and surrounding commercial and industrial activities are the dominating factors that influence the propagation of noise. Energy equivalent noise level Leq (in dB(A)) was the primary parameter selected.

Excessively high noise levels are a concern for sensitive receptors, i.e., hospitals, educational institutions and courts.

The Central Pollution Control Board has specified ambient noise levels for diverse land uses for day and night times. Weightage was given to the timing of exposure and areas designated as sensitive. The National Ambient Noise Level Standards are given in **Appendix 4.2c**.

## Sampling Criteria and Locations

Locations for noise monitoring stations along the project corridors are identified based on the same criteria used for air monitoring but the relative importance of each criteria carries a weighting in arriving at the final set of locations.

Hourly noise levels were recorded at identified six locations along Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44, eight locations along Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 and eighteen locations along Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 using sound level meter. Ambient Noise monitoring locations are shown in Baseline Monitoring Report of Project roads( Appendix 4.1). The hourly noise values were used to calculate daytime and night time equivalent noise levels. In order to arrive at daytime noise levels the logarithmic average of hourly values was taken from 6:00 AM to 10:00 PM. The night time noise levels were derived by taking logarithmic average of hourly values from 10:00 PM to 06:00 AM. The hours of day and night were considered as specified durations for 'day' and 'night' in Noise Rules Published by the MoEF & CC.

## Ambient Noise Levels in Study Area

The equivalent noise levels at various sampling stations are given in **Table 4-21** and shown in **Figure 4-18**, **Figure 4-19** and **Figure 4-20**. Ambient Noise Monitoring photographs are provided in Annexure 1 of Appendix 4.1.

**Table 4-21 Recorded Noise Levels at Various Locations along Project Roads**

Station Code	Location	Type of Area	Leq (dBA) Day	Leq (dBA) Night	Permissible limits as per CPCB standards	
					Day(dBA)	Night (dBA)
<b>Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH4</b>						
ANQ1	School and temple at Naduvapatti	Sensitive	48.8	37.4	50	40
ANQ2	Temple at Sippipari	Commercial	59.7	48.6	65	55



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Station Code	Location	Type of Area	Leq (dBA) Day	Leq (dBA) Night	Permissible limits as per CPCB standards	
ANQ3	Temple at Nakkalamuttampatti Village	Sensitive	48.2	38.7	50	40
ANQ4	Cross junction of NH-7 at Kovilpatti Municipal Area	Commercial	58.8	50.6	65	55
ANQ5	Built-up area at Ettayapuram	Residential cum commercial	52.2	42.6	55	45
ANQ6	Near Maha Kavi bharathiyar Memorial, Ettayapuram	Commercial	61.4	50.9	65	55
<b>Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89</b>						
ANQ25	Govt.school	Sensitive	49.4	37.7	50	40
ANQ26	School Near Elankulam Village	Sensitive	45.1	36.4	50	40
ANQ27	RECT College Vijayanarayanam	Sensitive	46.8	35.9	50	40
ANQ28	Medical dispensary	Sensitive	48.2	37.5	50	40
ANQ29	School Sevandiapuram	Sensitive	47.5	38.0	50	40
ANQ30	College Near cross junction of SH-93 ( Vallure to turchun)	Commercial	58.7	49.6	65	55
ANQ31	School Idaiyangudi village	Sensitive	47.6	36.8	50	40
ANQ32	School and Church Ovari	Sensitive	48.8	37.2	50	40
<b>Rajapalayam-Sankarankoil-Tirunelveli Section of SH-41</b>						
ANQ1	College	Sensitive Zone	48.9	37.6	50	40
ANQ2	Vandimahali Aman Temple	Sensitive Zone	46.8	35.4	50	40
ANQ3	Mahatma Gandhi college of Art & Science for Women	Sensitive Zone	47.3	36.0	50	40
ANQ4	Polytechnic college	Sensitive Zone	47.7	36.5	50	40
ANQ5	Govt. Hospital and Bus Shelter	Sensitive Zone	48.1	35.9	50	40
ANQ6	A.V.K. International School and PKR Cotton Mill, Sankarakovil	School and Factory Area	49.3	38.2	50	40
ANQ7	Vaiyapuri-School and Temple, Sankarakovil	Sensitive Location	48.6	37.8	50	40
ANQ8	Mutharamalinga Thevar College and	Sensitive Location	45.9	33.7	50	40



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Station Code	Location	Type of Area	Leq (dBA) Day	Leq (dBA) Night	Permissible limits as per CPCB standards	
	Hostel Canteen					
ANQ9	Govt. Hospital and Govt. High School	Sensitive Location	47.4	35.6	50	40
ANQ10	Elisabetta Vitale Matriculation School and Church, Lodola Nagar, Devarkulam	Sensitive Location	48.0	36.1	50	40
ANQ11	Govt. High School	Educational Area	47.9	36.5	50	40
ANQ12	Eskiamanv Temple	Sensitive Location	48.3	37.2	50	40
ANQ13	Manur Village	Residential	50.9	39.6	55	45
ANQ14	Govt. Middle School and Temple	Silence Zone	46.1	37.0	50	40
ANQ15	Nanjankulam Regrouped Stone Mines, Indian Cement Ltd., Seduroyan Paddur	Open Caste Mining Area	56.5	48.7	65	55
ANQ16	T.N., Veterinary College and Research Institute of Veterinary and Animal Science University, Tirunveli	Silence Zone	46.5	35.9	50	40
ANQ17	Sudalai Temple, Tirunelveli	Sensitive Zone	47.0	36.6	50	40
ANQ18	At Junction	Commercial Area	59.8	51.3	65	55

Day time monitoring done from 6.00 am – 10.00 pm, Night time monitoring done from 10.00 pm – 6.00 am

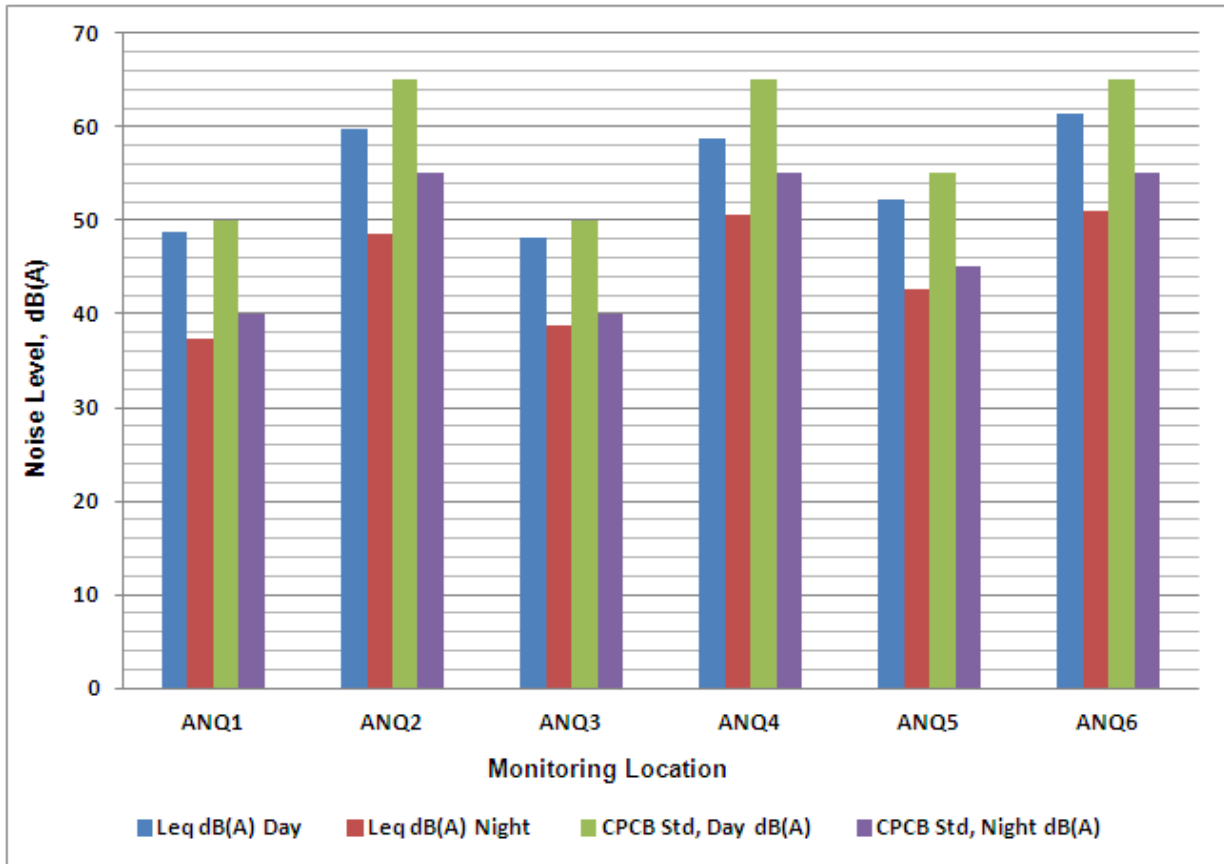
Source: Baseline Monitoring done by M/S Green Chem Solutions Pvt. Ltd.

## Results Analysis

### 1) Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44

The monitored noise levels were ranging from 61.4 dB(A) to 37.4 dB(A) along the Project Road. The measured day time mean values of noise levels and hourly values for the period of 6am to 10pm at all locations are well below the permissible limits of CPCB. The night time mean values and hourly values for the period of 10 pm to 6 am at all locations are well below the accepted limits as per specification. The noise levels at all monitoring locations along with category wise CPCB standards are presented as below.

**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

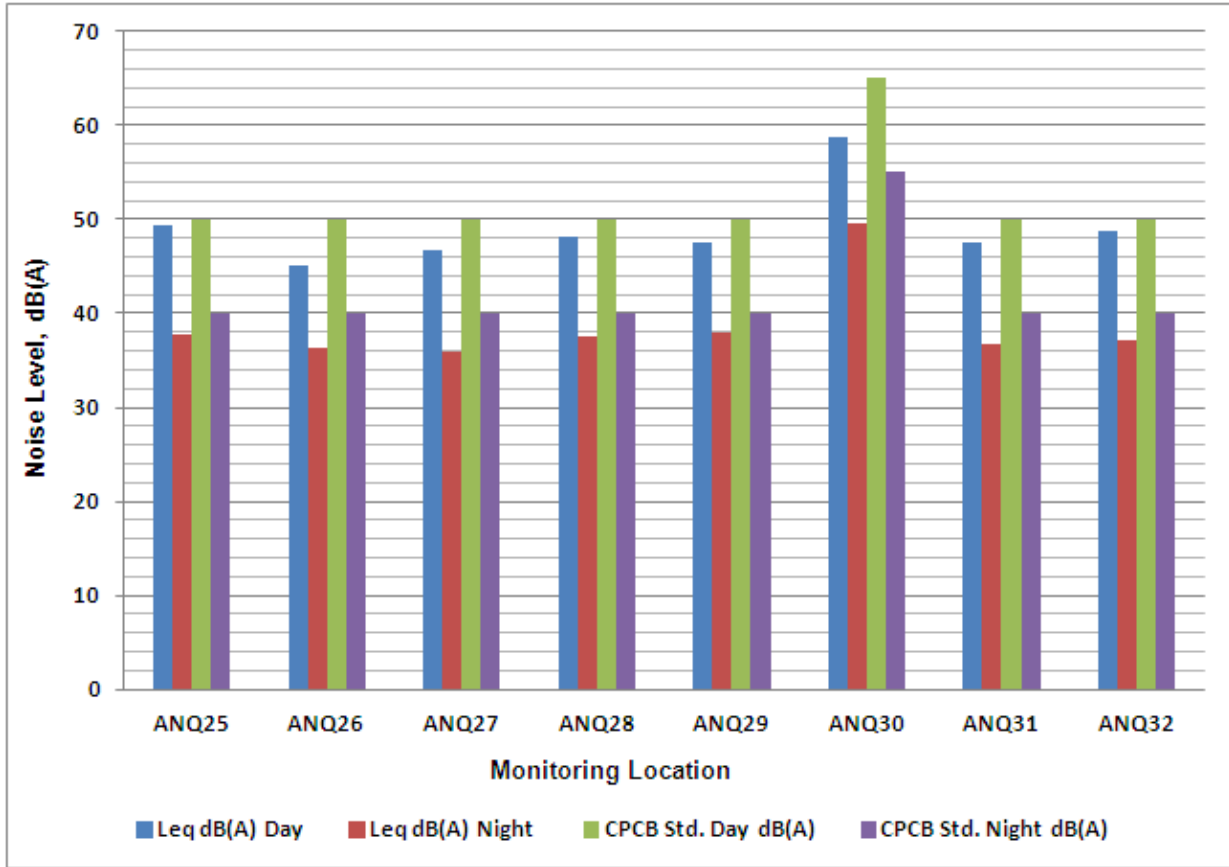


**Figure 4-18: Noise levels monitored along Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44**

**2) Nanguneri - Bharatavaram Ovari Road upto ECR Junction Section of SH 89**

The monitored noise levels were ranging from 58.7 dB(A) to 36.4 dB(A) along the Project Road. The measured day time mean values and hourly values for the period of 6 am to 10pm at all locations are well below the permissible limits of CPCB. The night time mean values and hourly values for the period of 10 pm to 6 am at all locations are well below the accepted limits as per specification. The noise levels at all monitoring locations along with category wise CPCB standards are presented as follows.

**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41



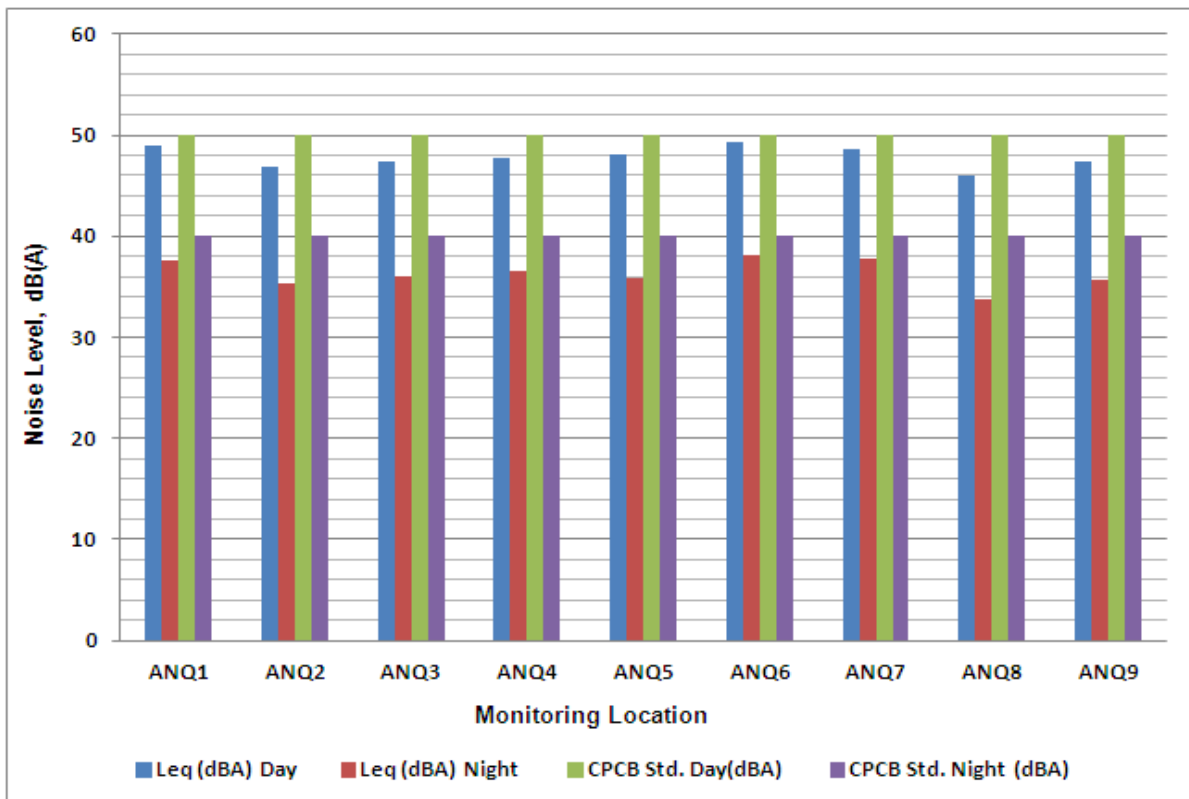
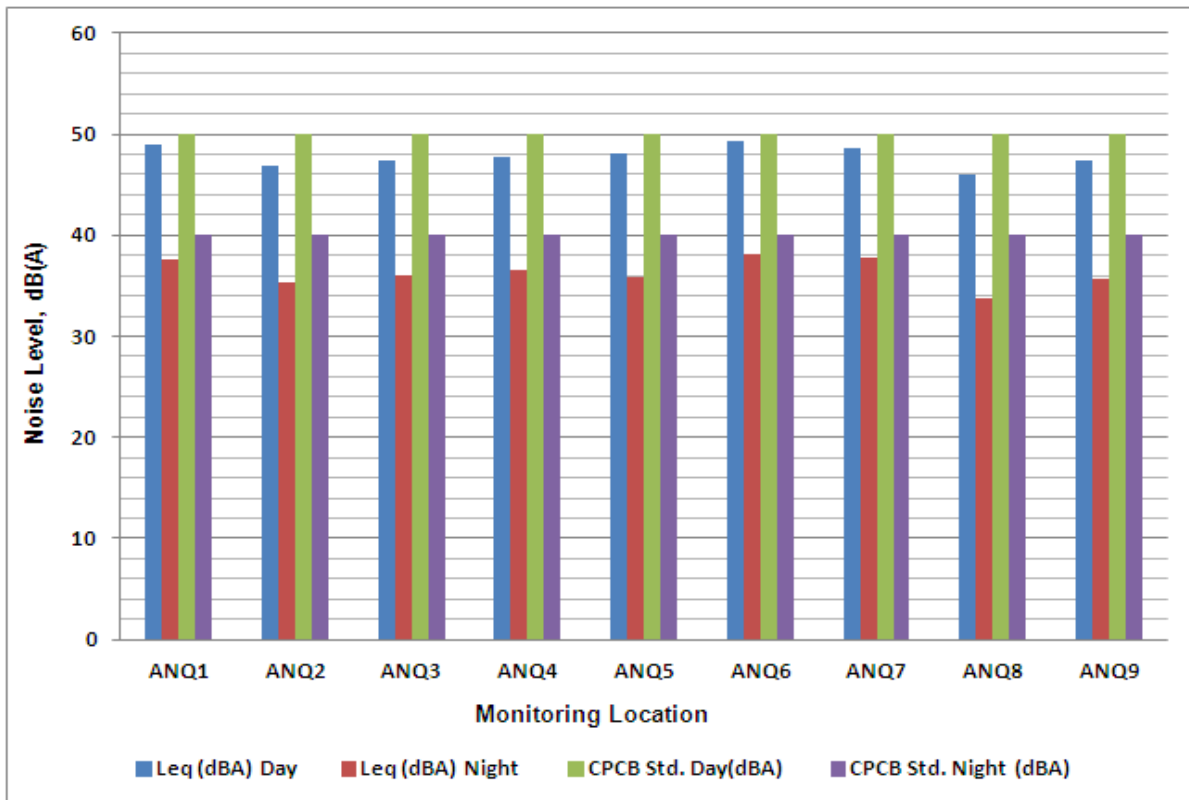
**Figure 4-19: Noise levels monitored along Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89**

**3) Rajapalayam-Sankarankoil-Tirunelveli Road section of SH-41**

The monitored noise levels were ranging from 59.8 dB(A) to 35.4 dB(A) along the Project Road. The measured day time mean values of noise levels and hourly values for the period of 6am to 10pm at all locations are well below the permissible limits of CPCB. The night time mean values and hourly values for the period of 10 pm to 6 am at all locations are well below the accepted limits as per specification. The noise levels at all monitoring locations along with category wise CPCB standards are presented as follows.



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41



**Figure 4-20: Noise levels monitored along Rajapalayam-Sankarankoil-Tirunelveli Road section of SH-41**





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
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 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

## 4.6 FLORA AND FAUNA – BASELINE

### 4.6.1 Forest Area

The recorded forest area in Tamil Nadu is 22,877 km<sup>2</sup> which constitutes 17.59% of the geographical area of the state. Reserved Forests comprise 84.75%, Protected Forests 9.54% and Unclassified Forests constitute 5.71%. The forest cover in project districts is presented in **Table 4-22**.

**Table 4-22 : Forest Cover in the Project Districts**

District	Geographical Area (GA)	VDF	MDF	OF	Total	% of GA
Tirunelveli	6,810	278	760	179	1,217	17.87
Toothukudi	4,621	0	25	134	159	3.44
Virudhnagar	4,283	29	182	69	280	6.54

Source: India State of Forest Report, 2011

VDF: Very Dense Forest, MDF: Moderately Dense Forest, OF: Open Forest

Tirunelveli district has the maximum area under forest cover as compared to other project district.

In Tirunelveli, the entire forest within the district stretches along the Western Ghats. Various types of forests from luxuriant tropical wet evergreen forests to southern thorn scrub forests occur in the district owing to its diverse geographical factors. The forests in the district are technically classified as Southern hilltop tropical evergreen forests, West Coast tropical evergreen forests, Southern moist mixed deciduous forests, Ochiandra reed forests, Carnatic umbrella thorn forests, Southern Euphrosia scrub and Southern thorn scrub. The major floral species are coconut, palm, tamarind, neem, banyan, pungan, manjanathi, teak, usil, vagai and odai.

The forests are found on the eastern slopes of the Western Ghats in Virudhnagar district. Only 6.54% of the total geographical area of the district is under forests. The forests of Alagarkoil valley in Srivilliputtur taluk and Saduragiri are known for rare medicinal plants. The medicinal value of 275 plants has been recorded and reported. The forests host a rich variety of orchids and ferns



ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

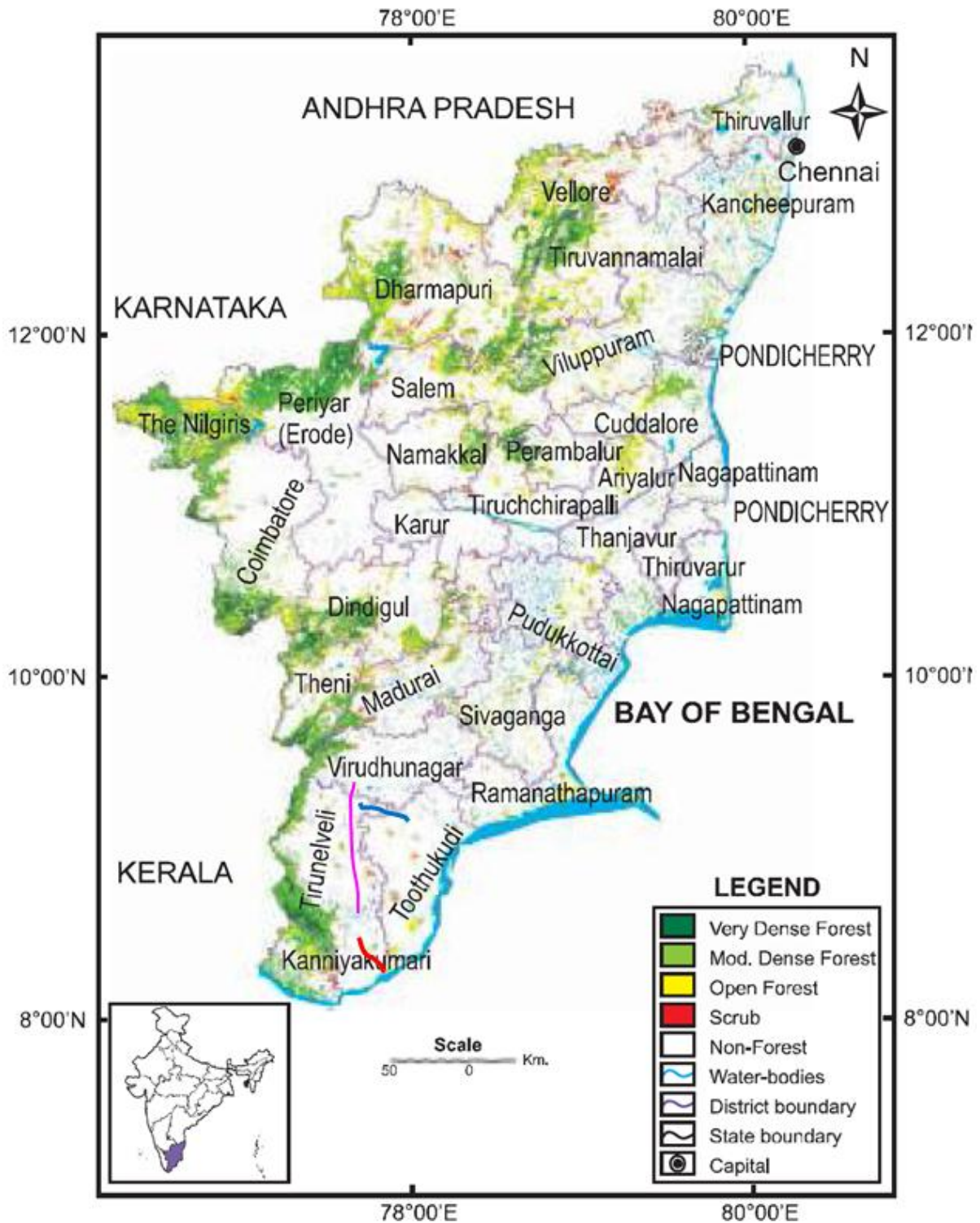


Figure 4-21: Forest Cover map of Tamil Nadu showing Project Roads

LEGENDS	
	Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44
	Rajapalayam - Sankarankoil - Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41
	Nanguneri - Bharatavaram - Uvari Road (km 0/000 to km 35/200), Section of SH 89



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

The Reserved Forests falling within the 15km distance from either side of project roads is as listed below:

Name of Reserved Forest (RF)	Aerial Distance from Road and side
<b>Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44</b>	
Kurumalai RF	9.5km on RHS
<b>Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89</b>	
Sathankulam RF	6.5km on LHS
Kalakadu RF	12.5km on RHS
<b>Rajapalayam-Sankarankoil-Tirunelveli section of SH-41</b>	
Valaikkulam Parambu RF	6 km on RHS
Sappaniparambu RF	5.2 km on RHS
Srivilliputtur RF	6 km on RHS
Settur RF	10 km on RHS
Mottamalai PF	1.1 km on LHS
Ottumalai RF	3.5 km on RHS
Kottaimalai PF	10 km on RHS
Kavalkutti Parambu RF	8.8 km on RHS
Talaiyuttu RF	5.6 km on LHS
Gangaikondan PF	10 km on LHS
Melpattam RF	8.4 km on LHS
Muttur Malai, Wolf hill RF	10 km on LHS

Source: Survey of India, Toposheets

The above RFs are shown in Eco sensitivity map of Project Roads in **Appendix 4.3**.

**Involvement of forest land in project roads: As per the screening study, there is no reserved or protected forest within ROW of the project roads.** Although, there is no forest land involved, but still for the purpose of safeguard the process for obtaining NOC from concerned DFOs has been initiated.

#### 4.6.2 Protected Areas

There are five national parks, eight wildlife sanctuaries, twelve bird sanctuaries, three biosphere reserves, one zoological park, three crocodile farms and one conservation reserve in the State of Tamil Nadu. (Source: Tamil Nadu Forest Department). Out of these protected areas, two wild life sanctuaries and one bird sanctuary fall in Tirunelveli district, one wildlife sanctuary fall in Toothukudi district and one sanctuary fall in Virudhnagar district. There is no National Park in either of project districts.

There is no protected area (National Park, Wildlife Sanctuary, reserved forest, biosphere reserve, wetland) within the ROW of project roads. The details of the protected areas falling within 10 km radius of the project roads are presented in Table 4-23.



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**Table 4-23: Protected Area along Project Roads**

Project Road	Protected Area	Distance from road	District
Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89	Koonthakulam Kadankulam bird sanctuary	About 7.5 Km from km13/000 of the project road	Tirunelveli
Rajapalayam-Sankarankoil-Tirunelveli section of SH-41	Srivilliputtur Giant Grizzled Squirrel Wildlife Sanctuary	6 km from Rajapalayam (Start point of project road)	Virudhnagar

### 1) Koonthakulam Kadankulam bird sanctuary

The environmental experts of consultant team visited the Koonthakulam Bird Sanctuary to get the information about the sanctuary. DFO, Tirunelveli who is the concerned Wildlife Warden for the sanctuary was consulted regarding the Koonthakulam Bird Sanctuary details including sanctuary size, extent, map, bird species found in sanctuary, migratory birds etc. The details are as follows:

Name of DFO, Tirunelveli (Concerned Wildlife Warden): Mr. Thiru J.S. Ambrose

District: Tirunelveli

Date of Consultation: 19.05.2014

Point of Discussion	Information provided by DFO (Tirunelveli )
Geographical Location and Area of Sanctuary	Koonthakulam Bird Sanctuary covering an area of 129.33 ha comes under Nanguneri taluk of Tirunelveli District in Tamilnadu and comprises of two fresh water wetlands, namely Koonthakulam and Kadankulam. It is located at Koonthakulam village, about 15 km west of Nanguneri and 35 km from Tirunelveli city. The approach road from Tirunelveli is through Moolakaraipatti, which is 6 kms away from the sanctuary. The water tanks in Koonthakulam and Kadankulam, were declared as Koonthakulam bird sanctuary on 30.11.1994. Map of the sanctuary is shown in <b>Figure 4-22</b> .
Existing Water Tanks nearby sanctuary	Ariyakulam, Hanumanapudukulam, Silayam, Kannan Kulam, Man kulam, Padakkam, Kudankulam, Eduppal Kulam, Arumuganeri Kadambankulam etc.
No. of bird species	More than 50 species of regular wetland birds, both resident and migratory can be observed in every year
Main species of Migratory birds at Koonthakulam Bird Sanctuary	White stork (Germany), Barheaded goose(Siberia), Pintail(Siberia), Common teal (Siberia), Bluewinged, Teal (Siberia), Common sandpiper(Ladhak), Green sandpiper, (Siberia), Spotted sandpiper (Siberia), Green Shank(Northern end of Siberia, Coot (Central Siberia) and Large flamingo(Partially from Germany)
Local species of the birds	Larger Flamingo, Grey Pelican, Painted Storks, Ibis, Pin Tail, Larger Flamingo, Comb Duck, Sand pipers etc.
Visiting Period of Migratory birds	Migratory and resident birds visit every year regularly in the month of January/February and used to vacate in the month of July/August after



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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Point of Discussion	Information provided by DFO (Tirunelveli )
	nesting, hatching and nurturing the young ones.
Breeding Ground	Babul Plantation
Importance of birds for Farmers	Farmer get excretion of birds" Guano" in summer and use as fertilizer
Eco Sensitive Zone around the Sanctuary	A proposal has been submitted to MoEF & CC for declaration of Eco Sensitive Zone around Koonthakulam Bird Sanctuary by Tirunelveli Forest Division in 2013. Eco sensitive zone proposal area for Koonthakulam is not uniform belt around the sanctuary limits but it varies from 1.5 kms to 8 kms. Existing main roads, tanks and foot trails are demarcated as zone boundaries.

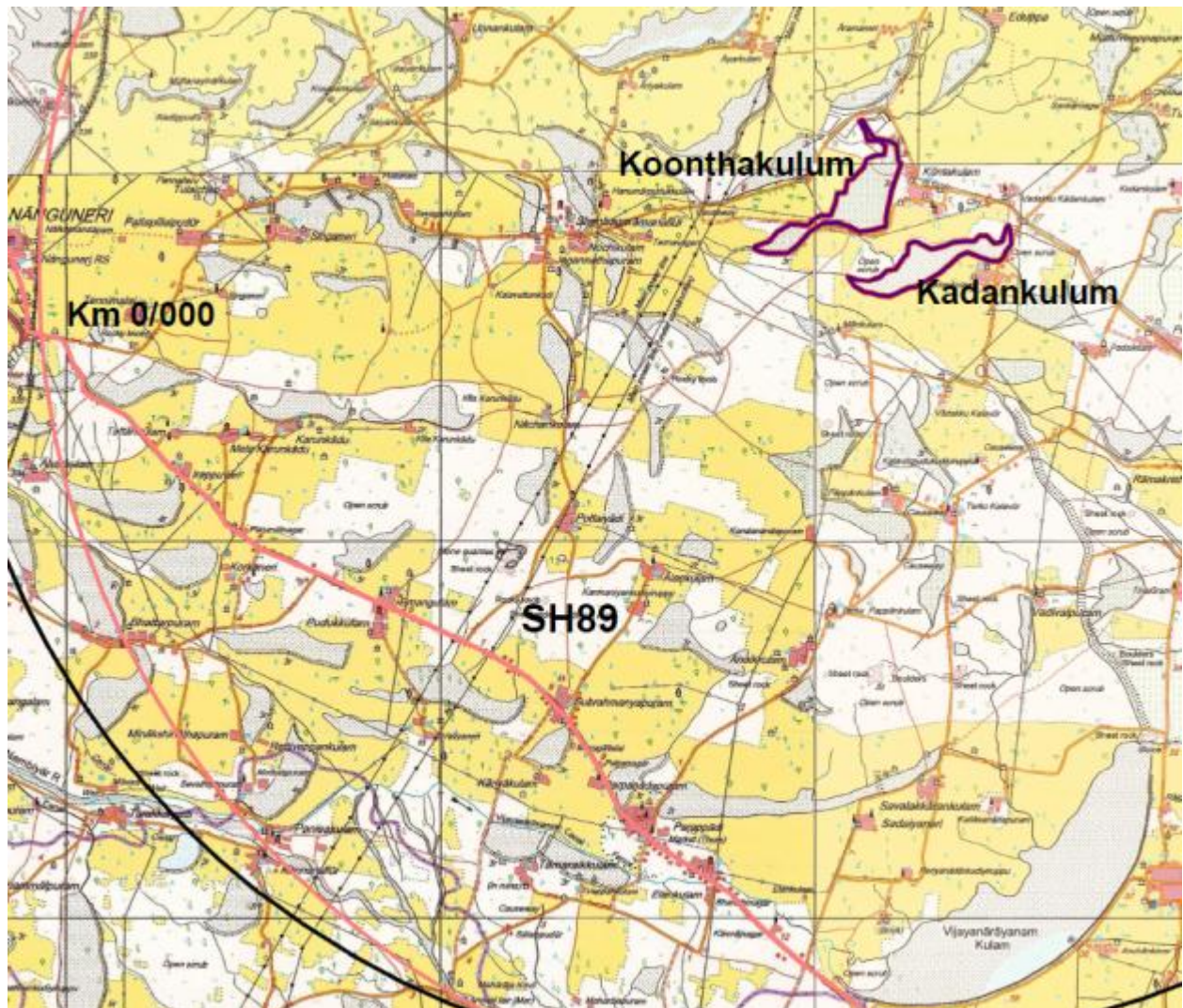
The detailed list of local and migratory birds (common name and scientific name) visiting the sanctuary, map showing the area demarcated for declaration of Eco Sensitive Zone along with list of villages demarcated for Eco Sensitive Zone creation around Koonthakulam Bird Sanctuary other than Koonthakulam and Kadankulam is provided in **Appendix 4.4a**. It also includes other fauna and flora of the sanctuary.

**The nearest distance of proposed Eco Sensitive Zone around Koonthakulam Bird Sanctaury from project road is 5.25km (Refer Figure 2 of Appendix 4.4). However, the proposed Eco Sensitive Zone around the sanctuary has not been notified yet by MoEF & CC. Till the ESZ is notified by MoEF & CC, a default area of 10 km distance shall be considered as ESZ around the Koonthakulam Kadankulam Bird sanctuary.**

*Source: District Forest Office, Tirunelveli*



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**Figure 4-22: Map Showing Koonthakulam Bird Sanctuary with project road marked (Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89)**

The photographs taken at Koonthakulam Bird Sanctuary are as follows:





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Birds Sanctuary Board



Map showing migratory birds and route



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**Koonthakulam tank**



**General consultation regarding sanctuary**

**2) Srivilliputtur Giant Grizzled Squirrel Wildlife Sanctuary**

The environmental experts of consultant team consulted with Wildlife Warden of Srivilliputtur Giant Grizzled Squirrel Wildlife Sanctuary regarding sanctuary size, extent, map, faunal and floral species found in sanctuary etc. The details are as follows:

**Name of Wildlife Warden, Srivilliputtur Giant Grizzled Squirrel Wildlife Sanctuary:** Mr. Ashok Kumar

**District:** Virudhnagar

**Date of Consultation:** 03.06.2014

Point of Discussion	Information provided by Wildlife Warden
Geographical Location and Area of Sanctuary	Srivilliputtur Grizzled Squirrel Wildlife Sanctuary is located at about 80km from Madurai, represents tropical eco system and is part of Southern Western ghats, lies between 09 <sup>o</sup> 23'38" to 09 <sup>o</sup> 49'51" N latitude and between 77 <sup>o</sup> 21'51" to 77 <sup>o</sup> 47'20" E longitude in Virudhnagar district (256.20 sq.km) and Madurai district (220.42 sq.km.). This sanctuary is bounded on the southern



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Point of Discussion	Information provided by Wildlife Warden
	<p>side by Tirunelveli Forest Division, on the south western side by Periyar Tiger Reserve of Kerela, on North western side by Theni Forest Division and on the northern side by Madurai Forest Division.</p> <p>The sanctuary was declared as per G.O., Ms. No. 399, E&amp;F Department dated 26-12-1988.</p> <p>Map of the sanctuary is shown in <b>Figure 4-23</b>.</p>
Biodiversity in sanctuary	<p>The area is an important and unique habitat known for varied flora and fauna which provide an ecologically sustainable habitat for about 32 species of mammals including endangered species like tiger, elephant, Lion tail macaque, Grizzled Squirrel, Nilgiri Tahr etc., more than 200 species of birds including great Indian hornbill, Srilankan frog mouth, painted sand grouse, Horn owl etc., 53 species of reptiles, 24 species of amphibians, 56 species of butterfly flies, 203 species of flora including 81 species of trees, 37 species of shrubs, 16 species of climbers, 21 species of grasses are recorded in the sanctuary.</p>
Major endangered and endemic species	<p>Grizzled Giant Squirrel (<i>Ratufa macroura</i>) is highly endangered and endemic to Tamilnadu, Kerala and Sri Lanka. This sanctuary is designated mainly to conserve these species and hence this is considered as flagship species for this sanctuary. This species is included in schedule-I Part- I of Wildlife (Protection) Act and Appendix-II of CITES.</p> <p>Nilgiri Tahr is endemic to Tamilnadu and Kerela. This species is included in Schedule I Part-I of Wildlife (Protection) Act and the IUCN designated this as vulnerable species.</p> <p>Lion Tailed Macaque is endemic to Western Ghats and is included in Schedule I Part-I of Wildlife (Protection) Act and is on verge of extinction due to habitat destruction and hunting.</p>
Feeding time of squirrels and food trees	<p>The feeding time of Squirrel at is Morning 6 am to 11 am and at Evening is 3 to 4 pm.</p> <p>The important food trees of Squirrel are Tamarind, Vagai, Usil, Naval, Neem and Mango.</p>
Eco Sensitive Zone around the Sanctuary	<p>A draft proposal has been submitted to MoEF&amp;CC for declaration of Eco Sensitive Zone to act as shock absorber around the sanctuary by Committee formed for sanctuary in 2011 (No. F.No. 1-9/2007 WL-1(pt)). Further few minor changes were made in the proposal in 2013.</p> <p>The said eco sensitive zone is comprising only patches of Government lands such as PWD tanks, Revenue hillocks, HR&amp;CE lands and Reserved forests without human habitation around the boundary of the protected area of Grizzled Squirrel Wildlife Sanctuary in Virudhunagar and Madurai districts of Tamilnadu between 09<sup>o</sup> 23' 38" to 09<sup>o</sup> 49' 51" N latitude and between 77<sup>o</sup> 21' 51" to 77<sup>o</sup> 47' 20" E longitude.</p>
Impacts on fauna due to road accident on SH41 Impact due to road widening	<p>In the recent years no accident of wild animal on SH-41 road (Rajapalayam to Tirunelveli Road) has been recorded.</p> <p>If this road will be widened and strengthen, then the numbers of Tourists and visitors will be increased leading to increase in revenue for this sanctuary.</p>

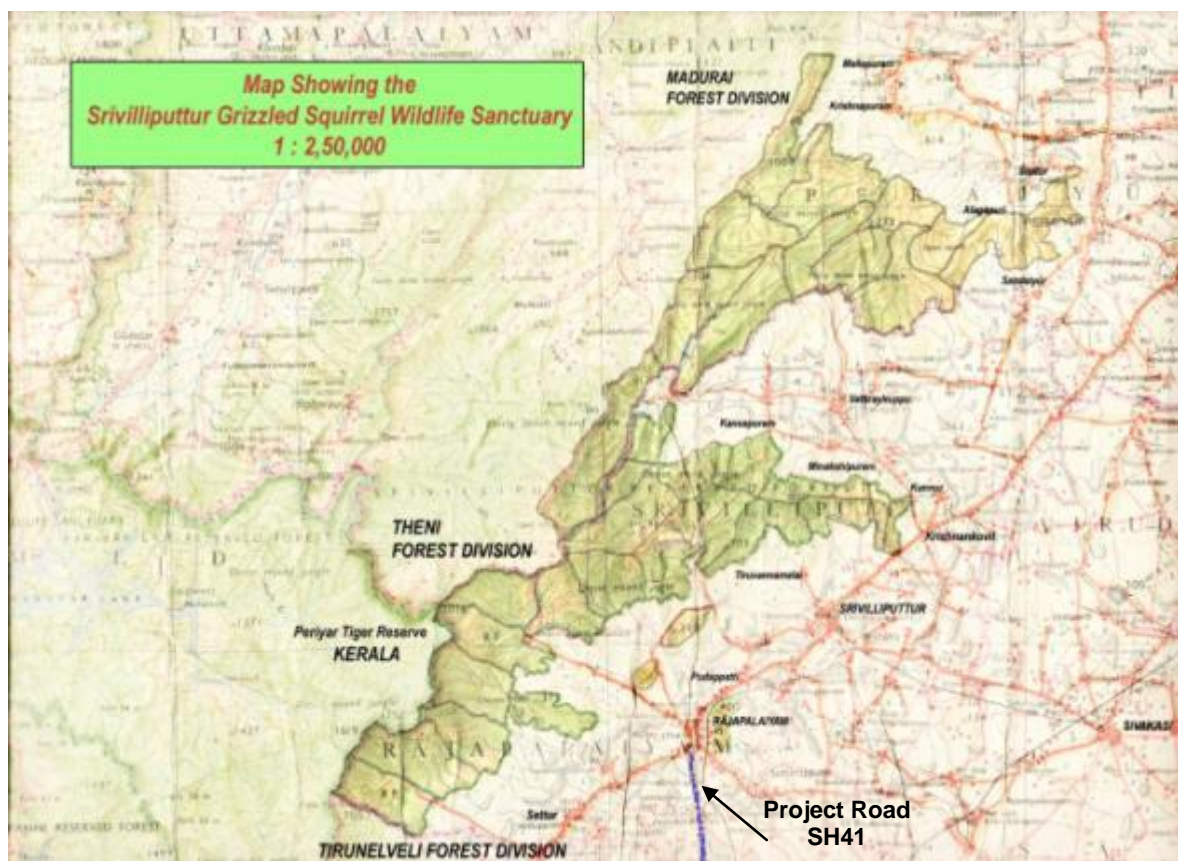


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The detailed list of mammals, amphibians, reptiles (common name and scientific name) found in the sanctuary along with their IUCN, IW (P) A and endemic status, map showing the sanctuary on 1:50,000 scale (Figure 1) and area demarcated for declaration of Eco Sensitive Zone (Figure 2) around Srivilliputtur Grizzled Squirrel Wildlife Sanctuary provided by Wildlife Warden is provided in **Appendix 4.4b**. List of plant species serving as food for squirrels is also included in this Appendix.

**The nearest distance of boundary of Srivilliputtur Grizzled Squirrel sanctuary is 6 km from Rajapalayam, the start point of Rajapalayam-Sankarankoil-Tirunelveli section of SH-41. The proposed Eco Sensitive Zone around the sanctuary has not been notified yet, thus. Till the ESZ is notified by MoEF & CC, a default area of 10 km distance shall be considered as ESZ around the sanctuary.**

Figure 3 of **Appendix 4.4b** also shows the 10km buffer from nearest sanctuary boundary to the project road, Rajapalayam-Sankarankoil-Tirunelveli section of SH-41. The 10 km buffer intersects the project road at Km 6/000.



Source: Wildlife Warden, Srivilliputtur Grizzled Squirrel Sanctuary, Virudhnagar District

**Figure 4-23: Map Showing Srivilliputtur Grizzled Squirrel Sanctuary (Along Rajapalayam-Sankarankoil-Tirunelveli section of SH-41)**



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### 4.6.3 Flora

#### Road side Trees:

The road side trees falling within Corridor of Impact of project roads have been enumerated as per the available design. The tree enumeration details of trees >30cm girth size along with local and scientific name of tree species along Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44, Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89 and Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41 are provided in **Table 4-24**, **Table 4-25** and **Table 4-26** respectively.

The roadside trees are continuous throughout the corridor except some stretches where open land/agricultural land are observed. The trees are generally having good canopy during environmental impact survey. Every effort has been made by engineering and environmental team to save these trees.

There is no green tunnel along the project roads.

**Table 4-24: Summary of Tree Enumeration within Corridor of Impact (>30cm) of Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44**

Start Chainage (m)	End Chainage (m)	LHS		RHS	
		No. of Trees	Tree Species	No. of Trees	Tree Species
22500	23000	15	Vatha narayanam, Neer karuvai, Pulee, Neem	6	Vatha narayanam, Neer karuvai, Pulee, Odai, Neem
23000	24000	12	Manjanathi, Odai, Neer karuvai, Neem	9	Neer karuvai, Odai, Neem
24001	25000	9	Thenna Tree, Pulee, Aalamaram	8	Illavan panchi, Neem, Odai, Atti
25001	26000	2	Odai	8	Manjanathi, Neer karuvai, Odai
26001	27000	20	Neem, Vatha,	8	Pulee, Neem
27001	28000	3	Manjanathi, Neem	16	Thenna Tree, Pulee, Neem, Lemon, Odai
28001	29000	0	-	0	-
29001	30000	90	Takku, Thenna Tree, Pulee Kodaikaapulli, Manjanathi, Neer karuvai, Tamarind	0	-
30001	31000	8	Pulee, Odai	2	Odai
31001	32000	10	Odai, Neem	6	Palmyra palm, Odai
32001	33000	4	Odai	1	Palmyra palm
33001	34000	0	-	16	Odai, Konrai, Neem,
34001	35000	1	Odai	2	Neem



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Start Chainage (m)	End Chainage (m)	LHS		RHS	
		No. of Trees	Tree Species	No. of Trees	Tree Species
35001	36000	5	Pulee, Usil	17	Thekku, Savukku, Neem, Pungan, Pulee, Usil,
36001	37000	18	Neem, Pulee	20	Manjanathi, Vagai, Odai, Pulee, Neem
37001	38000	61	Pulee, Neem	64	Pulee
38001	39000	45	Pulee	44	Pulee
39001	40000	Kovilpatti City not in scope			
40001	41300				
41301	42000	21	Neem, Pungan, Aalamaram, Vatha, Pulee, Naval, Atti, Arasu, Vagai	13	Aalamaram, Vagai, Neem, Konnai, Pulee, Pungan
42001	43000	11	Neem, Vagai	6	Neem, Arasu, Pulee, Kodaikaapulli
43001	44000	4	Neem, Vagai, Pungan, Pulee	4	Konnai, Neem, Vagai, Odai
44001	45000	45	Neem, Pungan, Pulee, Murungai, Arasu, Puvarasu, Vagai, Odai	28	Neem, Kodaikaapulli, Savukku, Puvarasu, Arasu, Murungai
45001	46000	42	Odai, Pulee, Palmyra palm,	35	Odai, Pulee, Palmyra palm,
46001	47000	67	Pulee, Vagai, Thenna Tree, Neem, Palmyra palm, Odai	38	Pulee, Odai
47001	48000	10	Odai, Neem,	8	Odai, Pungan
48001	49000	4	Odai, Pulee	9	Odai, Neem, Palmyra palm
49001	50000	35	Odai, Palmyra palm, Pulee	23	Odai, Neem, Palmyra palm, Kodaikaapulli
50001	51000	75	Pulee, Odai, Palmyra palm, Kodaikaapulli, Manjanathi	42	Pulee, Odai, Palmyra palm, Kodaikaapulli, Neem
51001	52000	0	-	2	Manjanathi, Murungai
52001	53000	0	-	15	Pulee, Pungan, Neem, Nettalinkam, Badam Tree
53001	54000	21	Odai, Pulee, Neem	19	Odai, Pulee
54001	55000	5	Neem	9	Pulee, Neem, Nettalinkam, Vagai,
55001	56000	26	Pulee, Neem, Nettalinkam, Vagai, Thenna Tree	23	Pulee, Neem, Nettalinkam, Vagai,





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

Start Chainage (m)	End Chainage (m)	LHS		RHS	
		No. of Trees	Tree Species	No. of Trees	Tree Species
56001	56747	19	Palmyra palm, Odai	1	Neem
<b>Total</b>		<b>688</b>		<b>502</b>	

Source: Tree Enumeration, March-April 2014

As observed from above tree details, a total of 1190 trees >30cm girth size (688 on LHS and 502 on RHS) fall within Col of project road.

Also, tree enumeration has been done for trees <30cm. A total of 351 trees <30cm girth size (177 on LHS and 174 on RHS) fall within Col of the project road.

The local and scientific names of tree species observed along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44 along with their IUCN status are listed below:

Local name	Scientific name	IUCN Status	Local name	Scientific name	IUCN Status
<b>Trees</b>					
Aalamaram	<i>Ficus bengalensis</i>	Not yet been assessed.	Paneer	<i>Millingtonia tibetans</i>	Not yet been assessed.
Arasu	<i>Ficus religiosa</i>	Not yet been assessed.	Pansea Poo	<i>Millingtonia hortensis</i>	Not yet been assessed.
Atti	<i>Ficus racemosa</i>	Not yet been assessed.	Pulee	<i>Tamarindus indica</i>	Not yet been assessed.
Illavan panchi	<i>Ceiba petendra</i>	Not yet been assessed.	Pungan	<i>Pongamia pungan</i>	Not yet been assessed.
Kodaikaapulli	<i>Inga dulcis</i>	Least Concern ver 3.1	Poovarasu/ Puvarasu	<i>Thespesia populnea</i>	Not yet been assessed.
Konrai	<i>Delonix regia</i>	Vulnerable B1+2c ver 2.3	Savukku	<i>Casurina equisetifolia</i>	Not yet been assessed.
Mahalingam	<i>Crataeva reliigosa</i>	Not yet been assessed.	Soundal	<i>Leucaenia leucocaphala</i>	Not yet been assessed.
Manjanathi	<i>Morinda tomentosa</i>	Not yet been assessed.	Tekku	<i>Tectona grandis</i>	Not yet been assessed.
Murungai	<i>Moringa oleifera</i>	Not yet been assessed.	Thagarai	<i>Cassia surattensis</i>	Not yet been assessed.



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Local name	Scientific name	IUCN Status	Local name	Scientific name	IUCN Status
Naval	<i>Eugenia argentea</i>	Not yet been assessed.	Usil	<i>Albizia procera</i>	Not yet been assessed.
Neem	<i>Azadirachta indica</i>	Not yet been assessed.	Vagai	<i>Albizia labbeck</i>	Not yet been assessed.
Neer karuvai	<i>Prosopis juliflora</i>	Not yet been assessed.	Vatha narayanam	<i>Delonix elata</i>	Not yet been assessed.
Nettalinkam	<i>Polyalthia longifolia</i>	Not yet been assessed.	Vatha/Vatta	<i>Macaranga peltata</i>	Not yet been assessed.
Odai	<i>Acacia planifrons</i>	Not yet been assessed.	Vilvam	<i>Aegle marmelos</i>	Not yet been assessed.
Palmyra palm	<i>Borassus flabellifer</i>	Endangered B2ab(iii); D ver 3.1			
<b>Other Trees with economic value</b>					
Cotton	<i>Ceiba pentandra</i>	Not yet been assessed.			
Kaju Badam	<i>Anacardium occidentale</i>	Not yet been assessed.			
Lemon	<i>Citrus sp.</i>	Not yet been assessed.			
Thenna Tree	<i>Cocos nucifera</i>	Not yet been assessed.			

The dominant tree species along the project road are Pulee, Odai and Neem.

**Table 4-25: Summary of Tree Enumeration within Corridor of Impact (>30cm) of Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89**

Start Chainage (m)	End Chainage (m)	LHS		RHS	
		No. of Trees	Tree Species	No. of Trees	Tree Species
0	1000	14	Neem, Neer karuvai, Pungan, Manjanathi, Usil, Pulee	23	Neem, Neer karuvai, Pungan, Pulee, Tekku
1000	2000	2	Neem, Palmyra palm	0	-
2000	3000	33	Neem, Neermarudu, Atti,	23	Neem, Puvarasu,



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Start Chainage (m)	End Chainage (m)	LHS		RHS	
		No. of Trees	Tree Species	No. of Trees	Tree Species
			Vatha narayanam, Puvarasu, Naval, Pulee, Neer karuvai		Pungan, Naval, Palmyra palm, Nelli
3000	4000	9	Neem, Aalamaram, Arasu	5	Neem, Puvarasu, Naval,
4000	5000	18	Neem, Tekku, Nettalinkam, Malai vembu, Palmyra palm, Neer karuvai	2	Odai
5000	6000	22	Neem, Malai vembu, Malaipoovarasu, Murungai, Neer karuvai, Nandiavattai	19	Neem, Neer karuvai, Konnai
6000	7000	1	Pulee	1	Eucalyptus
7000	8000	5	Usil, Pungan, Neem	25	Eucalyptus, Usil, Neem, Vatha narayanam, Pulee
8000	9000	24	Neem, Usil	20	Neem, Usil, Puvarasu, Palmyra palm
9000	10000	16	Usil, Puvarasu, Vatha narayanam	18	Neem, Uthain, Pungan, Puvarasu, Murungai
10000	11000	31	Neem, Arasu Puvarasu, Pungan, Atti, Murungai, Usil,	10	Neem, Atti, Usi, Vatha narayanam, Puvarasu,
11000	12000	2	Neem, Puvarasu,	2	Neem, Puvarasu, Uthian
12000	13000	3	Usil, Neem, Puvarasu	4	Neem
13000	14000	16	Neem, Vagai	9	Neem, Uthian
14000	15000	2	Aalamaram, Arasu	5	Neem
15000	16000	3	Neem, Arasu, Aalamaram	1	Neem
16000	17000	7	Neem, Usil	1	Uthian
17000	18000	0	-	0	-
18000	19000	0	-	10	Neer Karuvai, Palmyra palm
19000	20000	1	Palmyra palm	3	Palmyra palm
20000	21000	27	Palmyra palm, Neem, Manjanathi, Murungai, Thenna Tree, Konnai, Puvarasu	13	Palmyra palm, Neem, Uthian, Murungai,
21000	22000	1	Usil	7	Palmyra palm, Pulee, Uthian, Aalamaram
22000	23000	0	-	8	Palmyra palm,



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Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Start Chainage (m)	End Chainage (m)	LHS		RHS	
		No. of Trees	Tree Species	No. of Trees	Tree Species
23000	24000	10	Palmyra palm, Neem, Usil	5	Palmyra palm, Puvarasu
24000	25000	9	Palmyra palm, Neem, Puvarasu	9	Palmyra palm, Pulee, Uthian, Odai, Konnai
25000	26000	5	Puvarasu, Konnai	2	Neer karuvai, Aalamaram
26000	26800	0	-	13	Manjanathi, Neem, Pulee
26800	30000		Tisaiyanvillai Village not in Scope		
30000	31000	19	Odai, Tekku, Neer karuvai, Neem, Pungan	13	Palmyra palm, Neem, Pulla, Neer karuvai, Puvarasu
31000	32000	23	Rohida, Neem, Odai, Chinnapu, Pungan,	47	Rohida, Vagai, Puvarasu Neem, Pulee, Pungan, Konrai,
32000	33000	6	Neem, Pulee, Neer karuvai,	12	Puvarasu, Vagai, Rohida, Neem
33000	34000	5	Neem, Palmyra palm	17	Palmyra palm, Arasu, Thenna Tree, Neem, Savukku,
34000	35200	69	Thenna Tree, Murungai, Puvarasu, Vagai, Mango, Arasu, Naaval Pazham	63	Neem, Palmyra palm, Thenna Tree, Kaju Badam, Pulee, Odai
<b>Total</b>		<b>383</b>		<b>390</b>	

Source: Tree Enumeration, March-April 2014

As observed from above tree details, a total of 773 trees >30cm girth size (383 on LHS and 390 on RHS) fall within Col of the project road.

Also, as per the tree enumeration of <30cm girth size trees, a total of 251 trees (144 on LHS and 107 on RHS) fall within Col of the project road.

The local and scientific names of tree species observed along Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 along with their IUCN status are listed below:

Local name	Scientific name	IUCN Status	Local name	Scientific name	IUCN Status
<b>Trees</b>					
Aalamaram	<i>Ficus bengalensis</i>	Not yet been assessed.	Naval	<i>Eugenia argentea</i>	Not yet been assessed.
Konrai	<i>Delonix regia</i>	Vulnerable B1+2c ver 2.3 Not	Neem	<i>Azadirachta indica</i>	Not yet been assessed.
Arasu	<i>Ficus religiosa</i>	Not yet been assessed.	Neer karuvai	<i>Prosopis juliflora</i>	Not yet been assessed.



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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Local name	Scientific name	IUCN Status	Local name	Scientific name	IUCN Status
<b>Trees</b>					
Nettalingm	<i>Polyalthia longifolia</i>	Not yet been assessed.	Neermarudu	<i>Terminalia arjuna</i>	Not yet been assessed.
Atti	<i>Ficus racemosa</i>	Not yet been assessed.	Odai	<i>Acacia planifrons</i>	Not yet been assessed.
Chinnapu	<i>Lagerstoemia indica</i>	Not yet been assessed.	Palmyra palm	<i>Borassus flabellifer</i>	Endangered B2ab(iii); D ver 3.1
Konnai	<i>Cassia fistula</i>	Not yet been assessed.	Poovarasu/ Puvarasu	<i>Thespesia populnea</i>	Not yet been assessed.
Malaipoovarasu	<i>Bischofia javanica</i>	Not yet been assessed.	Pulla	<i>Kydia calycina</i>	Not yet been assessed.
Malai vembu	<i>Melia dubia</i>	Not yet been assessed.	Pungan	<i>Pongamia pungan</i>	Not yet been assessed.
Mango	<i>Mangifera indica</i>	Data Deficient ver 2.3 (needs updating)	Savukku	<i>Casurina equisetifolia</i>	Not yet been assessed.
Manjanathi	<i>Morinda tomentosa</i>	Not yet been assessed.	Pulee	<i>Tamarindus indica</i>	Not yet been assessed.
Manjapoo pavazha malli	<i>Nyctanthes arbor-tristis</i>	Not yet been assessed.	Tekku	<i>Tectona grandis</i>	Not yet been assessed.
Murungai	<i>Moringa oleifera</i>	Not yet been assessed.	Usil	<i>Albizia procera</i>	Not yet been assessed.
Naaval Pazham	<i>Syzygium cumini</i>	Not yet been assessed.	Uthain	<i>Lannea coromandelica</i>	Not yet been assessed.
Nalodai	<i>Acacia planifrons</i>	Not yet been assessed.	Vagai	<i>Albizia labbeck</i>	Not yet been assessed.
Nandiavattai	<i>Tabernaemontana divartica</i>	Not yet been assessed.	Vatha narayanam	<i>Delonix elata</i>	Not yet been assessed.
<b>Other Trees with economic value</b>					
Cotton	<i>Ceiba pentandra</i>	Not yet been assessed.			
Kaju Badam	<i>Anacardium occidentale</i>	Not yet been assessed.			
Thenna Tree	<i>Cocos nucifera</i>	Not yet been assessed.			

The dominant tree species along Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 are Neem and Coconut.

**Table 4-26: Summary of Tree Enumeration within Corridor of Impact (>30cm) of Rajapalayam-Sankarankoil-Tirunelveli section of SH-41**

Chainage		No. of Tree		Major Tree Species
Start Chainage (m)	End Chainage (m)	LHS	RHS	
1800	2000	13	8	Neem, Poonga
2000	3000	42	37	Neem, Banyan, Pulee
3000	4000	46	42	Coconut, Neem, Palm, Pulee, Vaagai
4000	5000	20	43	Malaivembu, Neem, Palm, Poonga, Pulee





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

Chainage		No. of Tree		Major Tree Species
Start Chainage (m)	End Chainage (m)	LHS	RHS	
5000	6000	33	68	Neem, Poonga, Pungai
6000	7000	23	86	Neem, Poonga, Pungai, Pulee
7000	8000	37	50	Neem, Poonga, Pulee
8000	9000	24	18	Arasamaram, Malaivembu Murungai Pulee, Neem
9000	10000	22	29	Neem, Pulee
10000	11000	28	29	Malavagai, Neem
11000	12000	6	8	Neem
12000	13000	13	10	Pulee, Neem
13000	14000	6	6	Manjanathi, Pulee
14000	15000		5	Neem
15000	16000	17	19	Neem, Pulee
16000	17000	28	55	Malaivembu, Neem, Poogai Pulee, Vagai Pungai
17000	18000	9	6	Neem Pungai Pulee
18000	19000	2	11	Neem
19000	20000	9	8	Neem, Pulee
20000	21000	20	19	Neem, Poogai Usil, Tamarin, Usil
21000	22000	22	17	Malaivembu, Murungai Neem, Poonga, Usil, Vagai
22000	23000	6	6	Palm
23000	24000	10	20	Palm
24000	25000	28	29	Pulee, Palm
25000	26000	5	4	Neem, Pulee
26000	27000	21	8	Mamaram, Neem, Palm, Pulee
27000	28000	6	7	Neem
28000	28100	1	0	Neem
28000	29000	Sankarankoil ByPass		
29000	30000			
30000	31000			
31000	32000			
32000	33800			
33800	34000	14	9	Arasamaram, Poonga Tamarind, Vagai, Pulee
34000	35000	41	62	Coconut, Tamarind Vagai, Kaka mull Mamaram, Neermarudhu, Poogai, Pulee



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

Chainage		No. of Tree		Major Tree Species
Start Chainage (m)	End Chainage (m)	LHS	RHS	
35000	36000	18	32	Manjanathi, Neem,Palm, Pulee vagai
36000	37000	24	60	Neem, Poonga, Pulee, Nava
37000	38000	45	56	Neem
38000	39000	49	40	Neem, Pulee
39000	40000	73	36	Banyan
40000	41000	24	19	Banyan, Neem, Pulee, Cotton Tree, Palm, Udai
41000	42000	3	4	Neem,Vathanarayanan, Palm, Udai
42000	43000	32	37	Neem, Palm, Teak
43000	44000	75	36	Neem, Palm, Tamarind, Thekku
44000	45000	64	109	Neem, Palm
45000	46000	126	109	Neem, Palm, Pulee
46000	47000	47	23	Neem, Palm, Pulee, Udai
47000	48000	64	73	Neem, Palm, Pulee,Udai
48000	49000	7	49	Neem, Vagai
49000	50000	24	29	Neem, Pulee,Udai, Vagai
50000	51000	8	12	Neem, Pulee, Udai
51000	52000	19	14	Udai, Palm
52000	53000	37	51	Udai
53000	54000	17	32	Neem, Udai, Pulee, Udai, Vagai
54000	55000	33	44	Mala Vagai, Neem, Pulee
55000	56000	24	7	Palm, Neem
56000	57000	2	8	Vagai, Neem
57000	58000	15	32	Murungai Neem, Pulee
58000	59000	26	39	Tamarind, vagai
59000	60000	15	24	Neem, Vagai
60000	61000	30	17	Mala vagai, Neem, Vagai, Banyan
61000	62000	20	10	Mala vagai, Neem, Vagai, Neem
62000	63000	11	11	Manganathi, Mala vagai, Neem
63000	64000	43	37	Manganathi, Neem, Palm
64000	65000	0	3	Manganathi, Pulee
65000	66000	10	21	Manganathi, Pulee
66000	67000	8	16	Neem, Udai
67000	68000	8	4	Neem, Usil
68000	69000	19	20	Neem, Usil, Poonga



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

Chainage		No. of Tree		Major Tree Species
Start Chainage (m)	End Chainage (m)	LHS	RHS	
69000	70000	18	19	Usil, Poonga
70000	71000	20	5	Mala vagai
71000	72000	22	11	Manganathi, Neem, Usil, Neem, Poonga, Pulee, Udai, Vagai
72000	73000	54	48	Koiya, Manganathi, Neem, Nellika, Poonga, Pulee, Usil
73000	74000	9	12	Manganathi, Neem,,Palm
74000	75000	7	13	Mala vagai, Neem
75000	76000	12	7	Neem, Usil
76000	77000	7	10	Neem, Usil
77000	78000	42	25	Pulee, Neem, Usil
78000	79000	14	23	Usil
79000	80000	22	15	Neem, Usil
80000	81000	27	20	Manganathi, Usil
81000	82000	5	39	Neem, Usil
82000	82800	6	6	Neem, Usil
Total Trees		1837	2086	
		3923		

Source: Tree Enumeration, June-July 2014

As observed from above tree details, a total of 3923 trees >30cm girth size (1837 on LHS and 2086 on RHS) fall within Col of the project road.

Also, as per the tree enumeration of <30cm girth size trees, a total of 1015 trees (540 on LHS and 475 on RHS) fall within Col of the project road.

The local and scientific names of tree species observed along Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 are listed below:

Local Name	Scientific Name	IUCN Status
Akatthi	<i>Sesbania grandiflora</i>	Not yet been assessed
Ala Maram	<i>Ficus bengalensis</i>	Not yet been assessed
Aarasamaram	<i>Ficusr eligiosa</i>	Not yet been assessed
Arjun	<i>Terminalia arjuna</i>	Not yet been assessed
Athi	<i>Ficus racemosa</i>	Not yet been assessed
Badam	<i>Terminalia catappa</i>	Not yet been assessed
Christmas tree	<i>Picea sp.</i>	
Thennai tree	<i>Cocos nucifera</i>	Not yet been assessed
Cotton tree	<i>Ceiba pentandra</i>	Not yet been assessed
Guava	<i>Psidium guajava</i>	Not yet been assessed
Itchu(Flus)		
Kakaipalai	<i>Micromelum minutum</i>	Not yet been assessed



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

Local Name	Scientific Name	IUCN Status
Kodukkapuli	<i>Murraya koenigii</i>	Not yet been assessed
Malai Vembu	<i>Melia azedarach</i>	Not yet been assessed
Mamaram	<i>Mangifera indica</i>	Data Deficient ver 2.3
Manjanathi	Not yet been assessed.	Not yet been assessed
Murungai	<i>Moringa oleifera Lank</i>	Not yet been assessed
Naval	<i>Eugenia argentea</i>	Not yet been assessed
Neerkaruvai	<i>Prosopis juliflora</i>	Not yet been assessed
Neem	<i>Azadirachta indica</i>	Not yet been assessed
Neermarudhu	<i>Terminalia arjuna</i>	Not yet been assessed
nellikai	<i>Phyllanthus emblica</i>	Not yet been assessed
Nettalingam	<i>Polyalthia ongifolia</i>	Not yet been assessed
Palmyra palm	<i>Borassus flabellifer</i>	Endangered B2ab(iii); D ver 3.1
Pinari	<i>Ailanthus excelsa</i>	Not yet been assessed
Puvarasu	<i>Thespesia populnea</i>	Not yet been assessed
Pungan	<i>Pongamia pungan</i>	Not yet been assessed
Savukku	<i>Casurina equisetifolia</i>	Not yet been assessed
Siridam/Vagai	<i>Albizia lebbek</i>	Not yet been assessed
Pulee	<i>Tamarindus indica</i>	Not yet been assessed
Tekku	<i>Tectona grandis</i>	Not yet been assessed
Udai /Odai	<i>Acacia planifrons</i>	Not yet been assessed
Usil	<i>Albizia procera</i>	Not yet been assessed
Vathanarayanan	<i>Delonix elata</i>	Not yet been assessed
vilvam/Velvam	<i>Aegle marmelos</i>	Not yet been assessed

### Flora in Influence Zone

Various types of forests from luxuriant tropical wet evergreen forests to southern thorn scrub forests occur in the district owing to its diverse geographical factors. The forests in Tirunelveli district are technically classified as Southern hilltop tropical evergreen forests, West Coast tropical evergreen forests, Southern moist mixed deciduous forests, Ochiandra reed forests, Carnatic umbrella thorn forests, Southern Euphorbia scrub and Southern thorn scrub. The forests of Alagarkoil valley in Srivilliputtur taluk and Saduragiri of Virudhnagar district are known for rare medicinal plants. The medicinal value of 275 plants has been recorded and reported. The forests host a rich variety of orchids and ferns.

Major tree species along the road include tamarind, neem, usil, arasu, babool, pungan, tekku and puvarasu.

As per the reconnaissance survey, there is a protected area named Koonthakulam Kadankulam bird sanctuary located at a distance of 7.5 km from km 13/000 of Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 project road.

*The major floral species found in Koonthakulam Bird Sanctuary are Acacia nilotica, Cassia*



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*auriculata*, *Calotropis* and few planted species like *Azadirachta indica*, *Tamarindus indica*, *Zizuphus jujuba*, *Bassia latifolia*, *Pongamia pinnata*, *Ficus benghalensis*, *Ficus retusa*, *Ficus religiosa*, *Borassus flabellifer*, etc. Aquatic vegetation comprises of *Hydrilla*, *Pistia*, *Nymphoides*, *Trapa*, *Cyperus*, *Scirpus*, etc. (Source: district and block forest offices, Tirunelveli).

The detailed information of flora found in Koonthakulam Bird Sanctuary is provided in **Appendix 4.4**.

Also, as per the reconnaissance survey there is a protected area named Srivilliputtur Giant Grizzled Squirrel Wildlife Sanctuary located at distance of 6 km from start point of Rajapalayam-Sankarankoil-Tirunelveli section of SH-41. 203 species of flora including 81 species of trees, 37 species of shrubs, 16 species of climbers, 21 species of grasses are recorded in the sanctuary.

No tree along road side fall in CITES list of plant. However, as per IUCN one plant found as Endangered namely *Borassus flabellifer*; three plants found as Vulnerable namely *Chloroxylon swietenia*, *Delonix regia* & *Sapindus oahuensis*; one Least Concern plant namely *Inga dulcis* and one Data Deficient plant namely *Mangifera indica*. Other than the above all taxon listed has not yet been assessed for the IUCN Red List.

#### 4.6.4 Fauna

##### Fauna within Impact Corridor

The major terrestrial fauna observed and recorded during the reconnaissance survey including livestock along the project corridor are monkey, snake, grey headed bulbul, buffalo, sheep, goat, pig etc.

##### Fauna within Influence Zone

**Koonthakulam Bird Sanctuary** is the largest breeding water-bird reserve in Southern Tamilnadu, located in Tirunelveli District. It has the distinction of being a bird refuge that has received protection from the local people for generations, well before the site was officially declared as a bird sanctuary. Koonthakulam wetlands are a safe haven for migratory and resident wetland birds of the bio-geographic region. These wetlands are buffer irrigation reservoirs for paddy cultivations and receive water supply from Manimuthar Irrigation system on alternative years. Major fauna includes Macaques, Mongoose and variety of reptiles. More than 50 species of regular wetland birds, both resident and migratory can be observed every year like Larger Flamingo, Grey Pelican, Painted Storks, Ibis, Pin Tail, Comb Duck, Sand pipers, etc. to name a few.

The detailed list of local and migratory birds (common name and scientific name) visiting the sanctuary along with their Status as per WPA (Wildlife Protection Act), 1972, CITES (Convention on International Trade in Endangered Species) and IUCN (International Union for Conservation of Nature) is provided in **Appendix 4.4a**.

**Srivilliputtur Grizzled Squirrel Wildlife Sanctuary** is located at distance of 6km from Rajapalayam, Rajapalayam-Sankarankoil-Tirunelveli section of SH-41. It is recognized as one of the 25 Global hot spots of biodiversity.





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The area is an important and unique habitat known for varied flora and fauna which provide an ecologically sustainable habitat for about 32 species of mammals including endangered species like tiger, elephant, Lion tail macaque, Grizzled Squirrel, Nilgiri Tahr etc., more than 200 species of birds including great Indian hornbill, Srilankan frog mouth, painted sand grouse, Horn owl etc., 53 species of reptiles, 24 species of amphibians, 56 species of butterfly flies,

The detailed list of faunal diversity along with their Status as per WPA (Wildlife Protection Act), 1972 and Status as per IUCN (International Union for Conservation of Nature and Natural Resources) is provided in **Appendix 4.4b**.

#### 4.6.4.1 Coastal Ecology

The coastline of Tamil Nadu has a length of about 1076 kms which constitutes about 15% of the total coastal length of India and stretches along the Bay of Bengal, Indian Ocean and Arabian Sea. The coastal length in project districts, viz. Tirunelveli and Toothukudi is 48.9Km and 163.5 Km respectively.

In the coastal zone, there are several areas where development has already taken place before 1991. In 1991, the Coastal Zone Regulation notification was issued by the Union Ministry of Environment and Forests to protect the 500 meters zone from the high tide line and along rivers and creeks upto the area of tidal action. CRZ Notification 1991 has been amended in 2011.

CRZ-I comprises ecologically sensitive area and area between Low Tide Line and High Tide Line, CRZ-II covers the already developed areas and CRZ-III, constitutes comparatively little developed, and those do not belong to either CRZ-I or II and CRZ IV covers the water area from the Low Tide Line to twelve nautical miles on the seaward side. The regulation and enforcement in the state is being overseen by the Tamil Nadu Coastal Zone Management Authority (TNCZMA), Chennai. GIS cell, Department of Environment, GoTN has prepared draft 31 CZMP maps in 1:25000 scale in the place of existing approved CZMP maps prepared by the DTCP (copies available with the Department of Town Country Planning), based on the HTL demarcation map furnished by the Institute of Remote Sensing, Anna University, Chennai by retaining the existing zonation's viz., CRZ-I, II & III as per the existing approved Coastal Zone Management Plan Maps.

No project road fall under CRZ. In order to avoid the applicability of CRZ Notification, the end point of Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 has been considered upto Km 35.200 (intersection with SH 176, TTK Road), which is about 1Km away from high tidal point of Sea.

## 4.7 SOCIO ECONOMIC ENVIRONMENT

As mentioned in earlier sections also Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44 fall in three districts of Tamil Nadu state, Tirunelveli (Taluk- Sankarankoil), Toothukudi (Taluk- Kovilpatti and Ettayapuram) and Virudhnagar (Taluk- Sattur). Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89 passes through



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

only Tirunelveli (Taluk- Nanguneri and Radhapuram) district and Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 passes through Tirunelveli district (Sankrakovil and Tirunelveli taluks) and Virudhnagar district (Rajapalayam taluk).

The socio-economic indicators of the project districts are as tabulated below:

**Table 4-27 : Socio Economic Indicators of Project Districts**

Parameter	Tirunelveli	Toothukudi	Virudhnagar
<b>Total Population</b>	3077233	1750176	1942288
Male population	1520912	865021	967709
Female Population	1556321	885155	974579
Sex Ratio (Per 1000)	1023	1023	1007
<b>Literacy rate (%)</b>	82.50	86.16	80.15
Male Literacy Rate (%)	89.24	91.14	87.71
Female Literacy Rate (%)	75.98	81.33	72.69
Population Density	460	369	458
Population GROWth Rate (%)	12.97	11.32	10.91%
<b>Scheduled Castes Population</b>	569714	347895	399831
SC Male	279570	172663	198704
SC Female	290144	175232	201127
<b>Scheduled Tribes Population</b>	10270	4911	2294
Male ST	5109	2466	1182
Female ST	5161	2445	1112
<b>Child Population</b>	321687	1,83,763	197134
Male Population 0-6	164157	93,605	100827
Female Population 0-6	157530	90,158	96307
<b>Occupational Pattern</b>			
Working Population	560279	748095	950158
No. of Agriculture labour	321083	161418	168174
Main Working Population	1271407	657447	854066
Non-Working Population	1640779	1002081	992130

Source: Census 2011

### ***Tirunelveli District***

The area of the Tirunelveli district is 6,693 sq.km As per 2011 census, Tirunelveli has population of 3,077,233 of which male and female are 1,520,912 and 1,556,321 respectively. Average literacy rate of Tirunelveli in 2011 is 82.50% compared to 76.09% of 2001. If things are looked out at gender wise, male and female literacy are 89.24% and 75.98% respectively. With regards to Sex Ratio, it stood at 1023 per 1000 male compared to 2001 census figure of 1042. The average national sex ratio in India is 940 as per latest reports of Census 2011 Directorate. Children under 0-6 formed 10.45% of District with equal distribution of male and female child. The SC and ST population distribution in the district is 18.51 % and 0.33% respectively.



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### **Toothukudi District**

The area of the Thoothukkudi district is 4,745 Sq.km. As per 2011, Thoothukkudi has population of 1,750,176 of which male and female are 865,021 and 885,155 respectively. Average literacy rate of in 2011 is 86.16% compared to 81.52% of 2001. If things are looked out at gender wise, male and female literacy are 91.14% and 81.33% respectively. With regards to Sex Ratio in Thoothukkudi, it stood at 1023 per 1000 male compared to 2001 census figure of 1050. In 2011, Children under 0-6 formed 10.50 % of Thoothukkudi District compared to 11.73 percent of 2001. The SC and ST population distribution in the district is 19.88% and 0.28% respectively.

### **Virudhnagar District**

The area of the Virudhnagar district is 4,241 Sq.km. As per 2011, Virudhnagar has population of 19,42,288 of which male and female are 9,67,709 and 9,74,579 respectively. Average literacy rate of in 2011 is 80.15% compared to 73.70% of 2001. Male and female literacy are 87.71% and 72.69% respectively. With regards to Sex Ratio in, Virudhnagar stood at 1007 per 1000 male compared to 2001 census figure of 1012. In 2011, Children under 0-6 formed 10.15 % of the district compared to 11.94 percent of 2001. The SC and ST population distribution in the district is 21% and 0.12% respectively.

#### **4.7.1 Settlements/villages**

This section outlines the population details of the settlement abutting project road.

**Table 4-28: Revenue villages along project roads**

#### **1) Along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44**

S.No	Chainage		District	Taluk	Name of Village
	From (km)	To (km)			
1	2/600	23/150	Tirunelveli	Sankarankoil	Naduvapatti
2	23/150	25/800	Thoothukkudi	Kovilpatti	Mukkuttumalai
3	25/800	27/000	Virudhnagar	Sattur	Sippipari
4	27/000	28/650	Thoothukkudi	Kovilpatti	Nakkal muttampatti
5	28/650	33/150	Thoothukkudi	Kovilpatti	Ilaiyarsanendal
6	33/150	35/200	Thoothukkudi	Kovilpatti	Ayyaneri
7	35/200	38/150	Thoothukkudi	Kovilpatti	Appaneri
8	38/150	38/400	Thoothukkudi	Kovilpatti	Kovilpatti
9	38/400	39/250	Thoothukkudi	Kovilpatti	Alampatti
10	39/250	41/950	Thoothukkudi	Kovilpatti	Kovilpatti
11	41/950	42/800	Thoothukkudi	Kovilpatti	Iluppaiyurani
12	42/899	45/800	Thoothukkudi	Kovilpatti	Tittangulam
13	45/800	48/650	Thoothukkudi	Ettayapuram	Chidambarapuram
14	48/650	51/700	Thoothukkudi	Ettayapuram	Kumaragiri
15	51/700	54/200	Thoothukkudi	Ettayapuram	Ilambuvanam
16	54/200	56/273	Thoothukkudi	Ettayapuram	Ettayapuram



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

Source: SIA Report, DPR, Volume VII Part B

## 2) Along Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89

S.No	Chainage		District	Taluk	Village
	From (km)	To (km)			
1	0/000	2/400	Tirunelveli	Nanguneri	Nanguneri
2	2/400	3/600	Tirunelveli	Nanguneri	IraippOvari
3	3/600	4/100	Tirunelveli	Nanguneri	karunkadu
4	4/100	8/450	Tirunelveli	Nanguneri	Iraipubari
5	8/450	13/250	Tirunelveli	Nanguneri	Alangulam
6	13/250	13/700	Tirunelveli	Radhapuram	Kovangulam
7	13/700	21/200	Tirunelveli	Nanguneri	Vijayanarayanam
8	21/200	21/600	Tirunelveli	Radhapuram	Kottaikarungulam
9	21/600	25/450	Tirunelveli	Radhapuram	Kumarapuram
10	25/450	29/400	Tirunelveli	Radhapuram	Tisaiyanvillai
10	29/400	30/950	Tirunelveli	Radhapuram	Appuvilai
11	30/950	32/300	Tirunelveli	Radhapuram	Tisaiyanvillai
12	32/300	34/200	Tirunelveli	Radhapuram	Muthumuthamozhi
13	34/200	35/220	Tirunelveli	Radhapuram	KaraichuthOvari

Source: SIA Report, DPR, Volume VII Part B

## 3) Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41

Chainage	Village Name	District Name	Taluk Name
0/000-1/000	Rajapallayam	Virudhunagar	Rajayapalam
1/000-2/000	INTUC Nagar	Virudhunagar	Rajayapalam
2/000-3/000	INTUC Nagar	Virudhunagar	Rajayapalam
3/000-4/000	-	Virudhunagar	Rajayapalam
4/000-5/000	Madhukudy	Virudhunagar	Rajayapalam
5/000-6/000	Madhukudy	Virudhunagar	Rajayapalam
6/000-7/000	Desigapuram	Virudhunagar	Rajayapalam
7/000-8/000	Cholapuram	Virudhunagar	Rajayapalam
8/000-9/000	Cholapuram	Virudhunagar	Rajayapalam
9/000-10/000	Cholapuram	Virudhunagar	Rajayapalam
10/000-11/000	Perumalpatti	Tirunelveli	Sankrakovil
11/000-12/000	Perumalpatti	Tirunelveli	Sankrakovil
12/000-13/000	Solaiseri	Tirunelveli	Sankrakovil
13/000-14/000	Solaiseri	Tirunelveli	Sankrakovil
14/000-15/000	Solaiseri	Tirunelveli	Sankrakovil
15/000-16/000	P.Reddypatti	Tirunelveli	Sankrakovil
16/000-17/000	K.R. Naidu Nagar	Tirunelveli	Sankrakovil
17/000-18/000	Paruvakudi	Tirunelveli	Sankrakovil



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

Chainage	Village Name	District Name	Taluk Name
18/000-19/000	Paruvakudi	Tirunelveli	Sankrakovil
19/000-20/000	Karivalamvanthanallur	Tirunelveli	Sankrakovil
20/000-21/000	Karivalamvanthanallur	Tirunelveli	Sankrakovil
21/000-22/000	Kulalaikanni	Tirunelveli	Sankrakovil
22/000-23/000	Kulalaikanni	Tirunelveli	Sankrakovil
23/000-24/000	Alagunachiyarpuram	Tirunelveli	Sankrakovil
24/000-25/000	Ramalingapuram	Tirunelveli	Sankrakovil
25/000-26/000	Ramalingapuram	Tirunelveli	Sankrakovil
26/000-27/000	Shrigomathipuram	Tirunelveli	Sankrakovil
27/000-28/000	Vadikottai	Tirunelveli	Sankrakovil
28/000-29/000	Pulayampatti	Tirunelveli	Sankrakovil
29/000-30/000	Sankrakovil	Tirunelveli	Sankrakovil
30/000-31/000	Sankrakovil	Tirunelveli	Sankrakovil
31/000-32/000	Sankrakovil	Tirunelveli	Sankrakovil
32/000-33/000	Sankrakovil	Tirunelveli	Sankrakovil
33/000-34/000	Sankrakovil	Tirunelveli	Sankrakovil
34/000-35/000	Sankrakovil	Tirunelveli	Sankrakovil
35/000-36/000	Sankrakovil	Tirunelveli	Sankrakovil
37/000-37/000	Nedungulam	Tirunelveli	Sankrakovil
37/000-38/000	Maruthapapuram	Tirunelveli	Sankrakovil
38/000-39/000	Muthukrishapuram	Tirunelveli	Sankrakovil
39/000-40/000	Muthukrishapuram	Tirunelveli	Sankrakovil
40/000-41/000	Gurukulpatti	Tirunelveli	Sankrakovil
41/000-42/000	Gurukulpatti	Tirunelveli	Sankrakovil
42/000-43/000	Gurukulpatti	Tirunelveli	Sankrakovil
43/000-44/000	Melaneelithanallur	Tirunelveli	Sankrakovil
44/000-45/000	Melaneelithanallur	Tirunelveli	Sankrakovil
45/000-46/000	Thirumalapuram	Tirunelveli	Sankrakovil
46/000-47/000	Thirumalapuram	Tirunelveli	Sankrakovil
47/000-48/000	Panavadalachathiram	Tirunelveli	Sankrakovil
48/000-49/000	Panavadalachathiram	Tirunelveli	Sankrakovil
49/000-50/000	Marukkalankulam	Tirunelveli	Sankrakovil
50/000-51/000	Marukkalankulam	Tirunelveli	Sankrakovil
51/000-52/000	Mesiyapuram	Tirunelveli	Sankrakovil
52/000-53/000	Mesiyapuram	Tirunelveli	Sankrakovil
53/000-54/000	Vennikonendhal	Tirunelveli	Sankrakovil
54/000-55/000	Vennikonendhal	Tirunelveli	Sankrakovil
55/000-56/000	Vennikonendhal	Tirunelveli	Sankrakovil
56/000-57/000	Adaikalapuram	Tirunelveli	Sankrakovil
57/000-58/000	Devarkulam	Tirunelveli	Sankrakovil
58/000-59/000	Devarkulam	Tirunelveli	Sankrakovil





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

Chainage	Village Name	District Name	Taluk Name
59/000-60/000	Devarkulam	Tirunelveli	Sankrakovil
60/000-61/000	Suppiahpuram	Tirunelveli	Tirunelveli
61/000-62/000	Suppiahpuram	Tirunelveli	Tirunelveli
62/000-63/000	Suppiahpuram	Tirunelveli	Tirunelveli
63/000-64/000	Alakiyapandiapuram	Tirunelveli	Tirunelveli
64/000-65/000	Alakiyapandiapuram	Tirunelveli	Tirunelveli
65/000-66/000	Alakiyapandiapuram	Tirunelveli	Tirunelveli
66/000-67/000	Pillayarkulam	Tirunelveli	Tirunelveli
67/000-68/000	Pillayarkulam	Tirunelveli	Tirunelveli
68/000-69/000	Pillayarkulam	Tirunelveli	Tirunelveli
69/000-70/000	Kanarpatti	Tirunelveli	Tirunelveli
70/000-71/000	Manur	Tirunelveli	Tirunelveli
71/000-72/000	Manur	Tirunelveli	Tirunelveli
72/000-73/000	Jami Nagar	Tirunelveli	Tirunelveli
73/000-74/000	Salaipudur	Tirunelveli	Tirunelveli
74/000-75/000	Rastha	Tirunelveli	Tirunelveli
75/000-76/000	Rastha	Tirunelveli	Tirunelveli
76/000-77/000	Nariyuthu	Tirunelveli	Tirunelveli
77/000-78/000	Sedurayanpudur	Tirunelveli	Tirunelveli
78/000-79/000	Sedurayanpudur	Tirunelveli	Tirunelveli
79/000-80/000	Sedurayanpudur	Tirunelveli	Tirunelveli
80/000-81/000	Sedurayanpudur	Tirunelveli	Tirunelveli
81/000-82/000	Ramainpatti	Tirunelveli	Tirunelveli
82/000-83/000	Ramainpatti	Tirunelveli	Tirunelveli
83/000-84/000	Ramainpatti	Tirunelveli	Tirunelveli
84/000-85/000	Rajajipuram	Tirunelveli	Tirunelveli
85/000-85/750	Rajajipuram	Tirunelveli	Tirunelveli

Source: SIA Report, DPR, Volume VII Part B

#### 4.7.2 Socio-Cultural Properties and Land Acquisition

The proposed project will have impact on residential, commercial as well as other community's properties. The summary of the impacted structures along the project roads is listed in **Table 4-29**.

**Table 4-29: Type of impacted structures along the project roads**

Project Road	Residential (nos.)	Commercial (nos.)	Residential & Commercial (nos.)	Others (nos.)	Total (nos.)
Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44	42	123	16	2	183



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Project Road	Residential (nos.)	Commercial (nos.)	Residential & Commercial (nos.)	Others (nos.)	Total (nos.)
Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89	35	80	10	2	127
Rajapalayam-Sankarankoil-Tirunelveli section of SH-41	82	257	35	18	392

Source: SIA Report, DPR, Volume VII Part B

The proposed project also requires land for widening, junction improvement, geometric improvement for project roads. Total **2.020 hectare** of land is required for Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44 and **7.256 hectare** of land is required for Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89. About **4.692 hectare** of land requirement has been estimated for proposed development of Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41. The Land Plan Schedule for project roads has been prepared and submitted to TNRSP by the consultant.

#### 4.7.3 Common Property Resources (CPRs) and Sensitive receptors

There are important community structures along the project roads, which has cultural and sociological importance. The details of common property resources and sensitive receptors along the project roads along are as detailed in **Table 4-30**.

**Table 4-30 : Common Property Resources and Sensitive Receptors along the Project Roads**

**Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44**

##### 1) List of Hand pumps

Chainage (Km)	Side	CPR	Village
28.25	RHS	Hand Pump	Parapatti
31.03	LHS	Hand Pump	Ilaiyaranandal
40.85	LHS	Hand Pump	Kovilpatti
41.60	LHS	Hand Pump	Kovilpatti
42.12	RHS	Hand Pump	Kovilpatti
44.65	RHS	Hand Pump	Kovilpatti
91.8 of SH32	RHS	Hand Pump	Ettayapuram
55.50	RHS	Hand Pump	Ettayapuram
55.90	RHS	Hand Pump	Ettayapuram

Source: Primary suvery, February – March 2014



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## 2) List of Open Wells

Chainage (Km)	Side	CPR	Village
24.85	RHS	Open Well	Naduvapatti
25.15	LHS	Open Well(with boundry)	Naduvapatti
26.10	LHS	Open Well	Naduvapatti
26.70	LHS	Open Well	Naduvapatti
26.70	RHS	Open Well	Naduvapatti
27.58	LHS	Open Well	Parapatti
27.80	RHS	Open Well	Parapatti
29.00	RHS	Open Well	Parapatti
29.50	LHS	Open Well	Parapatti
34.80	LHS	Open Well	Venkadasalapuram
40.18	RHS	Open Well	Kovilpatti
44.50	RHS	Open Well	Kovilpatti
51.84	RHS	Open Well	Kumaragiri
54.50	LHS	Open Well Tank	Ilambuvanam

Source: Primary suvery, February – March 2014

## 3) List of Tubewells and Tap Water Tank (TWT)

Chainage (Km)	Side	CPR	Village
26.30	LHS	Tubewell with Shelter	Naduvapatti
37.40	RHS	Tubewell	Puthuapaneri
24.85	RHS	TWT +Tubewell	Naduvapatti
25.17	LHS	TWT +Tubewell	Naduvapatti
28.25	RHS	TWT +Tubewell	Parapatti
31.03	RHS	TWT +Tubewell	Ilaiyaranandal
36.55	LHS	TWT+Tubewell	Puthuapaneri
31.02	RHS	TWT	Ilaiyaranandal
49.80	RHS	TWT	kovilpatti

Source: Primary suvery, February – March 2014

## 4) List of Religious Structures (Sensitive Receptors)

Chainage (Km)	Side	CPR	Village
24.410	RHS	Kannivinayagar Temple	Mukkuttumalai
26.200	LHS	Ramapuli Ayyarnar, Temple	Sippipari
27.500	RHS	Kali Amman Temple	Nakkal muttampatti
27.620	RHS	Shaktivinayagar Temple	Nakkal muttampatti
27.650	RHS	R.C. Christian Church and School	Nakkal muttampatti
30.200	LHS	Irulasu Swamy Temple	Ilaiyaranandal
30.500	LHS	Pathinattampadi Karuppaswamy	Ilaiyaranandal
39.950	LHS	Sembaveliyamma Temple	Kovil Patti
39.980	RHS	Mangla Vinayagar Temple	Kovil Patti
41.200	LHS	Varasakthi Vinayagar Temple and Income Tax Office	Kovil Patti
44.500	RHS	Kali Aman Temple	Tittangulam



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Chainage (Km)	Side	CPR	Village
45.000	LHS	Church	Tittangulam
46.900	LHS	Vinayagar Temple	Tittangulam
52.350	LHS	Pomariamman Temple (Big Temple)	Ilambuvanam
54.600	LHS	Chellathai Amman Temple	Ilambuvanam
55.600	LHS	Vinayagar Temple	Ilambuvanam
56.000	RHS	Vinayagar Temple	Ilambuvanam
92.00 (SH-32)	LHS	Uttandaraman Temple	Ilambuvanam

Source: Primary suvery, February – March 2014

### 5) List of Educational Institutes (Sensitive Receptors)

Chainage (Km)	Side	CPR	Village
24.460	RHS	Panchayat and Library	Mukkuttumalai
24.840	LHS	Indu Elementary School	Mukkuttumalai
27.520	RHS	Old R.C. Elementary School	Nakkal muttampatti
27.530	RHS	Self Helf Group (Woman)	Nakkal muttampatti
27.650	RHS	R.C. Christian Church and School	Nakkal muttampatti
30.800	LHS	Govt. Higher Sec. School	Ilaiyarsanendal
36.000	LHS	G. Venkataswamy Nadu College	Kovil Patti
38.000	LHS	Micro Point ITI college	Kovil Patti
41.600	LHS	Govt. Ladies Hostel	Kovil Patti
41.8	LHS	Govt. Library	Kovil Patti
42.100	RHS	V.O.C. Govt. Higher Sec. School	Kovil Patti
42.200	LHS	Kammavar Ladies Higer Sec. School	Kovil Patti
43.500	LHS	Thiruvalluvar ITI college	Kovil Patti
44.600	LHS	Govt. Primary School	Tittangulam
50.900	RHS	C.K.T. Matriculation Higer Sec. School	Kumaragiri
52.400	RHS	Govt. Primary School	Ilambuvanam
52.450	RHS	Self Helf Group (Woman)	Ilambuvanam
53.300	LHS	Bharathiar Ladies Polytechnique college	Ettayapuram
53.300	RHS	Bharathiar Ladies Polytechnique college Hostel	Ettayapuram
53.400	RHS	Bharathiar Ladies Ladies Higher Sec. School	Ettayapuram
54.500	LHS	Mariappa Elementary School	Ettayapuram
54.650	LHS	Sub Registrar Office	Ettayapuram
55.000	LHS	Maha Kavi Subramaniabharathiar Memorial Hall and Park	Ettayapuram

Source: Primary suvery, February – March 2014

### 6) List of Hospital/Health Centers (Sensitive Receptors)

Chainage (Km)	Side	CPR	Village
31.600	LHS	Govt. Public Health Center	Ilaiyarsanendal
40.025	LHS	Gowori Hospital	Kovil Patti
41.800	RHS	Vetanary Hospital	Kovil Patti

Source: Primary suvery, February – March 2014



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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

## Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89

### 1) List of Hand pumps

Chainage (Km)	Side	CPR	Village
2.710	LHS	Hand Pump	EraippOvari
5.550	LHS	Hand Pump	Eamankulam
5.790	LHS	Hand Pump	Eamankulam
6.010	LHS	Hand Pump	Eamankulam
9.580	LHS	Hand Pump	Subramaniapuram
19.300	RHS	Hand Pump	Mannarpuram
33.600	LHS	Hand Pump	Idaiyangudi

Source: Primary suvery, February – March 2014

### 2) List of Open Wells

Chainage (Km)	Side	CPR	Village
0.060	LHS	Open Well and Water Tank	Nanguneri
2.700	LHS	Open Well	EraippOvari
8.210	LHS	Open Well and Over Water Tank	Subramaniapuram
9.580	LHS	Open Well	Subramaniapuram
15.400	LHS	Open well	South Vijaynarayanam
16.440	RHS	Open Well	South Vijaynarayanam
17.780	LHS	Open Well	South Vijaynarayanam
25.100	LHS	Open Well	Kumaraapuram
25.750	LHS	Open Well	Kumaraapuram
31.400	LHS	Open Well	Idaiyangudi

Source: Primary suvery, February – March 2014

### 3) List of Tube wells

Chainage (Km)	Side	CPR	Village
0.035	RHS	Tube Well	Nanguneri
2.200	LHS	Tube well with Tap Water Tank	Thattankualm
2.760	LHS	Tube well with Tap Water Tank	EraippOvari
3.680	LHS	Tube well with Tap Water Tank	Perumal Nagar
5.550	LHS	Tube well with Tap Water Tank	Eamankulam
5.780	LHS	Tube well with Tap Water Tank	Eamankulam
8.390	RHS	Tube well with Tap Water Tank	Subramaniapuram
8.600	LHS	Tube well with Tap Water Tank	Subramaniapuram
10.580	RHS	Tube well with Tap Water Tank	Elangulan
11.400	LHS	Tube well with Tap Water Tank	Elangulan
12.190	LHS	Tube well with Tap Water Tank	Kamaraj Nagar
12.400	RHS	Tube well with Tap Water Tank	Vijaynarayanam
16.300	RHS	Tube well with Tap Water Tank	South Vijaynarayanam
34.000	LHS	Tube well and Chamber	Uvary
34.400	LHS	Tube well and Chamber	Uvary





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Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Chainage (Km)	Side	CPR	Village
34.580	LHS	Tube well and Chamber	Uvary
34.650	LHS	Tube well and Chamber	Uvary

Source: Primary suvery, March-April 2014

#### 4) List of Water Tanks and Over Head Tanks

Chainage (Km)	Side	CPR	Village
2.700	LHS	Over Head Water Supply Tank	EraippOvari
5.300	LHS	Tap Water Tank	Eamankulam
10.800	RHS	Tap Water Tank	Elangulan
13.100	RHS	Tap Water Tank	Vijaynarayanam
14.650	RHS	Open Water Tank	South Vijaynarayanam
15.450	LHS	Tap Water Tank	South Vijaynarayanam
16.300	LHS	Over Head Water Supply Tank	South Vijaynarayanam
24.800	RHS	Over Head Water Supply Tank	Kumaraapuram
25.300	LHS	Over Head Water Supply Tank	Kumaraapuram
27.800	LHS	Over Head Water Supply Tank	Bala Sithivanagar
29.500	RHS	Water Supply Tank (PHED)	Appuvilai
29.600	LHS	Over Head Water Supply Tank	Appuvilai
33.600	LHS	Over Head Water Supply Tank	Idaiyangudi

Source: Primary suvery, February – March 2014

#### 5) List of Religious Structures (Sensitive Receptors)

Chainage (Km)	Side	CPR	Village
0.060	RHS	Balavinayagar Temple	Nanguneri
0.800	LHS	Meborn Assembly of God	Nanguneri
2.730	LHS	Amman Temple	EraippOvari
2.790	LHS	Sudalaisamy Temple	EraippOvari
3.300	LHS	St. Antony S. Church	West KaranKadu
3.700	LHS	Shri Athisaya Vinayagar Temple	Perumal Nagar
5.830	LHS	Sudalaisamy Temple	Eamankulam
8.400	RHS	Temple	Subramaniyapuram
8.400	RHS	Temple	Subramaniyapuram
8.500	RHS	Amman Temple	Subramaniyapuram
8.630	RHS	Sudalai Andavar Temple Temple	Subramaniyapuram
10.540	RHS	Antony Church	Subramaniyapuram
10.620	LHS	CSI Church	Elangulan
11.300	LHS	Church	Elangulan
11.450	LHS	Terumal Temple	Bharati Nagar
15.600	RHS	Sodalai Temple	South Vijaynarayanam
16.000	RHS	Sodalai Temple	South Vijaynarayanam
17.350	RHS	Sodalai Temple	South Vijaynarayanam
18.000	RHS	St. Lorth Matha Church	Mannarpuram
19.300	RHS	Essakiamman Temple	Mannarpuram
20.800	LHS	Arockiamatha Church	Mannarpuram



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

Chainage (Km)	Side	CPR	Village
21.300	RHS	The Pent Coastal Mission	Mannarpuram
25.350	RHS	CSI Church	Kumaraapuram
27.500	RHS	Nallamadasamy Temple	Bala Sithivanagar
28.500	RHS	Vinayagar Temple	Bala Sithivanagar
28.800	RHS	Santhi Amman Temple	Bala Sithivanagar
29.400	RHS	Soran Vinayagar Temple	Bala Sithivanagar
29.510	RHS	Shri Mutharamman Temple	Appuvilai
29.600	RHS	Shri. Selva Vinayagar Temple	Appuvilai
31.900	LHS	Church	Idaiyangudi

Source: Primary suvery, February – March 2014

### 6) List of Educational Institutes (Sensitive Receptors)

Chainage (Km)	Side	CPR	Village
0.200	RHS	Old Age Home, Arsan Rural Development Society	Nanguneri
0.450	RHS	Little Flower Community College	Nanguneri
5.800	LHS	Panchayat Library	Eamankulam
8.390	RHS	Shivguru Nursery School	Subramaniapuram
9.070	RHS	Govt. Nursery School	Subramaniapuram
9.900	RHS	Rattish Nursery and Primary School	Subramaniapuram
10.500	RHS	T.D.T.A. Govt. Middle School	Subramaniapuram
10.550	RHS	Govt. Higher Sec. School	Elangulan
14.400	LHS	RECT Poly Technic college	South Vijaynarayanam
14.910	LHS	Panchayat Union School	South Vijaynarayanam
16.900	LHS	R.C. Agasthiar School	South Vijaynarayanam
22.300	LHS	St. Antony S. College of Education	Anagal Nagar
25.000	LHS	Panchayat Union middle School	Kumaraapuram
30.200	RHS	Lions Matriculation School	Appuvilai
32.050	LHS	Cold Well Memorial Higher Sec. School	Idaiyangudi

Source: Primary suvery, February – March 2014

### 7) List of Graveyards

Chainage (Km)	Side	CPR	Village
0.010	LHS	Grave Yard	Nanguneri
0.05	LHS	Grave Yard	Nanguneri
3.000	LHS	Grave Yard	West KaranKadu
6.000	Both Side	Grave Yard	Eamankulam
8.900	RHS	Grave Yard	Subramaniapuram
17.770	Both Side	Grave Yard	South Vijaynarayanam
23.300	RHS	Grave Yard	Nalandullah

Source: Primary Social Survey, February – March 2014



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

## Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41

### 1) List of Hand pumps

Chainage (Km)	Side	CPR	Village
5+410	RHS	Hand pump	Madhukudy
17+390	LHS	Hand pump	Paruvakudi
18+060	RHS	Hand pump	Paruvakudi
18+080	RHS	Hand pump	Paruvakudi
18+100	RHS	Hand pump	Paruvakudi
21+570	RHS	Hand pump	Kulalaikanni
74+680	RHS	Hand pump	Rastha
73+880	LHS	Hand pump	Salaipudur

Source: Primary Social Survey: March-April 2014

### 2) List of Wells

Chainage (Km)	Side	CPR	Village
15+860	LHS	Open Well	Paruvakudi
18+050		Open bore well	Paruvakudi
74+840	RHS	Well	Rastha

Source: Primary Social Survey: March-April 2014

### 3) List of Over Head Tanks(OHT) and Water Tanks

Chainage (Km)	Side	CPR	Village
8+550	LHS	OHT	Cholapuram
12+850	LHS	Water Tank	Solaicherry
20+120	RHS	Water Tank	Karivalamvanthanallur
20+600	RHS	OHT	Karivalamvanthanallur
41+100	LHS	OHT	Gurukulpatti
47+700	LHS	Water Tank	Panavadalichaithiram
52+800	RHS	Water Tank	Masiyapuram
55+800	RHS	OHT	Durkanagar
72+980	LHS	Water Tank	Salaipudi
70+720	RHS	Water Tank	Manur
74+760	RHS	Water Tank	Rastha
78+600	RHS	Water Tank	Sedurayanpudur

Source: Primary Social Survey: March-April 2014

### 4) List of Religious Structures (Sensitive Receptors)

Chainage (Km)	Side	CPR	Village
4+300	RHS	Temple	Mudhukudi
5+450	RHS	Shrine	Mudhukudi
6+550	RHS	Temple	Mudhukudi
6+570	RHS	Temple	Mudhukudi
6+700	LHS	Shrine	Mudhukudi



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

Chainage (Km)	Side	CPR	Village
7+200	LHS	Temple	Cholapuram
7+400	RHS	Temple	Cholapuram
7+800	LHS	Church	Cholapuram
7+900	RHS	Church	Cholapuram
8+500	RHS	Temple	Cholapuram
9+420	LHS	Temple	Cholapuram
10+900	RHS	Temple	Velayuthapuram
19+000	RHS	Temple	Paruvakudi
19+970	RHS	Temple	Karivalamvanthanallur
20+100	RHS	Temple	Karivalamvanthanallur
20+140	LHS	Shrine	Karivalamvanthanallur
20+500	RHS	Temple	Karivalamvanthanallur
20+600	RHS	Temple	Karivalamvanthanallur
21+400	LHS	Church	Karivalamvanthanallur
21+600	RHS	Church	Karivalamvanthanallur
25+150	LHS	Church	Paramputurdarm
25+200	LHS	Temple	Paramputurdarm
25+570	LHS	Temple	Paramputurdarm
25+600	RHS	Temple	Paramputurdarm
26+110	RHS	Temple	Paramputurdarm
29+400	LHS	Temple	Sankarakovil
29+400	RHS	Temple	Sankarakovil
29+500	RHS	Temple	Sankarakovil
30+900	LHS	Temple	Sankarakovil
32+050	LHS	Church	Sankarakovil
33+200	RHS	Temple	Sankarakovil
34+600	RHS	Temple	Sankarakovil
34+850	LHS	Temple	Sankarakovil
34+900	LHS	Temple	Sankarakovil
47+900	RHS	Shrine	Panavadalichaithiram
49+800	RHS	Temple	Tirpannavacroli
53+000	RHS	Temple	Masiyapuram
58+000	RHS	Temple	Deverkulam
58+100	LHS	Church	Deverkulam
58+500	RHS	Temple	Deverkulam
59+900	RHS	Temple	Suppiahpuram
63+400	RHS	Temple	Aliapandipuram
64+800	RHS	Temple	Alakiyapandiapuram
70+000	RHS	Temple	Manur
70+900	RHS	Temple	Manur
72+170	RHS	Temple	Mavadi
72+970	RHS	Temple	Salaipudi
74+850	RHS	Temple	Rastha
76+400	RHS	Temple	Nariuth



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

Chainage (Km)	Side	CPR	Village
78+400	RHS	Temple	Sadurayanpudur

Source: Primary Social Survey: March-April 2014

### 5) List of Educational Institutes (Sensitive Receptors)

Chainage (Km)	Side	CPR	Village
9+400	RHS	School	Cholapuram
16+200	LHS	College	Paruvakudi
26+800	LHS	School	Sankarakovil
27+750	RHS	School	Sri Gomathipuram
29+500	LHS	School	Sankarakovil
44+500	LHS	School	Melaneelithnudur
47+200	RHS	School	Ayalpatti
55+200	RHS	School	Vannikonedhal
57+100	RHS	School	Adikulampuram

Source

### 6) List of Hospitals (Sensitive Receptors)

Chainage (Km)	Side	CPR	Village
21+200	RHS	Hospital	Karivalamvanthanallur

Source: Primary Social Survey: March-April 2014

### 7) List of Graveyards

Chainage (Km)	Side	CPR	Village
7+150	RHS	Grave Yard	Cholapuram
32+400	LHS	Grave Yard	Sankarakovil
59+150	LHS	Grave Yard	Deverkulam

Source: Primary Social Survey: March-April 2014

### 8) List of Petrol Pumps

Chainage (Km)	Side	CPR	Village
9+000	RHS	Patrol Pump	Cholapuram
19+300		Patrol Pump	Karivalamvanthanallur
32+200	LHS	Patrol Pump	Sankarakovil
46+900	LHS	Patrol Pump	Ayalpatti
53+400	LHS	Patrol Pump	Masiyapuram
71+200	RHS	Patrol Pump	Manur
84+320	RHS	Patrol Pump	Ramaianpatti

Source: Primary Social Survey: March-April 2014

### 9) List of Bus Shelters

Chainage (Km)	Side	CPR	Village
7+850	RHS	Bus Shelter	Cholapuram
7+950	RHS	Bus Shelter	Cholapuram
9+900	LHS	Bus Shelter	Velayuthapuram





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Chainage (Km)	Side	CPR	Village
10+900	LHS	Bus Shelter	Velayuthapuram
12+800	RHS	Bus Shelter	Solaicherry
13+030	RHS	Bus Shelter	Solaicherry
14+400	RHS	Bus Shelter	Senthattiyapuram
16+250	LHS	Bus Shelter	Paruvakudi
17+300	LHS	Bus Shelter	Paruvakudi
18+100	LHS	Bus Shelter	Paruvakudi
20+900	RHS	Bus Shelter	Karivalamvanthanallur
21+200	RHS	Bus Shelter	Karivalamvanthanallur
21+900	RHS	Bus Shelter	Kuvalaikanni
23+500	RHS	Bus Shelter	Alagnchiapuram
25+210	LHS	Bus Shelter	Paramputurdarm
26+100	LHS	Bus Shelter	Paramputurdarm
26+850	LHS	Bus Shelter	Paramputurdarm
27+750	RHS	Bus Shelter	Sri Gomathipuram
28+420	LHS	Bus Shelter	Sri Gomathipuram
29+600	LHS	Bus Shelter	Sankarakovil
29+650	RHS	Bus Shelter	Sankarakovil
31+800	LHS	Bus Shelter	Sankarakovil
35+800	RHS	Bus Shelter	K. Marudhappapuram
37+300	RHS	Bus Shelter	Kovinamkulam
38+400	LHS	Bus Shelter	Muthukrishnapuram
40+150	RHS	Bus Shelter	Gurukulpatti
45+700	RHS	Bus Shelter	Thirumalapuram
46+000	RHS	Bus Shelter	Ayalpatti
48+020	LHS	Bus Shelter	panavadalichaithiram
48+700	RHS	Bus Shelter	Badakpanavadali
49+850	RHS	Bus Shelter	Tirkpannavacrol
50+400	RHS	Bus Shelter	Narikudi
52+800	RHS	Bus Shelter	Masiyapuram
56+200	RHS	Bus Shelter	Adikulampuram
60+500	LHS	Bus Shelter	Suppiahapuram
64+400	LHS	Bus Shelter	Alakiyapandiapuram
67+100	LHS	Bus Shelter	Keelapilaiyar
67+850	RHS	Bus Shelter	Kanarpatti
70+800	RHS	Bus Shelter	Manur
71+700	LHS	Bus Shelter	Jemi nagar
72+200	LHS	Bus Shelter	Mavadi
73+050	RHS	Bus Shelter	Salaipudi
74+800	RHS	Bus Shelter	Rastha
76+700	RHS	Bus Shelter	Nariuth
78+900	LHS	Bus Shelter	Sadurayanpudur
79+900	RHS	Bus Shelter	S.R.R Nagar
82+780	RHS	Bus Shelter	Ramaianpatti



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Source: Primary Social Survey: March-April 2014

#### 10) List of Other Structures

Chainage (Km)	Side	CPR	Village
5+300	RHS	Ambedker statue	Mudhukudi
21+800	LHS	Panchyat office	Kuvalaikanni

Source: Primary Social Survey: March-April 2014

#### 4.7.4 Cultural heritage sites

Tamil Nadu has a rich cultural heritage. As part of baseline assessment, secondary literature review and stakeholder consultations were undertaken including local community consultations to assess the cultural environment in the project districts.

Based on the consultations and review of secondary literature, it is observed that there are no archaeological and historical sites of importance in proximity to the project roads.



## **CHAPTER 5**

### **STAKEHOLDER CONSULTATION**



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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## 5 STAKEHOLDER CONSULTATION

### 5.1 INTRODUCTION

Stakeholder consultation is one of the integral issues of the road project. Stakeholder consultation is a two way process which involves the interaction of various stakeholders and the project proponent. It is highly desirable for all key stakeholders to arrive at a consensus on sensitive features, issues, impacts and remedial actions. It is useful for gathering making them understand the project alternatives and mitigation and enhancement measures and last but not the least the compensation packages arrived for the affected population.

Consultative procedure since the inception of the project has been continued during design and Environmental Assessment stage (First round) considering the fact that involving local communities in the project planning is basis of the participatory planning. Because, often suggestion and option given by the people improves technical and economic efficiency of the project and suggested improvements proposals (if adopted by the project) of the people also generates sense of ownership within communities thus eases implementation process.

Following section highlights level of consultative procedure adopted at various stages, strategies to participatory and continued consultation, lessons learnt from the stakeholder's consultation in project planning.

### 5.2 PRELIMINARY CONSULTATION

**Informal public consultations** with locals were conducted by environmental and social experts along the project roads during site visit. The main objective of the public consultation was to aware the community with regard to the proposed development and to obtain their views and suggestions on the likely impacts due to the project and their mitigations. The details of informal consultations are provided in **Appendix 5.1**.

### 5.3 CONSULTATION PLANNING

#### 5.3.1 Identification of Stakeholders

Identification of important Stakeholders for this project is done taking into consideration of their expected roles in the planning and implementation of the project. Primary stakeholders are the main stakeholders with whom the project will have direct interaction.

Primary Stakeholders	Secondary Stakeholders
<ul style="list-style-type: none"> <li>Potential PAPs;</li> <li>DFO (District Forest Officer) of Tirunelveli, Toothukudi and Virudhunagar Districts</li> <li>District Administration</li> <li>Revenue Department</li> <li>Local Bodies</li> <li>Block Development Officers</li> </ul>	<ul style="list-style-type: none"> <li>Groups of affected people</li> <li>Highways Engineers/ TNRSP Officials</li> <li>Village representatives like Sarpanch and members, PRIs, Village level health workers, Patwaris</li> <li>Local voluntary organizations like CBOs and NGOs</li> </ul>



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### 5.3.2 Planning for Consultation

The consultation mechanism has been planned in stages at each level of project preparation. While village level and Block level consultation was planned during environmental assessment continue till the operation stage, District level consultation, key informant interview and other focused consultative procedure was planned during detailed environmental impact assessment stage. One of the features of present consultation program is to have continued involvement of local engineers of TNRSP in planning and preparation of environmental management framework for the implementation of project largely based on input from concern stakeholders. The consultation strategies and phases have been discussed below.

**Table 5-1: Planning and Present Status of Consultation**

Stakeholders	Level of Consultation	Start Stages	Future course
PPAPs, community, Women groups, NGOs	Village	Design and DPR stage	Completed FGD conducted
TNRSP Officials	PIU and Field Offices	Design and DPR stage	Continued
Revenue Officials, Forest Officials	Tehsil/Block	DPR stage	Continued
District Officials of line Department, such as DRDA, Forest, SLAO	District	DPR stage	Continued
Pollution Control Board	State	DPR stage	Continued
District and State Forest Officials	State	DPR stage	Continued

## 5.4 CONSULTATION DURING DESIGN STAGE–FIRST ROUND CONSULTATION

### 5.4.1 Structured Consultation – Local Level

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.

Such planned consultation has brought emergent issues of proposed road improvement in the agenda for discussion, some of the suggestion given by the community really highlighted crux of local concern of proposed improvement as well as management plan needs to adopted for their local concern.

One of the basic feature of the present consultation strategy to involve local R&B engineers, revenue administration in project planning simultaneously so that implementation could be faster and focused

**Structured Public Consultations (PC)** were conducted jointly by Technical, Social and Environment team members along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam -





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Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44 on 13.05.2014 and Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89 on 15.05.2014. Consultations were conducted along Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 on 24.06.2014. These public consultations were planned for every 15-20km stretch on roads (2 consultations were conducted for each road-SH44 and SH89 project road sections and 3 consultations were conducted for SH41 project road section). All technical, social and environmental issues pertaining to that stretch were briefed and discussed.

After a systematic analysis, the project team of consultant invited above mentioned identified major groups of stakeholders (section 5.3.1) related to this project to attend the formal public consultations.

The details of public consultations along with minutes, attendance sheets and photographs are provided in **Appendix 5.1**. Videography of consultations has been submitted to TNRSP separately.

The Outcomes of Public Consultation are as follows:

**Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44:**

- Bypass proposal for Ettayapuram is not feasible. Hence the Ettayapuram habitat is restricted to edge to edge improvement in congested area to avoid loss of livelihood from km 56/100 to km57/600
- The Mahakavi Bharathiyar Memorial and Birth place will be provided with enhanced tourist attraction measures.
- Boundaries of the open well, ponds will be provided with boundary walls as a mitigation measure.
- Curve improvement with realignment in Sippiparai and Ayyaneri Village to reduce accidents.

**Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89:**

- Realignment feasibility studied for Tisayanvilai and major realignment is approved by the World Bank and TNRSP.
- The Idaingudi by pass proposal was studied and decision was made saying unviable. The Idanyankudi Village will be strengthened with edge to edge improvement.
- The Ovari Siva Temple will be considered for enhanced proposal of development nearby tourist/ pilgrimage places.
- The road will be extended upto ECR junction.

**Rajapalayam-Sankarankoil-Tirunelveli section of SH-41:**

- The Public Consultation process in Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 helped the design team for a better understanding for the rationale for Sankarankoil Bypass.
- The public highlighted the accident prone areas which need to be addressed.
- The meetings expressed the interest of the public for better roads.



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- The consultation process helped the villagers and elected representative to get clarified and to avoid misunderstanding about the project implementation.
- These meetings acted as a preliminary rapport building exercise to assure cooperation from the public.
- Identified the need for improved quality bridges along the road.

#### 5.4.2 Focussed Group Discussion

FGDs were held along project roads to address and understand various issues including religious properties, relocation of community buildings, relocation of water resources and enhancement proposal for Hot spot zones (even if not affected). The details are included in Social Impact Assessment Report, Volume VII Part B of DPR.

#### 5.4.3 District Level Consultation

**Consultation with Forest Officials :** Since, the Koonthakulam Bird Sanctuary is located within 10km radius of SH89, consultation was conducted with Divisional Forest Officer, Tirunelveli, who is the warden for the Koonthakulam Bird Sanctuary regarding details of sanctuary such as location, size, bird species, migratory birds their RET status etc. Consultation was also conducted with Wildlife Warden, Srivilliputtur Grizzled Squirrel Wildlife Sanctuary (falling within 10km distance from project road) regarding details of sanctuary such as location, size, species and their RET status etc. The details are provided in section 4.6.2 of Chapter 4.

#### 5.4.4 State Level Consultation

State level consultation was held at Chennai involving State Secretaries of Highways, Forest and Environment Department, along with official of Tamil Nadu State Pollution Control Board and TNRSP Officials. The prime concern of the State level consultation was to formalize procedure and mechanism of regulatory clearances, utility shifting, land acquisition etc. various other issues are discussed regularly with state level officers.

### 5.5 LESSONS LEARNT FROM CONSULTATION AND SUGGESTED FRAMEWORK FOR ENVIRONMENTAL MANAGEMENT PLAN

#### 5.5.1 Issues of Tree Cutting

The proposed widening of project roads will lead to tree cutting falling within COI. While discussing strategies to save trees people suggested that small trees (<30cm girth size) should be replanted. Thus, survey has been conducted to identify such trees for transplantation and is a part of tree plantation strategy.

Also, locals suggested saving old pulee and neem trees and plantation of these species for road side plantation. Therefore, it was decided that tree felling would be restricted and alignment design has been prepared with an objective to save maximum number of trees.



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### 5.5.2 Compensatory Afforestation

Compensatory plantation will be done in the ratio of 1:10 for affected trees >30cm in girth size.

Community during consultation has suggested to plant local species, which provide shelter to the people (Canopy building trees) and fruit bearing trees.

### 5.5.3 Monitoring Plan and Training

Information collected during environment (air quality, water quality and other parameters) survey and consultation suggests periodic monitoring plan should be gauged by considering specific but limited number of environmental parameters. Therefore, Monitoring strategies for the project should devise a specific plan. Training and capacity building component of environmental team should be part of consolidated training program and budgeted in training and institutional component of the project.

### 5.5.4 Community Properties Resources (CPRs) Enhancement

Enhancement measures have been proposed for some community properties. This is learnt from consultation that generally CPRs do not receive due attention during construction as a result actual enhancement do not take place. Therefore project authority should plan for alternative implementation arrangement or strengthen its periodic monitoring of physical and financial progress of such enhancement.



## **CHAPTER 6**

### **ANALYSIS OF ALTERNATIVES**



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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## 6 ANALYSIS OF ALTERNATIVES

### 6.1 GENERAL

There are few sharp and blind curves along the project roads for which major and minor realignments have been proposed to improve the geometric and safety. No bypass is proposed along project roads.

A Bypass is proposed at Sankarankoil from Km 28/000 to Km 33/800 on Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41 by C&M Highways Department. The same is not under consultant's scope of work.

Along Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89, consultant have explored the possibility of major realignment at Tisaiyanvillai village, a major congested point. Consultant has carried out the option study of the alternatives possible based on environmental, social and technical aspects.

### 6.2 REALIGNMENTS ALONG SH44- NADUVAPATTI - KOVILPATTI - ETTAYAPURAM ROAD (KM 22/500 TO KM 38/750 AND KM 41/300 TO KM 56/700)

#### 1) Details of Realignment (major horizontal curve improvements)

##### e) Km 24/430 to Km 24/605

The stretch is passing through Mukkuttumalai village. Straight realignment is proposed to improve the curve radius. One well is being impacted due to this realignment. There is no major environmental impact.

##### f) Km 26/200 to km 26/350

- The stretch from km 26/200 to km 26/350 is passing through sippiparai village. The existing alignment has a continuous sharp curve with the poor sight distance. So, to improve the geometry of the road, realignment is proposed.
- There is no major environmental and social impact in this realignment.

##### g) Km 30/100 to km 30/200

- The stretch is passing through Elayarasanenedal village. To improve the curve radius, realignment is proposed for a length of 100m.
- There is no major environmental and social impact in this realignment.

##### h) Km 35/220 to km 35/600

- The stretch from km 35/220 to km 35/600 is passing through Ayyaneri village. The existing alignment has a continuous sharp reverse curve with the poor sight distance.
- Also, a major causeway exists across the project road with pipe vents which are in poor condition. So to improve the geometry of the road, realignment with a curve radius of 240m is proposed and a minor bridge is proposed.
- There is no major environmental and social impact in this realignment.



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### 6.3 REALIGNMENTS ALONG SH89- NANGUNERI - BHARATAVARAM -OVARI ROAD UPTO ECR JUNCTION (KM 0/000 TO KM 35/200)

#### 1. Major Realignment from km 26+200 to km 26+700

The alignment from km 26+200 to km 26+700 has a continuous sharp reverse curve with the poor sight distance. The existing Features at this location are given below:

S.No	Description	Features
1	Village Name	Tisaiyanvillai
2	Carriageway width	7.0 m
3	Existing ROW	20m -24m
4	Pavement condition	Poor
5	Land Use	Agriculture/Open Land
6	Geometrical Deficiencies	4 sharp curves of radius 30m,130m, 180m & 40m
7	Existing Speed	20 kmph
8	Environmental Issues	Nallah running parallel to road
9	Social Issues	3 Houses and 1 temple along the road
10	CD Structures	1 Slab Culvert & 1 Causeway



**Sharp Curve (1) at Chainage 26+440, SH89**





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**Sharp Curve (2) at Chainage 26+615, SH89**



**Sharp Curve (3 & 4) at Chainage 26+800, SH89**

From the above features, it is observed that, the exiting alignment need to be improved geometrically to achieve the minimum design speed of 80 kmph, so that the homogeneous speed can be maintained.

The geometrical improvement for the individual curve has the less possibility to achieve the design speed and sight distance. Hence to make the curve ease and to accommodate the two lane with paved shoulder, a single curve is proposed from km 26+200 to km 26+700 for the design speed of 80kmph.



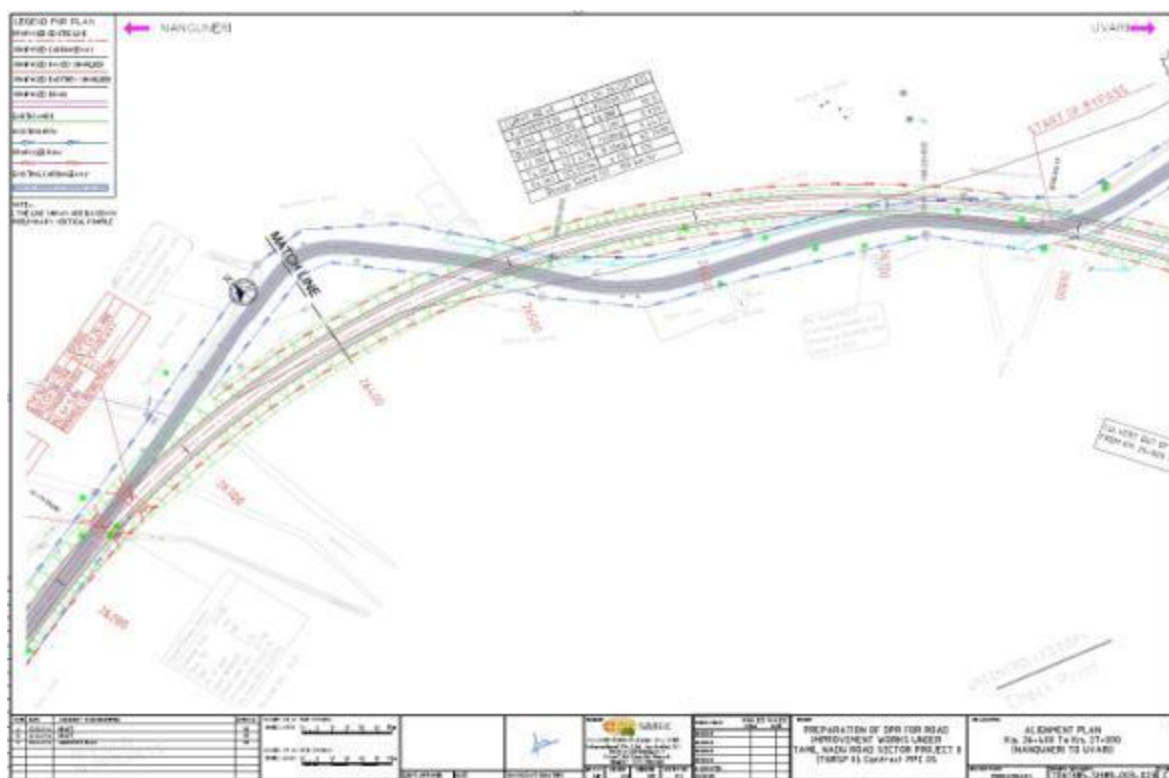
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The features of proposed realignment are given below:

S.No	Description	Features
1	Carriageway width	7.0 m
2	Shoulder Width	1.5m Paved, 1m Earthen on Both sides
3	Drain	Unlined Drain 1.5m
4	PROW	23m (Rural Section)
5	Geometrical Improvements	Single curve of radius 500m
6	Proposed Speed	80 kmph
7	Environmental Issues	Passing through Agriculture land
8	Social Issues	Land Acquisition- about 1.45 Hectares
9	CD Structures Proposed	1 Minor Bridge, Widening of existing culvert

Thus, the realignment is justified taking into account technical, social and environmental issues.

The horizontal design for the improvement proposal is given below:



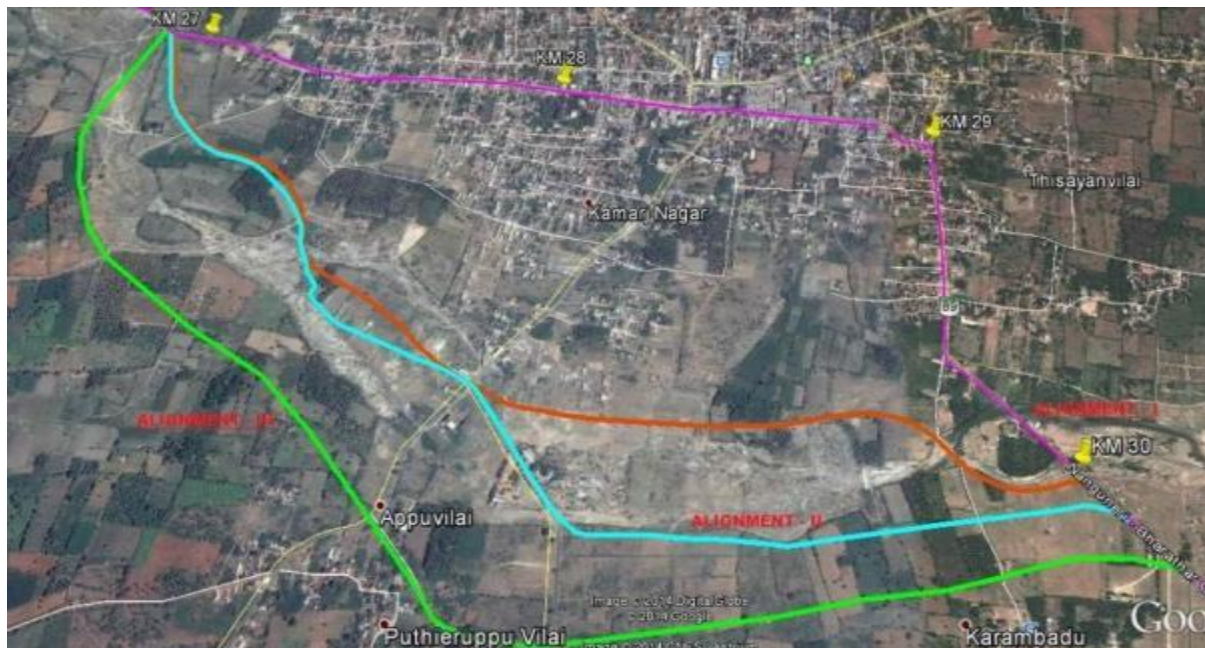
**Proposed Realignment along SH89 from km 26+250 to km 26+800**

2. **Major Realignment** – Tisaiyanvillai village between km 26+800 to km 29+672 is the major congested stretch along SH89 for which a major realignment is required. Consultants have studied three alternative options to propose the realignment.

The alternative options (I, II and III) are shown below in the figure and the comparative statement of these options is presented in subsequent table.



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### Alternative options for Tisaiyanvillai major Realignment

**Table 6-1: Comparative Statement for Various Tisaiyanvillai Realignment option-SH89**

S.No	Description	Option 1	Option 2	Option 3	
1	Length	2.96 km	3.19 km	3.70 km	
2	Land Passes through	Wet - 20%, Dry - 80%	Wet - 40%, Dry - 60%	Wet - 60%, Dry - 40%	
3	Number of curves	6 nos	8 nos	6 nos	
4	Number of CD Structures	1 pipe vent causeway	1 culvert	-	
5	Number of Junctions	3 nos	3 nos	3 nos	
6	Number of Built up sections passing	1 no	3 nos	3 nos	
7	Alignment passing existing road	120m	550m	320m	
8	Environmental Impacts	Trees to be cut	Around 35 tress	Around 60 tress	Around 90 trees
		Water Bodies	Crossing one stream	Crossing at two locations	Crossing at two locations
		Wildlife/Bird Sanctuary	Nil	Nil	Nil
		Reserve Forest	Nil	Nil	Nil
9	Social Impacts	Structures Affected	1 Motor pump building	6 structures	10 structures
		Well/Sump/Tank	1	Nil	Nil
		Land Acquisition	5.50 Hectares	5.30 Hectares	7.0 Hectares
		CRZ	Nil	Nil	Nil
10	Approximate Project Cost (Including LA)	9 Crores	9.8 Crores	11.5 Crores	



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On the basis of above optional studies of alternative alignments based on environmental, social and technical aspects, **Option I** has been suggested by the Consultant and subsequently approved by TNRSP.

### 3. Details of other realignments (major horizontal curve improvements)

There are also proposal for minor realignments to improve the geometric and safety along the road. These are as follows:

#### Realignment from km 0/600 to km 0/800

The alignment length is 250 m located at village Nanguneri

#### Realignment from km 24/100 to km 24/600

The alignment length is 500m m located at village Mamnapuram

### 6.4 REALIGNMENTS ALONG RAJAPALAYAM - SANKARANKOIL – TIRUNELVELI (KM 1/800 TO KM 28/000 AND KM 33/800 TO KM 82/800), SECTION OF SH41

There are only following proposed realignments along the project road:

**Table 6-2: Realignment sections along Rajapalayam-Sankarankoil-Tirunelveli section of SH-41**

Chainage		Length (km)	Reason for Realignment
From (km)	To (km)		
16/850	17/250	0.40	Curve Improvement
25/050	25/400	0.35	Curve Improvement
34/450	34/600	0.15	Curve Improvement
41/380	41/780	0.40	Curve Improvement
50/620	50/880	0.26	Curve Improvement
50/980	51/300	0.32	Curve Improvement
70/950	71/150	0.20	Curve Improvement

Thus, there is no applicability of undertaking alternate analysis for this project road.



## **CHAPTER 7**

### **PROJECT IMPACTS AND ISSUES**





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## 7 PROJECT IMPACTS AND ISSUES

### 7.1 PROJECT IMPACTS AND ISSUES

Previous chapters of this report have dealt about-proposed improvement and existing environmental condition. Following sections summarizes impact of proposed improvement of project roads on existing environment. As mentioned in earlier section the improvement proposal envisages 2-lane roads with paved/earthen shoulder as a result direct impact zone up to towline is in the range of 16-23 meters of corridors (except a small stretch of 4 laning along SH44 project road where direct impact zone will be 28m) and magnitude of indirect impact varies depending upon location of environmental receptors and type of impact. The planning of proposed project intervention point towards the impacts in the pre construction, the construction stages and the operation stage. The subsequent sections deal with the prediction of impacts due to the project on the natural environment and socio & cultural environment.

**Table 7-1** and **Table 7-2** present the general environmental impacts expected due to the proposed up-gradation of the project roads. Impacts have been assessed based on the information collected from the screening & scoping of environmental attributes. The quanta of all the impacts on Natural Environment are discussed in details in subsequent paragraphs.





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**Table 7-1: General Impacts on Natural Environment**

Project Activity	Planning and Design Phase	Pre-construction Phase		Construction Phase					Road Operation	Indirect effects of operation or Induced development
		Removal of Structures	Removal of trees and vegetation	Earth works including quarrying	Laying of pavement	Vehicle & Machine operation & maintenance	Asphalt & crusher plants	Sanitation & Waste (labour campus)		
Env. component Affected	Land acquisition	Removal of Structures	Removal of trees and vegetation	Earth works including quarrying	Laying of pavement	Vehicle & Machine operation & maintenance	Asphalt & crusher plants	Sanitation & Waste (labour campus)	Vehicle operation	
Air		Dust generation during dismantling	Reduced buffering of air and noise pollution, Hotter, drier microclimate	Dust generation	Asphalt odour	Noise, dust, pollution	Noise, soot, odour, dust, pollution	Odour / smoke	Noise, dust, pollution	other pollution
Land	Loss of productive Land	Generation of debris	Erosion and loss of top soil	Erosion and loss of top soil		Contamination by fuel and lubricants Compaction	Contamination Compaction of soil	Contami-nation from wastes	Spill from accidents Deposition of lead	Change in cropping pattern
Water	Loss of water sources	Siltation due to loose earth	Siltation due to loose earth	Alteration of drainage Break in continuity of ditches Siltation, Stagnant water pools in quarries.	Reduction of ground water recharge area	Contamination by fuel and lubricants	Contamination by asphalt leakage or fuel	Contami-nation from wastes Overuse	Spill Contami-nation by fuel, lubricants and washing of vehicles	Increased con-tamination of ground water
Noise		Noise Pollution	Noise Pollution due to machinery	Noise Pollution		Noise Pollution	Noise Pollution		Noise Pollution	Noise Pollution
Flora		Loss of Biomass		Lowered productivity Loss of ground for vegetation		Removal of vegetation	Lower productivity Use as fuel wood	Felling trees for fuel	Impact of pollution on vegetation Lowered productivity Toxicity of vegetation.	
Fauna			Disturbance Habitat loss	Disturbance		Disturbance	Disturbance	Poaching	Collision with traffic	Distorted habitat



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Besides, above-mentioned impact on natural environment there will be socio-economic impacts due to disruptions on the social and economic interactions of communities. This involves effect on both the adjacent communities (mostly direct) as well as the nearby communities (mostly indirect). The various impacts have been detailed as:

- General impacts that apply to the entire project corridor,
- Specific impacts on likely properties and PAPs, within the Corridor of Impact (Col) of the project corridors.



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**Table 7-2: General Impacts on Social and Cultural Environment**

Project Activity	Planning and Design Phase	Pre Construction Phase			Construction Phase					Operation	
										Direct	Indirect Induced development
Social Component Affected	Design decisions & Implementation policies	Land acquisition	Removal of Structures	Removal of trees & vegetation	Earth works including quarrying	Laying of pavement	Vehicle & machine operation & maintenance	Asphalt and crusher plants	Labour Camps	Vehicle operation	-
Agricultural land	-	Change in land prices	Loss of land economic value	Loss of standing crops	Loss of productive land	-	-	Dust on agricultural land reduce n productivity	-	-	Conversion of Agricultural Land
Buildings and built structures	-	-	Loss of structures, Debris generation, Noise and Air pollution	-	Noise, vibration may cause damage to structures	-	Noise, vibration may cause damage to structures	Dust accumulation on building and structure	-	Vibration and noise	Change in building use and characteristics
People and Community	Anxiety and fear among community	-	Displacement of people Psychological impact on people loss of livelihood	Loss of shade & community trees, Loss of fuel wood and fodder, Loss of income	Noise and Air pollution	Odour and dust	Noise and Air pollution, Collision with pedestrians livestock and vehicles	Air and noise pollution and discomfort	Community clashes with migrant labour	Noise pollution, Risk of accident	Induced pollution
Cultural Assets	-	-	Displacement loss of structure from ROW	Loss of sacred trees.	Noise, vibration may cause damage to structure	-	Damage from vibration & air pollution	Dust accumulation	-	Damage from vibration & air pollution	-
Utilities and Amenities	-	-	Interruption in supply	-	-	-	Damage to utility and amenities	Dust accumulation on water bodies	Pressure on existing amenities	-	-



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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Project Activity	Planning and Design Phase	Pre Construction Phase			Construction Phase					Operation	
										Direct	Indirect Induced development
Labour's Health & Safety	-	-	-	-	Increase of stagnant water and disease	Asphalt odour and dust	Collisions with vehicles, pedestrians & livestock	Impact on health due to inhale of dust	Increase in communicable diseases	Collisions pedestrians & livestock	-



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## 7.2 PROJECT INTERVENTION

The project intervention necessitates dismantling of few roadside residential and commercial structures, removal of vegetation.

Potential impacts and requirement of man, material and machineries required for project roads are provided in **Table 7-3**.

**Table 7-3: Potential Impacts and Requirement of Man, Materials & Machinery**

Sr.No.	Description	Unit	Quantity SH44	Quantity SH89	Quantity SH41	Remarks
1	Land Acquisition	Ha	2.020	7.256	4.692	LPS prepared and submitted
2	Dismantling of Structures	No.s	183	127	392	Residential/Commercial/both
3	Removal of trees (within COI)	No.s	1190	773	3923	>30cm girth size
<b>Man, Material and Machinery Requirement for Construction Activity</b>						
5	Labour	No.s	45	50	125	Total No.s of man days divided by time allotted for construction activity
6	Operators and drivers	No.s	20	25	50	Total Machinery working time divided by 8hours of operator working.
7	Semi skilled labour-mate/supervisor	No.s	7	8	13	One male/supervisor over 8 labours.
8	Officers/in-charge	No.s	3	4	12	
9	Borrow Earth	cum	1,40,464	1,73,834	81,030	Requirement for embankment, subgrade shoulder etc
10	Sand	cum	36,408	37,940	103121	Concrete works, screening material and in GSB
11	Blue Metal	cum	12,096	2,15,409	1,89,665	WMM, GSB, DBM
12	Water	Cum/day	159	175	290	All construction activities and for worker use.
13	Crusher Plant/BT plant/Batching Plant	No.s	1	1	2	Based on the project requirement, capacity will be judged.
16	Paver, Grader,	No.s	1 each	1 each	2 each	



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Sr.No.	Description	Unit	Quantity SH44	Quantity SH89	Quantity SH41	Remarks
17	Dumpers	No.s	12	15	35	

### 7.3 LAND ACQUISITION

The project will require land acquisition for up-gradation of existing 2L carriageway to 2LPS (16m and 23m PROW). Besides the horizontal and vertical alignment improvement, additional land will be required to for realignment and geometric improvement as per IRC/MoRTH guidelines.

**Table 7.4** below presents the chainage wise details of land acquisition required for the project intervention.

**Table 7-4: Land Acquisition Details along Project roads**

Road Name	No. of Km	No. of villages	No. of villages where LA is involved	Name of the village where LA is involved	Extent of LA (in 'Ha')
Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44	32.4	14	6	Ilayarasananthal	0.5072
				Nakkalamuthanpatti	0.0238
				Appaneri	0.9576
				Ayyaneri	0.2159
				Mukkutumalai	0.3156
<b>Total</b>					<b>2.0201</b>
Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89	35.2	14	9	Theku Nanguneri	0.6570
				Irapuvari	0.5596
				Karangadu	0.0501
				Ilanguham	0.0164
				Vijayanarayanam	0.7392
				Kottaikarungulam	0.1229
				Thisayanvillai	1.0360
				Mudhumothanmozhi	0.9087
				Kumarapuram	1.3280
Kuttam	0.2510				





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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Road Name	No. of Km	No. of villages	No. of villages where LA is involved	Name of the village where LA is involved	Extent of LA (in 'Ha')
				Karaichuttu Uvari	1.5879
<b>Total</b>					<b>7.2568</b>
Rajapalayam-Sankarankoil-Tirunelveli section of SH-41	75.2	44	19	Samsikapuram	0.2569
				Therku Venganallur	0.1529
				Cholapuram	0.0774
				Perumalpatti	0.0186
				Pandhapalli	0.0288
				Paruvakudi	0.1698
				Karivalamvanthanallur	0.1166
				Kuvalaikani	0.7062
				Perumpattur	0.6565
				Therku Sankarankoil	0.2127
				Kurukkalpatti	0.1884
				Vadaku pannavadali	0.1803
				Marukalangulam	0.6543
				Vanniconenthal	0.029
				Devarkulam	0.0256
				Alagiapandiyapuram	0.8335
				Manur	0.2921
				Mavadi	0.0429
				Melaneelithanallur	0.0503
<b>Total</b>					<b>4.6928</b>

\*LA excluding Tisayanvillai Realignment at SH89 – The assessment of LA is under study.

Source: Detailed Project Report



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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### 7.3.1 Removal of structures

Table 7.5 below presents the details of pavement scarification and cross drainage structures to be removed for the up-gradation of the project roads. Strategies have been adopted to reuse of these materials so that impact of disposal of these materials could be minimized. Hume pipes have limitation of its re-use because of its fixed diameter and suitability to specific conditions.

**Table 7-5: Estimated Quantity from demolition of structures and Pavement**

S. No.	Item	Unit	Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44	Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89	Rajapalayam-Sankarankoil-Tirunelveli section of SH-41
1.	Bituminous Material	cum	16770	2820	2649
2.	Non Bituminous Material	cum	23933	6980	3447
3.	Stone Masonry	cum	0	0	2229
4.	Hume Pipes	m	0	45	421
5.	Dismantling of PCC (Plain Cement Concrete)	cum	204	77	496
6.	Dismantling of RCC (Reinforced Cement Concrete)	cum	43	11	1198
7.	Dismantling of Brick masonry	cum	891	458	114

Unlike sustainable use of pavement and sub grade materials, roadside dwelling and business unit would also be impacted and their impact may not be transformed rather need mitigation measures. Engineering Design team in consultation with environmental and social team has minimized/restricted land width in contiguous built-up areas. Even after such engineering efforts some of this residential and business unit required to be dismantled (partially or fully). Table 7.6, Table 7.7 and Table 7.8 provide total built-up area and number of structure affected Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44, Nanguneri – Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 and Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 respectively. (For detail analysis of impact please refer Social Assessment Report, DPR, Volume VIIB)



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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**Table 7-6: Removal of Roadside structures along Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44**

S.No	Name of the Revenue Village	Usage of Structure				Total
		Resi	Comm	Resi & Comm	Others	
1	Naduvapatti	2	0	1	0	3
2	Mukkutumalai	1	1	0	0	2
3	Sippiparai	0	0	0	0	0
4	Nakkalamuthanpatty	2	1	0	0	3
5	Ilayarasendal	0	12	3	0	15
6	Ayyaneri	0	1	0	0	1
7	Appaneri	0	5	2	0	7
8	Kovilpatti	2	41	3	1	47
9	Thittangulam	19	21	6	1	47
10	Chidamparapuram	0	0	0	0	0
11	Kumaragiri	1	3	0	0	4
12	Ilampuvanam	0	3	0	0	3
13	Ettayapuram	15	35	1	0	51
<b>Total</b>		<b>42</b>	<b>123</b>	<b>16</b>	<b>2</b>	<b>183</b>

Source: SIA Report, DPR, Volume VII B

**Table 7-7: Removal of Roadside structures along Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89**

S.No	Name of the Village	Resi	Comm	Resi & Comm	Others	Total
1	Nanguneri	3	1	2	0	6
2	IraipOvari	14	7	4	0	25
3	Madamkarungadu	3	1	0	2	6
4	IraipOvari	0	0	0	0	0
5	Ilangulam	5	40	3	0	48
6	Kovangulam	0	0	0	0	0
7	Vijayanarayanam	5	27	1	0	33
8	Kottaikarungulam	0	0	0	0	0
9	Kumarapuram	0	2	0	0	2
10	Tisayanvillai	3	2	0	0	5
11	Appuvillai	0	0	0	0	0
12	Tisayanvillai	0	0	0	0	0
13	Mudamottamuzhi	0	0	0	0	0
14	Kuttam	0	0	0	0	0



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S.No	Name of the Village	Resi	Comm	Resi & Comm	Others	Total
15	Karaichittu Ovari	2	0	0	0	2
	<b>Total</b>	<b>35</b>	<b>80</b>	<b>10</b>	<b>2</b>	<b>127</b>

Source: SIA Report, DPR, Volume VII B

**Table 7-8: Removal of Roadside structures along Rajapalayam-Sankarankoil-Tirunelveli section of SH-41**

S.No	Village Panchayat	Name of the Village	Usage of Structure				Total
			Resi	Comm	R&C	Others	
1	Alagiapandiyapuram	Alagiapandiyapuram	0	1	0	0	1
2	Venganallur	annamaikaranager	0	2	0	0	2
3	Alagiapandiyapuram	Chetikurchi	0	0	1	0	1
4	Devarkulam	Devarkulam	8	27	6	0	41
5	Keelanellinur	East panavadlichatram	1	0	0	0	1
6	Karivallamvanthanallur	Karivallamvanthanallur	11	74	2	3	90
7	Keelanellinur	Keelanellinur	0	2	0	0	2
8	kurrukalpati	Kurrukalpati	2	9	1	1	13
9	kuvalai kanni	kuvalai kanni	1	5	0	0	6
10	manavanupuram	Manavanupuram	1	0	0	0	1
11	Mannur	Mannur	5	32	0	0	37
12	Murampu	Murampu	0	2	0	0	2
13	Muthupatti / Venganallur	Muthupatti	3	10	1	0	14
14	muthukrishnaapuram	muthukrishnaapuram	4	10	4	2	20
15	Nariyuthu	Nariyuthu	0	1	0	0	1
16	North panavadlichathiram	North panavadlichathiram	0	0	0	1	1
17	North panavadlichathiram	Panavadalichatram	10	13	8	0	31
18	pantna pvli reteyarpatti	pantna pvli reteyarpatti	0	1	0	0	1
19	Perumal Patti	Perumal Patti	0	1	0	1	2
20	Ramayanpatti	Ramayanpatti	0	1	0	0	1
21	Rastha	Rastha	2	0	0	0	2
22	panthappuli	Rediyyapatti	0	1	0	0	1
23	Cholapuram	Cholapuram	6	5	1	2	14
24	south venganallure	south venganallure	2	2	0	0	4
25	Thirumalpuram	Thirumalpuram	2	5	0	1	8
26	Vadakuthalaivanpatti	Vadakuthalaivanpatti	3	6	4	0	13
27	Vanni konandal	Vanni konandal	9	36	6	1	52
28	Venganallur	Venganallur	12	11	1	6	30
<b>Total</b>			<b>82</b>	<b>257</b>	<b>35</b>	<b>18</b>	<b>392</b>



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Source: SIA Report, DPR, Volume VIIB

### 7.3.2 Removal of Trees and Vegetation

Upgradation, widening and geometric improvement of the project road Table will lead to loss of trees and vegetation. Tree up to toeline is to be felled. Cases to case basis felling of trees will be considered for those trees, which are found at the embankment of slope of carriageway. About 1190 (688 on LHS and 502 on RHS), 773 (383 on LHS and 390 on RHS) and 3923 trees (1837 on LHS and 2086 on RHS) trees of >30cm girth size are required to be uprooted because of project improvement along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44, Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 and Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 respectively.

### 7.3.3 Extraction of material for Construction Activity

**Table 7.9** below presents the details of construction material required for project road upgradation. The quarries for these aggregates and borrow earth are locally available hence NO significant direct impact is envisaged. For details refer Chapter 4: Baseline Environment.

**Table 7-9: Construction material requirement for the project roads**

S. No.	Description	Unit	Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44	Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89	Rajapalayam-Sankarankoil-Tirunelveli section of SH-41	Remarks
1	Borrow Earth	cum	1,40,464	1,73,834	81,030	Requirement for embankment, subgrade shoulder etc
2	Fly Ash	cum	36,408	37,940	31,351	Coal based Tuticorin Thermal Power Plant (2X500MW) located at Harbour Estate, Tuticorin fall within 100km radius of project roads.
3	Sand	cum	1,93,30	28,288	1,03,121	Concrete works, screening material and in GSB
4	Blue Metal	cum	12,096	2,15,410	1,8,9665	WMM, GSB, DBM



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S. No.	Description	Unit	Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44	Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89	Rajapalayam-Sankarankoil-Tirunelveli section of SH-41	Remarks
5	Cement	Tonnes	10,430	7,905	31,460	
6	Bitumen	Tonnes	471	425	995	
7	Steel	Tonnes	885	608	675	
8	Water	Cum/d	159	175	290	All construction activities and for worker use.

### 7.3.4 Construction Machinery

**Table 7.10** presents the quantum of vehicles & machinery required for project intervention and their influence area. These machineries will have its bearing on surrounding environment especially on air quality subject to emission level of machinery.

**Table 7-10: Construction machinery**

Sr.No.	Construction Machinery	Quantity (no.s)			Influence area
		SH44	SH89	SH41	
1	Dumpers	12	15	35	Quarry approach and Project road
2	Excavators	4	5	12	Quarry sites & Project Road
3	Road Rollers	3	4	10	Project road
4	Graders/ Pavers	1	1	4	Project Road
5	Stone Crusher /BT Plant	1	1	2	Plant site

### 7.3.5 Labor for Construction Activity

Table 7-11 presents the number of laborers required/used in the construction activity.





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**Table 7-11: Labor for Construction activity**

Sr.No.	Construction Activity	Number of labor involved in Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44		Number of labor involved in Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89		Number of labor involved in Rajapalayam-Sankarankoil-Tirunelveli section of SH-41	
		Local People	Contractor's	Local People	Contractor's	Local People	Contractor's
1	Quarry	25	2	28	4	60	7
2	Clearing & Grubbing	10	5	12	6	25	10
3	Crusher Plant	1	3	2	4	4	7
4	BT Plant	3	5	4	6	6	12
5	Paving	5	5	6	6	12	12
6	Drivers/Operators	10	20	12	22	25	50
7	Other Staff	3	10	4	12	6	27

About 50 nos., 60 nos. and 125 nos. of contractor's staff and labor will be migrated to the project corridor of Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44, Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 and Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 respectively.

## 7.4 AIR ENVIRONMENT- IMPACTS

Motor vehicles have emerged as one of the major sources of air pollution especially in urban areas. Due to the proposed road improvements aimed at enhancing the efficiency of road transport system the number of vehicles on these roads will be increased over time, so impacts on ambient air environment may be significant, which needs detailed analysis.

### 7.4.1 Meteorological factors and climate

Due to the construction and operation of the project no impacts are expected to contribute to the micro-climatic and meteorological conditions of the Project affected region. The project will have a comprehensive plantation programme and avenue plantation. This could provide shade and canopy to larger areas. This could reverse if any minor or negligible impacts do exists due to the widening of the project road.

### 7.4.2 Air quality – emissions

**Preconstruction Stage:** The preconstruction stage activities include site clearance, shifting of utilities, removal of trees present in the corridor of impact, transportation of man and material, construction of accommodations, construction of stock yards, installation of construction plants and construction of office buildings. Dust generation during such activities would be the



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predominant polluting activity during pre-construction stage and particularly so if pre-construction tasks are performed during dry weather.

The impacts due to the pre construction activities are temporary and location specific and the width of the impacts is limited. Quantification of impacts at the pre construction stage is very difficult as these are very temporary and localized.

**Construction Stage:** During the construction stage the most predominant air pollutant would be particulate matter along with various other gaseous pollutants like oxides of nitrogen, carbon monoxide, sulphur dioxide and carbon based emissions from the hot mix plants

The air pollution during the construction phase may be considerable locally, particularly near the working zones, construction plant sites, quarries and from construction machinery and construction vehicles. The list of activities which generate air pollutants are:

- Dust generation from the construction zone during different stages of the construction such as clearing and grubbing, materials dumping, drying of materials, brushing of the surface etc.,
- Dust generation from the access roads to the soil borrow-areas, aggregate quarries construction plants and construction camp sites.
- Operation of the construction plants such as hot mix plants, Crushers, WMM plants and Concrete Batching Plants
- Material storage, transportation and handling (loading/unloading) of different construction materials such as sand, earth from borrow pits and aggregates.
- Asphalt odor during paving of asphalt layers
- Odor and smoke from construction labor camp.

**Operational Stage:** During the operational stage air pollutant will be from vehicular movements on roads and dust emission from tyres.

The severity of impact of gaseous pollutants due to vehicles plying on the highway at any given time will depend upon the traffic volume, emission rates of auto exhausted pollutants and prevailing metrological condition within the project corridor. Emissions are part and parcel of overall infrastructural development process and efficiency augmentation of transport system. However, compliance with future statutory regulatory requirements with respect to emission limits, auto-technology, vehicular fuel quality should be adequate to prevent any negative public health impacts of this project.

#### **7.4.2.1 Prediction of Carbon Monoxide (CO) Concentration Using CALINE 4 Dispersion Model along the Project Road.**

To assess the impact on air quality of the project area during operation phase, air pollution dispersion modeling was carried out using future traffic projections for the project roads. The modeling was carried out using CALINE-4, line source model developed by the California



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Transport Department. Carbon monoxide (CO) is the main component of the vehicular pollution. So, prediction of CO concentration is representative of the impacts of air pollution due to traffic movement. The study is conducted to predict 1-hour worst case increment in CO for projected traffic in 2020, 2030 and 2040. The methodology used for conducting the model is elaborated briefly in the following paragraphs

#### a) **Environmental Significance of Carbon Monoxide (CO)**

Carbon Monoxide is colorless and odorless gas, chemically inert under normal conditions and has an estimated atmospheric mean life of about two and half months. CO is emitted by incomplete burning of fossil fuel. The National Ambient Air Quality Standard (CPCB) prescribes standard limit for CO in the ambient air as 2 mg/m<sup>3</sup> for 8 hourly monitoring and 4 mg/m<sup>3</sup> for 1 hourly weighted average. At higher concentrations, i.e., above 5 mg/m<sup>3</sup> it can seriously affect human aerobic metabolism, owing to its high affinity for haemoglobin and thus would affect the central nervous system, impairing a person's time interval discrimination and brightness discrimination and over 10 mg/m<sup>3</sup>, concentration would result in cardiac, pulmonary functional changes/failure leading to death.

#### b) **Objective**

The objective of the study is to predict CO concentration in the ambient air on project roads using CALINE 4 dispersion model for projected traffic in 2020, 2030 and 2040.

#### i) **CALINE 4 Dispersion model**

CALINE 4 (Caltras, 1989) is a dispersion model that predicts CO impacts near roadways. CALINE 4 is a simple line source Gaussian plume dispersion model.

#### **Meteorology:**

The meteorological data regarding the conditions prevailing on the site such as wind speed, direction, mixing height, stability class, temperature etc. are required to run the model. Meteorological parameters have been considered for winter season (January) to predict worst case CO incremental concentration. For calculating the emissions, worst-case scenario is assumed and concentrations are obtained for worst wind direction, an option in-built into the program itself. Mixing height is the altitude to which thermal turbulence occurs due to solar heating of the ground. Hourly mixing height data is taken referring book published by S.D Attri, Siddhartha Singh, B. Mukhopadhaya and A.K Bhatnagar. Atmospheric Stability Class is a measure of the turbulence of the atmosphere. Values 1 through 6 corresponds to the standard definitions for stability class A through F. Stability class F (or 6) represent the most stable conditions. Atmospheric stability is expressed as a function of wind speed, insulation and cloud cover. The wind direction standard deviation is used to know the flexibility of wind direction and is important input parameters in worst case run condition. The higher value of wind direction standard deviation helps in dispersion of pollutants and hence reduces the pollution level.



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### Traffic data:

Traffic volume counts were carried out at two homogenous sections of project roads in 2013-14. Based on the estimated growth rates, traffic was projected over the design period for these sections. Hourly traffic volumes for project roads were projected for years 2015 to 2040 to be used for air modelling.

**Table 7-12: Homogeneous Sections along Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44**

S.No	Section	Chainage		Length (Km)
		From	To	
1	S1-Naduvapatti-Kottayam	Km 22+500	Km 38+750	16.250
2	S2-Kottayam-Ettayapuram	Km 41+300	Km 56+700	15.400
<b>Total Length</b>				<b>31.650</b>

**Table 7-13: Homogeneous Sections along Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89**

S.No	Section	Chainage		Length(Km)
		From	To	
1	R1-Nangunuru- Mannarpuram Junction	Km 0+000	Km 20+000	20.000
2	R2-Mannarpuram Junction- Ovari	Km 20+000	Km 35+200	15.200
<b>Total length</b>				<b>35.200</b>

**Table 7-14: Homogeneous Sections along Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41**

S.No	Section	Chainage		Length(Km)
		From	To	
1	S1 Rajapalayam - Sankarankoil	Km 2.000	Km 28.000	26.000 Km
2	S2 Sankarankoil-Tirunelveli	Km 33.800	Km 82.800	49.000 Km
<b>Total Length</b>				<b>73.000 Km</b>

The traffic was suitably reclassified so that the emission factors calculated above could be used in the model directly. The model was run for peak traffic hour.

### Run Type:

Run type determines averaging times (for CO concentrations) and how the hourly average wind angle (s) will be determined. In the present case "worst-case wind angle" run type has been considered to assess the air quality during project operation in worst meteorological conditions.

### Roughness Coefficient

Sub urban = 100 cm was used to determine the amount of local air turbulence that affects plume spreading.



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### **Ambient Pollutant Concentration:**

This measure reflects the pre-existing background level of Carbon Monoxide, expressed in parts per million (ppm). The background concentration is assumed to be zero to predict the incremental concentration as a result of the proposed expansion.

### **Road Geometry**

In the CALINE-4 model the entire length of the road sections is divided into various links. The division of sections into links has been done in such way, so that the link can be fairly considered as straight stretch of road having homogenous geometry with uniform width, height and traffic volume. The coordinates of end points of links specify the location of the links in the model. The model uses Gaussian dispersion parameters that are fairly accurate up to 10 Km distance. The maximum numbers of link in each road section are 20.

The width of proposed 2 lane carriageway is 7 m. The mixing zone width is taken equal to 13 m. The whole stretch of the project roads have been assumed to be at grade.

### **Emission Factor:**

One of the important requirements for Caline-4 model is the input for emission factor for vehicles. In the present study, "Emission Factors for Different Categories of Vehicle in India (ARAI, 2007)" and "Emission Factor for different categories of vehicle in India CPCB 2000". have been used for calculation of weighted emission factors. These emission factors have been expressed for various pollutants and vehicle types in terms vintage of the vehicle (i.e., year of manufacture), type of fuel used (petrol or diesel). The improvement in engine technology, resulting in reduced emission factors are reflected in these standard emission factors. Since, there is only one input requirement for total no. of vehicles in the CALINE 4 model, whereas, there are different categories of vehicles (viz. 2/3 wheelers, cars, LCVs and HCVs) with different manufacturing year and fuel type, it is essential that a single value representing the equivalent emission factors for all the vehicles is calculated. Thus, Weighted Emission Factor expressed in g/mile has been calculated for the present study.

It was observed that the maximum emission load due to road traffic on **Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44** for section S1 occurred between 0900 and 1000 hour for all years of traffic projections and for section S2 between 1000 and 1100 hours for all years of traffic projections.

For **Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89**, maximum emission load for section R1 occurred between 1800 and 1900 hour for all years of traffic projections and for section R2 between 1700 and 1800 hours for all years of traffic projections.

For **Rajapalayam-Sankarankoil-Tirunelveli section of SH41**, the maximum emission load for section S1 occurred between 1600 and 1700 hour for all years of traffic projections and for



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section S2 between 1000 and 1100 hours for all years of traffic projections.

### Receptors

The concentrations have been predicted at all the locations where ambient air monitoring and noise levels were measured along the project roads.

### Averaging Interval:

Simulation is carried out for 1-hour average CO concentration at all the receptors. Thus the predicted incremental CO concentration is averaged over 1 hour interval to predict the maximum possible concentration or the worst case scenario. However the background CO concentration monitored is averaged over 8 hour.

**Table 7-15: Input parameters for CO modelling for project roads**

Input Parameters	Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44	Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89	Rajapalayam-Sankarankoil-Tirunelveli Road (SH41) Section 1 (Rajapalayam to Sankarankoil)	Rajapalayam-Sankarankoil-Tirunelveli Road (SH41) Section 2 (Sankarankoil-Tirunelveli)
Wind Speed (m/s)	1	3	3.6	2.0
Wind direction	As "Worst-Case" is selected, CALINE4 does not use this input.	As "Worst-Case" is selected, CALINE4 does not use this input.	As "Worst-Case" is selected, CALINE4 does not use this input.	As "Worst-Case" is selected, CALINE4 does not use this input.
Wind Direction Standard Deviation	10°	10°	20°	10°
Stability Class	(7)F – Most Stable	(7)F- Most Stable	(5)E	(6)F
Mixing Height (m)	500	850	1000	700
Aerodynamic Roughness Coefficient (cm)	Suburban -100	Suburban -100	Suburban -100	Suburban -100
Temperature (deg C)	21	20	19	20
Altitude (m)	100	70	150	100





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Input Parameters	Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44	Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89	Rajapalayam-Sankarankoil-Tirunelveli Road (SH41) Section 1 (Rajapalayam to Sankarankoil)	Rajapalayam-Sankarankoil-Tirunelveli Road (SH41) Section 2 (Sankarankoil-Tirunelveli)
Mixing zone width (m)	13	13	13	13
Emission Factor (g/mile)	6.39	6.40	6.39	6.40

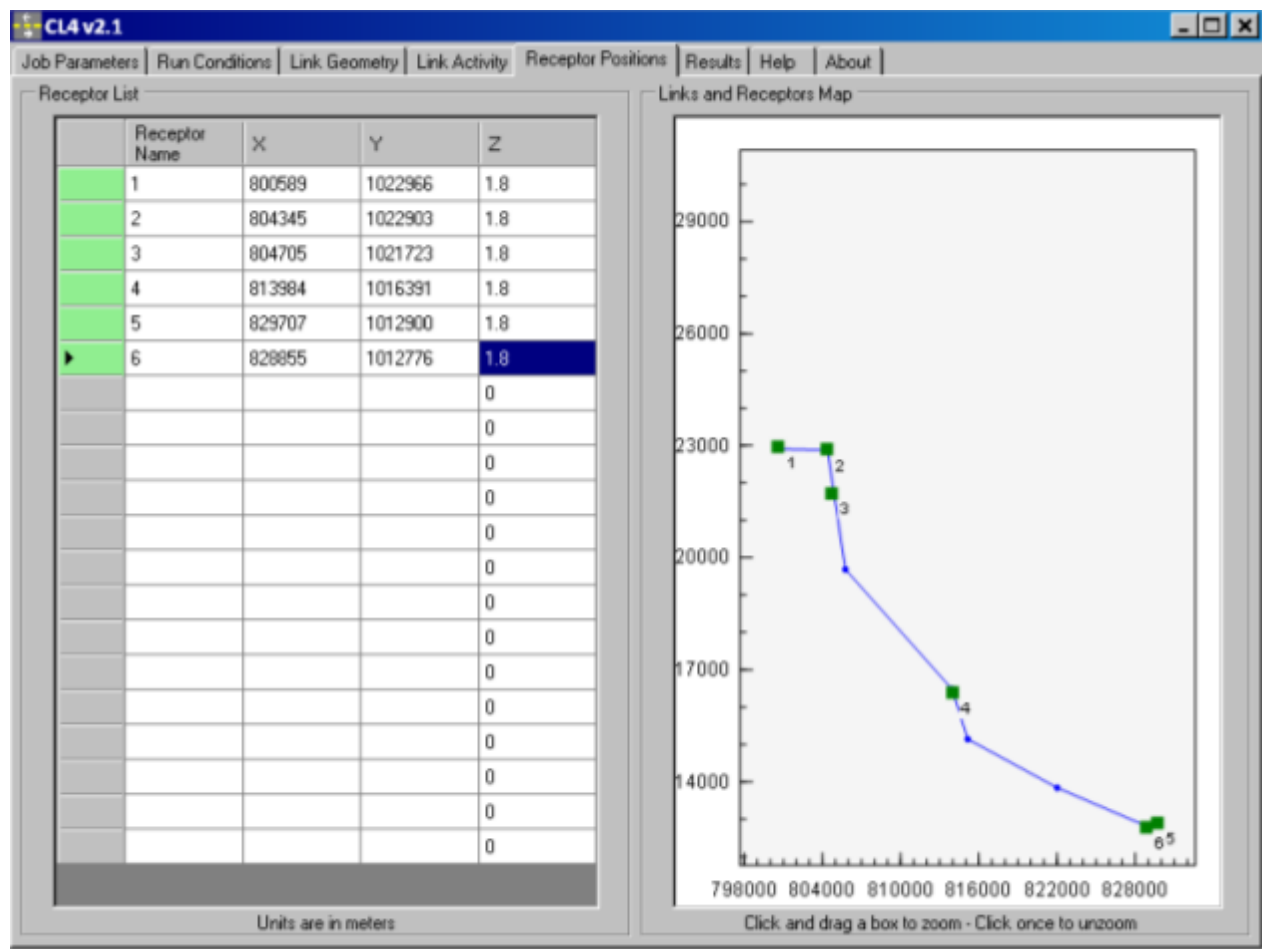
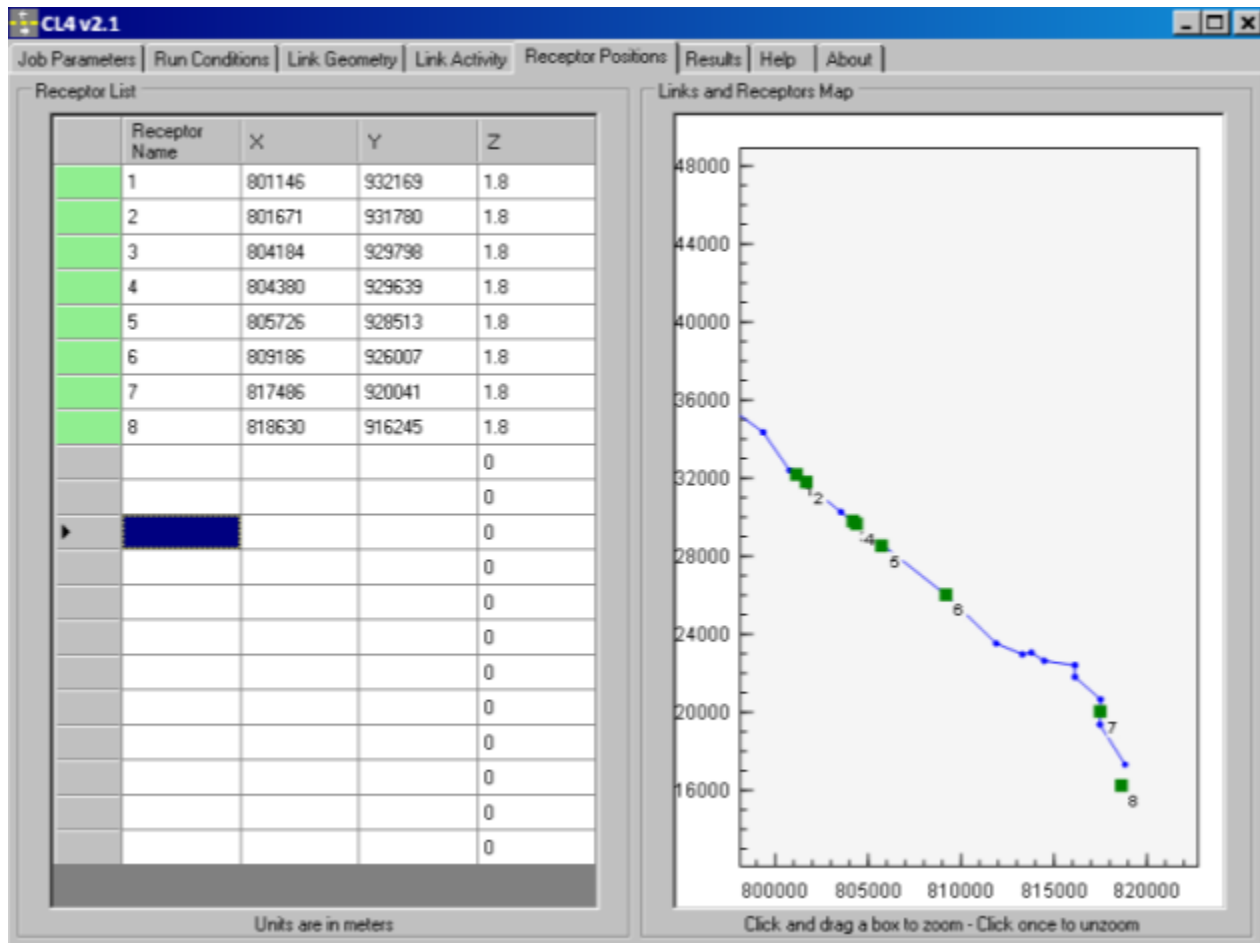


Figure 7-1: Link Geometry and Receptors Input for CO Dispersion Study – Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44



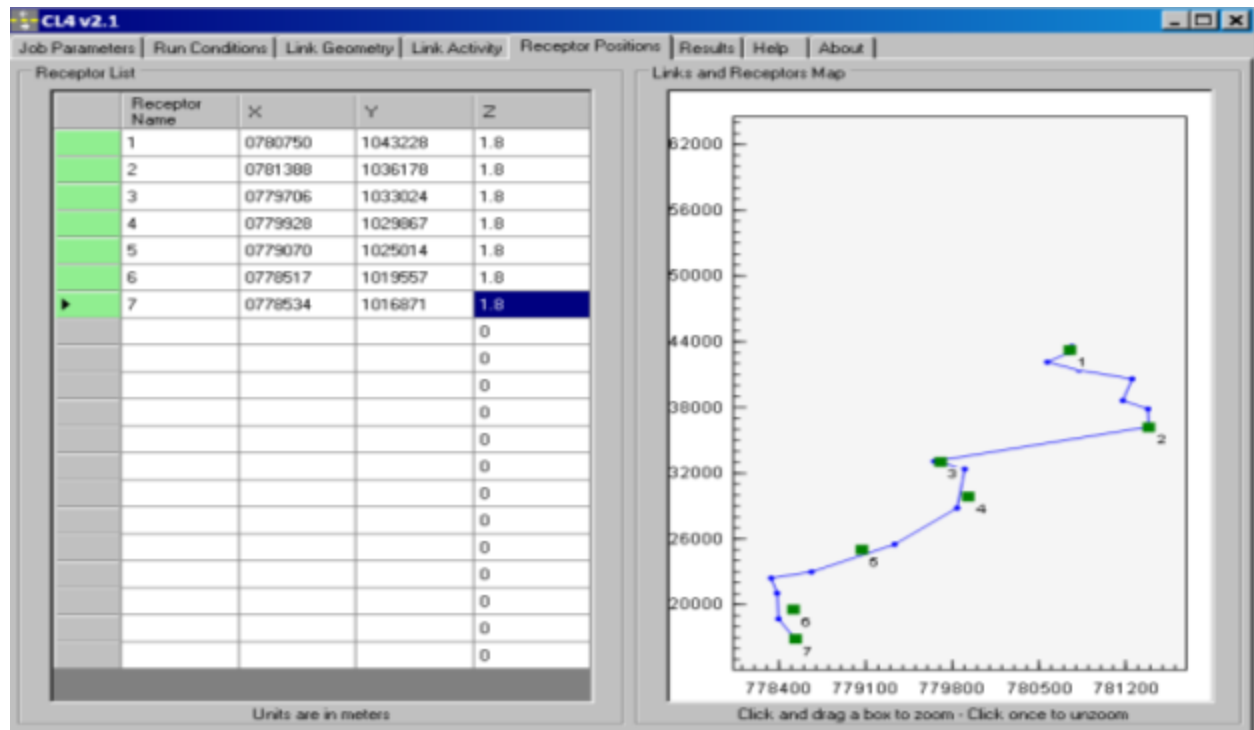
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**Figure 7-2: Link Geometry and Receptors Input for CO Dispersion Study – Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89**

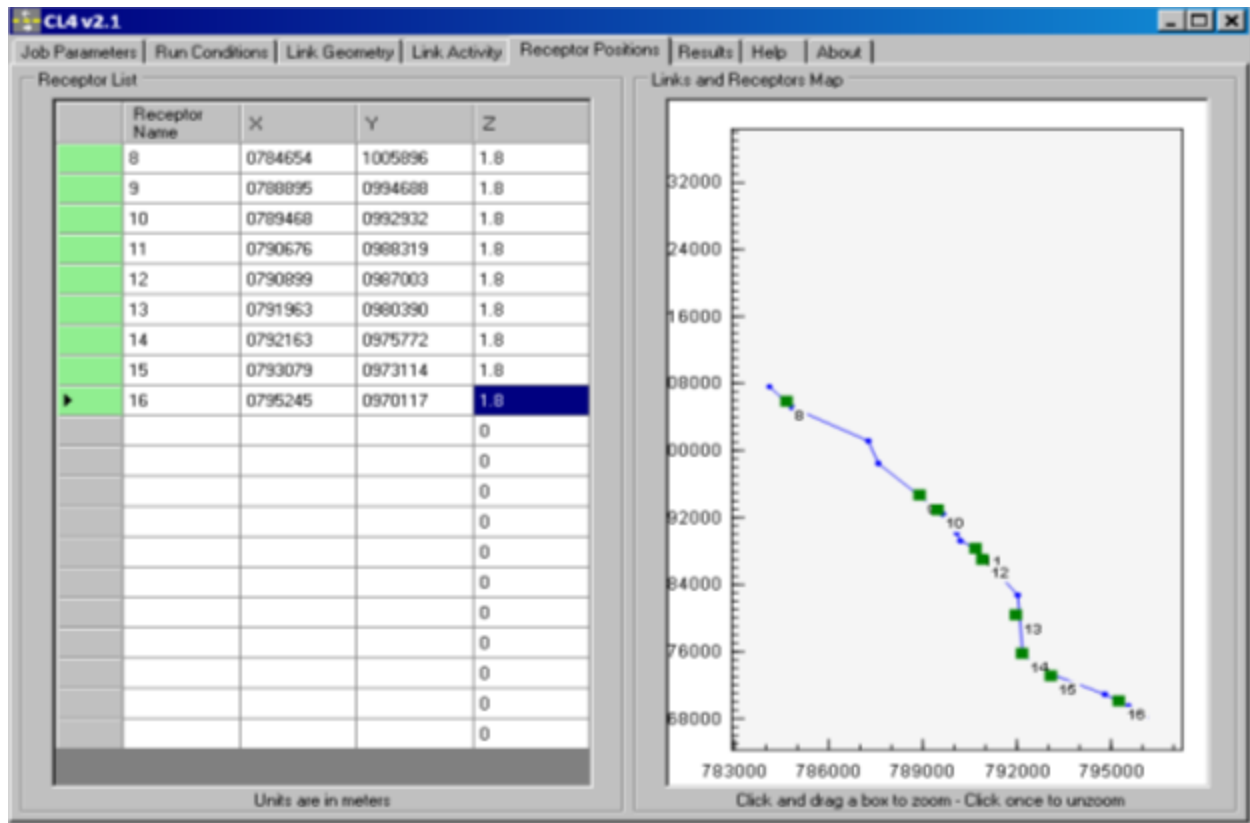


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**Figure 7-3: Link Geometry and Receptors Input for CO Dispersion Study – Rajapalayam-Sankarankoil-Tirunelveli section of SH41, Section 1**

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**Figure 7-4: Link Geometry and Receptors Input for CO Dispersion Study – Rajapalayam-Sankarankoil-Tirunelveli section of SH41, Section 2**

**j) Predicted Pollution Levels**

CALINE 4 CO dispersion model software was run by using data on link geometry, traffic volume and environmental receptors given in the table above. Simulation is carried out with the projected traffic scenario for project roads for different years as shown in **Table 7-16**.

**Table 7-16: Predicted CO Concentration at Receptors**

Receptor Code	Receptor No.	Area Type	Background GLC's (mg/m <sup>3</sup> ) (8 hourly)	Predicted incremental 'CO' Conc. (mg/m <sup>3</sup> )			NAAQS for CO (mg/m <sup>3</sup> ) for Residential, Rural & Other areas (1 hourly)
				2020	2030	2040	
<b>Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44</b>							
AAQ1	1	Sub-urban	0.80	0.10	0.20	0.30	4.00
AAQ2	2	Sub-urban	0.85	0.30	0.50	0.60	4.00
ANQ*	3	Sub-urban	-	0.10	0.20	0.20	4.00
AAQ3	4	Sub-urban	0.95	0.20	0.40	0.50	4.00



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Receptor Code	Receptor No.	Area Type	Background GLC's	Predicted incremental 'CO' Conc. (mg/m <sup>3</sup> )			NAAQS for CO (mg/m <sup>3</sup> ) for
ANQ*	5	Sub-urban	-	0.10	0.20	0.20	4.00
AAQ4	6	Sub-urban	0.90	0.20	0.40	0.40	4.00
<b>Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89</b>							
ANQ*	1	Sub-urban	-	0.10	0.10	0.10	4.00
AAQ12	2	Sub-urban	0.85	0.10	0.10	0.10	4.00
AAQ13	3	Sub-urban	0.80	0.10	0.10	0.20	4.00
ANQ*	4	Sub-urban	-	0.10	0.20	0.30	4.00
ANQ*	5	Sub-urban	-	0.00	0.10	0.10	4.00
AAQ14	6	Sub-urban	0.95	0.20	0.40	0.70	4.00
ANQ*	7	Sub-urban	-	0.20	0.30	0.50	4.00
AAQ15	8	Sub-urban	0.80	0.00	0.00	0.10	4.00
<b>Rajapalayam - Sankarankoil - Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41</b>							
AAQ1	1	Sub-urban	0.80	0.0	0.0	0.0	4.00
ANQ*	2	Sub-urban	-	0.1	0.2	0.3	4.00
AAQ2	3	Sub-urban	0.85	0.1	0.1	0.2	4.00
ANQ*	4	Sub-urban	-	0.0	0.1	0.1	4.00
AAQ3	5	Sub-urban	0.85	0.0	0.0	0.1	4.00
ANQ*	6	Sub-urban	-	0.0	0.0	0.1	4.00
AAQ4	7	Sub-urban	0.95	0.2	0.3	0.6	4.00
AAQ5	8	Sub-urban	0.80	0.1	0.2	0.3	4.00
AAQ6	9	Sub-urban	0.80	0.2	0.3	0.4	4.00
ANQ*	10	Sub-urban	--	0.4	0.7	1.1	4.00
AAQ7	11	Sub-urban	0.80	0.3	0.6	0.9	4.00
ANQ*	12	Sub-urban	-	0.1	0.2	0.2	4.00
AAQ8	13	Sub-urban	0.90	0.1	0.2	0.2	4.00
ANQ*	14	Sub-urban	-	0.3	0.5	0.8	4.00
ANQ*	15	Sub-urban	-	0.1	0.2	0.2	4.00
ANQ*	16	Sub-urban	-	0.2	0.3	0.5	4.00

\*ANQ: CO dispersion modeling has also been conducted at locations where baseline noise levels were measured.

### k) Interpretation of Results

#### Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44

The predicted incremental CO concentrations on existing ambient level at all locations are found to be well within the National Ambient Air Quality Standards for the proposed project. The worst case maximum incremental concentration of CO is 0.6 ppm, found at AAQ2 in the year 2040. It is to be noted that all the receptors are located between distance of 5m to 15m from the centerline of project road except AAQ3.

Thus it can be concluded that the proposed project will not have any significant impact on the



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existing ambient air quality.

### **Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89**

The predicted incremental CO concentrations on existing ambient level at all locations are found to be well within the National Ambient Air Quality Standards for the proposed project. The worst case maximum incremental concentration of CO is 0.7 ppm, found at AAQ14 in the year 2040. It is to be noted that all the receptors are located between distance of 5m to 15m from the centerline of project road except AAQ15 which is located at a distance of about 700m from project road. Thus, the incremental CO concentration is not significant at this location.

Thus it can be concluded that the proposed project will not have any significant impact on the existing ambient air quality.

### **Rajapalayam-Sankarankoil-Tirunelveli section of SH-41**

The predicted incremental CO concentrations on existing ambient level at all locations are found to be well within the National Ambient Air Quality Standards for the proposed project. The worst case maximum incremental concentration of CO is 1.1 ppm, found at Receptor no.10 in the year 2040. It is to be noted that all the receptors are located between distance of 5m to 15m from the centerline of project road except Receptor 1 which is located at a distance of about 700m away from start point of project road (Km 1.800).

Also, AAQ 9 has not been considered for prediction of CO levels as it is located at Km 85.6 which is 2.8km distance away from end point of project road (Km 82.800).

Above CO prediction results show that the proposed project will not have any significant impact on the existing ambient air quality.

## **7.5 LAND ENVIRONMENT - IMPACTS**

### **7.5.1 Impact on Topography**

The design has not suggested any substantial change in the height of the embankments of the roads except to raise in low lying areas. The overall topography of the area is not going to alter due to these minor changes which will relieve the flooding situation, providing positive impacts. List of embankment raising sections along project roads are listed below. (Embankment raising is >0.5m)





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**Table 7-17: List of embankment raising sections**

Start Chainage (m)	End Chainage (m)	Approx. Length (m)	Raising Height (m)	Reason/ remarks
<b>Road: Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44</b>				
23960	24100	140	0.6	Dip portion, to be raised
25900	25960	60	0.6	Dip portion, to be raised
26320	26480	160	1	Water on road during rain
27520	27620	100	0.6	Road flushing with ground levels
29560	29760	200	0.6	Road flushing with ground levels
35280	35520	240	2	Causeway location
48720	48820	100	0.6	Dip portion, to be raised
<b>Road: Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89</b>				
700	800	100	0.6	Road level almost flushing with ground and water flow above road
5880	5960	80	0.6	Road at ground level and water from hills come to the road
8200	8600	400	0.6	Water gets accumulated near to the road
12700	13300	600	0.6	Water gets stagnated all the time on left side
26260	26500	240	2.0	Causeway location
32600	33060	460	0.6	Road flushes with the ground and water stagnant on the side
16100	16200	100	0.6	Road flushing with ground levels and dip portion
18400	18650	250	0.6	Road flushing with ground levels and dip portion
<b>Road: Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41</b>				
19500	19700	200	0.6	Dip portion, to be raised
72100	72600	500	0.6	Road flushing with ground levels
74000	74300	300	0.6	Road flushing with ground levels

### 7.5.2 Impact on Geology

Likely impact on the geological resources will occur from the extraction of materials (borrow of earth, granular sub base and aggregates for base courses and bridges). The boulders will be procured from the authorized suppliers and prevalent rules will be followed for borrowing of soil,

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sand and aggregates. Hence, the impact on general geology of the region is insignificant. At the construction sites, no blasting is proposed; therefore, there will be no added impact on the geology of the area.

### 7.5.3 Impact on Seismology

According to 2012 seismic zoning map of India, the state of Tamil Nadu fall in Zone II to Zone III, least active to moderate zone of seismic hazard (Ref. Figure 7-5). All the three project roads fall in Zone II, least active zone.

Also, as per Global Seismic Hazards Assessment Program (GSHAP) data (Figure 7-6) the state of Tamil Nadu fall mostly in a region of low seismic hazard with the exception of western border areas that lie in a low to moderate hazard zone.

The project roads fall in low hazard zone.



Figure 7-5 Seismic zone Map of India

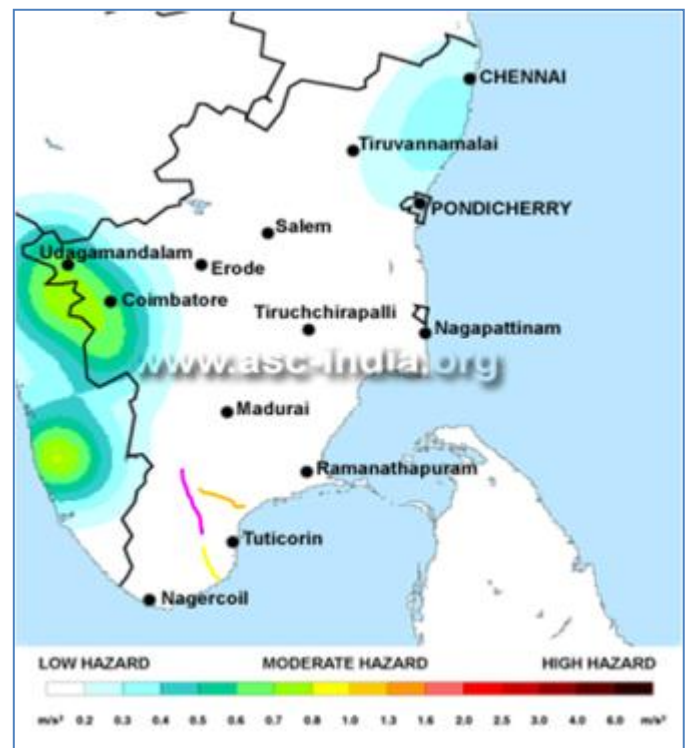


Figure 7-6 Seismic Zone Map of Tamil Nadu (GSHAP) with marked project roads

The construction and operation of the project road will not lead to any adverse impact on seismology settings of the regional environment. On the contrary, the seismic events that could

LEGENDS	
	Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44
	Rajapalayam - Sankarankoil - Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41
	Nanguneri - Bharatavaram - Uvari Road (km 0/000 to km 35/200), Section of SH 89



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occur on the region could damage the road and structures if not constructed as per the specification recommended for the seismic zone. Present upgradation will incorporate both, existing structures will be checked & complied and new structures will be designed earth quake resistant.

#### 7.5.4 Impact on Land

**Loss of land:** One of the major 'local' impacts due to highway project is upon the local land resources required for widening and improvement of the project road. There are stretches along the corridors where acquisition of agricultural land has been unavoidable due to non-availability of sufficient right of way to accommodate the proposed cross-sections. **Refer Table 7.4.**

**Generation of Debris:** The major source of debris generation is dismantling of existing cross drainage structures and road side residential and commercial structures. **Refer Table 7.5, Table 7.6, Table 7.7 and Table 7.8.**

**Soil Erosion:** Erosion of top-soil can be considered a moderate, direct and long-term negative impact resulting from the construction and maintenance of roads. The potential for soil erosion is high and pervasive during the construction stage. Starting with clearing and grubbing of trees vegetation is stripped away, exposing raw soil. The construction of new fill slopes for grading and bridge-end fills also exposes large areas to erosion, if protection methods are not implemented. Finally, during the operation or maintenance phase of highway development, erosion can continue to occur in areas not vegetated. Fills are exposed to long-term exposure to water and wind. Although soil erosion occurs sporadically on highway corridors, the sites most affected are generally bridge end fills and over-steep banks.

##### a) Road slopes and spoils

Erosion problems may occur on newly constructed slopes and fills depending on soil type, angle of slope, height of slope and climatic factors like wind (direction, speed and frequency) and rain (intensity and duration). Since slope protection methods (re-vegetation or stone pitching) form part of good engineering practice, and have been incorporated into the detailed design for the roads, erosion concerns should be minimised. However, failure to maintain soil erosion protection can reduce the security of high road embankments and add siltation to the rivers during the monsoon season.

##### b) Improvement and construction of bridges and culverts

Along each corridor rehabilitation/reconstruction/widening of a number of major and minor bridges and culverts is planned. Construction of new bridges involves excavation of river bed and banks for the construction of the foundation and piers. If the residual spoil is not properly disposed of, increased sedimentation downstream of the bridge may take place during the monsoon. Also, the bridge-end fills require armouring to ensure gullying and slumping are minimised. The details of proposals for culverts are provided in **Table 2.22, Table 2.23 and Table 2.24** and details of bridge proposed for reconstruction are provided in **Table 2.25, Table**



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## 2.26 and Table 2.27.

During the construction period some amount of drainage alteration and downstream erosion/siltation is anticipated. Some of these alterations may be because of construction of temporary traffic detours/diversion. Except for these temporary works, in almost all cases there should be an improvement in the drainage characteristics of the surrounding area due to improved design and added culvert/ditch capacity. Changes in the drainage pattern due to the raising of the road profile has not been discussed in specific cases, as the likely impact is not adverse and does not warrant mitigation (as the road design itself takes care of cross-pavement drainage). New culverts are being incorporated in the project roads not only to prevent over-topping but also to maintain equal water distribution on either side of the road. In fact, the bridges and culverts, as designed, are an automatic enhancement to the local environment (flooding, stagnation, scour, torrent run-off velocity– all would be reduced as a result of this project).

### c) Quarries and borrow areas

The excavation of quarries and borrow pits used for obtaining soil and aggregate materials for road construction can cause direct, and indirect long-term major adverse impacts on the environment. While loss of productive soil is the most direct negative impact, other significant indirect negative impacts can also occur.

Since most of the construction materials would be available from existing quarries nearby, relatively few new borrow areas will be required. Approximate requirement of geo-technical materials to the project corridors are already presented in **Table 7.9**.

One of the long-term residual adverse impacts of borrow pits not reclaimed is the spread of malaria. Mosquitoes breeding and multiplying in stagnant water that collects in these pits can affect humans in villages and towns close to the features.

## 7.5.5 Contamination of Soil

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

- Scarified bitumen wastes, over production of bituminous product,
- Debris generation due to dismantling of structures,
- Maintenance of the machinery and operation of the diesel generator sets on site,
- Oil Spill from the operation of the diesel pumps and diesel storage, during transportation and transfer, parking places, and diesel generator sets,
- Operation of the emulsion sprayer and laying of hot mix,
- Operation of the residential facilities for the labour and officers,



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- Storage and stock yards of bitumen and emulsion,
- Excess production of hot mix and rejected materials,

**Operation Stage:** During the operation stage, soil may get contaminated with similar reasons, as mentioned above, during routine and periodical maintenance of the project road. ***The implications of accidental discharge are potentially disastrous. But, it must be emphasized that the probability of such an accident is quite low, as one of the objectives of the design is the enhancement of road safety.***

## 7.6 WATER ENVIRONMENT –IMPACTS

Due to the proposed project there will be some direct and indirect long-term impacts on the water resources. Table below presents the major adverse impacts on the water resources and the indicators chosen to assess the impacts for the study.

**Table 7-18: Impacts on Water Resources Due To Construction Activities**

Impacts Due To Construction	Indicators
Loss of water bodies	Area of water bodies affected
Loss of other water supply sources	Number of wells affected
Alteration of drainage, run off, flooding	No. of cross drainage channels
Depletion of Ground Water recharge	Area rendered impervious
Use of Water Supply for Construction	Quantum of water used
Contamination from fuel and lubricants	Nature and quantum of contaminants
Contamination from improper sanitation and Waste Disposal in Construction Camps	Area of camp / disposal site and, proximity to water bodies / channels

### 7.6.1 Impact on Water Bodies

Ponds and check dams are the major water bodies along the project roads. Locals use that water for bathing and washing purposes. There is no river crossing along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44 and Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89. However many streams and two major river crosses Rajapalayam-Sankarankoil-Tirunelveli section of SH-41.

#### Surface Water Bodies







**Table 7-19, Table 7-20 and Table 7-21** present the details of the existing surface water bodies and possible impacts along project roads.





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**Table 7-19: Impact on Surface Water Bodies – Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44**

<b>Chainage</b>	22.500		24.350			
<b>Structure ID No</b>	Pond		Pond			
<b>Village Name</b>	Naduvapatti		Mukkatumalai			
<b>Side (Left/Right)</b>	LHS		RHS			
<b>Distance from ECL (m)</b>	5.4m		10-12m			
<b>Length (m)</b>	20m		40m			
<b>Proposed Widening</b>	Concentric		Eccentric on LHS			
<b>Impact</b>	Impacted		No impact			
<b>Chainage</b>	24.650				26.500	
<b>Structure ID No</b>	Pond				Pond/coffer dam	
<b>Village Name</b>	Mukkatumalai	Sippiparai				
<b>Side (Left/Right)</b>	RHS	LHS				
<b>Distance from ECL (m)</b>	Earthen wall=5-6m Stone wall=7.5m	6-7m				
<b>Length (m)</b>	150m	100m				
<b>Proposed Widening</b>	Concentric	Concentric				
<b>Impact</b>	Partially Impacted	Not Impacted				
<b>Chainage</b>	27.220			35.000		
<b>Structure ID No</b>	Pond with stone wall			Drain and Check Dam		
<b>Village Name</b>	Nakkalmuttam patti		Ayyaneri			
<b>Side (Left/Right)</b>	LHS		LHS			
<b>Distance from ECL (m)</b>	9-10m(upper catchment area 25m (lower/core area with stone wall		6-20m			
<b>Length (m)</b>	50		500m			
<b>Proposed Widening</b>	Concentric		Concentric			
<b>Impact</b>	No impact		No impact			





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<b>Chainage</b>	42.400		54.500	
<b>Structure ID No</b>	Pond		Pond with stone wall	
<b>Village Name</b>	Kovilpatti		Ettayapuram	
<b>Side (Left/Right)</b>	LHS		RHS	
<b>Distance from ECL (m)</b>	20m		8-10m	
<b>Length (m)</b>	200m		30	
<b>Proposed Widening</b>	Concentric		Eccentric on RHS	
<b>Impact</b>	No impact		No impact	
<b>Chainage</b>	55.270		55.300	
<b>Structure ID No</b>	Pond		Pond	
<b>Village Name</b>	Ettayapuram		Ettayapuram	
<b>Side (Left/Right)</b>	RHS		LHS	
<b>Distance from ECL (m)</b>	25m		6-7m	
<b>Length (m)</b>	200m		20-25m	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No impact		No impact (saved by curve improvement and realignment)	
<b>Chainage</b>	55.740			
<b>Structure ID No</b>	Pond			
<b>Village Name</b>	Ettayapuram			
<b>Side (Left/Right)</b>	RHS			
<b>Distance from ECL (m)</b>	8-10m			
<b>Length (m)</b>	8m			
<b>Proposed Widening</b>	Concentric			
<b>Impact</b>	No impact (saved by reduction in curve radius)			

A total of 7 ponds and 1 check dam fall within ROW of project road, out of which 2 will be partially impacted due to the proposed development.









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**Table 7-20 : Impact on Surface Water Bodies – Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89**

<b>Chainage</b>	0.350		1.100	
<b>Structure ID No</b>	Pond		Pond	
<b>Village Name</b>	Nanguneri		Nanguneri	
<b>Side (Left/Right)</b>	LHS		RHS	
<b>Distance from ECL (m)</b>	8.0m		40m	
<b>Length (m)</b>	150m		50m	
<b>Proposed Widening</b>	Eccentric on RHS		Concentric	
<b>Impact</b>	No impact		No impact	
<b>Chainage</b>	1.300		1.500	
<b>Structure ID No</b>	Check dam\Bund		Water Pond on Rocky Pit	
<b>Village Name</b>	Nanguneri		Nanguneri	
<b>Side (Left/Right)</b>	LHS		RHS	
<b>Distance from ECL (m)</b>	Bund Wall is 5-7m from centerline		15-20m	
<b>Length (m)</b>	150		200	
<b>Proposed Widening</b>	Eccentric on RHS		Concentric	
<b>Impact</b>	No impact		No impact	
<b>Chainage</b>	2.650		5.000	
<b>Structure ID No</b>	Small earthen Check dam\Bund		Check dam \Bund	
<b>Village Name</b>	IraippOvari		Iraipubari	
<b>Side (Left/Right)</b>	RHS		LHS	
<b>Distance from ECL (m)</b>	5-30m		200m	
<b>Length (m)</b>	300		200	
<b>Proposed Widening</b>	Eccentric on RHS		Concentric	
<b>Impact</b>	Partially Impacted		No impact	




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<b>Chainage</b>	8.400		9.3	
<b>Structure ID No</b>	Check dam \Bund		Check dam \Bund	
<b>Village Name</b>	Iraipubari		Alangulam	
<b>Side (Left/Right)</b>	RHS		Both sides	
<b>Distance from ECL (m)</b>	10-30m		Adjoining on both side	
<b>Length (m)</b>	40m		300	
<b>Proposed Widening</b>	Concentric		Eccentric on RHS	
<b>Impact</b>	No impact		No impact (Saved by considering PROW of 16m instead of 23m)	
<b>Chainage</b>	13.00		15.00	
<b>Structure ID No</b>	Coffer dam		Pond	
<b>Village Name</b>	Alangulam		Vijayanarayanam	
<b>Side (Left/Right)</b>	LHS		LHS	
<b>Distance from ECL (m)</b>	50-60m		8.2m	
<b>Length (m)</b>	500		40m	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No impact		No impact	
<b>Chainage</b>	16.580		21.750	
<b>Structure ID No</b>	Pond and Drain		Canal	
<b>Village Name</b>	Vijayanarayan am		Kumarapuram	
<b>Side (Left/Right)</b>	LHS		RHS and crossing	
<b>Distance from ECL (m)</b>	12m		10-12m and crossing at 22.800	
<b>Length (m)</b>	20		1.30 km along the road on RHS	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No impact		No impact (Saved by considering PROW of 16m instead of 23m)	






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<b>Chainage</b>	23.400	Photo not available	24.450	
<b>Structure ID No</b>	Pond		Check dam\Bund	
<b>Village Name</b>	Kumarapuram		Kumarapuram	
<b>Side (Left/Right)</b>	LHS		RHS	
<b>D Distance from ECL (m)</b>	8-9m		7-8m	
<b>Length (m)</b>	100m		60m	
<b>Proposed Widening</b>	Concentric		Eccentric on LHS	
<b>Impact</b>	Partially Impacted		No impact (Saved by realignment on LHS)	

There are 5 nos. of ponds and 5 nos. of check dams/bunds within ROW of the project road, out of which 1 no. of ponds and 1 no. of check dam are likely to be partially impacted due to the proposed development.

**Table 7-21: Impact on Surface Water Bodies along Rajapalayam-Sankarankoil-Tirunelveli section of SH41**

<b>Chainage</b>	3.00		4.980	Photo not available
<b>Structure ID No</b>	Earthen Check Dam		Pond	
<b>Village Name</b>			Madhukudy	
<b>Side (Left/Right)</b>	LHS		LHS	
<b>Distance from ECL (m)</b>	15-20m		7m (Earthen wall)	
<b>Length (m)</b>	400m		52m	
<b>Proposed Widening</b>	Eccentric on LHS		Eccentric on RHS	
<b>Impact</b>	No direct Impact		No direct Impact	
<b>Chainage</b>	7.00		8.050	
<b>Structure ID No</b>	Earthen Check Dam		Chozhapuram River and Check dam on RHS	
<b>Village Name</b>	Cholapuram		Cholapuram	
<b>Side (Left/Right)</b>	LHS		Both side & crossing	
<b>Distance from ECL (m)</b>	9-12m		RHS-along the Bridge LHS-along the Bridge approach	
<b>Length (m)</b>	20m		50m RHS 200m LHS	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No direct Impact		Siltation of river	









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<b>Chainage</b>	11.250		13.550	
<b>Structure ID No</b>	Pond		Check Dam	
<b>Village Name</b>	Perumalpatti		Solaiseri	
<b>Side (Left/Right)</b>	LHS		RHS	
<b>Distance from ECL (m)</b>	5-6m		5-9m	
<b>Length (m)</b>	30m		1000m	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	Directly Impacted Siltation and Encroachment of catchment area-		Directly Impacted Damage to Bund wall at few locations	
<b>Chainage</b>	17.00		17.250	
<b>Structure ID No</b>	Check Dam		Check Dam	
<b>Village Name</b>	Paruvakudi		Paruvakudi	
<b>Side (Left/Right)</b>	RHS		RHS	
<b>Distance from ECL (m)</b>	Along the road		8-20m	
<b>Length (m)</b>	200m		700m	
<b>Proposed Widening</b>	Realignment		Concentric	
<b>Impact</b>	No direct Impact du eto curve improvement		Directly Impacted Damage to Bund wall at few locations	
<b>Chainage</b>	20.600		23.100	
<b>Structure ID No</b>	Nala and Check Dam		Pond with stone stairs	
<b>Village Name</b>	Karivalamvanthallur		Alagunachiyarpuram	
<b>Side (Left/Right)</b>	LHS and Crossing		LHS	
<b>Distance from ECL (m)</b>	6-50m		20m	
<b>Length (m)</b>	10 and 20m		20m	
<b>Proposed Widening</b>	Concentric		Eccentric on RHS	
<b>Impact</b>	Siltation		No direct Impact	





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 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

<b>Chainage</b>	23.700		24.380	
<b>Structure ID No</b>	Pond		Pond	
<b>Village Name</b>	Alagunachiyarpuram		Ramalingapuram	
<b>Side (Left/Right)</b>	RHS		LHS	
<b>Distance from ECL (m)</b>	20m		8-9m	
<b>Length (m)</b>	30m		30m	
<b>Proposed Widening</b>	Concentric		Eccentric on LHS	
<b>Impact</b>	No direct Impact		Directly Impacted Damage to earthen wall	
<b>Chainage</b>	25.600		26.200	
<b>Structure ID No</b>	Pond		Check Dam	
<b>Village Name</b>	Ramalingapuram		Shrigomathipuram	
<b>Side (Left/Right)</b>	LHS		Both side	
<b>Distance from ECL (m)</b>	5-6m		Along the road	
<b>Length (m)</b>	20m		50m	
<b>Proposed Widening</b>	Eccentric on LHS		Concentric	
<b>Impact</b>	Directly Impacted Pond wall damage		Directly Impacted Encroachment of catchment area, bund wall damage	
<b>Chainage</b>	29.00		33.400	
<b>Structure ID No</b>	Check Dam		Pond with stone wall	
<b>Village Name</b>	Sankrakovil		Sankrakovil	
<b>Side (Left/Right)</b>	RHS		LHS	
<b>Distance from ECL (m)</b>	20-25		4-5m	
<b>Length (m)</b>	500m		20m	
<b>Proposed Widening</b>	Not in scope as bypass proposal is from km 28 to km 33.8		Not in scope as bypass proposal is from km 28 to km 33.8	
<b>Impact</b>	No Impact		No Impact	





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

<b>Chainage</b>	33.800		40.200	
<b>Structure ID No</b>	Check Dam		Check Dam	
<b>Village Name</b>	Sankrakovil		Gurukulpatti	
<b>Side (Left/Right)</b>	RHS		RHS	
<b>Distance from ECL (m)</b>	15-20m		30-50m	
<b>Length (m)</b>	1200m		400m	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	Impact on bund wall from km 34.520 to km 34.570		No Impact	
<b>Chainage</b>	42.400		44.00	
<b>Structure ID No</b>	Pond		Check Dam	
<b>Village Name</b>	Gurukulpatti		Melaneelithanallur	
<b>Side (Left/Right)</b>	RHS		LHS	
<b>Distance from ECL (m)</b>	6-7m		15-30m	
<b>Length (m)</b>	25m		40m	
<b>Proposed Widening</b>	Concentric		Eccentric on RHS	
<b>Impact</b>	Earthen wall impacted		No Impact	
<b>Chainage</b>	53.400		53.570	
<b>Structure ID No</b>	Pond/Check Dam		Check Dam	
<b>Village Name</b>	Vennikonendhal		Vennikonendhal	
<b>Side (Left/Right)</b>	RHS		LHS	
<b>Distance from ECL (m)</b>	5-10m		5-25m	
<b>Length (m)</b>	100m		350m	
<b>Proposed Widening</b>	Concentric		Eccentric on RHS	
<b>Impact</b>	Directly Impacted Encroachment of catchment area Siltation		Directly Impacted Damage to bund wall (15m)	



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

<b>Chainage</b>	60.400		61.700	
<b>Structure ID No</b>	Pond		Check Dam with channels	
<b>Village Name</b>	Suppiahpuram		Suppiahpuram	
<b>Side (Left/Right)</b>	LHS		RHS	
<b>Distance from ECL (m)</b>	25-30m		5-100m	
<b>Length (m)</b>	40m		500m	
<b>Proposed Widening</b>	Eccentric on RHS		Eccentric on RHS	
<b>Impact</b>	No Impact		Directly Impacted Damage to bund wall (5m)	
<b>Chainage</b>	62.400		64.400	
<b>Structure ID No</b>	Check Dam with steel channels/doors		Pond in rock trench	
<b>Village Name</b>	Suppiahpuram		Alakiyapandiapuram	
<b>Side (Left/Right)</b>	RHS and cross to LHS		LHS	
<b>Distance from ECL (m)</b>	40-60m		15-20m	
<b>Length (m)</b>	150		40	
<b>Proposed Widening</b>	Realignment		Concentric	
<b>Impact</b>	No Impact		No Impact	
<b>Chainage</b>	69.000		69.600	
<b>Structure ID No</b>	Pond in rock trench		Check Dam	
<b>Village Name</b>	Kanarpatti		Kanarpatti	
<b>Side (Left/Right)</b>	RHS		RHS	
<b>Distance from ECL</b>	25-30m		6-8m	
<b>Length (m)</b>	20m		300m	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No Impact		Directly Impacted Damage to bund wall (5m)	



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41


<b>Chainage</b>	79.600		83.400	
<b>Structure ID No</b>	Check Dam		Lake	
<b>Village Name</b>	Sedurayanpudur		Ramainpatti	
<b>Side (Left/Right)</b>	RHS		RHS	
<b>Distance from ECL (m)</b>	15-20m		8-12m	
<b>Length (m)</b>	40m		100m	
<b>Proposed Widening</b>	Concentric		Not in scope , road ending at Km 82.8	
<b>Impact</b>	No Impact		No Impact	

A total of 17 check dams and 10 ponds fall within ROW of project road, out of which 4 ponds (pond wall impacted) and 8 check dams (bund wall impacted) are partially impacted due to the proposed development.

### Ground water resources

Table 7-22, Table 7-23 and Table 7-25 presents the details of existing ground water resources and possible impacts along project roads.

### Table 7-22 : Impacts on Ground Water Bodies- Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44

<b>Chainage</b>	27+580		28.25	
<b>Structure ID No</b>	Hand pump		Hand Pump	
<b>Village Name</b>	Parapatti		Parapatti	
<b>Side (Left/Right)</b>	Right		Right	
<b>Distance from ECL (m)</b>	11.0		9.1	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No direct Impact		Impacted	
<b>Chainage</b>	31.03			
<b>Structure ID No</b>	Hand pump	Hand pump		
<b>Village Name</b>	Ilaiyarsanen dal	Kovilpatti		
<b>Side (Left/Right)</b>	LHS	LHS		
<b>Distance from ECL (m)</b>	8.2	4.5		
<b>Proposed Widening</b>	Concentric	Not in scope		
<b>Impact</b>	No direct Impact	No Impact		



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

<b>Chainage</b>	41.60		42.12	
<b>Structure ID No</b>	Hand pump		Hand pump	
<b>Village Name</b>	Kovilpatti		Kovilpatti	
<b>Side (Left/Right)</b>	LHS		RHS	
<b>Distance from ECL (m)</b>	7		7.5	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	Impacted		Impacted	
<b>Chainage</b>	44.65		91.8 of SH32	
<b>Structure ID No</b>	Hand pump		Hand pump	
<b>Village Name</b>	Kovilpatti		Ettayapuram	
<b>Side (Left/Right)</b>	RHS		RHS	
<b>Distance from ECL (m)</b>	10		7.5	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No direct Impact		Impacted	
<b>Chainage</b>	55.50		55.90	
<b>Structure ID No</b>	Hand pump		Hand pump	
<b>Village Name</b>	Ettayapuram		Ettayapuram	
<b>Side (Left/Right)</b>	RHS		RHS	
<b>Distance from ECL (m)</b>			10	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No direct Impact		No direct Impact	
<b>Chainage</b>	24.85		25.15	
<b>Structure ID No</b>	Open Well		Open Well (with boundary)	
<b>Village Name</b>	Naduvapatti		Naduvapatti	
<b>Side (Left/Right)</b>	RHS		LHS	
<b>Distance from ECL (m)</b>	9.5		5	
<b>Proposed Widening</b>	Eccentric on LHS		Concentric	
<b>Impact</b>	No direct Impact		Impacted	










**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

<b>Chainage</b>	26.10		26.70	
<b>Structure ID No</b>	Open Well		Open Well	
<b>Village Name</b>	Naduvapatti		Naduvapatti	
<b>Side (Left/Right)</b>	LHS		RHS	
<b>Distance from ECL (m)</b>	10.20		10	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No direct Impact		No direct Impact	
<b>Chainage</b>	27.58		27.80	
<b>Structure ID No</b>	Open Well		Open Well	
<b>Village Name</b>	Parapatti		Parapatti	
<b>Side (Left/Right)</b>	LHS		RHS	
<b>Distance from ECL (m)</b>	6		13	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	Impacted		No direct Impact	
<b>Chainage</b>	29.00		29.50	
<b>Structure ID No</b>	Open Well		Open Well	
<b>Village Name</b>	Parapatti		Parapatti	
<b>Side (Left/Right)</b>	RHS		LHS	
<b>Distance from ECL (m)</b>	13.1		10	
<b>Proposed Widening</b>	Concentric		Eccentric on LHS	
<b>Impact</b>	No direct Impact		No direct Impact	
<b>Chainage</b>	34.80		40.18	
<b>Structure ID No</b>	Open Well		Open Well	
<b>Village Name</b>	Venkadasalapuram		Kovilpatti	
<b>Side (Left/Right)</b>	LHS		RHS	
<b>Distance from ECL (m)</b>	11.7		7.8	
<b>Proposed Widening</b>	Concentric		Not in Scope (Kovilpatti city)	
<b>Impact</b>	No direct Impact		No direct Impact	










**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

<b>Chainage</b>	44.50		51.84	
<b>Structure ID No</b>	Open Well		Open Well	
<b>Village Name</b>	Kovilpatti		Kumaragiri	
<b>Side (Left/Right)</b>	RHS		RHS	
<b>Distance from ECL</b>	13		9.5	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No direct Impact		No direct Impact	
<b>Chainage</b>	54.50			
<b>Structure ID No</b>	Open Well Tank			
<b>Village Name</b>	Ilambuvanam			
<b>Side (Left/Right)</b>	LHS			
<b>Distance from ECL (m)</b>	8.3			
<b>Proposed Widening</b>	Concentric			
<b>Impact</b>	No direct Impact			
<b>Chainage</b>	26.30		37.40	
<b>Structure ID No</b>	Tubewell with Shelter		Tubewell	
<b>Village Name</b>	Naduvapatti		Puthuapaneri	
<b>Side (Left/Right)</b>	LHS		RHS	
<b>Distance from ECL (m)</b>	8.6		13	
<b>Proposed Widening</b>	Realignment		Concentric	
<b>Impact</b>	No direct Impact		No direct Impact	
<b>Chainage</b>	24.85		25.17	
<b>Structure ID No</b>	TWT +Tubewell		TWT +Tubewell	
<b>Village Name</b>	Naduvapatti		Naduvapatti	
<b>Side (Left/Right)</b>	RHS		LHS	
<b>Distance from ECL (m)</b>	27.5		12.13	
<b>Proposed Widening</b>	Eccentric on LHS		Concentric	
<b>Impact</b>	No direct Impact		Impacted	





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

<b>Chainage</b>	28.25		31.03	
<b>Structure ID No</b>	TWT +Tubewell		TWT +Tubewell	
<b>Village Name</b>	Parapatti		Ilaiyarsanendal	
<b>Side (Left/Right)</b>	RHS		RHS	
<b>Distance from ECL (m)</b>	8.2		13.5	
<b>Proposed Widening</b>	Eccentric on LHS		Eccentric on LHS	
<b>Impact</b>	No direct Impact		No direct Impact	
<b>Chainage</b>	36.55		31.02	
<b>Structure ID No</b>	TWT +Tubewell		TWT	
<b>Village Name</b>	Puthuapaneri		Ilaiyarsanendal	
<b>Side (Left/Right)</b>	LHS		RHS	
<b>Distance from ECL (m)</b>	8.5		12.5	
<b>Proposed Widening</b>	Eccentric on LHS		Concentric	
<b>Impact</b>	No direct Impact		No direct Impact	
<b>Chainage</b>	49.80			
<b>Structure ID No</b>	TWT			
<b>Village Name</b>	kovilpatti			
<b>Side (Left/Right)</b>	RHS			
<b>Distance from ECL (m)</b>	4			
<b>Proposed Widening</b>	Concentric			
<b>Impact</b>	No direct Impact			

Out of the 20 nos. existing ground water sources 8 nos. are under direct impact, needs to be relocated before the start of project road.

**Table 7-23 : Impacts on Ground Water Bodies- Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89**

<b>Chainage</b>	2.710		5.550	
<b>Structure ID No</b>	Hand Pump		Hand Pump	
<b>Village Name</b>	EraippOvari		Eamankulam	
<b>Side (Left/Right)</b>	LHS		LHS	
<b>Distance from</b>	13m		15m	



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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

<b>ECL (m)</b>				
<b>Proposed Widening</b>	Eccentric on RHS		Concentric	
<b>Impact</b>	No direct impact		No direct impact	
<b>Chainage</b>	5.790		6.010	
<b>Structure ID No</b>	Hand Pump		Hand Pump	
<b>Village Name</b>	Eamankulam		Eamankulam	
<b>Side (Left/Right)</b>	LHS		LHS	
<b>Distance from ECL (m)</b>	8m		11m	
<b>Proposed Widening</b>	Eccentric on LHS		Concentric	
<b>Impact</b>	Impacted		No direct impact	
<b>Chainage</b>	9.580			
<b>Structure ID No</b>	Hand Pump	Hand Pump		
<b>Village Name</b>	Subramaniya puram	Mannarpuram		
<b>Side (Left/Right)</b>	LHS	RHS		
<b>Distance from ECL (m)</b>	12m	14m		
<b>Proposed Widening</b>	Concentric	Concentric		
<b>Impact</b>	No direct impact	No direct impact		
<b>Chainage</b>	33.600	Photo not available		0.060
<b>Structure ID No</b>	Hand Pump		Open Well and Water Tank	
<b>Village Name</b>	Idaiyangudi		Naguneri	
<b>Side (Left/Right)</b>	LHS		LHS	
<b>Distance from ECL</b>	8m		12m	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	Impacted		No direct impact	
<b>Chainage</b>	2.700			8.210
<b>Structure ID No</b>	Open Well	Open Well and Over Water Tank		
<b>Village Name</b>	EraippOvari	Subramaniyapur		



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

<b>Side (Left/Right)</b>	LHS		am
<b>Distance from ECL (m)</b>	12m		LHS
<b>Proposed Widening</b>	Eccentric on RHS		14-15m
<b>Impact</b>	No direct impact		Concentric
<b>Chainage</b>	9.580		15.400
<b>Structure ID No</b>	Open Well		Open well
<b>Village Name</b>	Subramaniya puram		South Vijaynarayanam
<b>Side (Left/Right)</b>	LHS		LHS
<b>D Distance from ECL (m)</b>	12-15m		7m
<b>Proposed Widening</b>	Concentric		Concentric
<b>Impact</b>	No direct impact		Impacted
<b>Chainage</b>	16.440		17.780
<b>Structure ID No</b>	Open Well		Open Well
<b>Village Name</b>	South Vijaynarayana m		South Vijaynarayanam
<b>Side (Left/Right)</b>	RHS		LHS
<b>Distance from ECL (m)</b>	9-10m		10-11m
<b>Proposed Widening</b>	Concentric		Concentric
<b>Impact</b>	No direct impact		No direct impact
<b>Chainage</b>	25.010		25.750
<b>Structure ID No</b>	Open Well		Open Well
<b>Village Name</b>	Kumaraapuram		Kumaraapuram
<b>Side (Left/Right)</b>	LHS		LHS
<b>Distance from ECL (m)</b>	11m		11.5m
<b>Proposed Widening</b>	Concentric		Concentric
<b>Impact</b>	No direct impact		No direct impact



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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

<b>Chainage</b>	31.400	Photo not available	0.035	
<b>Structure ID No</b>	Open Well		Tube Well	
<b>Village Name</b>	Idaiyangudi		Nanguneri	
<b>Side (Left/Right)</b>	LHS		RHS	
<b>Distance from ECL (m)</b>	7.5m		9.5	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No Impact		No direct impact	
<b>Chainage</b>	2.200		2.760	
<b>Structure ID No</b>	Tube well with Tap Water Tank		Tube well with Tap Water Tank	
<b>Village Name</b>	Thattankualem		Eraipparuvaram	
<b>Side (Left/Right)</b>	LHS		LHS	
<b>Distance from ECL (m)</b>	5m		7m	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	Impacted		Impacted	
<b>Chainage</b>	3.680		5.550	
<b>Structure ID No</b>	Tube well with Tap Water Tank		Tube well with Tap Water Tank	
<b>Village Name</b>	Perumal Nagar		Eamankulam	
<b>Side (Left/Right)</b>	LHS		LHS	
<b>Distance from ECL (m)</b>	7-8m		9-10m	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	Impacted		No direct impact	
<b>Chainage</b>	5.780		8.390	
<b>Structure ID No</b>	Tube well with Tap Water Tank		Tube well with Tap Water Tank	
<b>Village Name</b>	Eamankulam		Subramaniapuram	
<b>Side (Left/Right)</b>	LHS		RHS	





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

<b>Distance from ECL (m)</b>	5.5m		7-8m	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	Impacted		Impacted	
<b>Chainage</b>	8.600		10.580	
<b>Structure ID No</b>	Tube well with Tap Water Tank		Tube well with Tap Water Tank	
<b>Village Name</b>	Subramaniya puram		Elangulan	
<b>Side (Left/Right)</b>	LHS		RHS	
<b>Distance from ECL (m)</b>	9-10m		15m	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No direct impact		No direct impact	
<b>Chainage</b>	11.400		12.190	
<b>Structure ID No</b>	Tube well with Tap Water Tank		Tube well with Tap Water Tank	
<b>Village Name</b>	Elangulan		Kamaraj Nagar	
<b>Side (Left/Right)</b>	LHS		LHS	
<b>Distance from ECL (m)</b>	10-11m		7-8m	
<b>Proposed Widening</b>	Concentric		Eccentric on LHS	
<b>Impact</b>	No direct impact		Impacted	
<b>Chainage</b>	12.400		16.300	
<b>Structure ID No</b>	Tube well with Tap Water Tank		Tube well with Tap Water Tank	
<b>Village Name</b>	Vijaynarayana m		South Vijaynarayanam	
<b>Side (Left/Right)</b>	RHS		RHS	
<b>Distance from ECL (m)</b>	10-12m		8-10m	
<b>Proposed Widening</b>	Concentric		Concentric	



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

<b>Impact</b>	No direct impact		Impacted	
<b>Chainage</b>	2.700		5.300	Photo not available
<b>Structure ID No</b>	Over Head Water Supply Tank		Tap Water Tank	
<b>Village Name</b>	EraippOvari		Eamankulam	
<b>Side (Left/Right)</b>	LHS		LHS	
<b>Distance from ECL (m)</b>	13m		8m	
<b>Proposed Widening</b>	Eccentric on RHS		Concentric	
<b>Impact</b>	No direct impact		Impacted	
<b>Chainage</b>	10.800		13.100	
<b>Structure ID No</b>	Tap Water Tank		Tap Water Tank	
<b>Village Name</b>	Elangulan		Vijaynarayanam	
<b>Side (Left/Right)</b>	RHS		RHS	
<b>Distance from ECL (m)</b>	7m		9-10m	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	Impacted		No direct impact	
<b>Chainage</b>	14.650		15.450	
<b>Structure ID No</b>	Open Water Tank		Tap Water Tank	
<b>Village Name</b>	South Vijaynarayanam		South Vijaynarayanam	
<b>Side (Left/Right)</b>	RHS		LHS	
<b>Distance from ECL (m)</b>	5m		6.5m	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	Impacted		Impacted	





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

<b>Chainage</b>	16.300		24.800	
<b>Structure ID No</b>	Over Head Water Supply Tank		Over Head Water Supply Tank	
<b>Village Name</b>	South Vijaynarayana m		Kumaraapuram	
<b>Side (Left/Right)</b>	LHS		RHS	
<b>Distance from ECL (m)</b>	10m		12.15	
<b>Proposed Widening</b>	Concentric		Eccentric on RHS	
<b>Impact</b>	No direct impact		No direct impact	
<b>Chainage</b>	25.300			
<b>Structure ID No</b>	Over Head Water Supply Tank	Over Head Water Supply Tank		
<b>Village Name</b>	Kumaraapuram	Bala Sithivanagar		
<b>Side (Left/Right)</b>	LHS	LHS		
<b>Distance from ECL (m)</b>	12m	7m		
<b>Proposed Widening</b>	Eccentric on LHS	Not in Scope (Thisayanvilai )		
<b>Impact</b>	No direct impact	No direct impact		
<b>Chainage</b>	29.500	Photo not available	29.600	Photo not available
<b>Structure ID No</b>	Water Supply Tank (PHED)		Over Head Water Supply Tank	
<b>Village Name</b>	Appuvilai		Appuvilai	
<b>Side (Left/Right)</b>	RHS		LHS	
<b>Distance from ECL (m)</b>	5.5m		11m	
<b>Proposed Widening</b>	Not in Scope (Thisayanvilai )		Not in Scope (Thisayanvilai )	
<b>Impact</b>	No direct impact		No direct impact	



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

<b>Chainage</b>	33.600	Photo not available		
<b>Structure ID No</b>	Over Head Water Supply Tank			
<b>Village Name</b>	Idaiyangudi			
<b>Side (Left/Right)</b>	LHS			
<b>Distance from ECL (m)</b>	11m			
<b>Proposed Widening</b>	Eccentric on LHS			
<b>Impact</b>	No direct impact			

Out of the 34nos. existing ground water sources 18nos. are under direct impact, needs to be relocated before the start of project road.

**Table 7-24 Impacts on Ground Water Bodies along Rajapalayam-Sankarankoil-Tirunelveli section of SH41**

S.No	Chainage	Description	Category	Locaton
1.	5+410	Hand Pump	Hand Pump	RHS
2.	17+390	Hand Pump	Hand Pump	LHS
3.	18+060	Hand Pump	Hand Pump	RHS
4.	18+080	Hand Pump	Hand Pump	RHS
5.	18+100	Hand Pump	Hand Pump	RHS
6.	21+570	Hand Pump	Hand Pump	RHS
7.	74+680	Hand Pump	Hand Pump	RHS
8.	73+880	Hand Pump	Hand Pump	LHS
9.	14+380	Borewell Point	Borewell Point	LHS
10.	18+050	Open Bore Well	Bore well	RHS
11.	15+860	Open Well	Open Well	LHS
12.	25+660	OHT TWAD	OHT	LHS
13.	70+720	Water Tank(PWD)	Water Tank	RHS
14.	74+760	Water Tank(PWD)	Water Tank	RHS
15.	74+840	(PWD)Open Bore Well and Hand Pump	Open Well	RHS
16.	78+600	water tank(pwd)	Water Tank	RHS
17.	74+580	open well	Open Well	LHS
18.	16+290	TWAD	Water Tap	LHS
19.	16+980	TWAD	Water Tap	LHS
20.	17+030	TWAD	Water Tap	LHS
21.	17+040	TWAD	Water Tap	LHS



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S.No	Chainage	Description	Category	Locaton
22.	17+290	TWAD	Water Tap	LHS
23.	18+000	TWAD	Water Tap	LHS
24.	18+060	TWAD	Water Tap	LHS
25.	18+400	TWAD	Water Tap	LHS
26.	23+890	TWAD	Water Tap	LHS
27.	23+890	TWAD	Water Tap	LHS
28.	24+600	TWAD	Water Tap	LHS
29.	25+560	TWAD	Water Tap	LHS
30.	25+920	TWAD	Water Tap	LHS
31.	26+050	TWAD	Water Tap	LHS
32.	26+220	TWAD	Water Tap	LHS
33.	71+680	TWAD	Water Tap	LHS
34.	72+280	TWAD	Water Tap	LHS
35.	72+780	TWAD	Water Tap	LHS
36.	72+980	TWAD	Water Tap	LHS
37.	72+980	TWAD	Water Tap	LHS
38.	73+550	TWAD	Water Tap	LHS
39.	74+320	TWAD	Water Tap	LHS
40.	79+890	TWAD	Water Tap	LHS
41.	82+780	TWAD	Water Tap	LHS

Source: SIA Volume VII B

Out of the 41nos. impacted ground water sources, 8 nos. are hand pumps, 23 nos. are water taps, 3 nos. are open wells, 2 nos. are borewells, 1 no. OHT and 4 nos. water tanks will be impacted. These CPRs need to be relocated before the start of project road.

### 7.6.2 Alteration of Cross Drainage

During the construction period some amount of drainage alteration is anticipated, due to construction of temporary traffic diversions. Table 7-25 elaborates the need of diversion for the reconstruction and new proposed bridges.



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**Table 7-25 : Bridges reconstruction along project roads**

S. No	Existing Chainage	Existing Arrangement of span (No. x Span)	Proposed Arrangement of span (No. x Span)	Recommendation	Diversion
<b>Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44</b>					
1	23/982	8x1.6	3x6.0	Reconstruction	Diversion
2	35/200	10x0.9	1x36.0	Reconstruction due Vented Causeway (New minor bridge)	Diversion
3	48/313	6x 2.5	2x6.0	Reconstruction	Diversion
4	48/886	3 x 2.5	2x4.0	Reconstruction	Diversion
5	52/200	3x6.5	3x6.0	Reconstruction	Diversion
6	54/200	2x3.3	2x6.0	Reconstruction	Diversion
<b>Nanguneri – Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89</b>					
1	4/500	-	3x6.0	New Minor Bridge (Existing Causeway)	Diversion
2	11/121	4x1.6	3x6.0	New Minor Bridge (Existing Vented Causeway)	Diversion
3	13/610	-	2x6.0	New Minor Bridge (Existing Causeway)	Diversion
4	26/300		1x 36.0	New Minor Bridge (Existing Causeway)	Diversion
<b>Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41</b>					
1	3/750	3X2.7	2 x 6	Reconstruction	Diversion
2	6/580	5X2.3	2 x 6	Reconstruction	Diversion
3	19/800	5X10.5	2 x 28 c/c Brg.	Reconstruction	Diversion
4	20/493	3X3.3	2 x 6	Reconstruction	Diversion
5	23/165	4X5.0	3 x 6	Reconstruction	Diversion
6	25/980	5X2.9	2 x 6	Reconstruction	Diversion
7	41/358	4X3.2	3 x 6	Reconstruction	Diversion
8	58/416	5X1.70	2 x 6	Reconstruction	Diversion
9	82/253	3X3.5	2 x 6	Reconstruction	Diversion

Source: Detailed Project Report

With these widening and improvement of minor bridges and bridging of existing causeways, there will be an improvement in the drainage characteristics of the surrounding area. And the alteration will be temporary in nature. All the diversions will be provided with adequate water way for drainage.



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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

### 7.6.3 Run-off and Drainage

Sediment accumulation in water bodies decreases the storage capacity for road run-off. To worsen the situation road construction activities can lead to increased run-off both, during the construction and operational stage. This can be considered a high adverse impact.

Sr. No.	Phase of Construction	Reason
1	Construction phase	The removal of vegetation and compaction of soil can lead to increased run-off during the monsoon
2	Operational phase	The area of open ground lost and added impervious black top surface increases the amount and rate of run-off.

The project involves widening of existing roads within the ROW, with addition of 2x1.5 paved shoulders to the existing pavement of 7m; provision of 2x1m earthen (98 per cent compacted) shoulders; raising the pavement and as a result widening the embankment. Overall the increase in the impervious surface would be 3m. During the operation phase increased run-off can be calculated using the formula:

*Increase in runoff per year (m<sup>3</sup>) = increase in runoff coefficient due to construction \* annual rainfall in the area (m) \* area of the constructed surface (m<sup>2</sup>)*

*The appropriate run-off coefficients are: 0.95 for asphalt, 0.2 for silty and sandy soil, 0.3 for loamy soil, and 0.55 for Black cotton soil.*

#### **Hence, for Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44**

Annual average rainfall is equals to 758.9mm say 0.758m (IMD data) (five years average is taken from baseline)

The increase in construction surface (BT) equals to 96,000 sqm

Increase in runoff (cum) = (0.95-0.2) X 0.758 X 96 X 10<sup>3</sup> = 54.57 x 10<sup>3</sup> cum

Hence additional 0.55 lakh KL of additional storm water will be required to drain off.

#### **For Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89:**

Annual average rainfall is equals to 948.68mm say 0.949m (IMD data) (five years average is taken from baseline)

The increase in construction surface (BT) equals to 1,05,600 sqm

Increase in runoff (cum) = (0.95-0.2) X 0.949 X 105.6 X 10<sup>3</sup> = 75.16 x 10<sup>3</sup> cum

Hence additional 0.75 lakh KL of additional storm water will be required to drain off.

#### **For Rajapalayam-Sankarankoil-Tirunelveli section of SH41:**

Annual average rainfall is equals to 758.9mm say 0.758m (IMD data) (five years average is taken from baseline)



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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

The increase in construction surface (BT) equals to 225,000 sqm

Increase in runoff (cum) =  $(0.95-0.2) \times 0.758 \times 225 \times 10^3 = 127.9 \times 10^3$  cum

Hence additional 1.28 lakh KL of additional storm water will be required to drain off.

Since soil erosion is associated with concentrated flow of water it is imperative to prevent any increased diversion of run-off into drainage channels.

#### 7.6.4 Water requirement for project

The water requirement for construction depends on the climatic conditions, type of equipment, type of material available, mix design, type of construction plant and number of people working on the project. With the following assumptions the approximate water quantity required for the Project has been calculated.

- 1 8-10% of weight of soil for the embankment construction
- 2 7-8% of weight of soil for sub grade construction
- 3 5-6% of weight of GSB materials for GSB and WMM
- 4 150 liters/ cum for concrete

The water requirement has been assumed based on past project experiences and on the strict quality control basis. Domestic requirement of 150 liters per worker has been assumed. For this project about 60 nos., 50 nos. and 125 nos. resident workers have been considered for SH89, SH44 and SH41 project road sections respectively. Details of the water requirement assessed for the project roads are presented in Table 7.26.

**Table 7-26: Requirement of Water for Proposed Construction Works**

S. No.	Purpose	Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44 (Cum/day)	Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 (Cum/day)	Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 (Cum/day)
1	Permanent works (Total quantity in cum)	90 kl/day	100 kl/day	185 kl/day
2	Dust Suppression at work zone in (cum/day)	15	18	30
3	Curing (cum/day)	8	10	10
4	Laboratory (cum/day)	5	5	7
5	Haul Roads (cum/day)	15	15	18
6	Crusher (cum/day)	10	10	12
7	Plant Cleaning and workshop	8	8	10





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

S. No.	Purpose	Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44 (Cum/day)	Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 (Cum/day)	Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 (Cum/day)
	washing in (cum/day)			
8	Domestic Purpose in (cum/day)	8	9	18
<b>Total Requirement(cum/day)</b>		<b>159</b>	<b>175</b>	<b>290</b>

### 7.6.5 Water Quality

#### Increased Sedimentation

Degradation of water quality due to sediment transport may occur from activities like removal of trees, removal of grass cover, excavation, stock piling of materials as part of the pre construction and construction activities. The soil type present along the project corridor consists of the sandy soil.

The impacts due to increased sediment laden run-off will make the water more turbid. This is a significant negative impact on the water bodies supporting aquatic life. Heavier sediment may smother the algae growing in the lower strata and could completely alter the nature of the watercourse. Excessive sediment loads may also mean disruption to areas of fish breeding.

#### Contamination of Water

**Construction Stage:** The degradation of the surface and to a much less extent ground water quality can occur from pavement construction works, bridge construction works, construction plants, machinery and accommodations of workers. The sources of water pollution from the construction activities are as follows;

- Water flow from scarified bitumen materials
- From the foundation works of the bridges and culverts such as piling and excavation for open/ well foundations
- Oil spills from the Maintenance of the machinery and operation of the diesel generator sets on site.
- Oil Spill from the operation of the diesel pumps and diesel storage, transportation and transfer, parking places, and diesel generators.
- Operation of the emulsion sprayer and laying of hot mix.
- Operation of the residential facilities for the labour and officers and offices
- Storage and stock yards of bitumen and emulsion



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

**Operation Stage:** During the operation stage, water may get contaminated with similar reasons, as mentioned above, during routine and periodical maintenance of the project road. ***The implications of accidental discharge are potentially disastrous. But, it must be emphasized that the probability of such an accident is quite low, as one of the objectives of the design is the enhancement of road safety.***

## 7.7 NOISE ENVIRONMENT - IMPACT

Environmental noise particularly highway traffic noise, is a complex phenomenon because its intensity and characteristics vary with time depending upon the frequency as well as type of vehicles on the road.

The impacts of noise due to the project will be of temporary significance locally in the construction phase. Table below present the source of noise pollution and the impact categorization.

**Table 7-27 Source of noise pollution**

Sl. No.	Phase	Source of Noise pollution	Impact categorization
1	Pre construction	<ul style="list-style-type: none"> <li>Man, material &amp; machinery movements</li> <li>establishment of labor camps onsite offices, stock yards and construction plants</li> </ul>	✓ all activities will last for a short duration and also shall be localized in nature
2	Construction Phase	<ul style="list-style-type: none"> <li>Plant Site</li> <li>stone crushing, asphalt production plant and batching plants, diesel generators etc</li> <li>Work zones</li> <li>Community residing near to the work zones</li> </ul>	✓ Plant Site: Impact will be significant within 500m. ✓ Work zones: Such impacts again will be of temporary nature as the construction site will go on changing with the progress of the works.
3	Operation Phase	<ul style="list-style-type: none"> <li>due to increase in traffic (due to improved facility)</li> </ul>	✓ will be compensated with the uninterrupted movement of heavy and light vehicles till the facility reaches the level of service C.

List of the sensitive receptors located along the project road are presented in **Table 7.28.**

**Table 7-28 :Sensitive Receptors with respect to Noise Pollution along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44**



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<b>Chainage</b>	24.460		24.840	
<b>Structure ID No</b>	Panchayat and Library		Indu Elementary School	
<b>Village Name</b>	Mukkuttumalai		Mukkuttumalai	
<b>Side (Left/Right)</b>	RHS		LHS	
<b>Distance from ECL(m)</b>	40-45m		12-15m	
<b>Length (m)x Breadth (m)</b>	40x15		20x10	
<b>Proposed Widening</b>	Concentric		Eccentric on LHS	
<b>Impact</b>	No direct Impact		No direct Impact	
<b>Chainage</b>	27.520		27.530	
<b>Structure ID No</b>	Old R.C. Elementary School		Self Hef Group (Woman)	
<b>Village Name</b>	Nakkalmuttampatti		Nakkalmuttampatti	
<b>Side (Left/Right)</b>	RHS		RHS	
<b>Distance from ECL(m)</b>	3.5-4m		7m	
<b>Length (m)x Breadth (m)</b>	10x5		5x7	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No Impact		No direct Impact	
<b>Chainage</b>	27.650		30.800	
<b>Structure ID No</b>	R.C. Christian Church and School		Govt. Higher Sec. School	
<b>Village Name</b>	Nakkalmuttampatti		Ilaiyarsanendal	
<b>Side (Left/Right)</b>	RHS		LHS	
<b>Distance from ECL(m)</b>	9m		11m	
<b>Length (m)x Breadth (m)</b>	50x20		150x45	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No direct Impact		No direct Impact	



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

<b>Chainage</b>	36.000		41.600	
<b>Structure ID No</b>	G. Venkataswamy Nadu College		Govt. Ladies Hostel	
<b>Village Name</b>	Kovil Patti		Kovil Patti	
<b>Side (Left/Right)</b>	LHS		LHS	
<b>Distance from ECL(m)</b>	50-60m		15m	
<b>Length (m)x Breadth (m)</b>	200x200		20x25	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No direct Impact		No direct Impact	
<b>Chainage</b>	41.800		42.100	
<b>Structure ID No</b>	Govt. Library		V.O.C. Govt. Higher Sec. School	
<b>Village Name</b>	Kovil Patti		Kovil Patti	
<b>Side (Left/Right)</b>	LHS		RHS	
<b>Distance from ECL(m)</b>	40m		10m	
<b>Length (m)x Breadth (m)</b>	30x25		150x100	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No direct Impact		No direct Impact	
<b>Chainage</b>	42.200		43.500	
<b>Structure ID No</b>	Kammavar Ladies Higer Sec. School		Thiruvalluvar ITI college	
<b>Village Name</b>	Kovil Patti		Kovil Patti	
<b>Side (Left/Right)</b>	LHS		LHS	
<b>Distance from ECL(m)</b>	12m		40m	
<b>Length (m)x Breadth (m)</b>	30x80		20x70	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No direct Impact		No direct Impact	






**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

<b>Chainage</b>	44.600		50.900	
<b>Structure ID No</b>	Govt. Primary School		C.K.T. Matriculation Higer Sec. School	
<b>Village Name</b>	Tittangulam		Kumaragiri	
<b>Side (Left/Right)</b>	LHS		RHS	
<b>Distance from ECL(m)</b>	40mx20m		15	
<b>Length (m)x Breadth (m)</b>	50x20		150x100	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No direct Impact		No direct Impact	
<b>Chainage</b>	52.400		52.450	
<b>Structure ID No</b>	Govt. Primary School		Self Helf Group (Woman)	
<b>Village Name</b>	Ilambuvanam		Ilambuvanam	
<b>Side (Left/Right)</b>	RHS		RHS	
<b>Distance from ECL(m)</b>	9m		10m	
<b>Length (m)x Breadth (m)</b>	40x40		40x20	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No direct Impact		No direct Impact	
<b>Chainage</b>	53.300		53.300	
<b>Structure ID No</b>	Bharathiar Ladies Polytechnique college		Bharathiar Ladies Polytechnique college Hostel	
<b>Village Name</b>	Ettayapuram		Ettayapuram	
<b>Side (Left/Right)</b>	LHS		RHS	
<b>Distance from ECL(m)</b>	15-20m		40-50m	
<b>Length (m)x Breadth (m)</b>	600x200		100x30	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No direct Impact		No direct Impact	







**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

<b>Chainage</b>	54.500		31.600	
<b>Structure ID No</b>	Mariappa Elementary School		Govt. Hospital and Health Center	
<b>Village Name</b>	Ettayapuram		Ilaiyarsanendal	
<b>Side (Left/Right)</b>	LHS		LHS	
<b>Distance from ECL(m)</b>	8m		20m	
<b>Length (m)x Breadth (m)</b>	40x30		50x20	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No direct Impact		No direct Impact	
<b>Chainage</b>	40.025		41.800	
<b>Structure ID No</b>	Gowori Hospital		Vetanary Hospital	
<b>Village Name</b>	Kovil Patti		Kovil Patti	
<b>Side (Left/Right)</b>	LHS		RHS	
<b>Distance from ECL(m)</b>	9m		40m	
<b>Length (m)x Breadth (m)</b>	10x20m		40x70	
<b>Proposed Widening</b>	Not In Scope (Kovilpatti city)		Concentric	
<b>Impact</b>	No direct Impact		No direct Impact	







**Table 7-29 Sensitive Receptors with respect to Noise Pollution along Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89**

<b>Chainage</b>	0.200		0.450	
<b>Structure ID No</b>	Old Age Home, Arsan Rural Development Society		Little Flower Community College	
<b>Village Name</b>	Nanguneri		Nanguneri	
<b>Side (Left/Right)</b>	RHS		RHS	
<b>Distance from ECL(m)</b>	12m		14m	
<b>Length (m)x Breadth (m)</b>	L- 60m		L-150m	
<b>Proposed Widening</b>	Eccentric on RHS		Eccentric on RHS	
<b>Impact</b>	No direct impact		No direct impact	





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

<b>Chainage</b>	5.800		8.390	
<b>Structure ID No</b>	Panchayat Library		Shivguru Nursery School	
<b>Village Name</b>	Eamankulam		Subramaniyapuram	
<b>Side (Left/Right)</b>	LHS		RHS	
<b>Distance from ECL(m)</b>	15m		9-10m	
<b>Length (m)x Breadth (m)</b>	L- 10m		L- 12m	
<b>Proposed Widening</b>	Eccentric on LHS		Concentric	
<b>Impact</b>	No direct impact		No direct impact	
<b>Chainage</b>	9.070		9.900	
<b>Structure ID No</b>	Govt. Nursery School		Rattish Nursery and Primary School	
<b>Village Name</b>	Subramaniyapuram		Subramaniyapuram	
<b>Side (Left/Right)</b>	RHS		RHS	
<b>Distance from ECL(m)</b>	25-30m		30m	
<b>Length (m)x Breadth (m)</b>	L- 10m		L- 10m	
<b>Proposed Widening</b>	Concentric		Eccentric on RHS	
<b>Impact</b>	No direct impact		No direct impact	
<b>Chainage</b>	10.500		10.550	
<b>Structure ID No</b>	T.D.T.A. Govt. Middle School		Govt. Higher Sec. School	
<b>Village Name</b>	Subramaniyapuram		Elangulan	
<b>Side (Left/Right)</b>	RHS		RHS	
<b>Distance from ECL(m)</b>	8m		13m	
<b>Length (m)x Breadth (m)</b>	L- -70m		L- 150m	
<b>Proposed Widening</b>	Concentric		Concentric	



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

<b>Impact</b>	No direct impact		No direct impact	
<b>Chainage</b>	14.400		14.910	
<b>Structure ID No</b>	RECT Poly Technic college		Panchayat Union School	
<b>Village Name</b>	South Vijaynarayanam		South Vijaynarayanan	
<b>Side (Left/Right)</b>	LHS		LHS	
<b>Distance from ECL(m)</b>	40-50m		10m	
<b>Length (m)x Breadth (m)</b>	L- 400m		L- 15m	
<b>Proposed Widening</b>	Eccentric on LHS		Concentric	
<b>Impact</b>	No direct impact		No direct impact	
<b>Chainage</b>	16.900			
<b>Structure ID No</b>	R.C. Agasthiar School		St. Antony S. College of Education	
<b>Village Name</b>	South Vijaynarayanam		Anagal Nagar	
<b>Side (Left/Right)</b>	LHS		LHS	
<b>Distance from ECL(m)</b>	10-11m		8m	
<b>Length (m)x Breadth (m)</b>	L- 40m		L- 100m	
<b>Proposed Widening</b>	Concentric		Eccentric on RLHS	
<b>Impact</b>	No direct impact		No impact	
<b>Chainage</b>	25.000			
<b>Structure ID No</b>	Panchayat Union middle School		Lions Matriculation School	Photo Not Available
<b>Village Name</b>	Kumaraapuram		Appuvilai	
<b>Side (Left/Right)</b>	LHS		RHS	
<b>Distance from ECL(m)</b>	12m		5.5m	
<b>Length (m)x Breadth (m)</b>	L- 40m		L- 35m	
<b>Proposed Widening</b>	Eccentric on RHS		Eccentric on RHS	
<b>Impact</b>	No direct impact		No Direct Impact	
<b>Chainage</b>	32.050			



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

<b>Structure ID No</b>	Cold Well Memorial Higher Sec. School	Photo Not Available		
<b>Village Name</b>	Idaiyangudi			
<b>Side (Left/Right)</b>	LHS			
<b>Distance from ECL(m)</b>	6.5m			
<b>Length (m)x Breadth (m)</b>	L- 150m			
<b>Proposed Widening</b>	Eccentric on RHS			
<b>Impact</b>	No direct impact			

**Table 7-30: Sensitive Receptors with respect to Noise Pollution along Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41**

<b>Chainage</b>	9+400		16+200
<b>Structure ID No</b>	School		College
<b>Village Name</b>	Cholapuram		Paruvakudi
<b>Side (Left/Right)</b>	RHS		LHS
<b>Distance from ECL</b>	15		12
<b>Proposed Widening</b>	Concentric		Concentric
<b>Impact</b>	No Direct Impact		No Direct Impact
<b>Chainage</b>	26+800		27+750
<b>Structure ID No</b>	School		School
<b>Village Name</b>	Sankarakovil		Sri Gomathipuram
<b>Side (Left/Right)</b>	LHS		RHS
<b>Distance from ECL</b>	20		10
<b>Proposed Widening</b>	Concentric		Eccentric on RHS
<b>Impact</b>	No Direct Impact		No Impact
<b>Chainage</b>	29+500		44+500
<b>Structure ID No</b>	School		School
<b>Village Name</b>	Sankarakovil		Melaneelithnudur
<b>Side (Left/Right)</b>	LHS		LHS
<b>Distance from ECL</b>	12		12
<b>Proposed Widening</b>	Not in Scope		Eccentric on LHS
<b>Impact</b>	No Impact		No direct impact
<b>Chainage</b>	47+200		55+200
<b>Structure ID No</b>	School		School
<b>Village Name</b>	Ayalpatti		Vannikonedhal
<b>Side (Left/Right)</b>	RHS		RHS



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

<b>Distance from ECL</b>	10		10
<b>Proposed Widening</b>	Eccentric on RHS		Concentric
<b>Impact</b>	No Impact		No direct Impact
<b>Chainage</b>	57+100		21+200
<b>Structure ID No</b>	School		Hospital
<b>Village Name</b>	Adikulampuram		Karivalamvanthanallur
<b>Side (Left/Right)</b>	RHS		RHS
<b>Distance from ECL</b>	15		10
<b>Proposed Widening</b>	Concentric		Concentric
<b>Impact</b>	No direct impact		No direct impact

As evident from above table, there is no impact on other any of the sensitive receptors due to proposed development along project roads.

### 7.7.1 Prediction of Noise Levels

Although the baseline day & night time noise levels monitored at various locations along the project roads are within permissible limits specified by the CPCB for residential and sensitive areas, still, noise is a major area of concern, especially since sensitive receptors (schools, colleges and hospitals) have been located quite close to the road. To assess the noise levels at the various sensitive receptors located along the project roads, the prediction of noise levels<sup>6</sup> has been made for the horizon years 2020, 2030 and 2040, using the FHWA Transport Noise Model

#### 7.7.1.1 FHWA Transport Noise Model

The Highway Noise Model presented below is based upon calculating the hourly Leq for all category-wise vehicles separately and then adding these logarithmically to obtain the overall hourly Leq as follows:

<sup>6</sup> Operational noise for the highway are predicted through the model developed by Federal Highway

Administration, Department of Transportation of the U.S. Likely noise levels at various receptor locations predicted through FHWA noise model in present study. The various assumptions predicting the noise levels along the corridor through the FHWA model were:

- No significant change in the vehicle characteristics is anticipated during the projected period;
- There are no major grade differences in the project area as it is generally a plain terrain and gentle slopes of 1% to 3%, and no significant effect of grade on the noise levels is anticipated;
- The traffic along the proposed section is assumed to flow simultaneously in both the lanes and in both directions;
- Noise from other sources apart from the highway is not being accounted for in the modelling; and
- The receptor is considered to be independent of the noise emitted from the adjacent stretches.



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$$eq (hi) = Loei + 10 \log [Ni / (Si T)] + 10 \log [(15/D) ^ (1+\alpha)] - 13 + \delta S$$

Where,

- Leq (hi) Equivalent noise level at the hour (hi) for vehicle type (i)  
 Loei Reference means energy level for (ith) vehicle type  
 Ni Number of vehicles of (ith) class passing in time (T) one Hour (1 hour)  
 Si Average Speed of vehicles of (ith) class (kmph)  
 T Time duration corresponding to Ni, one hour  
 D Perpendicular distance in (m) from centreline of the traffic lane to observer  
 $\alpha$  Factor relating to absorption characteristics of the ground cover between roadway and observer (to be conservative, this is taken as 0 in actual modelling, but considered qualitatively in the final analysis)  
 $\delta S$ : Shielding factor for barrier (to be conservative, this is taken as 0 in actual modelling, but considered qualitatively in the final analysis)

The combined effect of all the vehicle categories can be determined at the receptor by adding the individual values using the following equation.

$$Leq(h,total) = \log_{10} \sum 10^{Leq(hi)/10}$$

### Reference Noise Levels

The vehicular noise emission levels significantly vary with vehicle speed. It is therefore necessary that speed dependency of noise emissions for various categories of vehicles is taken into account while using the model for noise prediction due to the roadway. In this work the speed-noise relations presented by National Environmental Engineering Research Institute (NEERI) in their report on Environmental and Social Assessment Delhi - NOIDA Bridge Project have been adopted as follows:

### Speed-Noise Relationships for Various Motor Vehicles

Speed (kmph)	Cars (dB (A))	Trucks & Buses (dB (A))	2/3 Wheelers (dB (A))
30	56.0	73.0	58.0
40	59.0	76.0	61.0
50	63.0	80.0	66.0
60	68.0	81.0	68.0
70	68.0	81.5	70.0
80	70.0	82.0	72.0
90	72.0	83.0	74.0
100	74.0	83.5	76.0

### Traffic Volumes and Speed

Traffic volume counts were carried out at two homogenous sections each at Paruvakudi -



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Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44, Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 and Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 in 2013-14 (As used for CO modelling). Based on the estimated gROWth rates, traffic was projected over the design period for these sections. Hourly traffic volumes project roads were projected for years 2015 to 2040 which was used for noise modelling.

### **Design Speed**

A design speed of 80 kmph and 65 kmph has been adopted for the design of widening of the project road sections for rural and urban stretches respectively.

The noise modelling has been done taking into account the design speed at various stretches. Different operative speeds have been used for various horizon years in the design life to get a realistic picture of the noise levels.

Predicted noise levels at noise monitoring locations are given in **Table 7-31**.





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

**Table 7-31 : Predicted Noise Levels at Project Roads**

S. No.	Chainage	Name of the location	Classification Description of location	Predicted Noise Level dB(A) IN 2020		Predicted Noise Level dB(A) in 2030		Predicted Noise Level dB(A) in 2040		Standard dB(A)	
				Day	Night	Day	Night	Day	Night	Day	Night
<b>Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44</b>											
1	Km 23.00	School and temple at Naduvapatti	Sensitive	67.7	61	69.2	62.7	71	64.4	50	40
2	Km 26.100	Temple at Sippihari	Commercial	67.7	61	69.2	62.7	71	64.4	65	55
3	Km 27.30	Temple at Nakkalamuttampatti	Sensitive	67.7	61	69.2	62.7	71	64.4	50	40
4	Km 40-41	Cross junction of NH-7 at Kovilpatti Municipal Area	Commercial	67.9	64.8	69.5	66.5	71.2	68.2	65	55
5	Km 57	Built-up area at Ettayapuram,	Residential cum commercial	71.9	68.8	73.5	70.5	75.2	72.2	65	55
6	Km 55	Near Mahakavibharathiyar memorial near Ettayapuram	Commercial	71.9	68.8	73.5	70.5	75.2	72.2	65	55
<b>Nanguneri – Bharatavaram Ovari Road upto ECR Junction, Section of SH 89</b>											
1	Km 9.2	Govt.school	Sensitive	67.1	61.2	68.7	63	70.7	64.8	50	40
2	Km 11.00	School Near Elankulam Village	Sensitive	67.1	61.2	68.7	63	70.7	64.8	50	40
3	Km 14.20	RECT College Vijayanarayanam	Sensitive	63.2	57.3	64.8	59	66.7	60.8	50	40
4	Km 14.600	Medical dispensary	Sensitive	67.1	61.2	68.7	63	70.7	64.8	50	40



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S. No.	Chainage	Name of the location	Classification Description of location	Predicted Noise Level dB(A) IN 2020		Predicted Noise Level dB(A) in 2030		Predicted Noise Level dB(A) in 2040		Standard dB(A)	
				Day	Night	Day	Night	Day	Night	Day	Night
5	16.5	School Sevandiapuram	Sensitive	67.1	61.2	68.7	63	70.7	64.8	50	40
6	Km 22.20	College Near cross junction of SH-93	Commercial	67.9	62.2	69.5	63.9	71.4	65.7	65	55
7	Km 32.4	School Idaiyangudi village	Sensitive	67.9	62.2	69.5	63.9	71.4	65.7	65	55
8	Km 35.90	School and Church Ovari	Sensitive	53.2	47.3	54.9	49.2	56.9	51	50	40
<b>Rajapalayam-Sankarankoil-Tirunelveli section of SH-41</b>											
1.	1.1	College	Sensitive Zone	65.1	62.2	66.8	64	68.1	65.1	50	40
2.	9.4	Vandimahali Aman Temple	Sensitive Zone	71.1	68.2	72.8	70	74.1	71.1	50	40
3.	13	Mahatma Gandhi college of Art & Science for Women	Sensitive Zone	71.1	68.2	72.8	70	74.1	71.1	50	40
4.	16	Polytechnic college	Sensitive Zone	71.1	68.2	72.8	70	74.1	71.1	50	40
5.	21.15	Govt. Hospital and Bus Shelter	Sensitive Zone	71.1	68.2	72.8	70	74.1	71.1	50	40
6.	26.8	A.V.K. International School and PKR Cotton Mill, Sankarakovil	School and Factory Area	71.1	68.2	72.8	70	74.1	71.1	50	40
7.	29.3	Vaiyapuri-School and Temple, Sankarakovil	Sensitive Location	71.1	68.2	72.8	70	74.1	71.1	50	40
8.	43	Mutharamalinga Thevar College and Hostel Canteen	Sensitive Location	70.4	65.4	71.9	67.1	73.5	68.4	50	40
9.	55.4	Govt. Hospital and Govt. High School	Sensitive Location	70.4	65.4	71.9	67.1	73.5	68.4	50	40
10.	57.05	Elisabetta Vitale Matriculation School and Church, Lodola Nagar, Devarkulam	Sensitive Location	70.4	65.4	71.9	67.1	73.5	68.4	50	40
11.	61.8	Govt. High School	Educational Area	70.4	65.4	71.9	67.1	73.5	68.4	50	40
12.	63.4	Eskiamanv Temple	Sensitive Location	70.4	65.4	71.9	67.1	73.5	68.4	50	40



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S. No.	Chainage	Name of the location	Classification Description of location	Predicted Noise Level dB(A) IN 2020		Predicted Noise Level dB(A) in 2030		Predicted Noise Level dB(A) in 2040		Standard dB(A)	
				Day	Night	Day	Night	Day	Night	Day	Night
13.	71.2	Manur Village	Residential	70.4	65.4	71.9	67.1	73.5	68.4	55	45
14.	74.75	Govt. Middle School and Temple	Silence Zone	70.4	65.4	71.9	67.1	73.5	68.4	50	40
15.	77.6	Nanjankulam Regrouped Stone Mines, Indian Cement Ltd., Seduroyan Paddur	Open Caste Mining Area	70.4	65.4	71.9	67.1	73.5	68.4	65	55
16.	81.2	T.N., Veterinary College and Research Institute of Veterinary and Animal Science University, Tirunveli	Silence Zone	70.4	65.4	71.9	67.1	73.5	68.4	50	40

The noise level variation with distance from centreline along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44, Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 and Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 has been shown in Figure 7-7, Figure 7-8 and Figure 7-9 respectively.

#### Interpretation of Results:

At noise sensitive receptors, noise levels are exceeding the limits from the start of project life till end at all three project roads. However, it is to be noted that the above-predicted values are considering without shielding effects of noise due to vegetations etc.

The road side avenue plantation will act as noise barrier for sensitive receptors. Vehicular noise & use of horns will be controlled through enforcement of laws and public awareness. It will be ensured that all the vehicles are using proper horn to keep noise within the permissible limits.

Regular monitoring of noise level at specified locations will be conducted periodically.

Figure 7-7: Predicted noise levels variation with distance (from centreline) – Naduvapatti to Ettayapuram Road- SH44

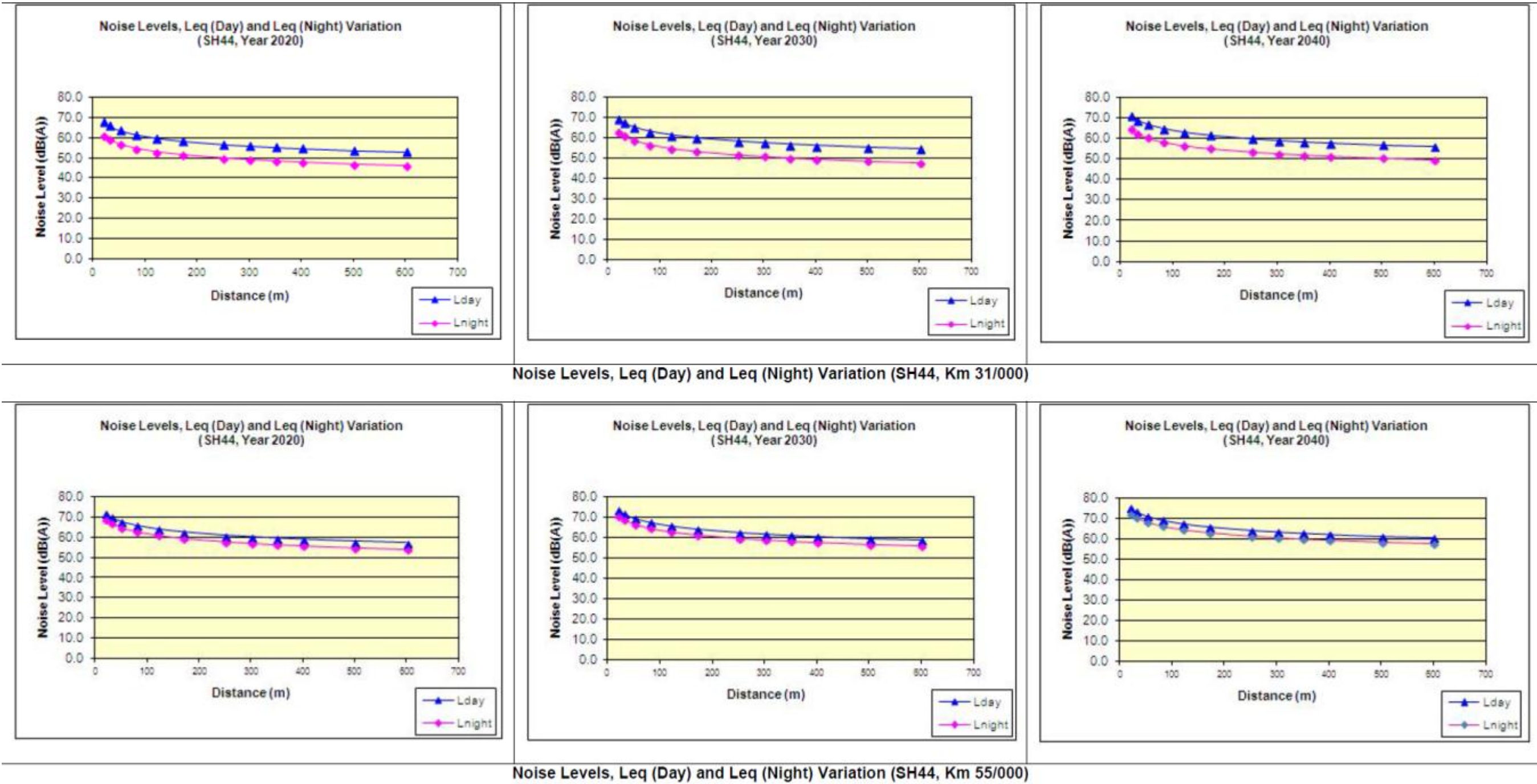




Figure 7-8: Predicted noise levels variation with distance (from centreline)- Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89

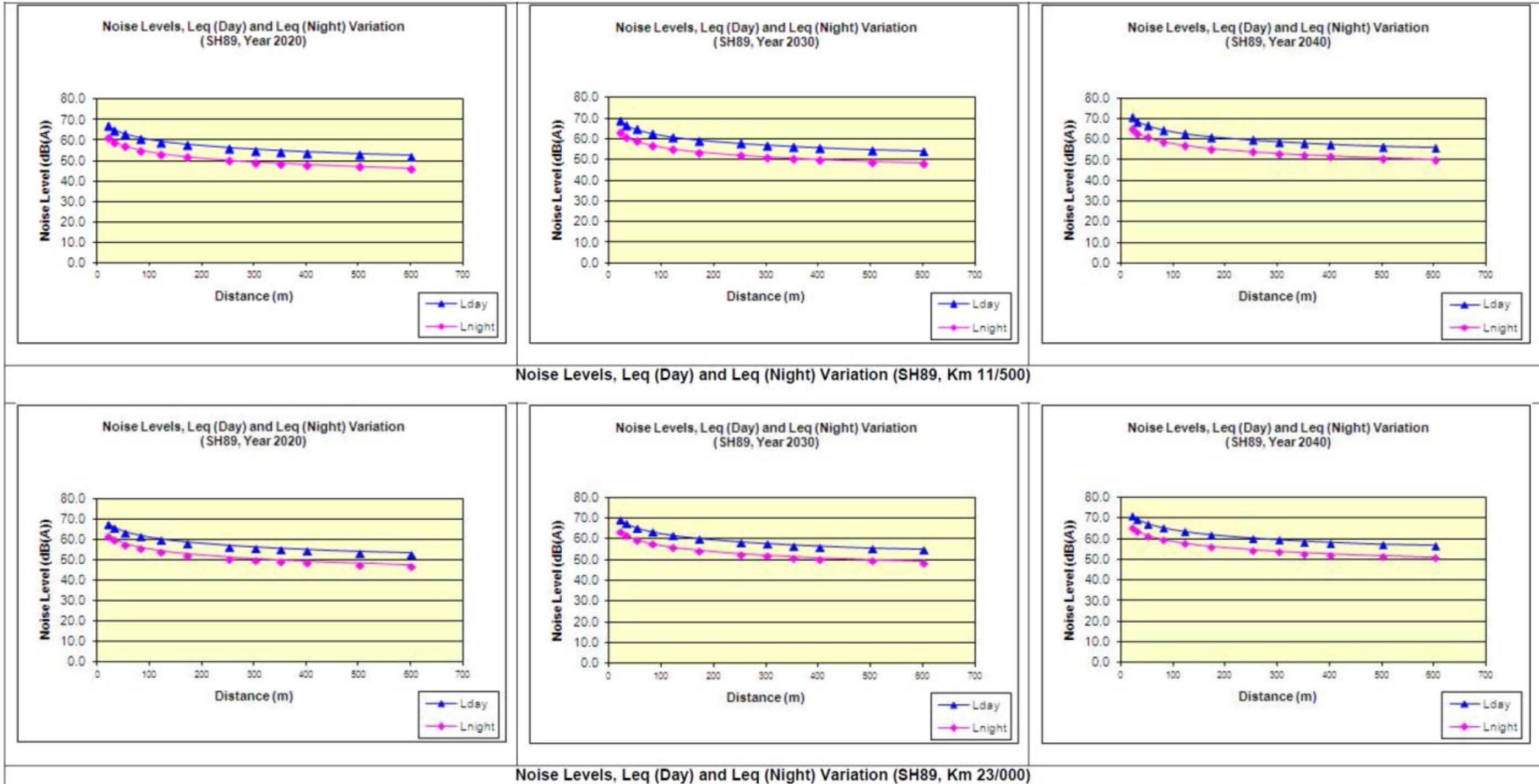
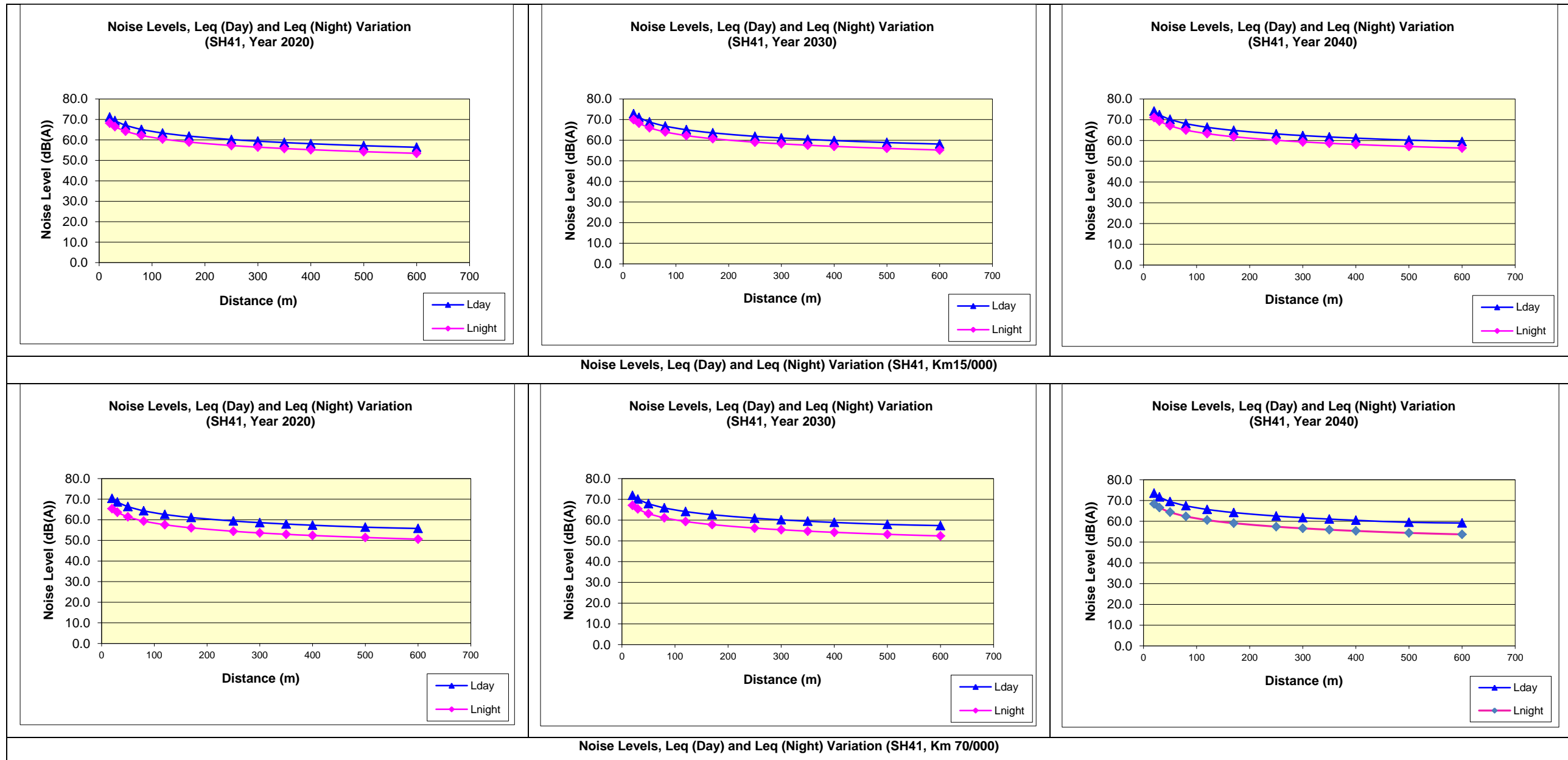


Figure 7-9: Predicted noise levels variation with distance (from centreline) – Rajapalayam-Sankarankoil-Tirunelveli Road (SH41)







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## 7.8 FLORA AND FAUNA - IMPACT

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

**Table 7-32 Impacts on flora & fauna due To Construction Activities**

Impacts Due To Construction	Indicators
Alteration of Wild life passage	Locations of wild life crossing of project road
Tree felling vegetation	No. of trees to be fell Area of vegetation loss
Cattle Grazing Ground	Area and location of grazing ground.

### 7.8.1 Forest Area

The project roads do not pass through the Forest land.

### 7.8.2 Wild Life

No wild life crossing is found along the project corridor.

However, Koonthakulam Bird Sanctuary is located at 7.5km distance from Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 and Srivilliputtur Giant Grizzled Squirrel Wildlife Sanctuary is located at 6km distance from Rajapalayam, start point of Rajapalayam-Sankarankoil-Tirunelveli section of SH41 for which recommendations from NBWL will be obtained as per the procedure specified by MoEF&CC.

### 7.8.3 Tree Cutting

Trees located within the toe line (bottom of formation) need to be removed for efficient construction workmanship and more importantly to prevent collision with the trees, in case of accident. Roadside trees with strong and rigid stems can pose safety hazards. Some trees obstruct clear sight distances. Others have a propensity to overturn when old and are potential safety hazards depending upon age and decay condition. All such trees that are safety hazards need to be cleared.

There will be a significant, direct impact on cutting of the roadside trees, it includes

- The loss of shade
- Loss of tree products.
- Loss of birds nesting place
- Removal of roadside trees will also reduce comfort levels for slow moving traffic and pedestrians.
- The removal of trees will facilitate erosion and contribute to the loss of the micro-ecosystems developed on the roadside.



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- Besides this trees act as noise barrier, dust absorption, air purifier etc.

A detailed tree inventory was carried out of all the existing trees within the corridor of impact, due care had been given in alignment design to reduce/minimize the loss of flora and green tunnels. As a result a total of about **1190>30cm girth size, 773>30cm girth size and 3923>30cm girth size trees are required to be cut for the proposed development along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44, Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 and Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 respectively.** The summarized details of girthwise impacted trees along project roads are as follows (species wise detailed inventory is provided in **Appendix 7.1**):

LHS/RHS	Summary of Impacted Trees (Girth wise , cm)							Total
	30-60	60-90	90-120	120-150	150-180	180-210	Above 210	
<b>Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44</b>								
LHS	99	149	175	117	82	38	28	688
RHS	59	117	102	101	66	32	25	502
<b>Total</b>	<b>158</b>	<b>266</b>	<b>277</b>	<b>218</b>	<b>148</b>	<b>70</b>	<b>53</b>	<b>1190</b>
<b>Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89</b>								
LHS	131	97	82	34	12	11	16	383
RHS	122	94	85	56	11	7	15	390
<b>Total</b>	<b>253</b>	<b>191</b>	<b>167</b>	<b>90</b>	<b>23</b>	<b>18</b>	<b>31</b>	<b>773</b>
<b>Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41</b>								
LHS	658	350	385	152	57	69	166	1837
RHS	612	415	522	180	92	82	183	2086
<b>Total</b>	<b>1270</b>	<b>765</b>	<b>907</b>	<b>332</b>	<b>149</b>	<b>151</b>	<b>349</b>	<b>3923</b>

The major trees affected are Neem, Tamarind and Palm. Cutting of trees for fuel by workers, especially near their camps is of major concern. Therefore adequate training of the workers and availability of their fuel requirements are to be ensured by the Contractor.

#### 7.8.4 Removal of Vegetation

Clearing and grubbing of the area is the foremost requirement to start the construction activities in accordance with MoRTH specifications. The impact due to removal of vegetation includes

- Dust generation during windy atmosphere
- Loss of productive top soil
- Soil erosion during rainy season, may lead to water contamination.

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



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### 7.8.5 Cattle Grazing

No cattle grazing grounds have been found along the corridor of Impact.

## 7.9 SOCIO-ECONOMIC ENVIRONMENT-IMPACTS

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

- General impacts that apply to the entire project Influence Area (Refer Table 7-2)
- Specific impacts on likely properties and PAPs, within the Corridor of Impact.

### General Impacts

Engineering, environmental and socio-economic surveys, conducted during the design phase, for the generation of the baseline information, give indications of several adverse impacts in the vicinity of the alignment, which are related to common human psychology and general in nature.

#### 7.9.1 Fear of uncertainties regarding future

These normally become long lived, given the length of time, which elapses between initial surveys and commencement of construction.

Land and property owners are subjected to sufferings regarding uncertainties of the extent of loss and the nature of compensation. These involve:

- uncertainty of the amount of land/property to be acquired,
- time of acquisition and evacuation,
- extent and amount compensation,
- Provision of alternative land or job, etc.

#### 7.9.2 Inducement of Land Prices

Once the project becomes common knowledge, there may be a danger of unscrupulous speculators moving in to purchase land at what might seem to be advantageous prices, prior to the commencement of the official procedures. Such impact is more likely to occur in the case of urban fringe areas during the design and pre-construction phase.

#### 7.9.3 Inducement of Squatter Influx

Squatters may attempt to occupy land along and adjacent to the proposed alignments, in the hope of receiving compensation or some other inducements to leave when construction commences. Such squatters could cause undue pressure on local resources such as water and firewood, which could result in conflicts with those who are harvesting the resources presently.



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#### 7.9.4 Loss of utilities and amenities

Site clearance involves removal of various assets, utilities and amenities that are:

- Natural (trees, bushes and grasslands), and
- Physical structures (public or private assets and utilities).
- Relocation of utilities like electricity, water and telephone lines

For people dependent on the above, this constitutes economic loss for some time before these are restored to their previous status. These will be further discussed in the RAP.

#### 7.9.5 Public health and safety

a) Impacts on Public health and safety may arise during the phases of pre-construction, construction and operation phases. During the pre-construction and construction phases, dismantling of the structures for Col clearance and road construction activities may result in the following health hazards:

- Dismantling of properties has psychological impacts on their owners and others associated with them.
- Debris generated on account of the above mentioned activities.

b) Labour Camps during construction period can bring the following problems.

- In the case of non-local labour (if so is arranged by the contractor), labour camps are set up at one or more sites adjacent to the alignment, and at some ancillary sites, like aggregate quarries. These labourers hired from outside can have clashes with the local population on account of cultural and religious differences. The influx of a large work force to an area, already hard pressed for basic services (medical services, power, water supply, etc.), can impose additional stress on these facilities.
- If alternative fuels are not made available to the workforce, there is a likelihood that trees will be cut down for cooking or heating purposes.
- In sanitary conditions in the labour camps might also result in impact on health of labourers as well as the local population. Transmission of diseases is also facilitated by the migration of people. During the construction phase work, crews and their dependants may bring with them a multitude of communicable diseases including sexually transmitted diseases (STDs) like AIDS. This is more so if the nature of the project requires more male-workers, who have migrated from other parts of the state or country.

c) Allied activities during construction period may cause local disruption.

- During road construction allied activities like quarrying and crushing operations, traffic diversions, etc., may cause disruption of social and economic life of the local population of the nearby areas.
- Dust and noise generated in crushing and blasting operations may cause nuisance to the nearby communities.
- Traffic jams and congestion, loss of access and other road accident risks, as a result of diversion of traffic and construction work on road.



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- There will be some impact on land during construction, limited mainly to temporary acquisition to cater to road diversion or traffic detours and establishment of labour camps.

#### d) Accidents and Safety

- Although the design speeds have been kept lower in the major settlement areas, some amount of severance is expected in the rural areas. Especially where the residential area is on one side and their agricultural land and other facilities are on the other side of the highway. School children and ladies carrying pots full of water from the water sources (ponds/wells) also get exposed to this risk. In rural areas it was seen that cattle also cross the highways near the settlement.

### 7.9.6 Resettlement of People

People, displaced from their homes and agricultural lands on account of the project, shall induce additional pressures to the local resource base. These include pressure on:

- water resources in areas where availability is low,
- grazing lands and fuel-wood,
- Public services such as schools and medical facilities.

### 7.9.7 Land Use Changes

Land use changes along the road corridors are anticipated. These shall bring about a change in the characteristics of the adjacent lands. There would be succession of land uses and higher return uses would displace the lower return uses. This phenomenon will occur at major intersections and in settlement areas along the project corridors. The urban fringe areas along the project roads will be subjected to ribbon development.

### 7.9.8 Disturbance to the Road side Services

Along the highway, near settlements, small shops get attracted to serve the local people as well as the highway users. A composite socio-economically inter-dependent has been developed as a consequence. The shops serve dual purpose by providing income and employment to locals as well as service to the road users. It is likely that due to implementation of the project some of the shops may get displaced. This would cause negative impact on the livelihood of people as well as loss of service to the local people and road users.

### 7.9.9 Removal of encroachments and squatters

In order to reduce the number of PAPs, land clearing shall be restricted to within the Corridor of Impact (CoI) which principally lies within the ROW. Width of the CoI varies according to the design and is narrower in the settlement areas (16m), where the numbers of PAPs are likely to be more. However, some amount of land clearing will be essential in several of these stretches.

The potential impacts likely to arise from clearance of encroached residential areas (especially



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in settlements along the project corridors) may involve loss of valuable residential space to the residents. In the case of squatter settlements, displacement might lead to loss of shelter if adequate measures are not taken for their resettlement. Compensation may not be enough for the effected persons to gain access to shelter. Other impacts include disturbance to family and community life and increased distance from their workplace. In such cases the displaced persons may again resort to squatting.

The extent of loss in the case of encroached agricultural lands shall be relatively less, in comparison with residential and commercial properties. This because, the encroached lands form only a small part of the total cropped land of the farmers.

### Specific Impact



Other socio-economic impacts involve the presence of sensitive community facilities within the Corridor of Impact such as worship places and cultural properties.

#### 7.9.10 Sensitive Community Structures

Utmost care has been taken in finalising the horizontal and vertical alignment so that the impact on cultural properties could be better avoided than mitigated.

**Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44:** Out of the 18no.s cultural properties existing along the road, two temples and one church are in direct impact, i.e. lying within the COI of the proposed widening/upgradation. The total list of cultural properties identified along the road that will have experience positive or negative impact is provided in the Table 7.33.







**Table 7-33 : List of sensitive community structures along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44**

Chainage	24.410		26.400	
Structure ID No	Kannivinayagar Temple		RamapuliAyyarn ar, Temple	
Village Name	Mukkuttumalai		Sippipari	
Side (Left/Right)	R		L	
Distance from ECL (m)	8-10m		8-15m	
Length (m)x Breadth (m)	30x12		20x20	
Proposed Widening	Eccentric on LHS		Concentric	
Impact	Boundary wall impacted		No direct Impact	






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<b>Chainage</b>	27.500		27.620	
<b>Structure ID No</b>	Kali Amman Temple		Shaktivinayagar Temple	
<b>Village Name</b>	Nakkalmuttam patti		Nakkalmuttampatti	
<b>Side (Left/Right)</b>	R		R	
<b>Distance from ECL (m)</b>	9m		10m	
<b>Length (m)x Breadth (m)</b>	15x7		3x3	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No direct Impact		No direct Impact	
<b>Chainage</b>	30.200		30.500	
<b>Structure ID No</b>	IrulasuSwamy Temple		Pathinattampadi Karuppaswamy	
<b>Village Name</b>	Ilaiyarsanendal		Ilaiyarsanendal	
<b>Side (Left/Right)</b>	L		L	
<b>Distance from ECL (m)</b>	40m		15m	
<b>Length (m)x Breadth (m)</b>	50x30		30x15	
<b>Proposed Widening</b>	Curve improvement on RHS		Concentric	
<b>Impact</b>	No direct Impact		No direct Impact	
<b>Chainage</b>	39.950		39.980	
<b>Structure ID No</b>	Sembaveliya mman Temple		ManglaVinayagar Temple	
<b>Village Name</b>	Kovil Patti		Kovil Patti	
<b>Side (Left/Right)</b>	L		R	
<b>Distance from ECL (m)</b>	30m		4m	
<b>Length (m)x Breadth (m)</b>	30x30		7x5	
<b>Proposed Widening</b>	Kovipatti city is not in scope		Kovipatti city is not in scope	
<b>Impact</b>	No impact		No impact	
<b>Chainage</b>	41.400		44.500	
<b>Structure ID No</b>	VarasakthiVinayagar Temple and Income Tax Office		Kali Aman Temple	
<b>Village Name</b>	Kovil Patti		Tittangulam	





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<b>Side (Left/Right)</b>	L		R	
<b>Distance from ECL (m)</b>	12m		10m	
<b>Length (m)x Breadth (m)</b>	10x5		20x12	
<b>Proposed Widening</b>	Kovipatti city is not in scope		Concentric	
<b>Impact</b>	No impact		Impacted	
<b>Chainage</b>	45.000		46.900	
<b>Structure ID No</b>	Church		Vinayagar Temple	
<b>Village Name</b>	Tittangulam		Tittangulam	
<b>Side (Left/Right)</b>	L		L	
<b>Distance from ECL (m)</b>	50m		10m	
<b>Length (m)x Breadth (m)</b>	30x60		30x12	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No direct Impact		No direct Impact	
<b>Chainage</b>	52.350		54.600	
<b>Structure ID No</b>	Pomariamman Temple (Big Temple)		Chellathai Amman Temple	
<b>Village Name</b>	Ilambuvanam		Ilambuvanam	
<b>Side (Left/Right)</b>	L		L	
<b>Distance from ECL (m)</b>	10m		10-11m	
<b>Length (m)x Breadth (m)</b>	40x25		7x7	
<b>Proposed Widening</b>	Concentric		Eccentric on LHS	
<b>Impact</b>	No direct Impact		No direct Impact	
<b>Chainage</b>	55.600		55.800	
<b>Structure ID No</b>	Vinayagar Temple		Vinayagar Temple	
<b>Village Name</b>	Ilambuvanam		Ilambuvanam	
<b>Side (Left/Right)</b>	L		R	
<b>Distance from ECL (m)</b>	13m		30m	
<b>Length (m)x Breadth (m)</b>	5x7		20x20	
<b>Proposed Widening</b>	Concentric		Concentric	



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

<b>Impact</b>	No direct Impact		No direct Impact	
<b>Chainage</b>	92.00 (SH-32)		27.520	
<b>Structure ID No</b>	Uttandaraman Temple		Old R.C. Church	
<b>Village Name</b>	Ilambuvanam		Mukutumalai	
<b>Side (Left/Right)</b>	L		RHS	
<b>Distance from ECL (m)</b>	40m		3.5-4m	
<b>Length (m)x Breadth (m)</b>	70x50		10x5	
<b>Proposed Widening</b>			Concentric	
<b>Impact</b>	No direct Impact		Impacted	

**Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89:** Out of the 30no.s cultural properties existing along the road, five temples are impacted, and boundary wall of two church are in direct impact, i.e. lying within the formation width of the proposed widening/upgradation. The total list of cultural properties identified along the road that will have experience positive or negative impact is provided in the **Table 7.35**.

**Table 7-34 : List of sensitive community structures along Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89**

<b>Chainage</b>	0.060		0.800	
<b>Structure ID No</b>	Balavinayagar Temple		Meborn Assembly of God	
<b>Village Name</b>	Naguneri		Naguneri	
<b>Side (Left/Right)</b>	RHS		LHS	
<b>Distance from ECL (m)</b>	12m		60m	
<b>Length (m)x Breadth (m)</b>	7x6m		15x8m	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No direct impact		No direct impact	
<b>Chainage</b>	2.730		2.790	
<b>Structure ID No</b>	Amman Temple		Sudalaisamy Temple	
<b>Village Name</b>	EraippOvari		EraippOvari	
<b>Side (Left/Right)</b>	LHS		LHS	
<b>Distance from ECL (m)</b>	L- 10m		L- 3.5m	
<b>Length (m)x</b>	7x5m	8x5		



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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

<b>Breadth (m)</b>				
<b>Proposed Widening</b>	Eccentric on RHS		Eccentric on RHS	
<b>Impact</b>	No direct impact		Impacted	
<b>Chainage</b>	3.300		3.700	
<b>Structure ID No</b>	St. Antony S. Church		Shri Athisaya Vinayagar Temple	
<b>Village Name</b>	Kalambarambu Village		Perumal Nagar	
<b>Side (Left/Right)</b>	LHS		LHS	
<b>Distance from ECL (m)</b>	11-12m		5-7m	
<b>Length (m)x Breadth (m)</b>	40x15m		13x7m	
<b>Proposed Widening</b>	Eccentric on LHS		Eccentric on RHS	
<b>Impact</b>	Boundary wall is impacted		Partially impacted	
<b>Chainage</b>	5.830		8.400	
<b>Structure ID No</b>	Sudalaisamy Temple		Temple	
<b>Village Name</b>	Eamankulam		Subramaniyapuram	
<b>Side (Left/Right)</b>	LHS		RHS	
<b>Distance from ECL (m)</b>	9-10m		7-8m	
<b>Length (m)x Breadth (m)</b>	25x10m		8x4m	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No direct impact		No direct impact	
<b>Chainage</b>	8.400		8.500	
<b>Structure ID No</b>	Temple		Amman Temple	
<b>Village Name</b>	Subramaniyapuram		Subramaniyapuram	
<b>Side (Left/Right)</b>	RHS		RHS	
<b>Distance from ECL (m)</b>	40-45m		8-9m	
<b>Length (m)x Breadth (m)</b>	15x40m		6x4m	
<b>Proposed</b>	Concentric		Concentric	





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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
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<b>Widening Impact</b>	No direct impact		No Impact	
<b>Chainage</b>	8.630		10.540	
<b>Structure ID No</b>	Sudalai Andavar Temple		Antony Church	
<b>Village Name</b>	Subramaniyapuram		Subramaniyapuram	
<b>Side (Left/Right)</b>	RHS		RHS	
<b>Distance from ECL (m)</b>	7-10m		9m	
<b>Length (m)x Breadth (m)</b>	10x7m		5x4m	
<b>Proposed Widening</b>	Concentric		Eccentric on LHS	
<b>Impact</b>	Impacted		No direct impact	
<b>Chainage</b>	10.620			
<b>Structure ID No</b>	CSI Church	Church		
<b>Village Name</b>	Elangulan	Elangulan		
<b>Side (Left/Right)</b>	LHS	LHS		
<b>Distance from ECL (m)</b>	30m	15m		
<b>Length (m)x Breadth (m)</b>	15x15m	200x50m		
<b>Proposed Widening</b>	Eccentric on LHS	Concentric		
<b>Impact</b>	No direct impact	No direct impact		
<b>Chainage</b>	11.450			15.600
<b>Structure ID No</b>	Terumal Temple		Sodalai Temple	
<b>Village Name</b>	Bharati Nagar		South Vijaynarayanam	
<b>Side (Left/Right)</b>	LHS		RHS	
<b>Distance from ECL (m)</b>	10m		10m	
<b>Length (m)x Breadth (m)</b>	15x10m		7x5m	
<b>Proposed Widening</b>	Concentric		Eccentric on RHS	
<b>Impact</b>	No direct impact		No direct impact	
<b>Chainage</b>	16.000			17.350
<b>Structure ID No</b>	Sodalai Temple	Sodalai Temple		
<b>Village Name</b>	South Vijaynarayana	South Vijaynarayanam		
<b>Side (Left/Right)</b>	RHS	RHS		



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<b>Distance from ECL (m)</b>	7-10m		7-8m	
<b>Length (m)x Breadth (m)</b>	10x10m		15x8m	
<b>Proposed Widening</b>	Eccentric on RHS		Concentric	
<b>Impact</b>	No direct impact		Impacted	
<b>Chainage</b>	18.000		19.300	
<b>Structure ID No</b>	St. Lorth Matha Church		Essakiamman Temple	
<b>Village Name</b>	Mannarpuram		Mannarpuram	
<b>Side (Left/Right)</b>	RHS		RHS	
<b>Distance from ECL (m)</b>	10-11m		8m	
<b>Length (m)x Breadth (m)</b>	15x7m		8x5m	
<b>Proposed Widening</b>	Concentric		Concentric	
<b>Impact</b>	No direct impact		Partially impacted	
<b>Chainage</b>	20.800		21.300	
<b>Structure ID No</b>	Arockiamatha Church		The Pent Coastal Mission	
<b>Village Name</b>	Mannarpuram		Mannarpuram	
<b>Side (Left/Right)</b>	LHS		RHS	
<b>Distance from ECL (m)</b>	12m		12-13m	
<b>Length (m)x Breadth (m)</b>	8x6m		80x25m	
<b>Proposed Widening</b>	Concentric		Eccentric on RHS	
<b>Impact</b>	No direct impact		No direct impact	
<b>Chainage</b>	25.350		27.500	
<b>Structure ID No</b>	CSI Church		Nallamadasamy Temple	
<b>Village Name</b>	Kumaraapuram		Bala Sithivanagar	
<b>Side (Left/Right)</b>	RHS		RHS	
<b>Distance from ECL (m)</b>			3.5m	
<b>Length (m)x Breadth (m)</b>	10x20m		20x10m	
<b>Proposed Widening</b>	Eccentric on LHS		Tisaiyanvillai Realignment	
<b>Impact</b>	No direct impact		No direct impact	





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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
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<b>Chainage</b>	28.500		28.800	
<b>Structure ID No</b>	Vinayagar Temple		Santhi Amman Temple	
<b>Village Name</b>	Bala Sithivanagar		Bala Sithivanagar	
<b>Side (Left/Right)</b>	RHS		RHS	
<b>Distance from ECL (m)</b>	4.5m		3.5m	
<b>Length (m)x Breadth (m)</b>	12x10m		5x5m	
<b>Proposed Widening</b>	Tisaiyanvillai Realignment		Tisaiyanvillai Realignment	
<b>Impact</b>	No direct impact		No direct impact	
<b>Chainage</b>	29.400	Photo Not Available	29.510	Photo Not Available
<b>Structure ID No</b>	Soran Vinayagar Temple		Shri Mutharamman Temple	
<b>Village Name</b>	Bala Sithivanagar		Appuvilai	
<b>Side (Left/Right)</b>	RHS		RHS	
<b>Distance from ECL (m)</b>	5.5m		12m	
<b>Length (m)x Breadth (m)</b>	20x9m		20x12m	
<b>Proposed Widening</b>	Tisaiyanvillai Realignment		Tisaiyanvillai Realignment	
<b>Impact</b>	No direct impact		No direct impact	
<b>Chainage</b>	29.600	Photo Not Available	31.900	Photo Not Available
<b>Structure ID No</b>	Shri. Selva Vinayagar Temple		Church	
<b>Village Name</b>	Appuvilai		Vijayanagaram	
<b>Side (Left/Right)</b>	RHS		LHS	
<b>Distance from ECL (m)</b>	5-6m		6m	
<b>Length (m)x Breadth (m)</b>	40x15m		15x20m	
<b>Proposed Widening</b>	Tisaiyanvillai Realignment		Concentric	
<b>Impact</b>	No direct impact		Compund wall impacted	



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### **Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41**

There are 50 cultural properties existing along the project road (Refer Table 4-30-List of temples along SH41 project road section). The list of identified impacted cultural properties along the road is provided in the Table 7.36.

**Table 7-35: List of impacted sensitive community structures along Rajapalayam-Sankarankoil-Tirunelveli section of SH41**

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
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

Source: SIA Report of Rajapalayam-Sankarankoil-Tirunelveli section of SH41

Besides direct impact, there are many possible indirect impacts due to construction activities, as follows.

- Access to religious places would be difficult during the construction period due to the



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presence of working areas, consequent traffic management issues, presence of heavy equipment, machineries and numerous workers and controlled sign boards.

- Many existing signs boards and information boards will be removed for the construction work. This will make it more complicated for identifying the pilgrimage location, routes and landmarks.
- Safety issues and accidents could go high during the construction period.

### 7.9.11 Bus Shelter, Bus Bays, Truck Lay Bys, Resting Place

There is no existing truck lay bye and rest area along project roads. Impacted bus shelters will be considered in utility shifting.

### 7.9.12 OTHER COMMUNITY UTILITY PROPERTIES

Besides cultural/religious properties, few community utility properties exist within the Corridor of Impact. The table below presents the details of existing features.

**Table 7-36 : List of other Community Utility Properties along project roads**

Along SH44 -Naduvapatti - Kovilpatti - Ettayapuram Road (Km 22/400 to Km 56/100)				
Chainage	55.000		54.650	
Structure ID No	MahaKaviSubramania bharathiar Memorial Hall and Park		Sub Registrar Office	
Village Name	Ettayapuram		Ettayapuram	
Side (Left/Right)	L		L	
Distance from ECL(m)	5-7m		10-11m	
Length (m)x Breadth(m)	50x70		40x35	
Proposed Widening	Concentric		Concentric	
Impact	No direct Impact		No direct Impact	
Along SH89- Nanguneri - Bharatavaram -Ovari Road (Km 0/000 to Km 35/200)				
Chainage	0.200			
Structure ID No	Old Age Home, Arsan Rural Development Society			
Village Name	Nanguneri			
Side (Left/Right)	RHS			
Distance from ECL(m)	12m			
Length(m)	L- 60m			
Proposed	Concentric			



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<b>Widening</b>			
<b>Impact</b>	No direct impact		
<b>Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41</b>			
<b>Chainage</b>	5.300		21.800
<b>Structure ID No</b>	Ambedkar Statue		Panchayat Office
<b>Village Name</b>	Mudhukudi		Kuvalaikanni
<b>Side (Left/Right)</b>	RHS		LHS
<b>Distance from ECL (m)</b>	5m		8m
<b>Proposed Widening</b>	Concentric		Eccentric on RHS
<b>Impact</b>	Direct Impact		Direct Impact



## **CHAPTER 8**

### **IMPACT MITIGATION AND ENHANCEMENT**



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

## 8 IMPACT MITIGATION AND ENHANCEMENT

### 8.1 MITIGATION, AVOIDANCE AND ENHANCEMENT

Prevention or avoidance of impact is better than mitigation of impact. Hence avoidance and reduction of adverse impacts approaches were adopted during the design stage through continued interaction between the design and environmental teams. This is reflected in the designs of the horizontal & vertical alignment, cross sections adopted, construction methods and construction materials. In-depth site investigations have been carried out so that sensitive environmental resources are effectively avoided, leading to the environmentally best-fit alignment option. As a result many of the trees, cultural properties, water bodies etc. have been avoided at the design stage itself, as presented as follows.

**Table 8-1: Environmental features saved through Avoidance measure at design stage along project roads**

Environmental Features	Potential Impact	Under Direct Impact	Saved through alignment design	Potential Impact	Under Direct Impact	Saved through alignment design	Potential Impact	Under Direct Impact	Saved through alignment design
	SH44-Naduvapatti - Kovilpatti - Ettayapuram Road (Km 22/500 to Km 56/700)			SH89-Nanguneri - Bharatavaram -Ovari Road (Km 0/000 to Km 35/200)			Rajapalayam - Sankarankoil - Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41		
Trees (nos.)>30cm girth size		1190			773		6829	3923	2249
Surface Water source	8	2	6	10	2	8	27	12 (partial impact)	15
Ground Water source	20	8	12	34	18	16	41	41	0
Schools and Hospitals	22	1	21	15	0	15	10	0	10
Sensitive Community Properties	18	3	15	30	7	23	50	25	25
Other community structures	2	0	2	1	0	1	2	2	0

### 8.2 AIR ENVIRONMENT – MITIGATION

Motor vehicles have emerged as one of the major sources of air pollution especially in urban areas. Due to the proposed road improvements aimed at enhancing the efficiency of road transport system the number of vehicles on these roads will be increased over time. Summary of potential impact and mitigation measures proposed is mentioned below:

Sr. No.	Item	Impact	Impact (Reason)	Mitigation/Enhancement
1	Meteorological factors and climate	Marginal impact	Due to production and laying of hot bituminous mix.	<ul style="list-style-type: none"> <li>✓ Avenue plantation</li> <li>✓ Plantation in realignment sections</li> </ul>





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Sr. No.	Item	Impact	Impact (Reason)	Mitigation/Enhancement
2a	Air quality - emissions  Pre-construction stage	Temporary and location specific  (Dust Generation)	<ul style="list-style-type: none"> <li>▪ shifting of utilities,</li> <li>▪ removal of trees &amp; vegetation,</li> <li>▪ transportation of material</li> <li>▪ installation of construction plants</li> </ul>	<ul style="list-style-type: none"> <li>✓ Sprinkling of Water</li> <li>✓ Fine materials to be completely covered, during transport &amp; stocking.</li> <li>✓ Plant to be installed in downwind direction from nearby settlement.</li> </ul>
2b	Air quality - emissions  Construction Stage	Moderate impact  (Gaseous pollutants & Dust generation)	<ul style="list-style-type: none"> <li>▪ clearing and grubbing</li> <li>▪ materials dumping</li> <li>▪ brushing of the surface</li> <li>▪ access roads to borrow-areas</li> <li>▪ hot mix plants, Crushers</li> <li>▪ paving of asphalt layers</li> <li>▪ Labour Camps</li> </ul>	<ul style="list-style-type: none"> <li>✓ Air pollution Norms will be enforced,</li> <li>✓ Laborers will be provided mask.</li> <li>✓ Local people will be educated on safety and precaution on access roads, newly constructed embankment etc.</li> </ul>
2c	Air quality - emissions  Operation Stage	Moderate impact  (Gaseous pollutants)	<ul style="list-style-type: none"> <li>▪ air pollutants from traffic</li> <li>▪ dust emission from tyres</li> </ul>	<ul style="list-style-type: none"> <li>✓ compliance with future statutory regulatory requirements</li> <li>✓ auto-technology, vehicular fuel quality- improvement</li> </ul>
3	Air quality - monitoring	--	Effectiveness / shortfall (if any) Any unforeseen impact.	<ul style="list-style-type: none"> <li>✓ Measures will be revised &amp; improved to mitigate/ enhance environment due to any unforeseen impact.</li> </ul>

***Emissions from the vehicles are potentially disastrous. But, it must be emphasized that the air pollution from vehicle emission will reduce on completion, as one of the objectives of the design is enhancement of facility to cater traffic requirement.***

### 8.2.1 Meteorological Factors and Climate - mitigation

As indicated in previous chapter, there will not be any micro-climatic effect/impact due to increased traffic emission on the project road during construction and operation phase, if any minor impact do exists due to widening will be counter by compensatory and avenue plantation.

### 8.2.2 Air Quality Emissions - mitigation

**Pre-construction Stage:** As indicated in previous chapter, the dust generation due to pre-construction activities is temporary and localized, and will be efficiently countered by sprinkling of water.

**Construction Stage:** During the construction stage, there are two major sources: the first one



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is construction activities at working zones, which cause primarily dust emission and second are from operation of the construction plant, equipments and machinery, which causes gaseous pollutants. The specific measures include:

- Locating Plant at a significant distance from nearest human settlement in the predominant down wind direction.
- Vehicles delivering fine materials like soil and fine aggregates shall be covered to reduce spills on existing roads.
- Water will be sprayed on earthworks, temporary haulage and diversions on a regular basis.
- Batch type hot mix plants fitted with the bag filter / cyclone and scrubber will be installed for the reduction of the air pollution.
- Pollution control systems like water sprinkling and dust extractors and cover on conveyors will be installed for the crushers.
- All vehicles, equipment and machinery used for construction will be regularly maintained to ensure that the emission levels conform to the SPCB/CPCB norms.
- Air pollution monitoring plan has been delineated for construction phase separately for checking the effectiveness of the mitigation measures adopted during the construction phase of the contract.

**Operation Stage:** As indicated in previous chapter, the air pollutant will be from vehicular movement on road and dust emission by tyres. As such the nation and international bodies are quite active in controlling the air pollution through emission limit, auto technology and fuel quality which will counter the increase in air pollution due to increase in traffic during operation phase. Also, as per air modeling of CO, it is concluded that the concentration of CO will remain within permissible CPCB limits along the project roads for projected traffic in future design years till 2040. Additional measures/proposed are below:

- Pollution resistant species, which can grow in high pollutant concentrations or even absorb pollutants, can be planted along the roadside.
- Monitoring of air pollution levels at sensitive locations shall be carried out all through the operation stage to check that the pollution levels are within standards prescribed by CPCB. A monitoring plan to this effect has been prepared for all roads separately and is presented in the individual EMPs.
- Other measures such as the reduction of vehicular emissions, ensuring vehicular maintenance and up-keep, educating drivers about driving behavior / methods that will reduce emissions are beyond the scope of the Project but will be far more effective in reducing the pollutant levels.

### 8.2.3 Air Quality Monitoring - mitigation

Apart from provision of the mitigation measures, their effectiveness and further improvement in designs to reduce the air pollution with increase in traffic shall be monitored. The monitoring plan shall be functional in construction as well as in operation stages. The frequency, duration and responsibility will be as per the **Appendix 8.1: Guidelines for Environmental Monitoring**. For location refer Table 1.2: Ambient Air Quality Monitoring Locations. National Ambient Air Quality Standards are given in Appendix 4.2a. Any value/result not within acceptable limits will be reported to engineer, for remedial measures.



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### 8.3 LAND ENVIRONMENT- MITIGATION MEASURES

Land Acquisition, soil erosion and contamination of soil have emerged as major sources of land impact especially in urban areas and near by watercourses. Due to the proposed road improvements aimed at enhancing the efficiency of road transport system, which will result in economic gROWth in the region over time.

Sr.No.	Item	Impact	Impact (Reason)	Mitigation/Enhancement
1	Change in Topography	Marginal impact	Due to embankment raising.	Embankment raising to relieve water logging.
2	Change in Geology	Direct , long term, negative impact	Extraction of materials (borrow earth, coarse & fine aggregates).	No blasting is envisaged. Quarry redevelopment plan need to be enforced
3	Change in Seismology	No Negative Impact		Cross drainage structures are checked and complied with the seismological settings of the region. (Zone)
4	Change in Land environment			
a	Loss of land	Direct, long-term negative impact	Land Acquisition Change in land use pattern	Land acquisition to be minimized
b	Generation of Debris	Negative Impact	May contaminate air, water and land, if not disposed properly.	Proper disposal of debris to avoid contamination
c	Soil Erosion	Moderate, direct, long-term negative impact	Road slopes and spoils  Construction of new bridges and culverts  Quarry and Borrow areas	Embankment protection: For Embankment height >3m Stone pitching, Embankment height<3m Turfing.  Residual spoil need to be disposed properly. Silt Fencing need to be provided.  Quarries need to be reclaimed
5	Contamination of Soil	Direct, long term negative impact	Scarified bitumen wastes  Oil & diesel spills Emulsion sprayer and laying of hot mix plant, production of hot mix and rejected materials	Hazardous Wastes (Management, Handling and Trans boundary Movement) Rules, 2008 to be enforced.  Oil Interceptor will be provided for accidental spill of oil and diesel.



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Sr.No.	Item	Impact	Impact (Reason)	Mitigation/Enhancement
			Residential facilities for the labor and officers  Routine and periodical maintenance	Rejected material will be layed on village roads or as directed by engineer.  Septic tank will be construction for waste disposal.
6	Soil quality - monitoring		Effectiveness / shortfall (if any) Any unforeseen impact	Measures will be revised & improved to mitigate/ enhance environment due to any unforeseen impact.

***The implications of accidental discharge are potentially disastrous. But, it must be emphasized that the probability of such an accident is quite low, as one of the objectives of the design is the enhancement of road safety.***

### 8.3.1 Change in Topography – mitigation

As indicated in previous chapter, there is not much change in the embankment of the project road (refer Table 2.29 Embankment raising sections) hence no appreciable change in topography. Pavement height will be raised only to accommodate structural layers over the existing pavement. The raising due to submergence and profile improvement are positive impacts on the local environment. The raised sections are located away from habitations. Adequate measures have been taken so that the raising if any in settlement areas should be minimum possible and in no case exceed 0.5 m.

### 8.3.2 Change in Geology- mitigation

As part of the Project preparation, the sources of quarries for the fine and coarse aggregates have been identified for use in road works and structural works, details of the quarries have been presented in Chapter 4 Baseline Environment. No new quarry has been proposed for the Project requirements. Only existing, live, licensed quarries will be used as sources of coarse and fine aggregates. It will be ensured that the aggregates procured during construction stage will be from the authorized or licensed suppliers only. In case of use of any new quarry by contractor, the instructions/procedure as detailed in **Appendix 8.2: Guidelines for Aggregate Quarry Management** will be applicable.

Selected soil borrow areas have been identified during the design stage of the Project. Most of these borrow areas are local borrow areas, and agricultural fields not in productive use, and where farmers want to lower the level of the land (reduction of energy requirement for the watering and reduce loss of water, nutrients, and fertilizer through the seepage). The borrow areas lead charts for project roads are given in Chapter 4 Baseline Environment. In case of taking earth from any of these borrow areas the instructions / procedure as detailed in **Appendix 8.3: Guidelines for Borrow Area Management**, will be applicable.

### 8.3.3 Change in Seismology - mitigation

As indicated in previous chapter, there will be no impact on the seismological setting of the region. Rather, as part of the project all the existing structures will be checked and constructed



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as per the seismological requirements of the region in conformity to the IRC 6, 2000 guidelines. Refer Fig 7.5 & 7.6 Seismology map of India and Tamil Nadu respectively.

### 8.3.4 Change in Land Environment - Mitigation

**Loss of Land:** As far as possible the land acquisition has been kept to the minimum, by restricting the geometric improvement within the existing right of way. The same can be seen as only 2.020, 7.256 and 4.692 hectare land is required for upgradation of Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44, Nanguneri – Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 and Rajapalayam-Sankarankoil-Tirunelveli section of SH-41 respectively. However the land acquisition will be done at sections having width, insufficient to accommodate the approved cross-sections & geometric improvements. For Land acquisition sections refer table 7.4 Land Acquisition Details.

**Debris Generation:** Due to the removal of structures (Residential and commercial), pavement scarification and cross drainage structures lot of debris will generate, which need to be disposed properly to avoid contamination of land and water. For safe and environmental friendly disposal of waste debris the instruction/procedure specified in **Appendix 8.4: Guideline for Debris Disposal Sites**, will be applicable.

**Soil Erosion:** soil erosion could cause sever negative impact if not dealt with, in time, as this harms the environment in two ways, firstly it erodes the top soil and secondly it spoils the resource where it settles, mostly water course. Hence soil erosion cause loss of top-soil and contamination of water bodies/sources/channels.

A comprehensive instruction/procedure is prepared in **Appendix 8.5: Guidelines for Site Clearance and Tree Felling**

#### d) Road slopes and spoils

Adequate measures have been devised for control of the soil erosion from the embankments, the slopes have been restricted to 1 vertical: 2 horizontal for most of the sections. Soil erosion through embankments is prevented and controlled by following methods.

**Alternative 1. Grassing of slopes:** (for embankment height < 3.0m). For this purpose it is best to use locally growing grasses and bushes, as these are best adapted to the local soil, temperature and rainfall conditions. Plantation is best done just after the first pre-monsoon showers, which gives a time of 2-3 weeks for the grass to take root before the onset of monsoon. Normally, no watering of the grassed slopes is done following the planting. However, watering of the slopes may be provided if the planting is done in the non-monsoon season, or to respond to dry conditions following planting. The above methods of providing vegetation cover on embankment slopes follow provisions in IRC-56-1974, "Recommended Practice for Treatment of Embankment Slopes for Erosion Control".

**Alternative 2. Use of Pitching to Control Erosion:** (for embankment height  $\geq$  3.0m). Stones or bricks are hand laid on the surface and lightly tamped. The interstices between the stones are filled up with soil. Grasses may be dibbled into the soil filled spaces. As the grass grows, it develops a good binding effect on the pitching. List of stone pitching sections is provided in



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previous chapter.

#### e) Construction of new bridges and culverts

Contractor will be responsible of removing all the debris/ earth generated due to dismantling of existing structure and excavation of the foundation of cross drainage works, from the water course before the onset of monsoon.

#### f) Quarries and borrow areas

A comprehensive management plan for restoring of quarry and borrow area is prepared. Refer **Appendix 8.2: Guidelines for Aggregate Quarry Management & Appendix 8.3: Guidelines for Borrow Area Management.**

Prior to the start of the relevant construction, the contractor shall submit to the Engineer for approval, his schedules for carrying out temporary and permanent erosion/sedimentation control works as are applicable for the items of clearing and grubbing, roadway and drainage excavation, embankment/sub-grade construction, bridges and other structures across water courses, pavement courses and shoulders. He shall also submit for approval his proposed method of erosion/sedimentation control on service road and borrow pits and his plan for disposal of waste materials. **No construction activity will start prior to approval by engineer, of the measures and method to be adopted by contractor.**

### 8.3.5 Contamination of soil: Mitigation

Contamination of soil can spoil the soil and can also contaminate the surface as well as ground water sources. Details of the activities from which the contamination can occur are presented below:

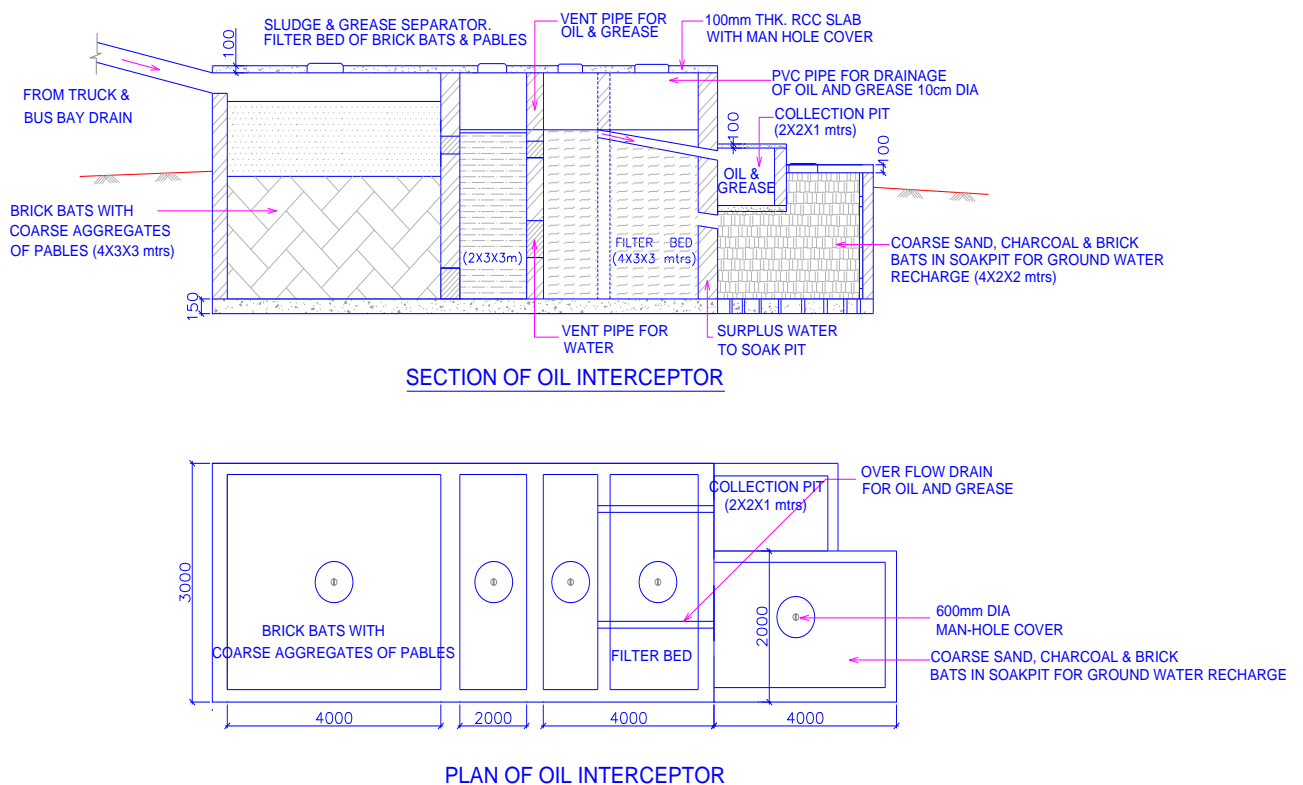
Potential Impact	Mitigation/Enhancement
Storage of hazardous material	Hazardous material will be stored according to Environment, Health and Safety guidelines to avoid soil contamination. EHS guidelines will include proper measures to manage solvents and chemicals including disposals
Scarified bitumen wastes, Excess production of hot mix and rejected materials.	Scarified waste and excess/rejected hot mix, with the consent of village authority, will be used in village roads construction.
Debris generated from dismantling of structures.	A comprehensive list of instructions/procedures has been suggested in <b>Appendix 8.4: Guideline for Debris Disposal Sites</b> , for contractor to adhere to for safe and environmental friendly disposal of debris.
Maintenance of the machinery and operation of the diesel generator sets on site	The base of all machinery, generators will be paved and all the waste/spill will be drained to oil interceptor before discharging. Figure of oil interceptor is presented in drawing no. 8.1.
Oil Spill from the operation of the diesel pumps and diesel storage, during transportation and transfer, parking places, and diesel generator sets	



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Potential Impact	Mitigation/Enhancement
Operation of the emulsion sprayer and laying of hot mix	Proper demarcation of the surface to be sprayed /paved will be done to minimize the excessive spread of emulsion/hot mix.
Operation of the residential facilities for the labour and officers	The residential facilities will be provided with proper sanitation, and planned setup of construction camp. A comprehensive plan of construction camp is prepared in <b>Appendix 8.6: Guideline for Siting &amp; Layout of Construction Camp</b>
Storage and stock yards of bitumen and emulsion	The base of bitumen/emulsion stock yard will be paved and all the waste/spill will be drained to oil interceptor before discharging. Figure of oil interceptor is presented below

**Oil interceptor:** Oil and grease from polluting run-off is another major concern. During construction, discharge of Oil and Grease is most likely from work shops, oil and waste oil storage areas, diesel oil pumps, vehicle parking areas from the construction camps. Vehicle/machinery and equipment maintenance and refuelling will be carried out so that spillage of fuels and lubricants do not contaminate the soil. The source is well defined and restricted. An “oil interceptor” will be provided for wash down and refuelling areas. Fuel storage will be in proper bunded areas. All spills and collected petroleum products will be disposed off in accordance with MoEF & CC and SPCB guidelines. Fuel storage and fuelling areas will be located at least 300m away from all cross drainage structures and significant water bodies. **Drawing 8.1** provides the details of the arrangement for the oil interceptor for the removal of oil and grease.





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### Drawing No. 8.1: Conceptual plan of Oil Interceptor

#### 8.3.6 Soil Quality Monitoring – mitigation

Apart from provision of the mitigation measures, their effectiveness and further improvement in designs to reduce the concentration of pollutants in the soil due to construction activity shall be monitored, as contamination of soil is directly linked with contamination of water. The monitoring plan shall be functional in construction as well as in operation stages. The frequency, duration and responsibility will be as per the **Appendix 8.1: Guidelines for Environmental Monitoring Program**. For location refer Table 1.2: Soil Quality Monitoring Locations.

#### 8.4 WATER ENVIRONMENT-MITIGATION MEASURES

Due to the proposed project there will be some direct and indirect long term impacts on the water resources. Table below presents the major adverse impacts on the water resources and the mitigation measures taken.

Sr.No.	Item	Impact	Impact (Reason)	Mitigation/Enhancement
1	Loss of water Bodies	Major, direct impact	Part or complete acquisition of source of water	Land acquisition to be minimized with provision of Retaining walls. Provision of pond wall Relocation of ground/surface water sources.
2	Alteration of Cross Drainage	Very Low Impact	Minor bridge over existing causeway. Widening of minor bridges and culverts.	Widening of minor bridges and bridging of existing causeways, will lead to improvement in the drainage characteristics of the project area
3	Runoff and drainage	Direct Impact	Siltation of water bodies Reduction in ground recharge.  Increased drainage discharge	Silt fencing to be provided. Recharge well to be provided to compensate the loss of pervious surface. Drain is provided in identifies sections, unlined in rural area and lined in urban areas.
4	Water requirement for project	Direct Impact	Water requirement for construction activity.  Water requirement of labour.	Contractor needs to obtain approvals for taking adequate quantities of water from surface and ground water sources. This is required to avoid depletion of water resources
5	Water Quality			
a	Increased sedimentation	Direct impact	Increased sediment laden run-off alter the nature & capacity of the	Silt fencing to be provided.  Instructions given in Appendix 8.7: Soil Erosion and Sedimentation



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Sr.No.	Item	Impact	Impact (Reason)	Mitigation/Enhancement
			watercourse	Control
b	Contamination of Water	Direct adverse impact	<ul style="list-style-type: none"> <li>• Scarified bitumen wastes</li> <li>• Oil &amp; diesel Spills</li> <li>• Emulsion sprayer and laying of hot mix</li> <li>• Production of hot mix and rejected materials</li> <li>• Residential facilities for the labor and officers</li> <li>• Routine and periodical maintenance</li> </ul>	<p>Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008 to be enforced.</p> <p>Oil Interceptor will be provided for accidental spill of oil and diesel.</p> <p>Rejected material will be layed in village roads or as directed by engineer.</p> <p>Septic tank will be construction for waste disposal.</p>
6	Water quality - monitoring		<p>Effectiveness / shortfall (if any)</p> <p>Any unforeseen impact</p>	Measures will be revised & improved to mitigate/ enhance environment due to any unforeseen impact.

***The implications of accidental discharge are potentially disastrous. But, it must be emphasized that the probability of such an accident is quite low, as one of the objectives of the design is the enhancement of road safety.***

#### **8.4.1 Loss of Water Bodies-Mitigation**

#### **8.4.2 Surface Water Bodies**

**SH44-Naduvapatti - Kovilpatti - Ettayapuram Road (Km 22/500 to Km 56/1700):** Ten Surface water bodies are present along the corridor, 9 no.s ponds and 1 check dam. (Refer table 8.2)

**SH89- Nanguneri - Bharatavaram -Ovari Road upto ECR Junction (Km 0/000 to Km 35/200):** Fourteen surface water bodies are present along the corridor,6 nos. ponds and 7 nos. check dams. (Refer table 8.2)

There are 17 nos. of check dams and 10 nos. of ponds along **Rajapalayam-Sankarankoil-Tirunelveli section of SH41**. Mitigation/enhancement measures for surface water bodies are proposed in Table 8.2.

Mitigation/enhancement measures for surface water bodies are proposed in **Table 8.2**.



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**Table 8-2: Surface Water Bodies-Mitigation**

S. No.	Ch.(km)	LHS/ RHS	Type of Water Body	Distance from CL (m)	Impacted/No Impact	Mitigation /Enhancement
<b>Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44</b>						
1	22.500	LHS	Pond	5.4	Partially Impacted	Provision of retaining wall
2	24.350	RHS	Pond	10-12	No Direct Impact	
3	24.650	RHS	Pond	Earthen wall =5-6m Stone wall=7.5m	Partially Impacted	Enhancement measure proposed (Ref Drawing no. 1 of Appendix 8.8)
4	27.220	LHS	Pond with stone wall	9-10m (upper catchment area 25m (lower/ core area with stone wall	No Direct Impact	
5	35.000	LHS	Drain and Check Dam	6-20	No Direct Impact	
6	42.400	LHS	Pond	20	No Direct Impact	
7	54.500	RHS	Pond with stone wall	8-10	No Direct Impact	It's a very old pond with stone wall. Enhancement measure proposed (Ref Drawing no.2 of Appendix 8.8)
8	55.270	RHS	Pond	25	No Direct Impact	
9	55.300	LHS	Pond	6-7	No Direct Impact (saved by curve improvement and realignment)	
10	55.740	RHS	Pond	8-10	No Direct Impact (saved by reduction in curve radius)	
<b>Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89</b>						
1	0.350	LHS	Pond on rocky surface	8.0	No Direct Impact	
2	1.100	RHS	Pond	40	No Direct Impact	
3	1.300	LHS	Check	Bund Wall is	No Direct Impact	



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S. No.	Ch.(km)	LHS/ RHS	Type of Water Body	Distance from CL (m)	Impacted/No Impact	Mitigation /Enhancement
			dam\Bund	5-7m from centreline	(saved through RHS widening)	
4	1.500	RHS	Water Pond on Rocky Pit	15-20	No Direct Impact	
5	2.650	RHS	Small earthen Check dam\Bund	5-30	Partially Impacted	Rehabilitation of damaged bund wall Provision of Retaining Wall Safety provisions along bund
6	5.000	LHS	Check dam \Bund	200	No Direct Impact	
7	8.400	RHS	Check dam \Bund	10-30	No Direct Impact	
8	9.3	Both sides	Check dam \Bund	Adjoining on both side	No Direct Impact	
9	13.00	LHS	Coffer dam	50-60	No Direct Impact	
10	15.00	LHS	Pond	8.2	No Direct Impact	Enhancement measure proposed (Ref Drawing no. 4 of Appendix 8.8)
11	16.580	LHS	Pond and Drain	12	No Direct Impact	
12	21.750	RHS and crossing	Canal	10-12m and crossing at 22.800	No Direct Impact	
13	23.400	LHS	Pond	8-9	Partially Impacted	Provision of retaining wall
14	24.450	RHS	Check dam\Bund	7-8	No Direct Impact (Saved by realignment on LHS)	
<b>Rajapalayam Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41</b>						
1.	3.00	LHS	Earthen Check Dam	15-20	No Impact	
2.	4.98	LHS	Pond	7	No Impact	Enhancement measure proposed (Ref Drawing no. 5 of Appendix 8.8)
3.	7.00	LHS	Earthen Check Dam	9-12	No Impact	
4.	8.050	Both side	Chozhapuram	RHS-along	Siltation	



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S. No.	Ch.(km)	LHS/ RHS	Type of Water Body	Distance from CL (m)	Impacted/No Impact	Mitigation /Enhancement
		& crossing	river and Check dam on RHS	the Bridge LHS-along the Bridge approach		
5.	11.250	LHS	Pond	5-6	Directly Impacted Siltation and Encroachment of catchment area	Enhancement measure proposed (Ref Drawing no. 6 of Appendix 8.8)
6.	13.550	RHS	Check Dam	5-9	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	8-20	Damage to Bund wall at few locations	
9.	20.600	LHS and Crossing	Nala and Check Dam/Pond	6-50	Siltation during construction	
10.	23.100	RHS	Pond with stone stairs	20	No Impact	
11.	23.700	RHS	Pond	20	No Impact	
12.	24.380	LHS	Pond with cement concrete wall	8-9	Pond wall impacted	Enhancement measure proposed (Ref Drawing no.7 of Appendix 8.8)
13.	25.600	LHS	Pond	5-6	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	15-20	Impact on bund wall from km 34.520 to km 34.570	
16.	40.200	RHS	Check Dam	30-50	No Impact	
17.	42.200	RHS	Pond	6-7	Directly Impacted (earthen wall)	Enhancement measure proposed (Ref Drawing no. 8 of Appendix 8.8)





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 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S. No.	Ch.(km)	LHS/ RHS	Type of Water Body	Distance from CL (m)	Impacted/No Impact	Mitigation /Enhancement
18.	44.00	LHS	Check Dam	15-30	No Impact	
19.	53.400	RHS	Pond/Check Dam	5-10	Directly Impacted Encroachment of catchment area Siltation	
20.	53.570	LHS	Check Dam	5-25	Directly Impacted Damage to bund wall (15m)	
21.	60.400	LHS	Pond	25-30	No Impact (check, not shown in design)	
22.	61.700	RHS	Check Dam with channels	5-100	Directly Impacted Damage to bund wall (5m)	
23.	62.400	RHS and cross to LHS	Check Dam with steel channels/doors	40-60	No Impact	
24.	66.400	LHS	Pond in rock trench	15-20	No Impact	
25.	69.000	RHS	Pond in rock trench	25-30	No Impact	
26.	69.600	RHS	Check Dam	6-8	Directly Impacted Damage to bund wall (5m)	
27.	79.600	RHS	Check Dam	15-20	No Impact	

### 8.4.3 Ground water resources

Loss of other water supply sources includes; removal of private and community ground water sources like bore wells, tube wells and open wells. These losses have been covered under the utility relocation process in the pre-construction phase of the EMAP. Compensatory water supply sources will be set up before the start of construction activities.

**Table 8-3: Ground water Sources along Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44-Mitigation/Enhancement**

Chainage (Km)	Side	CPR	Village	Distance from CL (m)	Impact	Mitigation/Enhancement
28.25	RHS	Hand Pump	Parapatti	9.1	Direct Impact	Will be relocated to the nearest place



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Chainage (Km)	Side	CPR	Village	Distance from CL (m)	Impact	Mitigation/Enhancement
						Drain and soak pit as per Drawing 8.2A
31.03	LHS	Hand Pump	Ilaiyarsanendal	8.2	No Direct Impact	Drain and soak pit as per Drawing 8.2A
40.85	LHS	Hand Pump	Kovilpatti	4.5	No Direct Impact	Drain and soak pit as per Drawing 8.2A
41.60	LHS	Hand Pump	Kovilpatti	7	Direct Impact	Will be relocated to the nearest place Drain and soak pit as per Drawing 8.2A
42.12	RHS	Hand Pump	Kovilpatti	7.5	Direct Impact	Will be relocated to the nearest place Drain and soak pit as per Drawing 8.2A
44.65	RHS	Hand Pump	Kovilpatti	10	No Direct Impact	Drain and soak pit as per Drawing 8.2A
91.8 of SH32	RHS	Hand Pump	Ettayapuram	7.5	Direct Impact	Will be relocated to the nearest place Drain and soak pit as per Drawing 8.2A
55.50	RHS	Hand Pump	Ettayapuram	10	No Direct Impact	Drain and soak pit as per Drawing 8.2A
55.90	RHS	Hand Pump	Ettayapuram	10	No Direct Impact	Drain and soak pit as per Drawing 8.2A
24.85	RHS	Open Well	Naduvapatti	9.5	No Direct Impact	Drain and soak pit as per Drawing 8.2B
25.15	LHS	Open Well (with boundary)	Naduvapatti	5	Direct Impact	Will be relocated to the nearest place Drain and soak pit as per Drawing 8.2B
26.10	LHS	Open Well	Naduvapatti	10.2	No Direct Impact	Drain and soak pit as per Drawing 8.2B
26.70	LHS	Open Well	Naduvapatti	10	No Direct Impact	Drain and soak pit as per Drawing 8.2B



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Chainage (Km)	Side	CPR	Village	Distance from CL (m)	Impact	Mitigation/Enhancement
26.70	RHS	Open Well	Naduvapatti	15	Direct Impact	Will be relocated to the nearest place Drain and soak pit as per Drawing 8.2B
27.58	LHS	Open Well	Parapatti	6	Direct Impact	Will be relocated to the nearest place Drain and soak pit as per Drawing 8.2B
27.80	RHS	Open Well	Parapatti	13	No Direct Impact	Drain and soak pit as per Drawing 8.2B
29.00	RHS	Open Well	Parapatti	13.1	No Direct Impact	Drain and soak pit as per Drawing 8.2B
29.50	LHS	Open Well	Parapatti	10	No Direct Impact	Drain and soak pit as per Drawing 8.2B
34.80	LHS	Open Well	Venkadasalapuram	11.7	No Direct Impact	Drain and soak pit as per Drawing 8.2B
40.18	RHS	Open Well	Kovilpatti	7.8	No Direct Impact	Drain and soak pit as per Drawing 8.2B
44.50	RHS	Open Well	Kovilpatti	13	No Direct Impact	Drain and soak pit as per Drawing 8.2B
51.84	RHS	Open Well	Kumaragiri	9.5	No Direct Impact	Drain and soak pit as per Drawing 8.2B
54.50	LHS	Open Well Tank	Ilambuvanam	8.3	No Direct Impact	Drain and soak pit as per Drawing 8.2B
26.30	LHS	Tubewell with Shelter	Naduvapatti	8.6	No Direct Impact	
37.40	RHS	Tubewell	Puthuapaneri	13	No Direct Impact	
24.85	RHS	TWT + Tubewell	Naduvapatti	27.5	No Direct Impact	



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Chainage (Km)	Side	CPR	Village	Distance from CL (m)	Impact	Mitigation/Enhancement
25.17	LHS	TWT +Tube well	Naduvapatti	12.13	Direct Impact	Will be relocated to the nearest place
28.25	RHS	TWT +Tube well	Parapatti	8.2	No Direct Impact	
31.03	RHS	TWT +Tube well	Ilaiyarsanendal	13.5	No Direct Impact	
36.55	LHS	TWT+ Tubewell	Puthuapaneri	8.5	No Direct Impact	
31.02	RHS	TWT	Ilaiyarsanendal	12.5	No Direct Impact	
49.80	RHS	TWT	kovilpatti	4		

**Table 8-4: Ground water Sources along SH89- Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200) - Mitigation/Enhancement**

Chainage (Km)	Side	CPR	Village	Distance from CL (m)	Impact	Mitigation/Enhancement
2.710	LHS	Hand Pump	EraippOvari	13m	No Direct Impact	Drain and soak pit as per Drawing 8.2B
5.550	LHS	Hand Pump	Eamankulam	15m	No Direct Impact	Drain and soak pit as per Drawing 8.2B
5.790	LHS	Hand Pump	Eamankulam	8m	Direct Impact	Will be relocated to the nearest place Drain and soak pit as per Drawing 8.2A
6.010	LHS	Hand Pump	Eamankulam	11m	No Direct Impact	Drain and soak pit as per Drawing 8.2A
9.580	LHS	Hand Pump	Subramaniya puram	12m	No Direct Impact	Drain and soak pit as per Drawing 8.2A
19.300	RHS	Hand Pump	Mannarpuram	14m	No Direct Impact	Drain and soak pit as per Drawing 8.2A
33.600	LHS	Hand Pump	Idaiyangudi	8m	Direct Impact	Will be relocated to the nearest place Drain and soak pit as per Drawing 8.2A
0.060	LHS	Open Well and Water Tank	Nanguneri	12m	No Direct Impact	Drain and soak pit as per Drawing 8.2B
2.700	LHS	Open Well	EraippOvari	12m	No Direct Impact	
8.210	LHS	Open Well and Over Water Tank	Subramaniya puram	14-15m	No Direct Impact	Drain and soak pit as per Drawing 8.2B



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Chainage (Km)	Side	CPR	Village	Distance from CL (m)	Impact	Mitigation/Enhancement
9.580	LHS	Open Well	Subramaniya puram	12-15m	No Direct Impact	Drain and soak pit as per Drawing 8.2B
15.400	LHS	Open well	South Vijaynarayan am	7m	Direct Impact	Will be relocated to the nearest place Drain and soak pit as per Drawing 8.2B
16.440	RHS	Open Well	South Vijaynarayan am	9-10m	No Direct Impact	Drain and soak pit as per Drawing 8.2B
17.780	LHS	Open Well	South Vijaynarayan am	10-11m	No Direct Impact	Drain and soak pit as per Drawing 8.2B
25.100	LHS	Open Well	Kumaraapuram	11m	No Direct Impact	Drain and soak pit as per Drawing 8.2B
25.750	LHS	Open Well	Kumaraapuram	11.5m	No Direct Impact	Drain and soak pit as per Drawing 8.2B
31.400	LHS	Open Well	Idaiyangudi	7.5m	No Impact	Drain and soak pit as per Drawing 8.2B
0.035	RHS	Tube Well	Nanguneri	9.5	No Direct Impact	
2.200	LHS	Tube well with Tap Water Tank	Thattankualm	5m	Direct Impact	Will be relocated to the nearest place
2.760	LHS	Tube well with Tap Water Tank	EraippOvari	7m	Direct Impact	Will be relocated to the nearest place
3.680	LHS	Tube well with Tap Water Tank	Perumal Nagar	7-8m	Direct Impact	Will be relocated to the nearest place
5.550	LHS	Tube well with Tap Water Tank	Eamankulam	9-10m	No Direct Impact	
5.780	LHS	Tube well with Tap Water Tank	Eamankulam	5.5m	Direct Impact	Will be relocated to the nearest place
8.390	RHS	Tube well with Tap Water Tank	Subramaniya puram	7-8m	Direct Impact	Will be relocated to the nearest place
8.600	LHS	Tube well with Tap Water Tank	Subramaniya puram	9-10m	No Direct Impact	
10.580	RHS	Tube well with Tap Water Tank	Elangulan	15m	No Direct Impact	
11.400	LHS	Tube well with Tap Water Tank	Elangulan	10-11m	No Direct Impact	
12.190	LHS	Tube well with Tap Water Tank	Kamaraj Nagar	7-8m	Direct Impact	Will be relocated to the nearest place
12.400	RHS	Tube well	Vijaynarayan	10-12m	No Direct	



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

Chainage (Km)	Side	CPR	Village	Distance from CL (m)	Impact	Mitigation/Enhancement
		with Tap Water Tank	am		Impact	
16.300	RHS	Tube well with Tap Water Tank	South Vijaynarayan am	8-10m	Direct Impact	Will be relocated to the nearest place
34.000	LHS	Tube well and Chamber	Ovary	5m	Direct Impact	Will be relocated to the nearest place
34.400	LHS	Tube well and Chamber	Ovary	4m	Direct Impact	Will be relocated to the nearest place
34.580	LHS	Tube well and Chamber	Ovary	4.5m	Direct Impact	Will be relocated to the nearest place
34.650	LHS	Tube well and Chamber	Ovary	4m	Fully Impacted	Will be relocated to the nearest place
2.700	LHS	Over Head Water Supply Tank	EraippOvari	13m	No Direct Impact	
5.300	LHS	Tap Water Tank	Eamankulam	8m	Direct Impact	Will be relocated to the nearest place
10.800	RHS	Tap Water Tank	Elangulan	7m	Direct Impact	Will be relocated to the nearest place
13.100	RHS	Tap Water Tank	Vijaynarayan am	9-10m	No Direct Impact	
14.650	RHS	Open Water Tank	South Vijaynarayan am	5m	Direct Impact	Will be relocated to the nearest place
15.450	LHS	Tap Water Tank	South Vijaynarayan am	6.5m	Direct Impact	Will be relocated to the nearest place
16.300	LHS	Over Head Water Supply Tank	South Vijaynarayan am	10m	No Direct Impact	
24.800	RHS	Over Head Water Supply Tank	Kumaraapuram	11m	No Direct Impact	
25.300	LHS	Over Head Water Supply Tank	Kumaraapuram	12m	No Direct Impact	
27.800	LHS	Over Head Water Supply Tank	Bala Sithivanagar	7m	No Direct Impact	
29.500	RHS	Water Supply Tank (PHED)	Appuvilai	5.5m	No Direct Impact	
29.600	LHS	Over Head Water Supply Tank	Appuvilai	11m	No Direct Impact	
33.600	LHS	Over Head Water Supply Tank	Idaiyangudi	11m	No Direct Impact	





ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**Table 8-5: Ground water Sources along Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41- mitigation & Enhancement**

S.No	Chainage	Description	Category	Locaton	Mitigation or Enhancement
1.	5+410	Hand Pump	Hand Pump	RHS	Will be relocated to the nearest place as per RAP Drain and soak pit as per Drawing 8.2A
2.	17+390	Hand Pump	Hand Pump	LHS	
3.	18+060	Hand Pump	Hand Pump	RHS	
4.	18+080	Hand Pump	Hand Pump	RHS	
5.	18+100	Hand Pump	Hand Pump	RHS	
6.	21+570	Hand Pump	Hand Pump	RHS	
7.	74+680	Hand Pump	Hand Pump	RHS	
8.	73+880	Hand Pump	Hand Pump	LHS	
9.	14+380	Borewell Point	Borewell Point	LHS	Relocation as per RAP
10.	18+050	Open Bore Well	Bore well	RHS	Relocation as per RAP
11.	15+860	Open Well	Open Well	LHS	Will be relocated to the nearest place as per RAP Drain and soak pit as per Drawing 8.2B
12.	25+660	OHT TWAD	OHT	LHS	Relocation as per RAP
13.	70+720	Water Tank(PWD)	Water Tank	RHS	Relocation as per RAP
14.	74+760	Water Tank(PWD)	Water Tank	RHS	Relocation as per RAP
15.	74+840	(PWD)Open Bore Well and Hand Pump	Open Well	RHS	Will be relocated to the nearest place as per RAP Drain and soak pit as per Drawing 8.2B
16.	78+600	water tank(pwd)	Water Tank	RHS	
17.	74+580	open well	Open Well	LHS	Will be relocated to the nearest place as per RAP Drain and soak pit as per Drawing 8.2B
18.	16+290	TWAD	Water Tap	LHS	Relocation as per RAP
19.	16+980	TWAD	Water Tap	LHS	Relocation as per RAP
20.	17+030	TWAD	Water Tap	LHS	Relocation as per RAP
21.	17+040	TWAD	Water Tap	LHS	Relocation as per RAP
22.	17+290	TWAD	Water Tap	LHS	Relocation as per RAP
23.	18+000	TWAD	Water Tap	LHS	Relocation as per RAP
24.	18+060	TWAD	Water Tap	LHS	Relocation as per RAP
25.	18+400	TWAD	Water Tap	LHS	Relocation as per RAP
26.	23+890	TWAD	Water Tap	LHS	Relocation as per RAP
27.	23+890	TWAD	Water Tap	LHS	Relocation as per RAP
28.	24+600	TWAD	Water Tap	LHS	Relocation as per RAP
29.	25+560	TWAD	Water Tap	LHS	Relocation as per RAP



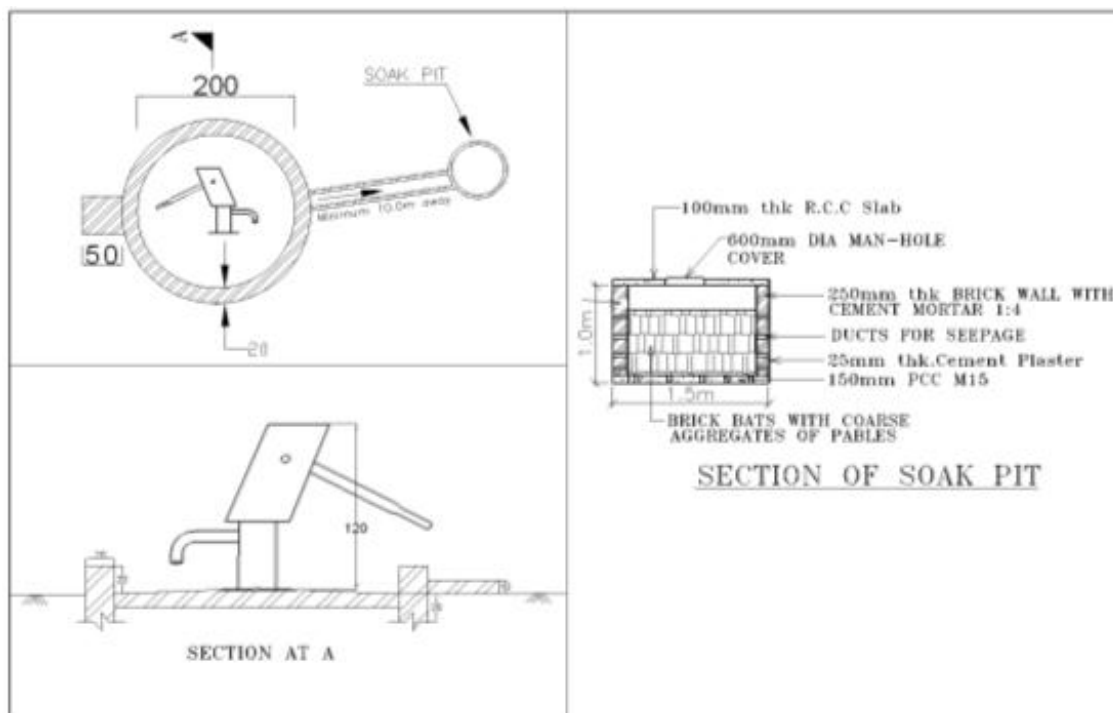
**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
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S.No	Chainage	Description	Category	Locaton	Mitigation or Enhancement
30.	25+920	TWAD	Water Tap	LHS	Relocation as per RAP
31.	26+050	TWAD	Water Tap	LHS	Relocation as per RAP
32.	26+220	TWAD	Water Tap	LHS	Relocation as per RAP
33.	71+680	TWAD	Water Tap	LHS	Relocation as per RAP
34.	72+280	TWAD	Water Tap	LHS	Relocation as per RAP
35.	72+780	TWAD	Water Tap	LHS	Relocation as per RAP
36.	72+980	TWAD	Water Tap	LHS	Relocation as per RAP
37.	72+980	TWAD	Water Tap	LHS	Relocation as per RAP
38.	73+550	TWAD	Water Tap	LHS	Relocation as per RAP
39.	74+320	TWAD	Water Tap	LHS	Relocation as per RAP
40.	79+890	TWAD	Water Tap	LHS	Relocation as per RAP
41.	82+780	TWAD	Water Tap	LHS	Relocation as per RAP

Note: OHT: Over Head Tank: RAP Resettlement Action Plan

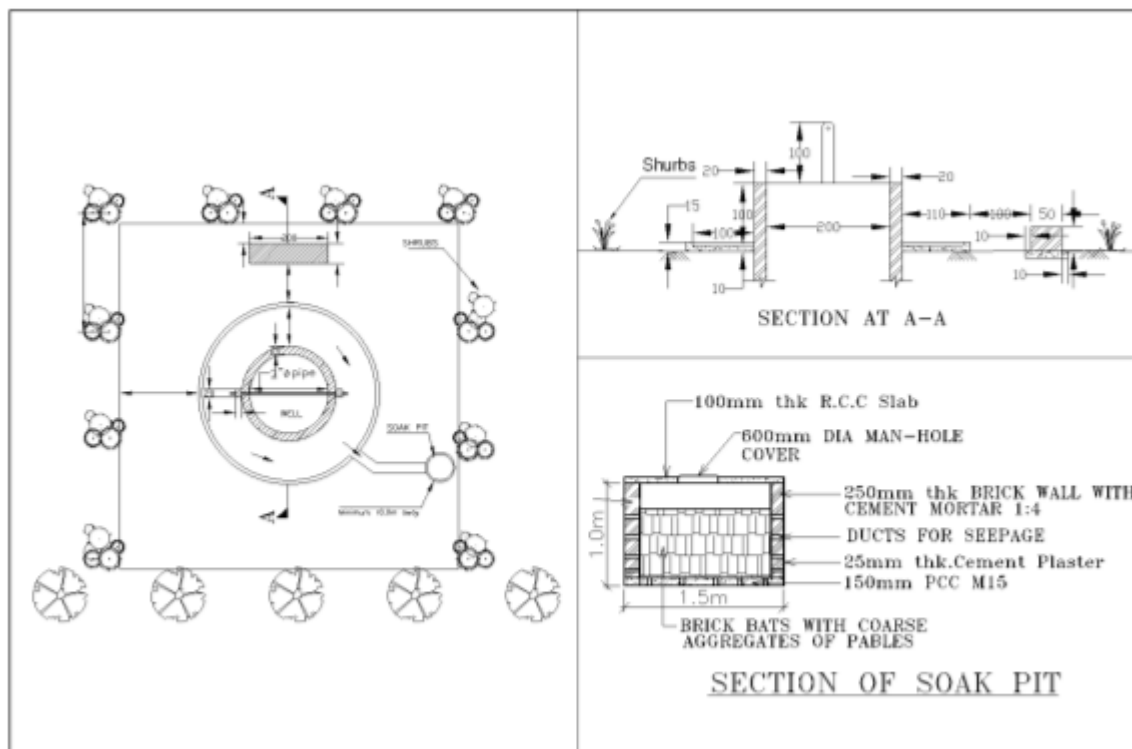
Any source of community water (potable or otherwise) such as open wells, ponds, tube-wells and over head tanks, accidentally lost will be replaced immediately. The location and sitting of the replaced source of water will be as close as possible to the original source.

The project road passes through over exploited region of Tamil Nadu, loss of water has sever impact, hence soak pits are provided for the waste water from the hand pump to recharge the ground water, which otherwise would have lost by evaporation. The typical layout of the soak pit is presented below in **Drawing No. 8.2 A** and **Drawing No. 8.2 B**.



**Drawing No. 8.2 A: Conceptual plan of Soak Pit for Hand Pump**

**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
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**Drawing No. 8.2 B: Conceptual Plan of Soak Pit for Open Well**

#### 8.4.4 Alteration of cross drainage

- Roadside drainage is designed for a 25-year return period of rainfall of appropriate duration as suggested in IRC: SP-42. The proposed roadside drainage arrangements are designed for efficient collection and disposal of storm water. A detailed hydrological study had been carried to calculate the design discharge.
- Storm water from all longitudinal and cross drainage works will be connected to the natural drainage courses.
- 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 ponds.
- Side drains are provided on both sides of the road, obstruction if any to be removed immediately.

#### 8.4.5 Runoff and drainage

- Lined drain is provided at identified stretches in built-up locations for quick drainage.
- Recharge pits are provided in urban stretches where pucca drain is proposed
- Increased runoff due to increased impervious surface is countered through increased pervious surface area through soak pits proposed in built up areas.
- The local bodies need to discourage /stop the filling of private water bodies, ponds etc to develop commercial places and shops due to the improved roads and improved connectivity

### 8.4.6 Water Requirement for Project

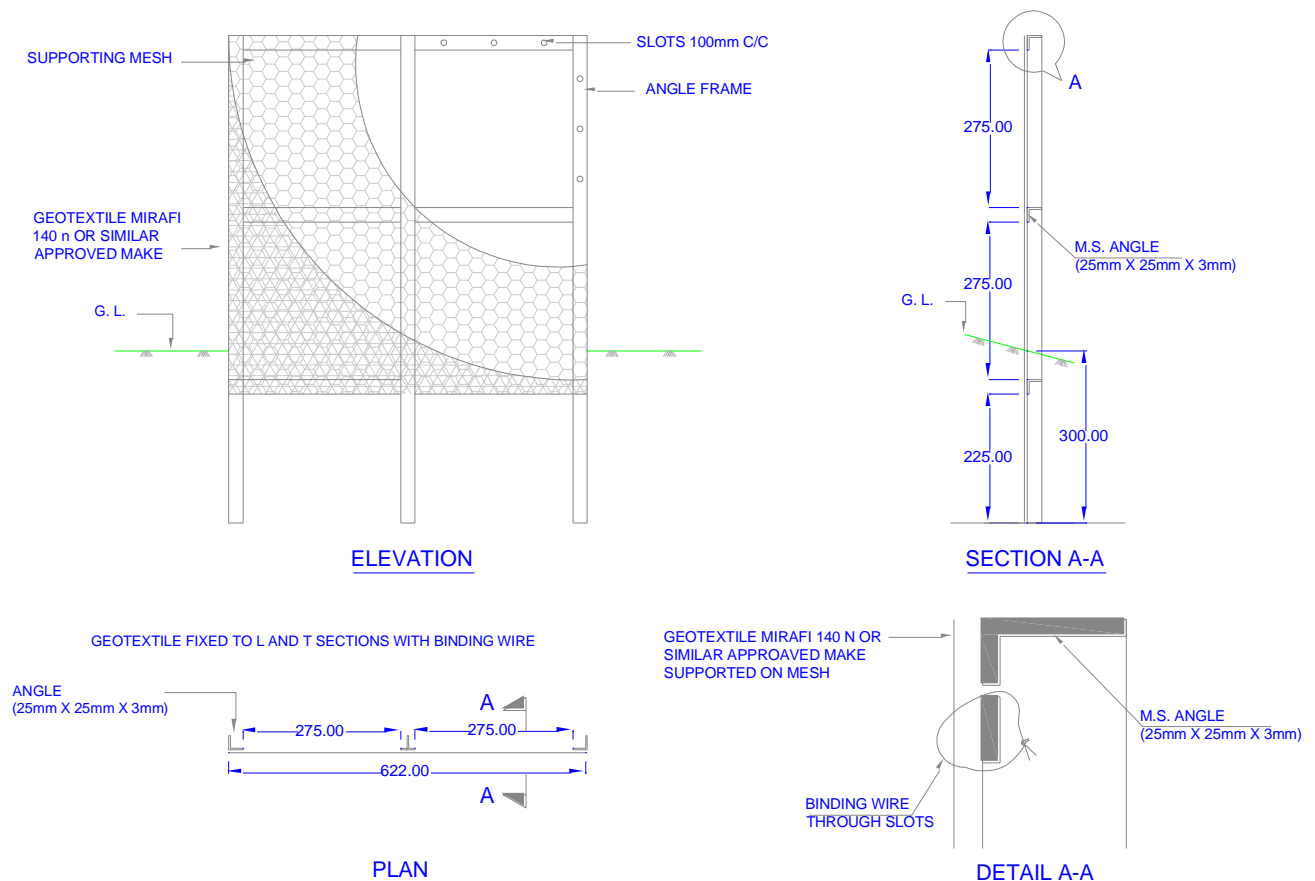
Acquisition and management of water for construction is an issue that must be addressed by the contractor. The Contractor is expected to obtain water for construction purposes that is of a high water quality.

- Contractor needs to obtain approvals for taking adequate quantities of water from surface and ground water sources. This is required to avoid depletion of water resources.
- Contractor is required to minimise wastage of water.
- Water conservation methods to be adopted during construction process to make optimum use of water.

### 8.4.7 Water Quality

#### a) Increased sedimentation

- Silt fencing will be provided along nearby water bodies (ponds and canal)
- Desilting will be done for the existing ponds/water bodies along project roads
- Desilting of the waste water will be ensured before the discharge of drain water into natural stream
- Instructions given in **Appendix 8.7: Guidelines for Sediment Control** to be enforced



Drawing No. 8.3: Conceptual plan of silt fencing.



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b) Contamination of water.

- Oil interceptor will be provided at plant site
- Construction work close to the streams or water bodies will be avoided during monsoon.
- The discharge standards promulgated under the Environmental Protection Act, 1986 will be strictly adhered to. All wastes arising from the project will be disposed off in a manner that is acceptable to the State Pollution Control Board (SPCB).
- All relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Service) Act, 1996 will be adhered to.
- Construction labourers' camps will be located at least 1000m away from the nearest habitation.
- Unless otherwise authorised by the local sanitary authority, arrangements for proper disposal of excreta by incineration at the workplace suitably approved by the local medical health or municipal authorities will be made.
- All approach roads to rivers and other surface water bodies need to be closed permanently to avoid vehicle washing and to avoid major pollution sources. This applicable to all areas including the secondary construction sites.
- Automotive service centres will be discouraged from establishing along the corridors with out installing preventive measures against petroleum and oil contamination.

#### 8.4.8 Water Quality Monitoring – mitigation

Apart from provision of the mitigation measures, their effectiveness and further improvement in designs to reduce the concentration of pollutants in the soil due to construction activity shall be monitored, as contamination of soil is directly linked with contamination of water. The monitoring plan shall be functional in construction as well as in operation stages. The frequency, duration and responsibility will be as per the **Appendix 8.1: Guidelines for Monitoring Program**. For location refer Table 1.2: Ambient Water Quality Monitoring Locations. Standard/acceptable values are given in Appendix 4.2b. Any value/result not within acceptable limits will be reported to engineer, for remedial measures.

### 8.5 NOISE ENVIRONMENT-MITIGATION MEASURES

Environmental noise particularly highway traffic noise, is a complex phenomenon because its intensity and characteristics vary with time depending upon the frequency as well as type of vehicles on the road.

No.	Item	Impact	Impact (Reason)	Mitigation/Enhancement
1a	Noise Pollution (Pre-Construction Stage)	Direct impact, short duration	Man, material & machinery movements Establishment of labor camps onsite offices, stock yards and construction plants	<ul style="list-style-type: none"> <li>• Area specific and for short duration</li> <li>• Machinery to be checked &amp; complied with noise pollution regulations.</li> <li>• Camps to be setup away from the settlements, in the down wind direction.</li> </ul>



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No.	Item	Impact	Impact (Reason)	Mitigation/Enhancement
1b	Noise Pollution (Construction Stage)	Marginal Impact	stone crushing, asphalt production plant and batching plants, diesel generators etc  Community residing near to the work zones	<ul style="list-style-type: none"> <li>Camps to be setup away from the settlements, in the down wind direction.</li> <li>Noise pollution regulation to be monitored and enforced.</li> <li>Temporary as the work zones will be changing with completion of construction</li> </ul>
1c	Noise Pollution (Operation Stage) Sensitive receptors	Direct impact	Increase in noise pollution	<ul style="list-style-type: none"> <li>2-3 ROWs of trees are recommended around such receptors which will act as vegetative barrier.</li> <li>Traffic calming devices to be used.</li> <li>No Horn Zone sign Post.</li> <li>will be compensated with the uninterrupted movement of heavy and light vehicles till the facility reaches the level of service C.</li> </ul>
3	Noise Pollution Monitoring		Effectiveness / shortfall (if any) Any unforeseen impact	<ul style="list-style-type: none"> <li>Measures will be revised &amp; improved to mitigate/ enhance environment due to any unforeseen impact.</li> </ul>

### 8.5.1 Sensitive Receptors – mitigation

The baseline noise levels monitored along sensitive receptors along project roads are within permissible limits (Refer Table 4.21).

Temporary noise barriers shall be provided during construction stage to avoid noise impact on urban areas.

Requirement of any noise barrier along these locations will be analysed during construction period based on projected traffic.

### 8.5.2 Noise Pollution – Mitigation

- Noise standards will be strictly enforced for all vehicles, plants, equipment, and construction machinery. All construction equipment used for an 8-hour shift will conform to a standard of less than 90dB (A). If required, high noise producing generators such as concrete mixers, generators, graders, etc. must be provided with noise shields.
- Machinery and vehicles will be maintained regularly, with particular attention to silencers and mufflers, to keep construction noise levels to minimum.
- Workers in the vicinity of high noise levels will be provided earplugs, helmets and will be engaged in diversified activities to prevent prolonged exposure to noise levels of more than 90dB(A) per 8 hour shift.





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- During construction vibratory compactors will be used sparingly within the urban areas. In case of complaints from roadside residents, the engineer will ask the site engineer to take suitable steps of restricting the work hours even further or use an alternative roller.
- Proposed tree and shrub plantations planned for avenue plantation especially close to settlements, may form an effective sound buffer during the operation stage.
- People will be convinced / educated to prevent sensitive land uses from developing up adjacent to the project corridors.

### 8.5.3 Noise Pollution Monitoring – mitigation

Apart from provision of the mitigation measures, their effectiveness and further improvement in designs to reduce the concentration of pollutants in the soil due to construction activity shall be monitored, as contamination of soil is directly linked with contamination of water. The monitoring plan shall be functional in construction as well as in operation stages. The frequency, duration and responsibility will be as per the **Appendix 8.1: Guidelines for Monitoring Program**. For location refer Table 1.2: Ambient Noise Quality Monitoring Locations. National Ambient Noise Quality Standards are provided in Appendix 4.2c. Any value/result not within acceptable limits will be reported to engineer, for remedial measures.

### 8.6 FLORA & FAUNA – MITIGATION

The major impact in this project on flora involves the removal of trees to permit construction and to provide clear zone for safety of the road users. No wild life habitat/wild life crossing has been observed along the project corridors. However, Koonthakulam Bird Sanctuary is located at a distance of 7.5 km from Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89 (from km 13.000).

Trees located within the clear zone need to be removed to prevent collision with the trees, in case of accident. Roadside trees with strong and rigid stems can pose safety hazards. Some trees obstruct clear sight distances; others may have a propensity to overturn when old and are potential safety hazards depending upon age and decay condition. All such trees that are safety hazards need to be cleared.

Sr.No.	Item	Impact	Impact (Reason)	Mitigation/ Enhancement
1	Forest area	No Impact	No Forest land involved	Nil
2	Wild Life	<ul style="list-style-type: none"> <li>▪ Indirect impact (Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89)</li> <li>▪ Indirect impact (Rajapalayam-Sankarankoil-Tirunelveli section of SH-41)</li> <li>▪ No Impact</li> </ul>	Koonthakulam Bird Sanctuary located at 7.5 km distance from SH89  Srivilliputtur Grizzled Squirrel Wildlife Sanctuary located at 6.0km distance from strat point of SH41	No widening is proposed in road stretches falling within 10km buffer zone from sanctuary. Only 2 lane without paved shoulder is proposed in these stretches.  Signboards (depicting sanctuary name and distance) shall be displayed at start and end locations of project road's stretch falling within 10km radius of sanctuary <ul style="list-style-type: none"> <li>▪ For section of SH41 :at Km0/000 and km 6/000</li> <li>▪ For section of SH89: at km 0/000 and km 15/500</li> </ul>



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Sr.No.	Item	Impact	Impact (Reason)	Mitigation/ Enhancement
		(Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44)		
3	Trees Cutting	Direct impact	<ul style="list-style-type: none"> <li>▪ Increase in soil erosion, silting of water bodies</li> <li>▪ Dust &amp; noise pollution</li> <li>▪ Loss of shade &amp; loss of tree products</li> </ul>	<ul style="list-style-type: none"> <li>▪ Maximum deviation in alignment design to save the road side trees</li> <li>▪ Compensatory tree plantation in the ratio of 1:10, i.e. for each tree cut, ten saplings will be planted</li> <li>▪ Avenue plantation along corridor</li> </ul>
4	Vegetation	Direct Impact	<ul style="list-style-type: none"> <li>▪ Increase in soil erosion, silting of water bodies</li> <li>▪ Dust &amp; noise pollution</li> </ul>	<ul style="list-style-type: none"> <li>▪ Clearing and grubbing will be minimized, and sprinkled with water to reduce dust pollution.</li> <li>▪ Exposed surface like embankment slopes will be protected with stone pitching and turfing</li> <li>▪ Open land in and around plant will be vegetated</li> </ul>
5	Cattle Grazing	No Impact	No cattle grazing found	Nil

### 8.6.1 Forest Area – Mitigation

There is no involvement of forest area in the project.

### 8.6.2 Wild Life – Mitigation

No wild life habitat/wild life crossing has been observed along the project corridor. However, Koonthakulam Bird Sanctuary is located at a distance of 7.5 km from SH-89 and Srivilliputtur Grizzled Squirrel Wildlife Sanctuary located at 6.0km distance from start point of SH41 (km 13.000)

- No widening is proposed in road stretches falling within 10km buffer zone from sanctuary. Only 2 lane without paved shoulder is proposed in these stretches.
- Signboards (depicting sanctuary name and distance) shall be displayed at start and end locations of project road's stretch falling within 10km radius of sanctuary
  - For section of SH41 : at Km0/000 and at km 6/000
  - For section of SH89: at km 0/000 and at km 15/500
- Strict vigil during construction stage to be maintained that sand, stones pebbles and other material to be used in widening of the road should be brought from outside of the sanctuary area

### 8.6.3 Trees – Mitigation

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 objective of planting trees at selected enhancement sites and against the felled trees is as



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follows:

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

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

- a) Transplantation of trees (girth size up to 30 cm): suggested 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**

Transplantation can be done for the trees with girth size up to 30 cm.

**Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44:** Based on the actual site condition of existing tree species, 194 trees have been identified for transplantation out of total 351 no. of trees of girth size <30cm. Major species, which can be transplanted, are Neem, Tamarind, Manjanathi and Poonga.

**Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89:** As per the actual scenario of existing tree species, 110 trees have been identified for transplantation out of total 251 no. of trees of girth size <30cm. Major species, which can be transplanted, are Neem, Manjanathi, Poovarasu and Arasas.

**Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41:** Based on the actual condition of existing tree species at site, 362 trees have been identified for transplanted out of total 1015 no. of trees of girth size <30cm. Major species, which can be transplanted is Neem.

The chainage and species wise details of trees <30 cm which can be transplanted are enclosed in **Appendix 8.9** and guidelines for transplantation is provided in **Appendix 8.10**.

#### **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. Refer **Appendix 8.11: Arrangement for Compensatory Plantation**. To minimise loss of trees, clearance of only those trees identified from the design will be removed. Endangered species, if found during construction, are



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suggested to be transplanted as per the Appendix 8.10: Guidelines for Transplantation of Trees. For compensatory plantation, 10-times plantation against each felled tree of >30 cm girth size has been considered.

**Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44**

1190 trees of girth size > 30 cm need to be uprooted along the alignment of SH-44 because of project intervention. Following the above guideline, 11,900 trees are recommended for plantation against felled trees >30cm girth size. Tree fencing will be provided for saplings.

Depending on the area available at ground within EROW, 18,083 trees (9803 on LHS and 9000 on RHS) trees can be planted along SH-44. The area available throughout the stretch is not homogenous. Therefore, 1/2/3 rows plantation has been taken care in small patch, depending on availability of area. A total of 11,900 saplings (details as given above) can be planted in these available areas along the road as a part of compensatory plantation. Leftover area after compensatory plantation will be used for avenue plantation (6183 no. of saplings).

**Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89**

773 trees of girth size > 30 cm need to be uprooted along the alignment of SH-89 because of project intervention. Following the guideline mentioned above, 7730 trees are recommended for plantation against felled trees >30cm girth size.

Depending on the area available at ground within EROW, 7217 trees (3900 on LHS and 3317 on RHS) trees can be planted along SH-89. The area available throughout the stretch is not homogenous. Therefore, 1/2/3 rows plantation has been taken care in small patch, depending on availability of area. A maximum of 7217 saplings can only be planted in this available area along the road as a part of compensatory plantation. Remaining 513 sapling plantation will be taken up along with avenue plantation.

**Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41**

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.

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.



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### 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 50 saplings can be planted as an enhancement along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44, details are as below:

- As part of the enhancement measure, 18 trees will be planted around existing pond (Chainage 54+500) along SH-44.(Refer Drawing no. 2 of Appendix 8.8)
- Available land has been identified in front of a house owned by Late M. K. Bharthiyar' (Freedom fighter) at in between chainage 55+600 and 55+700 on LHS along SH-44. A total of 32 trees can be planted in that area along with other enhancement facilities. .(Refer Drawing no. 3 of Appendix 8.8)

Flowering and fruit bearing trees like *Delonix elata*, *Morinda tomentosa*, *Crataeva religiosa*, *Mangifera indica* may be planted in such places. Refer Appendix 8.12: Selection of tree Species.

A total of around 90 saplings can be planted as an enhancement measure along Rajapalayam-Sankarankoil-Tirunelveli section of SH-41, 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 earthen embankment of existing pond (Chainage 11+250).(Refer Drawing no. 2 of Appendix 8.8)

Ornamental and fruit bearing trees like *Sesbania grandiflora*, *Delonix elata*, *Morinda tomentosa*, *Psidium guajava* may be planted in such places. Refer **Appendix 8.12: Selection of Tree Species**.

### d) Avenue Plantation

In addition to the compensatory plantation, trees shall be planted along the project corridors by the TNRSP through Contractors. Such 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. 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

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 instead of 3m (as considered in compensatory plantation). Refer **Appendix 8.13: Avenue Plantation**

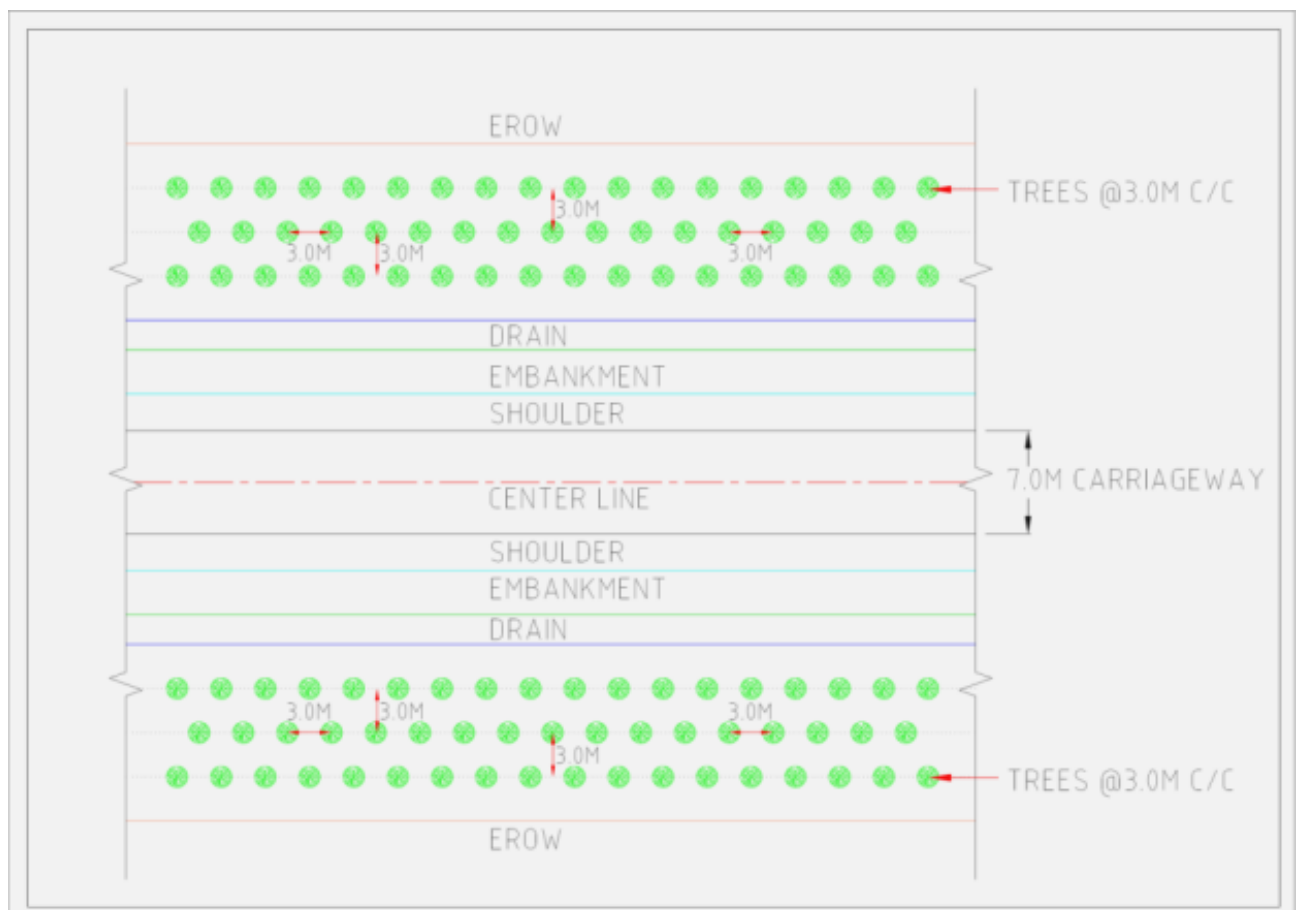
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**Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44:** Out of total length, 19.330 km is rural stretch, where 7732 nos. of saplings can be planted covering both side of this stretch.

**Nanguneri - Bharatavaram Ovari Road upto ECR Junction, Section of SH 89:** Out of total length, 24.185 km is rural stretch, where 9674 nos. of saplings can be planted covering both side of this stretch.

**Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41**

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, which will be considered as compensatory plantation (total 39,230 saplings is to be planted). Remaining 16,801 saplings (compensatory plantation) will be planted in the space between PRow and ERow (considering 3 m c/c spacing, Refer Drawing 8.4), wherever available.



**Drawing No. 8.4: Conceptual Plan for Avenue Plantation**

#### e) Plantation at Realignment Section

In the realignment sections, saplings can be planted along the edge of existing road wherever barren land is available.





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### 8.6.4 Vegetation - Mitigation

High embankment will be re-vegetated with local shrubs and grasses to prevent soil erosion from the bare earth, prior to the monsoon.

### 8.6.5 Cattle Grazing - Mitigation

No cattle grazing seen along the corridor.

## 8.7 SOCIO-ECONOMIC ENVIRONMENT - MITIGATION

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

- General impacts that apply to the entire corridor,
- Specific impacts on likely properties and PAPs, within the Corridor of Impact (CoI) of the project corridor.

### 8.7.1 General Impacts – Mitigation

Sr. No.	Item	Impact	Impact (Reason)	Mitigation/Enhancement
1	Fear of uncertainties regarding future	Direct, long Impact	Land and property owners are subjected to sufferings regarding uncertainties of the extent of loss and the nature of compensation	Public participation sessions were/will be conducted in different stages of project.
2	Inducement of land prices	Direct impact	Danger of unscrupulous speculators moving in to purchase land	Market Value Assessment Committee will decide the actual cost of land
3	Inducement of squatter influx	Direct impact	Squatters may attempt to occupy adjacent land in the hope of receiving compensation undue pressure on local resources	The dates of base-line socio-economic survey have been considered as cut off date for identification of project affected people PAP.
4	Loss of utilities and amenities	Direct Impact	Natural (trees, bushes and grasslands), and Physical structures (public or private assets and utilities).	Relocation of utilities will be completed prior to start of project work. These have been further discussed in details in RAP
5a	Public Health and Safety	High direct	Psychological impacts on their owners and others	Advance notice will be given to the owners of the affected



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Sr. No.	Item	Impact	Impact (Reason)	Mitigation/Enhancement
		adverse impact	associated with them.  Debris generated	properties.  Debris, so generated will be disposed to the satisfaction of Engineer. Refer Appendix 8.4: Guidelines for Debris Disposal Site and Management.  Monitoring of air, water, noise and land during construction and operation phase. Refer Appendix 8.1: Guidelines for Monitoring Program.  Refer Appendix 8.14: Guidelines for Environment Friendly construction Methodology.
5b	Allied activities	Indirect Impact	Social and economic life of the local population due to quarrying and crushing operations, traffic diversions, etc.  traffic jams and congestion, loss of access and other road accident risks  temporary land acquisition	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.
5d	Accidents and Safety	Direct Impact	School children  ladies carrying pots full of water	The contractor will provide, erect and maintain barricades, including signs marking flags lights and flagmen as required by the Engineer.
6	Resettlement of People	In direct impact	Pressure on civil amenities, water sources, grazing lands, fuel wood, medical facilities etc.	A comprehensive resettlement action plan has been prepared to improve the standard of living of the affected population



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Sr. No.	Item	Impact	Impact (Reason)	Mitigation/Enhancement
7	Land Use Changes	Indirect impact	Succession of land uses and higher return uses would displace the lower return uses at major intersections and in settlement areas.  Urban fringe areas will be subjected to ribbon development.	Project is widening of existing roads, hence no major change in land use pattern is envisaged along the project road.
8	Disturbance to road side services	Indirect Impact	Some Shops may be shifted, no income from highway users hence loss of service to the local people	The cleaning of such informal establishment will be carried out as phase-wise resettlement Programme
9	Removal of encroachments and squatters	Indirect impact	loss of shelter  disturbance to family and community life	Impact will be avoided by implementation of phase-wise resettlement action Programme
10	Sensitive community facilities	Indirect impact	Loss of community facilities or institutions	Discussed in detail in following paragraphs.

❖ **Fear of uncertainties regarding future**

The Project is only of widening and strengthening of the existing roads, and within the confines of the existing ROW, the fear of uncertainties is most likely limited to the people squatting and encroaching in the ROW. At places where the community utilities are to be affected a certain amount of anxiety will be among the people in that particular community.

To remove such fear from the people, public participation sessions were/will be conducted in different stages of project, viz. pre-design, design, pre-construction and construction.

In the pre-design stage, a comprehensive socio-economic survey was conducted to prepare base line status of the households squatting or encroached upon the ROW. During the survey each households were contacted/interviewed and they were explained about the purpose of the survey, need of the project and benefits associated with the project etc.

The second stage of public participation was in the form of village meetings, focus group discussion, individual interviews, voluntary and academic institution consultation.

The third stage of participation session will start before pre-construction. The EMU will verify and consult the individual EPs with the help of an NGO for distribution of ID card. At this stage the EPs will be explained about their entitlement and R&R framework.



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All people likely to be displaced will be informed in advance through NGO by a time bound Programme about resettlement to remove fear of uncertainty.

During the construction stage the consultation process will continue to avoid any inconvenience to the community at any point of time.

#### ❖ **Inducement of Land Prices**

As the project becomes common knowledge, the land prices along the corridor will increase. For realignment and geometric improvement of highway, extra additional land may be required; Market Value Assessment Committee will decide the actual cost of such land. The actual cost of land may be different from induced land cost. The MVAC have time bound Programme to calculate the actual cost of land. In calculating the actual land cost individual project affected person (PAP) & NGOs will be involved.

#### ❖ **Inducement of Squatter Influx**

Once the project becomes common knowledge, people may attempt to occupy the land along the corridor in anticipation of compensation. To avoid such, the dates of base-line socio-economic survey have been considered as cut off date for identification of project affected people, who are eligible for compensation. The cut off dates will be used to establish whether a person located in the right way qualifies as a PAP for the disbursement of compensation. All the PAPs recorded during socio-economic baseline survey are eligible for compensation after verification by EMU.

#### ❖ **Loss of utilities and amenities**

The site clearance for construction of road may result in loss or relocation of certain utilities and amenities, viz. electricity, water and telephone line etc. People dependent upon these utilities and amenities may experience inconvenience and economic loss. Though such impacts are unavoidable keeping in mind the scale of work, but every care will be taken in co-ordination with concerned departments, to restore the facility within shortest possible time to avoid any prolonged hardship or inconvenience to the community. Similarly other utilities like water source, cattle trough etc. will be constructed or replaced at appropriate place with the consent of community prior to dismantling the existing one.

#### ❖ **Public Health and Safety**

During the Pre-construction and Construction Phases dismantling of the structures for Col clearance and road construction may result in health hazards. To minimise this potential negative impact the following recommendations should be adopted:

- To avoid the psychological impacts due to the demolition of properties on the owners and other tenants. The advance notice as per RAP will be given to the owners of the affected properties. An advance notice will be served at least four months before construction commences. For squatters needing relocation, all R&R activities will be undertaken and entitlements will be completed before construction starts.
- Debris generated from the demolition of properties will be properly disposed of to avoid the health problems in the safeties. Earth material, if required will be dumped in borrow areas as approved by the engineer. Borrow areas will be filled to avoid health hazards



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Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

from stagnant water collecting in these areas. The contractor will make all arrangements for dismantling and cleaning up of debris. Implementation will be as per the approval and direction of the engineer.

- Instructions as given in **Appendix 8.14: Guidelines for Environment Friendly Construction Methodology**, to be enforced

a) Allied activities during construction period may cause local disruption:

In the construction phase, there may be inconvenience to the local people as well as the highway passengers due to traffic jams and congestion, loss of access and other road accident risk as a result of construction. Detailed traffic control plans shall be prepared and submitted to the engineer for approval 5 days prior to commencement of work on any section of road. In the preparation of the traffic control plan special consideration shall be given to the safety of pedestrians and workers at night.

b) Accidents and Safety

To avoid the accidents during construction phase, contractor shall take all necessary measures to ensure traffic safety. The contractor will provide, erect and maintain barricades, including signs marking flags lights and flagmen as required by the Engineer.

In the operation phase, traffic control measures such as speed breakers and sign boards (including speed limits) will be provided and strictly enforced in residential areas, near schools and water bodies like ponds and wells.

#### ❖ **Resettlement of People**

People displaced from their home and livelihood on account of the proposed activity will be taken care in the project. A comprehensive resettlement action plan is being prepared to improve the standard of living of the affected population if not at least restore their livelihood and regaining their former standard of living (Refer Resettlement Action Plan Report).

#### ❖ **Land Use Changes**

As regards land use changes, it is likely that the impact would be very minimal. Since the project is widening of road within the existing ROW, the possibility of major land acquisition is not envisaged. In design stage utmost care has been taken to keep the land acquisition at minimal for road realignment and geometric purpose. The probable impact on road-side business and trees within ROW has been reduced and avoided through design.

#### ❖ **Disturbance to Roadside Service**

Along the highway, near settlements, small shops serve the local people as well as highway users. Some of these shops are within the ROW. To avoid any impact on livelihood of people dependent on roadside business, the cleaning of such informal establishment will be carried out as phase-wise resettlement Programme. Loss of livelihood of the displaced shop owners will be compensated as per assistance or entitlements in Entitlement Framework of Tamil Nadu.

#### ❖ **Removal of Encroachments and Squatters**

The impact due to removal of encroachments and squatters will be avoided by implementation of phase-wise resettlement action Programme. To avoid the severance of impact, advance



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notice will be given to the encroachers and squatters. The notice will be given four months prior to construction phase starts. Relocation of all such impacted persons will be as per R&R schedule.

#### ❖ **Sensitive Community Facilities**

The impacts due to project on the sensitive community facilities or institution along the project corridor such as education institution, health facilities, a number of recreational facilities and others like ponds and cultural community assets avoided in the design phase of the project. These are discussed in detail in subsequent paragraphs.

### **8.7.2 Specific Impacts – Mitigation**

#### ❖ **Sensitive Community Structures**

A no. of sensitive community assets exists within the Corridor of Impact.

Mitigation and enhancement measures for such structures are provided in Social Impact Assessment Report, Volume-VIIB, DPR.

Besides mitigation & enhancement, following measures will be taken for safety of the locals:

- Local people will be informed about the schedule of construction activity, so that the local people remain prepared in advance.
- The existing sign boards will not be removed but shifted to appropriate place during construction, so that people don't find problem in identifying the tourist/religious place.
- During construction proper demarcation and sign board, indicators and flag man will be deputed for safe traffic movement. (Refer drawing 8.5)

Also, as a part of enhancement measures, it is proposed to enhance the identified available land in front of a house owned by Late M. K. Bharthiyar' located on LHS of SH44 between chainage 55+600 and 55+700. Enhancement measures will include facilities like bench, shady trees, solar street light and landscaping. (Refer **Drawing no. 3 of Appendix 8.8**)

## **8.8 BUS SHELTER AND BUS BAYS**

As a part of road improvement, bus shelters will be constructed/repared at all built up locations. The same has been considered under utility shifting plan.

### **Truck Layby and Parking Area**

There is no existing or proposed truck lay bye along SH44 and SH89

## **8.9 AVOIDANCE OF DISRUPTION AND SAFETY RISKS DURING THE CONSTRUCTION STAGE**

### **8.9.1 Disruption to the community**

#### ❖ **Loss of access**

At all times, the Contractor will provide safe and convenient passage for vehicles, pedestrians and livestock to and from side roads and property accesses connecting the project road. Work



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that affects the use of side roads and existing accesses will not be undertaken without providing adequate provisions.

The works will not interfere unnecessarily or improperly with the convenience of public or the access to, use and occupation of public or private roads, railways and any other access footpaths to or of properties whether public or private.

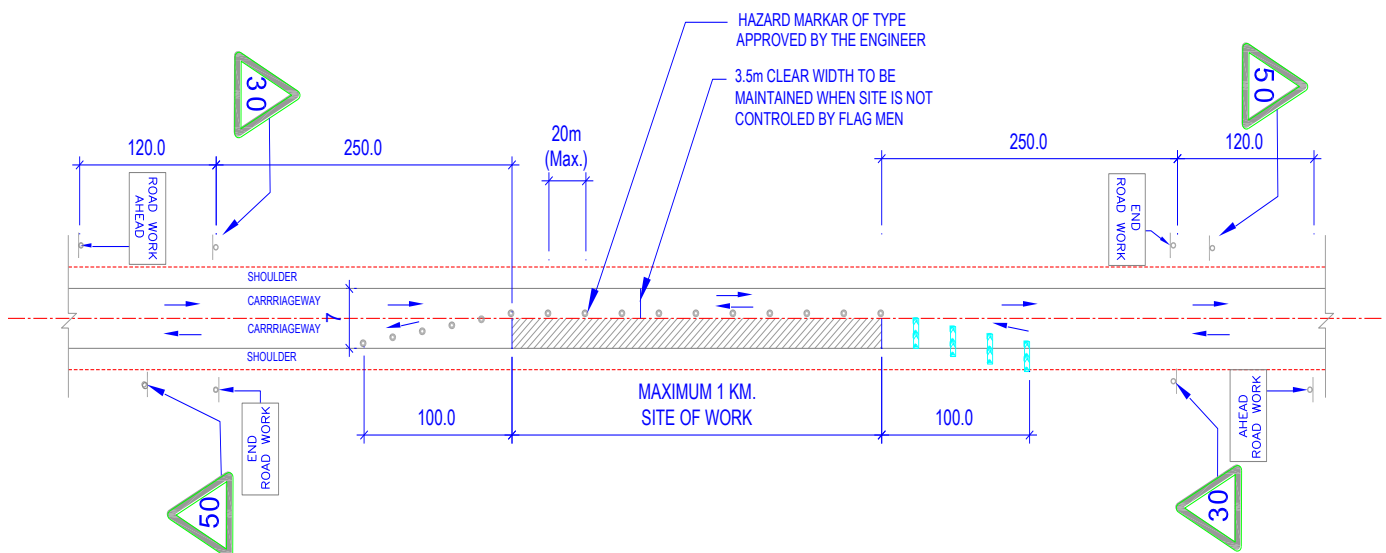
❖ **Traffic jams, congestion and safety**

Detailed Traffic Control Plans will be prepared prior to commencement of works on any section of road. The traffic control plans will contain details of temporary diversions, details of arrangements for construction under traffic and details of traffic arrangement after cessation of work each day.

Temporary diversion (including scheme of temporary and acquisition) will be constructed with the approval of the Engineer and the EMU. Special consideration will be given in the preparation of the traffic control plan to the safety of pedestrians and workers at night.

The Contractor will ensure that the running surface is always properly maintained, particularly during the monsoon so that no disruption to the traffic flow occurs. The temporary traffic detours will be kept free of dust by frequent application of water, if necessary.

The Contractor will take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as may be required by the Engineer for the information and protection of traffic approaching or passing through the section of the highway under improvement.



**Drawing No. 8.5: Conceptual Plan for traffic Diversion**

### 8.9.2 Safety of the workers

- Refer **Appendix 8.6:** Guidelines for Sitting and Layout of Construction Camp.



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- Refer **Appendix 8.14**: Guidelines for Environment Friendly Construction Methodology.
- Refer **Appendix 8.15**: Guidelines for Workers Safety During Construction.
- Refer **Appendix 8.16**: Guidelines for Storage, Handling Use And Emergency.

❖ **Risk from operations**

The Contractor is required to comply with all the precautions as required for the safety of the workmen as per the International Labour Organisation (ILO) Convention No. 62 as far as those are applicable to this contract. The contractor will supply all necessary safety appliances such as safety goggles, helmets, masks, etc., to the workers and staff. The contractor has to comply with all regulation regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress.

❖ **Risk from electrical equipment**

Adequate precautions will be taken to prevent danger from electrical equipment. No material or any of the sites will be so stacked or placed as to cause danger or inconvenience to any person or the public. All necessary fencing and lights will be provided to protect the public. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provisions and to the satisfaction of the Engineer.

❖ **Risk at hazardous activity**

All workers employed on mixing asphaltic material, cement, lime mortars, concrete etc., will be provided with protective footwear and protective goggles. Workers, who are engaged in welding works would be provided with welder's protective eye-shields. Stone-breakers will be provided with protective goggles and clothing and will be seated at sufficiently safe intervals.

The use of any herbicide or other toxic chemical will be strictly in accordance with the manufacturer's instructions. The Engineer will be given at least 6 working days notice of the proposed use of any herbicide or toxic chemical. A register of all herbicides and other toxic chemicals delivered to the site will be kept and maintained up to date by the Contractor. The register will include the trade name, physical properties and characteristics, chemical ingredients, health and safety hazard information, safe handling and storage procedures, and emergency and first aid procedures for the product.

❖ **Risk of lead pollution**

No man below the age of 18 years and no woman will be employed on the work of painting with products containing lead in any form. No paint containing lead or lead products will be used except in the form of paste or readymade paint. Face masks will be supplied for use by the workers when paint is applied in the form of spray or a surface having lead paint dry rubbed and scrapped.

❖ **Risk caused by force' majeure**

All reasonable precaution will be taken to prevent danger of the workers and the public from fire, flood, drowning, etc. All necessary steps will be taken for prompt first aid treatment of all



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injuries likely to be sustained during the course of work.

#### ❖ **Risk from explosives**

Except as may be provided in the contract or ordered or authorised by the Engineer, the Contractor will not use explosives. Where the use of explosives is so provided or ordered or authorised, the Contractor will comply with the requirements of the following Sub-Clauses of this Clause besides the law of the land as applicable: (also refer **Appendix 8.16: Storage, Handling use and emergency response for hazardous chemicals**)

- The Contractor will at all times take every possible precaution and will comply with appropriate laws and regulations relating to the importation, handling, transportation, storage and use of explosives and will, at all times when engaged in blasting operations, post sufficient warning flagmen, to the full satisfaction of the Engineer.
- The Contractor will at all times make full liaison with and inform well in advance and obtain such permission as is required from all Government Authorities, public bodies and private parties whatsoever concerned or affected or likely to be concerned or affected by blasting operations.

#### ❖ **Malarial risk**

The Contractor will, at his own expense, conform to all anti-malarial instructions given to him by the Engineer, including filling up any borrow pits which may have been dug by him.

Borrow pits and any other water bodies created during the construction process will be situated 1 to 2km away from the human settlements. Pits dug up closer than these will be adequately drained to prevent water logging.

Similarly compensatory measures for filling up part of the water bodies situated adjacent to the project corridors will be directed towards deepening of the water bodies concerned. This way the capacity of the water body remains the same, while water surface available for breeding of mosquitoes is reduced. This will have an additional advantage of decreased evaporation losses, which will be important in water-scarce corridors.

#### ❖ **First aid**

At every workplace, a readily available first aid unit including an adequate supply of sterilised dressing material and appliances will be provided as per the Factory Rules. Workplaces remote and far away from regular hospitals will have indoor health units with one bed for every 250 workers. Suitable transport will be provided to facilitate take injured or ill person(s) to the nearest applicable hospital. At every workplace an ambulance room containing the prescribed equipment and nursing staff will be provided as prescribed.

#### ❖ **Potable water**

In every workplace at suitable and easily accessible places a sufficient supply of cold potable water (as per IS) will be provided and maintained. If the drinking water is obtained from an intermittent public water supply then, storage tanks will be provided. All water supply storage will be at a distance of not less than 15m from any latrine, drain or other source of pollution. Where water has to be drawn from an existing well, which is within such proximity of any latrine,



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drain or any other source of pollution, the well will be properly chlorinated before water is drawn from it for drinking water. All such wells will be entirely closed in and be provided with a trap door, which will be dust proof and waterproof. A reliable pump will be fitted to each covered well. The trap door will be kept locked and opened only for cleaning or inspection, which will be done at least once a month.

#### ❖ Hygiene

The Contractor during the progress of work will provide, erect and maintain necessary (temporary) living accommodation and ancillary facilities for labour to standards and scales approved by the resident engineer. Refer Appendix 8.6: Sitting and layout of construction Camp.

These will be provided within the precincts of every workplace, latrines and urinals in an accessible place, and the accommodation, separately for each for these, as per standards set by the Building and other Construction Workers (regulation of Employment and Conditions of Service) Act, 1996. Except in workplaces provided with water-flushed latrines connected with a water borne sewage system, all latrines will be provided with dry-earth system (receptacles) which will be cleaned at least four times daily and at least twice during working hours and kept in a strict sanitary condition. Receptacles will be tarred inside and outside at least once a year. If women are employed, separate latrines and urinals, screened from those for men and marked in the vernacular will be provided. There will be adequate supply of water, close to latrines and urinals.

All temporary accommodation must be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking and washing. 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. Compliance with the relevant legislation must be strictly adhered to. Garbage bins must be provided in the camp and regularly emptied and the garbage disposed off in a hygienic manner. Construction camps are to be sited away from vulnerable people and adequate health care is to be provided for the work force.

Unless otherwise arranged for by the local sanitary authority, arrangement for proper disposal of excreta by incineration at the workplace will be made by means of a suitable incinerator approved by the local medical health or municipal authorities. Alternatively, excreta may be disposed off by putting a layer of night soils at the bottom of a permanent tank prepared for the purpose and covering it with 15 cm layer of waste or refuse and then covering it with a layer of earth for a fortnight (by then it will turn into manure).

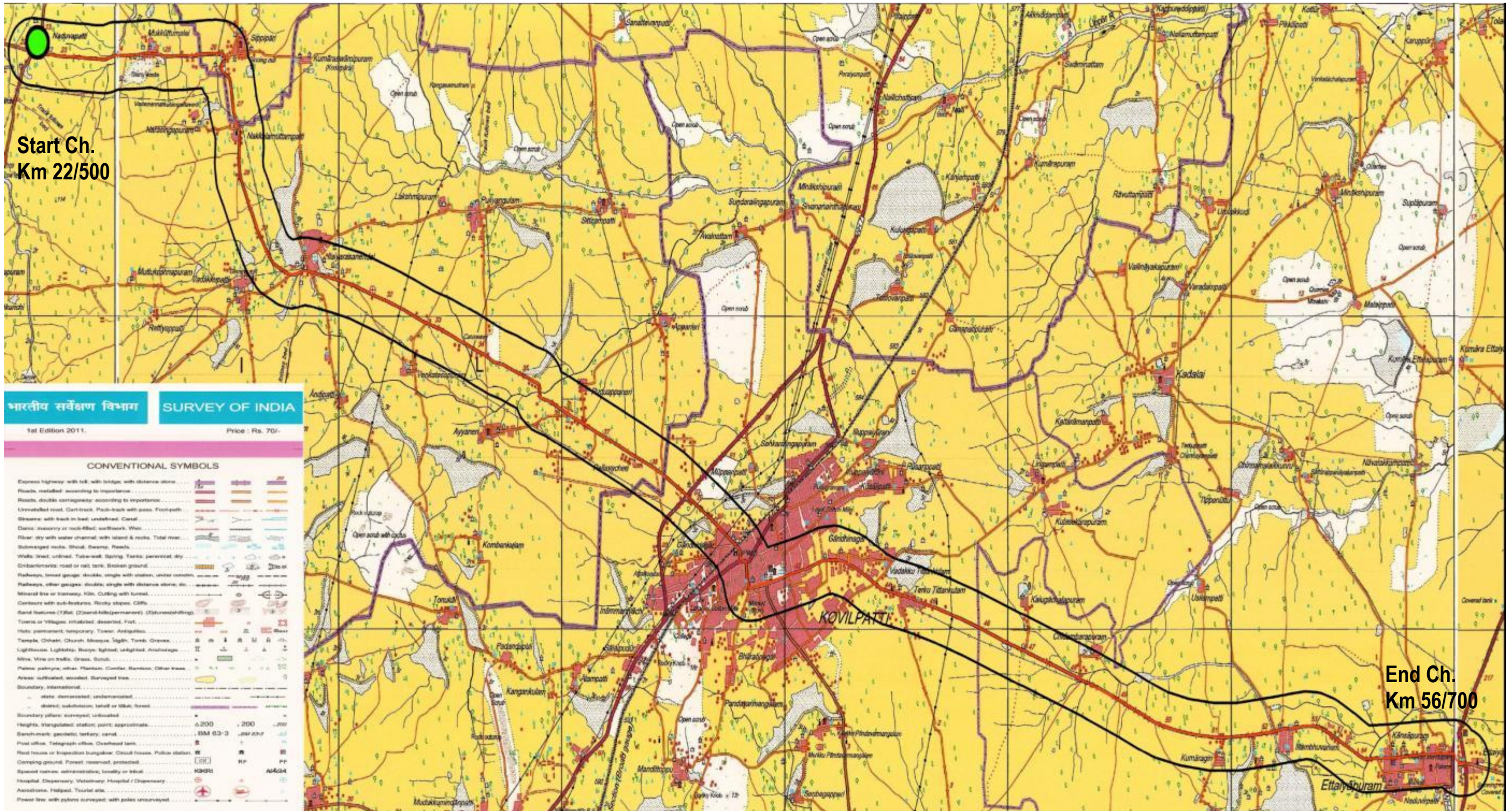
On completion of the works, the whole of such temporary structures will be cleared away, all rubbish burnt, excreta or other disposal pits or trenches filled in and effectively sealed off and the whole of the site left clean and tidy, at the Contractor's expense, to the entire satisfaction of the Engineer



# APPENDICES



APPENDIX 1.1: TOPOSHEETS SHOWING 500M BUFFER AREA AROUND PROJECT ROADS

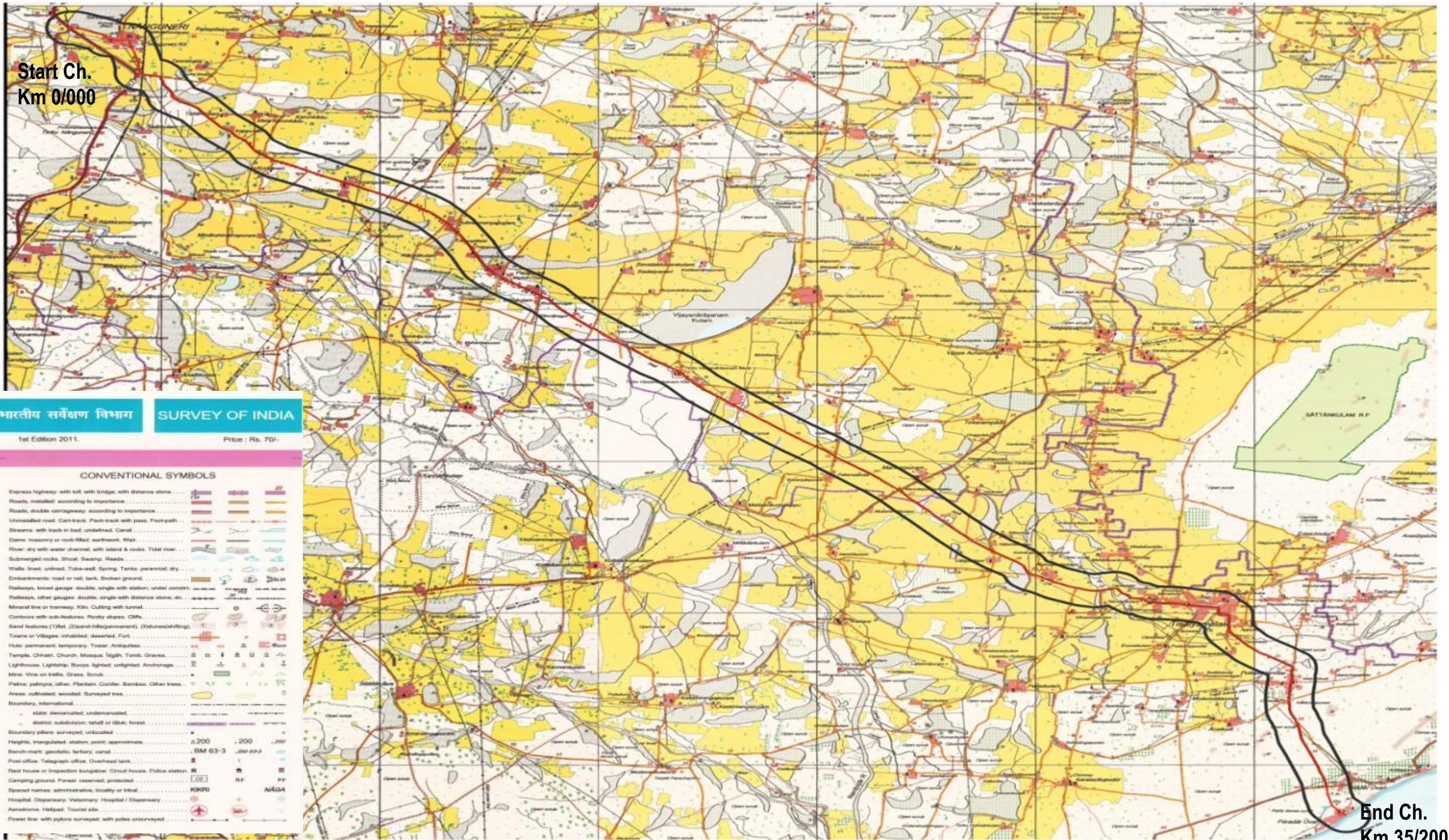


Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44





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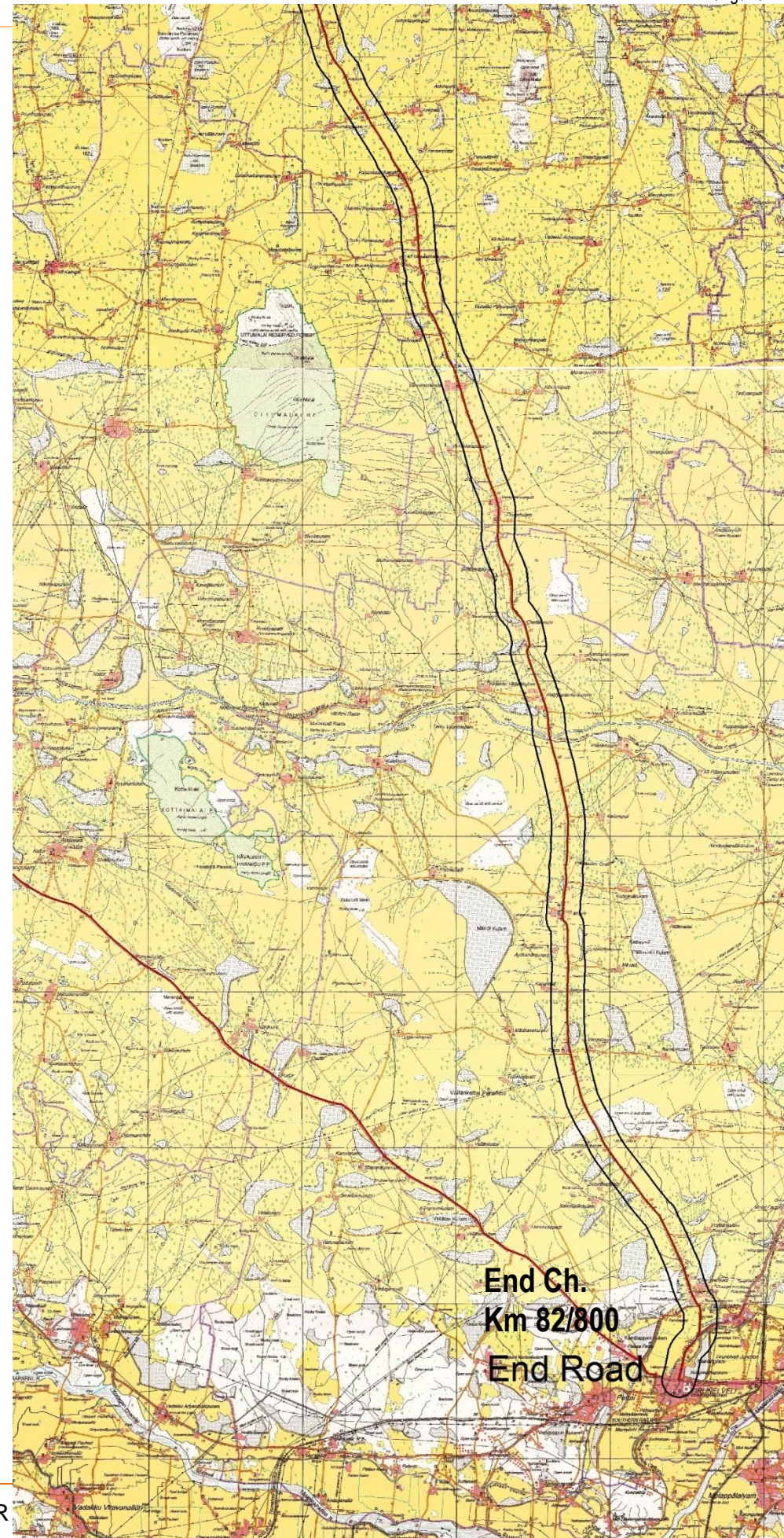
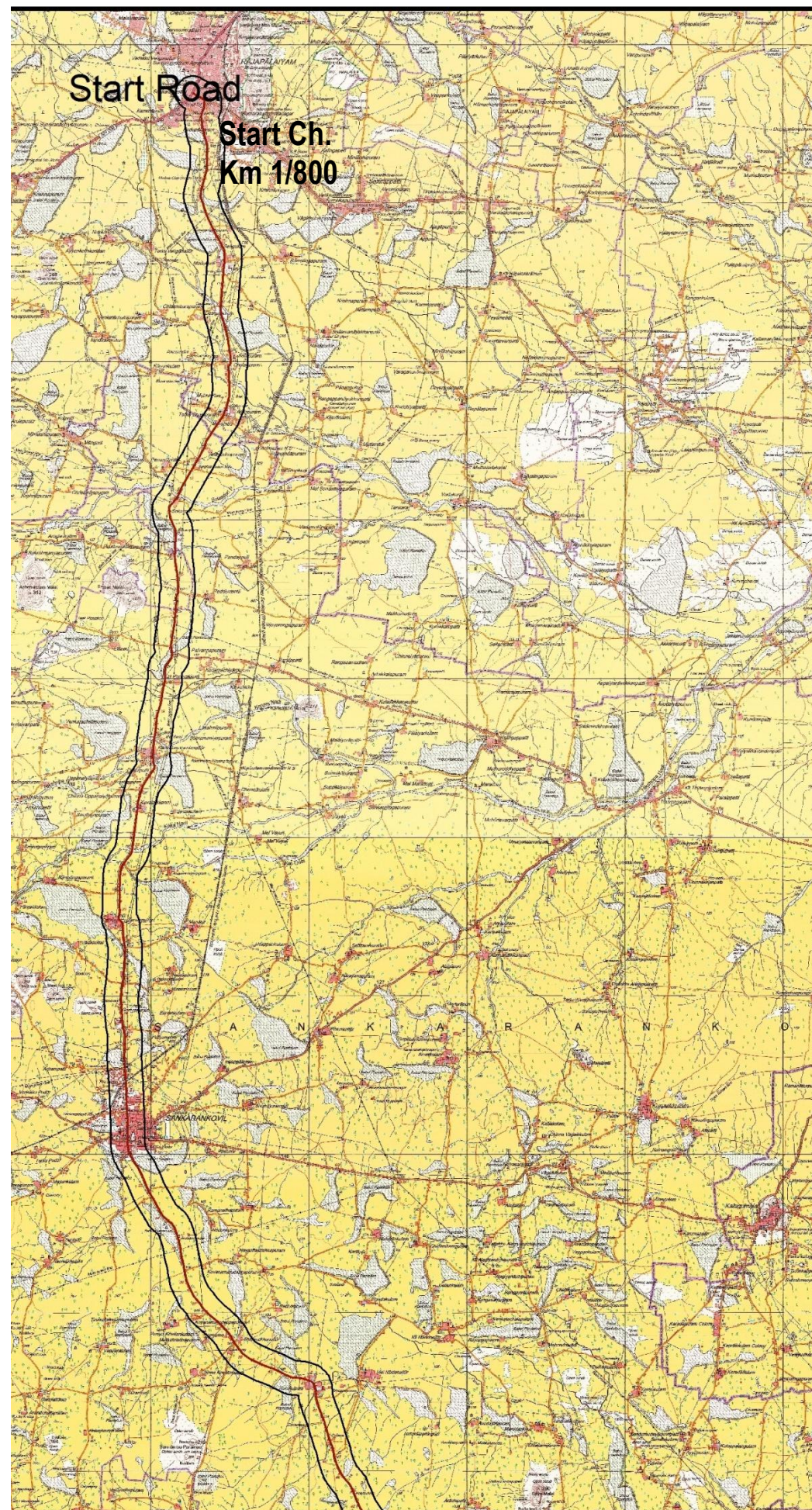


Nanguneri - Bharatavaram - Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89





ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44 Nanguneri - Bharatavaram - Ovari Road upto ECR Junction(Km 0/000 to Km 35/200), Section of SH 89 koil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41



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CONVENTIONAL SYMBOLS

Express highway: with toll; with bridge; with distance stone		20
Roads, metalled: according to importance		75#
Roads, double carriageway: according to importance		20
Unmetalled road. Cart-track. Pack-track with pass. Foot-path		
Streams: with track in bed; undefined. Canal		
Dams: masonry or rock-filled; earthwork. Weir		
River: dry with water channel; with island & rocks. Tidal river		
Submerged rocks. Shoal. Swamp. Reeds		
Wells: lined; unlined. Tube-well. Spring. Tanks: perennial; dry		
Embankments: road or rail; tank. Broken ground		
Railways, broad gauge: double; single with station; under constrn.		20
Railways, other gauges: double; single with distance stone; do.		RS
Mineral line or tramway. Kiln. Cutting with tunnel		
Contours with sub-features. Rocky slopes. Cliffs		
Sand features: (1)flat. (2)sand-hills(permanent). (3)dunes(shifting)		
Towns or Villages: inhabited; deserted. Fort		
Huts: permanent; temporary. Tower. Antiquities		
Temple. Chhatri. Church. Mosque. Idgah. Tomb. Graves		
Lighthouse. Lightship. Buoys: lighted; unlighted. Anchorage		
Mine. Vine on trellis. Grass. Scrub		
Palms: palmyra; other. Plantain. Conifer. Bamboo. Other trees		
Areas: cultivated; wooded. Surveyed tree		
Boundary, international		
.. state: demarcated; undemarcated		
.. district; subdivision; tahsil or taluk; forest		
Boundary pillars: surveyed; unlocated		
Heights, triangulated: station; point; approximate		200 .200 .200
Bench-mark: geodetic; tertiary; canal		BM 63.3 .BM 63.3 .63
Post office. Telegraph office. Overhead tank		
Rest house or inspection bungalow. Circuit house. Police station		
Camping ground. Forest: reserved; protected		RF PF
Spaced names: administrative, locality or tribal		KIKRI NAGA
Hospital. Dispensary. Veterinary: Hospital / Dispensary		
Aerodrome. Heliport. Tourist site		
Power line: with pylons surveyed; with poles unsurveyed		

Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41





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## APPENDIX 2.1: EROW DETAILS OF PROJECT ROADS

### Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22+500 to km 38+750 and km 41+300 to km 56+700), Section of SH44

S.NO	Existing Chainage		EROW (m)
	From (km)	To (km)	
1	22+500	23+000	17.4
2	23+000	24+000	26.4
3	24+000	25+000	21.4
4	25+000	26+000	18.1
5	26+000	27+000	26
6	27+000	28+000	25.7
7	28+000	29+000	20
8	29+000	30+000	17.7
9	30+000	31+000	25.7
10	31+000	32+000	24.44
11	32+000	33+000	32.08
12	33+000	34+000	27.53
13	34+000	35+000	21.1
14	35+000	36+000	21.6
15	36+000	37+000	27.85
16	37+000	38+000	27.25
17	38+000	39+000	20.23
18	39+000	40+000	16.7
19	40+000	41+000	18.3
20	41+000	42+000	22.5
21	42+000	43+000	20.5
22	43+000	44+000	24
23	44+000	45+000	27.3
24	45+000	46+000	34.2
25	46+000	47+000	33.76
26	47+000	48+000	37.03
27	48+000	49+000	32.8
28	49+000	50+000	33.5
29	28+000	51+000	26.5
30	51+000	52+000	28
31	52+000	53+000	41.8
32	53+000	54+000	28.04



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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S.NO	Existing Chainage		EROW (m)
	From (km)	To (km)	
33	54+000	55+000	32.56
34	55+000	56+000	15.5
35	56+000	57+000	16

Source: SIA Report, DPR, Volume VII B

**Nanguneri - Bharatavaram Ovary Road upto ECR Junction  
 (km 0+000 to km 35+200), Section of SH 89**

S.NO	Existing Chainage		EROW (m)
	From (km)	To (km)	
1	0+000	1+000	31.75
2	1+000	2+000	24.06
3	2+000	3+000	33.3
4	3+000	4+000	23.85
5	4+000	5+000	26.3
6	5+000	6+000	27.6
7	6+000	7+000	23.2
8	7+000	8+000	24
9	8+000	9+000	22.36
10	9+000	10+000	19.34
11	10+000	11+000	25.62
12	11+000	12+000	24.95
13	12+000	13+000	29.81
14	13+000	14+000	23.23
15	14+000	15+000	17.33
16	15+000	16+000	20.57
17	16+000	17+000	23.01
18	17+000	18+000	23.33
19	18+000	19+000	18.01
20	19+000	20+000	21.86
21	20+000	21+000	19.93
22	21+000	22+000	20.09
23	22+000	23+000	20.3
24	23+000	24+000	22.62
25	24+000	25+000	30.4
26	25+000	26+000	22.17
27	26+000	27+000	21.91
28	27+000	28+000	22.11



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S.NO	Existing Chainage		EROW (m)
29	28+000	29+000	10.15
30	29+000	30+000	19.08
31	30+000	31+000	13.95
32	31+000	32+000	8.38
33	32+000	33+000	18.9
34	33+000	34+000	11.5
35	34+000	35+000	7.45

Source: SIA Report, DPR, Volume VIIB

**Rajapalayam - Sankarankoil – Tirunelveli**  
**(km 1+800 to km 28+000 and km 33+800 to km 82+800), Section of SH41**

S.NO	Existing Chainage		EROW (m)
	From (km)	To (km)	
1.	1+000	2+000	10-20m
2.	2+000	3+000	20-23m
3.	3+000	4+000	25-28m
4.	4+000	5+000	16-27m
5.	5+000	6+000	13-27m
6.	6+000	7+000	17-25m
7.	7+000	8+000	12-27m
8.	8+000	9+000	12-30m
9.	9+000	10+000	16-23m
10.	10+000	11+000	15-25m
11.	11+000	12+000	20-25m
12.	12+000	13+000	15-35m
13.	13+000	14+000	20-35m
14.	14+000	15+000	20-30m
15.	15+000	16+000	25-30m
16.	16+000	17+000	25-30m
17.	17+000	18+000	20-28m
18.	18+000	19+000	22-28m
19.	19+00	20+000	15-25m
20.	20+000	21+000	20-28m
21.	21+000	22+000	25-27m
22.	22+000	23+000	15-25m
23.	23+000	24+000	25-27m
24.	24+000	25+000	15-25m
25.	25+000	26+000	25-30m
26.	26+000	27+000	25-30m
27.	27+000	28+000	20-25m



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
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 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**Rajapalayam - Sankarankoil – Tirunelveli**  
**(km 1+800 to km 28+000 and km 33+800 to km 82+800), Section of SH41**

S.NO	Existing Chainage		EROW (m)
	From (km)	To (km)	
28.	28+000	29+000	15-25m
29.	29+000	30+000	15-25m
30.	30+000	31+000	13-25m
31.	31+000	32+000	10-15m
32.	32+000	33+000	15-25m
33.	33+000	34+000	20-30m
34.	34+000	35+000	15-30m
35.	35+000	36+000	20-30m
36.	37+00	37+000	25-35m
37.	37+000	38+000	25-35m
38.	38+000	39+000	15-35m
39.	39+000	40+000	20-30m
40.	40+000	41+000	12-30m
41.	41+000	42+000	12-25m
42.	42+000	43+000	20-28m
43.	43+000	44+000	15-28m
44.	44+000	45+000	28-33m
45.	45+000	46+000	18-29m
46.	46+000	47+000	26-34m
47.	47+000	48+000	12-28m
48.	48+000	49+000	18-33m
49.	49+000	50+000	27-47m
50.	50+000	51+000	25-46m
51.	51+000	52+000	30-40m
52.	52+000	53+000	30-35m
53.	53+00	54+000	14-25m
54.	54+000	55+000	20-28m
55.	55+000	56+000	25-30m
56.	56+000	57+000	25-35m
57.	57+000	58+000	12-28m
58.	58+000	59+000	12-25m
59.	59+000	60+000	25-33m
60.	60+000	61+000	25-35m
61.	61+000	62+000	20-39m
62.	62+000	63+000	25-45m
63.	63+000	64+000	20-30m
64.	64+000	65+000	15-30m
65.	65+000	66+000	28-33m





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

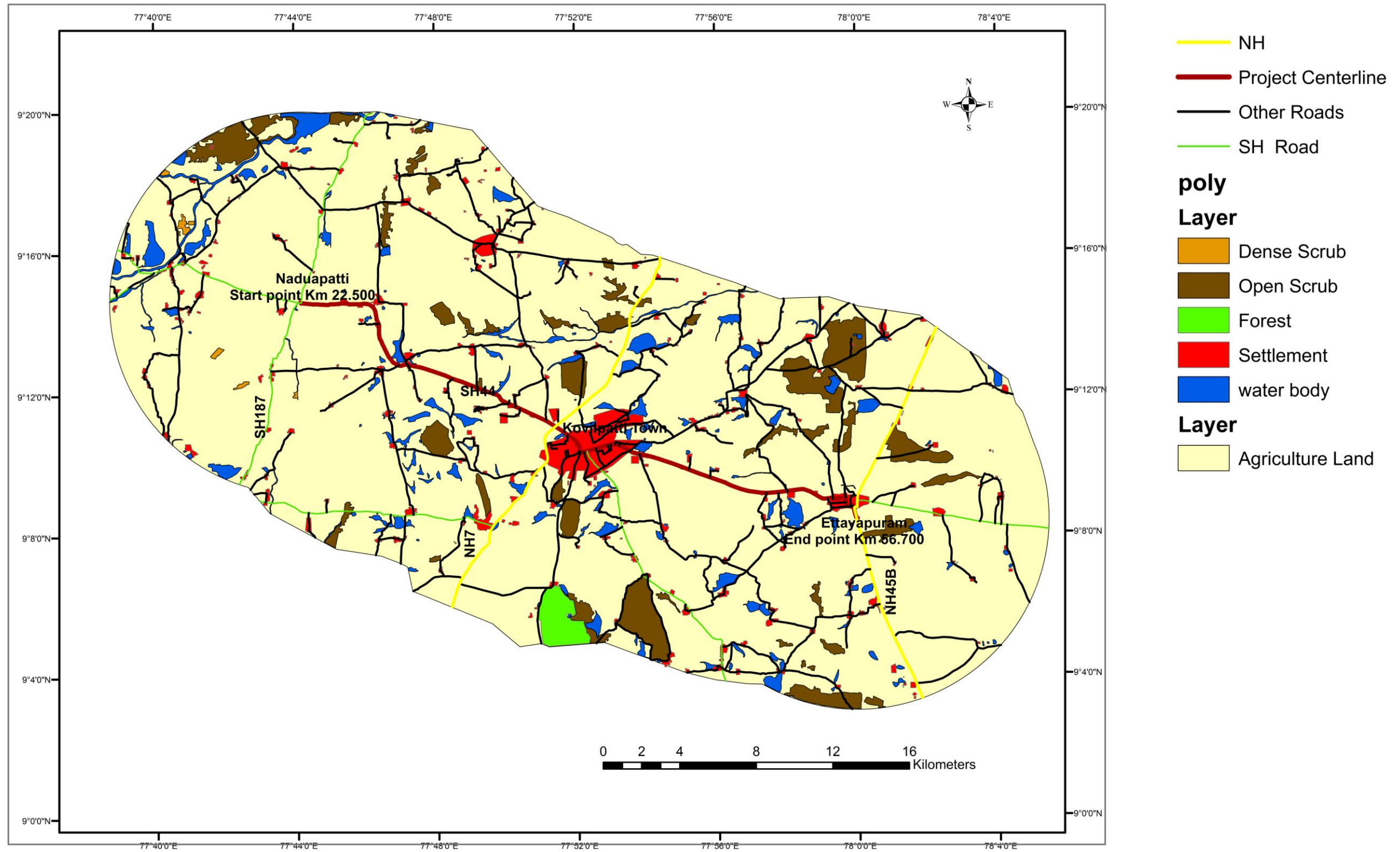
**Rajapalayam - Sankarankoil – Tirunelveli**  
**(km 1+800 to km 28+000 and km 33+800 to km 82+800), Section of SH41**

S.NO	Existing Chainage		EROW (m)
	From (km)	To (km)	
66.	66+00	67+000	30-38m
67.	67+000	68+000	25-47m
68.	68+000	69+000	25-35m
69.	69+000	70+000	25-35m
70.	70+00	71+000	13-20m
71.	71+000	72+000	15-35m
72.	72+000	73+000	15-25m
73.	73+000	74+000	20-35m
74.	74+000	75+000	15-30m
75.	75+000	76+000	25-35m
76.	76+000	77+000	25-38m
77.	77+000	78+000	30-37m
78.	78+000	79+000	25-35m
79.	79+000	80+000	30-50m
80.	80+000	81+000	25-33m
81.	81+000	82+000	25-35m
82.	82+000	83+000	15-20m

Source: SIA Report, DPR, Volume VII B



### APPENDIX 2.2: LAND USE MAP OF PROJECT ROADS WITHIN 10KM RADIUS OF PROJECT ROADS

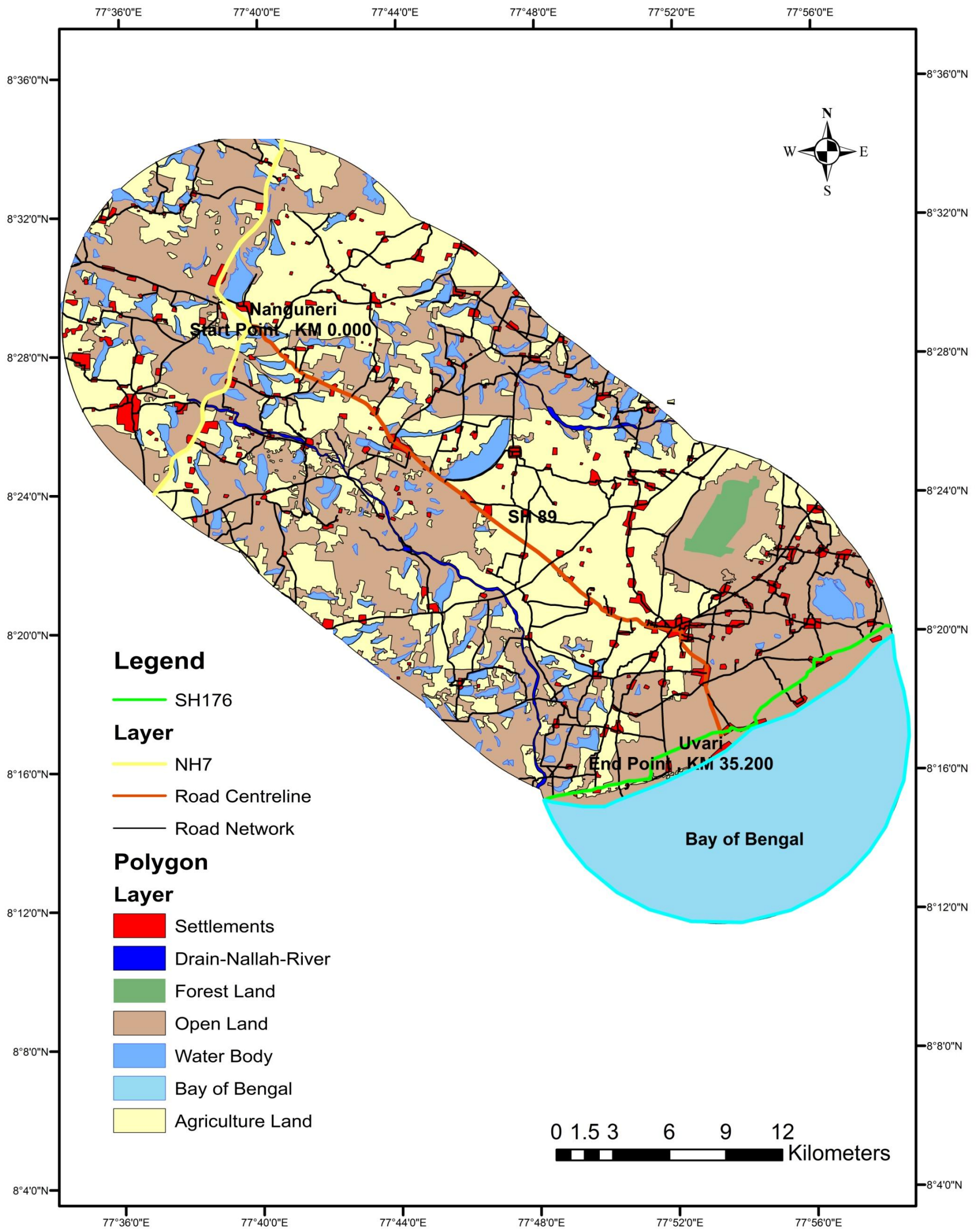


Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44





ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44 Nanguneri - Bharatavaram - Uvari Road (Km 0/000 to Km 35/200), Section of SH 89 Rajapalayam-Sankarankovil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41



Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89





Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41



# ENVIRONMENTAL ANALYSIS REPORT



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<b>Date</b>	
<b>Report</b>	Environmental Analysis Report (SH-44,SH-39,SH-89)
<b>Prepared by</b>	Miss, S.Prabha, Senior Chemist
Signature	
<b>Reviewed by</b>	Mr. T.Jeenly Xavier Anand, Lab In Charge
Signature	
<b>Approved by</b>	Mr. A. Jawahar, Quality Manager
Signature	



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## INTRODUCTION

SMEC India Pvt. Ltd ,Gurgaon (smec India ) is deputed Green Chem Solutions (P) Ltd, Chennai (GCSPL) for monitoring Ambient Air , Ambient Noise , Ground Water, Surface water and Soil quality in different locations of the Project Road (SH-44,SH-39,SH-89) This will helps to identify and evaluate the environmental effects arising from the existing/proposed activities in selected sites and execute mitigation measures to avoid or reduce the environmental impacts.

### Ambient Air Quality:

Figure 1,2 and 3 shows the details of the selected air quality monitoring (fifteen) stations in SH-44, SH-39, SH-89. The monitoring of ambient air quality parameter specified by CPCB at these sites was carried out during the month of the mar-2014. Samples were collected at the selected sites for a period of about four weeks in march-2014. Table.1 shows the schedule of monitoring at selected sites.

Table: 1.Monitoring Schedule

Site Code	First Week		Second Week		Third Week		Fourth week	
	First Time	Second Time	First Time	Second Time	First Time	Second Time	First Time	Second Time
SH-44	26.02.2014	03.03.2014	07.03.2014	10.03.2014	14.03.2014	17.03.2014	21.03.2014	24.03.2014
	To 27.02.2014	To 04.03.2014	To 08.03.2014	To 11.03.2014	To 15.03.2014	To 18.03.2014	To 22.03.2014	To 25.03.2014
SH-39	27.02.2014	02.03.2014	06.03.2014	09.03.2014	13.03.2014	16.03.2014	20.03.2014	23.03.2014
	To 28.02.2014	To 03.03.2014	To 07.03.2014	To 10.03.2014	To 14.03.2014	To 17.03.2014	To 21.03.2014	To 24.03.2014
SH-89	01.03.2014	04.03.2014	08.03.2014	11.03.2014	15.03.2014	18.03.2014	22.03.2014	25.03.2014
	To 02.03.2014	To 05.03.2014	To 09.03.2014	To 12.03.2014	To 16.03.2014	To 19.03.2014	To 23.03.2014	To 26.03.2014





Figure.1 Map showing project Road SH-44

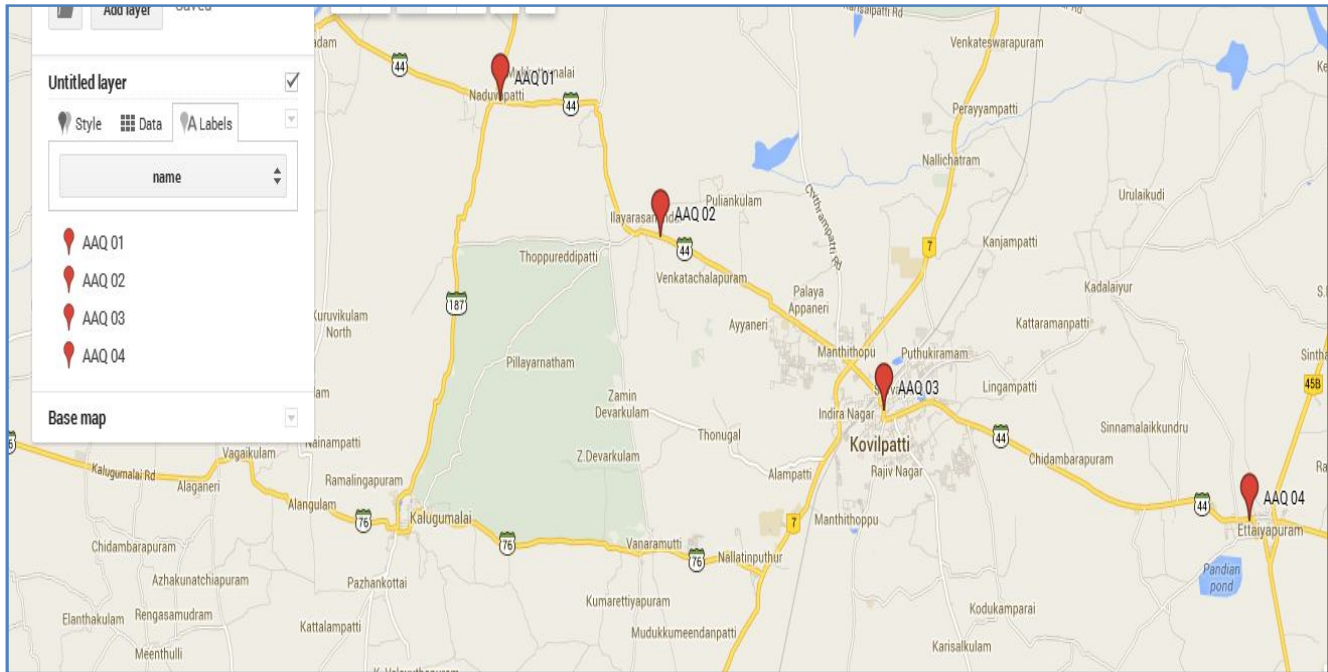


Figure.2 Map showing project Road SH-39

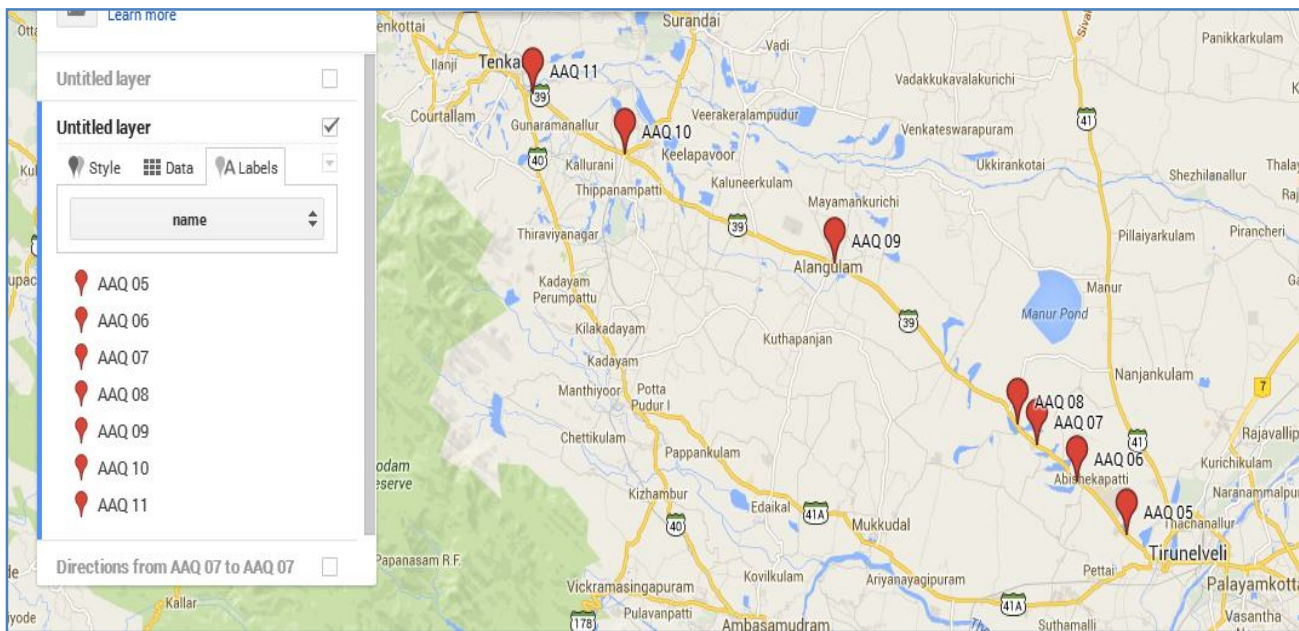
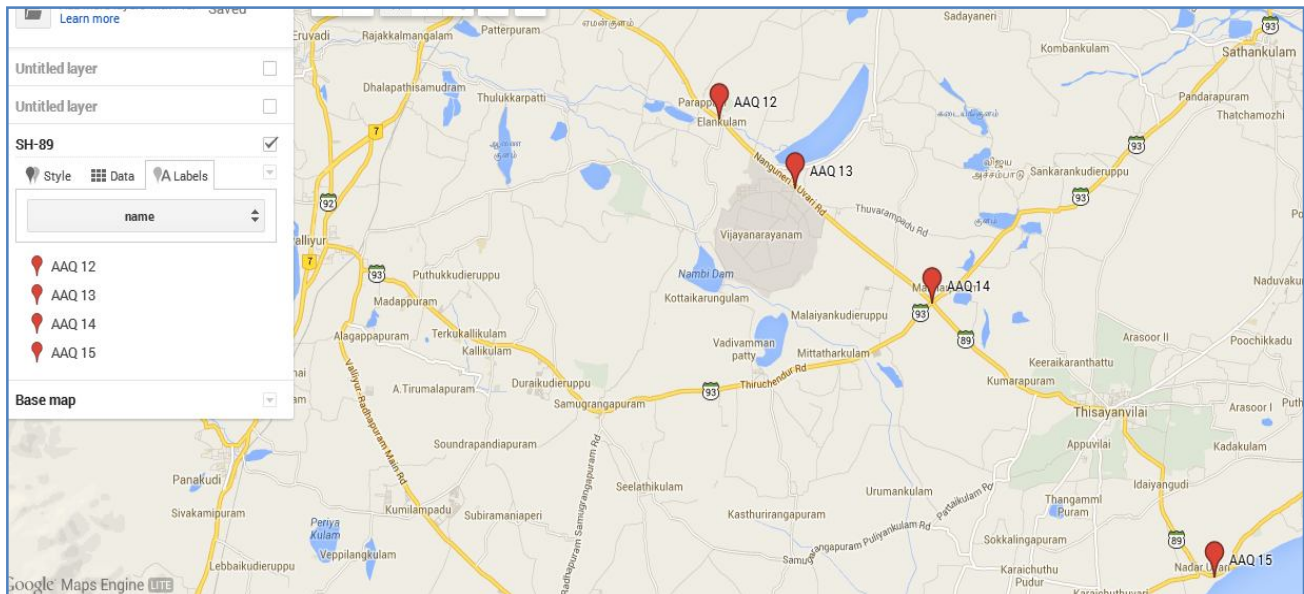




Figure.3 Map showing project Road SH-89



**Noise Monitoring:**

Figure 4, 5 and 6 shows the details of the selected Noise monitoring (thirty two) stations in SH-44, SH-39, SH-89. The noise monitoring parameter specified by CPCB at these sites was carried out during the month of the march-2014.

Figure.4 Map showing project Road SH-44

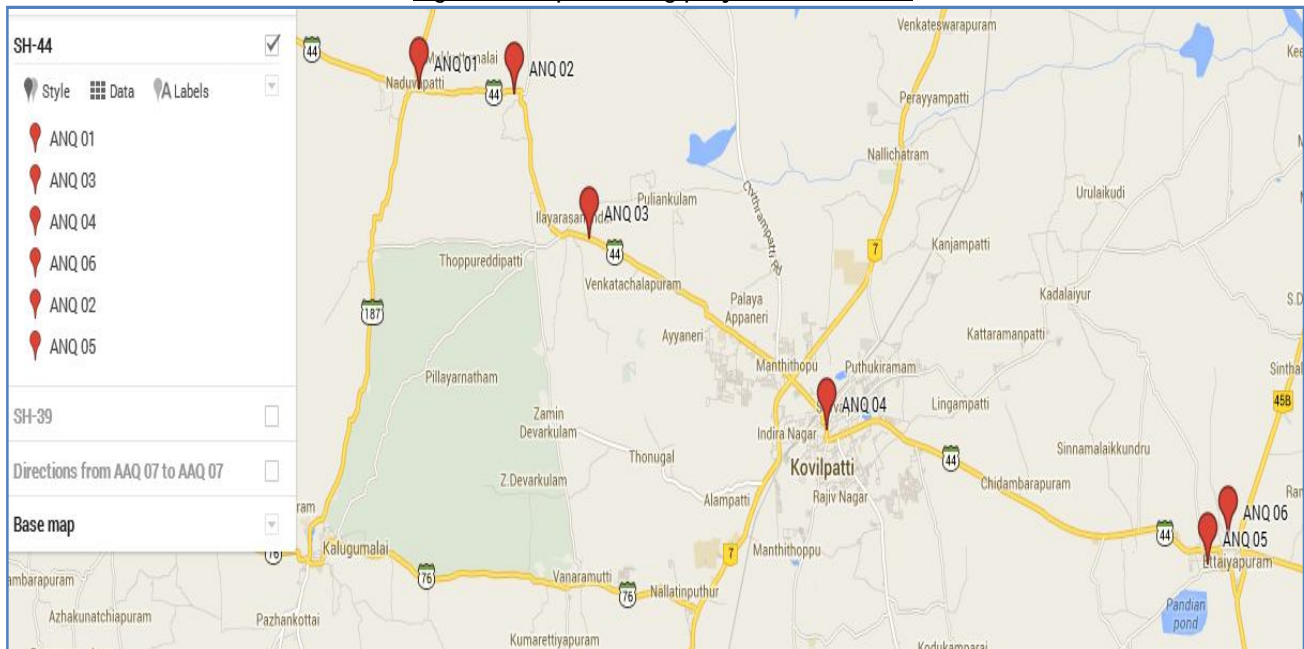






Figure.5 Map showing project Road SH-39

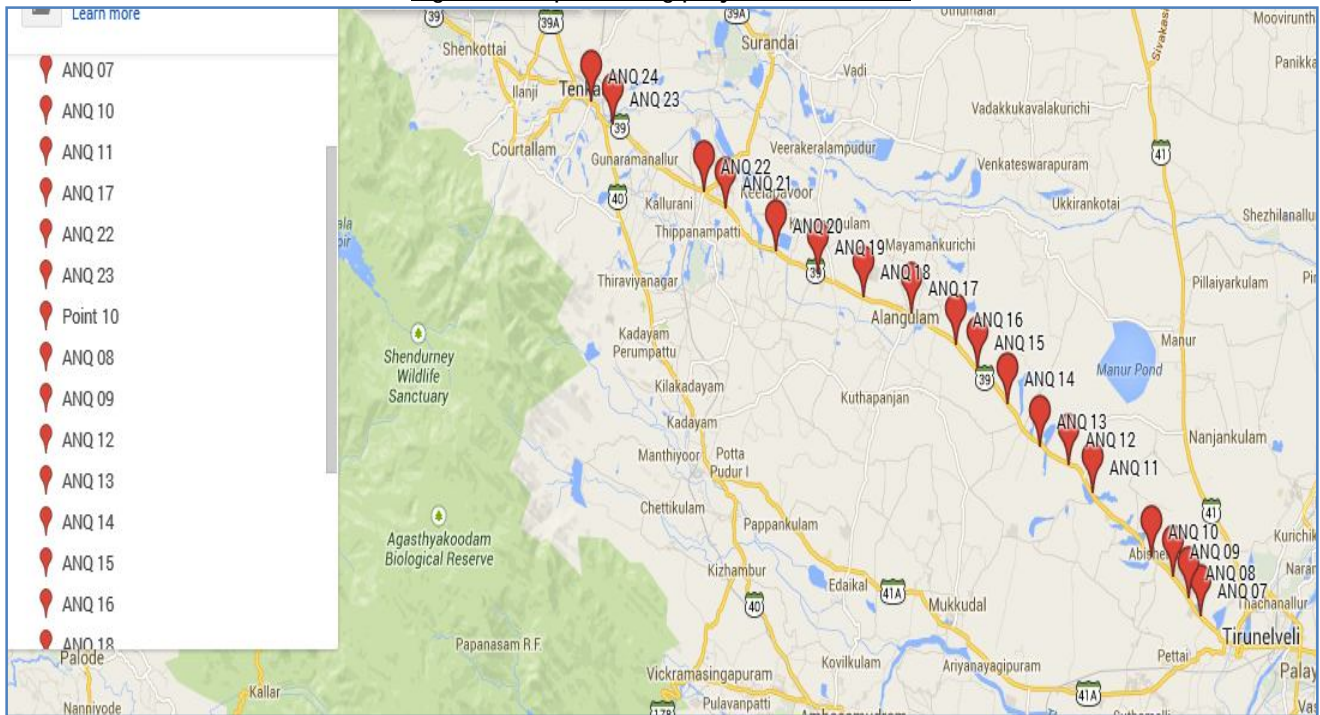
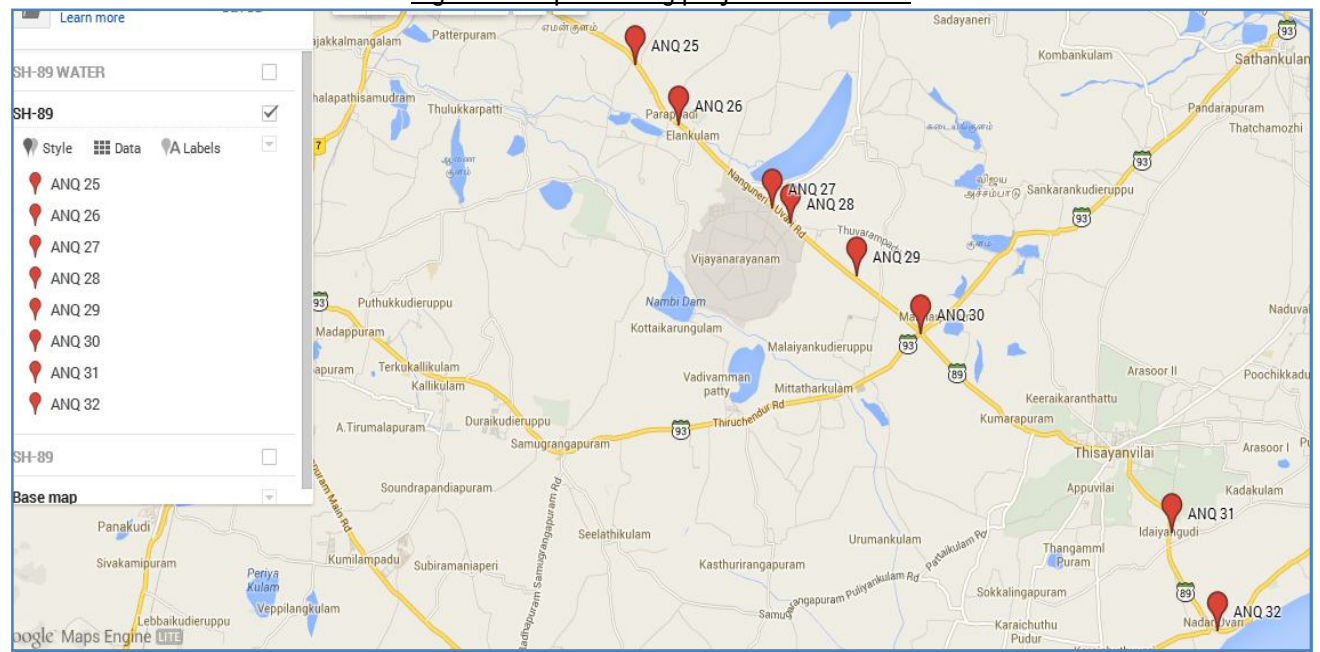


Figure.6 Map showing project Road SH-89





Water Monitoring:

Figure 7, 8 and 9 shows the details of the selected water monitoring (seventeen) stations in SH-44, SH-39, SH-89. The water monitoring parameter specified by CPCB at these sites was carried out during the month of the march-2014.

Figure.7 Map showing project Road SH-44

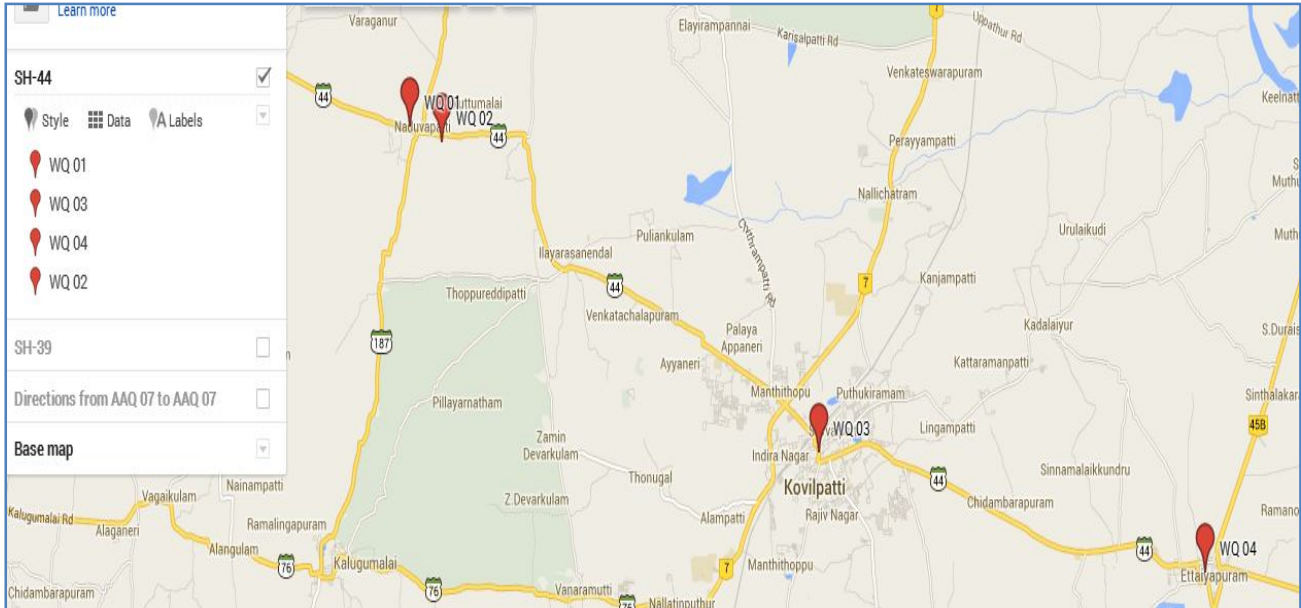


Figure.8 Map showing project Road SH-39

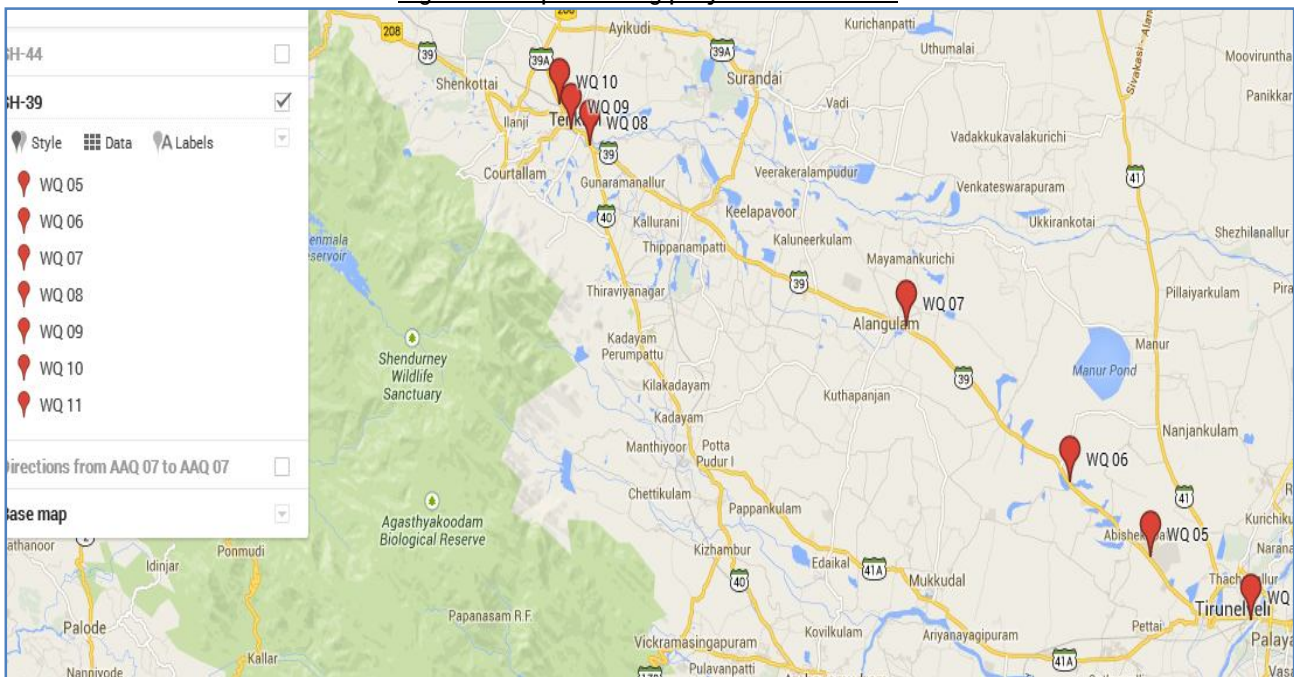
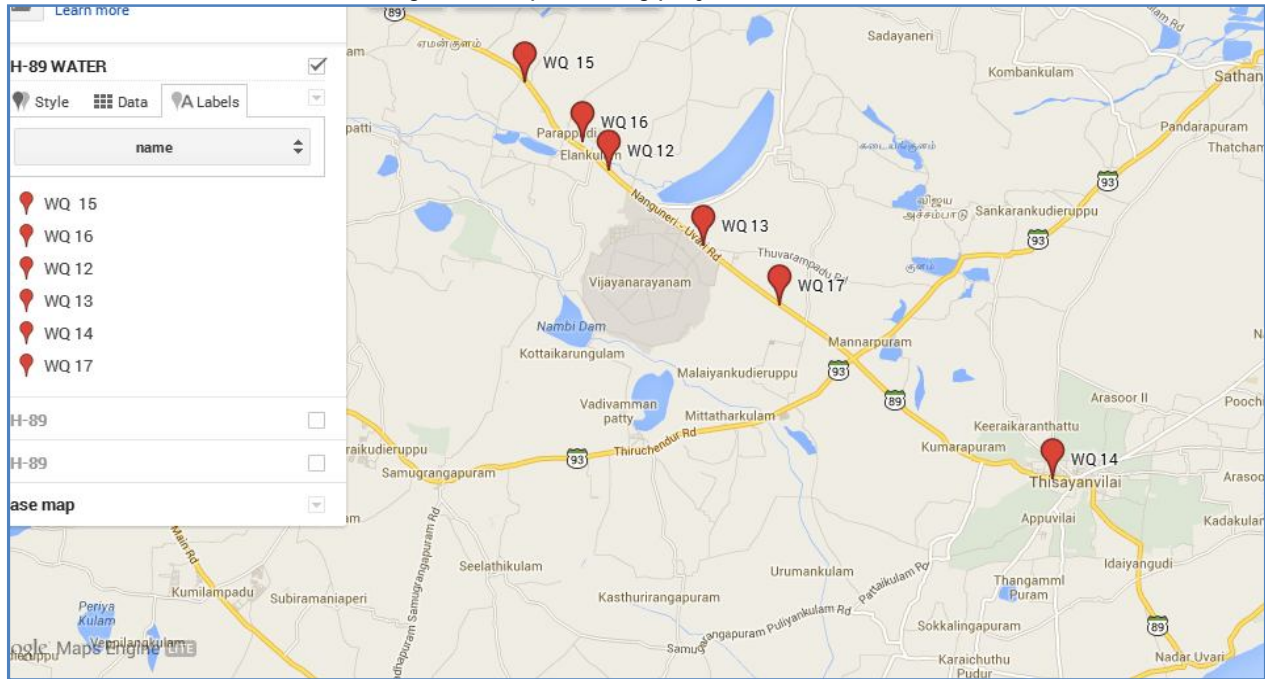






Figure.9 Map showing project Road SH-89



Soil Monitoring:

Figure 10, 11 and 12 shows the details of the selected water monitoring (seventeen) stations in SH-44, SH-39, SH-89.

Figure.10 Map showing project Road SH-44

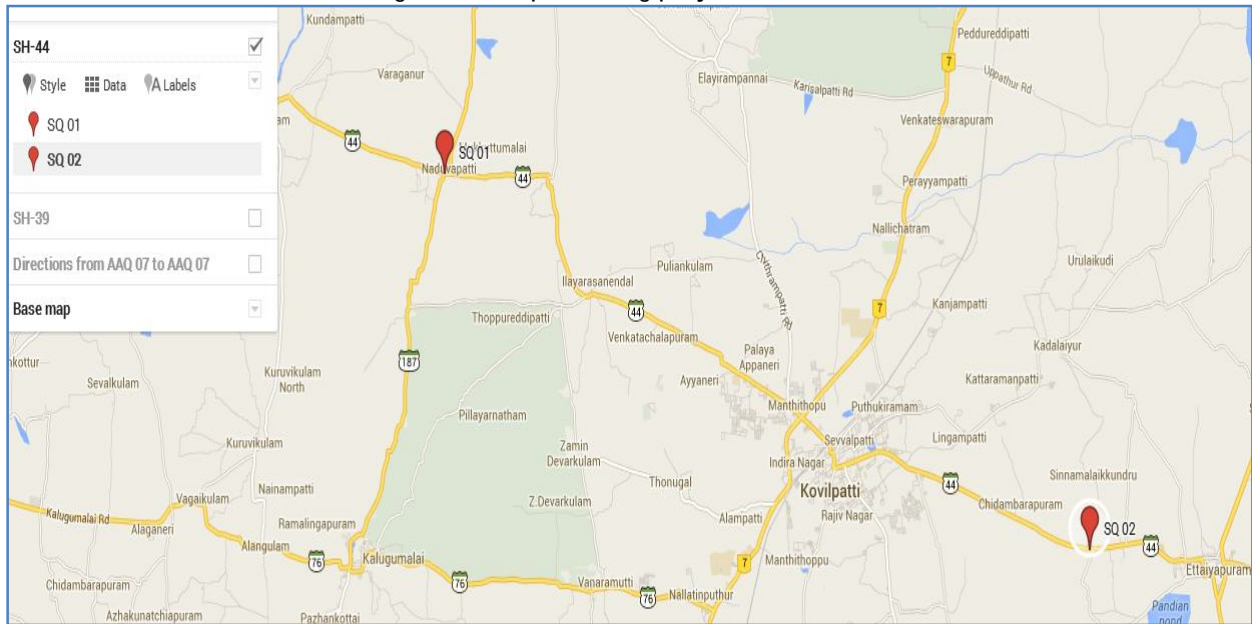






Figure.11 Map showing project Road SH-39

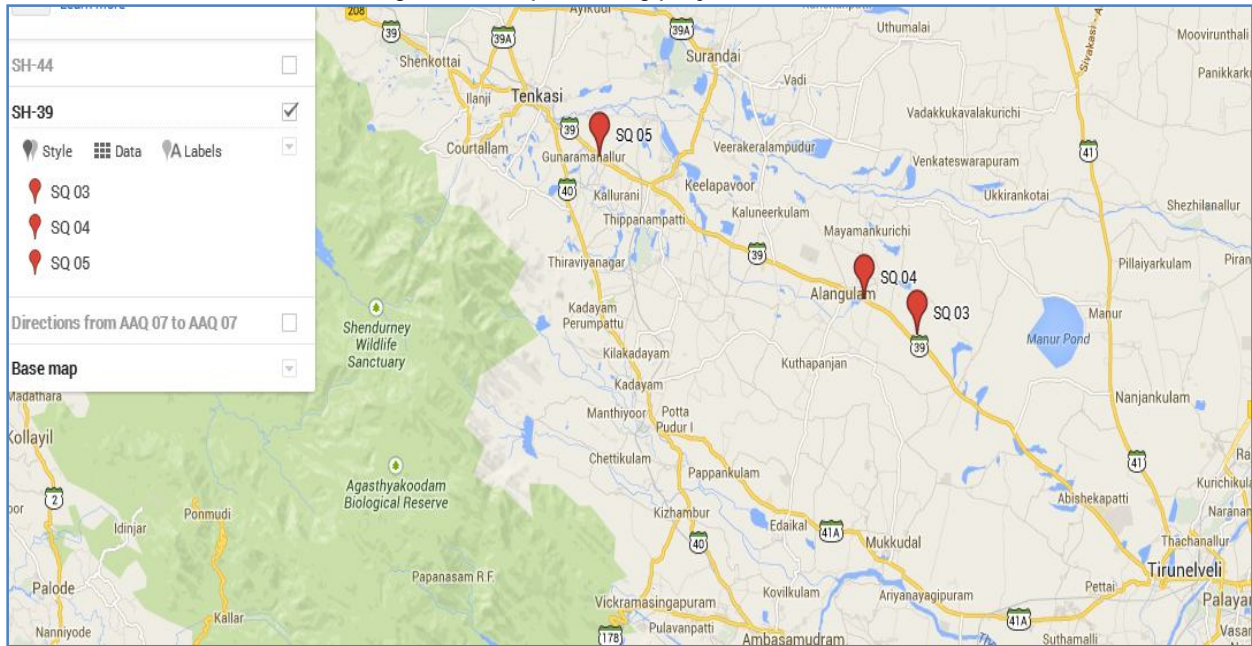
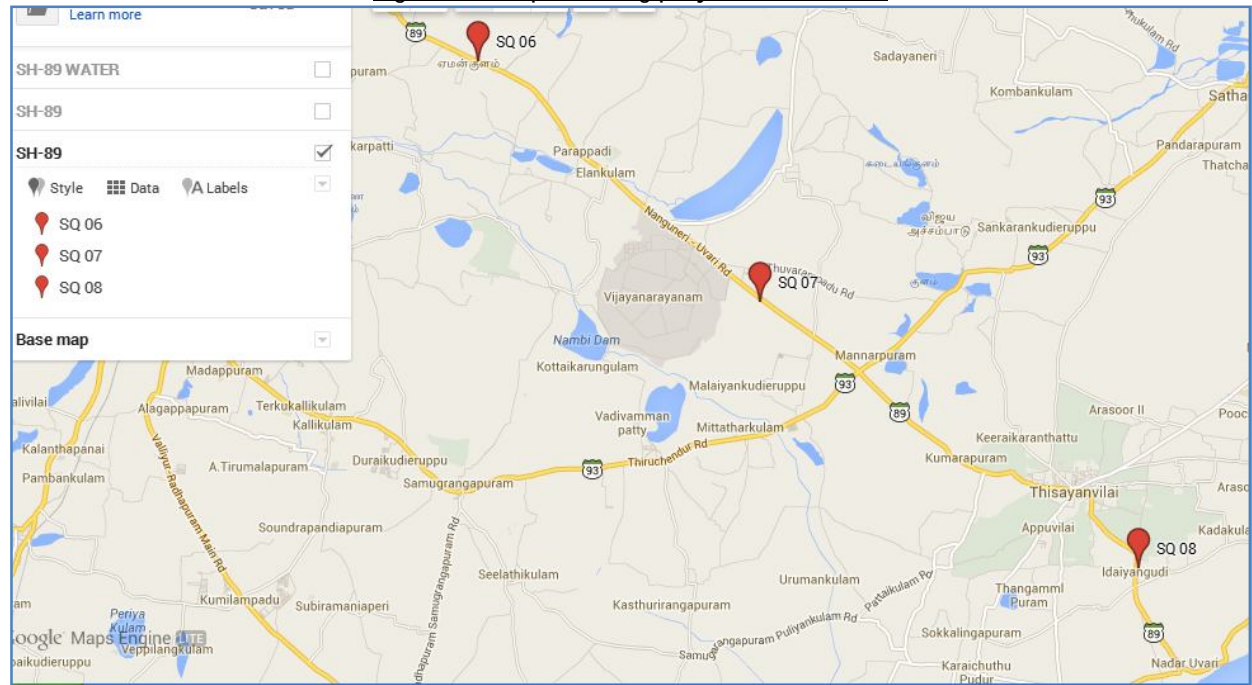


Figure.12 Map showing project Road SH-89





## 1. AMBIENT AIR QUALITY

Table.2 gives the list of pollutants monitored in this project, instruments used and frequency of sampling.

Particular	PM10	PM 2.5	NOX	SO2	CO
<b>Sampling Instrument</b>	RDS Sampler	PM2.5 sampler	Impingers attached to High volume sampler	Impingers attached to High volume sampler	Automatic analyzer
<b>Sampling Principle</b>	Filtration of aerodynamic sizes	Filtration of aerodynamic sizes with a size cut by impaction followed by cyclone separation	Chemical absorption in suitable media	Chemical absorption in suitable media	Suction by Pump As per instrument specification
<b>Flow rate</b>	0.8-1.2 m3/min	16.7 LPM	0.4 LPM	0.4 LPM	0.2 – 0.5 LPM
<b>Sampling Period</b>	24 hourly	24 Hourly	24 Hourly	24 Hourly	8 Hourly
<b>Sampling frequency</b>	Weekly twice for four week	Weekly twice for four week	Weekly twice for four week	Weekly twice for four week	Weekly twice for four week
<b>Analytical instrument</b>	Electronic Balance	Electronic Micro Balance	Spectrophotometer	Spectrophotometer	Automatic Analyser
<b>Analytical method</b>	Gravimetric	Gravimetric	Colorimetric Improved West & Gaeke Method	Colorimetric Jacobs & Hochheiser Modified method	NDIR



Table 3. National Ambient Air Quality Standards (NAAQS), 2009

Pollutants	Time Weighted Average	Industrial, Residential, Rural & other Areas	Sensitive Areas
Sulphur Dioxide (SO <sub>2</sub> )	Annual Average	50 µg/m <sup>3</sup>	20 µg/m <sup>3</sup>
	24 hours	80 µg/m <sup>3</sup>	80 µg/m <sup>3</sup>
Oxides of Nitrogen as (NO <sub>2</sub> )	Annual Average	40 µg/m <sup>3</sup>	30 µg/m <sup>3</sup>
	24 hours	80 µg/m <sup>3</sup>	80 µg/m <sup>3</sup>
Particulate Matter (PM <sub>10</sub> )	Annual Average	60 µg/m <sup>3</sup>	60 µg/m <sup>3</sup>
	24 hours	100 µg/m <sup>3</sup>	100 µg/m <sup>3</sup>
Particulate Matter (PM <sub>2.5</sub> )	Annual Average	40 µg/m <sup>3</sup>	40 µg/m <sup>3</sup>
	24 hours	60 µg/m <sup>3</sup>	60 µg/m <sup>3</sup>
Carbon Monoxide (CO)	8 hours	2.0 mg/m <sup>3</sup>	2 mg/ m <sup>3</sup>
	1 hour	4.0 mg/m <sup>3</sup>	4 mg/m <sup>3</sup>



### 1.1 Detailsofmonitoringlocations

Location and classification of location are listed in Table: 4

Table: 4. Ambient air quality monitoring locations

Location code	Name of the location	Date of monitoring	Classification Description of location	GPS Point (Zone 43)
<b>SH-44: Naduvapatti- Kovilpatti- Ettayapuram</b>				
AAQ01	School and temple at	26.02.14 to 27.02.14,	Sensitive	E-0800589; N-1022966
AAQ02	Temple at Nakkalamuttampatti	03.03.14 to 04.03.14,	Sensitive	E-0804713; N-1021714
AAQ03	Cross junction of NH-7 at Kovilpatti Municipal Area	07.03.14 to 08.03.14, 10.03.14 to 11.03.14,	Commercial	E-0814234; N-1016308
AAQ04	Near Mahakavibharathiyar memorial near Ettayapuram	14.03.14 to 15.03.14, 17.03.14 to 18.03.14, 21.03.14 to 22.03.14, 24.03.14 to 25.03.14	Commercial	E-0828853; N-1012769
<b>SH-39: Tirunelveli to Tenkasi</b>				
AAQ05	Matriculation School, Palyapattai	27.02.14 to 28.02.14,	Sensitive	E-0793611; N-0967042
AAQ06	Manonmanium University	02.03.14 to 03.03.14,	Sensitive	E-0791166; N-0969370
AAQ07	Einstein College of Engineering,	06.03.14 to 07.03.14,	Sensitive	E-0787506; N-0971910
AAQ08	Sitaparappanallur Village	09.03.14 to 10.03.14,	Sensitive	E-0786645; N-0972495
AAQ09	CSI Christ Church Alangulam	13.03.14 to 14.03.14,	Sensitive	E-0774633; N-0981043
AAQ10	Temple Near cross junction of SH-	16.03.14 to 17.03.14,	Commercial	E-0761739; N-0986498
AAQ11	Municipality park at vettaikaramkulam	20.03.14 to 21.03.14, 23.03.14 to 24.03.14	Commercial	E-0756200; N-0989429
<b>SH-89: ( Nanguneri- Bharatavaram- Uvari)</b>				
AAQ12	School near Elankulam Village,	01.03.14 to 02.03.14,	Sensitive	E-0801670; N-0931779
AAQ13	RECT College Vijayanarayanam	04.03.14 to 05.03.14,	Sensitive	E-0804526; N-0929543
AAQ14	College near cross junction of SH-93 (Vallure to turchun)	08.03.14 to 09.03.14, 11.03.14 to 12.03.14, 15.03.14 to 16.03.14,	Commercial	E-0809188; N-0925979
AAQ15	School and Church Uvari	18.03.14 to 19.03.14, 22.03.14 to 23.03.14, 25.03.14 to 26.03.14	Sensitive	E-0818520; N-0916343



1.2 Table: 5. Ambient Air Quality Monitoring Average Results SH-44: Naduvapatti- Kovilpatti- Ettayapuram

Location	Classification of area	PM <sub>10</sub> (µg/m <sup>3</sup> )	PM <sub>2.5</sub> (µg/m <sup>3</sup> )	SO <sub>2</sub> (µg/m <sup>3</sup> )	NO <sub>x</sub> (µg/m <sup>3</sup> )	CO (mg/m <sup>3</sup> )
AAQ01	Sensitive	35.8	14.6	5.8	14.4	0.80
AAQ02	Sensitive	39.5	17.3	6.7	16.1	0.85
AAQ03	Commercial	44.2	20.1	7.5	17.3	0.95
AAQ04	Commercial	41.4	18.8	7.1	16.9	0.90

#### Discussion of Result: (SH-44: Naduvapatti- Kovilpatti- Ettayapuram)

The ambient air quality is well within limits stipulated by CPCB. It is observed from table that Particulate Matter (10) in all location is in between in 35.8 - 44.2 µg/m<sup>3</sup>. And Particulate matter (2.5) between 14.6 and 20.1, SO<sub>2</sub> content ranges between 5.8 – 7.5 µg/m<sup>3</sup> and NO<sub>x</sub> values ranges between 14.4 - 17.3 µg/m<sup>3</sup>. The results are tabulated in figure 4.

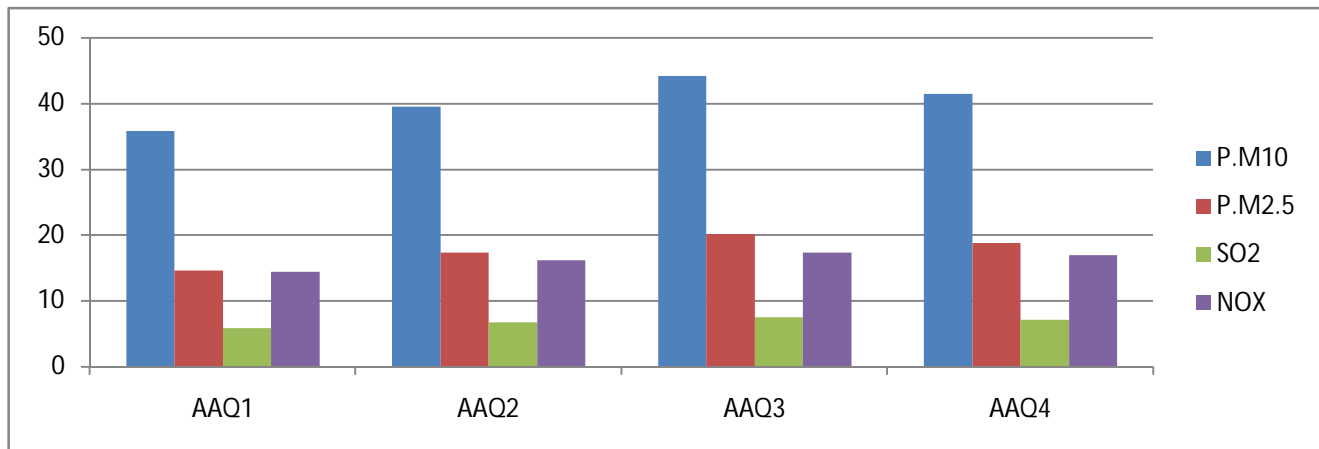


Figure 13.



**Table: 6. Ambient Air Quality Monitoring Average Results SH-39: Tirunelveli to Tenkasi**

Location	Classification of area	PM <sub>10</sub> (µg/m <sup>3</sup> )	PM <sub>2.5</sub> (µg/m <sup>3</sup> )	SO <sub>2</sub> (µg/m <sup>3</sup> )	NO <sub>x</sub> (µg/m <sup>3</sup> )	CO (mg/m <sup>3</sup> )
AAQ05	Sensitive	36.6	17.3	6.8	16.7	0.80
AAQ06	Sensitive	34.8	16.2	6.4	16.1	0.85
AAQ07	Sensitive	38.1	18.5	7.2	17.4	0.80
AAQ08	Sensitive	35.9	17.0	6.6	16.9	0.85
AAQ09	Sensitive	39.7	19.4	7.1	17.6	0.90
AAQ10	Commercial	42.3	20.8	8.1	18.2	0.95
AAQ11	Commercial	41.6	20.0	7.8	17.8	0.90

**Discussion of Result: (SH-39: Tirunelveli to Tenkasi)**

The ambient air quality is well within limits stipulated by CPCB. It is observed from table:8 that Particulate Matter (10) in all location is in between in 34.8 and 42.3 µg/m<sup>3</sup>. And Particulate matter (2.5) between 16.2 and 20.8, SO<sub>2</sub> content ranges between 6.4 – 8.1 µg/m<sup>3</sup> and NO<sub>x</sub> values ranges between 16.1- 18.2 µg/m<sup>3</sup>. The results are tabulated in figure 5.

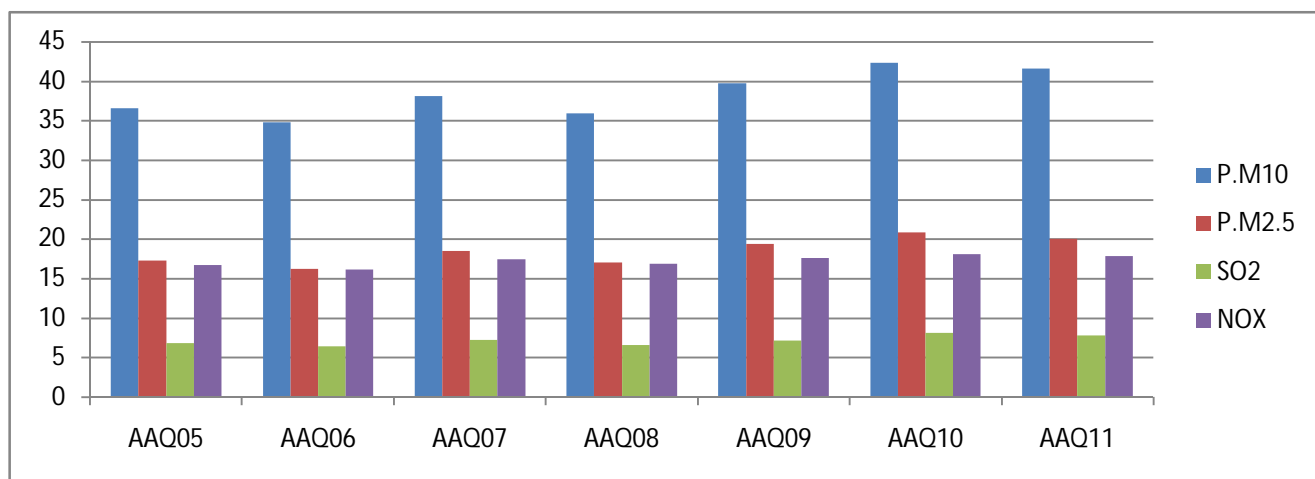


Figure 14.

**Table: 7. Ambient Air Quality Monitoring Average Results SH-89: ( Nanguneri- Bharatavaram- Uvari)**

Location	Classification of area	PM <sub>10</sub> ( $\mu\text{g}/\text{m}^3$ )	PM <sub>2.5</sub> ( $\mu\text{g}/\text{m}^3$ )	SO <sub>2</sub> ( $\mu\text{g}/\text{m}^3$ )	NO <sub>x</sub> ( $\mu\text{g}/\text{m}^3$ )	CO (mg/m <sup>3</sup> )
AAQ12	Sensitive	34.5	15.8	6.8	15.3	0.85
AAQ13	Sensitive	36.2	17.1	6.1	15.8	0.80
AAQ14	Commercial	40.4	19.6	7.8	17.1	0.95
AAQ15	Sensitive	39.6	18.3	6.4	16.5	0.80

**Discussion of Result:( SH-89 Nanguneri- Bharatavaram- Uvari)**

The ambient air quality is well within limits stipulated by CPCB. It is observed from table:9 that Particulate Matter (10) in all location is in between in 34.5 and 40.4  $\mu\text{g}/\text{m}^3$ . And Particulate matter (2.5) between 15.8 and 19.6, SO<sub>2</sub> content ranges between 6.1 – 7.8  $\mu\text{g}/\text{m}^3$  and NO<sub>x</sub> values ranges between 15.3- 17.1  $\mu\text{g}/\text{m}^3$ . The results are tabulated in figure 6.

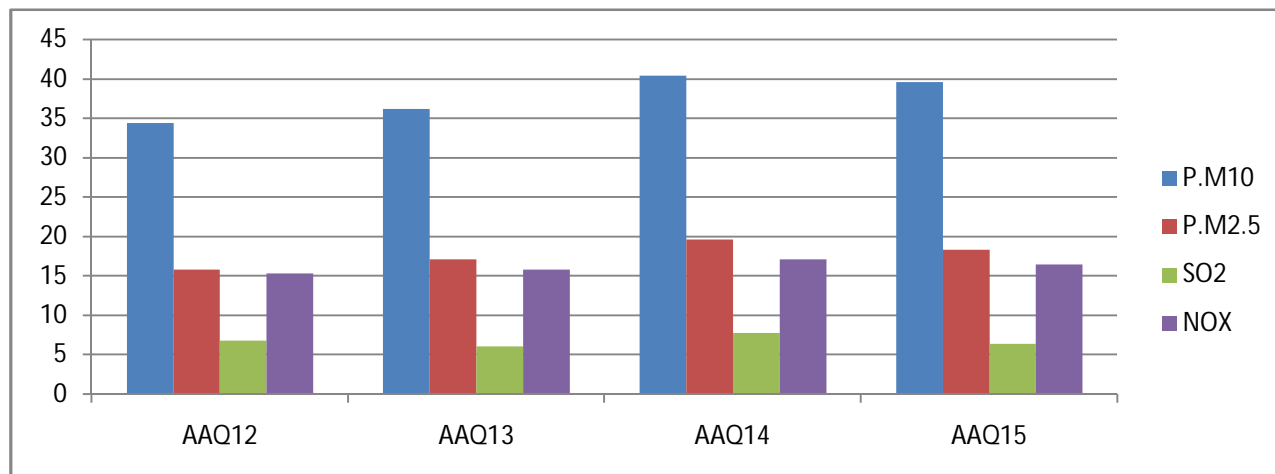


Figure 15.



## 2. NOISE QUALITY

### 2.1 Methodology for monitoring

Noise in general is sound which is composed of many frequency components of various loudness distributed over the audible frequency range. Noise monitoring is to be carried out during day and night time with a minimum of 4 readings per minute for 15 min in an hour for 24 hours. From the noted levels while using a handheld noise meter, in 'A' weighted averaging for ambient noise, Leq (Day) and Leq (Night) were calculated.

Table: 8. Duration of sampling

Parameter	Sampling duration
Noise Level Monitoring	Once (Hourly reading for 24 hrs Monitoring)

Table: 9. Ambient noise level monitoring locations

Location code	Name of the location	Date of monitoring	Classification Description of location	GPS Point (Zone 43)
<b>SH-44: Naduvapatti- Kovilpatti- Ettayapuram</b>				
ANQ01	School and temple at Naduvapatti	26.02.14 to 27.02.14	Sensitive	E-0800589; N-1022966
ANQ02	Temple at Sippipari		Commercial	E-0804345; N-1022903
ANQ03	Temple at Nakkalamuttampatti		Sensitive	E-0804705; N-1021723
ANQ04	Cross junction of NH-7 at Kovilpatti Municipal Area		Commercial	E-0814054; N-1064080
ANQ05	Built-up area at Ettayapuram		Residential cum commercial	E-0829707; N-1012900
ANQ06	Near Mahakavibharathiyar memorial near Ettayapuram		Commercial	E-0828855; N-1012776



Table: 9. Ambient noise level monitoring locations

Location code	Name of the location	Date of monitoring	Classification Description of location	GPS Point (Zone 43)
<b>SH-39: Tirunelveli to Tenkasi</b>				
ANQ07	Near Nivedhita Matriculation School,	27.02.14 to 28.02.14	Sensitive	E-0793612; N-0967005
ANQ08	Ooliyasthanam Teacher Training Institute & Middle School, Palyapattai		Sensitive	E-0793302; N-0967205
ANQ09	Near Gents hostel of veterinary college and research institute		Sensitive	E-0791947; N-0968653
ANQ10	Near Manonmaniam University		Sensitive	E-0791170; N-0969376
ANQ11	Sitaparappanallur Village		Sensitive	E-0786642; N-0972486
ANQ12	King Medical Dispensary		Sensitive	E-0785281; N-0974097
ANQ13	St. John Teacher training institute,	02.03.14 to 03.03.14	Sensitive	E-0782996; N-0975132
ANQ14	Mata Mandhir Temple		Commercial	E-0781836; N-0975897
ANQ15	ISMA School Balaji Nagar, Marandai		Sensitive	E-0780877; N-0977063
ANQ16	St. Mary's Church, Karumpuliuttu		Sensitive	E-0778744; N-0978713
ANQ17	Mani Hospital, Alangulam		Sensitive	E-0775167; N-0980876
ANQ18	Mata Mandhir Temple		Commercial	E-0770635; N-0982172
ANQ19	Sri Muppuathi Amman College of	06.03.14 to 07.03.14	Sensitive	E-0767999; N-0983119
ANQ20	Mutaramankovil Temple		Commercial	E-0766407; N-0983757
ANQ21	Harash Govt. Women School		Sensitive	E-0762321; N-0986139
ANQ22	Temple near cross junction of SH-39A		Commercial	E-0761743; N-0986486
ANQ23	Municipality Park at Vettaikaramkulam		Commercial	E-0755415; N-0989696
ANQ24	Mupidadiamankovil Temple		Commercial	E-0755051; N-0990388
<b>SH-89: (Nanguneri- Bharatavaram- Uvari)</b>				
ANQ25	Govt. School	01.03.14 to 02.03.14	Sensitive	E-0801146; N-0932169
ANQ26	School Near Elankulam Village		Sensitive	E-0801671; N-0931780
ANQ27	RECT College Vijayanarayanam		Sensitive	E-0804184; N-0929798
ANQ28	Medical Dispensary		Sensitive	E-0804380; N-0929639
ANQ29	School Sevandiapuram	04.03.14 to 05.03.14	Sensitive	E-0805726; N-0928513
ANQ30	College Near cross junction of SH-93 (Vallure to Turchun)		Commercial	E-0809186; N-0926007
ANQ31	School Idaiyankudi Village		Sensitive	E-0817486; N-0920041
ANQ32	School and Church Uvari		Sensitive	E-0818630; N-0916245



## 2.2 Presentation and discussions of results

Leq day and Leq night, are to be calculated using the monitoring results. Results are to be compared with the CPCB standards.

Table: 10. Ambient noise level monitoring Results SH-44: Naduvapatti- Kovilpatti- Ettayapuram

Location Code	Classification of area	Noise level Leq dB(A)		CPCB standard Leq dB(A)	
		Day	Night	Day	Night
ANQ01	Sensitive	48.8	37.4	50	40
ANQ02	Commercial	59.7	48.6	65	55
ANQ03	Sensitive	48.2	38.7	50	40
ANQ04	Commercial	58.8	50.6	65	55
ANQ05	Residential cum commercial	52.2	42.6	55	45
ANQ06	Commercial	61.4	50.9	65	55

Day time monitoring done from 6.00 am – 10.00 pm

Night time monitoring done from 10.00 pm – 6.00 am

Discussion of Result:

In the case of Noise levels the measured day time Mean values and hourly values for the period of 6AM to 10 PM at all the points are well below the accepted limits as per specification. The Night time mean values and hourly values for the period of 10 PM to 6 AM at all the points are well below the accepted limits as per specification.

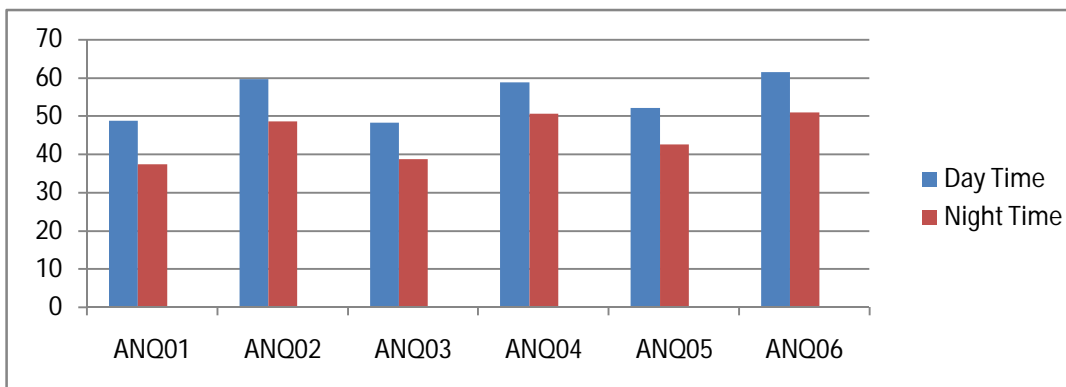


Figure 16.





Table: 11. Ambient noise level monitoring Results SH-39: Tirunelveli to Tenkasi

Location Code	Classification of area	Noise level Leq dB(A)		CPCB standard Leq dB(A)	
		Day	Night	Day	Night
ANQ07	Sensitive	48.7	37.9	50	40
ANQ08	Sensitive	48.3	38.8	50	40
ANQ09	Sensitive	49.5	37.5	50	40
ANQ10	Sensitive	49.1	39.2	50	40
ANQ11	Commercial	58.6	51.7	65	55
ANQ12	Sensitive	49.4	38.9	50	40
ANQ13	Sensitive	49.0	36.8	50	40
ANQ14	Commercial	59.5	52.3	65	55
ANQ15	Sensitive	48.1	36.7	50	40
ANQ16	Sensitive	48.9	37.3	50	40
ANQ17	Sensitive	49.2	38.8	50	40
ANQ18	Commercial	62.8	52.4	65	55
ANQ19	Sensitive	48.7	37.9	50	40
ANQ20	Commercial	62.1	50.6	65	55
ANQ21	Sensitive	49.6	39.0	50	40
ANQ22	Commercial	61.3	50.7	65	55
ANQ23	Commercial	59.8	53.4	65	55
ANQ24	Commercial	62.5	51.2	65	55

Day time monitoring done from 6.00 am – 10.00 pm

Night time monitoring done from 10.00 pm – 6.00 am



**Discussion of Result:**

In the case of Noise levels the measured day time Mean values and hourly values for the period of 6AM to 10 PM at all the points are well below the accepted limits as per specification. The Night time mean values and hourly values for the period of 10 PM to 6 AM at all the points are well below the accepted limits as per specification.

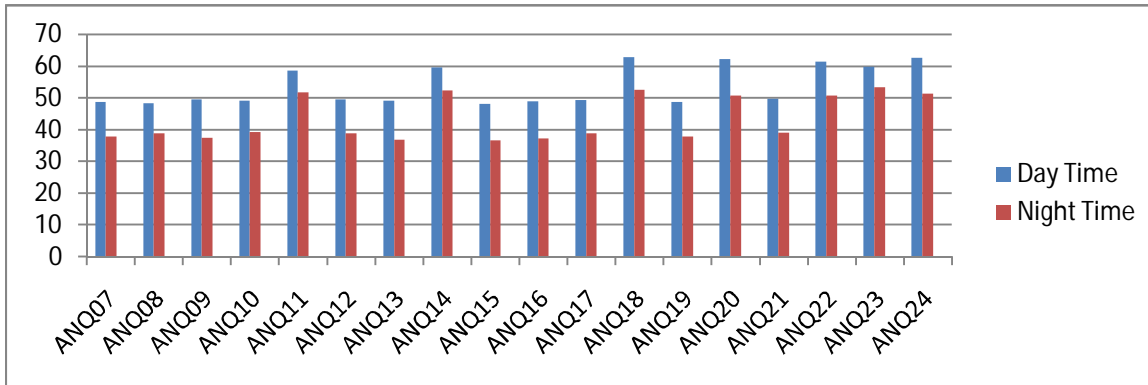


Figure 17.

Table: 12. Ambient noise level monitoring Results SH-89: ( Nanguneri- Bharatavaram- Uvari)

Location Code	Classification of area	Noise level Leq dB(A)		CPCB standard Leq dB(A)	
		Day	Night	Day	Night
ANQ25	Sensitive	49.4	37.7	50	40
ANQ26	Sensitive	45.1	36.4	50	40
ANQ27	Sensitive	46.8	35.9	50	40
ANQ28	Sensitive	48.2	37.5	50	40
ANQ29	Sensitive	47.5	38.0	50	40
ANQ30	Commercial	58.7	49.6	65	55
ANQ31	Sensitive	47.6	36.8	50	40
ANQ32	Sensitive	48.8	37.2	50	40

Day time monitoring done from 6.00 am – 10.00 pm

Night time monitoring done from 10.00 pm – 6.00 am



### Discussion

In the case of Noise levels the measured day time Mean values and hourly values for the period of 6AM to 10 PM at all the points are well below the accepted limits as per specification. The Night time mean values and hourly values for the period of 10 PM to 6 AM at all the points are well below the accepted limits as per specification.

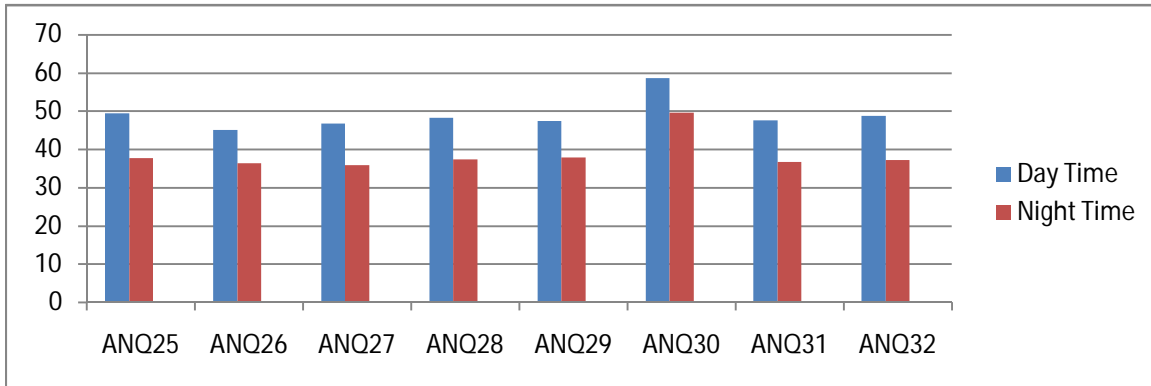


Figure 18.



### 3. WATER QUALITY MONITORING

Essential characteristics and bacteriological parameters for drinking water as per IS: 10500 of 1991 and important pollution indicators as per IS: 2296 -1982 (Class C) are analysed for all the water samples.

Sampling and analysis techniques:

Parameters for analysis of water quality were selected based on the utility of the particular source of water as per moef guidance. Water samples are collected from seventeen locations, Six surface waters from the pond and river and eleven ground water samples are collected. Samples are collected directly from the source and preserved in one liter can and for microbiological analysis separate 250ml sterilized bottles are used. The collected samples are analysed as per the methods prescribed by APHA and IS 3025. The quality of ground water was compared with IS 10500: 1991 for drinking purpose. Surface Water quality water compared with IS 2296 class C limits. Monitoring or sampling locations are tabulated in table 13.

Table: 13 water quality monitoring locations

Location code	Name of the location and Village	Source of water	Date of Sampling	GPS Point (Zone 43)
SH-44: Naduvapatti- Kovilpatti- Ettayapuram				
WQ01	Near Naduvapatti Village	Pond water (Surface water)	26.02.2014	E-0800474; N-1022900
WQ02	Near Naduvapatti Village	Community open well (Ground water)		E-0800520; N-1022963
WQ03	Kovilpatti	Hand Pump (Ground water)		E-0814860; N-1015862
WQ04	Near Sri Ram Match industries, Ettaiyapuram	Water Tank (Ground water)		E-0829707; N-1012900



Location code	Name of the location and Village	Source of water	Date of Sampling	GPS Point (Zone 43)
<b>SH-39: Tirunelveli to Tenkasi</b>				
WQ05	Gandhi Nagar Town (Tirunveli)	Hand Pump (Ground water)	28.02.2014	E-0792707; N-0967771
WQ06	Near Sitaparappanallur Village	Earthen Check dam/pond (Surface water)		E-0786456; N-0972452
WQ07	Alangulam Village	pond (Surface water)		E-0775590; N-0980751
WQ08	Tenkasi	Chitar River (Surface water)		E-0755153; N-0989922
WQ09	Near Bus stop, Tenkasi	Hand Pump (Ground water)		E-0753667; N-0991180
WQ10	Near Thagamayil, Tenkasi (Bus stop)	Bore water (Ground water)		E-075681; N-0991317
WQ11	TVS Bharath Petroleum, Vannarapatai, Tirunveli	Bore water (Ground water)		E-0799299; N-0965827
<b>SH-89: ( Nanguneri- Bharatavaram- Uvari)</b>				
WQ12	Elankulam village	Pond/Coffer dam (Surface water)	01.03.2014	E-0801698; N-0931806
WQ13	Vijayanarayanam village	Water supply Tank (Ground water)		E-0805011; N-0929083
WQ14	Tisaiyanvilai Village	Water supply Tank (Ground water)		E-0815605; N-0922587
WQ15	Km 10.80	Water over head Tank (Ground water)		E-0802390; N-0931129
WQ16	Km 12.20	Water over head Tank (Ground water)		E-0804439; N-0929556
WQ17	Km 16.6	Pond (Surface water)		E-0805853; N-0928425

Table. 14 Parameters and method of Analysis

Sl. No.	Parameters	Method of Analysis
1.	Temperature	IS 3025 Part 9 - 1984 (Reaff. 2006),
2.	pH @ 25°C	IS 3025 Part 11 - 1983 (Reaff. 2006)
3.	Turbidity , NTU	IS 3025 Part 10 - 1984 (Reaff. 2006)
4.	Conductivity 25c (micro mhos/cm)	IS:3025/P14/1984 Reaff 2006
5.	Colour , Hazen	IS 3025 Part 4 - 1983 (Reaff. 2006)
6.	Odour	IS 3025 Part 5 - 1983 (Reaff. 2006)
7.	Total Suspended Solids, mg/L	IS 3025 Part 17 - 1984 (Reaff.2006)
8.	Dissolved Solids [inorganic], mg/L	IS 3025 Part 16 - 1984 (Reaff. 2006)
9.	Dissolved Oxygen mg/L	IS 3025 Part 38 - 1989 (Reaff. 2009)
10.	COD, mg/L	IS 3025 Part 58 - 2006





Sl. No.	Parameters	Method of Analysis
11	BOD @ 27°C for 3 days, mg/L	IS 3025 Part 44 – 1993 (Reaff. 2009)
12	TKN mg/L	IS 3025 Part 34 – 1988 (Reaff. 2009)
13	Total Hardness as CaCO <sub>3</sub> , mg/L	IS 3025 Part 21 - 1983 (Reaff. 2006)
14	Sodium, mg/L	IS 3025 Part 45 - 1993 (Reaff. 2009)
15	Potassium, mg/L	IS 3025 Part 45 - 1993 (Reaff. 2009)
16	Calcium as Ca, mg/L	IS 3025 Part 40 - 1991 (Reaff. 2009)
17	Magnesium as Mg, mg/L	IS 3025 Part 46 - 1994 (Reaff. 2009)
18	Ammonia as NH <sub>3</sub> , mg/L	IS 3025 Part 34 - 1988 (Reaff. 2009)
19	Chloride as Cl, mg/L	IS 3025 Part 32 - 1988 (Reaff. 2009)
20	Phosphate as PO <sub>4</sub> , mg/L	IS 3025 Part 31 - 1988 (Reaff. 2009)
21	Nitrate as NO <sub>3</sub> , mg/L	IS 3025 Part 34 - 1988 (Reaff. 2009)
22	Fluoride as F, mg/L	IS 3025 Part 60 : 2008.
23	Surfactants, mg/L	APHA 22nd Edn. 5540 B.C
24	Dissolved Iron as Fe, mg/L	IS 3025 Part 53 - 2003 (Reaff. 2009)
25	Copper as Cu, mg/L	IS 3025 Part 42 - 1992 (Reaff. 2009)
26	Sulphate as SO <sub>4</sub> , mg/L	IS 3025 Part 24 - 1986 (Reaff. 2009)
27	Zinc as Zn, mg/L	IS 3025 Part 49 - 1994 (Reaff. 2009)
28	Arsenic as As, mg/L	IS 3025 Part 37 - 1988 (Reaff. 2009)
29	Mercury as Hg, mg/L	IS 3025 Part 48 - 1994 (Reaff. 2009)
30	Lead as Pb, mg/L	IS 3025 Part 47 - 1994 (Reaff. 2009)
31	Manganese as Mn, mg/L	IS 3025 Part 59 – 2006
32	Boron as B, mg/L	APHA 22nd Edn. 4500 B/B
33	Chromium as Cr <sup>6+</sup> , mg/L	IS 3025 Part 52 - 2003 (Reaff. 2009)
34	Phenolic compounds as	IS 3025 Part 43 – 1992 (Reaff. 2009)
35	Cadmium as Cd, mg/L	IS 3025 Part 41 - 1992 (Reaff. 2009)
36	Total Coliform	IS:1662 -1981 R.2003
37	Fecal Coliform	IS:1662 -1981 R.2003



Table: 15 Presentation and discussions of results SH-44: Naduvapatti- Kovilpatti- Ettayapuram

Sl. No	Parameters	Units	WQ01 (SW)	WQ02 (GW)	WQ03 (GW)	WQ04 (GW)	IS:10500 Desirable limits	IS:2296 Class C limits
1	Temperature	°C	29	28	29	29	--	--
2	pH @ 25°C	-	7.63	7.72	7.83	7.72	6.5 - 8.5	6.5 - 8.5
3	Turbidity	NTU	183	<0.5	<0.5	<0.5	5	--
4	Conductivity 25c	µmhos/cm	256	727	173	6390	--	--
5	Colour	Hazen	23	<1.0	<1.0	<1.0	5	300
6	Odour		Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	--
7	Total Suspended Solids	mg/L	30	<1.0	<1.0	<1.0	--	--
8	Dissolved Solids [inorganic]	mg/L	161	458	109	4026	500	1500
9	Dissolved Oxygen	mg/L	7.3	7.6	7.8	7.7	--	Min 4.0
10	COD	mg/L	18	10	BDL (DL:4.0)	8.0	--	--
11	BOD @ 27°C for 3 days	mg/L	5.40	3.0	BDL (DL:2.0)	2.40	--	3.0
12	TKN	mg/L	BDL (DL:1.0)	1.12	BDL (DL:1.0)	3.82	--	--
13	Total Hardness as CaCO <sub>3</sub>	mg/L	120	253	72	1452	300	--
14	Sodium	mg/L	4.7	20	3.75	228	--	--
15	Potassium	mg/L	1.64	5.10	1.25	51	--	--
16	Calcium as Ca	mg/L	38	73	19	396	75	--
17	Magnesium as Mg	mg/L	6.0	17	6.0	111	--	--
18	Ammonia as NH <sub>3</sub>	mg/L	BDL (DL :0.1)	BDL(DL:1.0)	BDL (DL:1.0)	BDL (DL:1.0)	--	--
19	Chloride as Cl	mg/L	14	60	15	913	250	600
20	Sulphate as SO <sub>4</sub>	mg/L	20	34	4.0	1975	200	400
21	Phosphate as P	mg/L	0.16	0.27	0.12	0.24	--	--
22	Nitrate as NO <sub>3</sub>	mg/L	2.64	1.04	BDL	32	45	50
23	Fluoride as F	mg/L	BDL (DL:0.1)	BDL (DL:0.1)	BDL (DL:0.1)	0.33	1.0	1.5
24	Surfactants	mg/L	Absent	Absent	Absent	Absent	0.2	1.0



Sl. No	Parameters	Units	SH-44: Naduvapatti- Kovilpatti- Ettayapuram				IS:10500 Desirable limits	IS:2296 Class C limits
			WQ01 (SW)	WQ02 (GW)	WQ03 (GW)	WQ04 (GW)		
25	Total Iron as Fe	mg/L	1.23	0.09	0.06	0.08	0.3	50
26	Copper as Cu	mg/L	BDL (DL : 0.01)	BDL (DL : 0.01)	BDL (DL : 0.01)	BDL (DL : 0.01)	0.05	1.5
27	Zinc as Zn	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	5.0	15
28	Arsenic as As	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	0.05	0.2
29	Mercury as Hg	mg/L	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	0.001	--
30	Lead as Pb	mg/L	BDL (DL : 0.1)	BDL (DL : 0.01)	BDL (DL : 0.1)	BDL (DL : 0.1)	0.05	0.1
31	Manganese as Mn	mg/L	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	0.1	--
32	Boron as B	mg/L	2.08	0.87	0.28	8.46	1.0	--
33	Chromium as Cr	mg/L	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	0.05	0.05
34	Phenolic compounds as	mg/L	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	0.001	0.005
35	Cadmium as Cd	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	0.01	0.01
36	Total Coliform	MPN/100ml	350	Absence	Absence	Absence	Absence	5000
37	Fecal Coliform	MPN/100ml	48	Absence	Absence	Absence	Absence	--

#### Results and Discussion: (SH-44: Naduvapatti- Kovilpatti- Ettayapuram)

Surface water samples collected from one location of WQ 01, all parameters should meet the standards IS 2296 Class C, except the BOD Parameter. Ground water samples collected from three locations WQ 02, WQ 03, & WQ 04. In this ground water samples collected from locations WQ 02, WQ 03, all parameters are well within the limits stipulated by IS 10500 desirable limits for drinking purposes. In Ground water sample location of WQ 04, all parameters are within the limits stipulated by IS 10500 desirable limits, except parameters TDS, Total Hardness, Calcium, Chloride, Sulphate & Boron. Hence ground water sample WQ 04, should not meet the standards IS 10500 desirable limits.



Table: 16 Presentation and discussions of results SH-39: Tirunelveli to Tenkasi

Sl. No	Parameters	Units	WQ05 (GW)	WQ06 (SW)	WQ07 (SW)	WQ08 (SW)	IS:10500 Desirable limits	IS:2296 Class C limits
1	Temperature	°C	29	29	28	29	--	--
2	pH @ 25°C	-	7.66	8.06	7.18	7.19	6.5 - 8.5	6.5 - 8.5
3	Turbidity	NTU	<0.5	3035	17.9	16.2	5	--
4	Conductivity 25c	µmhos/cm	1378	152	1533	842	--	--
5	Colour	Hazen	<1.0	70	32	8.0	5	300
6	Odour		Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	--
7	Total Suspended Solids	mg/L	<1.0	120	21	12	--	--
8	Dissolved Solids [inorganic]	mg/L	915	99	1012	554	500	1500
9	Dissolved Oxygen	mg/L	7.6	6.7	6.1	7.2	--	Min 4.0
10	COD	mg/L	9.0	69	152	16	--	--
11	BOD @ 27°C for 3 days	mg/L	2.34	14	22	5.12	--	3.0
12	TKN	mg/L	1.21	1.26	2.13	1.32	--	--
13	Total Hardness as CaCO <sub>3</sub>	mg/L	486	62	492	290	300	--
14	Sodium	mg/L	52	6.29	71	24	--	--
15	Potassium	mg/L	15	2.09	19	6.0	--	--
16	Calcium as Ca	mg/L	119	19	106	75	75	--
17	Magnesium as Mg	mg/L	45	3.6	55	25	--	--
18	Ammonia as NH <sub>3</sub>	mg/L	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	--	--
19	Chloride as Cl	mg/L	157	22	213	83	250	600
20	Sulphate as SO <sub>4</sub>	mg/L	46	15	316	21	200	400
21	Phosphate as P	mg/L	0.18	0.12	1.5	0.37	--	--
22	Nitrate as NO <sub>3</sub>	mg/L	3.2	BDL (DL : 0.1)	0.92	1.20	45	50
23	Fluoride as F	mg/L	0.37	BDL (DL : 0.1)	BDL (DL : 0.1)	0.27	1.0	1.5
24	Surfactants	mg/L	Absent	Absent	Absent	Absent	0.2	1.0
25	Total Iron as Fe	mg/L	0.06	1.12	0.57	0.93	0.3	50
26	Copper as Cu	mg/L	BDL (DL : 0.01)	BDL (DL : 0.01)	BDL (DL : 0.01)	BDL (DL : 0.01)	0.05	1.5
27	Zinc as Zn	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	5.0	15



Table: 16 Presentation and discussions of results SH-39: Tirunelveli to Tenkasi

Sl. No	Parameters	Units	SH-39: Tirunelveli to Tenkasi				IS:10500 Desirable limits	IS:2296 Class C limits
			WQ05 (GW)	WQ06 (SW)	WQ07 (SW)	WQ08 (SW)		
28	Arsenic as As	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	0.05	0.2
29	Mercury as Hg	mg/L	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	0.001	--
30	Lead as Pb	mg/L	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	0.05	0.1
31	Manganese as Mn	mg/L	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	0.1	--
32	Boron as B	mg/L	2.27	BDL (DL : 0.1)	0.62	0.68	1.0	--
33	Chromium as Cr	mg/L	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	0.05	0.05
34	Phenolic compounds as	mg/L	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	0.001	0.005
35	Cadmium as Cd	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	0.01	0.01
36	Total Coliform	MPN/100ml	Absence	950	1270	450	Absence	5000
37	Fecal Coliform	MPN/100m	Absence	140	190	60	Absence	--

Table: 16 Presentation and discussions of results SH-39: Tirunelveli to Tenkasi

Sl. No	Parameters	Units	SH-39: Tirunelveli to Tenkasi			IS:10500 Desirable limits	IS:2296 Class C limits
			WQ09 (GW)	WQ10 (GW)	WQ11 (GW)		
1	Temperature	°C	29	29	28	--	--
2	pH @ 25°C	-	7.32	7.69	7.71	6.5 - 8.5	6.5 - 8.5
3	Turbidity	NTU	<0.5	0.9	4.4	5	--
4	Conductivity 25c	µmhos/cm	1312	1743	2150	--	--
5	Colour	Hazen	<1.0	<1.0	5.0	5	300
6	Odour		Agreeable	Agreeable	Agreeable	Agreeable	--
7	Total Suspended Solids	mg/L	<1.0	2.0	13	--	--
8	Dissolved Solids [inorganic]	mg/L	866	1150	1420	500	1500
9	Dissolved Oxygen	mg/L	7.1	7.0	6.3	--	Min 4.0
10	COD	mg/L	10	12	78	--	--





Table: 16 Presentation and discussions of results SH-39: Tirunelveli to Tenkasi

Sl. No	Parameters	Units	SH-39: Tirunelveli to Tenkasi			IS:10500 Desirable limits	IS:2296 Class C limits
			WQ09 (GW)	WQ10 (GW)	WQ11 (GW)		
11	BOD @ 27°C for 3 days	mg/L	3.0	3.6	24.9	--	3.0
12	TKN	mg/L	1.11	1.13	1.15	--	--
13	Total Hardness as CaCO <sub>3</sub> ,	mg/L	363	511	824	300	--
14	Sodium	mg/L	31	69	110	--	--
15	Potassium	mg/L	7.75	17	28	--	--
16	Calcium as Ca	mg/L	87	92	143	75	--
17	Magnesium as Mg	mg/L	35	67	112	--	--
18	Ammonia as NH <sub>3</sub>	mg/L	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	--	--
19	Chloride as Cl	mg/L	109	243	467	250	600
20	Sulphate as SO <sub>4</sub>	mg/L	61	92	28	200	400
21	Phosphate as P	mg/L	0.61	0.27	0.13	--	--
22	Nitrate as NO <sub>3</sub>	mg/L	1.87	1.98	2.06	45	50
23	Fluoride as F	mg/L	0.12	0.23	0.21	1.0	1.5
24	Surfactants	mg/L	Absent	Absent	Absent	0.2	1.0
25	Total Iron as Fe	mg/L	0.10	0.06	1.03	0.3	50
26	Copper as Cu	mg/L	BDL (DL : 0.01)	BDL (DL : 0.01)	BDL (DL : 0.01)	0.05	1.5
27	Zinc as Zn	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	5.0	15
28	Arsenic as As	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	0.05	0.2
29	Mercury as Hg	mg/L	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	0.001	--
30	Lead as Pb	mg/L	BDL (DL : 0.1)	BDL (DL : 0.01)	BDL (DL : 0.1)	0.05	0.1
31	Manganese as Mn	mg/L	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	0.1	--
32	Boron as B	mg/L	3.22	3.26	BDL (DL : 0.1)	1.0	--
33	Chromium as Cr	mg/L	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	0.05	0.05
34	Phenolic compounds as	mg/L	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	0.001	0.005
35	Cadmium as Cd	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	0.01	0.01
36	Total Coliform	MPN/100ml	Absence	Absence	Absence	Absence	5000
37	Fecal Coliform	MPN/100ml	Absence	Absence	Absence	Absence	--

Results and Discussion: (SH-39: Tirunelveli to Tenkasi)

Surface water samples collected from three location of WQ 06, WQ 07 & WQ 08, all parameters should meet the standards IS 2296 Class C ,except the BOD Parameter. Ground water samples collected from four locations WQ 05, WQ 09, WQ 10, & WQ 11. In this ground water samples collected from locations WQ 05, WQ 09 & WQ 10 all parameters are within the limits stipulated by IS 10500 desirable limits, except parameters TDS, TH, Ca and boron. In Ground water sample location of WQ11 Sample all parameters are within the limits stipulated by IS 10500 desirable limits, except parameters TDS, TH, Ca, Cl and Fe. Ground water samples WQ 05, WQ 09, WQ 10, & WQ 11 should not meet the standards IS 10500 desirable limits for drinking purposes.

Table: 17 Presentation and discussions of results SH-89: ( Nanguneri- Bharatavaram- Uvari)

Sl. No	Parameters	Units	WQ12 (SW)	WQ13 (GW)	WQ14 (GW)	WQ15 (GW)	IS:10500 Desirable limits	IS:2296 Class C limits
1	Temperature	°C	29	29	28	29	--	--
2	pH @ 25°C	-	7.96	7.95	7.84	8.01	6.5 - 8.5	6.5 - 8.5
3	Turbidity	NTU	5.3	4.4	2.9	<0.5	5	--
4	Conductivity 25c	µmhos/cm	178	181	195	1038	--	--
5	Colour	Hazen	3.0	4.0	<1.0	<1.0	5	300
6	Odour		Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	--
7	Total Suspended Solids	mg/L	2.8	2.9	1.7	<1.0	--	--
8	Dissolved Solids [inorganic]	mg/L	112	114	123	484	500	1500
9	Dissolved Oxygen	mg/L	7.4	7.5	7.3	7.1	--	Min 4.0
10	COD	mg/L	BDL (DL : 4.0)	BDL (DL : 4.0)	BDL (DL : 4.0)	BDL (DL : 4.0)	--	--



Table: 17 Presentation and discussions of results SH-89: ( Nanguneri- Bharatavaram- Uvari)

Sl. No	Parameters	Units	SH-89: ( Nanguneri- Bharatavaram- Uvari)				IS:10500 Desirable limits	IS:2296 Class C limits
			WQ12 (SW)	WQ13 (GW)	WQ14 (GW)	WQ15 (GW)		
11	BOD @ 27°C for 3	mg/L	BDL (DL : 2.0)	BDL (DL : 2.0)	BDL (DL : 2.0)	BDL (DL : 2.0)	--	3.0
12	TKN	mg/L	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	--	--
13	Total Hardness as CaCO <sub>3</sub>	mg/L	70	78	82	293	300	--
14	Sodium	mg/L	4.67	4.0	5.0	63	--	--
15	Potassium	mg/L	1.62	2.9	1.42	22	--	--
16	Calcium as Ca	mg/L	21	21	23	63	75	--
17	Magnesium as Mg	mg/L	4.32	6.5	5.86	33	--	--
18	Ammonia as NH <sub>3</sub>	mg/L	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	--	--
19	Chloride as Cl	mg/L	14	13	15	189	250	600
20	Sulphate as SO <sub>4</sub>	mg/L	1.5	1.4	2.6	53	200	400
21	Phosphate as P	mg/L	BDL (DL : 0.01)	0.08	0.09	0.14	--	--
22	Nitrate as NO <sub>3</sub>	mg/L	0.53	0.55	0.65	2.2	45	50
23	Fluoride as F	mg/L	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	0.13	1.0	1.5
24	Surfactants	mg/L	Absent	Absent	Absent	Absent	0.2	1.0
25	Total Iron as Fe	mg/L	0.10	0.28	0.09	0.07	0.3	50
26	Copper as Cu	mg/L	BDL (DL : 0.01)	BDL (DL : 0.01)	BDL (DL : 0.01)	BDL (DL : 0.01)	0.05	1.5
27	Zinc as Zn	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	5.0	15
28	Arsenic as As	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	0.05	0.2
29	Mercury as Hg	mg/L	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	0.001	--
30	Lead as Pb	mg/L	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	0.05	0.1
31	Manganese as Mn	mg/L	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	0.1	--
32	Boron as B	mg/L	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	0.54	1.0	--
33	Chromium as Cr	mg/L	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	0.05	0.05
34	Phenolic compounds as	mg/L	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	0.001	0.005
35	Cadmium as Cd	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	0.01	0.01
36	Total Coliform	MPN/100ml	326	Absence	Absence	Absence	Absence	5000
37	Fecal Coliform	MPN/100ml	38	Absence	Absence	Absence	Absence	--



Table: 17 Presentation and discussions of results SH-89: ( Nanguneri- Bharatavaram- Uvari)

Sl. No	Parameters	Units	SH-89: ( Nanguneri Bharatavaram- Uvari)		IS:10500 Desirable limits	IS:2296 Class C limits
			WQ16 (GW)	WQ17 (SW)		
1	Temperature	°C	28	29	--	--
2	pH @ 25°C	-	7.57	7.96	6.5 - 8.5	6.5 - 8.5
3	Turbidity	NTU	<0.5	5.4	5	--
4	Conductivity 25c	µmhos/cm	851	187	--	--
5	Colour	Hazen	<1.0	6.0	5	300
6	Odour		Agreeable	Agreeable	Agreeable	--
7	Total Suspended Solids	mg/L	<1.0	2.4	--	--
8	Dissolved Solids [inorganic]	mg/L	478	118	500	1500
9	Dissolved Oxygen	mg/L	7.4	6.9	--	Min 4.0
10	COD	mg/L	BDL (DL : 4.0)	BDL (DL : 4.0)	--	--
11	BOD @ 27°C for 3 days	mg/L	BDL (DL : 2.0)	BDL (DL : 2.0)	--	3.0
12	TKN	mg/L	BDL (DL : 1.0)	BDL (DL : 1.0)	--	--
13	Total Hardness as CaCO <sub>3</sub>	mg/L	288	82	300	--
14	Sodium	mg/L	68	5.0	--	--
15	Potassium	mg/L	23	1.6	--	--
16	Calcium as Ca	mg/L	99	20	75	--
17	Magnesium as Mg	mg/L	19	7.92	--	--
18	Ammonia as NH <sub>3</sub>	mg/L	BDL (DL : 0.1)	BDL (DL : 0.1)	--	--
19	Chloride as Cl	mg/L	203	15	250	600
20	Sulphate as SO <sub>4</sub>	mg/L	25	3.8	200	400
21	Phosphate as P	mg/L	0.06	0.05	--	--
22	Nitrate as NO <sub>3</sub>	mg/L	2.64	0.53	45	50
23	Fluoride as F	mg/L	0.12	BDL (DL : 0.1)	1.0	1.5
24	Surfactants	mg/L	Absent	Absent	0.2	1.0



Table: 17 Presentation and discussions of results SH-89: ( Nanguneri- Bharatavaram- Uvari)

Sl. No	Parameters	Units	SH-89: ( Nanguneri Bharatavaram- Uvari)		IS:10500 Desirable limits	IS:2296 Class C limits
			WQ16 (GW)	WQ17 (SW)		
25	Total Iron as Fe	mg/L	0.09	0.12	0.3	50
26	Copper as Cu	mg/L	BDL (DL : 0.01)	BDL (DL : 0.01)	0.05	1.5
27	Zinc as Zn	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	5.0	15
28	Arsenic as As	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	0.05	0.2
29	Mercury as Hg	mg/L	BDL (DL : 0.001)	BDL (DL : 0.001)	0.001	--
30	Lead as Pb	mg/L	BDL (DL : 0.1)	BDL (DL : 0.01)	0.05	0.1
31	Manganese as Mn	mg/L	BDL (DL : 0.03)	BDL (DL : 0.03)	0.1	--
32	Boron as B	mg/L	0.86	BDL (DL : 0.1)	1.0	--
33	Chromium as Cr	mg/L	BDL (DL : 0.03)	BDL (DL : 0.03)	0.05	0.05
34	Phenolic compounds as	mg/L	BDL (DL : 0.001)	BDL (DL : 0.001)	0.001	0.005
35	Cadmium as Cd	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	0.01	0.01
36	Total Coliform	MPN/100	Absence	862	Absence	5000
37	Fecal Coliform	MPN/100	Absence	134	Absence	--

Results and Discussion: (Nanguneri Bharatavaram- Uvari)

Surface water collected from the two locations (WQ12 & WQ17) should meet the standards IS 2296 Class C surface water. Ground water from four locations WQ13, WQ14, WQ15 & WQ16 are well within the limits stipulated by IS 10500 for drinking purposes.





#### 4. SOIL CHARACTERISTICS

Soil samples are collected from the preferred location and analyzed as per the standard methods prescribed by Central Pollution Control Board.

Table: 18 Soil Location Details

Location code	Name of the location and village	Land Use	Date of Sampling	GPS Point (Zone 43)
<b>SH-44: Naduvapatti- Kovilpatti- Ettayapuram</b>				
SQ1	Naduvapatti Village	Agriculture and open land	26.02.2014	E-0801187; N-1022885
SQ2	Mathupuram	Agriculture land		E-0825722; N-1012709
<b>SH-39: Tirunelveli to Tenkasi</b>				
SQ3	Uganthampattai	Agriculture land	27.02.2014	E-0786246; N-0974339
SQ4	Ramachanrachatram /RC pattinam	Open land		E-0758533; N-0987767
SQ5	Alangulam village (pond opposite land)	Agriculture land		E-0775335; N-0980899
<b>SH-89: ( Nanguneri- Bharatavaram- Uvari)</b>				
SQ6	Subramanyapuram	Agriculture land	01.03.2014	E-0799648; N-0934023
SQ7	Sevandiapuram	Agriculture land		E-0806051; N-0928278
SQ8	Idaiyangudi	Open land		E-0817478; N-0919425

Table: 19 Desirable Soil Quality

Sl. No.	Parameters	Desirable Range
1.	pH ( 10% solution )	5.5-9.0
2.	Conductivity	0.2- 0.5 mmhos/cm
3.	Sand, Silt, Clay	---
4.	Texture	--
5.	Moisture Retention capacity	--
6.	Moisture	
7.	Infiltration rate	--
8.	Organic matter	--
9.	Nitrogen	0.01-0.02 %
10.	Potassium	>0.01%
11.	Phosphorous	--
12.	Sulphates	--
13.	Sodium Sulphate	--
14.	Calcium Sulphate	--
15.	Oil and grease	--

Table: 20 Presentation and discussions of results (SH-44: Naduvapatti- Kovilpatti- Ettayapuram)

Sl. No.	Parameters	Unit	SQ1	SQ2
1.	pH ( 10% solution )	--	7.65	7.91
2 .	Conductivity	mmhos/cm	0.254	0.229
3.	Sand	%	90	60
	Silt	%	10	40
	Clay	%	--	--
4	Texture		Sand Soil	Sand Soil
5.	Moisture Retention capacity	%	2.12	1.20
6.	Moisture	%	7.64	3.61
7.	Infiltration rate	mm/hr	1.7	1.6
8.	Organic matter	%	0.1012	0.014
9.	Nitrogen	%	0.0169	0.0172
10.	Potassium	%	0.0142	0.0114
11.	Phosphorous	%	0.0034	0.0029
12.	Sulphates	%	0.0084	0.0262
13.	Sodium Sulphate	%	0.0119	0.0302
14.	Calcium Sulphate	%	0.0141	0.0386
15.	Oil and grease	%	<1.0	<1.0

#### Results and Discussions

The soil sample does not show much variation in characteristics. The pH of the soil from the locations are neutral it range from 7.65-7.91, the conductivity in all locations does not show much variations it varies from 0.229-0.254.



Table: 21 Presentation and discussions of results (SH-39: Tirunelveli to Tenkasi)

Sl. No.	Parameters	Unit	SQ3	SQ4	SQ5
1.	pH ( 10% solution )	--	7.99	7.45	7.63
2.	Conductivity	mmhos/cm	0.282	0.204	0.346
3.	Sand	%	85	90	30
	Silt	%	5	10	10
	Clay	%	10	--	60
4	Texture		Sand Soil	Sand Soil	Clay Soil
5.	Moisture Retention capacity	%	2.43	0.42	6.56
6.	Moisture	%	6.74	1.26	19.67
7.	Infiltration rate	mm/hr	2.0	1.7	1.8
8.	Organic matter	%	0.126	0.113	0.114
9.	Nitrogen	%	0.0141	0.0124	0.0163
10.	Potassium	%	0.0136	0.0172	0.0125
11.	Phosphorous	%	0.0036	0.0019	0.0032
12.	Sulphates	%	0.0099	0.0081	0.0138
13.	Sodium Sulphate	%	0.0115	0.0116	0.0171
14.	Calcium Sulphate	%	0.0181	0.0093	0.022
15.	Oil and grease	%	<1.0	<1.0	<1.0

#### Results and Discussions

The soil sample does not show much variation in characteristics. The pH of the soil from all the locations are neutral it varies from 7.45 - 7.99, the conductivity in all locations does not show much variations it varies from 0.204-0.346.



Table: 22 Presentation and discussions of results (SH-89: Nanguneri- Bharatavaram- Uvari)

Sl. No.	Parameters	Unit	SQ6	SQ7	SQ8
1.	pH ( 10% solution )	--	7.91	7.84	7.67
2.	Conductivity	mmhos/cm	0.274	0.269	0.416
3.	Sand	%	80	70	60
	Silt	%	20	20	40
	Clay	%	--	10	--
4	Texture		Sand Soil	Sand Soil	Sand Soil
5.	Moisture Retention capacity	%	1.76	0.45	0.036
6.	Moisture	%	5.29	1.34	0.108
7.	Infiltration rate	mm/hr	1.9	1.8	1.8
8.	Organic matter	%	0.1014	0.1043	0.1019
9.	Nitrogen	%	0.0121	0.0138	0.0185
10.	Potassium	%	0.0148	0.0154	0.0172
11.	Phosphorous	%	0.0041	0.0039	0.0053
12.	Sulphates	%	0.0135	0.0081	0.0189
13.	Sodium Sulphate	%	0.0188	0.0141	0.0222
14.	Calcium Sulphate	%	0.0217	0.0163	0.2714
15.	Oil and grease	%	<1.0	<1.0	<1.0

#### Results and Discussions

The soil sample does not show much variation in characteristics. The pH of the soil from all the locations are neutral it varies from 7.67 -7.91, the conductivity in all locations does not show much variations it varies from 0.269- 0.416.



### ANNEXURE 1- PHOTOGRAPHS

NH-44:Naduvapatti-Kovilpatti- Ettayapuram

#### ❖ Ambient Air Monitoring Photos:



#### ❖ Noise Monitoring Photos:







❖ Noise Monitoring Photos:



❖ Water sampling Photos:





❖ Water sampling Photos:



❖ Soil sampling Photos:







NH-39: Tirunelveli to Tenkasi

❖ Ambient Air Monitoring Photos:





❖ Noise Monitoring Photos:







❖ Noise Monitoring Photos:







❖ Noise Monitoring Photos:



ANQ 23



ANQ 24

❖ Water sampling Photos:



WQ 05



WQ 06



WQ 07



WQ 08



WQ 09



WQ 10



❖ Water sampling Photos:



❖ Soil sampling Photos:







NH-89: ( Nanguneri- Bharatavaram- Uvari)

❖ Ambient Air Monitoring Photos:



❖ Noise Monitoring Photos:





❖ Noise Monitoring Photos:







❖ Water sampling Photos:



❖ Soil sampling Photos:







❖ Soil sampling Photos:



❖ Site Visit photos of SMEC





GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address		SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.						
Survey Description		School and temple at Naduvapatti (AAQ 01)						
Survey Conducted by		GCSPL						
Survey conducted on	Sample Received on	Test Completed on	Time (24 Hrs)	P.M10	P.M2.5	SO <sub>2</sub>	NO <sub>x</sub>	CO (8 hr)
26.02.2014 to 27.02.2014	28.02.2014	01.03.2014	07.30 to 07.30	39.6	15.4	6.4	14.7	0.80
03.03.2014 to 04.03.2014	05.03.2014	06.03.2014	11.15 to 11.15	38.1	13.7	5.9	15.4	0.75
07.03.2014 to 08.03.2014	09.03.2014	10.03.2014	09.30 to 09.30	39.4	14.6	4.7	13.8	0.80
10.03.2014 to 11.03.2014	12.03.2014	13.03.2014	17.00 to 17.00	40.6	15	6.2	14.1	0.75
14.03.2014 to 15.03.2014	16.03.2014	17.03.2014	09.10 to 17.10	39.8	15.9	5.6	13	0.80
			17.10 to 01.10	31.7				
			01.10 to 09.10	33.1				
17.03.2014 to 18.03.2014	19.03.2014	20.03.2014	18.15 to 02.15	34.4	13.2	5.3	16.2	0.90
			02.15 to 10.15	28.7				
			10.15 to 18.15	38.8				
21.03.2014 to 22.03.2014	22.03.2014	24.03.2014	09.15 to 17.15	38.6	14.9	6.8	14.1	0.85
			17.15 to 01.15	32.2				
			01.15 to 09.15	34.1				
24.03.2014 to 25.03.2014	26.03.2014	27.03.2014	17.00 to 01.00	36.9	14.4	5.5	13.9	0.75
			01.00 to 09.00	29.1				
			09.00 to 17.00	38.4				
Total Average Results				35.8	14.6	5.8	14.4	0.80
Unit				µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>
For Green Chem Solutions Pvt Ltd (Laboratory Division)								Authorized Signatory



GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address		SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.						
Survey Description		Temple at Nakkalamuttampatti Village (AAQ 02)						
Survey Conducted by		GCSPL						
Survey conducted on	Sample Received on	Test Completed on	Time (24 Hrs)	P.M10	P.M2.5	SO <sub>2</sub>	NO <sub>x</sub>	CO (8 hr)
26.02.2014 to 27.02.2014	28.02.2014	01.03.2014	07.45 to 07.45	43.3	16.7	6.9	14.9	0.85
03.03.2014 to 04.03.2014	05.03.2014	06.03.2014	11.30 to 11.30	42.7	18.9	7.1	16.5	0.90
07.03.2014 to 08.03.2014	09.03.2014	10.03.2014	09.45 to 09.45	44	17.5	6.5	15.7	0.95
10.03.2014 to 11.03.2014	12.03.2014	13.03.2014	17.15 to 17.15	41.9	15.8	5.2	17.3	0.90
14.03.2014 to 15.03.2014	16.03.2014	17.03.2014	09.25 to 17.25	43.4	17.1	6.4	15.9	0.80
			17.25 to 01.25	36.3				
			01.25 to 09.25	38.8				
17.03.2014 to 18.03.2014	19.03.2014	20.03.2014	18.30 to 02.30	36.5	18.4	7.7	16.4	0.75
			02.30 to 10.30	33.2				
			10.30 to 18.30	42.1				
21.03.2014 to 22.03.2014	22.03.2014	24.03.2014	09.30 to 17.30	44.6	16.3	7.3	15.6	0.85
			17.30 to 01.30	37.2				
			01.30 to 09.30	39.3				
24.03.2014 to 25.03.2014	26.03.2014	27.03.2014	17.15 to 01.15	35.4	18	6.6	16.8	0.80
			01.15 to 09.15	32.6				
			09.15 to 17.15	40.8				
Total Average Results				39.5	17.3	6.7	16.1	0.85
Unit				µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>
For Green Chem Solutions Pvt Ltd (Laboratory Division)								Authorized Signatory



GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address		SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.						
Survey Description		Cross junction of NH-7 at Kovilpatti Municipal Area (AAQ 03)						
Survey Conducted by		GCSPL						
Survey conducted on	Sample Received on	Test Completed on	Time (24 Hrs)	P.M10	P.M2.5	SO <sub>2</sub>	NO <sub>x</sub>	CO (8 hr)
26.02.2014 to 27.02.2014	28.02.2014	01.03.2014	08.00 to 08.00	49.2	19.9	8.1	16.9	0.90
03.03.2014 to 04.03.2014	05.03.2014	06.03.2014	11.45 to 11.45	47.4	22.4	7.6	18.4	1.00
07.03.2014 to 08.03.2014	09.03.2014	10.03.2014	10.00 to 10.00	48.6	19.1	6.6	15.9	0.95
10.03.2014 to 11.03.2014	12.03.2014	13.03.2014	16.45 to 16.45	48.1	20.5	6.9	18.6	1.00
14.03.2014 to 15.03.2014	16.03.2014	17.03.2014	09.45 to 17.45	47.3	18.7	7.4	17.1	0.95
			17.45 to 01.45	39.9				
			01.45 to 09.45	42.2				
17.03.2014 to 18.03.2014	19.03.2014	20.03.2014	18.00 to 02.00	44.6	20.2	8	18.2	0.90
			02.00 to 10.00	38.2				
			10.00 to 18.00	46.4				
21.03.2014 to 22.03.2014	22.03.2014	24.03.2014	09.45 to 17.45	48	19.3	7.3	16.5	1.00
			17.45 to 01.45	37.7				
			01.45 to 09.45	41.3				
24.03.2014 to 25.03.2014	26.03.2014	27.03.2014	17.30 to 01.30	43.7	21	8.2	16.8	0.90
			01.30 to 09.30	38.3				
			09.30 to 17.30	46.5				
Total Average Results				44.2	20.1	7.5	17.3	0.95
Unit				µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>
For Green Chem Solutions Pvt Ltd (Laboratory Division)								Authorized Signatory



GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address		SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.						
Survey Description		Near Mahakavibharathiyar memorial Near Ettayapuram (AAQ 04)						
Survey Conducted by		GCSPL						
Survey conducted on	Sample Received on	Test Completed on	Time (24 Hrs)	P.M10	P.M2.5	SO <sub>2</sub>	NO <sub>x</sub>	CO (8 hr)
26.02.2014 to 27.02.2014	28.02.2014	01.03.2014	08.40 to 08.40	42.9	19	6.9	16.8	0.85
03.03.2014 to 04.03.2014	05.03.2014	06.03.2014	12.00 to 12.00	43.5	17.7	7.4	17.2	0.90
07.03.2014 to 08.03.2014	09.03.2014	10.03.2014	10.45 to 10.45	41.9	20	8	16.5	0.95
10.03.2014 to 11.03.2014	12.03.2014	13.03.2014	17.45 to 17.45	44.7	19.4	5.9	17.9	1.00
14.03.2014 to 15.03.2014	16.03.2014	17.03.2014	10.20 to 18.20	42.4	16.8	6.2	15.6	0.75
			18.20 to 02.20	37.9				
			02.20 to 10.20	39.3				
17.03.2014 to 18.03.2014	19.03.2014	20.03.2014	19.00 to 03.00	41.2	18.7	7.6	17.4	1.00
			03.00 to 11.00	38.4				
			10.00 to 19.00	43.6				
21.03.2014 to 22.03.2014	22.03.2014	24.03.2014	10.15 to 18.15	43.3	19.8	7.1	16.7	0.80
			18.15 to 02.15	38.6				
			02.15 to 10.15	40.7				
24.03.2014 to 25.03.2014	26.03.2014	27.03.2014	18.00 to 02.00	41.8	19.1	7.5	17.3	0.95
			02.00 to 10.00	39.6				
			10.00 to 18.00	42.9				
Total Average Results				41.4	18.8	7.1	16.9	0.90
Unit				µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>
For Green Chem Solutions Pvt Ltd (Laboratory Division)								
Authorized Signatory								





GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address		SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.						
Survey Description		School near Elankulam Village (AAQ 12)						
Survey Conducted by		GCSP						
Survey conducted on	Sample Received on	Test Completed on	Time (24 Hrs)	P.M10	P.M2.5	SO <sub>2</sub>	NO <sub>x</sub>	CO (8 hr)
01.03.2014 to 02.03.2014	03.03.2014	04.03.2014	07.15 to 07.15	36.3	16.7	6.5	15.9	0.90
04.03.2014 to 05.03.2014	06.03.2014	07.03.2014	14.30 to 14.30	34.9	14.9	7.6	14.8	0.80
08.03.2014 to 09.03.2014	10.03.2014	11.03.2014	13.00 to 13.00	35.6	15.5	7	15.4	0.75
11.03.2014 to 12.03.2014	13.03.2014	14.03.2014	19.30 to 19.30	34.7	16.2	6.2	15.7	0.85
15.03.2014 to 16.03.2014	17.03.2014	18.03.2014	12.40 to 20.40	38.4	16.1	7.2	14.9	0.95
			20.40 to 04.40	32.2				
			04.40 to 12.40	36.7				
18.03.2014 to 19.03.2014	20.03.2014	21.03.2014	21.40 to 05.40	31.6	15.7	6.9	16.2	0.85
			05.40 to 13.40	33.2				
			13.40 to 21.40	37.3				
22.03.2014 to 23.03.2014	24.03.2014	25.03.2014	12.30 to 20.30	35.8	16.3	5.8	15.2	0.80
			20.30 to 04.30	30.6				
			04.30 to 12.30	33.4				
25.03.2014 to 26.03.2014	27.03.2014	28.03.2014	20.15 to 04.15	30.7	15	7.1	14.3	0.90
			04.15 to 12.15	32.6				
			12.15 to 20.15	37.9				
Total Average Results				34.5	15.8	6.8	15.3	0.85
Unit				µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>
For Green Chem Solutions Pvt Ltd (Laboratory Division)								
Authorized Signatory								



GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address		SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.						
Survey Description		RECT College Vijayanarayanam (AAQ 13)						
Survey Conducted by		GCSPL						
Survey conducted on	Sample Received on	Test Completed on	Time (24 Hrs)	P.M10	P.M2.5	SO <sub>2</sub>	NO <sub>x</sub>	CO (8 hr)
01.03.2014 to 02.03.2014	03.03.2014	04.03.2014	07.30 to 07.30	37.2	17.5	5.4	16.2	0.70
04.03.2014 to 05.03.2014	06.03.2014	07.03.2014	14.45 to 14.45	36.9	16.9	6.1	15.6	0.90
08.03.2014 to 09.03.2014	10.03.2014	11.03.2014	13.15 to 13.15	38.1	18.2	5.8	15.9	0.85
11.03.2014 to 12.03.2014	13.03.2014	14.03.2014	19.50 to 19.50	39.3	17.7	6.5	16	0.75
15.03.2014 to 16.03.2014	17.03.2014	18.03.2014	12.50 to 20.50	37.6	15.8	6.7	15.1	0.85
			20.50 to 04.50	31.9				
			04.50 to 12.50	35.8				
18.03.2014 to 19.03.2014	20.03.2014	21.03.2014	22.00 to 06.00	32.4	16.2	5.5	16.4	0.80
			06.00 to 14.00	35.5				
			14.00 to 22.00	39.2				
22.03.2014 to 23.03.2014	24.03.2014	25.03.2014	12.45 to 20.45	38.8	17.5	6.6	15.7	0.70
			20.45 to 04.45	32				
			04.45 to 12.45	35.3				
25.03.2014 to 26.03.2014	27.03.2014	28.03.2014	20.30 to 04.30	33.2	17	6.2	15.5	0.85
			04.30 to 12.30	36.4				
			12.30 to 20.30	39.8				
Total Average Results				36.2	17.1	6.1	15.8	0.80
Unit				µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>
For Green Chem Solutions Pvt Ltd (Laboratory Division)								Authorized Signatory



GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address		SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.						
Survey Description		College near cross junction of SH-93 (Vallure to turchun) (AAQ 14)						
Survey Conducted by		GCSPL						
Survey conducted on	Sample Received on	Test Completed on	Time (24 Hrs)	P.M10	P.M2.5	SO <sub>2</sub>	NO <sub>x</sub>	CO (8 hr)
01.03.2014 to 02.03.2014	03.03.2014	04.03.2014	07.45 to 07.45	43.6	20.4	8.2	16.4	1.00
04.03.2014 to 05.03.2014	06.03.2014	07.03.2014	15.10 to 15.10	44.8	18.8	6.9	17.2	0.90
08.03.2014 to 09.03.2014	10.03.2014	11.03.2014	13.35 to 13.35	40.5	19.6	7.5	16.3	0.95
11.03.2014 to 12.03.2014	13.03.2014	14.03.2014	20.15 to 20.15	42.2	18.2	8.4	18	1.00
15.03.2014 to 16.03.2014	17.03.2014	18.03.2014	13.10 to 21.10	41.4	20	7	17.5	0.90
			21.10 to 05.10	36.6				
			05.10 to 13.10	38.2				
18.03.2014 to 19.03.2014	20.03.2014	21.03.2014	22.15 to 06.15	36.3	20.8	8.8	17.7	0.95
			06.15 to 14.15	40.4				
			14.15 to 22.15	43.6				
22.03.2014 to 23.03.2014	24.03.2014	25.03.2014	13.00 to 21.00	42.6	19.3	8.3	16.8	0.90
			21.00 to 05.00	35				
			05.00 to 10.00	38.1				
25.03.2014 to 26.03.2014	27.03.2014	28.03.2014	20.45 to 04.45	37.6	19.9	7.6	17.1	1.00
			04.45 to 12.45	41.2				
			12.45 to 20.45	44.4				
Total Average Results				40.4	19.6	7.8	17.1	0.95
Unit				µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>
For Green Chem Solutions Pvt Ltd (Laboratory Division)								Authorized Signatory



GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address		SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.						
Survey Description		School and Church Uvari (AAQ 15)						
Survey Conducted by		GCSPL						
Survey conducted on	Sample Received on	Test Completed on	Time (24 Hrs)	P.M10	P.M2.5	SO <sub>2</sub>	NO <sub>x</sub>	CO (8 hr)
01.03.2014 to 02.03.2014	03.03.2014	04.03.2014	08.20 to 08.20	43.7	17.4	5.6	17.6	0.85
04.03.2014 to 05.03.2014	06.03.2014	07.03.2014	15.50 to 15.50	44.5	19.1	7.2	15.8	0.70
08.03.2014 to 09.03.2014	10.03.2014	11.03.2014	14.15 to 14.15	43.2	18.5	5.9	17.2	0.80
11.03.2014 to 12.03.2014	13.03.2014	14.03.2014	20.45 to 20.45	42.8	17.9	6.4	15.1	0.85
15.03.2014 to 16.03.2014	17.03.2014	18.03.2014	13.50 to 21.50	40.2	18.8	6.8	15.4	0.80
			21.50 to 05.50	34.8				
			05.50 to 13.50	37.6				
18.03.2014 to 19.03.2014	20.03.2014	21.03.2014	22.35 to 06.35	36.2	19	7.6	16.6	0.75
			06.35 to 14.35	38.3				
			14.35 to 22.35	42.6				
22.03.2014 to 23.03.2014	24.03.2014	25.03.2014	13.30 to 21.30	41.5	17.2	5.5	17.4	0.80
			21.30 to 05.30	34.2				
			05.30 to 13.30	38.6				
25.03.2014 to 26.03.2014	27.03.2014	28.03.2014	21.20 to 05.20	34.3	18.7	6.2	16.9	0.85
			05.20 to 13.20	38.8				
			13.20 to 21.20	41.9				
Total Average Results				39.6	18.3	6.4	16.5	0.80
Unit				µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>
For Green Chem Solutions Pvt Ltd (Laboratory Division)								
Authorized Signatory								



GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address		SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.						
Survey Description		Matriculation School, Palyapattai, (AAQ 05)						
Survey Conducted by		GCSP						
Survey conducted on	Sample Received on	Test Completed on	Time (24 Hrs)	P.M10	P.M2.5	SO <sub>2</sub>	NO <sub>x</sub>	CO (8 hr)
27.02.2014 to 28.02.2014	01.03.2014	03.03.2014	07.00 to 07.00	39.1	16.3	7.2	16.8	0.85
02.03.2014 to 03.03.2014	04.03.2014	05.03.2014	09.30 to 09.30	36.9	17.5	6.3	17.7	0.90
06.03.2014 to 07.03.2014	08.03.2014	9.03.2014	07.00 to 07.00	40.8	15.9	7.7	16.3	0.75
09.03.2014 to 10.03.2014	11.03.2014	12.03.2014	15.00 to 15.00	36.4	18.4	6.7	17.3	0.80
13.03.2014 to 14.03.2014	15.03.2014	17.03.2014	07.00 to 15.00	38.5	17.5	5.8	16.5	0.70
			15.00 to 23.00	35.6				
			23.00 to 07.00	32.3				
16.03.2014 to 17.03.2014	18.03.2014	19.03.2014	14.45 to 22.45	36.4	17.6	7.6	16.1	0.80
			22.45 to 06.45	30.4				
			06.45 to 14.45	38.9				
20.03.2014 to 21.03.2014	22.03.2014	24.03.2014	07.00 to 15.00	39.6	16.8	6.4	15.9	0.85
			15.00 to 23.00	36.2				
			23.00 to 07.00	33.8				
23.03.2014 to 24.03.2014	25.03.2014	26.03.2014	14.30 to 22.30	37.3	18.2	7	17	0.75
			22.30 to 06.30	33.7				
			06.30 to 14.30	39.4				
Total Average Results				36.6	17.3	6.8	16.7	0.80
Unit				µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>
For Green Chem Solutions Pvt Ltd (Laboratory Division)								
Authorized Signatory								





GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address		SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.						
Survey Description		Manonmanium University (AAQ 06)						
Survey Conducted by		GCSPL						
Survey conducted on	Sample Received on	Test Completed on	Time (24 Hrs)	P.M10	P.M2.5	SO <sub>2</sub>	NO <sub>x</sub>	CO (8 hr)
27.02.2014 to 28.02.2014	01.03.2014	03.03.2014	07.15 to 07.15	35.6	15.7	6.5	15.7	0.95
02.03.2014 to 03.03.2014	04.03.2014	05.03.2014	09.45 to 09.45	37.4	16.4	6.1	16.5	0.90
06.03.2014 to 07.03.2014	08.03.2014	9.03.2014	07.10 to 07.10	36.2	16.8	6.8	16	0.80
09.03.2014 to 10.03.2014	11.03.2014	12.03.2014	15.15 to 15.15	35.9	15.3	7	15.6	0.85
13.03.2014 to 14.03.2014	15.03.2014	17.03.2014	07.10 to 15.10	36.8	17	6.3	17.1	0.80
			15.10 to 23.10	33.2				
			23.10 to 07.10	31.9				
16.03.2014 to 17.03.2014	18.03.2014	19.03.2014	15.00 to 23.00	34.4	14.9	7.4	16.3	0.85
			23.00 to 07.00	32.2				
			07.00 to 15.00	36.1				
20.03.2014 to 21.03.2014	22.03.2014	24.03.2014	07.15 to 15.15	35.5	16.6	5.7	15.9	0.75
			15.15 to 23.15	32.4				
			23.15 to 07.15	33.8				
23.03.2014 to 24.03.2014	25.03.2014	26.03.2014	14.45 to 22.45	34.9	17.2	5.6	15.7	0.90
			22.45 to 06.45	33.7				
			06.45 to 14.45	36.6				
Total Average Results				34.8	16.2	6.4	16.1	0.85
Unit				µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>
For Green Chem Solutions Pvt Ltd (Laboratory Division)								
Authorized Signatory								



GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address		SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.						
Client Reference								
Survey Description		Einstein College of Engineering, Muttankulam (AAQ 07)						
Survey Conducted by		GCSPL						
Survey conducted on	Sample Received on	Test Completed on	Time (24 Hrs)	P.M10	P.M2.5	SO <sub>2</sub>	NO <sub>x</sub>	CO (8 hr)
27.02.2014 to 28.02.2014	01.03.2014	03.03.2014	07.30 to 07.30	39.2	19.2	7.3	18.3	0.70
02.03.2014 to 03.03.2014	04.03.2014	05.03.2014	10.00 to 10.00	40.4	19.4	6.5	17.5	0.80
06.03.2014 to 07.03.2014	08.03.2014	9.03.2014	07.25 to 07.25	38.8	18.3	8.3	18.1	0.75
09.03.2014 to 10.03.2014	11.03.2014	12.03.2014	15.30 to 15.30	39.6	17.9	7.7	16.9	0.90
13.03.2014 to 14.03.2014	15.03.2014	17.03.2014	07.25 to 15.25	39.9	18.6	7.1	17.1	0.85
			15.25 to 23.25	37.2				
			23.25 to 07.25	35.5				
16.03.2014 to 17.03.2014	18.03.2014	19.03.2014	15.15 to 23.15	37.2	17.5	6.4	16.5	0.80
			23.15 to 07.15	36.4				
			07.15 to 15.15	39.1				
20.03.2014 to 21.03.2014	22.03.2014	24.03.2014	07.30 to 15.30	39.8	18.2	7.6	17.3	0.75
			15.30 to 23.30	37.3				
			23.30 to 07.30	36.2				
23.03.2014 to 24.03.2014	25.03.2014	26.03.2014	15.00 to 23.00	37.6	19.2	6.9	17.6	0.85
			23.00 to 07.00	35.8				
			07.00 to 15.00	39.9				
Total Average Results				38.1	18.5	7.2	17.4	0.80
Unit				µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>
For Green Chem Solutions Pvt Ltd (Laboratory Division)								
Authorized Signatory								



GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address		SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.						
Survey Description		Sitaparappanallur Village (AAQ 08)						
Survey Conducted by		GCSPL						
Survey conducted on	Sample Received on	Test Completed on	Time (24 Hrs)	P.M10	P.M2.5	SO <sub>2</sub>	NO <sub>x</sub>	CO (8 hr)
27.02.2014 to 28.02.2014	01.03.2014	03.03.2014	07.40 to 07.40	36.3	16.5	5.9	17	0.95
02.03.2014 to 03.03.2014	04.03.2014	05.03.2014	10.10 to 10.10	37.1	17.7	6.2	16.3	0.75
06.03.2014 to 07.03.2014	08.03.2014	9.03.2014	07.35 to 07.35	37.6	16.8	7.5	17.7	0.90
09.03.2014 to 10.03.2014	11.03.2014	12.03.2014	15.40 to 15.40	35.5	16.6	7.3	16.5	0.85
13.03.2014 to 14.03.2014	15.03.2014	17.03.2014	07.35 to 15.35	37.5	17.3	6.8	17.2	0.80
			15.35 to 23.35	34.3				
			23.35 to 07.35	31.8				
16.03.2014 to 17.03.2014	18.03.2014	19.03.2014	15.25 to 23.25	38.2	16.4	7.1	15.9	0.85
			23.25 to 07.25	34.8				
			07.25 to 15.25	36.4				
20.03.2014 to 21.03.2014	22.03.2014	24.03.2014	07.40 to 15.40	37.7	18	5.7	16.7	0.90
			15.40 to 23.40	35				
			23.40 to 07.40	32.2				
23.03.2014 to 24.03.2014	25.03.2014	26.03.2014	15.10 to 23.10	38.7	16.9	6.5	17.8	0.80
			23.10 to 07.10	34.4				
			07.10 to 15.10	36.8				
Total Average Results				35.9	17.0	6.6	16.9	0.85
Unit				µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>
For Green Chem Solutions Pvt Ltd (Laboratory Division)								Authorized Signatory



GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address		SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.						
Survey Description		CSI Christ Church Alangulam (AAQ 09)						
Survey Conducted by		GCSPL						
Survey conducted on	Sample Received on	Test Completed on	Time (24 Hrs)	P.M10	P.M2.5	SO <sub>2</sub>	NO <sub>x</sub>	CO (8 hr)
27.02.2014 to 28.02.2014	01.03.2014	03.03.2014	08.00 to 08.00	43.4	20.7	7.7	16.5	0.85
02.03.2014 to 03.03.2014	04.03.2014	05.03.2014	10.30 to 10.30	41.2	18.6	6.1	17.6	0.90
06.03.2014 to 07.03.2014	08.03.2014	9.03.2014	08.00 to 08.00	44	18.2	7	18	0.95
09.03.2014 to 10.03.2014	11.03.2014	12.03.2014	16.05 to 16.05	42.5	20.6	7.8	16.9	0.85
13.03.2014 to 14.03.2014	15.03.2014	17.03.2014	08.00 to 16.00	41.1	19.4	7.3	17.7	0.95
			16.00 to 00.00	37.9				
			00.00 to 08.00	35.5				
16.03.2014 to 17.03.2014	18.03.2014	19.03.2014	15.45 to 23.45	42	18	6.6	18.4	0.90
			23.45 to 07.45	36.2				
			07.45 to 15.45	39.1				
20.03.2014 to 21.03.2014	22.03.2014	24.03.2014	08.00 to 16.00	41.9	19.8	7.5	17.3	0.95
			16.00 to 00.00	38.5				
			00.00 to 08.00	35.7				
23.03.2014 to 24.03.2014	25.03.2014	26.03.2014	15.30 to 23.30	41.8	20.2	6.8	18.5	0.85
			23.30 to 07.30	36.2				
			07.30 to 15.30	38.3				
Total Average Results				39.7	19.4	7.1	17.6	0.90
Unit				µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>
For Green Chem Solutions Pvt Ltd (Laboratory Division)								
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GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address		SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.						
Survey Description		Temple near cross junction of SH-39A (AAQ 10)						
Survey Conducted by		GCSPL						
Survey conducted on	Sample Received on	Test Completed on	Time (24 Hrs)	P.M10	P.M2.5	SO <sub>2</sub>	NO <sub>x</sub>	CO (8 hr)
27.02.2014 to 28.02.2014	01.03.2014	03.03.2014	08.20 to 08.20	45.4	19.4	7.9	18.6	1.00
02.03.2014 to 03.03.2014	04.03.2014	05.03.2014	10.50 to 10.50	43.8	21.2	8.4	17.8	0.90
06.03.2014 to 07.03.2014	08.03.2014	9.03.2014	08.20 to 08.20	44.6	20.7	7	17.4	0.95
09.03.2014 to 10.03.2014	11.03.2014	12.03.2014	16.30 to 16.30	43	19.9	8.2	19.1	0.90
13.03.2014 to 14.03.2014	15.03.2014	17.03.2014	08.20 to 16.20	45.6	22.2	8.7	18.5	1.00
			16.20 to 00.20	38.5				
			00.20 to 08.20	41.2				
16.03.2014 to 17.03.2014	18.03.2014	19.03.2014	16.10 to 00.10	38.2	21.6	7.3	17.9	0.90
			00.10 to 08.10	40.8				
			08.10 to 16.10	45.1				
20.03.2014 to 21.03.2014	22.03.2014	24.03.2014	08.20 to 16.20	45.2	20.4	8.5	18.4	0.95
			16.20 to 00.20	39.1				
			00.20 to 08.20	40.7				
23.03.2014 to 24.03.2014	25.03.2014	26.03.2014	15.50 to 23.50	39.6	21.2	8.8	18	1.00
			23.50 to 07.50	41.3				
			07.50 to 15.50	44.8				
Total Average Results				42.3	20.8	8.1	18.2	0.95
Unit				µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>
For Green Chem Solutions Pvt Ltd (Laboratory Division)								
Authorized Signatory								





GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address		SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.						
Survey Description		Municipality Park at Vettaikaramkulam (AAQ 11)						
Survey Conducted by		GCSPL						
Survey conducted on	Sample Received on	Test Completed on	Time (24 Hrs)	P.M10	P.M2.5	SO <sub>2</sub>	NO <sub>x</sub>	CO (8 hr)
27.02.2014 to 28.02.2014	01.03.2014	03.03.2014	08.35 to 08.35	44.1	20.2	7.2	18	0.80
02.03.2014 to 03.03.2014	04.03.2014	05.03.2014	11.05 to 11.05	44.5	19.3	8.5	17.3	0.95
06.03.2014 to 07.03.2014	08.03.2014	9.03.2014	08.35 to 08.35	43.4	19.9	8.6	18.8	0.80
09.03.2014 to 10.03.2014	11.03.2014	12.03.2014	16.45 to 16.45	45	20.4	7.5	18.4	1.00
13.03.2014 to 14.03.2014	15.03.2014	17.03.2014	08.35 to 16.35	43.6	21	6.9	18.1	0.95
			16.35 to 00.35	37.4				
			00.35 to 08.35	40.3				
16.03.2014 to 17.03.2014	18.03.2014	19.03.2014	16.25 to 00.25	37.5	19.6	8.7	16.7	0.90
			00.25 to 08.25	40.2				
			08.25 to 16.25	43.7				
20.03.2014 to 21.03.2014	22.03.2014	24.03.2014	08.35 to 16.35	44	20.5	7.9	17.9	0.85
			16.35 to 00.35	38.2				
			00.35 to 08.35	41.4				
23.03.2014 to 24.03.2014	25.03.2014	26.03.2014	16.05 to 00.05	38.1	19.3	7.1	17.2	0.95
			00.05 to 08.05	40.5				
			08.05 to 16.05	43.3				
Total Average Results				41.6	20.0	7.8	17.8	0.90
Unit				µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>
For Green Chem Solutions Pvt Ltd (Laboratory Division)								Authorized Signatory



GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	28.02.2014	
Survey Conducted by	GC SPL	Test Commenced on	01.03.2014	
Survey Conducted on	26.02.14 to 27.02.14	Test Completed on	01.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
School and temple at Naduvapatti (ANQ 01)	Day Time		48.8	
	6:00 AM	7:00 AM		40.94
	7:00 AM	8:00 AM		43.78
	8:00 AM	9:00 AM		45.18
	9:00 AM	10:00 AM		47.65
	10:00 AM	11:00 AM		49.36
	11:00 AM	12:00 PM		49.42
	12:00 PM	1:00 PM		50.83
	1:00 PM	2:00 PM		49.11
	2:00 PM	3:00 PM		50.02
	3:00 PM	4:00 PM		47.62
	4:00 PM	5:00 PM		50.00
	5:00 PM	6:00 PM		44.53
	6:00 PM	7:00 PM		42.73
	7:00 PM	8:00 PM		42.07
	8:00 PM	9:00 PM		39.01
	9:00 PM	10:00 PM	38.14	
	Night Time		Hourly Leq dB (A)	37.4
	10:00 PM	11:00 PM	33.96	
	11:00 PM	12:00 AM	33.27	
	12:00 AM	1:00 AM	33.88	
	1:00 AM	2:00 AM	33.63	
	2:00 AM	3:00 AM	33.32	
	3:00 AM	4:00 AM	37.26	
	4:00 AM	5:00 AM	37.02	
	5:00 AM	6:00 AM	38.58	
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
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GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	28.02.2014	
Survey Conducted by	GC SPL	Test Commenced on	01.03.2014	
Survey Conducted on	26.02.14 to 27.02.14	Test Completed on	01.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Temple at Sippipari (ANQ 02)	Day Time		59.7	
	6:00 AM	7:00 AM		53.92
	7:00 AM	8:00 AM		54.40
	8:00 AM	9:00 AM		56.44
	9:00 AM	10:00 AM		60.54
	10:00 AM	11:00 AM		62.14
	11:00 AM	12:00 PM		62.50
	12:00 PM	1:00 PM		64.37
	1:00 PM	2:00 PM		63.31
	2:00 PM	3:00 PM		62.62
	3:00 PM	4:00 PM		61.48
	4:00 PM	5:00 PM		59.30
	5:00 PM	6:00 PM		53.19
	6:00 PM	7:00 PM		52.53
	7:00 PM	8:00 PM		51.28
	8:00 PM	9:00 PM	47.94	
	9:00 PM	10:00 PM	41.84	
	Night Time		Hourly Leq dB (A)	48.6
	10:00 PM	11:00 PM	42.47	
	11:00 PM	12:00 AM	42.44	
12:00 AM	1:00 AM	43.58		
1:00 AM	2:00 AM	44.39		
2:00 AM	3:00 AM	49.05		
3:00 AM	4:00 AM	50.0		
4:00 AM	5:00 AM	50.76		
5:00 AM	6:00 AM	52.92		
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
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Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	28.02.2014	
Survey Conducted by	GCSPL	Test Commenced on	01.03.2014	
Survey Conducted on	26.02.14 to 27.02.14	Test Completed on	01.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Temple at Nakkalamuttampatti Village (ANQ 03)	Day Time		48.2	
	6:00 AM	7:00 AM		41.87
	7:00 AM	8:00 AM		45.57
	8:00 AM	9:00 AM		45.84
	9:00 AM	10:00 AM		49.44
	10:00 AM	11:00 AM		50.75
	11:00 AM	12:00 PM		50.74
	12:00 PM	1:00 PM		51.64
	1:00 PM	2:00 PM		50.26
	2:00 PM	3:00 PM		51.42
	3:00 PM	4:00 PM		48.79
	4:00 PM	5:00 PM		48.89
	5:00 PM	6:00 PM		46.49
	6:00 PM	7:00 PM		44.35
	7:00 PM	8:00 PM		42.75
	8:00 PM	9:00 PM	38.48	
	9:00 PM	10:00 PM	37.38	
	Night Time		Hourly Leq dB (A)	38.7
	10:00 PM	11:00 PM	36.10	
	11:00 PM	12:00 AM	34.83	
12:00 AM	1:00 AM	35.58		
1:00 AM	2:00 AM	35.90		
2:00 AM	3:00 AM	36.87		
3:00 AM	4:00 AM	40.25		
4:00 AM	5:00 AM	41.27		
5:00 AM	6:00 AM	41.94		
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
Authorized Signatory				



GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	28.02.2014	
Survey Conducted by	GC SPL	Test Commenced on	01.03.2014	
Survey Conducted on	26.02.14 to 27.02.14	Test Completed on	01.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Cross junction of NH-7 at Kovilpatti Municipal Area (ANQ 04)	Day Time		58.8	
	6:00 AM	7:00 AM		52.39
	7:00 AM	8:00 AM		53.31
	8:00 AM	9:00 AM		56.35
	9:00 AM	10:00 AM		60.30
	10:00 AM	11:00 AM		61.85
	11:00 AM	12:00 PM		62.30
	12:00 PM	1:00 PM		63.93
	1:00 PM	2:00 PM		62.49
	2:00 PM	3:00 PM		60.01
	3:00 PM	4:00 PM		58.23
	4:00 PM	5:00 PM		57.86
	5:00 PM	6:00 PM		52.84
	6:00 PM	7:00 PM		52.31
	7:00 PM	8:00 PM	50.84	
	8:00 PM	9:00 PM	48.28	
	9:00 PM	10:00 PM	43.90	
	Night Time		Hourly Leq dB (A)	50.6
	10:00 PM	11:00 PM	45.65	
	11:00 PM	12:00 AM	45.37	
12:00 AM	1:00 AM	43.56		
1:00 AM	2:00 AM	44.87		
2:00 AM	3:00 AM	49.52		
3:00 AM	4:00 AM	51.04		
4:00 AM	5:00 AM	52.97		
5:00 AM	6:00 AM	55.87		

For Green Chem Solutions Pvt Ltd  
(Laboratory Division)

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GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	28.02.2014	
Survey Conducted by	GC SPL	Test Commenced on	01.03.2014	
Survey Conducted on	26.02.14 to 27.02.14	Test Completed on	01.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Built-up area at Ettaiyapuram (ANQ 05)	Day Time		52.2	
	6:00 AM	7:00 AM		47.51
	7:00 AM	8:00 AM		49.61
	8:00 AM	9:00 AM		50.64
	9:00 AM	10:00 AM		52.02
	10:00 AM	11:00 AM		54.57
	11:00 AM	12:00 PM		56.92
	12:00 PM	1:00 PM		54.31
	1:00 PM	2:00 PM		55.28
	2:00 PM	3:00 PM		53.85
	3:00 PM	4:00 PM		51.39
	4:00 PM	5:00 PM		51.12
	5:00 PM	6:00 PM		51.61
	6:00 PM	7:00 PM		49.63
	7:00 PM	8:00 PM		48.62
	8:00 PM	9:00 PM	44.00	
	9:00 PM	10:00 PM	40.45	
	Night Time		Hourly Leq dB (A)	42.6
	10:00 PM	11:00 PM	38.98	
	11:00 PM	12:00 AM	38.09	
	12:00 AM	1:00 AM	38.9	
	1:00 AM	2:00 AM	38.23	
	2:00 AM	3:00 AM	38.42	
	3:00 AM	4:00 AM	43.89	
4:00 AM	5:00 AM	45.15		
5:00 AM	6:00 AM	47.25		
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
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GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	28.02.2014	
Survey Conducted by	GC SPL	Test Commenced on	01.03.2014	
Survey Conducted on	26.02.14 to 27.02.14	Test Completed on	01.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Near Mahakavibharathiyar memorial near Ettaiyapuram (ANQ 06)	Day Time		61.4	
	6:00 AM	7:00 AM		56.04
	7:00 AM	8:00 AM		58.13
	8:00 AM	9:00 AM		61.4
	9:00 AM	10:00 AM		63.29
	10:00 AM	11:00 AM		62.29
	11:00 AM	12:00 PM		64.87
	12:00 PM	1:00 PM		66.03
	1:00 PM	2:00 PM		63.22
	2:00 PM	3:00 PM		63.77
	3:00 PM	4:00 PM		62.02
	4:00 PM	5:00 PM		60.8
	5:00 PM	6:00 PM		57
	6:00 PM	7:00 PM		55.73
	7:00 PM	8:00 PM		54.64
	8:00 PM	9:00 PM	50.98	
	9:00 PM	10:00 PM	48.31	
	Night Time		Hourly Leq dB (A)	50.9
	10:00 PM	11:00 PM	43.82	
	11:00 PM	12:00 AM	43.91	
12:00 AM	1:00 AM	44.35		
1:00 AM	2:00 AM	46.07		
2:00 AM	3:00 AM	49.05		
3:00 AM	4:00 AM	53.33		
4:00 AM	5:00 AM	54.48		
5:00 AM	6:00 AM	54.6		

For Green Chem Solutions Pvt Ltd  
(Laboratory Division)

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GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	01.03.2014	
Survey Conducted by	GC SPL	Test Commenced on	01.03.2014	
Survey Conducted on	27.02.14 to 28.02.14	Test Completed on	01.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
	Day Time		48.7	
Near Nivedhita Matriculation School, Palyapattai (ANQ 07)	6:00 AM	7:00 AM		42.37
	7:00 AM	8:00 AM		45.64
	8:00 AM	9:00 AM		46.54
	9:00 AM	10:00 AM		49.75
	10:00 AM	11:00 AM		51.09
	11:00 AM	12:00 PM		51.02
	12:00 PM	1:00 PM		52.51
	1:00 PM	2:00 PM		50.79
	2:00 PM	3:00 PM		50.66
	3:00 PM	4:00 PM		50.13
	4:00 PM	5:00 PM		49.88
	5:00 PM	6:00 PM		46.28
	6:00 PM	7:00 PM		44.21
	7:00 PM	8:00 PM		42.9
	8:00 PM	9:00 PM	40.61	
9:00 PM	10:00 PM	40.04		
	Night Time		Hourly Leq dB (A)	
			Night time dB (A)	
	10:00 PM	11:00 PM	36.74	
	11:00 PM	12:00 AM	34.95	
	12:00 AM	1:00 AM	35.91	
	1:00 AM	2:00 AM	35.58	
	2:00 AM	3:00 AM	37.01	
	3:00 AM	4:00 AM	39.87	
	4:00 AM	5:00 AM	39.77	
	5:00 AM	6:00 AM	40.11	
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
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GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	01.03.2014	
Survey Conducted by	GC SPL	Test Commenced on	01.03.2014	
Survey Conducted on	27.02.14 to 28.02.14	Test Completed on	01.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Ooliyasthanam Teacher Training Institute & Middle School, Palyapattai (ANQ 08)	Day Time		48.3	
	6:00 AM	7:00 AM		42.11
	7:00 AM	8:00 AM		42.33
	8:00 AM	9:00 AM		48.79
	9:00 AM	10:00 AM		49.81
	10:00 AM	11:00 AM		52.64
	11:00 AM	12:00 PM		50.56
	12:00 PM	1:00 PM		51.28
	1:00 PM	2:00 PM		50.93
	2:00 PM	3:00 PM		48.68
	3:00 PM	4:00 PM		46.34
	4:00 PM	5:00 PM		45.71
	5:00 PM	6:00 PM		45.52
	6:00 PM	7:00 PM		44.06
	7:00 PM	8:00 PM		44.85
	8:00 PM	9:00 PM	47.45	
	9:00 PM	10:00 PM	41.84	
	Night Time		Hourly Leq dB (A)	38.8
	10:00 PM	11:00 PM	40.07	
	11:00 PM	12:00 AM	36.86	
12:00 AM	1:00 AM	36.5		
1:00 AM	2:00 AM	35.19		
2:00 AM	3:00 AM	37.03		
3:00 AM	4:00 AM	38.35		
4:00 AM	5:00 AM	40.35		
5:00 AM	6:00 AM	41.61		
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
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GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	01.03.2014	
Survey Conducted by	GC SPL	Test Commenced on	01.03.2014	
Survey Conducted on	27.02.14 to 28.02.14	Test Completed on	01.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Near Gents hostel of vet nary college and research institute (ANQ 09)	Day Time		49.5	
	6:00 AM	7:00 AM		45.56
	7:00 AM	8:00 AM		46.96
	8:00 AM	9:00 AM		49.4
	9:00 AM	10:00 AM		51.48
	10:00 AM	11:00 AM		51.71
	11:00 AM	12:00 PM		51.59
	12:00 PM	1:00 PM		51.54
	1:00 PM	2:00 PM		51.61
	2:00 PM	3:00 PM		51.12
	3:00 PM	4:00 PM		50.01
	4:00 PM	5:00 PM		49.46
	5:00 PM	6:00 PM		49.1
	6:00 PM	7:00 PM		46.59
	7:00 PM	8:00 PM		47.04
	8:00 PM	9:00 PM	42.34	
	9:00 PM	10:00 PM	40.95	
	Night Time		Hourly Leq dB (A)	37.5
	10:00 PM	11:00 PM	35.71	
	11:00 PM	12:00 AM	33.37	
	12:00 AM	1:00 AM	33.67	
	1:00 AM	2:00 AM	34.46	
	2:00 AM	3:00 AM	34.29	
	3:00 AM	4:00 AM	38.65	
	4:00 AM	5:00 AM	39.55	
	5:00 AM	6:00 AM	41.83	
For Green Chem Solutions Pvt Ltd (Laboratory Division)			Authorized Signatory	





GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	01.03.2014	
Survey Conducted by	GC SPL	Test Commenced on	01.03.2014	
Survey Conducted on	27.02.14 to 28.02.14	Test Completed on	01.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Near Manonmanium University (ANQ 10)	Day Time		49.1	
	6:00 AM	7:00 AM		44.49
	7:00 AM	8:00 AM		45.42
	8:00 AM	9:00 AM		49.12
	9:00 AM	10:00 AM		51.15
	10:00 AM	11:00 AM		51.21
	11:00 AM	12:00 PM		49.91
	12:00 PM	1:00 PM		50.47
	1:00 PM	2:00 PM		51.31
	2:00 PM	3:00 PM		50.67
	3:00 PM	4:00 PM		50.77
	4:00 PM	5:00 PM		50.23
	5:00 PM	6:00 PM		49.15
	6:00 PM	7:00 PM		47.54
	7:00 PM	8:00 PM		46
	8:00 PM	9:00 PM	41.16	
	9:00 PM	10:00 PM	40.37	
	Night Time		Hourly Leq dB (A)	39.2
	10:00 PM	11:00 PM	37.83	
	11:00 PM	12:00 AM	35.61	
	12:00 AM	1:00 AM	33.44	
	1:00 AM	2:00 AM	35.79	
	2:00 AM	3:00 AM	36.59	
	3:00 AM	4:00 AM	39.66	
	4:00 AM	5:00 AM	41.11	
	5:00 AM	6:00 AM	43.95	
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
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GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	01.03.2014	
Survey Conducted by	GC SPL	Test Commenced on	01.03.2014	
Survey Conducted on	27.02.14 to 28.02.14	Test Completed on	01.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Sitaparappanallur Village (ANQ 11)	Day Time		58.6	
	6:00 AM	7:00 AM		57.37
7:00 AM	8:00 AM	57.88		
8:00 AM	9:00 AM	55.92		
9:00 AM	10:00 AM	58.03		
10:00 AM	11:00 AM	62.19		
11:00 AM	12:00 PM	61.64		
12:00 PM	1:00 PM	61.72		
1:00 PM	2:00 PM	61.16		
2:00 PM	3:00 PM	60.42		
3:00 PM	4:00 PM	59.13		
4:00 PM	5:00 PM	57.94		
5:00 PM	6:00 PM	55.1		
6:00 PM	7:00 PM	53.05		
7:00 PM	8:00 PM	51.17		
8:00 PM	9:00 PM	50.16		
9:00 PM	10:00 PM	50.32		
Sitaparappanallur Village (ANQ 11)	Night Time		Hourly Leq dB (A)	51.7
	10:00 PM	11:00 PM	49.76	
	11:00 PM	12:00 AM	48.75	
	12:00 AM	1:00 AM	47.23	
	1:00 AM	2:00 AM	48.34	
	2:00 AM	3:00 AM	50.47	
	3:00 AM	4:00 AM	52.79	
	4:00 AM	5:00 AM	54.38	
5:00 AM	6:00 AM	55.08		
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
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GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	01.03.2014	
Survey Conducted by	GC SPL	Test Commenced on	01.03.2014	
Survey Conducted on	27.02.14 to 28.02.14	Test Completed on	01.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
King Medical Dispensary (ANQ 12)	Day Time		49.4	
	6:00 AM	7:00 AM		44.93
7:00 AM	8:00 AM	47.59		
8:00 AM	9:00 AM	49.07		
9:00 AM	10:00 AM	51.2		
10:00 AM	11:00 AM	51.99		
11:00 AM	12:00 PM	51.42		
12:00 PM	1:00 PM	50.78		
1:00 PM	2:00 PM	50.94		
2:00 PM	3:00 PM	49.89		
3:00 PM	4:00 PM	50.01		
4:00 PM	5:00 PM	49.54		
5:00 PM	6:00 PM	50.07		
6:00 PM	7:00 PM	48.61		
7:00 PM	8:00 PM	47.25		
8:00 PM	9:00 PM	41.14		
9:00 PM	10:00 PM	38.91		
King Medical Dispensary (ANQ 12)	Night Time		Hourly Leq dB (A)	38.9
	10:00 PM	11:00 PM	37.06	
	11:00 PM	12:00 AM	34.38	
	12:00 AM	1:00 AM	32.72	
	1:00 AM	2:00 AM	34.12	
	2:00 AM	3:00 AM	35.97	
	3:00 AM	4:00 AM	39.79	
	4:00 AM	5:00 AM	41.54	
5:00 AM	6:00 AM	43.36		

For Green Chem Solutions Pvt Ltd  
(Laboratory Division)

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GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	04.03.2014	
Survey Conducted by	GC SPL	Test Commenced on	04.03.2014	
Survey Conducted on	02.03.14 to 03.03.14	Test Completed on	04.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
	Day Time		49.0	
St. john Teacher training institute, marandai (ANQ 13)	6:00 AM	7:00 AM		43.24
	7:00 AM	8:00 AM		44.3
	8:00 AM	9:00 AM		49
	9:00 AM	10:00 AM		50.9
	10:00 AM	11:00 AM		52.68
	11:00 AM	12:00 PM		53.34
	12:00 PM	1:00 PM		53.2
	1:00 PM	2:00 PM		50.43
	2:00 PM	3:00 PM		48.58
	3:00 PM	4:00 PM		47.46
	4:00 PM	5:00 PM		45.92
	5:00 PM	6:00 PM		45.29
	6:00 PM	7:00 PM		45.1
	7:00 PM	8:00 PM		44.33
	8:00 PM	9:00 PM	43.65	
9:00 PM	10:00 PM	42.57		
	Night Time		Hourly Leq dB (A)	
	10:00 PM	11:00 PM	38.06	
	11:00 PM	12:00 AM	36.11	
	12:00 AM	1:00 AM	33.74	
	1:00 AM	2:00 AM	34.08	
	2:00 AM	3:00 AM	34.86	
	3:00 AM	4:00 AM	35.85	
	4:00 AM	5:00 AM	37.73	
	5:00 AM	6:00 AM	40.2	
			Night time dB (A)	
			36.8	

For Green Chem Solutions Pvt Ltd  
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GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	04.03.2014	
Survey Conducted by	GC SPL	Test Commenced on	04.03.2014	
Survey Conducted on	02.03.14 to 03.03.14	Test Completed on	04.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Mata Mandhir Temple (ANQ 14)	Day Time		59.5	
	6:00 AM	7:00 AM		58.35
	7:00 AM	8:00 AM		59.13
	8:00 AM	9:00 AM		59.96
	9:00 AM	10:00 AM		60.16
	10:00 AM	11:00 AM		62.26
	11:00 AM	12:00 PM		62.98
	12:00 PM	1:00 PM		63.11
	1:00 PM	2:00 PM		61.69
	2:00 PM	3:00 PM		61.2
	3:00 PM	4:00 PM		59.7
	4:00 PM	5:00 PM		58.28
	5:00 PM	6:00 PM		54.37
	6:00 PM	7:00 PM		51.71
	7:00 PM	8:00 PM		50.49
	8:00 PM	9:00 PM	50.22	
	9:00 PM	10:00 PM	50.09	
	Night Time		Hourly Leq dB (A)	52.3
	10:00 PM	11:00 PM	50.06	
	11:00 PM	12:00 AM	48.75	
	12:00 AM	1:00 AM	48.38	
	1:00 AM	2:00 AM	49.58	
	2:00 AM	3:00 AM	51.16	
	3:00 AM	4:00 AM	54.03	
	4:00 AM	5:00 AM	55.04	
	5:00 AM	6:00 AM	55.08	
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
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GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	04.03.2014	
Survey Conducted by	GC SPL	Test Commenced on	04.03.2014	
Survey Conducted on	02.03.14 to 03.03.14	Test Completed on	04.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
ISMA School balaji Nagar, marandai (ANQ 15)	Day Time		48.1	
	6:00 AM	7:00 AM		42.5
	7:00 AM	8:00 AM		44.78
	8:00 AM	9:00 AM		48.87
	9:00 AM	10:00 AM		49.7
	10:00 AM	11:00 AM		52.17
	11:00 AM	12:00 PM		52.86
	12:00 PM	1:00 PM		51.57
	1:00 PM	2:00 PM		50.05
	2:00 PM	3:00 PM		47.35
	3:00 PM	4:00 PM		45.58
	4:00 PM	5:00 PM		45.08
	5:00 PM	6:00 PM		44.97
	6:00 PM	7:00 PM		44.42
	7:00 PM	8:00 PM	42.08	
	8:00 PM	9:00 PM	41.25	
	9:00 PM	10:00 PM	39.08	
	Night Time		Hourly Leq dB (A)	36.7
	10:00 PM	11:00 PM	37.55	
	11:00 PM	12:00 AM	36.06	
12:00 AM	1:00 AM	32.27		
1:00 AM	2:00 AM	33.96		
2:00 AM	3:00 AM	35.43		
3:00 AM	4:00 AM	35.93		
4:00 AM	5:00 AM	37.6		
5:00 AM	6:00 AM	40.2		
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
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GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	04.03.2014	
Survey Conducted by	GC SPL	Test Commenced on	04.03.2014	
Survey Conducted on	02.03.14 to 03.03.14	Test Completed on	04.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
St. marys church, Karumpuliuttu (ANQ 16)	Day Time		48.9	
	6:00 AM	7:00 AM		44.07
	7:00 AM	8:00 AM		45.98
	8:00 AM	9:00 AM		47.94
	9:00 AM	10:00 AM		50.36
	10:00 AM	11:00 AM		52.95
	11:00 AM	12:00 PM		52.63
	12:00 PM	1:00 PM		51.41
	1:00 PM	2:00 PM		51.23
	2:00 PM	3:00 PM		50.48
	3:00 PM	4:00 PM		48.49
	4:00 PM	5:00 PM		46.14
	5:00 PM	6:00 PM		45.12
	6:00 PM	7:00 PM		44.49
	7:00 PM	8:00 PM	43.67	
	8:00 PM	9:00 PM	43.16	
	9:00 PM	10:00 PM	42.46	
	Night Time		Hourly Leq dB (A)	37.3
	10:00 PM	11:00 PM	39.43	
	11:00 PM	12:00 AM	36.68	
12:00 AM	1:00 AM	34.08		
1:00 AM	2:00 AM	32.06		
2:00 AM	3:00 AM	34.16		
3:00 AM	4:00 AM	36.98		
4:00 AM	5:00 AM	39.02		
5:00 AM	6:00 AM	39.96		
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
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GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	04.03.2014	
Survey Conducted by	GCSPL	Test Commenced on	04.03.2014	
Survey Conducted on	02.03.14 to 03.03.14	Test Completed on	04.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Mani Hospital, Alangulam (ANQ 17)	Day Time		49.2	
	6:00 AM	7:00 AM		43.69
	7:00 AM	8:00 AM		44.7
	8:00 AM	9:00 AM		49.44
	9:00 AM	10:00 AM		50.91
	10:00 AM	11:00 AM		52.61
	11:00 AM	12:00 PM		53.76
	12:00 PM	1:00 PM		53.36
	1:00 PM	2:00 PM		50.22
	2:00 PM	3:00 PM		49.54
	3:00 PM	4:00 PM		48.57
	4:00 PM	5:00 PM		46.39
	5:00 PM	6:00 PM		43.86
	6:00 PM	7:00 PM		44.31
	7:00 PM	8:00 PM	44.02	
	8:00 PM	9:00 PM	43.45	
	9:00 PM	10:00 PM	42.9	
	Night Time		Hourly Leq dB (A)	38.8
	10:00 PM	11:00 PM	40.41	
	11:00 PM	12:00 AM	37.94	
12:00 AM	1:00 AM	35.44		
1:00 AM	2:00 AM	34.35		
2:00 AM	3:00 AM	37.19		
3:00 AM	4:00 AM	39.2		
4:00 AM	5:00 AM	40.09		
5:00 AM	6:00 AM	41.13		
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
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Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	04.03.2014	
Survey Conducted by	GCSPL	Test Commenced on	04.03.2014	
Survey Conducted on	02.03.14 to 03.03.14	Test Completed on	04.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Mata Mandhir Temple (ANQ 18)	Day Time		62.8	
	6:00 AM	7:00 AM		56.57
	7:00 AM	8:00 AM		59.13
	8:00 AM	9:00 AM		61.05
	9:00 AM	10:00 AM		63.96
	10:00 AM	11:00 AM		64.14
	11:00 AM	12:00 PM		65.11
	12:00 PM	1:00 PM		65.91
	1:00 PM	2:00 PM		66.01
	2:00 PM	3:00 PM		65.51
	3:00 PM	4:00 PM		64.27
	4:00 PM	5:00 PM		62.43
	5:00 PM	6:00 PM		61.94
	6:00 PM	7:00 PM		60.29
	7:00 PM	8:00 PM		57.01
	8:00 PM	9:00 PM	54.17	
	9:00 PM	10:00 PM	50.83	
	Night Time		Hourly Leq dB (A)	52.4
	10:00 PM	11:00 PM	49.43	
	11:00 PM	12:00 AM	48.41	
12:00 AM	1:00 AM	47.84		
1:00 AM	2:00 AM	50.2		
2:00 AM	3:00 AM	53.44		
3:00 AM	4:00 AM	53.84		
4:00 AM	5:00 AM	54.48		
5:00 AM	6:00 AM	55.21		
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
Authorized Signatory				



Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	08.03.2014	
Survey Conducted by	GCSPL	Test Commenced on	08.03.2014	
Survey Conducted on	06.03.14 to 07.03.14	Test Completed on	08.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Sri Muppuathi Amman college of Education (ANQ 19)	Day Time		48.7	
	6:00 AM	7:00 AM		42.99
	7:00 AM	8:00 AM		44.71
	8:00 AM	9:00 AM		47.02
	9:00 AM	10:00 AM		50.39
	10:00 AM	11:00 AM		50.08
	11:00 AM	12:00 PM		51.19
	12:00 PM	1:00 PM		52.42
	1:00 PM	2:00 PM		50.52
	2:00 PM	3:00 PM		51.92
	3:00 PM	4:00 PM		50.26
	4:00 PM	5:00 PM		49.5
	5:00 PM	6:00 PM		46.59
	6:00 PM	7:00 PM		44.47
	7:00 PM	8:00 PM		42.98
	8:00 PM	9:00 PM	40.62	
	9:00 PM	10:00 PM	38.8	
	Night Time		Hourly Leq dB (A)	37.9
	10:00 PM	11:00 PM	35.72	
	11:00 PM	12:00 AM	35.03	
12:00 AM	1:00 AM	35.64		
1:00 AM	2:00 AM	35.39		
2:00 AM	3:00 AM	36.41		
3:00 AM	4:00 AM	38.54		
4:00 AM	5:00 AM	40.79		
5:00 AM	6:00 AM	40.63		
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
Authorized Signatory				





Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	08.03.2014	
Survey Conducted by	GCSPL	Test Commenced on	08.03.2014	
Survey Conducted on	06.03.14 to 07.03.14	Test Completed on	08.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Mutaramankovil Temple (ANQ 20)	Day Time		62.1	
	6:00 AM	7:00 AM		56.21
	7:00 AM	8:00 AM		58.30
	8:00 AM	9:00 AM		58.85
	9:00 AM	10:00 AM		60.73
	10:00 AM	11:00 AM		63.41
	11:00 AM	12:00 PM		65.96
	12:00 PM	1:00 PM		65.96
	1:00 PM	2:00 PM		66.07
	2:00 PM	3:00 PM		64.64
	3:00 PM	4:00 PM		63.36
	4:00 PM	5:00 PM		61.30
	5:00 PM	6:00 PM		59.44
	6:00 PM	7:00 PM		57.63
	7:00 PM	8:00 PM		55.86
	8:00 PM	9:00 PM	52.19	
	9:00 PM	10:00 PM	46.54	
	Night Time		Hourly Leq dB (A)	50.6
	10:00 PM	11:00 PM	45.65	
	11:00 PM	12:00 AM	45.37	
12:00 AM	1:00 AM	43.56		
1:00 AM	2:00 AM	44.87		
2:00 AM	3:00 AM	50.14		
3:00 AM	4:00 AM	51.85		
4:00 AM	5:00 AM	53.44		
5:00 AM	6:00 AM	54.90		
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
Authorized Signatory				



Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	08.03.2014	
Survey Conducted by	GCSPL	Test Commenced on	08.03.2014	
Survey Conducted on	06.03.14 to 07.03.14	Test Completed on	08.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Harash Govt. Women school (ANQ 21)	Day Time		49.6	
	6:00 AM	7:00 AM		44.5
	7:00 AM	8:00 AM		48.11
	8:00 AM	9:00 AM		49.86
	9:00 AM	10:00 AM		50.91
	10:00 AM	11:00 AM		52.61
	11:00 AM	12:00 PM		53.76
	12:00 PM	1:00 PM		53.36
	1:00 PM	2:00 PM		51.15
	2:00 PM	3:00 PM		50.27
	3:00 PM	4:00 PM		49.31
	4:00 PM	5:00 PM		46.39
	5:00 PM	6:00 PM		46.33
	6:00 PM	7:00 PM		44.31
	7:00 PM	8:00 PM		44.02
	8:00 PM	9:00 PM		43.45
	9:00 PM	10:00 PM	42.9	
	Night Time		Hourly Leq dB (A)	39.0
	10:00 PM	11:00 PM	41.13	
	11:00 PM	12:00 AM	38.07	
	12:00 AM	1:00 AM	35.32	
	1:00 AM	2:00 AM	34.61	
	2:00 AM	3:00 AM	37.15	
	3:00 AM	4:00 AM	39.2	
	4:00 AM	5:00 AM	40.61	
	5:00 AM	6:00 AM	41.13	
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
Authorized Signatory				



GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	08.03.2014	
Survey Conducted by	GCSPL	Test Commenced on	08.03.2014	
Survey Conducted on	06.03.14 to 07.03.14	Test Completed on	08.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Temple near cross junction of SH-39A (ANQ 22)	Day Time		61.3	
	6:00 AM	7:00 AM		56.3
	7:00 AM	8:00 AM		56.81
	8:00 AM	9:00 AM		57.82
	9:00 AM	10:00 AM		60.4
	10:00 AM	11:00 AM		62.64
	11:00 AM	12:00 PM		64.67
	12:00 PM	1:00 PM		64.78
	1:00 PM	2:00 PM		65.41
	2:00 PM	3:00 PM		64.64
	3:00 PM	4:00 PM		63.06
	4:00 PM	5:00 PM		60.75
	5:00 PM	6:00 PM		58.84
	6:00 PM	7:00 PM		57.63
	7:00 PM	8:00 PM	52.28	
	8:00 PM	9:00 PM	50.83	
	9:00 PM	10:00 PM	46.54	
	Night Time		Hourly Leq dB (A)	50.7
	10:00 PM	11:00 PM	45.65	
	11:00 PM	12:00 AM	45.37	
12:00 AM	1:00 AM	43.56		
1:00 AM	2:00 AM	44.87		
2:00 AM	3:00 AM	49.52		
3:00 AM	4:00 AM	51.42		
4:00 AM	5:00 AM	52.97		
5:00 AM	6:00 AM	55.87		
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
Authorized Signatory				



Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	08.03.2014	
Survey Conducted by	GCSPL	Test Commenced on	08.03.2014	
Survey Conducted on	06.03.14 to 07.03.14	Test Completed on	08.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Municipality Park at Vettaikaramkulam (Tenkasi) (ANQ 23)	Day Time		59.8	
	6:00 AM	7:00 AM		57.97
	7:00 AM	8:00 AM		59.04
	8:00 AM	9:00 AM		59.64
	9:00 AM	10:00 AM		60.54
	10:00 AM	11:00 AM		62.14
	11:00 AM	12:00 PM		62.5
	12:00 PM	1:00 PM		62.86
	1:00 PM	2:00 PM		62.14
	2:00 PM	3:00 PM		62.62
	3:00 PM	4:00 PM		61.48
	4:00 PM	5:00 PM		59.29
	5:00 PM	6:00 PM		53.19
	6:00 PM	7:00 PM		52.53
	7:00 PM	8:00 PM	51.28	
	8:00 PM	9:00 PM	51.44	
	9:00 PM	10:00 PM	51.04	
	Night Time		Hourly Leq dB (A)	53.4
	10:00 PM	11:00 PM	49.58	
	11:00 PM	12:00 AM	50.75	
12:00 AM	1:00 AM	50.35		
1:00 AM	2:00 AM	51.76		
2:00 AM	3:00 AM	52.7		
3:00 AM	4:00 AM	52.96		
4:00 AM	5:00 AM	56.14		
5:00 AM	6:00 AM	56.7		
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
Authorized Signatory				



GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	08.03.2014	
Survey Conducted by	GCSP	Test Commenced on	08.03.2014	
Survey Conducted on	06.03.14 to 07.03.14	Test Completed on	08.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Mupidadiumankovil Temple Ramalingayapuram (ANQ 24)	Day Time		62.5	
	6:00 AM	7:00 AM		55.48
	7:00 AM	8:00 AM		56.59
	8:00 AM	9:00 AM		58.93
	9:00 AM	10:00 AM		59.32
	10:00 AM	11:00 AM		62.31
	11:00 AM	12:00 PM		65.84
	12:00 PM	1:00 PM		66.74
	1:00 PM	2:00 PM		66.77
	2:00 PM	3:00 PM		65.61
	3:00 PM	4:00 PM		64.49
	4:00 PM	5:00 PM		61.85
	5:00 PM	6:00 PM		59.53
	6:00 PM	7:00 PM		59.57
	7:00 PM	8:00 PM	57.74	
	8:00 PM	9:00 PM	53.05	
	9:00 PM	10:00 PM	50.87	
	Night Time		Hourly Leq dB (A)	51.2
	10:00 PM	11:00 PM	49.19	
	11:00 PM	12:00 AM	47.78	
12:00 AM	1:00 AM	46.12		
1:00 AM	2:00 AM	47.19		
2:00 AM	3:00 AM	50.86		
3:00 AM	4:00 AM	52.88		
4:00 AM	5:00 AM	53.55		
5:00 AM	6:00 AM	54.3		
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
Authorized Signatory				





GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	03.03.2014	
Survey Conducted by	GCSP	Test Commenced on	03.03.2014	
Survey Conducted on	01.03.14 to 02.03.14	Test Completed on	03.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Govt.school (ANQ 25)	Day Time		49.4	
	6:00 AM	7:00 AM		43.54
	7:00 AM	8:00 AM		46.08
	8:00 AM	9:00 AM		47.36
	9:00 AM	10:00 AM		50.67
	10:00 AM	11:00 AM		51.5
	11:00 AM	12:00 PM		52.18
	12:00 PM	1:00 PM		52.31
	1:00 PM	2:00 PM		52.25
	2:00 PM	3:00 PM		51.32
	3:00 PM	4:00 PM		49.83
	4:00 PM	5:00 PM		49.1
	5:00 PM	6:00 PM		48.79
	6:00 PM	7:00 PM		46.76
	7:00 PM	8:00 PM		45.52
	8:00 PM	9:00 PM	43.74	
	9:00 PM	10:00 PM	42.9	
	Night Time		Hourly Leq dB (A)	37.7
	10:00 PM	11:00 PM	38.87	
	11:00 PM	12:00 AM	33.92	
12:00 AM	1:00 AM	35.78		
1:00 AM	2:00 AM	34.81		
2:00 AM	3:00 AM	35.02		
3:00 AM	4:00 AM	38.4		
4:00 AM	5:00 AM	40		
5:00 AM	6:00 AM	40.08		
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
Authorized Signatory				



GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	03.03.2014	
Survey Conducted by	GCSPL	Test Commenced on	03.03.2014	
Survey Conducted on	01.03.14 to 02.03.14	Test Completed on	03.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
School Near Elankulam Village (ANQ 26)	Day Time		45.1	
	6:00 AM	7:00 AM		41.25
	7:00 AM	8:00 AM		42.07
	8:00 AM	9:00 AM		45.44
	9:00 AM	10:00 AM		44.83
	10:00 AM	11:00 AM		48.22
	11:00 AM	12:00 PM		47.25
	12:00 PM	1:00 PM		48.23
	1:00 PM	2:00 PM		47.86
	2:00 PM	3:00 PM		47.62
	3:00 PM	4:00 PM		46.18
	4:00 PM	5:00 PM		44.27
	5:00 PM	6:00 PM		44.48
	6:00 PM	7:00 PM		41.87
	7:00 PM	8:00 PM		37.31
	8:00 PM	9:00 PM	33.65	
	9:00 PM	10:00 PM	32.32	
	Night Time		Hourly Leq dB (A)	36.4
	10:00 PM	11:00 PM	31.2	
	11:00 PM	12:00 AM	31	
	12:00 AM	1:00 AM	31.35	
	1:00 AM	2:00 AM	32.07	
	2:00 AM	3:00 AM	35.13	
	3:00 AM	4:00 AM	37.16	
	4:00 AM	5:00 AM	40.28	
	5:00 AM	6:00 AM	40.2	
For Green Chem Solutions Pvt Ltd (Laboratory Division)			Authorized Signatory	



GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	03.03.2014	
Survey Conducted by	GC SPL	Test Commenced on	03.03.2014	
Survey Conducted on	01.03.14 to 02.03.14	Test Completed on	03.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
RECT College Vijayanarayanam (ANQ 27)	Day Time		46.8	
	6:00 AM	7:00 AM		40.88
	7:00 AM	8:00 AM		42.77
	8:00 AM	9:00 AM		45.17
	9:00 AM	10:00 AM		48.93
	10:00 AM	11:00 AM		49.68
	11:00 AM	12:00 PM		49.24
	12:00 PM	1:00 PM		48.87
	1:00 PM	2:00 PM		48.85
	2:00 PM	3:00 PM		48.09
	3:00 PM	4:00 PM		46.21
	4:00 PM	5:00 PM		47.94
	5:00 PM	6:00 PM		47.47
	6:00 PM	7:00 PM		44.7
	7:00 PM	8:00 PM		42.92
	8:00 PM	9:00 PM	38.48	
	9:00 PM	10:00 PM	36.72	
	Night Time		Hourly Leq dB (A)	35.9
	10:00 PM	11:00 PM	33.68	
	11:00 PM	12:00 AM	32.58	
12:00 AM	1:00 AM	31.57		
1:00 AM	2:00 AM	31.32		
2:00 AM	3:00 AM	32.32		
3:00 AM	4:00 AM	35.43		
4:00 AM	5:00 AM	37.72		
5:00 AM	6:00 AM	41.07		
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
Authorized Signatory				



GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	03.03.2014	
Survey Conducted by	GC SPL	Test Commenced on	03.03.2014	
Survey Conducted on	01.03.14 to 02.03.14	Test Completed on	03.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Medical Dispensary (ANQ 28)	Day Time		48.2	
	6:00 AM	7:00 AM		41.88
	7:00 AM	8:00 AM		45.17
	8:00 AM	9:00 AM		46.05
	9:00 AM	10:00 AM		47.86
	10:00 AM	11:00 AM		50.21
	11:00 AM	12:00 PM		50.49
	12:00 PM	1:00 PM		50.75
	1:00 PM	2:00 PM		51.02
	2:00 PM	3:00 PM		48.83
	3:00 PM	4:00 PM		49.51
	4:00 PM	5:00 PM		49.15
	5:00 PM	6:00 PM		48.73
	6:00 PM	7:00 PM		46.92
	7:00 PM	8:00 PM	45.46	
	8:00 PM	9:00 PM	43.68	
	9:00 PM	10:00 PM	41.52	
	Night Time		Hourly Leq dB (A)	37.5
	10:00 PM	11:00 PM	39	
	11:00 PM	12:00 AM	33.2	
12:00 AM	1:00 AM	33.25		
1:00 AM	2:00 AM	34.53		
2:00 AM	3:00 AM	36.46		
3:00 AM	4:00 AM	37.83		
4:00 AM	5:00 AM	39.2		
5:00 AM	6:00 AM	40.32		
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
Authorized Signatory				



GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	06.03.2014	
Survey Conducted by	GC SPL	Test Commenced on	06.03.2014	
Survey Conducted on	04.03.14 to 05.03.14	Test Completed on	06.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
	Day Time		47.5	
School Sevandiapuram (ANQ 29)	6:00 AM	7:00 AM		40.81
	7:00 AM	8:00 AM		42.66
	8:00 AM	9:00 AM		46.68
	9:00 AM	10:00 AM		49.24
	10:00 AM	11:00 AM		49.31
	11:00 AM	12:00 PM		50.36
	12:00 PM	1:00 PM		50.46
	1:00 PM	2:00 PM		49.51
	2:00 PM	3:00 PM		49.63
	3:00 PM	4:00 PM		47.9
	4:00 PM	5:00 PM		48.56
	5:00 PM	6:00 PM		46.62
	6:00 PM	7:00 PM		44.96
	7:00 PM	8:00 PM		43.65
	8:00 PM	9:00 PM	41.36	
9:00 PM	10:00 PM	40.39		
	Night Time		38	
	Hourly Leq dB (A)			
	10:00 PM	11:00 PM		37.2
	11:00 PM	12:00 AM		34.22
	12:00 AM	1:00 AM		34.61
	1:00 AM	2:00 AM		35.23
	2:00 AM	3:00 AM		37.51
	3:00 AM	4:00 AM		39.93
	4:00 AM	5:00 AM	39.92	
	5:00 AM	6:00 AM	40.62	
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
Authorized Signatory				





GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	06.03.2014	
Survey Conducted by	GCSP	Test Commenced on	06.03.2014	
Survey Conducted on	04.03.14 to 05.03.14	Test Completed on	06.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
College Near cross junction of SH-93 ( Vallure to turchun) (ANQ 30)	Day Time		58.7	
	6:00 AM	7:00 AM		53.56
	7:00 AM	8:00 AM		53.39
	8:00 AM	9:00 AM		58.52
	9:00 AM	10:00 AM		59.49
	10:00 AM	11:00 AM		61.02
	11:00 AM	12:00 PM		61.79
	12:00 PM	1:00 PM		61.54
	1:00 PM	2:00 PM		60.5
	2:00 PM	3:00 PM		61.03
	3:00 PM	4:00 PM		58.59
	4:00 PM	5:00 PM		57.98
	5:00 PM	6:00 PM		58.79
	6:00 PM	7:00 PM		57.64
	7:00 PM	8:00 PM		55.63
	8:00 PM	9:00 PM	51.67	
	9:00 PM	10:00 PM	51.77	
	Night Time		Hourly Leq dB (A)	49.6
	10:00 PM	11:00 PM	49.04	
	11:00 PM	12:00 AM	48.73	
	12:00 AM	1:00 AM	47.62	
	1:00 AM	2:00 AM	48.5	
	2:00 AM	3:00 AM	49.32	
	3:00 AM	4:00 AM	49.63	
	4:00 AM	5:00 AM	51.03	
	5:00 AM	6:00 AM	51.58	
	For Green Chem Solutions Pvt Ltd (Laboratory Division)			Authorized Signatory



GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	06.03.2014	
Survey Conducted by	GCSP	Test Commenced on	06.03.2014	
Survey Conducted on	04.03.14 to 05.03.14	Test Completed on	06.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
School idaiyankudi village (ANQ 31)	Day Time		47.6	
	6:00 AM	7:00 AM		41.00
	7:00 AM	8:00 AM		42.98
	8:00 AM	9:00 AM		46.83
	9:00 AM	10:00 AM		49.31
	10:00 AM	11:00 AM		49.32
	11:00 AM	12:00 PM		49.45
	12:00 PM	1:00 PM		50.57
	1:00 PM	2:00 PM		50.66
	2:00 PM	3:00 PM		48.74
	3:00 PM	4:00 PM		47.57
	4:00 PM	5:00 PM		48.62
	5:00 PM	6:00 PM		48.69
	6:00 PM	7:00 PM		44.88
	7:00 PM	8:00 PM		43.65
	8:00 PM	9:00 PM		42.04
	9:00 PM	10:00 PM	39.53	
	Night Time		Hourly Leq dB (A)	36.8
	10:00 PM	11:00 PM	36.4	
	11:00 PM	12:00 AM	32.74	
	12:00 AM	1:00 AM	32.37	
	1:00 AM	2:00 AM	32.97	
	2:00 AM	3:00 AM	34.9	
	3:00 AM	4:00 AM	36.87	
	4:00 AM	5:00 AM	39.43	
	5:00 AM	6:00 AM	40.65	
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
Authorized Signatory				



GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	06.03.2014	
Survey Conducted by	GC SPL	Test Commenced on	06.03.2014	
Survey Conducted on	04.03.14 to 05.03.14	Test Completed on	06.03.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
	Day Time		48.8	
School and Church Uvari (ANQ 32)	6:00 AM	7:00 AM		42.77
	7:00 AM	8:00 AM		44.77
	8:00 AM	9:00 AM		46.22
	9:00 AM	10:00 AM		49.38
	10:00 AM	11:00 AM		50.86
	11:00 AM	12:00 PM		50.88
	12:00 PM	1:00 PM		51.42
	1:00 PM	2:00 PM		51.55
	2:00 PM	3:00 PM		49.42
	3:00 PM	4:00 PM		49.29
	4:00 PM	5:00 PM		49.2
	5:00 PM	6:00 PM		49.59
	6:00 PM	7:00 PM		48.1
	7:00 PM	8:00 PM		47.88
	8:00 PM	9:00 PM	43.02	
9:00 PM	10:00 PM	42.17		
	Night Time		37.2	
	Hourly Leq dB (A)			
	10:00 PM	11:00 PM		39.57
	11:00 PM	12:00 AM		32.23
	12:00 AM	1:00 AM		31.45
	1:00 AM	2:00 AM		33
	2:00 AM	3:00 AM		34.73
	3:00 AM	4:00 AM		37.24
	4:00 AM	5:00 AM	39.47	
	5:00 AM	6:00 AM	40.49	
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
Authorized Signatory				



<b>Date</b>	
<b>Report</b>	Environmental Analysis Report (SH-41)
<b>Prepared by</b>	Miss. S.Prabha, Senior Chemist
Signature	
<b>Reviewed by</b>	Mr. T.Jeenly Xavier Anand, Lab In Charge
Signature	
<b>Approved by</b>	Mr. A. Jawahar, Quality Manager
Signature	



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INTRODUCTION

SMEC India Pvt. Ltd ,Gurgaon (smec India ) is deputed Green Chem Solutions (P) Ltd, Chennai (GCSPL) for monitoring Ambient Air , Ambient Noise , Ground Water, Surface water and Soil quality in different locations of the Project Road (SH-41) This will helps to identify and evaluate the environmental effects arising from the existing/proposed activities in selected sites and execute mitigation measures to avoid or reduce the environmental impacts.

Ambient Air Quality:

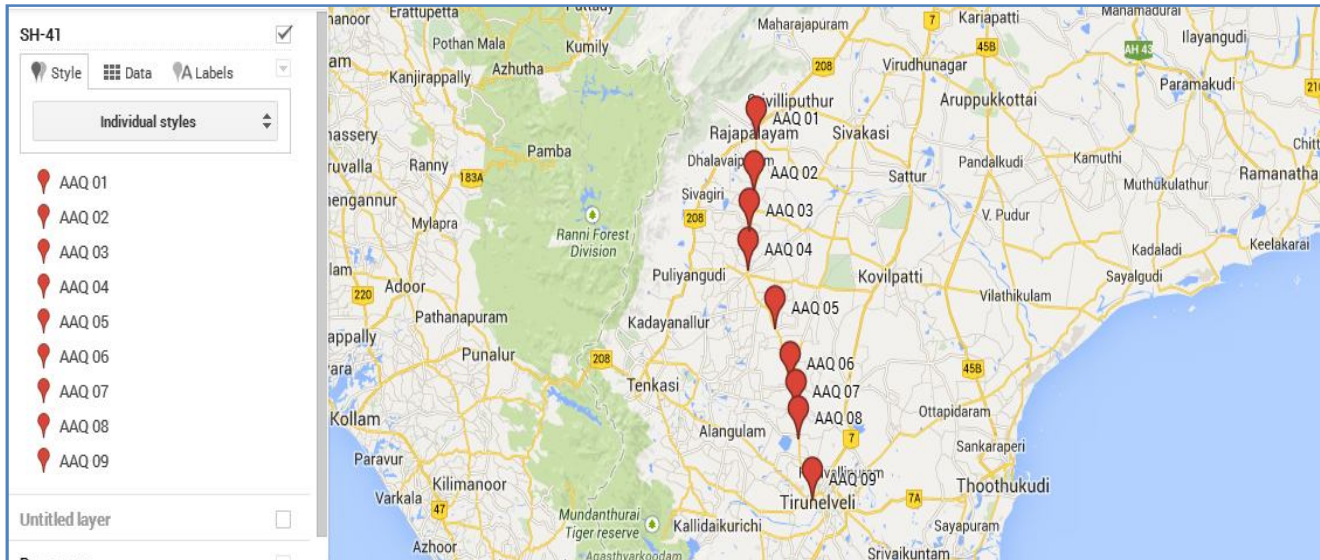
Figure. 1 shows the details of the selected air quality monitoring (Nine) stations in SH-41. The monitoring of ambient air quality parameter specified by CPCB at these sites was carried out during the month of the Jul-2014. Samples were collected at the selected sites for a period of about four weeks in jul-2014. Table.1 shows the schedule of monitoring at selected sites.

Table: 1.Monitoring Schedule

Site Code	First Week		Second Week		Third Week		Fourth week	
	First Time	Second Time	First Time	Second Time	First Time	Second Time	First Time	Second Time
SH-41 (Part1)	24.06.2014	27.06.2014	01.07.2014	04.07.2014	08.07.2014	11.07.2014	15.07.2014	18.07.2014
	To 25.06.2014	To 28.06.2014	To 02.07.2014	To 05.07.2014	To 09.07.2014	To 12.07.2014	To 16.07.2014	To 19.07.2014
SH-41 (Part 2)	25.06.2014	28.06.2014	02.07.2014	05.07.2014	09.07.2014	12.07.2014	16.07.2014	19.07.2014
	To 26.06.2014	To 29.06.2014	To 03.07.2014	To 06.07.2014	To 10.07.2014	To 13.07.2014	To 17.07.2014	To 20.07.2014



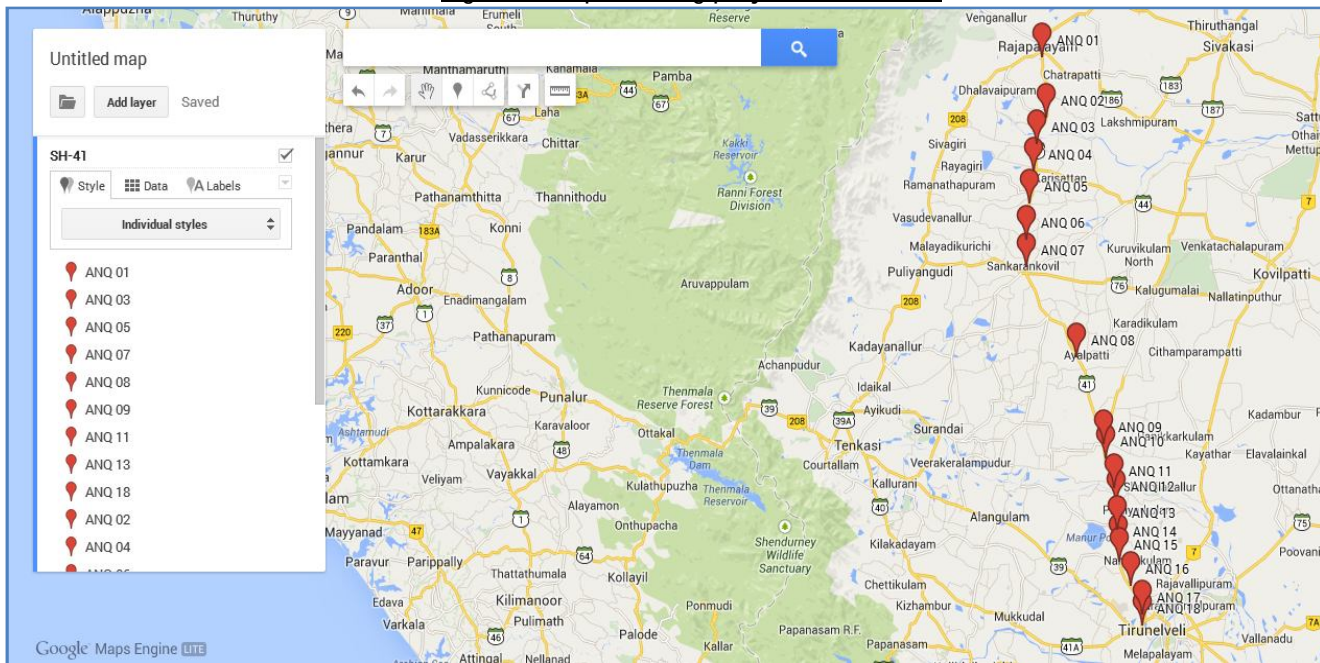
Figure.1 Map showing project Road SH-41



Noise Monitoring:

Figure .2 shows the details of the selected Noise monitoring (Eighteen) stations in SH-41. The noise monitoring parameter specified by CPCB at these sites was carried out during the month of the Jul-2014.

Figure.2 Map showing project Road SH-41



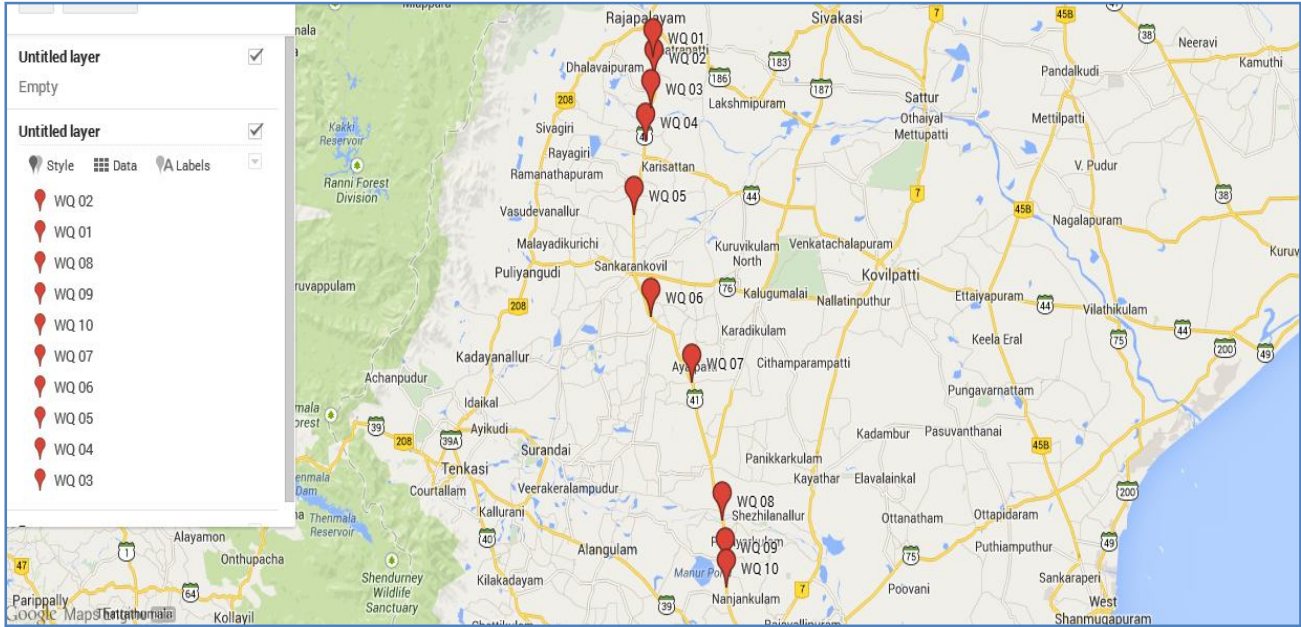




Water Monitoring:

Figure.3 shows the details of the selected water monitoring (Ten) stations in SH-41. The water monitoring parameter specified by CPCB at these sites was carried out during the month of the Jul-2014.

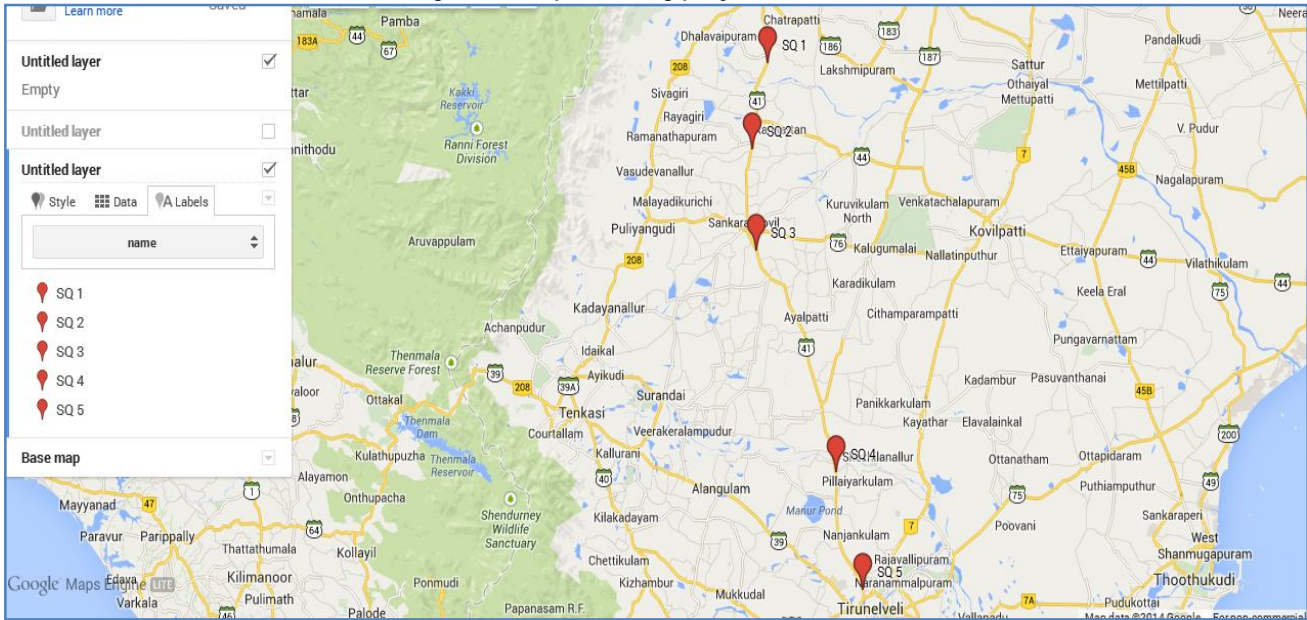
Figure.3 Map showing project Road SH-41



Soil Monitoring:

Figure 4 shows the details of the selected water monitoring (Five) stations in SH-41.

Figure.4 Map showing project Road SH-41





## 1. AMBIENT AIR QUALITY

Table.2 gives the list of pollutants monitored in this project, instruments used and frequency of sampling.

Particular	PM10	PM 2.5	NOX	SO2	CO
<b>Sampling Instrument</b>	RDS Sampler	PM2.5 sampler	Impingers attached to High volume sampler	Impingers attached to High volume sampler	Automatic analyzer
<b>Sampling Principle</b>	Filtration of aerodynamic sizes	Filtration of aerodynamic sizes with a size cut by impaction followed by cyclone separation	Chemical absorption in suitable media	Chemical absorption in suitable media	Suction by Pump As per instrument specification
<b>Flow rate</b>	0.8-1.2 m3/min	16.7 LPM	0.4 LPM	0.4 LPM	0.2 – 0.5 LPM
<b>Sampling Period</b>	24 hourly	24 Hourly	24 Hourly	24 Hourly	8 Hourly
<b>Sampling frequency</b>	Weekly twice for four week	Weekly twice for four week	Weekly twice for four week	Weekly twice for four week	Weekly twice for four week
<b>Analytical instrument</b>	Electronic Balance	Electronic Micro Balance	Spectrophotometer	Spectrophotometer	Automatic Analyser
<b>Analytical method</b>	Gravimetric	Gravimetric	Colorimetric Improved West & Gaeke Method	Colorimetric Jacobs & Hochheiser Modified method	NDIR Method





Table 3. National Ambient Air Quality Standards (NAAQS), 2009

Pollutants	Time Weighted Average	Industrial, Residential, Rural & other Areas	Sensitive Areas
Sulphur Dioxide (SO <sub>2</sub> )	Annual Average	50 µg/m <sup>3</sup>	20 µg/m <sup>3</sup>
	24 hours	80 µg/m <sup>3</sup>	80 µg/m <sup>3</sup>
Oxides of Nitrogen as (NO <sub>2</sub> )	Annual Average	40 µg/m <sup>3</sup>	30 µg/m <sup>3</sup>
	24 hours	80 µg/m <sup>3</sup>	80 µg/m <sup>3</sup>
Particulate Matter (PM <sub>10</sub> )	Annual Average	60 µg/m <sup>3</sup>	60 µg/m <sup>3</sup>
	24 hours	100 µg/m <sup>3</sup>	100 µg/m <sup>3</sup>
Particulate Matter (PM <sub>2.5</sub> )	Annual Average	40 µg/m <sup>3</sup>	40 µg/m <sup>3</sup>
	24 hours	60 µg/m <sup>3</sup>	60 µg/m <sup>3</sup>
Carbon Monoxide (CO)	8 hours	2.0 mg/m <sup>3</sup>	2 mg/ m <sup>3</sup>
	1 hour	4.0 mg/m <sup>3</sup>	4 mg/m <sup>3</sup>



1.1 Details of monitoring locations

Location and classification of location are listed in Table: 4

Table: 4. Ambient air quality monitoring locations

Location code	Name of the location	Date of monitoring	Classification Description of location	GPS Point (Zone 43)
<b>SH-41: Rajapalayam to Tirunelveli (Part –I)</b>				
AAQ01	College	24.06.2014 To 25.06.2014 27.06.2014 To 28.06.2014 01.07.2014 To 02.07.2014 04.07.2014 To 05.07.2014 08.07.2014 To 09.07.2014 11.07.2014 To 12.07.2014 15.07.2014 To 16.07.2014 18.07.2014 To 19.07.2014	Sensitive	E:0780738 N:1043165
AAQ02	Mahatma Gandhi college of Art & Science for Women		Sensitive	E:0779689 N:1033014
AAQ03	Govt. Hospital and Bus Shelter		Sensitive	E:0779040 N:1025009
AAQ04	Vaiyapuri-School and Temple, Sankarankovil		Sensitive	E:0778530 N:1016955
AAQ05	Mutharamalinga Thevar College and Hostel Canteen		Sensitive	E:0784659 N:1005827
<b>SH-41: Rajapalayam to Tirunelveli (Part –II)</b>				
AAQ06	Govt. Hospital and Govt. High School	25.06.2014 To 26.06.2014 28.06.2014 To 29.06.2014	Sensitive	E:0788914 N:0994554
AAQ07	Govt. High School	02.07.2014 To 03.07.2014 05.07.2014 To 06.07.2014	Sensitive	E:0790580 N:0988370
AAQ08	Manur Village	09.07.2014 To 10.07.2014 12.07.2014 To 13.07.2014	Residential	E:0791979 N:0980497
AAQ09	At Junction	16.07.2014 To 17.07.2014 19.07.2014 To 20.07.2014	Commercial Area	E:0795478 N:0966063



1.2 Table: 5. Ambient Air Quality Monitoring Average Results SH-41: Rajapalayam to Tirunelveli

Location	Classification of area	PM <sub>10</sub> (µg/m <sup>3</sup> )	PM <sub>2.5</sub> (µg/m <sup>3</sup> )	SO <sub>2</sub> (µg/m <sup>3</sup> )	NO <sub>x</sub> (µg/m <sup>3</sup> )	CO (mg/m <sup>3</sup> )
AAQ01	Sensitive	39.7	18.4	6.6	17.3	0.80
AAQ02	Sensitive	36.9	16.8	5.8	16.4	0.85
AAQ03	Sensitive	38.5	17.3	6.1	16.8	0.85
AAQ04	Sensitive	37.8	17.2	6.3	16.6	0.95
AAQ05	Sensitive	36.3	16.5	6.0	16.2	0.80
AAQ06	Sensitive	37.6	17.0	6.5	16.7	0.80
AAQ07	Sensitive	38.1	17.7	6.9	17.0	0.80
AAQ08	Residential	42.0	20.2	7.4	17.8	0.90
AAQ09	Commercial Area	48.5	22.6	8.8	18.5	1.00

#### Discussion of Result: (SH-41: Rajapalayam to Tirunelveli)

The ambient air quality is well within limits stipulated by CPCB. It is observed from table that Particulate Matter (10) in all location is in between in 36.3 - 48.5 µg/m<sup>3</sup>. And Particulate matter (2.5) between 16.5 and 22.6, SO<sub>2</sub> content ranges between 5.8 – 8.8 µg/m<sup>3</sup> and NO<sub>x</sub> values ranges between 16.2 - 18.5 µg/m<sup>3</sup>. The results are tabulated in figure 4.

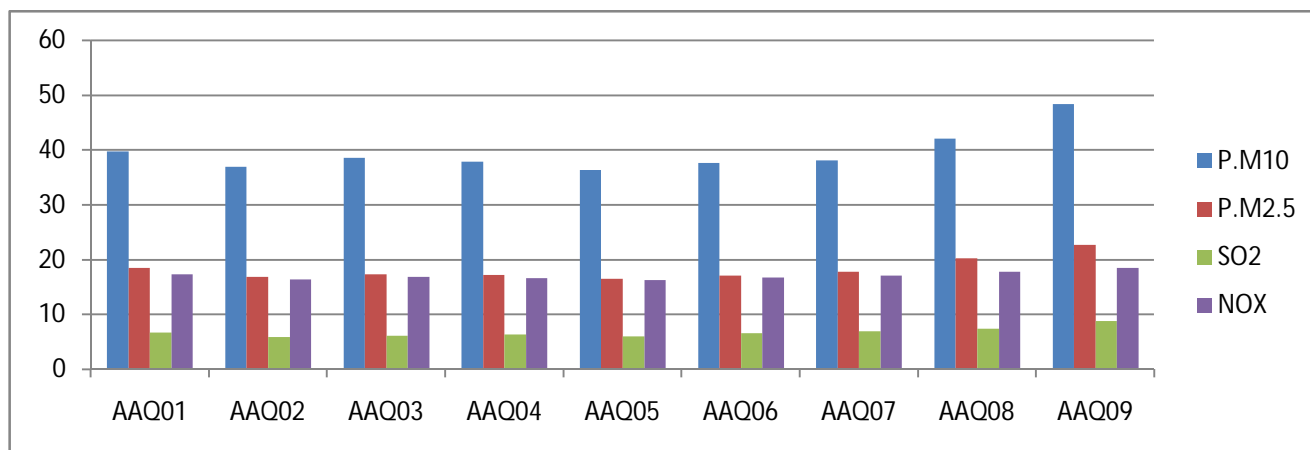


Figure 5.



## 2. NOISE QUALITY

### 2.1 Methodology for monitoring

Noise in general is sound which is composed of many frequency components of various loudness distributed over the audible frequency range. Noise monitoring is to be carried out during day and night time with a minimum of 4 readings per minute for 15 min in an hour for 24 hours. From the noted levels while using a handheld noise meter, in 'A' weighted averaging for ambient noise, Leq (Day) and Leq (Night) were calculated.

Table: 06. Duration of sampling

Parameter	Sampling duration
Noise Level Monitoring	Once (Hourly reading for 24 hrs Monitoring)

Table: 07. Ambient noise level monitoring locations

Location code	Name of the location	Date of monitoring	Classification Description of location	GPS Point (Zone 43)
<b>SH-41: Rajapalayam to Tirunelveli (Part -I)</b>				
ANQ01	College	24.06.2014 To 25.06.2014	Sensitive Zone	E:0780750 N:1043228
ANQ02	Vandimahali Aman Temple		Sensitive Zone	E:0781388 N:1036178
ANQ03	Mahatma Gandhi college of Art & Science for Women		Sensitive Zone	E:0779706 N:1033024
ANQ04	Polytechnic college		Sensitive Zone	E:0779928 N:1029867
ANQ05	Govt. Hospital and Bus Shelter		Sensitive Zone	E:0779070 N:1025014
ANQ06	A.V.K. International School and PKR Cotton Mill, Sankarakovil		School and Factory Area	E:0778517 N:1019557
ANQ07	Vaiyapuri-School and Temple, Sankarakovil		Sensitive Location	E:0778534 N:1016871
ANQ08	Mutharamalinga Thevar College and Hostel Canteen		Sensitive Location	E:0784654 N:1005896



Table: 07. Ambient noise level monitoring locations

Location code	Name of the location	Date of monitoring	Classification Description of location	GPS Point (Zone 43)
<b>SH-41: Rajapalayam to Tirunelveli (Part -II)</b>				
ANQ09	Govt. Hospital and Govt. High School	25.06.2014 To 26.06.2014	Sensitive Location	E:0788895 N:0994688
ANQ10	Elisabetta Vitale Matriculation School and Church, Lodola Nagar, Devarkulam		Sensitive Location	E:0789468 N:0992932
ANQ11	Govt. High School		Educational Area	E:0790676 N:0988319
ANQ12	Eskiamanv Temple		Sensitive Location	E:0790899 N:0987003
ANQ13	Manur Village		Residential	E:0791963 N:0980390
ANQ14	Govt. Middle School and Temple		Silence Zone	E:0792163 N:0975772
ANQ15	Nanjankulam Regrouped Stone Mines, Indian Cement Ltd., Seduroyan Puddur		Open Caste Mining Area	E:0793079 N:0973114
ANQ16	T.N., Vetenary College and Research Institute of Vetenary and Animal		Silence Zone	E:0795245 N:0970117
ANQ17	Sudalai Temple, Tirunelveli		Sensitive Zone	E:0795950 N:0967193
ANQ18	At Junction		Commercial Area	E:0795494 N:0966032





## 2.2 Presentation and discussions of results

Leq day and Leq night, are to be calculated using the monitoring results. Results are to be compared with the CPCB standards.

Table: 08. Ambient noise level monitoring Results SH-41: Rajapalayam to Tirunelveli

Location Code	Classification of area	Noise level Leq dB(A)		CPCB standard Leq dB(A)	
		Day	Night	Day	Night
ANQ01	Sensitive Zone	48.9	37.6	50	40
ANQ02	Sensitive Zone	46.8	35.4	50	40
ANQ03	Sensitive Zone	47.3	36.0	50	40
ANQ04	Sensitive Zone	47.7	36.5	50	40
ANQ05	Sensitive Zone	48.1	35.9	50	40
ANQ06	School and Factory Area	49.3	38.2	50	40
ANQ07	Sensitive Location	48.6	37.8	50	40
ANQ08	Sensitive Location	45.9	33.7	50	40
ANQ09	Sensitive Location	47.4	35.6	50	40
ANQ10	Sensitive Location	48.0	36.1	50	40
ANQ11	Educational Area	47.9	36.5	50	40
ANQ12	Sensitive Location	48.3	37.2	50	40
ANQ13	Residential	50.9	39.6	55	45
ANQ14	Silence Zone	46.1	37.0	50	40
ANQ15	Open Caste Mining Area	56.5	48.7	65	55
ANQ16	Silence Zone	46.5	35.9	50	40
ANQ17	Sensitive Zone	47.0	36.6	50	40
ANQ18	Commercial Area	59.8	51.3	65	55

Day time monitoring done from 6.00 am – 10.00 pm

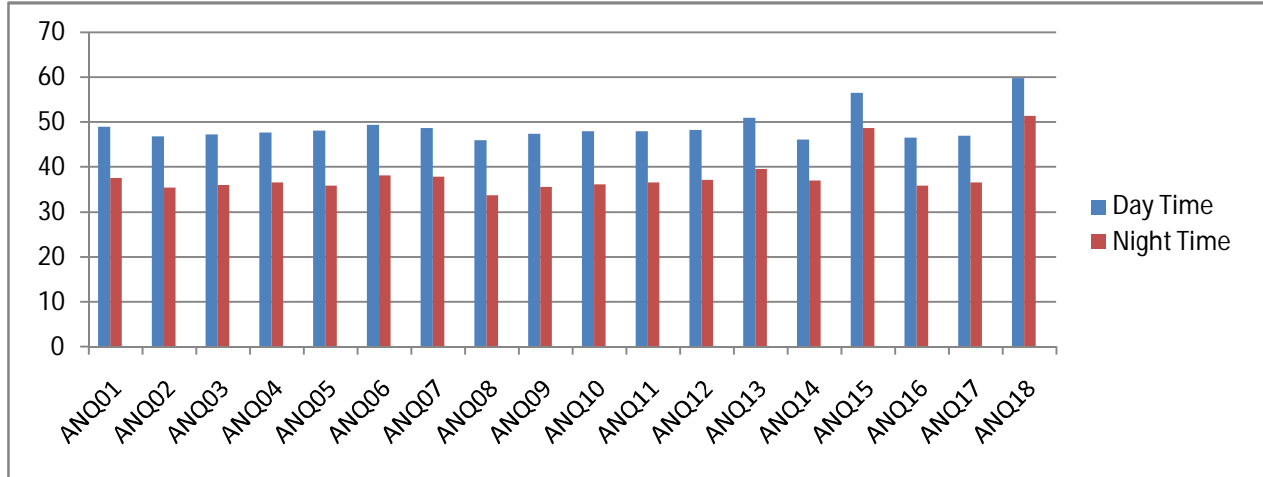
Night time monitoring done from 10.00 pm – 6.00 am

### Discussion of Result:

In the case of Noise levels the measured day time Mean values and hourly values for the period of 6AM to 10 PM at all the points are well below the accepted limits as per specification. The Night time mean values and hourly values for the period of 10 PM to 6 AM at all the points are well below the accepted limits as per specification.



Figure.6



### 3. WATER QUALITY MONITORING

Essential characteristics and bacteriological parameters for drinking water as per IS: 10500 of 1991 and important pollution indicators as per IS: 2296 -1982 (Class C) are analysed for all the water samples.

Sampling and analysis techniques:

Parameters for analysis of water quality were selected based on the utility of the particular source of water as per moef guidance. Water samples are collected from ten locations, four surface waters from the pond and dam and six ground water samples are collected. Samples are collected directly from the source and preserved in Two liter can and for microbiological analysis separate 250ml sterilized bottles are used. The collected samples are analysed as per the methods prescribed by APHA and IS 3025. The quality of ground water was compared with IS 10500: 1991 for drinking purpose. Surface Water quality water compared with IS 2296 class C limits. Monitoring or sampling locations are tabulated in table 09.



Table: 09 water quality monitoring locations

Location code	Name of the location and Village	Source of water	Date of Sampling	GPS Point (Zone 43)
SH-41: Rajapalayam to Tirunelveli				
WQ01	Near Marriage Garden, Rajapallayam	Hand Pump (GW)	24.06.2014	E:0781070 N:1040952
WQ02	Madhukudy	Pond (SW)		E:0781261 N:1040555
WQ03	Solaiseri	Over Head Water Tank (GW)		E:0779772 N:1033153
WQ04	K.R Naidu Nagar	Check Dam (SW)		E:0779857 N:1028826
WQ05	Ramalingapuram	Hand pump (GW)		E:0778441 N:1020695
WQ06	Muthukrishnapuram	Over Head Water Tank (GW)		E:0778161 N:1009058
WQ07	Panavadalachathiram	Over Head Water Tank (GW)	25.06.2014	E:0786968 N:1001727
WQ08	Alakiyapandiapuram	Sitaru River (SW)	No surface on River water (E:0791444 N:0985010)	
WQ09	Manur	Pond (SW)	25.06.2014	E:0791998 N:0980405
WQ10	Jami Nagar	Handpump (GW)		E:0792102 N:0978493



Table.10 Parameters and method of Analysis

Sl. No.	Parameters	Method of Analysis
1.	Temperature	IS 3025 Part 9 - 1984 (Reaff. 2006),
2.	pH @ 25°C	IS 3025 Part 11 - 1983 (Reaff. 2006)
3.	Turbidity , NTU	IS 3025 Part 10 - 1984 (Reaff. 2006)
4.	Conductivity 25c (micro mhos/cm)	IS:3025/P14/1984 Reaff 2006
5.	Colour , Hazen	IS 3025 Part 4 - 1983 (Reaff. 2006)
6.	Odour	IS 3025 Part 5 - 1983 (Reaff. 2006)
7.	Total Suspended Solids, mg/L	IS 3025 Part 17 – 1984 (Reaff.2006)
8.	Dissolved Solids [inorganic], mg/L	IS 3025 Part 16 - 1984 (Reaff. 2006)
9.	Dissolved Oxygen mg/L	IS 3025 Part 38 - 1989 (Reaff. 2009)
10.	COD, mg/L	IS 3025 Part 58 - 2006
11.	BOD @ 27°C for 3 days, mg/L	IS 3025 Part 44 – 1993 (Reaff. 2009)
12.	TKN mg/L	IS 3025 Part 34 – 1988 (Reaff. 2009)
13.	Total Hardness as CaCO <sub>3</sub> , mg/L	IS 3025 Part 21 - 1983 (Reaff. 2006)
14.	Sodium, mg/L	IS 3025 Part 45 - 1993 (Reaff. 2009)
15.	Potassium, mg/L	IS 3025 Part 45 - 1993 (Reaff. 2009)
16.	Calcium as Ca, mg/L	IS 3025 Part 40 - 1991 (Reaff. 2009)
17.	Magnesium as Mg, mg/L	IS 3025 Part 46 - 1994 (Reaff. 2009)
18.	Ammonia as NH <sub>3</sub> , mg/L	IS 3025 Part 34 - 1988 (Reaff. 2009)
19.	Chloride as Cl, mg/L	IS 3025 Part 32 - 1988 (Reaff. 2009)
20.	Phosphate as P, mg/L	IS 3025 Part 31 - 1988 (Reaff. 2009)
21.	Nitrate as NO <sub>3</sub> , mg/L	IS 3025 Part 34 - 1988 (Reaff. 2009)
22.	Fluoride as F, mg/L	IS 3025 Part 60 : 2008,
23.	Surfactants, mg/L	APHA 22nd Edn. 5540 B,C
24.	Total Iron as Fe, mg/L	IS 3025 Part 53 - 2003 (Reaff.2009)
25.	Copper as Cu, mg/L	IS 3025 Part 42 - 1992 (Reaff.2009)
26.	Sulphate as SO <sub>4</sub> , mg/L	IS 3025 Part 24 - 1986 (Reaff. 2009)
27.	Zinc as Zn, mg/L	IS 3025 Part 49 - 1994 (Reaff.2009)
28.	Arsenic as As, mg/L	IS 3025 Part 37 - 1988 (Reaff.2009)
29.	Mercury as Hg, mg/L	IS 3025 Part 48 - 1994 (Reaff.2009)
30.	Lead as Pb, mg/L	IS 3025 Part 47 - 1994 (Reaff.2009)
31.	Manganese as Mn, mg/L	IS 3025 Part 59 – 2006
32.	Boron as B, mg/L	APHA 22nd Edn. 4500 B/B
33.	Chromium as Cr <sup>6+</sup> , mg/L	IS 3025 Part 52 - 2003 (Reaff.2009)
34.	Phenolic compounds as	IS 3025 Part 43 – 1992 (Reaff.2009)
35.	Cadmium as Cd, mg/L	IS 3025 Part 41 - 1992 (Reaff.2009)
36.	Total Coliform	IS:1662 -1981 R.2003
37.	Fecal Coliform	IS:1662 -1981 R.2003



Table: 11 Presentation and discussions of results SH-41: Rajapalayam to Tirunelveli

Sl. No	Parameters	Units	WQ01 (GW)	WQ02 (SW)	WQ03 (GW)	WQ04 (SW)	IS:10500 Desirable limits	IS:2296 Class C limits
1	Temperature	°C	28	29	29	28	--	--
2	pH @ 25°C	-	7.80	7.86	7.99	8.15	6.5 - 8.5	6.5 - 8.5
3	Turbidity	NTU	4.6	120	3.0	58	5	--
4	Conductivity 25°C	µmhos/cm	4337	131	121	366	--	--
5	Colour	Hazen	<1.0	90	4.0	35	5	300
6	Odour		Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	--
7	Total Suspended Solids	mg/L	4.0	180	2.0	94	--	--
8	Dissolved Solids [inorganic]	mg/L	2689	76	68	216	500	1500
9	Dissolved Oxygen	mg/L	7.5	6.8	7.2	BDL (DL:0.2)	--	Min 4.0
10	COD	mg/L	BDL (DL:4.0)	10	BDL (DL:4.0)	28	--	--
11	BOD @ 27°C for 3 days	mg/L	BDL (DL:2.0)	2.0	BDL (DL:2.0)	10	--	3.0
12	TKN	mg/L	BDL (DL:1.0)	BDL (DL:1.0)	BDL (DL:1.0)	BDL (DL:1.0)	--	--
13	Total Hardness as CaCO <sub>3</sub> ,	mg/L	130	52	40	89	300	--
14	Sodium	mg/L	410	1.98	4.41	10	--	--
15	Potassium	mg/L	108	0.62	1.38	2.8	--	--
16	Calcium as Ca	mg/L	258	12.4	10	25	75	--
17	Magnesium as Mg	mg/L	92	5.0	3.6	6.48	--	--
18	Ammonia as NH <sub>3</sub>	mg/L	BDL (DL :0.1)	BDL(DL:1.0)	BDL (DL:1.0)	BDL (DL:1.0)	--	--
19	Chloride as Cl	mg/L	1229	5.8	15	34.7	250	600
20	Sulphate as SO <sub>4</sub>	mg/L	413	3.0	2.95	49	200	400
21	Phosphate as P	mg/L	0.15	BDL (DL:0.01)	BDL (DL:0.01)	BDL (DL:0.01)	--	--
22	Nitrate as NO <sub>3</sub>	mg/L	2.70	0.68	BDL (DL:0.5)	0.9	45	50
23	Fluoride as F	mg/L	0.23	BDL (DL:0.1)	BDL (DL:0.1)	0.14	1.0	1.5
24	Surfactants	mg/L	Absent	Absent	Absent	Absent	0.2	1.0





Sl. No	Parameters	Units	SH-41: Rajapalayam to Tirunelveli				IS:10500 Desirable limits	IS:2296 Class C limits
			WQ01 (GW)	WQ02 (SW)	WQ03 (GW)	WQ04 (SW)		
25	Total Iron as Fe	mg/L	0.73	17.5	0.07	8.82	0.3	50
26	Copper as Cu	mg/L	BDL (DL : 0.01)	BDL (DL : 0.01)	BDL (DL : 0.01)	BDL (DL : 0.01)	0.05	1.5
27	Zinc as Zn	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	5.0	15
28	Arsenic as As	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	0.05	0.2
29	Mercury as Hg	mg/L	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	0.001	--
30	Lead as Pb	mg/L	BDL (DL : 0.1)	BDL (DL : 0.01)	BDL (DL : 0.1)	BDL (DL : 0.1)	0.05	0.1
31	Manganese as Mn	mg/L	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	0.1	--
32	Boron as B	mg/L	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	1.0	--
33	Chromium as Cr	mg/L	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	0.05	0.05
34	Phenolic compounds as	mg/L	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	0.001	0.005
35	Cadmium as Cd	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	0.01	0.01
36	Total Coliform	MPN/100ml	Absence	Absence	Absence	Absence	Absence	5000
37	Fecal Coliform	MPN/100ml	Absence	Absence	Absence	Absence	Absence	--

Sl. No	Parameters	Units	SH-41: Rajapalayam to Tirunelveli				IS:10500 Desirable limits	IS:2296 Class C limits
			WQ05 (GW)	WQ06 (GW)	WQ07 (GW)	WQ09 (SW)		
1	Temperature	°C	28	29	28	28	--	--
2	pH @ 25°C	-	8.41	7.84	7.97	8.03	6.5 - 8.5	6.5 - 8.5
3	Turbidity	NTU	3.8	2.5	4.1	148	5	--
4	Conductivity 25°C	µmhos/cm	1428	2516	245	259	--	--
5	Colour	Hazen	<1.0	<1.0	<1.0	65	5	300
6	Odour		Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	--
7	Total Suspended Solids	mg/L	4.0	2.0	3.0	200	--	--
8	Dissolved Solids [inorganic]	mg/L	814	1536	142	153	500	1500
9	Dissolved Oxygen	mg/L	6.8	7.0	7.4	6.7	--	Min 4.0
10	COD	mg/L	BDL (DL:4.0)	BDL (DL:4.0)	BDL (DL:4.0)	8.0	--	--



Table 11 Presentation and discussions of results SH-41: Rajapalayam to Tirunelveli

Sl. No	Parameters	Units	WQ05 (GW)	WQ06 (GW)	WQ07 (GW)	WQ09 (SW)	IS:10500 Desirable limits	IS:2296 Class C limits
11	BOD @ 27°C for 3 days	mg/L	BDL (DL:2.0)	BDL (DL:2.0)	BDL (DL:2.0)	2.0	--	3.0
12	TKN	mg/L	BDL (DL:1.0)	BDL (DL:1.0)	BDL (DL:1.0)	BDL (DL:1.0)	--	--
13	Total Hardness as CaCO <sub>3</sub>	mg/L	557	541	85	92	300	--
14	Sodium	mg/L	65	183	6.3	3.43	--	--
15	Potassium	mg/L	19	54	1.8	1.1	--	--
16	Calcium as Ca	mg/L	142	120	24	25	75	--
17	Magnesium as Mg	mg/L	49	58	6.0	6.96	--	--
18	Ammonia as NH <sub>3</sub>	mg/L	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	--	--
19	Chloride as Cl	mg/L	246	641	19	12	250	600
20	Sulphate as SO <sub>4</sub>	mg/L	35	189	8.0	10	200	400
21	Phosphate as P	mg/L	0.12	0.14	BDL (DL : 0.01)	BDL (DL : 0.01)	--	--
22	Nitrate as NO <sub>3</sub>	mg/L	1.30	1.80	0.76	0.80	45	50
23	Fluoride as F	mg/L	0.16	0.21	BDL (DL : 0.1)	BDL (DL : 0.1)	1.0	1.5
24	Surfactants	mg/L	Absent	Absent	Absent	Absent	0.2	1.0
25	Total Iron as Fe	mg/L	0.18	0.10	0.09	21.2	0.3	50
26	Copper as Cu	mg/L	BDL (DL : 0.01)	BDL (DL : 0.01)	BDL (DL : 0.01)	BDL (DL : 0.01)	0.05	1.5
27	Zinc as Zn	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	5.0	15
28	Arsenic as As	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	0.05	0.2
29	Mercury as Hg	mg/L	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	0.001	--
30	Lead as Pb	mg/L	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	0.05	0.1
31	Manganese as Mn	mg/L	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	0.1	--
32	Boron as B	mg/L	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	BDL (DL : 0.1)	1.0	--
33	Chromium as Cr	mg/L	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	BDL (DL : 0.03)	0.05	0.05
34	Phenolic compounds as C <sub>6</sub> H <sub>5</sub> OH	mg/L	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	BDL (DL : 0.001)	0.001	0.005
35	Cadmium as Cd	mg/L	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	BDL (DL : 0.005)	0.01	0.01
36	Total Coliform	MPN/100ml	Absence	Absence	Absence	Absence	Absence	5000
37	Fecal Coliform	MPN/100m	Absence	Absence	Absence	Absence	Absence	--



Sl. No	Parameters	Units	SH-41: Rajapalayam to Tirunelveli	IS:10500 Desirable limits	IS:2296 Class C limits
			WQ10 (GW)		
1	Temperature	°C	29	--	--
2	pH @ 25°C	-	8.07	6.5 - 8.5	6.5 - 8.5
3	Turbidity	NTU	<0.5	5	--
4	Conductivity 25°C	µmhos/cm	842	--	--
5	Colour	Hazen	<1.0	5	300
6	Odour		Agreeable	Agreeable	--
7	Total Suspended Solids	mg/L	BDL(D.L:1.0)	--	--
8	Dissolved Solids [inorganic]	mg/L	487	500	1500
9	Dissolved Oxygen	mg/L	7.1	--	Min 4.0
10	COD	mg/L	BDL (DL:4.0)	--	--
11	BOD @ 27°C for 3 days	mg/L	BDL (DL:2.0)	--	3.0
12	TKN	mg/L	BDL (DL:1.0)	--	--
13	Total Hardness as	mg/L	291	300	--
14	Sodium	mg/L	30	--	--
15	Potassium	mg/L	8.6	--	--
16	Calcium as Ca	mg/L	69	75	--
17	Magnesium as Mg	mg/L	28	--	--
18	Ammonia as NH <sub>3</sub>	mg/L	BDL (DL : 0.1)	--	--
19	Chloride as Cl	mg/L	96	250	600
20	Sulphate as SO <sub>4</sub>	mg/L	45	200	400
21	Phosphate as P	mg/L	0.09	--	--
22	Nitrate as NO <sub>3</sub>	mg/L	1.1	45	50
23	Fluoride as F	mg/L	0.12	1.0	1.5
24	Surfactants	mg/L	Absent	0.2	1.0
25	Total Iron as Fe	mg/L	0.06	0.3	50
26	Copper as Cu	mg/L	BDL (DL : 0.01)	0.05	1.5
27	Zinc as Zn	mg/L	BDL (DL : 0.005)	5.0	15



Sl. No	Parameters	Units	SH-41: Rajapalayam to Tirunelveli	IS:10500	IS:2296
			WQ10 (GW)	Desirable limits	Class C limits
28	Arsenic as As	mg/L	BDL (DL : 0.005)	0.05	0.2
29	Mercury as Hg	mg/L	BDL (DL : 0.001)	0.001	--
30	Lead as Pb	mg/L	BDL (DL : 0.01)	0.05	0.1
31	Manganese as Mn	mg/L	BDL (DL : 0.03)	0.1	--
32	Boron as B	mg/L	BDL (DL : 0.1)	1.0	--
33	Chromium as Cr	mg/L	BDL (DL : 0.03)	0.05	0.05
34	Phenolic compounds as C <sub>6</sub> H <sub>5</sub> OH	mg/L	BDL (DL : 0.001)	0.001	0.005
35	Cadmium as Cd	mg/L	BDL (DL : 0.005)	0.01	0.01
36	Total Coliform	MPN/100ml	Absence	Absence	5000
37	Fecal Coliform	MPN/100ml	Absence	Absence	--

#### Results and Discussion: (SH-41: Rajapalayam to Tirunelveli)

Surface water samples collected from four locations of WQ 02, WQ 04, WQ 08, & WQ 09. WQ 08 one location river water no water is available. Another three location WQ 02, WQ 04 & WQ 09, Two location WQ 02, & WQ 09 all parameters should be meet the standards IS 2296 Class C, one location WQ 04 all parameters should be meet the standards IS 2296 Class C, except the DO & BOD Parameter. Ground water samples collected from Six locations WQ 01, WQ 03, WQ 05, WQ 06, WQ 07, & WQ 10. In this ground water samples collected from locations WQ 03, WQ 07 & WQ 10 all parameters are within the limits stipulated by IS 10500 desirable limits. In Ground water sample location of WQ01, WQ 05, & WQ 06 Sample all parameters are within the limits stipulated by IS 10500 desirable limits, except parameters TDS, TH, Ca, Cl and Sulphate. Ground water samples WQ01, WQ 05, & WQ 06 should not meet the standards IS 10500 desirable limits for drinking purposes.



#### 4. SOIL CHARACTERISTICS

Soil samples are collected from the preferred location and analyzed as per the standard methods prescribed by Central Pollution Control Board.

Table: 12 Soil Location Details

Location code	Name of the location and village	Land Use	Date of Sampling	GPS Point (Zone 43)
<b>SH-41: Rajapalayam to Tirunelveli</b>				
SQ1	Ammanpuram and Sonaganvilai	Rice Paddy Land	24.06.2014	E:0781390 N:1036199
SQ2	Sivasubramaniyapuram and Thenthirupperai	Rice Paddy Land		E:0779386 N:1026424
SQ3	Puliamkullam	Open Agriculture and Rice Paddy Land		E:0778954 N:1013876
SQ4	Parancheri	Agriculture	25.06.2014	E:0791397 N:0985629
SQ5	Vellanguli	Agriculture		E:0796070 N:0968172

Table: 13 Desirable Soil Quality

Sl. No.	Parameters	Desirable Range
1.	pH ( 10% solution )	5.5-9.0
2.	Conductivity	0.2- 0.5 mmhos/cm
3.	Sand, Silt, Clay	---
4.	Texture	--
5.	Moisture Retention capacity	--
6.	Moisture	
7.	Infiltration rate	--
8.	Organic matter	--
9.	Nitrogen	0.01-0.02 %
10.	Potassium	>0.01%
11.	Phosphorous	--
12.	Sulphates	--
13.	Sodium Sulphate	--
14.	Calcium Sulphate	--
15.	Oil and grease	--





Table: 14 Presentation and discussions of results (SH-41: Rajapalayam to Tirunelveli)

Sl. No.	Parameters	Unit	SQ1	SQ2
1.	pH ( 10% solution )	--	7.28	7.81
2.	Conductivity	mmhos/cm	0.224	0.432
3.	Sand	%	80	30
	Silt	%	15	20
	Clay	%	5.0	50
4	Texture		Sand Soil	Clay Soil
5.	Moisture Retention capacity	%	1.05	0.84
6.	Moisture	%	3.16	2.58
7.	Infiltration rate	mm/hr	1.7	1.5
8.	Organic matter	%	0.1023	0.1156
9.	Nitrogen	%	0.0164	0.0148
10.	Potassium	%	0.013	0.0102
11.	Phosphorous	%	0.0018	0.0021
12.	Sulphates	%	0.0014	0.0029
13.	Sodium Sulphate	%	0.0145	0.01090
14.	Calcium Sulphate	%	0.0304	0.0234
15.	Oil and grease	%	<1.0	<1.0



Sl. No.	Parameters	Unit	SQ3	SQ4	SQ5
1.	pH ( 10% solution )	--	7.76	7.79	7.18
2 .	Conductivity	mmhos/cm	0.447	0.280	0.374
3.	Sand	%	35	30	65
	Silt	%	15	10	10
	Clay	%	50	60	25
4	Texture		Clay Soil	Clay Soil	Sandy Soil
5.	Moisture Retention capacity	%	6.07	1.46	1.39
6.	Moisture	%	8.22	4.37	4.20
7.	Infiltration rate	mm/hr	1.6	1.7	1.6
8.	Organic matter	%	0.1127	0.1143	0.087
9.	Nitrogen	%	0.0157	0.0136	0.0172
10.	Potassium	%	0.0105	0.0102	0.0128
11.	Phosphorous	%	0.0014	0.0018	0.0027
12.	Sulphates	%	0.0023	0.0016	0.0018
13.	Sodium Sulphate	%	0.0116	0.0032	0.0082
14.	Calcium Sulphate	%	0.0564	0.035	0.0642
15.	Oil and grease	%	<1.0	<1.0	<1.0

#### Results and Discussions

The soil sample does not show much variation in characteristics. The pH of the soil from all the locations are neutral it varies from 7.18 - 7.81, the conductivity in all locations does not show much variations it varies from 0.224-0.447.



**ANNEXURE 1- PHOTOGRAPHS**

SH-41:Rajapalayam to Tirunelveli

❖ Ambient Air Monitoring Photos:



AAQ 01



AAQ 02



AAQ 03



AAQ 04



AAQ 05



AAQ 06



AAQ 07



AAQ 08





Noise Monitoring Photos:







ANQ 07



ANQ 08



ANQ 09



ANQ 10



ANQ 11



ANQ 12



ANQ 13



ANQ 14







❖ Water sampling Photos:







WQ 05



WQ 06



WQ 07



WQ 09



WQ 10



WQ 10





Soil sampling Photos:



SQ 01



SQ 02



SQ 03



SQ 04



SQ 05



❖ Site Visit photos of SMEC





GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address		SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.						
Survey Description		SH-41: Rajapalayam to Tirunelveli- <b>College (AAQ 01)</b>						
Survey Conducted by		GCSPL						
Survey conducted on	Sample Received on	Test Completed on	Sampling Time (24 Hrs)	P.M10	P.M2.5	SO <sub>2</sub>	NO <sub>x</sub>	CO (8 hr)
24.06.2014 to 25.06.2014	26.06.2014	27.06.2014	08.00 to 08.00	36.6	16.1	5.6	16.8	0.85
27.06.2014 to 28.06.2014	29.06.2014	01.07.2014	08.00 to 08.00	42.3	18.6	6.2	18.6	0.75
01.07.2014 to 02.07.2014	03.07.2014	04.07.2014	08.00 to 08.00	31.4	20.0	8.4	15.9	0.80
04.07.2014 to 05.07.2014	06.07.2014	08.07.2014	08.00 to 08.00	34.9	18.2	6.3	17.4	0.85
08.07.2014 to 09.07.2014	10.07.2014	11.07.2014	08.00 to 08.00	43.1	20.5	7.5	16.5	0.70
11.07.2014 to 12.07.2014	13.07.2014	15.07.2014	08.00 to 08.00	46.2	16.0	6.0	18.3	0.85
15.07.2014 to 16.07.2014	17.07.2014	18.07.2014	08.00 to 08.00	37.8	21.0	5.4	16.7	0.70
18.07.2014 to 19.07.2014	20.07.2014	22.07.2014	08.00 to 08.00	45.3	16.8	7.7	18.2	0.90
Total Average Results				39.7	18.4	6.6	17.3	0.80
Unit				µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>
For Green Chem Solutions Pvt Ltd (Laboratory Division)								Authorized Signatory



GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address		SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.						
Survey Description		SH-41: Rajapalayam to Tirunelveli- Mahatma Gandhi college of Art & Science for Women (AAQ 02)						
Survey Conducted by		GCSPPL						
Survey conducted on	Sample Received on	Test Completed on	Sampling Time (24 Hrs)	P.M10	P.M2.5	SO <sub>2</sub>	NO <sub>x</sub>	CO (8 hr)
24.06.2014 to 25.06.2014	26.06.2014	27.06.2014	08.30 to 08.30	32.4	19.8	5.5	15.8	0.90
27.06.2014 to 28.06.2014	29.06.2014	01.07.2014	08.30 to 08.30	38.0	17.5	6.7	14.3	0.70
01.07.2014 to 02.07.2014	03.07.2014	04.07.2014	08.30 to 08.30	37.6	16.9	5.0	19.1	0.85
04.07.2014 to 05.07.2014	06.07.2014	08.07.2014	08.30 to 08.30	36.0	15.4	6.9	16.3	0.95
08.07.2014 to 09.07.2014	10.07.2014	11.07.2014	08.30 to 08.30	35.1	18.0	5.3	16.9	0.90
11.07.2014 to 12.07.2014	13.07.2014	15.07.2014	08.30 to 08.30	33.3	14.9	6.1	16.5	0.95
15.07.2014 to 16.07.2014	17.07.2014	18.07.2014	08.30 to 08.30	37.4	15.3	4.8	14.8	0.80
18.07.2014 to 19.07.2014	20.07.2014	22.07.2014	08.30 to 08.30	45.2	16.7	6.2	17.6	0.75
Total Average Results				36.9	16.8	5.8	16.4	0.85
Unit				µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>
For Green Chem Solutions Pvt Ltd (Laboratory Division)								Authorized Signatory





GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address		SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.						
Survey Description		SH-41: Rajapalayam to Tirunelveli- Govt. Hospital and Bus Shelter (AAQ 03)						
Survey Conducted by		GCSPPL						
Survey conducted on	Sample Received on	Test Completed on	Sampling Time (24 Hrs)	P.M10	P.M2.5	SO <sub>2</sub>	NO <sub>x</sub>	CO (8 hr)
24.06.2014 to 25.06.2014	26.06.2014	27.06.2014	09.00 to 09.00	35.9	15.9	6.8	16.6	0.85
27.06.2014 to 28.06.2014	29.06.2014	01.07.2014	09.00 to 09.00	37.4	18.1	5.0	17.8	0.75
01.07.2014 to 02.07.2014	03.07.2014	04.07.2014	09.00 to 09.00	39.2	16.5	5.7	15.9	0.90
04.07.2014 to 05.07.2014	06.07.2014	08.07.2014	09.00 to 09.00	40.3	18.9	6.2	17.0	0.95
08.07.2014 to 09.07.2014	10.07.2014	11.07.2014	09.00 to 09.00	41.5	16.3	6.4	17.7	0.75
11.07.2014 to 12.07.2014	13.07.2014	15.07.2014	09.00 to 09.00	38.8	18.6	5.9	15.8	0.85
15.07.2014 to 16.07.2014	17.07.2014	18.07.2014	09.00 to 09.00	35.1	17.7	6.5	16.2	0.80
18.07.2014 to 19.07.2014	20.07.2014	22.07.2014	09.00 to 09.00	39.7	16.4	6.3	17.4	0.95
Total Average Results				38.5	17.3	6.1	16.8	0.85
Unit				µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>
For Green Chem Solutions Pvt Ltd (Laboratory Division)								Authorized Signatory



GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address		SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.						
Survey Description		SH-41: Rajapalayam to Tirunelveli- Vaiyapuri-School and Temple, Sankarankovil (AAQ 04)						
Survey Conducted by		GCSP						
Survey conducted on	Sample Received on	Test Completed on	Sampling Time (24 Hrs)	P.M10	P.M2.5	SO <sub>2</sub>	NO <sub>x</sub>	CO (8 hr)
24.06.2014 to 25.06.2014	26.06.2014	27.06.2014	09.30 to 09.30	31.8	20.1	7.3	18.9	0.95
27.06.2014 to 28.06.2014	29.06.2014	01.07.2014	09.30 to 09.30	38.2	16.4	7.1	15.3	1.00
01.07.2014 to 02.07.2014	03.07.2014	04.07.2014	09.30 to 09.30	32.4	20.5	6.0	19.1	0.95
04.07.2014 to 05.07.2014	06.07.2014	08.07.2014	09.30 to 09.30	43.1	14.8	5.2	18.5	1.00
08.07.2014 to 09.07.2014	10.07.2014	11.07.2014	09.30 to 09.30	39.6	13.3	7.7	14.0	0.85
11.07.2014 to 12.07.2014	13.07.2014	15.07.2014	09.30 to 09.30	42.9	18.6	5.4	17.2	0.90
15.07.2014 to 16.07.2014	17.07.2014	18.07.2014	09.30 to 09.30	31.5	19.9	5.5	15.3	0.95
18.07.2014 to 19.07.2014	20.07.2014	22.07.2014	09.30 to 09.30	42.7	14.0	6.1	14.7	1.00
Total Average Results				37.8	17.2	6.3	16.6	0.95
Unit				µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>
							For Green Chem Solutions Pvt Ltd (Laboratory Division)	
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Client Name & Address		SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.						
Survey Description		SH-41: Rajapalayam to Tirunelveli- Mutharamalinga Thevar College and Hostel Canteen (AAQ 05)						
Survey Conducted by		GCSP						
Survey conducted on	Sample Received on	Test Completed on	Sampling Time (24 Hrs)	P.M10	P.M2.5	SO <sub>2</sub>	NO <sub>x</sub>	CO (8 hr)
24.06.2014 to 25.06.2014	26.06.2014	27.06.2014	10.00 to 10.00	42.8	19.1	5.7	18.9	0.85
27.06.2014 to 28.06.2014	29.06.2014	01.07.2014	10.00 to 10.00	40.3	14.5	4.9	19.3	0.90
01.07.2014 to 02.07.2014	03.07.2014	04.07.2014	10.00 to 10.00	33.1	15.3	7.0	13.4	0.75
04.07.2014 to 05.07.2014	06.07.2014	08.07.2014	10.00 to 10.00	33.5	19.5	5.3	14.6	0.80
08.07.2014 to 09.07.2014	10.07.2014	11.07.2014	10.00 to 10.00	41.7	16.0	5.1	15.7	0.70
11.07.2014 to 12.07.2014	13.07.2014	15.07.2014	10.00 to 10.00	31.6	13.9	5.7	16.3	0.85
15.07.2014 to 16.07.2014	17.07.2014	18.07.2014	10.00 to 10.00	34.3	18.4	6.9	13.6	0.80
18.07.2014 to 19.07.2014	20.07.2014	22.07.2014	10.00 to 10.00	32.9	15.2	7.4	17.8	0.75
Total Average Results				36.3	16.5	6	16.2	0.80
Unit				µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>
							For Green Chem Solutions Pvt Ltd (Laboratory Division)	
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Client Name & Address		SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.						
Survey Description		SH-41: Rajapalayam to Tirunelveli- Govt. Hospital and Govt. High School (AAQ 06)						
Survey Conducted by		GCSPL						
Survey conducted on	Sample Received on	Test Completed on	Sampling Time (24 Hrs)	P.M10	P.M2.5	SO <sub>2</sub>	NO <sub>x</sub>	CO (8 hr)
25.06.2014 to 26.06.2014	27.06.2014	28.06.2014	10.30 to 10.30	42.9	20.2	6.9	18.4	0.75
28.06.2014 to 29.06.2014	30.06.2014	01.07.2014	10.30 to 10.30	30.3	15.8	7.2	14.9	0.85
02.07.2014 to 03.07.2014	04.07.2014	05.07.2014	10.30 to 10.30	40.5	14.3	5.8	17.5	0.80
05.07.2014 to 06.07.2014	07.07.2014	08.07.2014	10.30 to 10.30	38.2	20.6	5.3	17.9	0.70
09.07.2014 to 10.07.2014	11.07.2014	12.07.2014	10.30 to 10.30	35.0	15.4	6.1	15.7	0.80
12.07.2014 to 13.07.2014	14.07.2014	15.07.2014	10.30 to 10.30	39.6	19.5	6.0	17.3	0.75
16.07.2014 to 17.07.2014	18.07.2014	19.07.2014	10.30 to 10.30	41.1	15.7	7.2	13.8	0.90
19.07.2014 to 20.07.2014	21.07.2014	22.07.2014	10.30 to 10.30	33.4	14.6	7.7	18.2	0.85
Total Average Results				37.6	17	6.5	16.7	0.80
Unit				µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>
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Client Name & Address		SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.						
Survey Description		SH-41: Rajapalayam to Tirunelveli- Govt. High School (AAQ 07)						
Survey Conducted by		GCSP						
Survey conducted on	Sample Received on	Test Completed on	Sampling Time (24 Hrs)	P.M10	P.M2.5	SO <sub>2</sub>	NO <sub>x</sub>	CO (8 hr)
25.06.2014 to 26.06.2014	27.06.2014	28.06.2014	11.00 to 11.00	42.2	20.5	8.1	15.4	0.80
28.06.2014 to 29.06.2014	30.06.2014	01.07.2014	11.00 to 11.00	39.0	19.8	5.9	18.2	0.75
02.07.2014 to 03.07.2014	04.07.2014	05.07.2014	11.00 to 11.00	40	14.7	6.4	18.9	0.85
05.07.2014 to 06.07.2014	07.07.2014	08.07.2014	11.00 to 11.00	41.9	20.2	8.2	20.1	0.90
09.07.2014 to 10.07.2014	11.07.2014	12.07.2014	11.00 to 11.00	35.0	16.3	6.7	14.5	0.70
12.07.2014 to 13.07.2014	14.07.2014	15.07.2014	11.00 to 11.00	41.2	15.8	5.9	18.3	0.80
16.07.2014 to 17.07.2014	18.07.2014	19.07.2014	11.00 to 11.00	35.4	19.9	7.6	15.0	0.75
19.07.2014 to 20.07.2014	21.07.2014	22.07.2014	11.00 to 11.00	30.3	14.5	6.3	15.7	0.85
Total Average Results				38.1	17.7	6.9	17	0.80
Unit				µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>
							For Green Chem Solutions Pvt Ltd (Laboratory Division)	
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Client Name & Address		SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.						
Survey Description		SH-41: Rajapalayam to Tirunelveli- Manur Village (AAQ 08)						
Survey Conducted by		GCSP						
Survey conducted on	Sample Received on	Test Completed on	Sampling Time (24 Hrs)	P.M10	P.M2.5	SO <sub>2</sub>	NO <sub>x</sub>	CO (8 hr)
25.06.2014 to 26.06.2014	27.06.2014	28.06.2014	11.30 to 11.30	49.3	21.8	8.1	20.4	0.95
28.06.2014 to 29.06.2014	30.06.2014	01.07.2014	11.30 to 11.30	45.5	20.7	6.9	16.5	0.8
02.07.2014 to 03.07.2014	04.07.2014	05.07.2014	11.30 to 11.30	43.2	16.6	7.8	15.6	0.85
05.07.2014 to 06.07.2014	07.07.2014	08.07.2014	11.30 to 11.30	39.0	23.9	7.0	19.3	0.95
09.07.2014 to 10.07.2014	11.07.2014	12.07.2014	11.30 to 11.30	44.1	17.0	8.3	15.7	0.9
12.07.2014 to 13.07.2014	14.07.2014	15.07.2014	11.30 to 11.30	36.3	20.7	6.6	20.2	0.95
16.07.2014 to 17.07.2014	18.07.2014	19.07.2014	11.30 to 11.30	43.5	19.5	8.2	16.1	0.85
19.07.2014 to 20.07.2014	21.07.2014	22.07.2014	11.30 to 11.30	35.1	21.4	6.3	18.7	0.95
Total Average Results				42	20.2	7.4	17.8	0.90
Unit				µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>
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Client Name & Address		SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.						
Survey Description		SH-41: Rajapalayam to Tirunelveli- At Junction (AAQ 09)						
Survey Conducted by		GCSP						
Survey conducted on	Sample Received on	Test Completed on	Sampling Time (24 Hrs)	P.M10	P.M2.5	SO <sub>2</sub>	NO <sub>x</sub>	CO (8 hr)
25.06.2014 to 26.06.2014	27.06.2014	28.06.2014	12.00 to 12.00	55.2	26.8	9.9	21.5	1.00
28.06.2014 to 29.06.2014	30.06.2014	01.07.2014	12.00 to 12.00	52.4	21.3	7.6	20.4	0.95
02.07.2014 to 03.07.2014	04.07.2014	05.07.2014	12.00 to 12.00	50.6	19.5	8.0	16.3	1.00
05.07.2014 to 06.07.2014	07.07.2014	08.07.2014	12.00 to 12.00	41.8	26.1	8.9	20.1	0.95
09.07.2014 to 10.07.2014	11.07.2014	12.07.2014	12.00 to 12.00	53.7	19.4	7.7	16.9	1.00
12.07.2014 to 13.07.2014	14.07.2014	15.07.2014	12.00 to 12.00	44.9	18.9	10.4	19.8	0.95
16.07.2014 to 17.07.2014	18.07.2014	19.07.2014	12.00 to 12.00	40.7	23.1	9.5	17.2	1.00
19.07.2014 to 20.07.2014	21.07.2014	22.07.2014	12.00 to 12.00	47.1	25.6	8.3	15.7	1.00
Total Average Results				48.3	22.6	8.8	18.5	1.00
Unit				µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>
							For Green Chem Solutions Pvt Ltd (Laboratory Division)	
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Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.				
Survey Description	Noise Monitoring	Sample Received on	26.06.2014		
Survey Conducted by	GC SPL	Test Commenced on	26.06.2014		
Survey Conducted on	24.06.14 to 25.06.14	Test Completed on	26.06.2014		
Location	Time (Hrs)		Hourly Leq dB (A)	Daytime dB (A)	
	From	To			
	Day Time				
College (ANQ 01)	6:00 AM	7:00 AM	42.70	48.9	
	7:00 AM	8:00 AM	45.47		
	8:00 AM	9:00 AM	46.71		
	9:00 AM	10:00 AM	50.63		
	10:00 AM	11:00 AM	51.67		
	11:00 AM	12:00 PM	51.47		
	12:00 PM	1:00 PM	51.96		
	1:00 PM	2:00 PM	50.96		
	2:00 PM	3:00 PM	51.1		
	3:00 PM	4:00 PM	50.32		
	4:00 PM	5:00 PM	49.58		
	5:00 PM	6:00 PM	47.52		
	6:00 PM	7:00 PM	44.6		
	7:00 PM	8:00 PM	42.19		
	8:00 PM	9:00 PM	40.06		
	9:00 PM	10:00 PM	39.22		
		Night Time		Hourly Leq dB (A)	Night time dB (A)
		10:00 PM	11:00 PM	36.34	37.6
		11:00 PM	12:00 AM	34.15	
		12:00 AM	1:00 AM	33.45	
	1:00 AM	2:00 AM	34.56		
	2:00 AM	3:00 AM	36.83		
	3:00 AM	4:00 AM	39.74		
	4:00 AM	5:00 AM	39.66		
	5:00 AM	6:00 AM	40.21		

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Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	26.06.2014	
Survey Conducted by	GC SPL	Test Commenced on	26.06.2014	
Survey Conducted on	24.06.14 to 25.06.14	Test Completed on	26.06.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Vandimahali Aman Temple (ANQ 02)	Day Time		46.8	
	6:00 AM	7:00 AM		39.21
	7:00 AM	8:00 AM		41.30
	8:00 AM	9:00 AM		46.74
	9:00 AM	10:00 AM		49.83
	10:00 AM	11:00 AM		49.95
	11:00 AM	12:00 PM		50.55
	12:00 PM	1:00 PM		50.91
	1:00 PM	2:00 PM		49.92
	2:00 PM	3:00 PM		47.85
	3:00 PM	4:00 PM		45.26
	4:00 PM	5:00 PM		43.32
	5:00 PM	6:00 PM		42.54
	6:00 PM	7:00 PM		41.33
	7:00 PM	8:00 PM	39.66	
	8:00 PM	9:00 PM	37.41	
	9:00 PM	10:00 PM	35.12	
	Night Time		Hourly Leq dB (A)	35.4
	10:00 PM	11:00 PM	32.87	
	11:00 PM	12:00 AM	32.5	
12:00 AM	1:00 AM	32.85		
1:00 AM	2:00 AM	32.85		
2:00 AM	3:00 AM	33.20		
3:00 AM	4:00 AM	35.28		
4:00 AM	5:00 AM	38.39		
5:00 AM	6:00 AM	39.02		

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Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	26.06.2014	
Survey Conducted by	GC SPL	Test Commenced on	26.06.2014	
Survey Conducted on	24.06.14 to 25.06.14	Test Completed on	26.06.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Mahatma Gandhi college of Art & Science for Women (ANQ 03)	Day Time		47.3	
	6:00 AM	7:00 AM		42.67
	7:00 AM	8:00 AM		44.58
	8:00 AM	9:00 AM		46.89
	9:00 AM	10:00 AM		48.07
	10:00 AM	11:00 AM		49.54
	11:00 AM	12:00 PM		50.13
	12:00 PM	1:00 PM		49.83
	1:00 PM	2:00 PM		50.13
	2:00 PM	3:00 PM		49.63
	3:00 PM	4:00 PM		48.44
	4:00 PM	5:00 PM		47.62
	5:00 PM	6:00 PM		46.32
	6:00 PM	7:00 PM		43.76
	7:00 PM	8:00 PM		39.08
	8:00 PM	9:00 PM	39.01	
	9:00 PM	10:00 PM	35.75	
	Night Time		Hourly Leq dB (A)	36.0
	10:00 PM	11:00 PM	32.57	
	11:00 PM	12:00 AM	30.97	
12:00 AM	1:00 AM	30.76		
1:00 AM	2:00 AM	32.08		
2:00 AM	3:00 AM	33.19		
3:00 AM	4:00 AM	34.81		
4:00 AM	5:00 AM	37.15		
5:00 AM	6:00 AM	41.93		

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Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	26.06.2014	
Survey Conducted by	GC SPL	Test Commenced on	26.06.2014	
Survey Conducted on	24.06.14 to 25.06.14	Test Completed on	26.06.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
	Day Time		47.7	
Polytechnic college (ANQ 04)	6:00 AM	7:00 AM		42.63
	7:00 AM	8:00 AM		44.78
	8:00 AM	9:00 AM		45.95
	9:00 AM	10:00 AM		47.13
	10:00 AM	11:00 AM		50.49
	11:00 AM	12:00 PM		50.42
	12:00 PM	1:00 PM		49.85
	1:00 PM	2:00 PM		49.41
	2:00 PM	3:00 PM		48.51
	3:00 PM	4:00 PM		48.12
	4:00 PM	5:00 PM		48.17
	5:00 PM	6:00 PM		48.99
	6:00 PM	7:00 PM		47.28
	7:00 PM	8:00 PM		46.13
	8:00 PM	9:00 PM	40.60	
9:00 PM	10:00 PM	38.85		
	Night Time		Hourly Leq dB (A)	
	10:00 PM	11:00 PM	34.21	
	11:00 PM	12:00 AM	33.16	
	12:00 AM	1:00 AM	30.93	
	1:00 AM	2:00 AM	31.30	
	2:00 AM	3:00 AM	32.84	
	3:00 AM	4:00 AM	37.27	
	4:00 AM	5:00 AM	38.89	
	5:00 AM	6:00 AM	41.18	
			Night time dB (A)	
			36.5	

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Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	26.06.2014	
Survey Conducted by	GC SPL	Test Commenced on	26.06.2014	
Survey Conducted on	24.06.14 to 25.06.14	Test Completed on	26.06.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Govt. Hospital and Bus Shelter (ANQ 05)	Day Time		48.1	
	6:00 AM	7:00 AM		42.50
	7:00 AM	8:00 AM		44.78
	8:00 AM	9:00 AM		48.87
	9:00 AM	10:00 AM		50.28
	10:00 AM	11:00 AM		51.91
	11:00 AM	12:00 PM		51.97
	12:00 PM	1:00 PM		51.57
	1:00 PM	2:00 PM		50.29
	2:00 PM	3:00 PM		47.35
	3:00 PM	4:00 PM		47.28
	4:00 PM	5:00 PM		45.79
	5:00 PM	6:00 PM		45.86
	6:00 PM	7:00 PM		44.42
	7:00 PM	8:00 PM		42.08
	8:00 PM	9:00 PM	41.25	
	9:00 PM	10:00 PM	39.12	
	Night Time		Hourly Leq dB (A)	
	10:00 PM	11:00 PM	36.46	
	11:00 PM	12:00 AM	33.43	
	12:00 AM	1:00 AM	32.27	
	1:00 AM	2:00 AM	32.78	
	2:00 AM	3:00 AM	32.84	
	3:00 AM	4:00 AM	33.21	
	4:00 AM	5:00 AM	39.41	
	5:00 AM	6:00 AM	39.15	
			Night time dB (A)	
			35.9	

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Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	26.06.2014	
Survey Conducted by	GC SPL	Test Commenced on	26.06.2014	
Survey Conducted on	24.06.14 to 25.06.14	Test Completed on	26.06.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
A.V.K. International School and PKR Cotton Mill, Sankarakovil (ANQ 06)	Day Time		49.3	
	6:00 AM	7:00 AM		44.04
	7:00 AM	8:00 AM		48.00
	8:00 AM	9:00 AM		49.29
	9:00 AM	10:00 AM		51.34
	10:00 AM	11:00 AM		51.45
	11:00 AM	12:00 PM		51.47
	12:00 PM	1:00 PM		51.16
	1:00 PM	2:00 PM		50.77
	2:00 PM	3:00 PM		50.24
	3:00 PM	4:00 PM		50.01
	4:00 PM	5:00 PM		49.16
	5:00 PM	6:00 PM		48.99
	6:00 PM	7:00 PM		47.87
	7:00 PM	8:00 PM	48.19	
	8:00 PM	9:00 PM	42.84	
	9:00 PM	10:00 PM	40.62	
	Night Time		Hourly Leq dB (A)	38.2
	10:00 PM	11:00 PM	36.96	
	11:00 PM	12:00 AM	33.28	
12:00 AM	1:00 AM	31.71		
1:00 AM	2:00 AM	31.37		
2:00 AM	3:00 AM	35.80		
3:00 AM	4:00 AM	38.12		
4:00 AM	5:00 AM	41.14		
5:00 AM	6:00 AM	42.80		
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GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	26.06.2014	
Survey Conducted by	GC SPL	Test Commenced on	26.06.2014	
Survey Conducted on	24.06.14 to 25.06.14	Test Completed on	26.06.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Vaiyapuri-School and Temple, Sankarakovil (ANQ 07)	Day Time		48.6	
	6:00 AM	7:00 AM		42.68
	7:00 AM	8:00 AM		45.34
	8:00 AM	9:00 AM		47.92
	9:00 AM	10:00 AM		49.83
	10:00 AM	11:00 AM		52.71
	11:00 AM	12:00 PM		52.02
	12:00 PM	1:00 PM		52.36
	1:00 PM	2:00 PM		51.16
	2:00 PM	3:00 PM		49.85
	3:00 PM	4:00 PM		48.72
	4:00 PM	5:00 PM		46.11
	5:00 PM	6:00 PM		43.69
	6:00 PM	7:00 PM		43.24
	7:00 PM	8:00 PM	42.44	
	8:00 PM	9:00 PM	41.96	
	9:00 PM	10:00 PM	40.90	
	Night Time		Hourly Leq dB (A)	37.8
	10:00 PM	11:00 PM	38.87	
	11:00 PM	12:00 AM	33.92	
12:00 AM	1:00 AM	34.58		
1:00 AM	2:00 AM	35.71		
2:00 AM	3:00 AM	35.96		
3:00 AM	4:00 AM	38.40		
4:00 AM	5:00 AM	40.10		
5:00 AM	6:00 AM	40.08		

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(Laboratory Division)

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GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	26.06.2014	
Survey Conducted by	GC SPL	Test Commenced on	26.06.2014	
Survey Conducted on	24.06.14 to 25.06.14	Test Completed on	26.06.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Mutharamalinga Thevar College and Hostel Canteen (ANQ 08)	Day Time		45.9	
	6:00 AM	7:00 AM		41.21
	7:00 AM	8:00 AM		42.49
	8:00 AM	9:00 AM		43.74
	9:00 AM	10:00 AM		47.24
	10:00 AM	11:00 AM		48.59
	11:00 AM	12:00 PM		48.27
	12:00 PM	1:00 PM		48.87
	1:00 PM	2:00 PM		48.85
	2:00 PM	3:00 PM		48.09
	3:00 PM	4:00 PM		46.21
	4:00 PM	5:00 PM		45.45
	5:00 PM	6:00 PM		43.80
	6:00 PM	7:00 PM		43.44
	7:00 PM	8:00 PM		42.92
	8:00 PM	9:00 PM	38.48	
	9:00 PM	10:00 PM	36.72	
	Night Time		Hourly Leq dB (A)	33.7
	10:00 PM	11:00 PM	33.68	
	11:00 PM	12:00 AM	32.58	
12:00 AM	1:00 AM	31.57		
1:00 AM	2:00 AM	31.16		
2:00 AM	3:00 AM	31.68		
3:00 AM	4:00 AM	32.02		
4:00 AM	5:00 AM	33.56		
5:00 AM	6:00 AM	38.27		
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
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GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	27.06.2014	
Survey Conducted by	GC SPL	Test Commenced on	27.06.2014	
Survey Conducted on	25.06.14 to 26.06.14	Test Completed on	27.06.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Govt. Hospital and Govt. High School (ANQ 09)	Day Time		47.4	
	6:00 AM	7:00 AM		42.05
	7:00 AM	8:00 AM		43.52
	8:00 AM	9:00 AM		45.52
	9:00 AM	10:00 AM		47.91
	10:00 AM	11:00 AM		50.74
	11:00 AM	12:00 PM		51.25
	12:00 PM	1:00 PM		51.57
	1:00 PM	2:00 PM		50.52
	2:00 PM	3:00 PM		49.3
	3:00 PM	4:00 PM		48.28
	4:00 PM	5:00 PM		44.58
	5:00 PM	6:00 PM		43.08
	6:00 PM	7:00 PM		41.89
	7:00 PM	8:00 PM	38.91	
	8:00 PM	9:00 PM	36.93	
	9:00 PM	10:00 PM	36.25	
	Night Time		Hourly Leq dB (A)	35.6
	10:00 PM	11:00 PM	31.20	
	11:00 PM	12:00 AM	31.00	
12:00 AM	1:00 AM	31.35		
1:00 AM	2:00 AM	32.07		
2:00 AM	3:00 AM	35.13		
3:00 AM	4:00 AM	37.16		
4:00 AM	5:00 AM	37.76		
5:00 AM	6:00 AM	39.72		
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
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GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	27.06.2014	
Survey Conducted by	GC SPL	Test Commenced on	27.06.2014	
Survey Conducted on	25.06.14 to 26.06.14	Test Completed on	27.06.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Elisabetta Vitale Matriculation School and Church, Lodola Nagar, Devarkulam (ANQ 10)	Day Time		48.0	
	6:00 AM	7:00 AM		41.70
	7:00 AM	8:00 AM		44.24
	8:00 AM	9:00 AM		47.94
	9:00 AM	10:00 AM		49.69
	10:00 AM	11:00 AM		51.03
	11:00 AM	12:00 PM		51.79
	12:00 PM	1:00 PM		50.95
	1:00 PM	2:00 PM		50.05
	2:00 PM	3:00 PM		49.35
	3:00 PM	4:00 PM		48.49
	4:00 PM	5:00 PM		46.14
	5:00 PM	6:00 PM		45.12
	6:00 PM	7:00 PM		44.49
	7:00 PM	8:00 PM		43.67
	8:00 PM	9:00 PM	42.04	
	9:00 PM	10:00 PM	41.69	
	Night Time		Hourly Leq dB (A)	36.1
	10:00 PM	11:00 PM	37.86	
	11:00 PM	12:00 AM	33.71	
12:00 AM	1:00 AM	31.52		
1:00 AM	2:00 AM	30.91		
2:00 AM	3:00 AM	32.11		
3:00 AM	4:00 AM	35.97		
4:00 AM	5:00 AM	37.87		
5:00 AM	6:00 AM	39.96		

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GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	27.06.2014	
Survey Conducted by	GC SPL	Test Commenced on	27.06.2014	
Survey Conducted on	25.06.14 to 26.06.14	Test Completed on	27.06.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Govt. High School (ANQ 11)	Day Time		47.9	
	6:00 AM	7:00 AM		42.50
	7:00 AM	8:00 AM		44.29
	8:00 AM	9:00 AM		47.22
	9:00 AM	10:00 AM		49.29
	10:00 AM	11:00 AM		51.35
	11:00 AM	12:00 PM		51.79
	12:00 PM	1:00 PM		51.90
	1:00 PM	2:00 PM		50.20
	2:00 PM	3:00 PM		49.22
	3:00 PM	4:00 PM		47.27
	4:00 PM	5:00 PM		45.60
	5:00 PM	6:00 PM		43.86
	6:00 PM	7:00 PM		42.52
	7:00 PM	8:00 PM		41.27
	8:00 PM	9:00 PM	40.36	
	9:00 PM	10:00 PM	39.42	
	Night Time		Hourly Leq dB (A)	36.5
	10:00 PM	11:00 PM	37.10	
	11:00 PM	12:00 AM	33.10	
12:00 AM	1:00 AM	31.8		
1:00 AM	2:00 AM	33.09		
2:00 AM	3:00 AM	33.50		
3:00 AM	4:00 AM	35.96		
4:00 AM	5:00 AM	38.93		
5:00 AM	6:00 AM	40.50		
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
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GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	27.06.2014	
Survey Conducted by	GCSP	Test Commenced on	27.06.2014	
Survey Conducted on	25.06.14 to 26.06.14	Test Completed on	27.06.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Eskiamanv Temple (ANQ 12)	Day Time		48.3	
	6:00 AM	7:00 AM		42.60
	7:00 AM	8:00 AM		44.22
	8:00 AM	9:00 AM		46.00
	9:00 AM	10:00 AM		48.95
	10:00 AM	11:00 AM		49.99
	11:00 AM	12:00 PM		50.70
	12:00 PM	1:00 PM		50.97
	1:00 PM	2:00 PM		51.25
	2:00 PM	3:00 PM		49.36
	3:00 PM	4:00 PM		48.84
	4:00 PM	5:00 PM		48.57
	5:00 PM	6:00 PM		48.47
	6:00 PM	7:00 PM		47.56
	7:00 PM	8:00 PM		46.67
	8:00 PM	9:00 PM	42.74	
	9:00 PM	10:00 PM	41.16	
	Night Time		Hourly Leq dB (A)	37.2
	10:00 PM	11:00 PM	39.57	
	11:00 PM	12:00 AM	32.23	
12:00 AM	1:00 AM	31.45		
1:00 AM	2:00 AM	33.00		
2:00 AM	3:00 AM	34.73		
3:00 AM	4:00 AM	37.24		
4:00 AM	5:00 AM	39.47		
5:00 AM	6:00 AM	40.49		
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
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GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	27.06.2014	
Survey Conducted by	GCSP	Test Commenced on	27.06.2014	
Survey Conducted on	25.06.14 to 26.06.14	Test Completed on	27.06.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Manur Village (ANQ 13)	Day Time		50.9	
	6:00 AM	7:00 AM		45.47
	7:00 AM	8:00 AM		47.93
	8:00 AM	9:00 AM		50.46
	9:00 AM	10:00 AM		51.59
	10:00 AM	11:00 AM		52.28
	11:00 AM	12:00 PM		53.60
	12:00 PM	1:00 PM		53.48
	1:00 PM	2:00 PM		53.83
	2:00 PM	3:00 PM		52.32
	3:00 PM	4:00 PM		51.55
	4:00 PM	5:00 PM		51.30
	5:00 PM	6:00 PM		50.06
	6:00 PM	7:00 PM		48.25
	7:00 PM	8:00 PM		47.96
	8:00 PM	9:00 PM		45.45
	9:00 PM	10:00 PM	43.24	
	Night Time		Hourly Leq dB (A)	39.6
	10:00 PM	11:00 PM	40.24	
	11:00 PM	12:00 AM	33.92	
	12:00 AM	1:00 AM	35.78	
	1:00 AM	2:00 AM	35.38	
	2:00 AM	3:00 AM	38.17	
	3:00 AM	4:00 AM	39.82	
	4:00 AM	5:00 AM	41.94	
	5:00 AM	6:00 AM	43.20	
For Green Chem Solutions Pvt Ltd (Laboratory Division)			Authorized Signatory	





GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	27.06.2014	
Survey Conducted by	GC SPL	Test Commenced on	27.06.2014	
Survey Conducted on	25.06.14 to 26.06.14	Test Completed on	27.06.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Govt. Middle School and Temple (ANQ 14)	Day Time		46.1	
	6:00 AM	7:00 AM		42.24
	7:00 AM	8:00 AM		43.89
	8:00 AM	9:00 AM		45.18
	9:00 AM	10:00 AM		49.39
	10:00 AM	11:00 AM		50.05
	11:00 AM	12:00 PM		49.46
	12:00 PM	1:00 PM		48.80
	1:00 PM	2:00 PM		46.32
	2:00 PM	3:00 PM		46.45
	3:00 PM	4:00 PM		45.88
	4:00 PM	5:00 PM		45.90
	5:00 PM	6:00 PM		45.11
	6:00 PM	7:00 PM		42.89
	7:00 PM	8:00 PM	39.24	
	8:00 PM	9:00 PM	35.68	
	9:00 PM	10:00 PM	33.38	
	Night Time		Hourly Leq dB (A)	37.0
	10:00 PM	11:00 PM	30.98	
	11:00 PM	12:00 AM	30.68	
12:00 AM	1:00 AM	31.73		
1:00 AM	2:00 AM	32.75		
2:00 AM	3:00 AM	36.38		
3:00 AM	4:00 AM	38.20		
4:00 AM	5:00 AM	40.35		
5:00 AM	6:00 AM	40.85		

For Green Chem Solutions Pvt Ltd  
(Laboratory Division)

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GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	27.06.2014	
Survey Conducted by	GC SPL	Test Commenced on	27.06.2014	
Survey Conducted on	25.06.14 to 26.06.14	Test Completed on	27.06.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Nanjankulam Regrouped Stone Mines, Indian Cement Ltd., Seduroyan Paddur (ANQ 15)	Day Time		56.5	
	6:00 AM	7:00 AM		53.92
	7:00 AM	8:00 AM		54.40
	8:00 AM	9:00 AM		56.44
	9:00 AM	10:00 AM		58.57
	10:00 AM	11:00 AM		58.33
	11:00 AM	12:00 PM		59.01
	12:00 PM	1:00 PM		59.34
	1:00 PM	2:00 PM		59.67
	2:00 PM	3:00 PM		58.68
	3:00 PM	4:00 PM		57.95
	4:00 PM	5:00 PM		54.60
	5:00 PM	6:00 PM		53.19
	6:00 PM	7:00 PM		52.53
	7:00 PM	8:00 PM		51.28
	8:00 PM	9:00 PM	47.94	
	9:00 PM	10:00 PM	41.84	
	Night Time		Hourly Leq dB (A)	48.7
	10:00 PM	11:00 PM	42.47	
	11:00 PM	12:00 AM	42.44	
	12:00 AM	1:00 AM	43.58	
	1:00 AM	2:00 AM	45.17	
	2:00 AM	3:00 AM	49.05	
	3:00 AM	4:00 AM	50.00	
	4:00 AM	5:00 AM	50.97	
	5:00 AM	6:00 AM	52.92	
For Green Chem Solutions Pvt Ltd (Laboratory Division)			Authorized Signatory	



GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	27.06.2014	
Survey Conducted by	GC SPL	Test Commenced on	27.06.2014	
Survey Conducted on	25.06.14 to 26.06.14	Test Completed on	27.06.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
	Day Time			
T.N., Veterinary College and Research Institute of Veterinary and Animal Science University, Tirunveli (ANQ 16)	6:00 AM	7:00 AM	41.73	
	7:00 AM	8:00 AM	42.48	
	8:00 AM	9:00 AM	44.44	
	9:00 AM	10:00 AM	48.14	
	10:00 AM	11:00 AM	48.58	
	11:00 AM	12:00 PM	50.44	
	12:00 PM	1:00 PM	50.01	
	1:00 PM	2:00 PM	48.77	
	2:00 PM	3:00 PM	48.84	
	3:00 PM	4:00 PM	46.16	
	4:00 PM	5:00 PM	45.00	
	5:00 PM	6:00 PM	44.32	
	6:00 PM	7:00 PM	42.84	
	7:00 PM	8:00 PM	42.32	
	8:00 PM	9:00 PM	41.36	
	9:00 PM	10:00 PM	40.33	
	Night Time		Hourly Leq dB (A)	Night time dB (A)
	10:00 PM	11:00 PM	37.08	35.9
	11:00 PM	12:00 AM	32.75	
	12:00 AM	1:00 AM	31.04	
1:00 AM	2:00 AM	32.25		
2:00 AM	3:00 AM	33.96		
3:00 AM	4:00 AM	35.36		
4:00 AM	5:00 AM	38.85		
5:00 AM	6:00 AM	38.94		
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GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	27.06.2014	
Survey Conducted by	GCSP	Test Commenced on	27.06.2014	
Survey Conducted on	25.06.14 to 26.06.14	Test Completed on	27.06.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
Sudalai Temple, Tirunelveli (ANQ 17)	Day Time		47.0	
	6:00 AM	7:00 AM		41.70
	7:00 AM	8:00 AM		43.29
	8:00 AM	9:00 AM		45.74
	9:00 AM	10:00 AM		47.72
	10:00 AM	11:00 AM		48.92
	11:00 AM	12:00 PM		49.80
	12:00 PM	1:00 PM		50.72
	1:00 PM	2:00 PM		49.99
	2:00 PM	3:00 PM		48.58
	3:00 PM	4:00 PM		47.46
	4:00 PM	5:00 PM		45.92
	5:00 PM	6:00 PM		45.10
	6:00 PM	7:00 PM		44.11
	7:00 PM	8:00 PM	42.79	
	8:00 PM	9:00 PM	42.28	
	9:00 PM	10:00 PM	40.58	
	Night Time		Hourly Leq dB (A)	36.6
	10:00 PM	11:00 PM	38.63	
	11:00 PM	12:00 AM	35.04	
12:00 AM	1:00 AM	31.08		
1:00 AM	2:00 AM	30.60		
2:00 AM	3:00 AM	35.07		
3:00 AM	4:00 AM	36.15		
4:00 AM	5:00 AM	38.34		
5:00 AM	6:00 AM	39.78		
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
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GREEN CHEM SOLUTIONS (P) LTD.

Client Name & Address	SMEC INDIA PVT LTD, 5 <sup>th</sup> Floor, Tower C, Building No.8, DLF Cyber City, Phase II, Gurgaon, India, 122002.			
Survey Description	Noise Monitoring	Sample Received on	27.06.2014	
Survey Conducted by	GCSP	Test Commenced on	27.06.2014	
Survey Conducted on	25.06.14 to 26.06.14	Test Completed on	27.06.2014	
Location	Time (Hrs)		Hourly Leq dB (A)	
	From	To		
At Junction (ANQ 18)	Day Time		59.8	
	6:00 AM	7:00 AM		55.48
	7:00 AM	8:00 AM		56.59
	8:00 AM	9:00 AM		58.93
	9:00 AM	10:00 AM		59.32
	10:00 AM	11:00 AM		61.62
	11:00 AM	12:00 PM		62.34
	12:00 PM	1:00 PM		61.36
	1:00 PM	2:00 PM		61.22
	2:00 PM	3:00 PM		61.29
	3:00 PM	4:00 PM		61.41
	4:00 PM	5:00 PM		61.66
	5:00 PM	6:00 PM		59.53
	6:00 PM	7:00 PM		59.57
	7:00 PM	8:00 PM	57.74	
	8:00 PM	9:00 PM	53.05	
	9:00 PM	10:00 PM	50.87	
	Night Time		Hourly Leq dB (A)	51.3
	10:00 PM	11:00 PM	48.83	
	11:00 PM	12:00 AM	47.66	
12:00 AM	1:00 AM	46.41		
1:00 AM	2:00 AM	47.68		
2:00 AM	3:00 AM	51.26		
3:00 AM	4:00 AM	52.88		
4:00 AM	5:00 AM	53.84		
5:00 AM	6:00 AM	54.39		
For Green Chem Solutions Pvt Ltd (Laboratory Division)				
Authorized Signatory				





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

## APPENDIX 4.2: ENVIRONMENTAL STANDARDS FOR AIR, WATER AND NOISE

### APPENDIX 4.2a: 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 <sub>2</sub> ) µg/m <sup>3</sup>	Annual*	50	20	Improved West and Geake Method Ultraviolet Fluorescence
	24 hours**	80	80	
Oxides of Nitrogen (NO <sub>x</sub> ) µg/m <sup>3</sup>	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 <sub>10</sub> µg/m <sup>3</sup>	Annual*	60	60	Gravimetric TOEM Beta attenuation
	24 hours**	100	100	
Particulate Matter (Size less than 2.5 µm) or PM <sub>2.5</sub> µg/m <sup>3</sup>	Annual*	40	40	Gravimetric TOEM Beta attenuation
	24 hours**	60	60	
Ozone (O <sub>3</sub> ) µg/m <sup>3</sup>	8 hours**	100	100	UV Photometric Chemiluminescence Chemical Method
	1 hour**	180	180	
Lead (Pb) µg/m <sup>3</sup>	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	



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Concentration in Ambient Air				
Pollutant	Time Weighted Average	Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Method of Measurement
Carbon Monoxide (CO) mg/m <sup>3</sup>	8 hours**	02	02	Non Dispersive Infra Red (NDIR) Spectroscopy
	1 hour**	04	04	
Ammonia (NH <sub>3</sub> ) µg/m <sup>3</sup>	Annual*	100	100	Chemiluminescence Indophenol blue method
	24 hours**	400	400	
Benzene (C <sub>6</sub> H <sub>6</sub> ) µg/m <sup>3</sup>	Annual*	05	05	Gas Chromatography based continuous analyzer Adsorption and Desorption followed by GC analysis
Benzo (a) pyrene (BaP) – Particulate phase only, ng/m <sup>3</sup>	Annual*	01	01	Solvent extraction followed by HPLC/GC analysis
Arsenic (As) ng/m <sup>3</sup>	Annual*	06	06	AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
Nickel (Ni) ng/m <sup>3</sup>	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.



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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
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### APPENDIX 4.2b: 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°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°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°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°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.



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

S. No.	Parameters	Desirable Limit	Max. Permissible Limits in the absence of alternate source
<b>Essential Characteristics:</b>			
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 <sub>3</sub> ), 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	-
<b>Desirable Characteristics</b>			
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 <sub>4</sub> , mg/l	200	400
15.	Nitrate as NO <sub>3</sub> , mg/l	45	100
16.	Fluoride as F, mg/l	1.0	1.5
17.	Phenolic Compounds as C <sub>6</sub> H <sub>5</sub> OH, 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 <sup>6+</sup> , mg/l	0.05	No relaxation
27.	Polynuclear aromatic hydrocarbon 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	-	0.1
	ii. Beta Emitters, Bq/l	-	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



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### APPENDIX 4.2c: 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

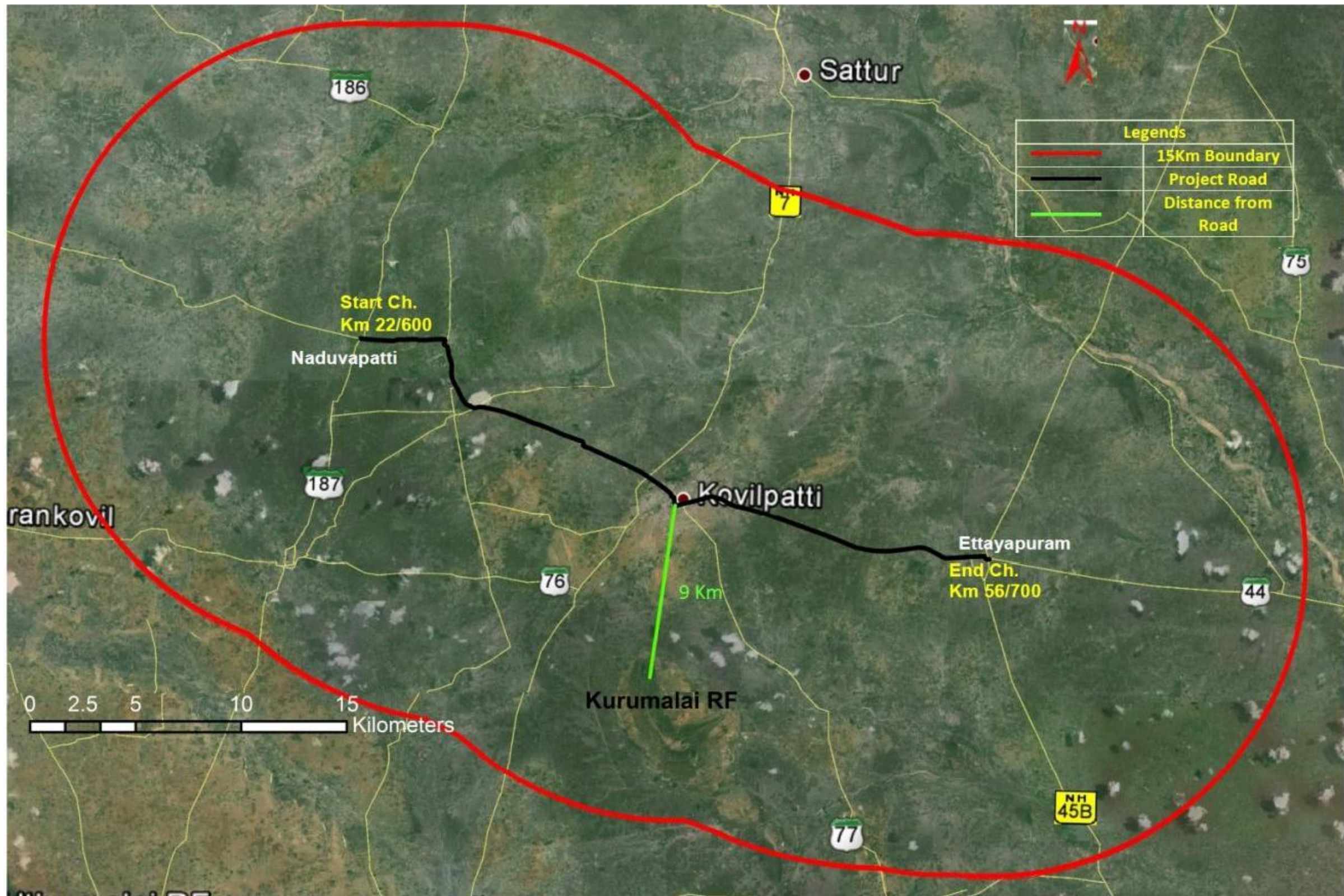
“A” in dB(A) Leq, denotes the frequency weighted in the measurement of the noise corresponds to frequency response characteristics of the human ear.

Leq: It is an energy means of the noise level over a specified period.



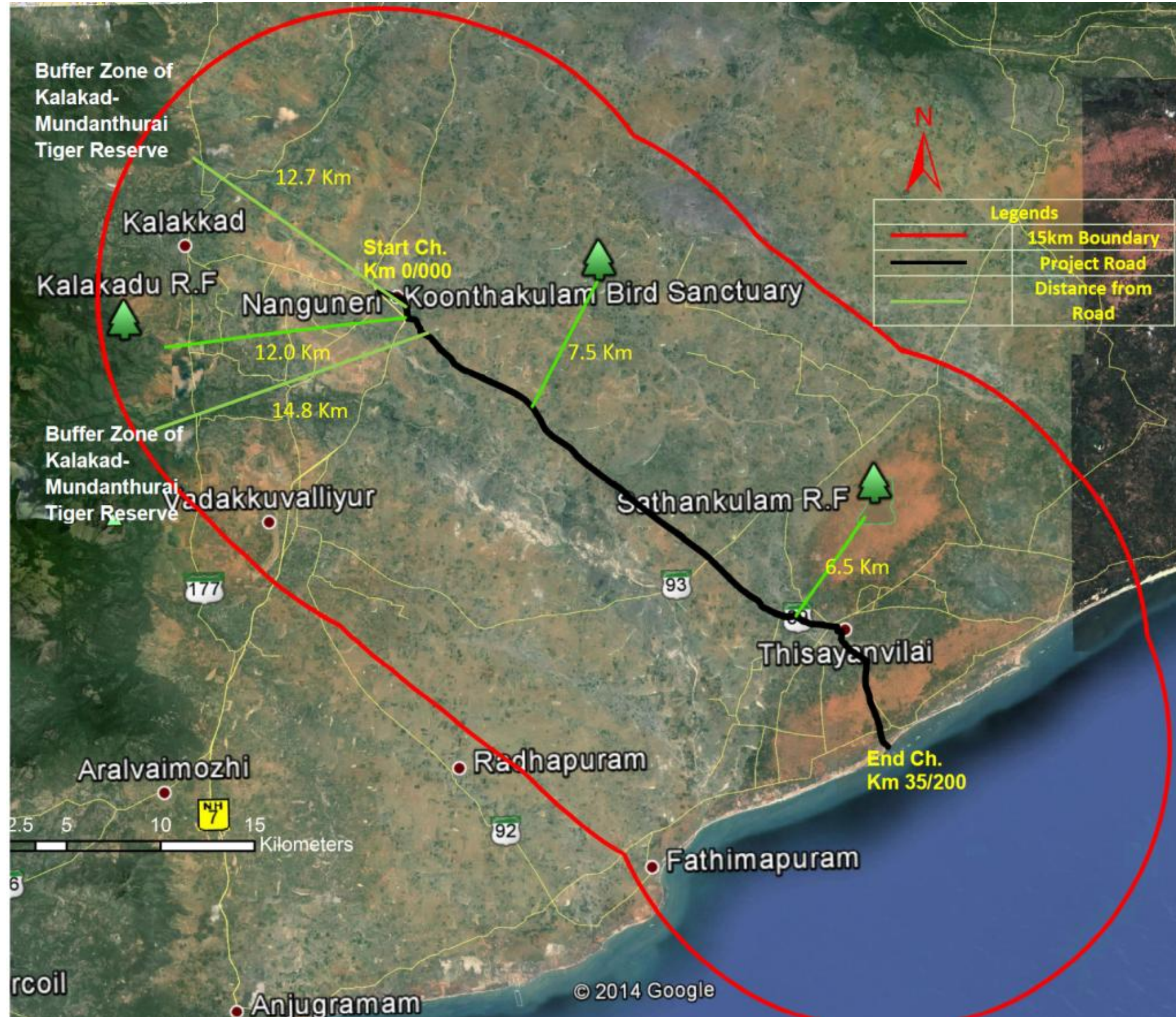


### APPENDIX 4.3: ECO-SENSITIVITY MAPS OF PROJECT ROADS



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



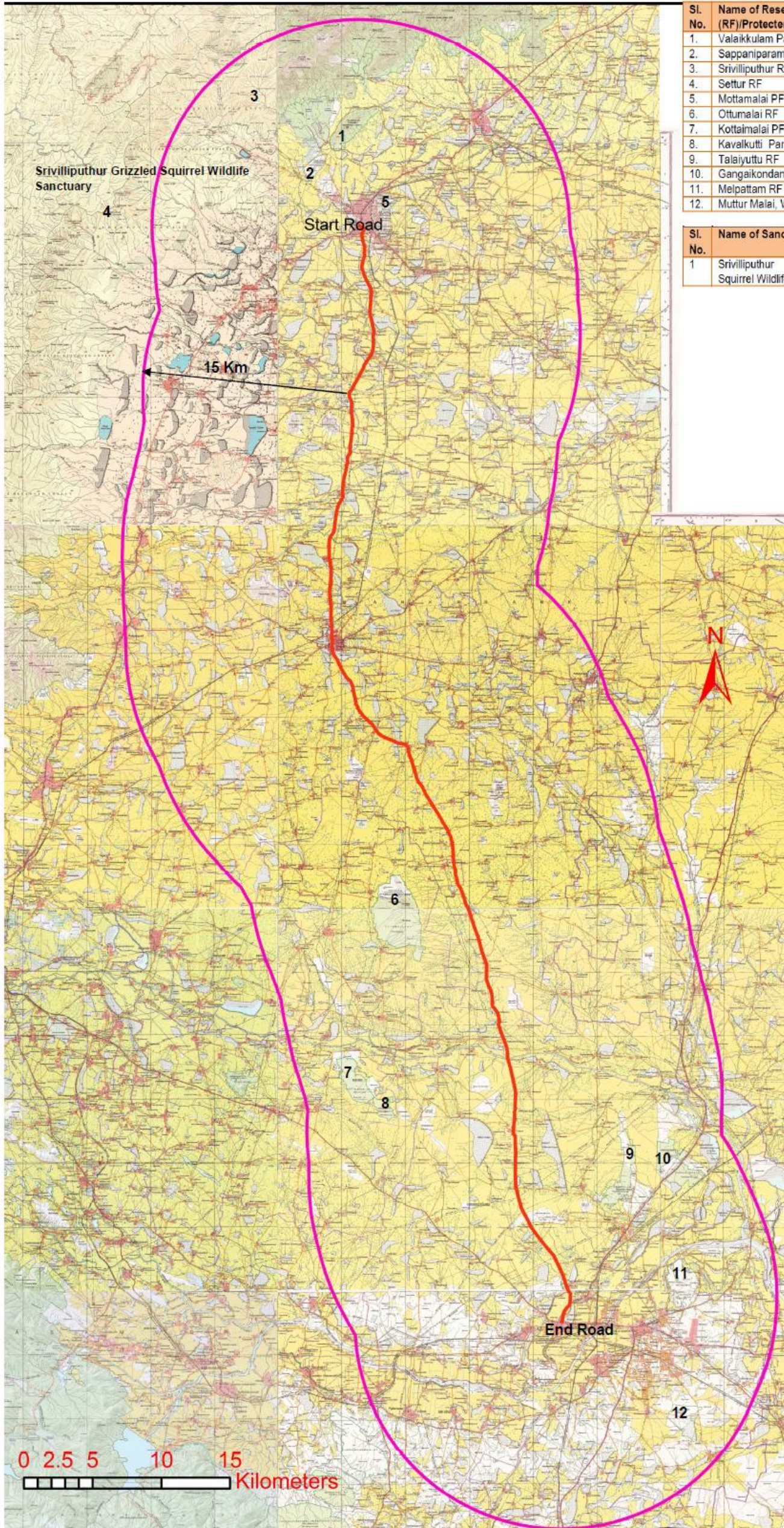


Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89





ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44 Nanguneri - Bharatavaram - Uvari Road (Km 0/000 to Km 35/200), Section of SH 89 Rajapalayam-Sankarankovil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41



Sl. No.	Name of Reserved Forest (RF)/Protected Forest (PF)	Aerial Distance from Road and side
1.	Valaikkulam Parambu RF	6 km on RHS
2.	Sappanparambu RF	5.2 km on RHS
3.	Srivilliputhur RF	6 km on RHS
4.	Settur RF	10 km on RHS
5.	Mottamalai PF	1.1 km on LHS
6.	Ottumalai RF	3.5 km on RHS
7.	Kottamalai PF	10 km on RHS
8.	Kavalkutti Parambu RF	8.8 km on RHS
9.	Talaiyuttu RF	5.6 km on LHS
10.	Gangaikondan PF	10 km on LHS
11.	Melpattam RF	8.4 km on LHS
12.	Muttur Malai, Wolf hill RF	10 km on LHS

Sl. No.	Name of Sanctuary	Aerial Distance from Road and side
1	Srivilliputhur Grizzled Squirrel Wildlife Sanctuary	10km from start point (Rajapalayam)

**Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41**



ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

#### APPENDIX 4.4a: DETAILS OF KOONTHAKULAM BIRD SANCTUARY



Source: DFO, Tirunelveli

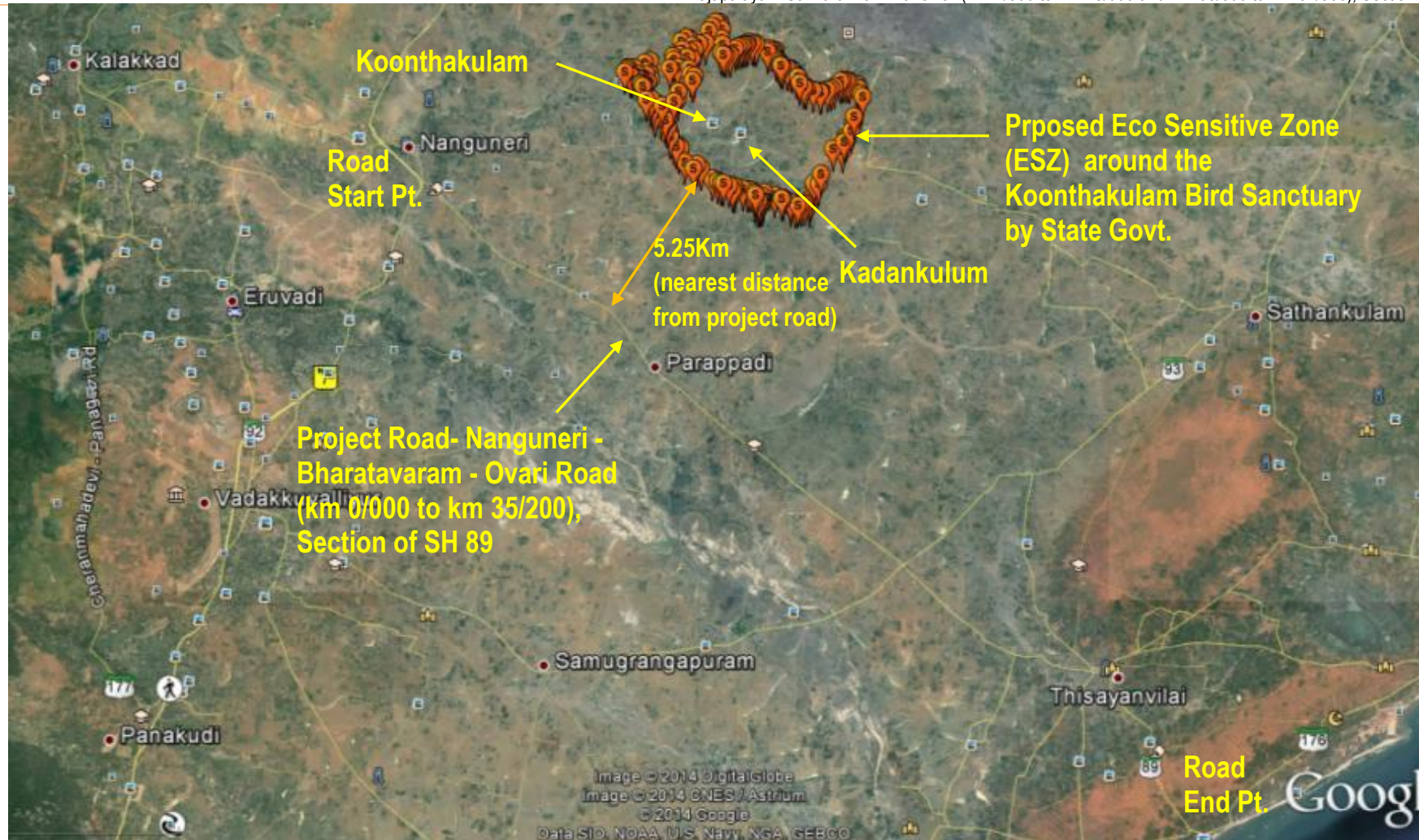
**Figure1: Map showing the area and villages demarcated for declaration of Eco Sensitive Zone around the Koonthakulam Bird Sanctuary by DFO, Tirunelveli**

The lists of villages, demarcated for Eco Sensitive Zone creation around Koonthakulam Bird Sanctuary other than Koonthakulam and Kadankulam, are as follows;

1. Kadankulam,
2. Arumuganeri,
3. Ayarakulam,
4. Ariyakulam,
5. Silayam,
6. Mankulam,
7. Kaluvur
8. Padakkam
9. Kadankulam
10. Tuttikulam
11. Eduppal



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Note: Eco Sensitive Zone has been marked based on GPS points obtained from DFO, Tirunelveli

**Figure 2: Google map showing project road and distance from proposed ESZ of Koonthakulam Bird Sanctuary**



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**Figure 3: Map showing 10km buffer from nearest point of Koonthakulam Bird Sanctuary intersecting Project road at km 15/500 (Nanguneri - Bharatavaram - Ovari Road upto ECR Junction, Section of SH 89)**



ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44 Nanguneri - Bharatavaram - Ovari Road (Km 0/000 to Km 35/200), Section of SH 89 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**Table 1: List of Birds visiting Koonthakulam Bird Sanctuary**

SL No.	Common English Name	Scientific Name	Status as per WPA, 1972	Status as per CITES	Status as per IUCN
1.	Ashy swallow shrike	<i>Artamus fuscus</i>	-	-	Least Concern <a href="#">ver 3.1</a>
2.	Avocet	<i>Recurvirostra avosetta</i>	-	-	Least Concern <a href="#">ver 3.1</a>
3.	Bar headed Goose	<i>Anser indicus</i>	-	-	Least Concern <a href="#">ver 3.1</a>
4.	Baya weaver bird	<i>Ploceus philippinus</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
5.	Blackcapped Kingfisher	<i>Halcyon pileata</i>	-	-	Least Concern <a href="#">ver 3.1</a>
6.	Black headed bulbul	<i>Pycnonotus atriceps</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
7.	Black headed myna or Brahminy	<i>Sturnus pagodarum</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
8.	Black ibis	<i>Pseudibis papillosa</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
9.	Blackwinged Stilt	<i>Himantopus himantopus</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
10.	Roller (or)Blue jay	<i>Coracias benghalensis</i>	-	-	Least Concern <a href="#">ver 3.1</a>
11.	Bluetailed bee-eater	<i>Merops philippinus</i>	-	-	Least Concern <a href="#">ver 3.1</a>
12.	Bluewinged Teal / Garganey	<i>Anas querquedula</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
13.	Brahminy Kite	<i>Haliastur Indus</i>	I	-	Least Concern <a href="#">ver 3.1</a>
14.	Bronzewinged Jacana	<i>Metopidius indicus</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
15.	Cattle Egret	<i>Bubulcus ibis</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
16.	Common Kingfisher	<i>Alcedo atthis</i>	-	-	Least Concern <a href="#">ver 3.1</a>
17.	Common pochard	<i>Aythya ferina</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
18.	Common Sandpiper	<i>Tringa hypoleucos</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
19.	Common Teal	<i>Anas crecca</i>	-	-	Least Concern <a href="#">ver 3.1</a>
20.	Comp Duck	<i>Sarkidiornis melanotos</i>	IV	II	Least Concern <a href="#">ver 3.1</a>
21.	Coot	<i>Fulica atra</i>	-	-	Least Concern <a href="#">ver 3.1</a>
22.	Cotton Teal or Pygmy Goose	<i>Nettapus coromandelianus</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
23.	Dabchick or Little Grebe	<i>Podiceps ruficollis</i>	-	-	Not yet been assessed
24.	Dalmatian Pelican	<i>Pelecanus philippensis</i>	IV	-	Not yet been assessed
25.	Darter or Snake Bird	<i>Anhinga rufa</i>	IV	-	Least Concern <a href="#">ver 3.1</a>





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SL No.	Common English Name	Scientific Name	Status as per WPA, 1972	Status as per CITES	Status as per IUCN
26.	Black Drongo (or) King crow	<i>Dicrurus adsimilis</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
27.	Common (or) Fantail snipe	<i>Gallinago gallinago</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
28.	Flamingo	<i>Phoenicopterus roseus</i>	-	-	Least Concern <a href="#">ver 3.1</a>
29.	Glossy Ibis	<i>Plegadis falcinellus</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
30.	Lesser Golden backed woodpecker	<i>Dinopium benghale</i>	IV	-	Not yet been assessed
31.	Crested lark	<i>Galerida cristata</i>	-	-	Least Concern <a href="#">ver 3.1</a>
32.	Great stone plover	<i>Esacus magirostrisnse</i>	-	-	Not yet been assessed
33.	Green Sandpiper	<i>Tringa ochropus</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
34.	Crested tree swift	<i>Hemiprocne longipennis</i>	-	-	Least Concern <a href="#">ver 3.1</a>
35.	Red wattled lapwing	<i>Vanellus indicus</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
36.	Grey Heron	<i>Ardea cinerea</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
37.	Grey or Spotted billed Pelican	<i>Pelecanus philippensis</i>	IV	-	Near Threatened <a href="#">ver 3.1</a>
38.	Black bellied (or) Grey plover	<i>Pluvialis squatarola</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
39.	Adjutant Stork	<i>Leptoptilos dubius</i>	IV	-	Endangered A2bcd+3bcd+4bcd;C2a(ii) <a href="#">ver 3.1</a>
40.	Grey tit	<i>Parus major</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
41.	Grey wagtail	<i>Motacilla cinerea</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
42.	Heart spotted wood pecker	<i>Hemicircus canente</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
43.	Hoopee	<i>Upupa epops</i>	-	-	Least Concern <a href="#">ver 3.1</a>
44.	House crow	<i>Corvus splendus</i>	V	-	Not yet been assessed
45.	House sparrow	<i>Passer domesticus</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
46.	House swift	<i>Apus affinis</i>	-	-	Least Concern <a href="#">ver 3.1</a>
47.	Indian Moorhen	<i>Gallinula chloropus</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
48.	Indian Myna	<i>Acridotheres tristis</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
49.	Indian Pied Wagtail	<i>Motacilla maderaspatensis</i>	IV	-	Not yet been assessed
50.	Indian tree pipit	<i>Anthus hodgsoni</i>	IV	-	Least Concern <a href="#">ver 3.1</a>



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SL No.	Common English Name	Scientific Name	Status as per WPA, 1972	Status as per CITES	Status as per IUCN
51.	Indian pitta	<i>Pitta brachyura</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
52.	Indian robin	<i>Szicoloides fulicata</i>	-	-	Not yet been assessed
53.	Indian small skylark	<i>Alauda gulgula</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
54.	Indian great reed warbler	<i>Acrocephalus stentoreus</i>	-	-	Least Concern <a href="#">ver 3.1</a>
55.	Jungle myna	<i>Acridotheres fuscus</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
56.	Junglw crow	<i>Corvus macrorhynchos</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
57.	Kestrel	<i>Falco tinnunculus linnaeus</i>	-	-	Least Concern <a href="#">ver 3.1</a>
58.	Large Cormorant	<i>Phalacrocorax carbo</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
59.	Large Egret	<i>Ardea alba</i>	-	-	Least Concern <a href="#">ver 3.1</a>
60.	Large Flamingo	<i>Phoenicopterus roseus</i>	-	-	Least Concern <a href="#">ver 3.1</a>
61.	Large pied wagtail	<i>Motacilla maderaspatensis</i>	IV	-	Not yet been assessed
62.	Lesser Corrmorant	<i>Phalacrocorax fuscicollis</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
63.	Little Cormorant	<i>Phalacrocorax niger</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
64.	Little Egret	<i>Egretta garzetta</i>	-	-	Least Concern <a href="#">ver 3.1</a>
65.	Little Ringed plover	<i>Charadrius dubius</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
66.	Little stint	<i>Calidris minuta</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
67.	Magpie-Robin	<i>Copsychus saularis</i>	-	-	Least Concern <a href="#">ver 3.1</a>
68.	Mallard	<i>Anas platyrhynchos</i>	-	-	Not yet been assessed
69.	Night Heron	<i>Nycticorax nycticorax</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
70.	Openbill Stork	<i>Anastomus oscitans</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
71.	Painted Stork	<i>Mycteria leucocephala</i>	IV	-	Near Threatened <a href="#">ver 3.1</a>
72.	Paradise fly catcher	<i>Terpsiphone paradisi</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
73.	Pheasant-tailed Jacana	<i>Hydrophasianus chirurgus</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
74.	Pied Kingfisher	<i>Ceryle rudis</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
75.	Pintail	<i>Anas acuta</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
76.	Pond Heron	<i>Ardeola grayii</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
77.	Purple Heron	<i>Ardea purpurea</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
78.	Purple Moorhen	<i>Porphyrio porphyrio</i>	-	-	Least Concern <a href="#">ver 3.1</a>
79.	Purpule sunbird	<i>Nectarinia asiatica</i>	-	-	Least Concern <a href="#">ver 3.1</a>
80.	Red turtle dove	<i>Streptopelia tranquebarica</i>	-	-	Least Concern <a href="#">ver 3.1</a>
81.	Red winged bush lark	<i>Mirafra erythroptera</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
82.	Redwattled Lapwing	<i>Vanellus indicus</i>	IV	-	Least Concern <a href="#">ver 3.1</a>



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 Nanguneri - Bharatavaram - Ovari Road (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

SL No.	Common English Name	Scientific Name	Status as per WPA, 1972	Status as per CITES	Status as per IUCN
83.	Ring dove	<i>Streptopelia decaocto</i>	IV	-	Least Concern <u>ver 3.1</u>
84.	River tren	<i>Sterna aurantia</i>	IV	-	Near Threatened <u>ver 3.1</u>
85.	Indian Shag	<i>Phalacrocorax fuscicollis</i>	IV	-	Least Concern <u>ver 3.1</u>
86.	Shama	<i>Copsychus malabaricus</i>	IV	-	Least Concern <u>ver 3.1</u>
87.	India Sandgrouse	<i>Pterocles exustus</i>	IV	-	Least Concern <u>ver 3.1</u>
88.	Shovellar	<i>Anas clypeata</i>	-	-	Least Concern <u>ver 3.1</u>
89.	Small blue kingfisher	<i>Alcedo atthis</i>	IV	-	Least Concern <u>ver 3.1</u>
90.	Small green bee-eater	<i>Merops orientalis</i>	-	-	Least Concern <u>ver 3.1</u>
91.	Smaller or Median Egret	<i>Egretta intermedia</i>	-	-	Least Concern <u>ver 3.1</u>
92.	Spoonbill	<i>Platalea leucorodia</i>	I	II	Least Concern <u>ver 3.1</u>
93.	Spotbill Duck	<i>Anas poecilorhyncha</i>	IV	-	Least Concern <u>ver 3.1</u>
94.	Spotted Sandpiper	<i>Tringa glareola</i>	IV	-	Least Concern <u>ver 3.1</u>
95.	Blackwinged Stilt	<i>Himantopus himantopus</i>	IV	-	Least Concern <u>ver 3.1</u>
96.	Stone curlew	<i>Burhinus oedichnemus</i>	IV	-	Least Concern <u>ver 3.1</u>
97.	Tailor bird	<i>Orthotomus sutorius</i>	IV	-	Least Concern <u>ver 3.1</u>
98.	Pale harrier	<i>Circus macrourus</i>	I	-	Near Threatened <u>ver 3.1</u>
99.	Spotted owlet	<i>Athene barama</i>	-	-	Not yet been assessed
100.	Tree pie	<i>Dendrocitta vagabonds</i>	-	-	Not yet been assessed
101.	Wigeon	<i>Anas penelope</i>	IV	-	Least Concern <u>ver 3.1</u>
102.	Indian Whiskeed tren	<i>Childonias hybrida</i>	I	-	Not yet been assessed
103.	Whitebreasted water hen	<i>Amauornis phoenicurus</i>	IV	-	Least Concern <u>ver 3.1</u>
104.	White bellied tree pie	<i>Dendrocitta leucogastra</i>	IV	-	Least Concern <u>ver 3.1</u>
105.	White breasted Kingfisher	<i>Halcyon smyrnensis</i>	IV	-	Least Concern <u>ver 3.1</u>
106.	White browed bulbul	<i>Pycnonotus lutelolus</i>	-	-	Not yet been assessed
107.	White eye	<i>Zosterops palpebrosa</i>	-	-	Not yet been assessed
108.	White Ibis	<i>Threskiornis melanocephala</i>	-	-	Not yet been assessed
109.	White scavenger vulture	<i>Neophron percnopterus</i>	IV	-	Endangered A2bcde+3bcde+4bcde <u>ver 3.1</u>
110.	White spotted Fantail Fly catcher	<i>Rhipidura albicollis</i>	IV	-	Least Concern <u>ver 3.1</u>
111.	White Stork	<i>Ciconia ciconia</i>	I	I	Least Concern <u>ver 3.1</u>





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

SL No.	Common English Name	Scientific Name	Status as per WPA, 1972	Status as per CITES	Status as per IUCN
112.	White wagtail	<i>Motacilla alba</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
113.	White breasted Kingfisher	<i>Halcyon smyrnensis</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
114.	White breasted Water hen	<i>Amaurornis phoenicurus</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
115.	Large whistling teal	<i>Dendrocygna javanica</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
116.	Yellow cheeked tit	<i>Parus canthogenys</i>	-	-	Not yet been assessed
117.	Yellow eyed babbler	<i>Chrysomma sinense</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
118.	Yellow legged button quail	<i>Vanellus malabaricus</i>	-	-	Not yet been assessed
119.	Yellow wag tail	<i>Motacila flava</i>	-	-	Not yet been assessed
120.	Yellow watted lapwing	<i>Vanellus malabaricus</i>	-	-	Not yet been assessed
121.	Broadbilled Roller	<i>Eurystomus orientalis</i>	IV	-	Least Concern <a href="#">ver 3.1</a>
122.	Little cormorant	<i>Phalacrocorax niger</i>	IV	-	Least Concern <a href="#">ver 3.1</a>

WPA 1972: Wildlife Protection Act 1972; CITES: Convention on International Trade in Endangered Species  
 (Source: District and block forest offices, Tirunelveli)

**Table2: List of Migratory Birds visiting Koonthakulam Bird Sanctuary**

Sl. No.	Common Name	Scientific name	Country from where migration takes place	Status as per WPA, 1972	Status as per CITES	Status as per IUCN
<b>Migratory birds coming from abroad</b>						
1.	White stork	<i>Ciconia ciconia</i>	Germany	I	I	Least Concern <a href="#">ver 3.1</a>
2.	Bar headed Goose	<i>Anser indicus</i>	Siberia	-	-	Least Concern <a href="#">ver 3.1</a>
3.	Pintail	<i>Anas acuta</i>	Siberia	IV	-	Least Concern <a href="#">ver 3.1</a>
4.	Common teal	<i>Anas crecca</i>	Siberia	-	-	Least Concern <a href="#">ver 3.1</a>
5.	Blue winged teal	<i>Anas querquedula</i>	Siberia	IV	-	Least Concern <a href="#">ver 3.1</a>
6.	Common sandpiper	<i>Tringa hypoleucos</i>	Ladhak	IV	-	Least Concern <a href="#">ver 3.1</a>
7.	Green sandpiper	<i>Tringa ochropus</i>	Siberia	IV	-	Least Concern <a href="#">ver 3.1</a>
8.	Spotted sandpiper	<i>Tringa glareola</i>	Siberia	IV	-	Least Concern <a href="#">ver 3.1</a>
<b>Possibly a mixed group of migratory and Indian populations</b>						
1.	Large Flamingo	<i>Phoenicopterus roseus</i>	Germany	-	-	Least Concern <a href="#">ver 3.1</a>
2.	Coot	<i>Fulica atra</i>	Northern Siberia	-	-	Least Concern <a href="#">ver 3.1</a>
3.	Green shank	<i>Tringa nebularia</i>	Central Siberia	-	-	Least Concern <a href="#">ver 3.1</a>



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(Source: District and block forest offices, Tirunelveli)

**Table3: Avifauna of Koonthakulam Bird Sanctuary (impact zone & influence zone)**

Common English Name	Scientific Name	Status as per WPA, 1972	Status as per CITES	Status as per IUCN
Grey or Spotted billed Pelican	<i>Pelecanus philippensis</i>	IV	-	Near Threatened <u>ver 3.1</u>
Adjutant Stork	<i>Leptoptilos dubius</i>	IV	-	Endangered A2bcd+3bcd+4bcd;C2a(ii) <u>ver 3.1</u>
Painted Stork	<i>Mycteria leucocephala</i>	IV	-	Near Threatened <u>ver 3.1</u>
River tren	<i>Sterna aurantia</i>	IV	-	Near Threatened <u>ver 3.1</u>
Pale harrier	<i>Circus macrourus</i>	I	-	Near Threatened <u>ver 3.1</u>

(Source: District and block forest offices, Tirunelveli)

**Table4: List of Fishes of Koonthakulam Bird Sanctuary**

Sl. No.	Zoological Name	Family	Common Name	Habitat
1	<i>Puntius chola (Ham.)</i>	Cyprinidae	Podikendea	Bottom dweller
2	<i>P. vittatus (Day.)</i>	Cyprinidae	Podikendea	Bottom and column
3	<i>P.ticto punctatus (Ham.)</i>	Cyprinidae	Pottukendea	Bottom dweller
4	<i>P.bimaculatus (Bleeker.)</i>	Cyprinidae	Kobalakendea	Bottom dweller
5	<i>Rasbora daniconius (Ham.)</i>	Cyprinidae	Kasalikendea	Column dweller
6	<i>Esomus thermoicos (Val.)</i>	Cvorinidae	Thadioaravi	Column dweller
7	<i>Amblypharyngodon</i>	Cyprinidae	Velichi	Surface dweller
8	<i>Salmostoma clupeoides</i>	Cyprinidae	Veplakendea	Surface dweller
9	<i>Barbodies sarana</i>	Cyprinidae	Natukendea	Generalized
10	<i>Lepidocephalus thermalis</i>	Cobitidae	Ira meen	Bottom and
11	<i>Mystus montanus</i>	Bagridae	Sampal kelithi	Confined to mud
12	<i>Mystus vittatus</i>	Bagridae	Nari kelithi	Confined to mud
13	<i>Ilapia mosambica</i>	Cichlidae	Cilapi kendea	Column and bottom
14	<i>Glossogobius giuris (Ham.)</i>	Cohiidae	Oluvi	Bottom dweller,
15	<i>Heteropneustes fossilis</i>	Heteropneust	Theli	Confined to mud
16	<i>Mastacebalus armatus</i>	Mastacembeli	Aral	Column dweller
<b>Note:</b>	16 species belong to 12 genera and 7 families			
	Dominant group- <i>Tilapia mossambica</i> - Exotic carp (introduced one)			

**Table 5: List of Water Organisms of Koonthakulam Bird Sanctuary**

Sl. No.	Common Name	Zoological Name	Family
1	Water bug	<i>Lethocerus grandis</i>	Belostomatidae
2	Water insect	<i>Notonecta sp.</i>	Notonectidae
3	Water scorpion	<i>Ranatra sp.</i>	Nepidae
4	Water scorpion	<i>Laccotrephes sp.</i>	Nepidae
5	Giant water bug	<i>Bellostoma sp.</i>	Belostomatidae
6	Frog	<i>Rana hexadactyla</i>	Class Amphibia



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Sl. No.	Common Name	Zoological Name	Family
7	Frog	<i>Bufo sp.</i>	Class Amphibia
8	Crab	<i>Paratelphsa hydrodromus</i>	Paratelphusidae
9	Water snake	<i>Natrix natrix</i>	Class Reptilia

**Table 6: List of Phytoplankton's of Koonthakulam Bird Sanctuary**

Sl. No.	Botanical Name	Class
1	<i>Ankistrodesmus sp.</i>	Chlorophyceae
2	<i>Chlamydomonous sp.</i>	Chlorophyceae
3	<i>Fragillaria sp.</i>	Bacillariophyceae
4	<i>Heterococcus caespitosus</i>	Cyanophyceae
5	<i>Merismopedia tenuispica</i>	Cyanophyceae
6	<i>Monocilia viridis</i>	Chrysophyceae
7	<i>Navicula sp.</i>	Bacillariophyceae
8	<i>Nostoc sp.</i>	Cyanophyceae
9	<i>Oscillatoria sp.</i>	Cyanophyceae
10	<i>Spirogyra sp.</i>	Chlorophyceae
11	<i>Spirulina sp.</i>	Chlorophyceae
12	<i>Stauroneis sp.</i>	Bacillariophyceae
13	<i>Tabellaria sp.</i>	Bacillariophyceae
14	<i>Tetraspora sp.</i>	Chlorophyceae
15	<i>Volvox sp.</i>	Chlorophyceae
16	<i>Ulothrix sp.</i>	Chlorophyceae

**Table 7: List of Zooplanktons of Koonthakulam Bird Sanctuary**

Sl. No.	Zoological Name	Family / Class
1	<i>Brachionus caudatus</i>	Brachionaea
2	<i>Calanus sp.</i>	Calanoidae
3	<i>Chironomus sp.</i>	Chironomidae
4	<i>Daphnia pulex</i>	Daphnidae
5	<i>Lepadella sp.</i>	Brachionaea
6	<i>Mesocyclops sp.</i>	Cyclopida
7	<i>Moina sp.</i>	Moinidae
8	<i>Nematode worm</i>	Class Nematoda
9	<i>Pila larva</i>	Class Gastropoda

**Table 8: List of Tree Species of Koonthakulam Bird Sanctuary**

Sl. No.	Botanical Name	Family
1	<i>Acacia nilotica</i>	Mimosaceae
2	<i>Azadirachta indica A.Juss.</i>	Meliaceae
3	<i>Ceiba pentandra (L.) Gaertn.</i>	Bombacaceae
4	<i>Cocos nucifera L.</i>	Palmaceae
5	<i>Borassus flabellifer L.</i>	Palmaceae
6	<i>Delonix elata Gamb.</i>	Caesalpiniaceae
7	<i>Ficus bengalensis L.</i>	Moraceae
8	<i>Ficus religiosa L.</i>	Moraceae
9	<i>Mangifera indica L.</i>	Anacardiaceae
10	<i>Marinda pubescens Smith.</i>	Rubiaceae
11	<i>Moringa oleifera L.</i>	Moringaceae
12	<i>Polyalthia longifolia Hk.f. &amp; T.</i>	Annonaceae
13	<i>Syzygium cuminii (L.) Skeels.</i>	Myrtaceae
14	<i>Tamarindus indica L.</i>	Caesalpiniaceae
15	<i>Odina wodier Roxb.</i>	Anacardiaceae
16	<i>Peltophorum petrocarpum (Dc.) Baker ex Heyne</i>	Caesalpiniaceae



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**Table 9: List of Herbs, Shrubs, Creepers & Climbers of Koonthakulam Bird Sanctuary**

Sl. No.	Botanical Name	Family
1	<i>Abutilon indicum</i> G.Don.	Malvaceae
2	<i>Acalypha indica</i> L.	Euphorbiaceae
3	<i>Achyranthes aspera</i> L.	Amaranthaceae
4	<i>Aerva lanata</i> Juss.	Amaranthaceae
5	<i>Altemanthera sessilis</i> R.Br.	Amaranthaceae
6	<i>Amaranthus polygamus</i> L.	Amaranthaceae
7	<i>Amaranthus spinosus</i> L.	Amaranthaceae
8	<i>Ammnia baccifera</i> L.	Lythraceae
9	<i>Andrographis paniculata</i> Nees.	Acanthaceae
10	<i>Anisomeles malabarica</i> R.Br.	Lamiaceae
11	<i>Argemone mexicana</i> L.	Papavaraceae
12	<i>Aristolochia bracteata</i> Retz.	Aristolochiaceae
13	<i>Barleria cuspidata</i> Heyne.	Acanthaceae
14	<i>Biophytum sensitivum</i> De..	Oxalidaceae
15	<i>Blainvillea acmella</i>	Asteraceae
16	<i>Blastania garcini</i> Cogn.	Cucurbitaceae
17	<i>Boerhaavia diffusa</i> L.	Nyctaginaceae
18	<i>Borresia hispida</i> K.Sch.	Rubiaceae
19	<i>Calotropis gigantea</i> R.Br.	Asclpiadaceae
20	<i>Cassia auriculata</i> L.	Caesalpiniaceae
21	<i>Cassia obtusa</i> Roxb.	Caesalpiniaceae
22	<i>Cassia occidentalis</i> L.	Caesalpiniaceae
23	<i>Celoisa polygonoides</i> Retz.	Amaranthaceae
24	<i>Citrus colocynthis</i> Schrad.	Cucurbitaceae
25	<i>Cissus quadrangularis</i> L.	Vitaceae
26	<i>Cleome viscosa</i> L.	Capparaceae
27	<i>Corrimelina benghalensis</i> L.	Commelinaceae
28	<i>Corchorus capsularis</i> L.	Tiliaceae
29	<i>Croton sparciflorus</i> Mor.	Euphorbiaceae
30	<i>Datura mete!</i> L.	Solanaceae
31	<i>Eclipta alba</i> Hassk.	Asteraceae
32	<i>Euphorbia hirta</i> L.	Euphorbiaceae
33	<i>Evolvulus alsinoides</i> L.	Convolvulaceae
34	<i>Geniosporum prostratum</i> Benth.	Lamiaceae
35	<i>Gisekia phamaceoides</i> L.	Aizoaceae
36	<i>Gomphrena globosa</i> L.	Amaranthaceae
37	<i>Gomphrena deccumbens</i> Jacq.	Amaranthaceae
38	<i>Indigofera enneaphylla</i> L.	Fabaceae
39	<i>Indigofera tinctoria</i> L.	Fabaceae
40	<i>Lawsonia inermis</i> L.	Lythraceae
41	<i>Leucas aspera</i> Spr.	Lamiaceae
42	<i>Lippia nodiflora</i> Mich.	Verbanaceae
43	<i>Marsilea</i> Sp.	Marsileaceae
44	<i>Merremia hastata</i> Hall.f.	Convolvulaceae
45	<i>Mollugo nudicaulis</i> Lam.	Aizoaceae
46	<i>Mollugo pentaphylla</i> L.	Aizoaceae
47	<i>Nothosaerva brachiata</i> W.	Amaranthaceae
48	<i>Ocimum basilicum</i> L.	Lamiaceae



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SI. No.	Botanical Name	Family
49	<i>Ocimum canum Sims.</i>	Lamiaceae
50	<i>Ocimum tenuiflorum L.</i>	Lamiaceae
51	<i>Oldenlandia umbellata L.</i>	Rubiaceae
52	<i>Oldenlandia corymbosa L.</i>	Rubiaceae
53	<i>Passiflora foetida L.</i>	Passifloraceae
54	<i>Pavonia zeylanica Cav.</i>	Malvaceae
55	<i>Pedaliium murex L.</i>	Pedaliaceae
56	<i>Phyllanthus amarus Skhum and Thonn</i>	Euphorbiaceae
57	<i>Phyllanthus maderaspatensis L.</i>	Euphorbiaceae
58	<i>Rungia repens Nees.</i>	Acanthaceae
59	<i>Rivea omata Choisty.</i>	Convolvulaceae
60	<i>Sida acuta Burm.</i>	Malvaceae
61	<i>Sida cordifolia L.</i>	Malvaceae
62	<i>Sphaeranthus indicus L.</i>	Asteraceae
63	<i>Tephrosia purpurea Pers.</i>	Fabaceae
64	<i>Trianthema portulacastrum L.</i>	Aizoaceae
65	<i>Tribulus terrestris L.</i>	Zygophyllaceae
66	<i>Trichodesma indicum R.Br.</i>	Boraginaceae
67	<i>Tridax procumbens L.</i>	Asteraceae
68	<i>Vernonia cinerea Less.</i>	Asteraceae
69	<i>Vicoa indica De.</i>	Asteraceae
70	<i>Waltheria indicca L.</i>	Sterculiaceae

**Table 10: List of Grasses of Koonthakulam Bird Sanctuary**

SI. No.	Botanical Name	Family
1	<i>Andropogon pumilus Roxb.</i>	Poaceae
2	<i>Aristida adscencionis L.</i>	Poaceae
3	<i>Aristida depressa Retz.</i>	Poaceae
4	<i>Cyperus difformis L.</i>	Cyperaceae
5	<i>Cyperus Kylingia</i>	Cyperaceae
6	<i>Cyperus tenuispica Stend.</i>	Cyperaceae
7	<i>Cynodon dactylon Pers.</i>	Poaceae
8	<i>Dactyloctenium aegyptium Beauv.</i>	Poaceae
9	<i>Eragrostis japonica Trin.</i>	Poaceae
10	<i>Eragrostis viscosa Stapf.</i>	Poaceae
11	<i>Eremopogon foveolatus Stapf.</i>	Poaceae
12	<i>Fimbristylis complanata (L) Vahl.</i>	Cyperaceae
13	<i>Fimbristylis complanata Link.</i>	Cyperaceae
14	<i>Perotis indica O.Ktz.</i>	Poaceae

**Table 11: List of Plants of Agricultural importance of Koonthakulam Bird Sanctuary**

SI. No.	Botanical Name	Family
1	<i>Arachis hypogaea Willd.</i>	Fabaceae
2	<i>Curcuma domestica L.</i>	Zingiberaceae
3	<i>Dolichos biflorus L.</i>	Fabaceae.
4	<i>Gossypium hirsutum</i>	Malvaceae
5	<i>Musa paradisiaca L.</i>	Musaceae
6	<i>Oryza sativa L.</i>	Poaceae
7	<i>Pisum sativum L.</i>	Fabaceae
8	<i>Sesamum indicum L.</i>	Pedaliaceae
9	<i>Solanum melongena L.</i>	Solanaceae
10	<i>Sorghum bicolor Moench.</i>	Poaceae





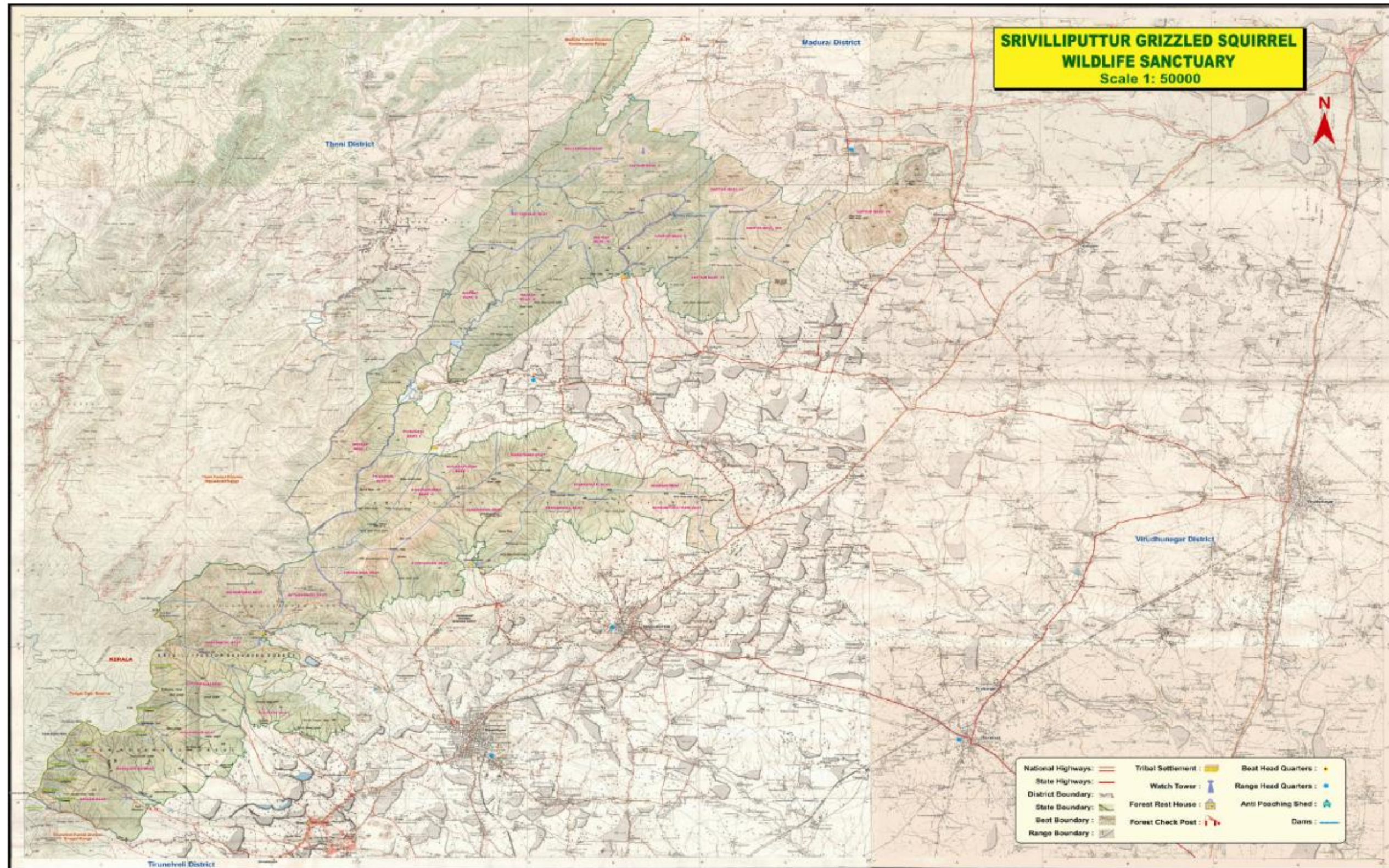
**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram - Ovari Road (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

SI. No.	Botanical Name	Family
11	<i>Vigna mungo L.</i>	Fabaceae





APPENDIX 4.4b: DETAILS OF SRIVILLIPUTTUR GRIZZLED GIANT SQUIRREL WILDLIFE SANCTUARY

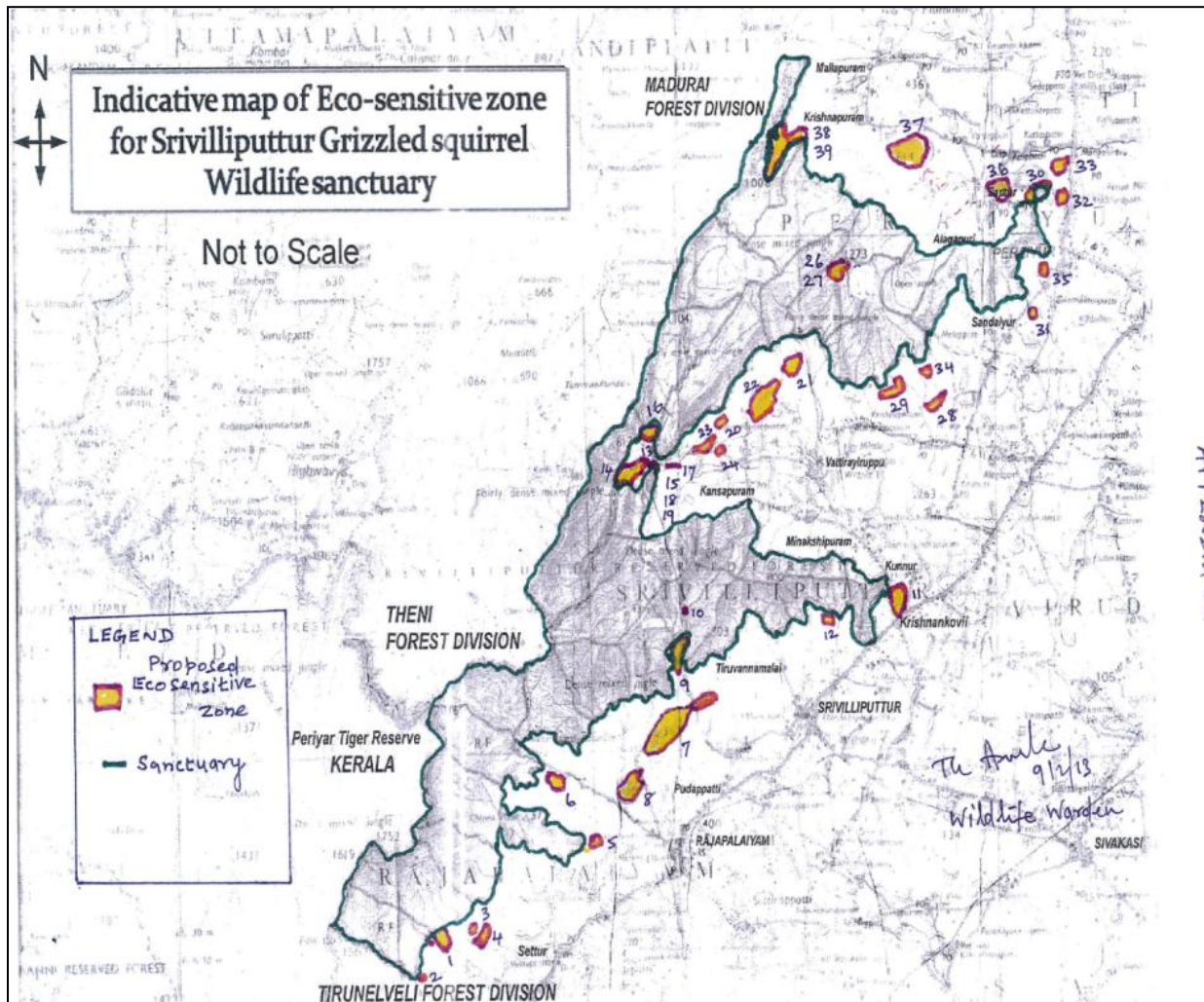


Source: Wildlife Warden, Srivilliputtur Grizzled Squirrel Sanctuary, Virudhnagar District

Figure1: Map showing the Srivilliputtur Grizzled Squirrel Sanctuary



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram - Ovari Road (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

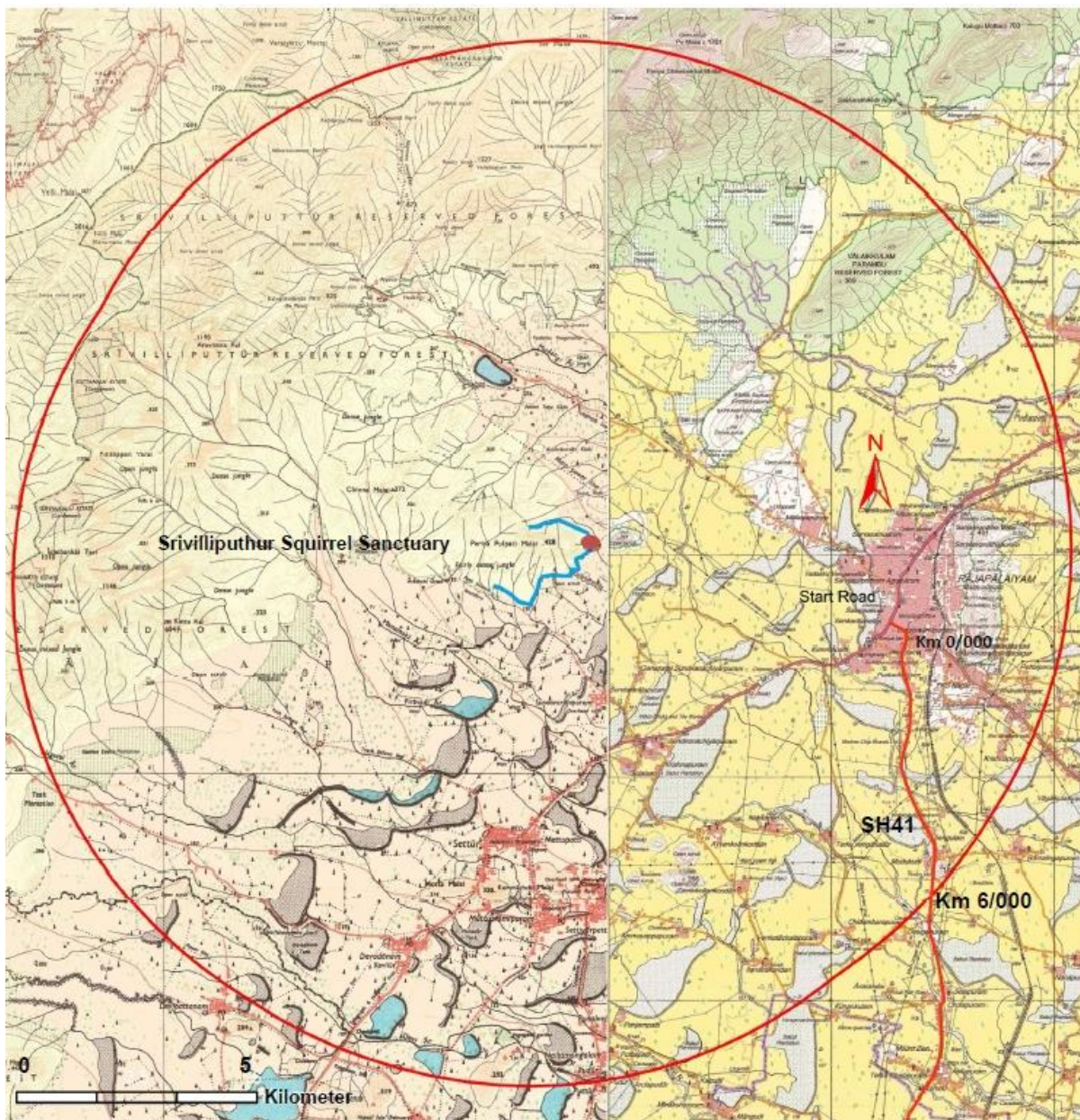


Source: Wildlife Warden, Srivilliputtur Grizzled Squirrel Sanctuary, Virudhnagar District

**Figure 2: Map Showing proposed ESZ around Srivilliputtur Grizzled Squirrel Sanctuary by State Govt.**



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44 Nanguneri - Bharatavaram - Ovari Road (Km 0/000 to Km 35/200), Section of SH 89 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41**



**Figure 3: Map showing 10km buffer from nearest point of Srivilliputtur Sanctuary intersecting Project road at km 6/000 (Rajapalayam-Sankarankoil-Tirunelveli section of SH-41)**



ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44 Nanguneri - Bharatavaram - Ovari Road (Km 0/000 to Km 35/200), Section of SH 89 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**Table 1: List of Mammals in Srivilliputtur Grizzled Giant Squirrel Wildlife Sanctuary**

Sl. No.	Common Name	Species Name	Family	Endemic Status	IUCN Threat Status	IW(P)A Schedule
1.	Gaur	<i>Bos gaurus</i>	Bovidae	No	VU	I
2.	Nilgiri tahr	<i>Hemitragus hylocrius</i>	Bovidae	To montane grasslands in the Western Ghats	LR/Nt	I
3.	Chital	<i>Axis axis</i>	Cervidae	No	LR/Lc	IV
4.	Sambar	<i>Cervus unicolor</i>	Cervidae	No	LR/Lc	III
5.	Barking deer	<i>Muntiacus muntjak</i>	Cervidae	No	LR/Lc	III
6.	Wild pig	<i>Sus scrofa</i>	Suidae	No	LR/Lc	III
7.	Mouse deer	<i>Moschiola meminna</i>	Tragulidae	No	LR/Lc	III
8.	Jackal	<i>Canis aureus</i>	Canidae	No	LR/Lc	II
9.	Indian wild dog	<i>Cuon alpinus</i>	Canidae	No	LR/nt	I
10.	Leopard	<i>Panther pardus</i>	Felidae	No	VU	I
11.	Tiger	<i>Panther tigris</i>	Felidae	To India	EN	I
12.	Sloth bear	<i>Melursus ursinus</i>	Ursidae	No	VU	I
13.	Common palm civet	<i>Paradoxurus hermaphroditus</i>	Viverridae	No	LR/Lc	II
14.	Small Indian civet	<i>Viverricula indica</i>	Viverridae	No	LR/Nt	II
15.	Short eared hedgehog	<i>Paeaechinus micropus nudiventris</i>	Erinaceidae	No	VU	
16.	Indian pangolin	<i>Manis crassicaudata</i>	Manidae	No	LR/Nt	I
17.	Bonnet macaque	<i>Macaca radiata</i>	Cercopithecidae			II
18.	Lion tailed macaque	<i>Macaca silenus</i>	Cercopithecidae		EN	I
19.	Common langur	<i>Semnopithecus entellus</i>	"	No	LR/Nt	
20.	Nilgiri langur	<i>Semnopithecus johnii</i>	"		VU	I
21.	Slender loris	<i>Loris tardigradus</i>	Loridae	No	LR/Nt	I
22.	Asian elephant	<i>Elephas maximus</i>	Elephantidae	No	EN	I
23.	Indian porcupine	<i>Hystrix indica</i>	Hystriidae	No	LR/Nt	I
24.	Three striped palm squirrel	<i>Funambulus palmarum</i>	Sciuridae	No	LR/Lc	
25.	Malabar giant squirrel	<i>Ratufa indica</i>	Sciuridae	To peninsular India	LR/Nt	
26.	Grizzled Giant Squirrel	<i>Ratufa macroura</i>	Sciuridae	No	EN	I
27.	Jungle cat	<i>Felis chaus</i>			LR/Nt	
28.	Common mongoose	<i>Herpestes edwardsi</i>			LR/LC	
29.	Striped	<i>Herpestes</i>			LR/Nt	IV





ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44 Nanguneri - Bharatavaram - Ovari Road (Km 0/000 to Km 35/200), Section of SH 89 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Sl. No.	Common Name	Species Name	Family	Endemic Status	IUCN Threat Status	IW(P)A Schedule
	necked mongoose	<i>vitticolis</i>				
30.	The striped hyaena	<i>Hyaena hyaena</i>	Herpestidae	No	LR/Nt	II
31.	Fruit bat	<i>Petopus Gigantus</i>	Hyaenidae	No	LR/Nt	
32.	Nilgiri Marten	<i>Martes Gwatkinsi</i>	Mustelidae	To higher elevation forests	DD	I

**Table 2: List of Amphibians in Srivilliputtur Grizzled Giant Squirrel Wildlife Sanctuary**

Sl. No.	Common Name	Species Name	Family	Endemic Status	IUCN Threat Status
1.	Marbled toad	<i>Bufo stomaticus</i>	Bufoidae	--	DD
2.	Common Indian toad	<i>Bufo melanostictus</i>	"	Vulnerable	Vu
3.	Ridges toad	<i>Bufo parietalis</i>	"	Endemic	LR-NT/N
4.	Small eared toad	<i>Bufo microtypanum</i>	Ranidae	Near threatened	LR-NT
5.	Indian pond frog	<i>Rana hexadactyla</i>	"		DD
6.	Indian Cricket frog	<i>Rana limnocharis</i>	"		Vu/N
7.	Skipping Frog	<i>Rana cyanophlyctis</i>	"		LR-NT
8.	Indian bull frog	<i>Rana tigerina</i>	"		Vu/N
9.	Fungoid frog	<i>Rana malabarica</i>	"	Near threatened	LR-NT
10.	Bronzed frog	<i>Rana temporalis</i>	"		
11.	Common tree frog	<i>Rhacophorus pleuresticus</i>	Rhacophoridae	Endemic	Vu
12.	Malabar flying frog	<i>Rhacophorus malabaricus</i>	"	Endemic	LR-NT
13.	Pretty bush frog	<i>Philtautus cf. pulcherrimus</i>	"	Vulnerable	Vu
14.	Seashachar's bush frog	<i>Philtautus charius</i>	"		LR-NT
15.	Tinkling frog	<i>Philtautus cf. variabilis</i>	"		LR-NT
16.	Bush frog	<i>Philtautus sp.</i>	"		LR-NT
17.	Narrow mouthed frog	<i>Ramanella sp.</i>	Microhylidae	Endemic	
18.	Beddome's leaping frog	<i>Indirana beddomi</i>	Ranixalidae	Vulnerable	Vu
19.	Thin legged leaping frog	<i>Indirana leptodactyla</i>	"	Vulnerable	Vu
20.	Brown leaping frog	<i>Indirana semipalatus</i>	"		
21.	Leaping frog	<i>Indirana sp.</i>			
22.	Verrucose frog	<i>Fejervarya keralensis</i>	Dicroglossidae		



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

Sl. No.	Common Name	Species Name	Family	Endemic Status	IUCN Threat Status
23.	Dusky torrent frog	<i>Micrixalus fuscus</i>	Micrixalidae		LR-NT
24.	Large wrinkled frog	<i>Nyctibatrachus major</i>	Nyctibatrachidae	Near threatened	LR-NT

**Table 3: List of Reptiles in Srivilliputtur Grizzled Giant Squirrel Wildlife Sanctuary**

Sl. No.	Common Name	Species Name	Family	Endemic Status	IUCN Threat Status
1.	Hemidactylus brookii	<i>Brooks gecko</i>	Gekkonidae	LR	
2.	Hemidactylus frenatus	<i>Asian house gecko</i>	Gekkonidae	LR	
3.	Hemidactylus leschenaultia	<i>Bark gecko</i>	Gekkonidae	LR	
4.	Nilgiri day gecko	<i>Cnemaspis indica</i>	Gekkonidae	E	Vu
5.	Ponmudi day gecko	<i>Cnemaspis nairi</i>	Gekkonidae		
6.	Ornate day gecko	<i>Cnemaspis ornatus</i>	Gekkonidae	E	Vu
7.	Day decko	<i>Cnemaspis sp.</i>	Gekkonidae		
8.	Anaimalai gecko	<i>Dravidogecko anamallensis</i>	Gekkonidae	E	Vu
9.	Spotted rock gecko	<i>Hemidactylus maculatus</i>	Gekkonidae	E	LR
10.	Elliot's forest lizard	<i>Calotes ellioti</i>	Agamidae	E	LR
11.	Large scaled forest lizard	<i>Calotes grandisquamis</i>	Agamidae	E	LR
12.	Western Ghats flying lizards	<i>Draco dussumieri</i>	Agamidae	E	LR
13.	Fan throated lizard	<i>Sitana ponticeriana</i>	Agamidae		LR
14.	Indian Garden lizard	<i>Calotes versicolor</i>	Agamidae		LR
15.	Common Green calotes	<i>Calotes calotes</i>	Agamidae		LR
16.	South Indian Rock lizard	<i>Psammophilus doasalis</i>	Agamidae	E	LR
17.	Bronzed skink	<i>Mabuya macularia</i>	Scincidae		LR
18.	Beddome's skink	<i>Scincella laterimaculatum</i>	Scincidae	E	NoE
19.	Travancore cat skink	<i>Ristella travancoricum</i>	Scincidae	E	Vu
20.	Keeled grass skink	<i>Mabuya carinata</i>	Scincidae		LR
21.	Beddom's grass skink	<i>Mabuya beddomii</i>	Scincidae		LR
22.	Snake skink	<i>Riopa punctata</i>	Scincidae		LR
23.	Common monitor	<i>Varanus bengalensis</i>	Varanidae		Vu
24.	Elliot's	<i>Uropeltis elliotis</i>	Uropeltidae	E	LR



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Sl. No.	Common Name	Species Name	Family	Endemic Status	IUCN Threat Status
	shieldtail				
25.	Periyar shieldtail	<i>Uropeltis acrticeps madurensis</i>	Uropeltidae	E	LR
26.	Anamalai shieldtail	<i>Uropeltis macrorhynchus</i>	Uropeltidae	E	DD
27.	Dindigul shieldtail	<i>Uropeltis Dindigullensis</i>	Uropeltidae	E	CR
28.	Montane trinket snake	<i>Coclognathus helena monticollaris</i>	Colubridae		
29.	Rat snake	<i>Ptyas mucosus</i>	Colubridae		
30.	Black spotted kukri snake	<i>Oligodon venustum</i>	Colubridae	E	LR
31.	Travancore kukri snake	<i>Oligodon travancoricus</i>	Colubridae	E	LR
32.	Travancore wolf snake	<i>Lycodon travancoricus</i>	Colubridae		LR
33.	Checkered keelback	<i>Xenochropis piscator</i>	Colubridae		LR
34.	Western Rat Snake	<i>Ptyas mucosus</i>	Colubridae		LR
35.	Common vine snake	<i>Ahaetulla nasutus</i>	Colubridae		LR
36.	Common Indian krait	<i>Bungarus caeruleus</i>	Elapidae		LR
37.	Indian cobra	<i>Naja naja</i>	Elapidae		LR
38.	King cobra	<i>Ophiophagus Hannah</i>	Elapidae		LR
39.	Russle's viper	<i>Vipera russelli</i>	Viperidae		LR
40.	Large scale pit viber	<i>Trimeresurus macrolepis</i>	Viperidae	E	LR
41.	Python	<i>Python molurus</i>	Boidae		LR
42.	Russet's earh Boa	<i>Eryx conica</i>	Boidae		LR
43.	Chameleon	<i>Chameaeleo zeylanicus</i>	Chamele onidae		VU
44.	Beddome's keelback	<i>Amphiesma beddomei</i>	Colubridae	E	LR
45.	Green keelback	<i>Macrophisthodon plumbicolor</i>	Colubridae		LR
46.	Cat snake	<i>Boiga ceylonensis</i>	Colubridae		NoE
47.	Gunther's vine snake	<i>Ahaetulla dispar</i>	Colubridae	E	LR
48.	Striped coral snake	<i>Calliophis nigrescens</i>	Elepidae	E	LR
49.	Hump nosed pit viper	<i>Hypnale hypnale</i>	Viperidae		LR
50.	Large scaled pit viper	<i>Trimeresurus macrolepis</i>	Viperidae	E	LR
51.	Malabar pit viper	<i>Trimeresurus malabaricus</i>	Viperidae	E	LR

(Source: Wildlife Warden, Srivilliputtur Grizzled Giant Squirrel Wildlife Sanctuary, Virudhnagar)



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**IUCN:** International Union for Conservation of Nature and Natural Resources; **EX:** Extinct; **CR:** Critically Endangered; **EN:** Endangered; **VU:** Vulnerable; **NT:** Near Threatened; **LC:** Least Concern; **DD:** Data Deficient; **IW(P)A:** Indian Wildlife (Protection) Act, 1972.

**Table 4: List of Plant Species serving as food for Grizzled Squirrel**

Sl. No.	Tree Species	Part Eaten
1.	<i>Tamarind Indica</i>	Bark, Seeds, Flower, Leaves and Fruits
2.	<i>Albizzia amara</i>	Bark and Fruits
3.	<i>Albizzia lebbeck</i>	Leaves and Flowers
4.	<i>Loranthus</i>	Leaves and Seeds
5.	<i>Santalum Album</i>	Fruits
6.	<i>Mangifera Indica</i>	Flower, Leaves and Fruits
7.	<i>Carrisa carandus</i>	Leaves and Fruits
8.	<i>Randia Dumetorum</i>	Fruits
9.	<i>Psidium guajava</i>	Flower, Fruits and Leaves

(Source: Wildlife Warden, Srivilliputtur Grizzled Giant Squirrel Wildlife Sanctuary, Virudhnagar)



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## APPENDIX 5.1: DETAILS OF PUBLIC CONSULTATION HELD ALONG PROJECT ROADS

### A. DETAILS OF INFORMAL PUBLIC CONSULTATIONS

S.No.	Name of Road	Type of Stakeholder	Date and Time	Issues Raised	Suggestion form Participants	Mitigation Measures
1.	Nanguneri - Bharatavaram - Ovari Road (km 0/000 to km 35/200), Section of SH 89	Shopkeeper and Customer at Tisaiyanvillai Village	06.12.13 at 12.00 noon  Photo Plate-1	<ul style="list-style-type: none"> <li>In Tisaiyanvillai village, road is very narrow and in day to day life, villagers face problem in crossing the market</li> <li>Loss of shops &amp; residential structures</li> <li>Negative impact on existing business</li> <li>Impact on religious structures and schools</li> </ul>	<ul style="list-style-type: none"> <li>Villagers suggested providing bypass in this area</li> <li>Dust suppression should be to minimize air pollution impacts during construction.</li> <li>Compensation should be paid to the affected persons before acquisition of land or assets</li> <li>The process of valuation should be transparent</li> <li>On Nanguneri - Ovari, road there are very few trees, hence, more trees should be planted along this road.</li> <li>Locals should be given preference during construction works of project road.</li> </ul>	<ul style="list-style-type: none"> <li>Provision of by pass in congested areas will be analyzed during detailed design</li> <li>Widening in built up areas having insufficient RoW will be avoided However, such stretches will be considered for strengthening only</li> <li>Project information shall be shared regularly with the local community</li> <li>Design shall be adjusted to avoid impact on religious structures, schools or any other sensitive structures</li> <li>Payment of compensation at market value</li> <li>Design adjustment to avoid impact on road side ponds</li> <li>Partially impacted ponds will be provided with protection wall</li> </ul>





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S.No.	Name of Road	Type of Stakeholder	Date and Time	Issues Raised	Suggestion form Participants	Mitigation Measures
2	Nanguneri - Bharatavaram - Ovari Road (km 0/000 to km 35/200), Section of SH 89	Mr. R. Isaac Paulraj (Ret. DSP) and Mr. Stefan (Ret. Teacher)  Idaiyangudi Village	27.03.2014  12:15pm  Photo Plate- 2A to 2D	<ul style="list-style-type: none"> <li>Impact on road side Caldwell Centenary Memorial Hr. Secondary School</li> <li>Total road width of 9 m near the end boundary wall of church and house of Mr. R. Isaac Paulraj (Ret. DSP) at chainage 31+595 (Photo Plate – 2B) and around 10m to 11 m from the boundary wall of Caldwell Centenary Memorial Hr. Secondary School from chainage 31-690 to 31+900 (Photo Plate -2C) which have around 1000 student.</li> <li>Also the existing road all over the stretch is narrow</li> </ul>	<ul style="list-style-type: none"> <li>Bypass from Chainage 31+100 to 32+800 to avoid demolition of structures of their 200 years old village for which they have objection.</li> <li>If the present alignment is chosen, it may also cause risk to the student of the School (Photo Plate – 2D) and structure demolition, which has objection from local people.</li> </ul>	<ul style="list-style-type: none"> <li>Considering the impacts and problems, the design has been restricted within available ROW in this stretch in Idaiyangudi Village</li> </ul>
3.	Paruvakudi - Kovilpatti	Villagers of Naduvadapatti	09.12.13 at	<ul style="list-style-type: none"> <li>Impact on temples</li> <li>Impact on road side ponds</li> </ul>	<ul style="list-style-type: none"> <li>There are number of ponds (Kulam and Oorani) along this road. Some of them are</li> </ul>	<ul style="list-style-type: none"> <li>Widening in built up areas having insufficient RoW will be avoided</li> </ul>



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

S.No.	Name of Road	Type of Stakeholder	Date and Time	Issues Raised	Suggestion form Participants	Mitigation Measures
	Ettayapuram - Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44	Village	10.00 am  Photo Plate-3	<ul style="list-style-type: none"> <li>Negative impact on existing business</li> <li>Social issues (Health, sanitation, Employment and Poverty and etc.)</li> </ul>	<p>very old and near to the road so they should be saved.</p> <ul style="list-style-type: none"> <li>Waiting shed, bus stop shed and public urinal should be constructed with the help of the project money</li> <li>Valuation of properties should be based on market values</li> <li>Religious structures and schools should be protected as far as possible</li> <li>Adequate livelihood support to the affected persons</li> <li>Local labours should be appointed in the construction of the road</li> <li>Noise barriers should be provided in front of school, temples and those houses that have come nearer to the proposed road due to the widening of the road.</li> </ul>	<p>However, such stretches will be considered for strengthening only</p> <ul style="list-style-type: none"> <li>Project information shall be shared regularly with the local community</li> <li>Design shall be adjusted to avoid impact on religious structures, schools or any other sensitive structures</li> <li>Payment of compensation at market value</li> <li>Design adjustment to avoid impact on road side ponds</li> <li>Partially impacted ponds will be provided with protection walls</li> </ul>
4.	Rajapalayam - Sankarankoil - Tirunelveli (km 1/800 to	Km 55/100 SH -41 School Staff of Govt. Higher	05/02/2014  11:00am  Photo Plate - 4	<ul style="list-style-type: none"> <li>Traffic noise problem in the school due to vehicles plying on the road.</li> <li>Possibility of road</li> </ul>	<ul style="list-style-type: none"> <li>Widening of road should be taken without creating noise.</li> <li>Proper road safety signage's along the road</li> <li>Speed breaker or other facilities should be provided</li> </ul>	<ul style="list-style-type: none"> <li>Suggestion regarding to road noise and road accident will be considered during road designing.</li> </ul>



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S.No.	Name of Road	Type of Stakeholder	Date and Time	Issues Raised	Suggestion form Participants	Mitigation Measures
	km 28/000 and km 33/800 to km 82/800), Section of SH41	Secondary School, Vannikonadal, Sankarankoil		accident in school zone. <ul style="list-style-type: none"><li>• Road crossing problem near the school gate.</li></ul>	to prevent road accident. <ul style="list-style-type: none"><li>• Green plantation strip should be developed along the road near school.</li></ul>	



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**Informal Public Consultation- Photo Plates**



**Photo Plate1: SH-89 (Nanguneri to Ovari), Tisaiyanvillai Village**



**Photo Plate 2A: Consultation with Mr. R. Isaac Paulraj (Ret. DSP) and Mr. Stefan (Ret. Teacher) Caldwell Entinary Memorial Hr. Secondary School, SH89**



**Photo Plate 2B: Boundary wall of Church and House of Mr. R. Isaac Paulraj (Ret. DSP) at Km 31+595, SH89**



**Photo Plate 2C: Caldwell Entinary Memorial Hr. Secondary School along SH89**



**Photo Plate 2D: Caldwell Entinary Memorial Hr. Secondary School, SH89**



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41



**Photo Plate 3: SH-44 (Naduvapatti to Ettayapuram), Naduvadapatti Village**



**Photo Plate 4: Public Consultation at Km 55/100 (SH-41) in the Govt. Higher Secondary School, Vannikonadal, Sankarankoil**





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

## B. DETAILS OF FORMAL PUBLIC CONSULTATIONS

### MINUTES OF THE PUBLIC CONSULTATION MEETING – PPC 05 – Meeting No: PC 01

**District:** Tirunelveli, Thoothukudi and Virudhunagar  
**Taluk:** Kovilpatti, Sankarankoil and Ettayapuram  
**Villages:** 10 villages and Kovilpatti Town (From Naduvapatti to Kovilpatti)  
**Road Stretch Name and No:** SH 44 – Naduvapatti – Kovilpatti – Ettayapuram Road  
**Road Length:** 33.700 km  
**Chainage:** From 22/500 km to 37/000 km  
(22/500 to 37/00 km for the Coverage for Public Consultation)  
**Nature of work:** Strengthening and widening of Roads  
**Name of the Consultant:** M/s SMEC India (P) Ltd (JV) SMEC INTERNATIONAL PTY. LTD.  
**Public Consultation Details:**  
**Date:** 13.05.2014  
**Time:** 10.00 am  
**Venue:** Lakshmi Mahal, Opp to East Police Station, Kovilpatti Town  
**Subject Matter of Public Consultation:** Preliminary Public Consultation for DPR preparation.  
**Date of intimation sent to stakeholders and others in vicinity:** 09.05.2014  
**Name and position of Key professionals attended the PC:**

- Mr. S.K.SINHA  
Team Leader, SMEC
- Mr. DEEPAK MALIK  
Environmental Specialist, SMEC
- Mrs. VIJAYA.V  
Social Development Specialist, SMEC

#### **Name and position of Sub Key professionals attended the PC:**

- Mr. MAHAVEER  
Environmental wing, SMEC
- Ms. SIPPY N KUMAR  
Environmental wing, SMEC
- Mr. AJAY SHARMA  
Social Development wing, SMEC
- Mr. Renu Kumar  
Administration wing, SMEC

#### **Stakeholders Attended:**

- Mr. Khaja Mohideen  
Town Planning Officer  
Kovilpatti Municipality
- Mr. Kumar  
Town Planning Inspector  
Kovilpatti Municipality
- Ms. Kalaiselvi  
Village Administrative Assistance  
Puliyamkulam Village
- Ms. Rajeswari  
Village Administrative Assistance  
Ayyaneri Village
- Mr. P.Pothiraju  
Village Administrative Officer



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Ayyaneri Village

- Mr. Sreekanth  
Village Administrative Officer  
Appaneri Village
- Mr. K.Srinivasan  
Village Administrative Officer  
Puliyamkulam Village
- Mr. Marimuthu  
Police Sub Inspector  
Kovilpatti East Police Station  
Kovilpatti.

(Attendance sheet attached)

**Government Officials attended:**

- Mrs. Geetha  
Additional Divisional Engineer,  
TNRSP  
Thoothukudi division
- Ms. A.Nirmala Jackuline  
Assistant Engineer,  
TNRSP  
Ramnad division

(Attendance sheet attached)

**MLAs/ MPs/ Chairperson/ panchayat presidents attended: Village panchayat presidents attended**

- Mr. Alagarsamy  
Panchayat President  
Mukkuttumalai Village
- Mr. Karuppasamy  
Panchayat President  
Ayyaneri Village
- Mr. Manikandan  
Panchayat President  
Puliyankulam Village
- Mr. Rajendran  
Panchayat Secretary  
Ilayarenthal Village

(Attendance sheet attached)

**Briefing of the project and subject matter of discussion:**

- Project briefing
- Technical details of road design
- Environmental aspects of road
- Social aspects of road

(Minutes of the Public Consultation meeting attached)



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**MINUTES OF THE PUBLIC CONSULTATION MEETING – PPC 05 – Meeting No: PC 02**

**District:** Tirunelveli and Thoothukudi  
**Taluk:** Kovilpatti and Ettayapuram  
**Villages:** 06 villages (From Tittankulam to Ettayapuram)  
**Road Stretch Name and No:** SH 44 – Naduvapatti – Kovipatti – Ettayapuram Road  
**Road Length:** 33.700 km  
**Chainage:** From 22/500 km to 37/000 km  
(37/00 km to 56 / 700km - Coverage for Public Consultation)  
**Nature of work:** Strengthening and widening of Roads  
**Name of the Consultant:** M/s SMEC India (P) Ltd (JV) SMEC INTERNATIONAL PTY. LTD.

**Public Consultation Details:**

**Date:** 13.05.2014  
**Time:** 03.00 pm  
**Venue:** Panchayat Community Hall, Ettayapuram Village.  
**Subject Matter of Public Consultation:** Preliminary Public Consultation for DPR preparation.  
**Date of intimation sent to stakeholders and others in vicinity:** 09.05.2014

**Name and position of Key professionals attended the PC:**

- Mr. S.K.SINHA  
Team Leader, SMEC
- Mr. DEEPAK MALIK  
Environmental Specialist, SMEC
- Mrs. VIJAYA.V  
Social Development Specialist, SMEC

**Name and position of Sub Key professionals attended the PC:**

- Mr. MAHAVEER  
Environmental wing, SMEC
- Ms. SIPPY N KUMAR  
Environmental wing, SMEC
- Mr. AJAY SHARMA  
Social Development wing, SMEC
- Mr. Renu Kumar  
Administration wing, SMEC

**Stakeholders Attended:**

- Mr. Balasubramaniam  
BSNL EPR

(Attendance sheet attached)

**Government Officials attended:**

- Mrs. Geetha  
Additional Divisional Engineer,  
TNRSP  
Thoothukudi division
- Ms. A.Nirmala Jackuline  
Assistant Engineer,  
TNRSP  
Ramnad division

(Attendance sheet attached)

**MLAs/ MPs/ Chairperson/ panchayat presidents attended: Village panchayat presidents attended**

- Mr. Govindasami  
Panchayat President



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Ettayapuram Village

- Mr.Ganesan  
Panchayat President  
Elambavanam Village

(Attendance sheet attached)

**Briefing of the project and subject matter of discussion:**

- Project briefing
  - Technical details of road design
  - Environmental aspects of road
  - Social aspects of road
- (Minutes of the Public Consultation meeting attached)



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

## MINUTES OF THE PUBLIC CONSULTATION MEETING – PPC 05 – Meeting No: PC 06

**District:** Thoothukudi  
**Taluk:** Nanguneri, and Radhapuram  
**Villages:** 10 villages.( From Nanguneri to Kakkan Nagar)  
**Road Stretch Name and No:** SH 89 – Nanguneri – Bharatvaram – Ovari Road  
**Road Length:** 35.200 km  
**Chainage:** From 0/000 to 35/200 km  
(0/000 km to 15/000km - Coverage for Public Consultation)  
**Nature of work:** Strengthening and widening of Roads.  
**Name of the Consultant:** M/s SMEC India (P) Ltd (JV) SMEC INTERNATIONAL PTY. LTD.

### Public Consultation Details:

**Date:** 15.05.2014  
**Time:** 10.00 am  
**Venue:** Panchayat Union Community Hall, Emankulam Village.  
**Subject Matter of Public Consultation:** Preliminary Public Consultation for DPR preparation.  
**Date of intimation sent to stakeholders and others in vicinity:** 09.05.2014

### Name and position of Key professionals attended the PC:

- Mr. S.K.SINHA  
Team Leader, SMEC
- Mr. DEEPAK MALIK  
Environmental Specialist, SMEC
- Mrs. VIJAYA.V  
Social Development Specialist, SMEC

### Name and position of Sub Key professionals attended the PC:

- Mr. MAHAVEER  
Environmental wing, SMEC
- Ms. SIPPY N KUMAR  
Environmental wing, SMEC
- Mr. AJAY SHARMA  
Social Development wing, SMEC
- Mr. Renu Kumar  
Administration wing, SMEC

### Stakeholders Attended:

- Mr.Ramanathan  
Sub Inspector of Police  
Nangauneri Police Station ,  
Nanguneri.
- Mr.Ravi  
Revenue Inspector  
Nanguneri.
- Mr.Robinraj  
Village Administration Officer  
Iraipubari Village.
- Mr.Samy.S  
Village Administration Officer  
Singaneri Village.

### Government Officials attended:

- Mr.Chandran  
Divisional Engineer,  
TNRSP





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Thoothukudi division.

- Mrs. Geetha  
Additional Divisional Engineer,  
TNRSP  
Thoothukudi division
- Mr. Akbar Ali  
Assistant Engineer,  
Highways Department  
C & M, Nanguneri.

(Attendance sheet attached)

**MLAs/ MPs/ Chairperson/ panchayat presidents attended: Village panchayat presidents attended**

- Mr.Manikaraj  
Ex MLA  
Nanguneri Constituency  
Nanguneri Village
- Mr.D.Ramunjam  
Panchayat Union Councilor  
Nanguneri Village
- Mr.R.Sivalingam  
Panchayat President  
Iraibupari paatapuramVillage
- Mr.Pauldurai  
Panchayat President  
Iraipubari Village.

(Attendance sheet attached)

**Briefing of the project and subject matter of discussion:**

- Project briefing
- Technical details of road design
- Environmental aspects of road
- Social aspects of road

(Minutes of the Public Consultation meeting attached)



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

## MINUTES OF THE PUBLIC CONSULTATION MEETING – PPC 05 – Meeting No: PC 07

**District:** Thoothukudi  
**Taluk:** Nanguneri, and Radhapuram  
**Villages:** 07 villages (From S.Vijayanagaram to Idaiyangudi)  
**Road Stretch Name and No:** SH 89 – Nanguneri – Bharatvaram – Ovari Road  
**Road Length:** 35.200 km  
**Chainage:** From 0/000 to 35/200 km  
(15/000km –35/200 km Coverage for Public Consultation)  
**Nature of work:** Strengthening and widening of Roads.  
**Name of the Consultant:** M/s SMEC India (P) Ltd (JV) SMEC INTERNATIONAL PTY. LTD.  
**Public Consultation Details:**  
**Date:** 15.05.2014  
**Time:** 03.00 pm  
**Venue:** Sree Avvoodaiammal Thirumana Mandapam, Tisanyanvillai.

**Subject Matter of Public Consultation:** Preliminary Public Consultation for DPR preparation.

**Date of intimation sent to stakeholders and others in vicinity:** 09.05.2014

### Name and position of Key professionals attended the PC:

- Mr. S.K.SINHA  
Team Leader, SMEC
- Mr. DEEPAK MALIK  
Environmental Specialist, SMEC
- Mrs. VIJAYA.V  
Social Development Specialist, SMEC

### Name and position of Sub Key professionals attended the PC:

- Mr. MAHAVEER  
Environmental wing, SMEC
- Ms. SIPPY N KUMAR  
Environmental wing, SMEC
- Mr. AJAY SHARMA  
Social Development wing, SMEC
- Mr. Renu Kumar  
Administration wing, SMEC

### Stakeholders Attended:

- Mr.Suyamburajan  
Lions District Governor
- Mr.R.Balan  
Vice President  
SOAUBY  
Singaneri Village.
- Mr.Timber Selvaraj  
President  
Shop Owners Association  
Tisayanvillai.
- Mr.Soundararajan  
State Joint Secretary  
Tamilnadu Shop Owners Association,  
Tisyanvilai.

### Government Officials attended:

- Mr.Chandran  
Divisional Engineer,



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

TNRSP

Thoothukudi division.

- Mrs. Geetha  
Additional Divisional Engineer,  
TNRSP  
Thoothukudi division

(Attendance sheet attached)

**MLAs/ MPs/ Chair person/ panchayat presidents attended: Village panchayat presidents attended**

- Mr. Michael Rayappan  
Member of State Assembly  
MLA  
Tisyanvillai.  
\*Mr. Michael Rayappan joint for discussion with the DE and DPR Consultant after the meeting, due to pre commitment.
- Mr. A.K. Srinivasan  
Panchayat Union Chairman  
Tisyanvilai Town Panchayat.
- Mr. V.S.R. Jeganathan  
Panchayat Union Chairman  
Radhapuram Union.
- Mr. K.P.K. Selvaraj  
Councilor  
Radhapuram Union.
- Ms. M. Jansirani  
Ward Councilor  
Tisyanvillai

(Attendance sheet attached)

**Briefing of the project and subject matter of discussion:**

- Project briefing
- Technical details of road design
- Environmental aspects of road
- Social aspects of road

(Minutes of the Public Consultation meeting attached)



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**MINUTES OF THE PUBLIC CONSULTATION MEETING – PPC 05 – Meeting No: PC 01**

**District:** Virudhunagar and Tirunelveli  
**Taluk:** Rajapalayam, Sankarankoil  
**Villages:** 8 villages (from Rajapalayam to Pandapuli)  
**Road Stretch Name and No:** SH 41 – Rajapalayam – Sankarankoil – Tirunelveli Road  
**Road Length:** 79.930 km  
**Chainage :** From km 0/000 to km 85/730  
(From km 0/000 to km 13/500 for the Coverage for Public Consultation)  
**Nature of work:** Strengthening and widening of Roads  
**Name of the Consultant:** M/s SMEC India (P) Ltd (JV) SMEC INTERNATIONAL P Ltd.  
**Public Consultation Details:**  
**Date:** 24.06.2014  
**Time:** 10.00 am  
**Venue:** Vignesh Mahal, Morambu, Cholapuram  
**Subject Matter of Public Consultation:** Preliminary Public Consultation for DPR preparation.  
**Date of intimation sent to stakeholders and others in vicinity:** 19.06.2014  
**Name and position of Key professionals attended the PC:**

- Mr. Elango  
Design Engineer, SMEC
- Dr. R. Rajkumr  
Social Development Specialist, SMEC

**Name and position of Sub key professionals attended the PC:**

- Mr. Mahaveer Saini  
Environmental wing, SMEC
- Ms. Jitendra  
GIS Specialist, SMEC
- Mr. Renu Kumar  
Administration wing, SMEC

**Stakeholders Attended:****Government Officials attended:**

- Mr. Kennedy  
Special DRO
- Mrs. Geetha  
Additional Divisional Engineer,  
TNRSP  
Thoothukudi division

(Attendance sheet attached)

**MLAs/ MPs/ Chair person/ panchayat presidents attended: Village panchayat presidents attended**

- **MR. Gnanaraj**  
Panchayat President, Sholapuram
- Vice President, Sholapuram  
(Attendance sheet attached)



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**Briefing of the project and subject matter of discussion:**

- Project briefing
- Technical details of road design
- Environmental aspects of road
- Social aspects of road

(Minutes of the Public Consultation meeting attached)





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**MINUTES OF THE PUBLIC CONSULTATION MEETING – PPC 05 – Meeting No: PC 02**

**District:** Virudhunagar and Tirunelveli  
**Taluk:** Sankarankoil  
**Villages:** 17 villages (From Tenmalai to Devarkulam)  
**Road Stretch Name and No:** SH 41 – Rajapalayam – Sankarankoil – Tirunelveli Road  
**Road Length:** 79.930 km  
**Chainage:** From km 0/000 to km 85/730  
(km 13/500 to km 59/000 - Coverage for Public Consultation)  
**Nature of work:** Strengthening and widening of Roads  
**Name of the Consultant:** M/s SMEC India (P) Ltd (JV) SMEC INTERNATIONAL P Lts  
**Public Consultation Details:**  
**Date:** 24.06.2014  
**Time:** 02.00 Pm  
**Venue:** A.S. Abishek mahal , Gurukulpatti.

**Subject Matter of Public Consultation:** Preliminary Public Consultation for DPR preparation.

**Date of intimation sent to stakeholders and others in vicinity:** 19.06.2014

**Name and position of Key professionals attended the PC:**

- Mr. Elango  
Design Engineer, SMEC
- Dr. R. Rajkumr  
Social Development Specialist, SMEC

**Name and position of sub key professionals attended the PC:**

- Mr. Mahaveer Saini  
Environmental wing, SMEC
- Ms. Jitendra  
GIS Specialist, SMEC
- Mr. Renu Kumar  
Administration wing, SMEC

**Stakeholders Attended:****Government Officials attended:**

- Mrs. Geetha  
Additional Divisional Engineer,  
TNRSP  
Thoothukudi division
- Mr. Appadurai  
Additional Divisional Engineer  
Sankarankoil

(Attendance sheet attached)

**MLAs/ MPs/ Chairperson/ panchayat presidents attended: Village panchayat presidents attended**

- Mr.S. Murugaian  
Union Chairman  
Melnilidanallur
- Mr.Subburaj  
Panchayat President  
Kilnilidanallur Village Panchayat

(Attendance sheet attached)



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**Briefing of the project and subject matter of discussion:**

- Project briefing
  - Technical details of road design
  - Environmental aspects of road
  - Social aspects of road
- (Minutes of the Public Consultation meeting attached)



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**MINUTES OF THE PUBLIC CONSULTATION MEETING – PPC 05 – Meeting No: PC 03**

**District:** Tirunelveli  
**Taluk:** Tirunelveli  
**Villages:** 10 villages. ( From Alagiapandiapuram to Ramayanpatti)  
**Road Stretch Name and No:** SH 41 – Rajapalayam – Sankarankoil – Tirunelveli Road  
**Road Length:** 79.930 km  
**Chainage :** From km 0/000 to km 85/730  
(km 59/000 to km 85/730 for the Coverage for Public Consultation)  
**Nature of work:** Strengthening and widening of Roads  
**Name of the Consultant:** M/s SMEC India (P) Ltd (JV) SMEC INTERNATIONAL P Ltd.  
**Public Consultation Details:**  
**Date:** 24.06.2014  
**Time:** 05.00 pm  
**Venue:** Community Hall, Manur.

**Subject Matter of Public Consultation:** Preliminary Public Consultation for DPR preparation.

**Date of intimation sent to stakeholders and others in vicinity:** 19.06.2014

**Name and position of Key professionals attended the PC:**

- Mr. Elango  
Design Engineer, SMEC
- Dr. R. Rajkumr  
Social Development Specialist, SMEC

**Name and position of sub key professionals attended the PC:**

- Mr. Mahaveer Saini  
Environmental wing, SMEC
- Ms. Jitendra  
GIS Specialist, SMEC
- Mr. Renu Kumar  
Administration wing, SMEC

**Stakeholders Attended:****Government Officials attended:**

- Mrs. Geetha  
Additional Divisional Engineer,  
TNRSP  
Thoothukudi division

(Attendance sheet attached)

**MLAs/ MPs/ Chair person/ panchayat presidents attended: Village panchayat presidents attended**

(Attendance sheet attached)

**Briefing of the project and subject matter of discussion:**

- Project briefing
- Technical details of road design
- Environmental aspects of road
- Social aspects of road

(Minutes of the Public Consultation meeting attached)



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**PUBLIC CONSULTATION MEETING MINUTES – PPC 05****PUBLIC CONSULTATION No: PC 01****PARUVAKUDI - KOVILPATTI - ETTAYAPURAM -VILATHIKULAM - VEMBAR ROAD (KM 22/500 TO KM 38/750 AND KM 41/300 TO KM 56/700), SECTION OF SH44**

Coverage: 22/500 to 37/00 km

Venue: Lakshmi Mahal ,Kovilpatti Town

Time: 10.00 am

S.No	Brief the impacts / Issues raised and by whom	Brief the points of discussion and suggestion and by whom	Brief the decision taken and by whom
1	<p>Issues raised by:            Mr. Alagarsami, Village Panchayat President, Mukkutumalai Village.</p> <ul style="list-style-type: none"> <li>• Impacts in the village</li> <li>• Whether the Vinayagar temple is affected and the structure next to the temple is likely to get affected</li> <li>• How the drinking water pipes will be replaced</li> <li>• Whether the Over Head Tank is getting affected</li> <li>• Impacts on ponds and lake in the region</li> <li>• Details regarding the starting point of the road</li> <li>• Whether the drinking water well in Manthiyur village is likely to be affected</li> <li>• Whether the project will pay compensation for loss of trees in patta land</li> <li>• Road width</li> </ul>	<p>Briefing of the issues / clarification regarding road design and technical details was given by the Team leader, issues related to environmental including existing/ baseline environmental quality of air, water and noise, impacted water bodies and trees, any protected area within 15km distance from road, any Reserved /Protected Forest within RoW, applicability of Coastal Regulation Zone (CRZ) Notification was explained by the Environmental Specialist and the issues related to Social impacts, structural loss, compensation and CPR relocation was clarified by the Social Development Specialist.</p> <ul style="list-style-type: none"> <li>• All the impacted villages along the road side from Chainage 22/500 to 37/000 km was listed.</li> <li>• Vinayagar Temple is likely to be affected and it was clearly explained that replacement of CPR will be made with enhanced replacement and focus group discussion will be held at village level for CPR relocation.</li> <li>• The structure near the temple is also likely to be affected and the compensation will be paid in accordance with the approved entitlement policy.</li> <li>• Drinking water pipes will be replaced by the</li> </ul>	<p>The Start point was shifted from 22/400 km to km 22/500            As agreed by the PIU and World Bank during their visit during December 2013.            The relocation of CPRs such as the Temple and a church will be relocated with enhanced measures as per the guidelines of the RAP.            Compensation of the affected structures will be paid as per the guidelines of the RAP/ Entitlement matrix.            Compensatory tree plantation will be twice the number of trees to be cut            Additional avenue plantation along road side as per IRC guidelines            The affected ponds and all the ponds along the project roads shall be mitigated with boundary walls, landscaping, and shady trees.</p>



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S.No	Brief the impacts / Issues raised and by whom	Brief the points of discussion and suggestion and by whom	Brief the decision taken and by whom
		<p>project.</p> <ul style="list-style-type: none"> <li>Impact on ponds – at 22/500 km and 24/650 km</li> <li>The start point of the project at Naduvapatti village at 22/600 km. the start point has been shifted from 22/500 km to 22/550km</li> <li>The drinking water well at Manthiyur is not affected.</li> <li>Compensatory plantation for impacted trees.</li> <li>The road width for the road is 16m in builtup area and 23m in non builtup area.</li> </ul>	
2	<p>Issues raised by:            Village Panchayat President, Ilayathenral Village.</p> <ul style="list-style-type: none"> <li>Impact on Structures likely to be affected</li> <li>Road width</li> </ul>	<ul style="list-style-type: none"> <li>No Structure is likely to be affected by the project.</li> <li>The road width for the road is 16m in builtup area and 23m in non builtup area.</li> </ul>	<ul style="list-style-type: none"> <li>Impact on the structures will be finalised only after the finalisation of the centre line and census / socio economic survey.</li> </ul>
3	<p>Issue raised by:            Mr. Manikandan , Village panchayat president Puliyanikulam Village</p> <ul style="list-style-type: none"> <li>Impact on Structures likely to be affected</li> </ul>	<ul style="list-style-type: none"> <li>No impact on the structures.</li> </ul>	<ul style="list-style-type: none"> <li>Impact on the structures will be finalised only after the finalisation of the centre line and census / socio economic survey.</li> </ul>
4	<p>Issue raised by:            Mr.Ravindran , Nakalammuthanpati</p> <ul style="list-style-type: none"> <li>Whether Puthupaneri church is affected</li> <li>Road width</li> </ul>	<ul style="list-style-type: none"> <li>Seven structures are likely to affect and all are residential in use.</li> </ul>	<ul style="list-style-type: none"> <li>Impact on the structures will be finalised only after the finalisation of the centre line and census / socio economic survey.</li> </ul>
5	<p>Issue raised by:            Mr. John , Saviour colony, Kovilpatti</p> <ul style="list-style-type: none"> <li>Whether this project will be extended up to Puruvakudi village.</li> <li>Why Kovipatti town is not widened.</li> <li>Whether the sharp curves at Ayyaneri village will be realigned.</li> </ul>	<ul style="list-style-type: none"> <li>The project road will be strengthened upto the junction near Naduvapatti village.</li> <li>Kovilpatti Town portion will be excluded from widening for a distance of 4 km.</li> <li>Sharp curves at Ayyaneri Village will be straighten / realignment will be considered.</li> <li>Proposed ROB for Kovilpatti.</li> </ul>	<ul style="list-style-type: none"> <li>Rational for Kovilpatti was explained and certain portion of Kovilapatti will be widened to 4 lane road as per the PIU and World Bank approval.</li> <li>Proposed ROB at Kovilpatti.</li> <li>Special provisions will be provided near educational institution and hospitals.</li> </ul>





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S.No	Brief the impacts / Issues raised and by whom	Brief the points of discussion and suggestion and by whom	Brief the decision taken and by whom
	<ul style="list-style-type: none"> <li>Whether bridge will be constructed near the College.</li> </ul>		
6	Issue raised by: Village Panchayat President Nakkalamamuntanpatti <ul style="list-style-type: none"> <li>Whether bus shelters will be replaced</li> <li>Components of compensation</li> <li>Who are all the people the survey team will meet when they come for Field visit</li> </ul>	<ul style="list-style-type: none"> <li>Bus Shelters will be replaced</li> <li>The compensation will usually cover the land compensation, structural value without depreciation, grant, assistance and allowance as per guidelines of World Bank.</li> <li>The Survey team will meet the panchayat president, community leaders and primarily the project affected households.</li> </ul>	<ul style="list-style-type: none"> <li>Bus Shelters replace design shall consider facility with basic amenities like drinking water, toilet facilities and chairs.</li> <li>Compensation shall be paid as per the approved RAP. / Entitlements matrix.</li> <li>( Since the public consultation is at the preliminary level of DPR , the key professionals explained it very clear that the views of the public will be taken into consideration in the DPR and other details like compensation and affected structures will be disclosed during the Public Disclosure meetings and Project Briefing meeting of TNRSP in future)</li> </ul>



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**PUBLIC CONSULTATION MEETING MINUTES – PPC 05****PUBLIC CONSULTATION No: PC 02****PARUVAKUDI - KOVILPATTI - ETTAYAPURAM -VILATHIKULAM - VEMBAR ROAD (KM 22/500 TO KM 38/750 AND KM 41/300 TO KM 56/700), SECTION OF SH44**

Coverage: 37/00 km to 56 / 700km

Venue: Panchayat Community Hall, Ettayapuram

Time: 3.00 pm

S.No	Brief the impacts / Issues raised and by whom	Brief the points of discussion and suggestion and by whom	Brief the decision taken and by whom
1	<p>Issues raised by:            Mr. Govindaraja Perumal, Village Panchayat President, Ettayapuram Village.</p> <ul style="list-style-type: none"> <li>• Impacts in the village</li> <li>• Proposed for a bypass to avoid Ettayapuram habitat area.</li> <li>• How the drinking water pipes will be replaced</li> <li>• Impacts on ponds in the village.</li> <li>• Road width</li> <li>• Trees plantation</li> <li>• Improvement of MahakaviBharathi Memorial</li> </ul>	<p>Briefing of the issues / clarification regarding road design and technical details was given by the Team leader, issues related to environmental including existing/ baseline environmental quality of air, water and noise, impacted water bodies and trees, any protected area within 15km distance from road, any Reserved /Protected Forest within RoW, applicability of Coastal Regulation Zone (CRZ) Notification was explained by the Environmental Specialist and the issues related to Social impacts, structural loss, compensation and CPR relocation was clarified by the Social Development Specialist.</p> <ul style="list-style-type: none"> <li>• All the impacted villages along the road side from Chainage 37/000 to 56/700 km were listed.</li> <li>• Vinayagar Temple is likely to be affected and it was clearly explained that replacement of CPR will be made with enhanced replacement and focus group discussion will be held at village level for CPR relocation.</li> <li>• The structure near the temple is also likely to be affected and the compensation will be paid in accordance with the approved entitlement policy.</li> <li>• Drinking water pipes will be replaced by the project.</li> </ul>	<ul style="list-style-type: none"> <li>• The Start point was shifted from 22/500 km to 22/600 km</li> </ul> <p>As agreed by the PIU and World Bank during their visit during December 2013.</p> <ul style="list-style-type: none"> <li>• The technical feasibility of bypass will be studied and decision will be taken accordingly.</li> <li>• The relocation of CPRs such as the Temple and a church will be relocated with enhanced measures as per the guidelines of the RAP.</li> <li>• Compensation of the affected structures will be paid as per the guidelines of the RAP/ Entitlement matrix.</li> <li>• Compensatory tree plantation will be twice the number of trees to be cut</li> <li>• Additional avenue plantation along road side as per IRC guidelines</li> <li>• Ancient pond at km 54.300 (RHS) shall be enhanced with repairing of boundary walls, landscaping, benches for sitting and shady trees.</li> <li>• The villagers suggested to plant saplings of Neem and Tamarind trees.</li> </ul>



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S.No	Brief the impacts / Issues raised and by whom	Brief the points of discussion and suggestion and by whom	Brief the decision taken and by whom
		<ul style="list-style-type: none"><li>• The start point of the project at Naduvapatti village at 22/600 km. the start point has been shifted from 22/550 km to 22/600km.</li><li>• The drinking water well at Manthiyur is not affected.</li><li>• .The road width for the road is 16m in built-up area and 23m in non-built-up area.</li><li>• The compensatory plantation of trees will be in the ratio of 1:2</li><li>• The project do provide the scope for enhancing memorial along the road side and an ancient pond at km 54.300 (RHS)</li></ul>	<ul style="list-style-type: none"><li>• Hence the Mahakavi Bharathi Memorial and his memorial house shall be enhanced with facilities like bench, shady trees and landscaping.</li></ul>
2	Issue raised by: Mr. Vigneshhraj, Vice President, Shop keepers Association, Ettayapuram. Demand for proposed bypass to avoid the likely loss of commercial structures in Ettayapuram.	<ul style="list-style-type: none"><li>• Out of the commercial structures likely to be affected, 50% are squatters. Hence there is a scope for replacement of shop or rehabilitation grant to enhance their livelihood.</li></ul>	<ul style="list-style-type: none"><li>• From 56/100km to 57/600km, edge to edge strengthening shall be made to avoid loss of commercial structures in Ettayapuram.</li></ul>



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**PUBLIC CONSULTATION MEETING MINUTES – PPC 05 –****PUBLIC CONSULTATION No: PC 06****NANGUNERI - BHARATAVARAM - OVARI ROAD (KM 0/000 TO KM 35/200), SECTION OF SH 89**

Coverage: 0/000 to 15/000 km

Venue: Panchayat Union Community Hall, Emankulam

Time: 10.00 am

S.No	Brief the impacts / Issues raised and by whom	Brief the points of discussion and suggestion and by whom	Brief the decision taken and by whom
1	<p>Issues raised by:</p> <p>Mr. Inbaraj, Emankulam</p> <ul style="list-style-type: none"> <li>Impact on structures</li> <li>Whether drain will be provided on either side of the proposed road</li> </ul> <p>Mr. Ashok , Emankulam</p> <ul style="list-style-type: none"> <li>Bus shelter shifting process</li> <li>Speed breakers near educational institutions and height of the breakers as per standards.</li> <li>Replacement of worship places</li> <li>Whether compensation will be paid for other assets</li> <li>Whether ROB is proposed in the road stretch</li> <li>Underground drinking water pipelines will be disturbed or damaged during road construction.</li> </ul> <p>Locals also demanded for the</p>	<p>Briefing of the issues / clarification regarding road design and technical details was given by the Team leader, issues related to environmental including existing/ baseline environmental quality of air, water and noise, impacted water bodies and trees, any protected area within 15km distance from road, any Reserved /Protected Forest within RoW, applicability of Coastal Regulation Zone (CRZ) Notification was explained by the Environmental Specialist and the issues related to Social impacts, structural loss, compensation and CPR relocation was clarified by the Social Development Specialist.</p> <ul style="list-style-type: none"> <li>Technical feasibility for ROB, stated that ROB is not needed for this road.</li> <li>Likelihood impact on structures was made.</li> <li>Drains shall be provided on either side of the road for 1mt width.</li> <li>Speed breakers would as per the standard specification throughout the TNRSP road package.</li> <li>Replacement of worship places with enhanced manner and public engagement shall be made.</li> <li>Compensation for other structures such as bore</li> </ul>	<ul style="list-style-type: none"> <li>ROB is not viable.</li> <li>Road design contains the component of drain facility.</li> <li>Speed breakers width and height shall be made as per IRC guidelines.</li> <li>CPR relocation as per the approved RAP.</li> <li>Compensation for structures and other assets as per the approved RAP.</li> <li>Utility shifting like pipelines shall be finalised based on finalization of implementation of project.</li> <li>Plantation of Neem trees shall be given preference for roadside avenue plantation.</li> <li>Since the public consultation is at the preliminary level of DPR, the key professionals explained it very clear that the views of the public will be taken into consideration in the DPR and other details like compensation and affected structures will be disclosed during the Public Disclosure meetings and Project Briefing meeting of TNRSP in future).</li> </ul>



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S.No	Brief the impacts / Issues raised and by whom	Brief the points of discussion and suggestion and by whom	Brief the decision taken and by whom
	plantation of Neem trees along the road.	<p>well, pump set, shed, pillars etc shall be paid.</p> <ul style="list-style-type: none"><li>• Underground water pipelines will not be disturbed during construction phase, or the concerned departments shall be coordinated to replace new pipelines based on TNRSP decision.</li><li>• Koonthakulam Bird Sanctuary is located on LHS at distance of about 7.5 km from project road (km 13/000) for which clearance shall be obtained from National Board for Wild Life (NBWL).</li></ul>	





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**PUBLIC CONSULTATION MEETING MINUTES – PPC 05****PUBLIC CONSULTATION No: PC 07****NANGUNERI - BHARATAVARAM - OVARI ROAD (KM 0/000 TO KM 35/200), SECTION OF SH 89****Coverage: 15/000 to 35/200 km****Venue: Shree Avoodaiammal Kalyana Mahal****Time: 03.00 pm**

S.No	Brief the impacts / Issues raised and by whom	Brief the points of discussion and suggestion and by whom	Brief the decision taken and by whom
1	<p>Issues raised by: Shop Owners Association</p> <ul style="list-style-type: none"> <li>Proposed for bye pass road for Thisyanvalai town to avoid the impact on commercial structures and where the existing width is congested.</li> <li>Road width</li> </ul> <p>Issue raised by Rtd. DSP , Idaiyangudi</p> <ul style="list-style-type: none"> <li>Proposed Bye pass road for Idaiyankudi village to minimise the impact on the structures which is considered to place historic importance of 160 years and also to minimize traffic congestion in the village.</li> </ul> <p>Issues raised by Chairman, Idaiyangudi</p> <ul style="list-style-type: none"> <li>Proposed Bye pass road for Idaiyangudi</li> <li>The road shall extend up to the ECR junction.</li> <li>The Siva temple in Ovari shall be connected with enhanced road, which is a well-known tourist place.</li> </ul>	<p>Briefing of the issues / clarification regarding road design and technical details was given by the Team leader, issues related to environmental including existing/baseline environmental quality of air, water and noise, impacted water bodies and trees, any protected area within 15km distance from road, any Reserved /Protected Forest within RoW, applicability of Coastal Regulation Zone (CRZ) Notification was explained by the Environmental Specialist and the issues related to Social impacts, structural loss, compensation and CPR relocation was clarified by the Social Development Specialist.</p> <ul style="list-style-type: none"> <li>Technical feasibility for the bye pass will be studied.</li> <li>Technical feasibility for the bye pass will be studied for Idaiyankudi, since already it was accepted by TNRSP to proceed for edge to edge improvement without disturbing the structures.</li> <li>As per the Environmental enhancement the tourist place at Ovari shall be considered for improvement.</li> <li>Koonthakulam Bird Sanctuary is located on LHS at distance of about 7.5 km from project road (km 13/000) for which clearance shall be obtained from National Board for Wild Life (NBWL).</li> </ul>	<ul style="list-style-type: none"> <li>Tisyanvilan Bye pass options will be finalised after a focused meeting for Bypass in future.</li> <li>The technical feasibility of Idaiyankudi Bye pass will be studied and based on the rational and TNRSP decision will be made.</li> <li>Extending the Road up to Ovari Temple and connecting to the ECR, study will be carried out.</li> <li>Since the public consultation is at the preliminary level of DPR, the key professionals explained it very clear that the views of the public will be taken into consideration in the DPR and other details like compensation and affected structures will be disclosed during the Public Disclosure meetings and Project Briefing meeting of TNRSP in future).</li> </ul>



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**PUBLIC CONSULTATION MEETING MINUTES – PPC 05****PUBLIC CONSULTATION No: PC 01****RAJAPALAYAM - SANKARANKOIL – TIRUNELVELI (KM 1/800 TO KM 28/000 AND KM 33/800 TO KM 82/800), SECTION OF SH41****Coverage: km 0/000 to km 13/500****Venue: Vignesh Mahal, Morambu Village****Time: 10.00 am**

S.No	Brief the impacts / Issues raised and by whom	Brief the points of discussion and suggestion and by whom	Brief the decision taken and by whom
1	Issues raised by: Mr. Senbagaram, Sholapuram Village. Whether land will be acquired on both sides of the road for widening	<ul style="list-style-type: none"> <li>Land will be acquired from the centre line; the extent would be 8 meters from the center line in each side (total of 16 meters) in urban and congested places and 11.5 meters from centre line (total of 23 meters) in rural areas.</li> <li>In most of the places, structures are not affected.</li> <li>Survey is being carried out and could be confirmed after survey is completed.</li> </ul>	Since the public consultation is at the preliminary level of DPR , the key professionals explained it very clear that the views of the public will be taken into consideration in the DPR and other details like compensation and affected structures will be disclosed during the Public Disclosure meetings and Project Briefing meeting of TNRSP in future
2	Mr. Dhanasekaran, TTS Grocery Shop, Morambu village <ul style="list-style-type: none"> <li>Some of the shops have only a 10' width, would widening of road affect their structures? if so business would be affected</li> </ul>	<ul style="list-style-type: none"> <li>If the structure is affected, compensation would be provided to the project affected persons and families.</li> <li>The centre line will be considered for acquisition of land on both sides</li> <li>There would not be any influence or partiality in acquiring land</li> </ul>	
3	Mr. Ravichandran, Businessman <ul style="list-style-type: none"> <li>Whether the centre line would be adhered in all through the project road for acquiring land or could be altered by the influential persons?</li> </ul>	<ul style="list-style-type: none"> <li>Centre line would be considered for acquiring land on both sides.</li> <li>There would not be any partiality</li> </ul>	
4	Mr. Gnanaguru, Public <ul style="list-style-type: none"> <li>How the land would be acquired?</li> </ul>	<ul style="list-style-type: none"> <li>The road width for the road is 16m in built-up area and 23m in non built-up area.</li> </ul>	



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S.No	Brief the impacts / Issues raised and by whom	Brief the points of discussion and suggestion and by whom	Brief the decision taken and by whom
		<ul style="list-style-type: none"> <li>Impact on the structures will be finalised during census / socio economic survey.</li> <li>The compensation will usually cover the land compensation, structural value without depreciation, grant, assistance and allowance as per guidelines of World Bank.</li> <li>The survey numbers of land identified for acquisition and owners will be informed through public disclosure meetings and notified in the news papers.</li> <li>The Survey team will meet the panchayat president, community leaders and primarily the project affected households.</li> <li>Compensation shall be paid as per the approved RAP. / Entitlements matrix.</li> </ul>	
5	Mr. Puliyuer Sami, Vekkaiamman Temple Priest, Sholapuram <ul style="list-style-type: none"> <li>Impact on steps of the temple would likely to be affected</li> </ul>	<ul style="list-style-type: none"> <li>Likely to be affected structures will be finalised after the completion of physical survey of road and structures.</li> <li>Compensation would be provided if the steps are affected</li> </ul>	
6	Issue raised by: Mr.Gnanaraj, Panchayat President, Sholapuram <ul style="list-style-type: none"> <li>Whether drainage could be constructed for four kilometres along the road passing through Sholapuram.</li> </ul>	<ul style="list-style-type: none"> <li>If it is applicable, the demand for drainage for four kilometres would be considered.</li> </ul>	
7	Issue raised by: Mr. Dhanasekaran <ul style="list-style-type: none"> <li>What could be done to water pipelines along and underneath road</li> <li>Could it be possible to circumvent affecting Kalamman temple by acquiring land on other side of the road</li> </ul>	<ul style="list-style-type: none"> <li>Shifting of utilities will be done properly by dovetailing the supports of respective departments during implementation of the project without affecting basic amenities, utilities and infrastructures.</li> <li>If the CPR located far from the land to be acquired, the temple would not be affected</li> </ul>	



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**PUBLIC CONSULTATION MEETING MINUTES – PPC 05 - PUBLIC CONSULTATION No: PC 02****RAJAPALAYAM - SANKARANKOIL – TIRUNELVELI (KM 1/800 TO KM 28/000 AND KM 33/800 TO KM 82/800), SECTION OF SH41**

Coverage: km 13/500 to km 59/000

Venue: A. S. Abhishek Mahal, Gurukulpatti

Time: 2.00 pm

S.No	Brief the impacts / Issues raised and by whom	Brief the points of discussion and suggestion and by whom	Brief the decision taken and by whom
1.	Issues raised by: Mr. Elango, Chockalingapuram <ul style="list-style-type: none"> <li>Whether the bus stand would be constructed through the project</li> </ul>	Briefing of the issues / clarification regarding road design and technical details was given by the Team leader, issues related to environmental, pond, water bodies, trees was explained by the Environmental Specialist and the issues related to Social impacts, structural loss, compensation and CPR relocation was clarified by the Social Development Specialist. <ul style="list-style-type: none"> <li>Bus shelters could be constructed in the appropriate places</li> </ul>	<ul style="list-style-type: none"> <li>New or replacement of old bus shelters could be built</li> </ul>
2.	Issue raised by: Mr. Paneer Selvam, Gurukulpatti <ul style="list-style-type: none"> <li>Would the project construct bridges those are not in good condition</li> </ul>	<ul style="list-style-type: none"> <li>Yes dilapidated and old bridges would be constructed through the project</li> </ul>	<ul style="list-style-type: none"> <li>While widening and strengthening the road, bridges could be constructed</li> </ul>
3.	Issues raised by: Mr. Kannan, Vanniconendal village <ul style="list-style-type: none"> <li>Could you build bus shelter by widening the road further to avoid traffic congestion in Gurukulpatti</li> <li>Would the project do the eviction of all encroachments on either side of the road</li> <li>Whether the drinking water well be demolished during implementation of project</li> </ul>	<ul style="list-style-type: none"> <li>Bus shelters would be constructed in appropriate places.</li> <li>Bus shelters could be built by widening the road would be possible where land is available</li> <li>Respective departments will carry out removing encroachments during the project. Suitable compensation will be provided to the PAPs.</li> <li>Drinking well would not be demolished or disturbed if alternative land is available.</li> </ul>	
4.	Issues raised by: Mr. Mangalraj <ul style="list-style-type: none"> <li>There are many curves in the road</li> </ul>	<ul style="list-style-type: none"> <li>Realignment would be done wherever it is necessary</li> <li>Roads will be broadened, curves will be straightened and the drivers could see the road from long distance, could avoid</li> </ul>	



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S.No	Brief the impacts / Issues raised and by whom	Brief the points of discussion and suggestion and by whom	Brief the decision taken and by whom
	<ul style="list-style-type: none"> <li>As the road has curves, accidents occur frequently</li> </ul>	accidents.	
5.	Issue raised by: Mr. Vijay, Gurukalpatti <ul style="list-style-type: none"> <li>Whether speed breakers would be constructed near school and hospital</li> <li>There is 'S' curve immediately after the village, more accidents take place, will it be rectified</li> </ul>	<ul style="list-style-type: none"> <li>Speed breakers would be created wherever it is necessary</li> <li>Road will be straightened to the maximum extent, speed will be controlled and accidents will be reduced.</li> </ul>	
6.	Mr. Ramachandran, Gurkalpatti <ul style="list-style-type: none"> <li>Whether the officials acquire more lands than the required</li> <li>Would the project affect Thamiraparani integrated water supply scheme pipelines underneath and along road</li> <li>Whether all shifting would be done before the commence of widening and strengthening of roads</li> </ul>	<ul style="list-style-type: none"> <li>No, only the required extent of land would be acquired with compensation</li> <li>Shifting of common utilities will be done with the help of respective departments, If the utilities such as water pipelines, EB post and transformers etc., likely to be affected</li> <li>All shifting of pipelines and other infrastructures would be done before the commencement of the proposed project.</li> </ul>	
7.	Mr. Thangadurai, Teacher <ul style="list-style-type: none"> <li>Will you provide compensation for shops, if shops are removed</li> </ul>	<ul style="list-style-type: none"> <li>Compensation for structures and other assets as per the approved RAP.</li> </ul>	
8.	Mr. Paulraj, Karivalamvanthanallur, <ul style="list-style-type: none"> <li>Could the project consider constructing over bridge in Karivalamvanthanallur to avoid traffic congestion, accidents and free flow of vehicles</li> </ul>	<ul style="list-style-type: none"> <li>The option for constructing bridge will be explored</li> </ul>	
9.	Mr. Sakthivel, Ward councillor, Gurukalpatti <ul style="list-style-type: none"> <li>Bridges at Kuthiraikoil, Gurukalpatti and Marukalangulam are very narrow with deep curve, there happens lot of fatal accidents at least 2 every month. All three bridges should</li> </ul>	<ul style="list-style-type: none"> <li>Planned to widening the road and possible straightening is planned. Planned to reduce speeding vehicles.</li> </ul>	





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S.No	Brief the impacts / Issues raised and by whom	Brief the points of discussion and suggestion and by whom	Brief the decision taken and by whom
	be widened with speed controls		
10.	Mr. Thankgaraj, Bank Staff, Gurikalpatti <ul style="list-style-type: none"> <li>There are many speed breakers are currently existing are not necessary and reduce the quality of travel</li> <li>Speed breakers are not in place where required</li> <li>Suggested for widening the road further where bus stops are planned to avoid congestion and to park the bus without hindering free flow of other vehicles in both sides.</li> </ul>	<ul style="list-style-type: none"> <li>Appropriate measures will be taken to create and remove speed breakers based on the necessity and by realigning the road.</li> <li>Suitable plan will be drawn for parking buses for engaging passengers at stops to circumvent congestions at Gurukalpatti and other villages.</li> </ul>	
11.	Mr. Paulraj, Gurukalpatti <ul style="list-style-type: none"> <li>Old bridges are not in good shape and dilapidated condition, suggested for renovation or new bridges</li> <li>Suggested for speed breakers near school</li> </ul>	<ul style="list-style-type: none"> <li>Planned for new and renovate old bridges</li> <li>Speed breakers near schools are planned and proper sign boards will also be installed.</li> </ul>	
12.	Mr. Anandakumar, Therkupannavadali <ul style="list-style-type: none"> <li>Whether compensation would be paid before the commencement of the project</li> </ul>	<ul style="list-style-type: none"> <li>Compensation would be paid to the PAPs/PAFs as per the RAP</li> </ul>	
13.	A Participant <ul style="list-style-type: none"> <li>Would you give compensation for the land to the squatters those have shops/business</li> </ul>	<ul style="list-style-type: none"> <li>Shifting and subsistence allowance could be provided to the PAP and not the cost of land as compensation.</li> </ul>	
14.	Mr. Murigaian, Union Chairman <ul style="list-style-type: none"> <li>Insisted for constructing bus stop at Vellakoil, for which the grant of Rs. 3 lakhs was given to the local body but could not construct the shelter due to encroachment and squatter.</li> <li>Water pipelines should not be affected during implementation</li> </ul>	<ul style="list-style-type: none"> <li>The bus shelter could be constructed if necessary with the help of revenue and department local bodies.</li> <li>Pipelines will be affected, proper shifting would be carried out.</li> </ul>	



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**PUBLIC CONSULTATION MEETING MINUTES – PPC 05 – PUBLIC CONSULTATION No: PC 03****RAJAPALAYAM - SANKARANKOIL – TIRUNELVELI (KM 1/800 TO KM 28/000 AND KM 33/800 TO KM 82/800), SECTION OF SH41**

Coverage: km 59/000 to km 82/800

Venue: Community Hall, Manur.

Time: 5.00 pm

S.No	Brief the impacts / Issues raised and by whom	Brief the points of discussion and suggestion and by whom	Brief the decision taken and by whom
1	Issues raised by: Mr. Yesuraja, Manur <ul style="list-style-type: none"> <li>• Asked for the details of the project</li> </ul>	Briefing of the issues / clarification regarding road design and technical details was given by the Team leader, issues related to environmental, pond, water bodies, trees was explained by the Environmental Specialist and the issues related to Social impacts, structural loss, compensation and CPR relocation was clarified by the Social Development Specialist. <ul style="list-style-type: none"> <li>• Technical feasibility for the bye pass will be studied.</li> <li>• Focused group discussion will be held along with the affected shop keepers and based on the felt need of the affected people, bye pass road proposal study shall be carried out.</li> </ul>	<ul style="list-style-type: none"> <li>• The Consultants and TNRSP officials minute the views to conduct a detailed bye pass study to assess the feasibility and rationale for the same.</li> <li>• Consultation is at the preliminary level of DPR, the key professionals explained it very clear that the views of the public will be taken into consideration in the DPR and other details like compensation and affected structures will be disclosed during the Public Disclosure meetings and Project Briefing meeting of TNRSP in future).</li> </ul>
2	Issues raised by: Mr. Thiagarajan, Manur <ul style="list-style-type: none"> <li>• When will be the project completed</li> </ul>	<ul style="list-style-type: none"> <li>• Project will be completed positively in 25-30 months time</li> </ul>	
	Mr. Jeyachandran, Kanarpadi, Panchayat President <ul style="list-style-type: none"> <li>• Drinking water pipelines would not be disturbed</li> </ul>	<ul style="list-style-type: none"> <li>• The pipelines would not be disturbed to the maximum extent, if not inevitable, pipes will be shifted with the help of respective Department without affecting the system.</li> </ul>	
	Mr. Jeyachandran, Manur <ul style="list-style-type: none"> <li>• More accidents and deaths due to deep curves</li> <li>• Whether widening in one or both sides</li> </ul>	<ul style="list-style-type: none"> <li>• Planning for realignment and straightening to avoid accidents</li> <li>• Widening would take place on both sides of the proposed widening of road</li> </ul>	



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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S.No	Brief the impacts / Issues raised and by whom	Brief the points of discussion and suggestion and by whom	Brief the decision taken and by whom
	Mr. Armugam, Sankarf Nagar <ul style="list-style-type: none"> <li>Whether drainage facilities would be provided</li> </ul>	<ul style="list-style-type: none"> <li>Drainage/storm water drain is planned to be implemented wherever necessary</li> </ul>	
	Mr. Ravi, Manur <ul style="list-style-type: none"> <li>Whether existing drainage would be used</li> </ul>	<ul style="list-style-type: none"> <li>If the existing drainage would not be affected, there would not be any alterations, if it is impacted drainage, new structures will be constructed</li> </ul>	
	Mr. Williams, Manur <ul style="list-style-type: none"> <li>Deep 'S' curve has to be taken care through the proposed project.</li> </ul>	<ul style="list-style-type: none"> <li>Most of the curves will be straightened with widening, hence the accidents will be curtailed.</li> </ul>	
	Mr. Chellaiah, Ward, Councillor, Manur <ul style="list-style-type: none"> <li>Need speed breakers near school</li> <li>How the private land be acquired?</li> <li>Assured to cooperate for successful implementation of the project</li> </ul>	<ul style="list-style-type: none"> <li>Speed breakers with sign boards will be installed near school.</li> <li>Extra space in the bus stops will be provided to avoid over crowd</li> <li>Extent of land will be identified</li> <li>Land acquired after negotiation, public disclosure and notification; compensation as per the RAP will be given to the owner.</li> </ul>	



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**Photographs taken during Public Consultations**

**PC01: Kovipatti Town, Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44**







**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**PC02: Ettayapuram Village, Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44**







**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**PC06: Emankulam Village, Nanguneri - Bharatavaram - Ovari Road (km 0/000 to km 35/200),**  
Section of SH 89





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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**PC07: Tisanyanvillai, Nanguneri - Bharatavaram - Ovari Road (km 0/000 to km 35/200), Section of SH 89**







**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
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Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**PC01: Cholapuram, Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41**





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**PC02: Gurukalpatti, Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41**







**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**PC03: Manur, Rajapalayam - Sankarankoil – Tirunelveli (km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41**







**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

## ATTENDANCE SHEETS OF PUBLIC CONSULTATIONS

Km - 92/550 to 44/100



INRSF

TAMILNADU ROAD SECTOR PROJECT - II  
ASSISTED BY WORLD BANK



DETAILED PROJECT REPORT FOR VARIOUS ROADS UNDER PPC 05  
PUBLIC CONSULTATION MEETING - Officials Attendance sheet

Date & Time: 13/05/2014 ; 11:30 Am.

Venue: Kovilpatti / 52-44

S.No	Name and Designation of the Official	Contact Number & Email ID	Signature
1.	P. GEETHA ADE (A) TNRSF (A/C)	9940770459 1969.geetha@gmail.com	P. Geetha
2.	A. NIRMALA JACKULINE AE(A) TNRSF, Ramanatha puram	9443078881 nirmalavaiz@gmail.com	A. Nirmala
3.	S.K. SINHA, Team leader, SMEC India Pvt Ltd.	9818860992 smec.sksinha@gmail.com	S.K. Sinha
4.	DEEPAK MALIK GM-ENV. SMEC INDIA PVT. LTD	9870699409 deepak.malik@smec.com	Deepak Malik
5.	M. KHANZA MOWAIDEN Town planning officer Kovilpatti Municipality	9442048900 makandeen@gmail.com	M. Khanza
6.	M. KUMAR Town planning Engineer Kovilpatti Municipality	9943783477 TKMKMY@gmail.com	M. Kumar
7.	N. கனகசீர்த்தினி திரை உதவி கமிஷனரி	9597417176	N. கனகசீர்த்தினி



INRSF

# TAMILNADU ROAD SECTOR PROJECT –II ASSISTED BY WORLD BANK



DETAILED PROJECT REPORT FOR VARIOUS ROADS UNDER PPC 05  
PUBLIC CONSULTATION MEETING -Officials Attendance sheet

Date & Time: 13/05/2014 11:30 Am Venue: Kovilpatti

S.No	Name and Designation of the Official	Contact Number & Email ID	Signature
8.	V. ஜெயமீனா தொலைத்துறையின் தலைவர்	9677871798	V. ஜெயமீனா
9.	P. சுவாமிநாதன் தொலைத்துறையின் தலைவர்	9486589656	
10.	K. S. சீனிவாசன் தொலைத்துறையின் தலைவர்	9994311762	
11.	K. சீனிவாசன் தொலைத்துறையின் தலைவர்	9789126113	
12.	Sippy K Kumar Environmental Engineer SMEC India Int. Ltd.	9990106162	
13	Dr Mahaveer Prasad sain Environment professional Sain Hot, SMEC India Pvt Ltd.	9509557249	
14	Ajay Kumar Sharma Social Expert M/S SMEC India Pvt LTD	8130294626 ajay.sharma@smec. com.	Ajaysharma



TNRSP

# TAMILNADU ROAD SECTOR PROJECT -II ASSISTED BY WORLD BANK



DETAILED PROJECT REPORT FOR VARIOUS ROADS UNDER PPC 05  
PUBLIC CONSULTATION MEETING -Officials Attendance sheet

Date & Time: 13/05/2014 at 11:30 am.

Venue: Kovilpatti (SH-44)

S.No	Name and Designation of the Official	Contact Number & Email ID	Signature
15	V. Vijaya Social Specialist	9444236943 vvijaya2k@gmail.com	
16	A. R. S. MUKUMAR O. Manager	9840762006	
17	K. Manimudhu East P.S Kovilpatti	9486553307	





TAMILNADU ROAD SECTOR PROJECT - II  
ASSISTED BY WORLD BANK



Date & Time: 13/05/2014

Time: 11:30am

Venue: Kowlpathi, SH44

S.No	Name of the Participant	Name of the Village	Signature
1.	P. GRESTHA	ARECO, INRSP, Jayakudi	P. Grestha
2.	A. NIRMALA JACKULINE	Asst. Engr INRSP, Ramenathapuram	A. Nirjala Jackuline
3.	T. 433001	சென்னை	T. 433001
4.	K. Shanmya S. Kamani V.A.	சென்னை	K. Shanmya S. Kamani
5.	B. LINGGUBAI	Union Overseer Kowlpathi	B. Linggubai
6.	R. Srinivasan	சென்னை	R. Srinivasan
7.	M. KARUPPASAMY	சென்னை	M. Karuppasamy
8.	S. 433001	சென்னை	S. 433001
9.	P. 433001	V.A.O சென்னை	P. 433001
10.	K. 433001	V.A.O சென்னை	K. 433001
11.	S. 433001	சென்னை	S. 433001
12.	K. Kishore	சென்னை	K. Kishore
13.	G. 433001	சென்னை	G. 433001
14.	N. 433001	சென்னை	N. 433001
15.	N. 433001	சென்னை	N. 433001
16.	M. 433001 V.A.	சென்னை	M. 433001
17.	L. Raveendran	சென்னை	L. Raveendran







TNRSP

# TAMILNADU ROAD SECTOR PROJECT -II ASSISTED BY WORLD BANK



DETAILED PROJECT REPORT FOR VARIOUS ROADS UNDER PPC 05

PUBLIC CONSULTATION MEETING -Officials Attendance sheet SH-44.

Date & Time: 13/05/2014

3:00 pm

Venue: Ettayaperam

S.No	Name and Designation of the Official	Contact Number & Email ID	Signature
1.	Dr. P. Anandaraman Sio R. A. Ramalingam Ettayaperam	9643562633	
2.	S. Carlson E. Lamburam Pany E. Lamburam	9965921307	S. Carlson
3.	S. Anandaram Sio R. A. Ramalingam Ettayaperam	9790 436333	
4	R. AYYANAR Sio A. Ramalingam Ettayaperam	9952620809	R. Ayyanar
5	P. GABRIE Sio Anandaram		
	Vijaya V. Sioit Specialist SMEC India (P) Ltd.	9444236943	



SMC  
 13/05/2014 at 3:00pm  
 Etayapuram

SH-44

Etayapuram

	Name and Designation of the Contact	Contact Number & Email ID	Signature
1	P. GEETHA ADECH) TRUST Tny Alc	9940770459 1967. geetha @ gmail.com	P. Geetha
2	S.K. SITHA, Team leader, SMEC,	9818282352 smec.sksitha@gmail.com	S.K. SITHA
3	DEEPAK MALIK GM - Environment SMEC	9810699409 deepak.malik@smec.com	Deepak Malik
4	A. NIRMALA JACKULINE Dist. Env. TRSP. Ramanathapuram	944307888, nirmalaaiz@gmail.com	Nirmala Jackuline
5	Dr. Mahaveer Prasad Sami Prof. Env. Scientist, SMEC	9509557249	Dr. Mahaveer Prasad Sami
6	SUNIL KUMAR Env. ENGR. SMEC	9990106162	Sunil Kumar
7	Ajay Kumar Sharma Social Scientist M/S. SMC, Indira Pt. LPD Gurgaon	9818862581 ajaysharma805@gmail.com	Ajay Sharma

8 VIJAYA V.  
Social Specialist  
SMEC Andhra

9444236943

Vijaya V.



## TAMILNADU ROAD SECTOR PROJECT –II ASSISTED BY WORLD BANK

DETAILED PROJECT REPORT FOR VARIOUS ROADS UNDER PPC 05  
PUBLIC CONSULTATION MEETING -Participants Attendance sheet

SH-44

Date & Time: 13/05/2014 + 2:00pm

Venue: Ettaya Puram.

S.No	Name of the Participants	Name of the Village	Signature
1.	P. S. Anandaram	Puduchery	P. S. Anandaram
2.	K. Prudhviraj (Tala)	Puduchery	K. Prudhviraj
3.	S. Suresh	Antichavasthi	S. Suresh
4.	W. Ganesan	Thirumithal	W. Ganesan
5.	A. Suresh Kumar	Thirumithal	A. Suresh Kumar
6.	J. Kalichandran	Thirumithal	J. Kalichandran
7.	S. Suresh Kumar	Thirumithal	S. Suresh Kumar
8.	A. Suresh	Thirumithal	A. Suresh
9.	S. Lakshminarasimhan	Thirumithal	S. Lakshminarasimhan
10.	P. Suresh Kumar	Thirumithal	P. Suresh Kumar
11.	K. Suresh Kumar	Thirumithal	K. Suresh Kumar
12.	P. Suresh Kumar	Thirumithal	P. Suresh Kumar
13.	M. BALARUBRAMANI BSNL ER	Thirumithal	M. Balaramani
14.	S. Suresh Kumar	Thirumithal	S. Suresh Kumar
15.	P. Chelvanathan	Thirumithal	P. Chelvanathan
16.	E. Lalitha	Thirumithal	E. Lalitha
17.	P. Suresh	Thirumithal	P. Suresh







# TAMILNADU ROAD SECTOR PROJECT -II ASSISTED BY WORLD BANK



DETAILED PROJECT REPORT FOR VARIOUS ROADS UNDER PPC 05  
PUBLIC CONSULTATION MEETING -Officials Attendance sheet

Date & Time: 15/5/2014, 10:30 am

Venue: Sririppuram, SH89

S.No	Name and Designation of the Official	Contact Number & Email ID	Signature
	D. Ramasayam, P. U. Councilor, Nanganur Eamankulam.	9788249157	
	V. Paulasurai Panchayat President Sri Puthur Eamankulam	8012061999	
	R. Sivalingam. President Sri Puthur Palkuram CO. O.K. P. block Eamankulam	9689198230	
	A. Akbar Ali Assistant Engineer (H). EXM, Nanganur	9443744061	
	S. Mani Suresh EXM Nanganur constituent	94431 54137	
	D. Chandran DEL (H) TNRS Tirunelveli A/c	94432- 58366	
	P. Geetha ADE (H) TNRS Tirunelveli A/c	9940770459	



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# TAMILNADU ROAD SECTOR PROJECT -II

## ASSISTED BY WORLD BANK



DETAILED PROJECT REPORT FOR VARIOUS ROADS UNDER PPC 05

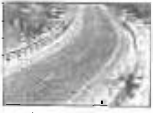
PUBLIC CONSULTATION MEETING -Officials Attendance sheet *Maippani*

Date & Time: *15-05-2014, 10:30 AM*

Venue: *Emankulam 8189*

S.No	Name and Designation of the Official	Contact Number & Email ID	Signature
	<i>1. Ramanathan Ssi Nanguneri Ps.</i>	<i>9486379991</i>	<i>[Signature] Ssi 15.5.14.</i>
	<i>D. Karunrajya 182 Nanguneri Ps</i>	<i>8681858982</i>	<i>[Signature] 15.5.14</i>
	<i>T. Ravi Ri, Nanguneri</i>	<i>999478355</i>	<i>[Signature] 15.5.14</i>
	<i>R. Robin Raj VAO, Erippuvaraidu</i>	<i>9994998590</i>	<i>[Signature] 15.5.14 24.5.14</i>
	<i>S. Samy. VAO, AH. Singaneri</i>	<i>8760195179</i>	<i>[Signature] 15.5.14 24.5.14</i>
	<i>VITAYA.V. Social Specialist SMEC</i>		<i>[Signature]</i>
	<i>Deepak Malik Environmental Specialist SMEC</i>		

*Mr. SK. SIVYA  
Team Leader  
SMEC*



INRSP

# TAMILNADU ROAD SECTOR PROJECT -II ASSISTED BY WORLD BANK



DETAILED PROJECT REPORT FOR VARIOUS ROADS UNDER PPC 05  
PUBLIC CONSULTATION MEETING -Participants Attendance sheet

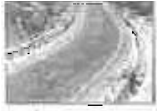
Date & Time:

Venue:

S.No	Name of the Participants	Name of the Village	Signature
1.	V. Robinson	Emankulam	V. Robinson
2.	K. ASHOK	Emankulam	K. Ashok
3	L. Ganesan	78/A Thiruvannamalai	L. Ganesan
4	A. Rajan	Thiruvannamalai	A. Rajan
5	P. Muthusujan	29/3 Thiruvannamalai	P. Muthusujan
6	J. Mohana	88/A Thiruvannamalai	J. Mohana
7	P. Teena	128/ Emankulam	P. Teena
8	D. Rajan	Thiruvannamalai	D. Rajan
9	M. Chitra	VAD. Emankulam	M. Chitra
10	T. Saral	Thiruvannamalai - 93	T. Saral
11	J. Manikam	139/B Emankulam	J. Manikam
12	A. Rajan	Thiruvannamalai	A. Rajan
13.	Chitra	Thiruvannamalai	Chitra
14	A. Rajan	Emankulam	A. Rajan
15	D. KANNARIRAN	Thiruvannamalai	D. Kannariran
16.	Vannamamalai	Nanguneri	Vannamamalai
17.	J. Manikam	Nanguneri	J. Manikam







INRSF

# TAMILNADU ROAD SECTOR PROJECT - II ASSISTED BY WORLD BANK



DETAILED PROJECT REPORT FOR VARIOUS ROADS UNDER PPC 05  
PUBLIC CONSULTATION MEETING -Participants Attendance sheet

Date & Time: 15/05/2014, 10:30 am

Venue: Tiruppur, TN 69

S.No	Name of the Participants	Name of the Village	Signature
17	S. Srinivasan	Thiruvannamalai	S. Srinivasan
18	J. Rajendran	Thiruvannamalai	J. Rajendran
19	A. Srinivasan	Thiruvannamalai	A. Srinivasan
20	A. Vimala Saroja	Thiruvannamalai	A. Vimala Saroja
21	D. Srinivasan	Thiruvannamalai	D. Srinivasan
22	U. Srinivasan	Thiruvannamalai	U. Srinivasan
23	L. Srinivasan	Thiruvannamalai	L. Srinivasan
24	R. Srinivasan		
25	P. Srinivasan	Thiruvannamalai	
26	G. Srinivasan	Thiruvannamalai	G. Srinivasan
27	T. Mahalingam	Parappadi	T. Mahalingam
28	V. Thelvan	Sambayalapuram	V. Thelvan
29	S. Srinivasan	Thiruvannamalai	S. Srinivasan
30	N. Paulraj	Bombaynagar	N. Paulraj
	N. Srinivasan	Thiruvannamalai	N. Srinivasan
	P. Srinivasan		P. Srinivasan





## TAMILNADU ROAD SECTOR PROJECT -II ASSISTED BY WORLD BANK

DETAILED PROJECT REPORT FOR VARIOUS ROADS UNDER PPC 05  
PUBLIC CONSULTATION MEETING -Local Elected Representatives/ MP / MLAs/  
President and others - Attendance sheet

Date & Time: 15/05/2014, 3:00pm

Venue: Tisaiyavillai, SH89

S.No	Name and Designation of the Elected Representatives /MP/MLA Presidents/ Community Leaders / NGOs	Contact Number & Email ID	Signature
	A.K. SRINIVASAN CHAIRMAN TISAIYAVILLAI TOWN PANCHAYAT	9842070001	
	K.P.K. Selvaraj Councillor Rathapuram P. Union	9486680859	
	J. J. Dorairaj Councillor Rathapuram P. Union	9442344888	
	M. Janai Rani 18-215 ward Councillor Tisaiyavillai	9943758768	M. Janai Rani
	S. Jaganmohan Councillor Rathapuram P. Union	9840525253	
	V.S.R. Jegathees CHAIRMAN Rathapuram Union	944 3371822	V.S.R. Jy.L



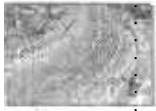
TAMILNADU ROAD SECTOR PROJECT -II  
ASSISTED BY WORLD BANK

DETAILED PROJECT REPORT FOR VARIOUS ROADS UNDER PPC 05  
PUBLIC CONSULTATION MEETING -Local Elected Representatives/ MP / MLAs/  
President and others - Attendance sheet

Date & Time: 15/05/2014 3:00PM

Venue: Tisaiyemillai, SH89

S.No	Name and Designation of the Elected Representatives /MP/MLA Presidents/ Community Leaders / NGOs	Contact Number & Email ID	Signature
	T. Sujanburajan Lions District Governor	9442641866	
	R. Balan Vice president Scouty	9843507722	



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# TAMILNADU ROAD SECTOR PROJECT - II ASSISTED BY WORLD BANK



Date & Time: 15/05/2014 3:00 PM

Venue: Puzosavillai, ST199

Sl. No	Name and Designation of the Elected Representative / MP/MLA / Panchayat / Grama Panchayat / Ward	Contact Number & Email ID	Signature
	P. Senthil Arumugam	P. Senthil Arumugam	P. Senthil Arumugam
	J. Senthil Arumugam	J. Senthil Arumugam	J. Senthil Arumugam
	P. Senthil Arumugam	P. Senthil Arumugam	P. Senthil Arumugam
	VADIVEL ARUMUGAM	Puzosavillai	Vadivel Arumugam
	R. Senthil Arumugam	Puzosavillai	R. Senthil Arumugam
	B. Senthil Arumugam	Puzosavillai	B. Senthil Arumugam



INRSF

# TAMILNADU ROAD SECTOR PROJECT –II ASSISTED BY WORLD BANK



DETAILED PROJECT REPORT FOR VARIOUS ROADS UNDER PPC 05  
PUBLIC CONSULTATION MEETING –Local Elected Representatives/ MP /  
MLAs/ President and others - Attendance sheet

Date & Time:

Venue:

S.No	Name and Designation of the Elected Representatives /MP/MLA Presidents/ Community Leaders / NGOs	Contact Number & Email ID	Signature
	D. Venkatesh RAO	Tissayanvilai	
	D. Sekar	Tissayan Vilai	D. Sekar
	L. Thirukumar	Tissayanvilai	L. Thirukumar
	R. K. Srinivasan	Tissayanvilai	R. K. Srinivasan
	S. Srinivasan	Tissayanvilai	S. Srinivasan
	K. Arun Kumar	Tissayanvilai	S. Srinivasan 9659677077



INRSF

# TAMILNADU ROAD SECTOR PROJECT –II ASSISTED BY WORLD BANK



DETAILED PROJECT REPORT FOR VARIOUS ROADS UNDER PPC 05  
PUBLIC CONSULTATION MEETING –Local Elected Representatives/ MP /  
MLAs/ President and others - Attendance sheet

Date & Time:

Venue:

S.No	Name and Designation of the Elected Representatives /MP/MLA Presidents/ Community Leaders / NGOs	Contact Number & Email ID	Signature
	S. சிவசுப்பிரமணியன்	9600013291	[Handwritten Signature]





TAMILNADU ROAD SECTOR PROJECT - II  
ASSISTED BY WORLD BANK



PUBLIC CONSULTATION MEETING -Participants Attendance sheet

Date & Time: 15/05/2014, 3:00 PM

Venue: Tisaiyanvilai, SHB9

S.No	Name of the Participants	Name of the Village	Signature
1	C. KUMAR	TISAIYAVILAI	
	S. Nani (Name)	Thasmodi (Name)	
3	B. V. (Name)	A. 2 (Name)	
4	S. (Name)	T. (Name)	
5	M. Subhan	Tisayanvila	M. S.
6	A. (Name)	(Name)	
7	G. (Name)	(Name)	G. (Name)
8	T. Venkandi	(Name)	T. (Name)
9	S. (Name)	(Name)	S. (Name)
10	K. (Name)	(Name)	K. (Name)
11	M. (Name)	(Name)	M. (Name)
12	N. (Name)	(Name)	N. (Name)
13	K. (Name)	(Name)	K. (Name)
14	H. Mohanlal Kasar	TISAIYAVILAI	
15	K. (Name)	Tisayanvilai	
16	D. Thompson	Idaiyangudi	
17	G. Arasa Kumar	Tisaiyanvilai	G. A. S.



INRSI

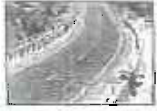
# TAMILNADU ROAD SECTOR PROJECT - II ASSISTED BY 'WORLD BANK



DETAILED PROJECT REPORT FOR VARIOUS ROADS UNDER PPC US

S.No	Name of the Participants	Name of the Village	Signature
	<i>K. [Signature]</i>		
	K. [Signature]	Tisaiyavillai	<i>[Signature]</i>
	A. DIVESH KUMAR	TISAIYANVILLAI	<i>[Signature]</i>
	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>
	E. CHINNAIYARACHARI	Thisayaavilai	<i>[Signature]</i>
	<i>[Signature]</i>	"	
	<i>[Signature]</i>	"	<i>[Signature]</i>
	<i>[Signature]</i>	"	
	N. Chandrasekhar	"	<i>[Signature]</i>
	C. Narayana Moorthy	"	<i>[Signature]</i>
	E. S. [Signature]	[Signature]	<i>[Signature]</i>
	S. L. [Signature]	[Signature]	<i>[Signature]</i>
	D. S. [Signature]	[Signature]	<i>[Signature]</i>
	N. [Signature]	[Signature]	<i>[Signature]</i>
	T. [Signature]	[Signature]	
	M. [Signature]		<i>[Signature]</i>
	F. Jayaram	[Signature]	<i>[Signature]</i>





TNRSP

# TAMILNADU ROAD SECTOR PROJECT -II ASSISTED BY WORLD BANK



DETAILED PROJECT REPORT FOR VARIOUS ROADS UNDER PPC 05  
PUBLIC CONSULTATION MEETING -Participants Attendance sheet

Date & Time:

Venue:

S.No	Name of the Participants	Name of the Village	Signature
	A. Senthil	Tisaiyevillai	A. Senthil
	A. Justin Rajapandian	Tisaiyevillai	A. Justin
	P. Mani Varadan	Tisaiyevillai	P. Mani Varadan
	S. Nagarajan	Tisaiyevillai	S. Nagarajan
	S. Manikandan	Tisaiyevillai	S. Manikandan
	Balaramanathan K.	Tisaiyevillai	Balaramanathan
	S. Muthuvelay	Tisaiyevillai	S. Muthuvelay
	K. Senthil	Tisaiyevillai	K. Senthil
	S. Senthil	Tisaiyevillai	S. Senthil
	M. Senthil	Tisaiyevillai	M. Senthil
	M. Senthil	Tisaiyevillai	M. Senthil
	P. Senthil	Tisaiyevillai	P. Senthil
	P. Senthil	Tisaiyevillai	P. Senthil
	P. Senthil	Tisaiyevillai	P. Senthil
	R. Senthil	Tisaiyevillai	R. Senthil
	R. Senthil	Tisaiyevillai	R. Senthil



INRSI

# TAMILNADU ROAD SECTOR PROJECT -II ASSISTED BY WORLD BANK



DETAILED PROJECT REPORT FOR VARIOUS ROADS UNDER PPC 05

PUBLIC CONSULTATION MEETING PARTICIPANTS ATTENDANCE SHEET

Date & Time:

Venue:

S.No	Name of the Participants	Name of the Village	Signature
18	P. Bala Sundar	Nadaruvami	P. Bala
19	A. D. PLOTTI	உத்திரை	A. D. PLOTTI
20	P. CHRISTOPHER	Idaiyangudi	P. Christopher
21	S. விஜயலக்ஷ்மி	செவ்வாண்டி	S. Vijayalakshmi
22	E. SELVARAJ	செவ்வாண்டி	E. Selvaraj
23	E. Sathish Sudehkar	செவ்வாண்டி	E. Sathish
24	M. Ramamattan	T. Sanyamillai	M. Ramamattan
25	S. DRAVIAM PONRAJ (Rtd HM)	T. Sanyamillai	S. Draviam Ponraj
26	Dr. R. SOLOMON	T. Sanyamillai	Dr. R. Solomon
27	K. ISAAC PAULAN	Idaiyangudi	K. Isaac Paulan
28	e. Jayakar	Idaiyangudi	e. Jayakar
29	செ. சிவசுப்பிரமணியன்	செவ்வாண்டி	செ. சிவசுப்பிரமணியன்
30	P. சுவாமிநாதன்	செவ்வாண்டி	P. Swaminathan
31	P. சுவாமிநாதன்	செவ்வாண்டி	P. Swaminathan
32	பி. சிவசுப்பிரமணியன்		
33	T.M. BRASSAN	செவ்வாண்டி	T.M. Brassan
34	D. PONSEWAR	செவ்வாண்டி	D. P. Sear





TNRSP

# TAMILNADU ROAD SECTOR PROJECT - II ASSISTED BY WORLD BANK



DETAILED PROJECT REPORT FOR VARIOUS ROADS UNDER PPC 05  
PUBLIC CONSULTATION MEETING -Participants Attendance sheet

Date & Time:

Venue:

S.No	Name of the Participants	Name of the Village	Signature
35	ச. சி. சி. சி. சி. சி.	சென்னை	ச. சி. சி. சி. சி.
36	செ. சி. சி. சி. சி. சி.	சென்னை	செ. சி. சி. சி. சி. சி.
37	பி. சி. சி. சி. சி. சி.	சென்னை	பி. சி. சி. சி. சி. சி.
38	பி. சி. சி. சி. சி. சி.	சென்னை	பி. சி. சி. சி. சி. சி.
39	வி. சி. சி. சி. சி. சி.	சென்னை	வி. சி. சி. சி. சி. சி.
40	E. NIUTHUVEL THAPPAN	Tisaiyannillai	
41	R.P.S. சி. சி. சி. சி. சி.	சென்னை	R.P.S.
42	V. Rajan	சென்னை	V. Rajan
43	R. Tharmar	சென்னை	R. Tharmar
44	E. Thanthiramanalagan	Tisaiyannillai	
45	V. சி. சி. சி. சி. சி.	சென்னை	V. சி. சி. சி. சி. சி.
46	பி. சி. சி. சி. சி. சி.	சென்னை	பி. சி. சி. சி. சி. சி.
47	வி. சி. சி. சி. சி. சி.	சென்னை	வி. சி. சி. சி. சி. சி.
48	பி. சி. சி. சி. சி. சி.	சென்னை	பி. சி. சி. சி. சி. சி.
49	சி. சி. சி. சி. சி. சி.	சென்னை	சி. சி. சி. சி. சி. சி.
50	பி. சி. சி. சி. சி. சி.	சென்னை	பி. சி. சி. சி. சி. சி.
51	சி. சி. சி. சி. சி. சி.	சென்னை	சி. சி. சி. சி. சி. சி.





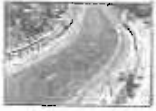
# TAMILNADU ROAD SECTOR PROJECT - II ASSISTED BY WORLD BANK



INDIA

DETAILED PROJECT REPORT FOR VARIOUS ROADS UNDER FOCUS  
PUBLIC CONSULTATION MEETING

S.No	Name of the Participant	Name of the Village	Signature
54A			
53	S. Vallikumar		
54	J. Sanyambu Raj		
55	G. Sivamogan	T. Saiyanvilai	
56	R. S. Ramani	Idg	
57	E. N. S. Srinivas		
58	S. Manikandan	T. Sanyambal	
59	J. S. Srinivasan		
60	D. Esakkimuthukumar	Thi saiyandurai	
61	A. Alogusanderan	T. Thi saiyandurai	
62	R. S. Raj		
63	M. S. Srinivasan		
64	J. S. Srinivasan		
65	S. Srinivasan		
66	J. J. Srinivasan		
67	P. Samuel		
68	J. M. Doss		



TNRSP

# TAMILNADU ROAD SECTOR PROJECT - II ASSISTED BY WORLD BANK



DETAILED PROJECT REPORT FOR VARIOUS ROADS UNDER PPC 05  
PUBLIC CONSULTATION MEETING -Participants Attendance sheet

Date & Time:

Venue:

S.No	Name of the Participants	Name of the Village	Signature
69.	L. Sivalayigandam	Idaiyangudi	[Signature]
70.	V. Kannan	Idaiyangudi	V. Kannan
71	J. SELVARATNAM	Idaiyangudi	[Signature]
72.	J. Sebakumatharavi	Idaiyangudi	[Signature]
73.	A. ANVAR	Idaiyangudi	A. Anvar
74	S. Srinivasan	Idaiyangudi	S. Srinivasan
75	A. Srinivasan	Idaiyangudi	A. Srinivasan
76	Un. Srinivasan	Idaiyangudi	[Signature]
77	Dr. Stephen Johns	Idaiyangudi	[Signature]
78	G. Balasubramanian	Idaiyangudi	G. Balasubramanian
79	P. Margaret Beulah	Idaiyangudi	P. Margaret Beulah
80	S. Srinivasan	Idaiyangudi	[Signature]
81	D. Vasanthi	Idaiyangudi	D. Vasanthi
82	S. Srinivasan	Idaiyangudi	[Signature]
83	S. Joan Pushparani	Idaiyangudi	S. Joan Pushparani
84	Rajini Thanasingh	Idaiyangudi	[Signature]
85	T. Mary	Idaiyangudi	[Signature]





NRSP

TAMILNADU ROAD SECTOR PROJECT - II  
ASSISTED BY WORLD BANK



S.No	Name of the Beneficiaries	Name of the Village	Signature
86	J. Chikavathy	Idaiyangudi	J. Chikavathy
88	I. Jesanth	Idaiyangudi	I. Jesanth
89	P. Srinivasan	Idaiyangudi	P. S.
90	Rasebud	Idaiyangudi	R.
91	P. Thangam	Idaiyangudi	P.
92	D. Karunasubila Bai	Idaiyangudi	D.
93	S. Seyanthi	Idaiyangudi	S. Seyanthi
94	C. Priscilla Christophe	Idaiyangudi	C. Priscilla Christophe
95	Priscilla Sekaraj	Idaiyangudi	P.
96	S. Idan	Idaiyangudi	S.
97	P. Srinivasan	Idaiyangudi	P. Srinivasan
98	S. Varanth	Idaiyangudi	S. Varanth
99	S. JOHN ALBERT	Idai	S. John Albert
100	D. Hanumantham	Idai	D. H.
101		Idai	S. Srinivasan
102	S. Rajandran	Idaiyangudi	S. Rajandran
103	G. Manthaleshram	Appuillai	G. Manthaleshram



TNRSP

# TAMILNADU ROAD SECTOR PROJECT -II ASSISTED BY WORLD BANK



DETAILED PROJECT REPORT FOR VARIOUS ROADS UNDER PPC 05  
PUBLIC CONSULTATION MEETING -Participants Attendance sheet

Date & Time:

Venue:

S.No	Name of the Participants	Name of the Village	Signature
1	T. Subbiah	Tisayanilla	T. Subbiah
2	S.R. Jany Badi	Tisayanilla	S.R. Jany Badi
3	R. HARITHARAN	Tisayanilla	R. Haritharan
4	D. Jofun Samuel	Idaiyangudi	D. Jofun Samuel
5	J. Kishak Kumar	Idaiyangudi	J. Kishak Kumar
6	V. Murugesan	Tisayanilla	V. Murugesan
7	P. Srinivasan	Tisayanilla	P. Srinivasan
8	M. Arin	Tisayanilla	M. Arin
9	D. Arulraj	Tisayanilla	D. Arulraj
10	I. Jothi	Tisayanilla	I. Jothi
11	V. LAWRENCE	IDAIYANGUDI	V. Lawrence
12	K. Arivanavasan	Tisayanilla	K. Arivanavasan
13	K.E. Murugesan	T.H.V -	K.E. Murugesan
14	S. Srinivasan	Tisayanilla	S. Srinivasan
15	A. Murugesan	Tisayanilla	A. Murugesan
16	V. Srinivasan	Tisayanilla	V. Srinivasan





NRSP

# TAMILNADU ROAD SECTOR PROJECT - II ASSISTED BY WORLD BANK



Sl.No	Name of the Participants	Name of the Village	Signature
	N. Dhanasekaran	Thiruvannamalai	
	M. Rajesh	Thiruvannamalai	
	MV B. B. L.	Thiruvannamalai	MV B. B.
	M. G. MARTIN	Thiruvannamalai	M. G. Martin
	S. Anantha	Thiruvannamalai	S. Ananth
	MV Ica Thirugesan	Thiruvannamalai	MV Ica
	S. Anantharaman	Thiruvannamalai	
	S. Kethuvelu	Thiruvannamalai	
	T. Dhanasekaran	Thiruvannamalai	
	M. Ratnakumar	Idaiyanganudi	M. Ram
	S. Daniel Anantharam	Idaiyanganudi	
	V. Esakkiammal	Thiruvannamalai	V. Esakkiammal
	S. Jeylot Jeya	Thiruvannamalai	S. Jeylot Jey
	S. Prathish Kumar	Thiruvannamalai	
	C. Wesley Prathap Singh	Thiruvannamalai	C. Wesley
	A. Ahmed M. A. Idris	Kudalpannai	A. A.
	N. Arappan	Thiruvannamalai	N. Arappan





INRSP

# TAMILNADU ROAD SECTOR PROJECT –II ASSISTED BY WORLD BANK



DETAILED PROJECT REPORT FOR VARIOUS ROADS UNDER PPC 05  
PUBLIC CONSULTATION MEETING -Participants Attendance sheet

Date & Time:

Venue:

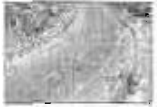
S.No	Name of the Participants	Name of the Village	Signature
	Loganathan.T.	Tisayanvillage	Loganathan.
	D.Thanmanai Selvan	Tisayanvillage	D.T. Selvan
	V. GANESAN	Tisayanvillage	V. Ganesh
	P. NATHAN	Tisayanvillage	P. Nathan
	A. Basil	Tisayanvillage	A. Basil
	D. Ramkrishnan	IDAIYANGUDI	D. Ramkrishnan
	P. DASAN	IDAIYANGUDI	P. Dasan
	George	Idaiyangudi	George
	Immanuel	Idaiyangudi	Immanuel
	Sam	Idaiyangudi	Sam
	Isaac	Idaiyangudi	Isaac
	J. Bhattaraj	Tisayanvillage	J. Bhattaraj
	S. Karanasi	Tisayanvillage	S. Karanasi
	N. Aravindan	Tisayanvillage	N. Aravindan
	S. Aravindan	Tisayanvillage	S. Aravindan
	P. Aravindan	Tisayanvillage	P. Aravindan
	E. Aravindan	Tisayanvillage	E. Aravindan











TNRSP

# TAMILNADU ROAD SECTOR PROJECT –II ASSISTED BY WORLD BANK



DETAILED PROJECT REPORT FOR VARIOUS ROADS UNDER PPC 05  
PUBLIC CONSULTATION MEETING –Local Elected Representatives/ MP /  
MLAs/ President and others - Attendance sheet

Date & Time:

Venue:

S.No	Name and Designation of the Elected Representatives /MP/MLA Presidents/ Community Leaders / NGOs	Contact Number & Email ID	Signature
	T. Shanthakumari	Thiruvananthapuram	



Tamil Nadu Road Sector Project  
Highways Department GoTN



Date 24.06.14.


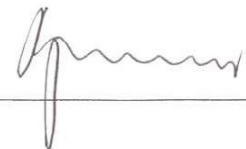


Venue Chalapuran

## Focus Group Discussion

PPC05-Preparation of DPR for Various Roads under TNRSP

SH-41(Rajaplayam-Tirunelveli)

VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS /officials

Sl No.	Name	Occupation	Signature
1.	J. GIVANARAJ	PANJAYAT PRESIDENT CHOLAPURAM	 24.06.14
2.	D. Rang Kennedy	Spl PRO Chennai	D. Rang Kennedy
3.	Dr. R. Rajamurugan	Social. Dev. Specialist	
4.	P. GEETHA	ADE TNRSP (H) Tay Dinan A/c	P. Geetha
5.	Dr. Mahaveer Sain	Environment Expert	
6.	B. ELANGO	Associate	B. Elango
7.	Sridhar Agreel	Sr. Engineer	
8.	A. NEELAKANDAN	Social Development Consultant	A. Neelakandan



Date 24/06/14

Venue Chelapura

## Focus Group Discussion Achilapuram

PPC05-Preparation of DPR for Various Roads under TNRSF

SH-41(Rajaplayam-Tirunelveli)

VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

Sl No.	Name	Occupation	Signature
1	E. ARIMURUGAN		E. Arimurugan
2	S. SHANMUGARAO	230C/2 SANKARATHAN MURUGAN	S. Shanmugan
3	S. P. SANKARARAO	222/2 SANKARARAO MURUGAN	S. P. Sankararao
4	D. SANKARARAO	116/2. SANKARARAO MURUGAN	D. Sankararao
5	S. SANKARARAO	116/2. SANKARARAO MURUGAN	S. Sankararao
6	S. SANKARARAO	SANKARARAO	S. Sankararao
7	V. SANKARARAO	SANKARARAO	V. Sankararao
8	P. SANKARARAO	SANKARARAO	P. Sankararao
9	A. SANKARARAO	SANKARARAO	A. Sankararao

Date 24/06/14

Venue Cholapalayam

## Focus Group Discussion

PPC05-Preparation of DPR for Various Roads under TNRSP

SH-41(Rajapalayam-Tirunelveli)

VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

Sl No.	Name	Occupation	Signature
10	க. சீர்தரிசலாட்சி தலைவர்	ஆர்வாய்	K. Sivaraj
11	வ. சீர்தரிசலாட்சி	ஆர்வாய்	V. Sivaraj
12	P. சீர்தரிசலாட்சி	ஆர்வாய்	P. Sivaraj
13	S. சீர்தரிசலாட்சி	ஆர்வாய்	S. Sivaraj
14	P. சீர்தரிசலாட்சி	ஆர்வாய்	P. Sivaraj
15	தி. சீர்தரிசலாட்சி	ஆர்வாய்	T. Sivaraj
16	M. சீர்தரிசலாட்சி	ஆர்வாய்	M. Sivaraj
17.	A. Suresh	Rice mill	A. Suresh
18	S. Ganesh	murum medicel	S. Ganesh



Date 24/02/14

Venue Chetapuram

Focus Group Discussion

PPC05-Preparation of DPR for Various Roads under TNRSP

SH-41(Rajaplayam-Tirunelveli)

VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

Sl No.	Name	Occupation	Signature
19	Rk. Govindarajan	சென்னை	Rk. Govindan
20	R. (H. Govindarajan)	சென்னை	சென்னை
21	சா. சுவாமிநாதன்	சென்னை	
22	P. Govindarajan		
23	ச. சுவாமிநாதன்	சென்னை	சென்னை
24	V. Koilpillai	Road (HD) Inspector	
25	சா. சுவாமிநாதன்	municipality	சென்னை
26	சா. சுவாமிநாதன்	municipality	சென்னை
27			



Date 24/06/14

Venue Cholepuram,

**Focus Group Discussion**

(Ashikapuram)

**PPC05-Preparation of DPR for Various Roads under TNRSP**

**SH-41(Rajaplayam-Tirunelveli)**

**VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS**

Sl No.	Name	Occupation	Signature
1	S. Gandhi	room rent	S. Gandhi
2	P. Sannugaray	cholapuram vice president.	P. Sannugaray
3	R. Sanjeevikumar.	panchayat secretary cholapuram panchayat.	R. Sanjeevikumar.
4	K. Balasubramanian	P. Soler	K. Balasubramanian
5	M. Rajaram	பிடிபிடிக்கிற	M. Rajaram
6	K. Narayana	பிடிபிடிக்கிற	K. Narayana
7	அ. சிவசுப்பிரமணியன்	பிடிபிடிக்கிற	அ. சிவசுப்பிரமணியன்
8	க. லக்ஷ்மீபதி	கூடு பிடி	க. லக்ஷ்மீபதி
9	A. E. Subramanian	பிடிபிடிக்கிற	A. E. Subramanian



Tamil Nadu Road Sector Project  
Highways Department GoTN



Date 24/01/14

Venue  
Cholapuram

## Focus Group Discussion

PPC05-Preparation of DPR for Various Roads under TNRSP

SH-41(Rajaplayam-Tirunelveli)

VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

SI No.	Name	Occupation	Signature
10	R. Chelba	Lab. B. 20000	R. Chelba
11	Arun	Real Estate	Arun
12	P. Rajendran	Business	P. Rajendran
13	M. Velmurugan M. Velmurugan	Business	M. Velmurugan
14	R. Rajendran	Business	R. Rajendran
15	V. S. S. S. S.	Business	V. S. S. S.
16	S. BALAKRISHNAN	POLICE	S. Balakrishnan
17	M. Jayaraman	POLICE	M. Jayaraman



Date 24/06/14

Venue Cholaburam

Focus Group Discussion

PPC05-Preparation of DPR for Various Roads under TNRSP

SH-41(Rajaplayam-Tirunelveli)

VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

Name: R. Anandhan

Address: Rajaplayam,

Phone No. 9788675856

Views/Suggestions

சாலை யோசனைகளை இடையூறுகள் போன்றவை  
ஏற்படுத்தாமல் கட்டுமானம் இடங்கடம், காலக்காலம் வரையில்  
கேள்யுள்ளவர்களுக்கு கட்டுமானம் ஏற்படாமல் இடங்கடம்  
ஏற்படுத்த வேண்டும். சாலை யோசனை பார்த்து, குடிநீர், மின்  
சார்பு ஏற்படுத்தாமல் கட்டுமானம் இடங்கடம், சாலை யோசனை  
கட்டுமானத்தை ஏற்படுத்தாமல் கட்டுமானம் இடங்கடம்.

சிறு R. Anandhan



Date 24.6.2014

Venue

Cholapuram

## Focus Group Discussion

PPC05-Preparation of DPR for Various Roads under TNRSP

SH-41(Rajaplayam-Tirunelveli)

VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS


Name: RAVI CHANDRAN, S.

Address: Saravana Stores, Murambur.

Phone No. 9442058882.

Views/Suggestions

Road extension starts from the centre of the existing road is appreciable. Try to avoid the inconveniences to the business community, in a shortest duration.

  
Ravi Chandran

Date 24/06/14

Venue  
Cholapuram

## Focus Group Discussion

PPC05-Preparation of DPR for Various Roads under TNRSP

SH-41(Rajaplayam-Tirunelveli)

VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

Name: ம. இராசரத்தினம்

Address: தி.வ. கி. மதுரைமேடு  
305 A/7 இராசரத்தினம், மதுரை  
செட்டியூர் அகலம் 626139  
இராசரத்தினம் (அ)  
மாநகராட்சி அலுவலகம்

Phone No. 9698127002

Views/Suggestions

1. திரு வடிக் குளம் அருகேயும் மூல சூழல் அமைக்கவேண்டும்.
2. திருவாரூர் சூழலுக்கும் மிக முக்கியமானதாக திரு வடிக் குளம்
3. நாமம் சென்று சைவம் அமைப்பது இடத்திற்கு திருவாரூர் அருகேயும் சைவம் முடியும்
4. திரு வடிக் குளம் அமைக்கும் போது வாய்பாடுகளும், மதுரை மக்களுக்கும், மதுரை செட்டியூருக்கும் திரு வடிக் குளம் அமைப்பதும் அமைப்பதும் கருப்பாக அமைப்பது வேண்டும் என்று திருவாரூர் பணியாளர்கள் கேட்டுக் கொள்கிறார்கள்
5. மிக முக்கியமான வாய்பாடுகளை அமைப்பதும் பாதைகளும் அமைப்பது வேண்டும் என்று திருவாரூர் பணியாளர்கள் கேட்டுக் கொள்கிறார்கள்.





SMEL

# Tamil Nadu Road Sector Project Highways Department GoTN

Date 24/6/14

Venue  
K. V. Kulpalai

## Focus Group Discussion

PPC05-Preparation of DPR for Various Roads under TNRSP

SH-41(Rajaplayam-Tirunelveli)

VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS /officials

Sl No.	Name	Occupation	Signature
1.	P. Geetha.	ADE(H) TNRSP Tirunelveli	P. Geetha
2.	Dr. R. Rajuvaran	Social Dept Speaker	[Signature]
3.	S. MURUGAIYAH	CHAIRMAN Panchayat Union Muvur.	S. Murugaiyah
4.	P. SANKARANARAYANAN.	B.D.O (VPE). Melaseeli + Panalva.	[Signature] 24.6.14
5.	N. Arumugam	BDO (BDO) Melaseeli + Panalva	[Signature] 24.6.14
6.	G. Arumugam	Block ENGINEER CPD	[Signature] 24.6.14
7.	S. Subbaraj	keelaseeli + Panalva	S. Subbaraj
8.	Dr. S. S. Srinivasan	Block Engineer CPD	Dr. S. S. Srinivasan
9.	Dr. Mahaveer Saini	Env. Engineer	[Signature]





Tamil Nadu Road Sector Project  
Highways Department GoTN



Date 24/06/14

Venue  
Kuzhulupatti

## Focus Group Discussion

PPC05-Preparation of DPR for Various Roads under TNRSP

SH-41(Rajaplayam-Tirunelveli)

VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

Sl No.	Name	Occupation	Signature
1	V. Srinivasan	Shopkeeper	[Signature]
2	D. Rajan	74P. Land -	[Signature]
3	P. Rajan	Rt. Meeh	P. Rajan
4	M. Kannan	Painter	M. Kan.
5	K. M. Ramachandran	Shopkeeper	K. M. Ramachandran
6	M. Thasanthan	study	M. Thasanthan
7	P. P. P. P.	[Signature]	P. P. P. P.
8	R. Rajan	Shopkeeper	[Signature]
9	M. S. S. S.	Shopkeeper	[Signature]

# Tamil Nadu Road Sector Project Highways Department GoTN



Date

Venue

## Focus Group Discussion

PPC05-Preparation of DPR for Various Roads under TNRSP

SH-41(Rajaplayam-Tirunelveli)

VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

Sl No.	Name	Occupation	Signature
	M. Velayutham	Business	M. Velayutham
	V. Jeyaraj	Business	V. Jeyaraj
	S. Paul Bay	Business	S. Paul Bay
	V. Jeyaraj	Business	V. Jeyaraj
	L. Jagan	Business	L. Jagan

# Tamil Nadu Road Sector Project Highways Department GoTN



Date

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## Focus Group Discussion

PPC05-Preparation of DPR for Various Roads under TNRSP

SH-41(Rajaplayam-Tirunelveli)

VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

Sl No.	Name	Occupation	Signature
	M. Velladurai	T.N.E.B. Red	
	T. Hilaraswami Sami	Ex President Vails	
	V. Subramanian	+2	
	R. Srinivasan	TRK PARTI	
	P. Srinivasan	TRK PARTI	
	V. Srinivasan	TRK PARTI	
	A. Srinivasan	TRK PARTI	
	A. Senthil Kumar	B.A.	
	A. Srinivasan	Business	

Tamil Nadu Road Sector Project  
Highways Department GoTN



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Covvilpalati

## Focus Group Discussion

PPC05-Preparation of DPR for Various Roads under TNRSP

SH-41(Rajaplayam-Tirunelveli)

VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

SI No.	Name	Occupation	Signature
	S.ivelraj	B.E	
	S.Vijaya Kumar	B.Sc	
	<del>P. S. S. S. S. S.</del> Muthiel	S.S.L.C	
	<del>A. S. S. S. S.</del>	+2	
	P. Ayiyar	மாண்புமிகு புள்ளித் துறை	P. Ayiyar 9659605101
	C. Venkateshwarar	S.S.L.C	
	P. Sundaram	B.Sc	
	<del>V. S. S. S. S.</del>	5	.
	S. Kandasamy	M.A	



# Tamil Nadu Road Sector Project Highways Department GoTN



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## Focus Group Discussion

PPC05-Preparation of DPR for Various Roads under TNRSP

SH-41(Rajaplayam-Tirunelveli)

VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

Sl No.	Name	Occupation	Signature
10	P. KUMAR	PRIVATE	
11,	M. Daniel Ponnudurai	Printer	M. Daniel P.
12.	S. Pradi	Studio	S. Pradi
13	S. Ganesh	Studio	S. Ganesh
14	S. Subbiah Pandi as	PARAURDA MILITARY	S. Subbiah
15	K. Muthu	Textile shop.	K. Muthu
16	P. ATHISAYARAJ	AS. MAHAL.	P. Athi
17.	S. S. S. S.		
18	S. Muthu Pandi.		

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SH-41(Rajaplayam-Tirunelveli)

VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

Sl No.	Name	Occupation	Signature
19	செல்வராஜ், ஜி.பி.பி.	சென்னை ஸ்டாப்கிங்	
20	M. THANGARAS.	Business	
21.	S. SASINDRAN	Farmer	
22.	S. சிவசுந்தரன்	சென்னை ஸ்டாப்கிங்	
23	G. Thangadurai Pazhavadalichambam	Textile contractor (A&A)	
24	செ.சுப்பிரமணியன்	சென்னை ஸ்டாப்கிங் Keshivelam Vandanshan	
25	C. Paulraj	Pic. President	
26.	செ.சுப்பிரமணியன்	சென்னை ஸ்டாப்கிங்	
27	A. Raju	சென்னை ஸ்டாப்கிங்	

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SH-41(Rajaplayam-Tirunelveli)

VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

Sl No.	Name	Occupation	Signature
	D. Christopher	TN. Police	
	R. Mahesh Kumar	TN. Police	
	K. MAAMALARAJ	Yarnari	
	T. Matharaj		
	A. Rajivendra	vayaliniitta	
	P. ANTONY	vayaliniitta	
	M. RAMASAMY	Former	
	M. Rajivendra	vayaliniitta	







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SH-41(Rajaplayam-Tirunelveli)

VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

Name:

K. RAMAR.

Address:

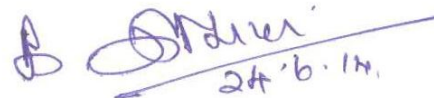
Zonal Deputy Tahsildar  
Sankarankovil.

Phone No.

94421-60564.

Views/Suggestions

To improve the road development the co-operation of the public is essential. This is welcomed.

  
24.6.14.





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PPC05-Preparation of DPR for Various Roads under TNRSP

SH-41(Rajaplayam-Tirunelveli)

VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

Name:

ச. சந்திர சேகர்

Address:

1/4 ரெயன் ரோடு , பனாபலா சந்திராபுரம்

Phone No.

04636-270136

Views/Suggestions

சீமென்ட் கால்வாய் கட்டுவதில் பணிகள்  
பனாபலா சந்திராபுரம் காலத்தில் அகப்படும் பகுதிகளில்  
கிடைக்கக்கூடிய - சீமென்ட் பனாபலா சந்திராபுரம் இயங்கிய,  
சீமென்ட் காலவாய் கட்டுவதில் காலம் 60 நாட்கள் காலமாக  
கிடைக்கக்கூடிய - சீமென்ட் காலவாய் கட்டுவதில்  
காலவாய் கட்டுவதில் காலவாய் கட்டுவதில்  
காலவாய் கட்டுவதில் காலவாய் கட்டுவதில்  
காலவாய் கட்டுவதில் காலவாய் கட்டுவதில்  
காலவாய் கட்டுவதில் காலவாய் கட்டுவதில்  
காலவாய் கட்டுவதில் காலவாய் கட்டுவதில்  
காலவாய் கட்டுவதில் காலவாய் கட்டுவதில்

சந்திர சேகர்  
24/6/2014



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PPC05-Preparation of DPR for Various Roads under TNRSP

SH-41(Rajaplayam-Tirunelveli)

VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

Name: G. Thiruvethiyar  
Address: 1/12A/5A, Salem Road,  
Kottalandy.

Phone No. 94434 96974

Views/Suggestions: செவ்வாடு மீ.

① சாலைவேலம் அடுத்த பகுதி, 100 கால்களில்  
பெரிய அளவில், அங்குள்ள பெரிய  
கட்டிடங்கள் பெரிய அளவில் கட்டப்படும்  
மேலும் சாலைவழி கட்டப்படும் போது  
அங்குள்ள கடைகளை சீரமைக்க சிபார்சு.

② கட்டிடங்கள் கட்டும் போது  
கட்டிடங்களை கட்டும்.

*[Signature]*  
24/11/14

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## Focus Group Discussion

PPC05-Preparation of DPR for Various Roads under TNRSP

SH-41(Rajaplayam-Tirunelveli)

VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

Name: C. PAULRAJ, Killage Pu. President

Address: 10/155A, Chinnachangy Nallem Massey  
Keevelam Vandana Itr, Sambarankovil

Phone No. 9486556939

Views/Suggestions

Improvements Roads, membalam at the  
cat-bridge.  
K-v-ndw village,

Tamil Nadu Road Sector Project  
Highways Department GoTN



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Maman

PUBLIC CONSULTATION  
~~Focus Group Discussion~~

PPC05-Preparation of DPR for Various Roads under TNRSP

SH-41(Rajaplayam-Tirunelveli)

VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

Sl No.	Name	Occupation	Signature
1	C. Kainyer		C. Kainyer
2	PAULRAJ-S	Soculwoker (N90)	PA
3	S. G. G. G. G. G.	Coopm.	
4	P. S. S. S. S.	U m m m m m	
5	C. K. K. K. K.	SSI manir	C. K. K. K. K.

Tamil Nadu Road Sector Project  
Highways Department GoTN



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Manjeri

~~Focus Group Discussion~~

PPC05-Preparation of DPR for Various Roads under TNRSP

SH-41(Rajaplayam-Tirunelveli)

VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

Sl No.	Name	Occupation	Signature
14. 6	A. L. Manoj	வியாபாரி Longer	A. Manoj
17. 7	S. CHANDRASEKARAN	INSERT SECTOR	S. Chy
12 8	P. Anand	பொருள் வியாபாரி	P. Anand
18 9	N. S. S.	வாடகை	N. S. S.
15 10	P. Marimuthu	Bees	P. Marimuthu
16 11	L. Ramesh	இயக்குநர்	L. Ramesh
17. 12	ச. சிவசுந்தரன்	வாடகை	1
18 13	S. S. S.		
19	P. DANIEL	பொருள் வியாபாரி	P. Daniel

21 S. S. S.

S. S. S.



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## Focus Group Discussion

PPC05-Preparation of DPR for Various Roads under TNRSP

SH-41(Rajaplayam-Tirunelveli)

VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

Sl No.	Name	Occupation	Signature
1	K. சித்திரிகாண்டி	உடைக்கிட்டு உயர்நாட்டி	K. Subbiah
2	A. சிவசாமி	மாநகராட்சி	A. Raju
3	A. ஜயசந்திரன்	சாலைக்கான உயர்நாட்டி	A. Jayachandran
4	செல்வசாமி	உயர்நாட்டி	
5	M. சிவசாமி	கடை	செல்வசாமி
6	C. பாலசுப்பிரமணியன்	உயர்நாட்டி கடை	C. Palisamy
7	ஜி. சி.	கடை	ஜி. சி.
8	M. Rehana	கடை	
9	M. Rajesh	கடை	M. Rajesh
10	K. Gopalan		

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VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

Sl No.	Name	Occupation	Signature
	S. MUTHUKOMAR		S. Muthukumar
	Jc. Chellappa		Jc. Chellappa
	D. ARUMUTHU		D. Arumuthu
	v. kani raja		v. Kani Raja
	Rajamanickam		Raman
	P. Selva		P. Selva
	S. Shanmugam		S. Shanmugam
	Subramanian		Subramanian
	K. Len - Shanmugam		K. Len Shanmugam

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VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

Sl No.	Name	Occupation	Signature
	P. Anni.		P. Anni
	S. S. Anand		S. S. Anand
	R. Santhapadi		R. Santhapadi
	Shirif		Shirif
	P. Karthikeyan	Business	P. Karthikeyan
	N. Rajendran		N. Rajendran
	K. Anand	Business	K. Anand
	S. Anand	S. Anand	S. Anand
	P. Anand		P. Anand

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Mannur

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PPC05-Preparation of DPR for Various Roads under TNRSP

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VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

Sl No.	Name	Occupation	Signature
1	M. D. P. [Handwritten]	[Handwritten]	M. Perumal
2	P. [Handwritten]	[Handwritten]	[Handwritten]
3	M. [Handwritten]	[Handwritten]	[Handwritten]
4	V. [Handwritten]	[Handwritten]	[Handwritten]
5	P. Rajendran	[Handwritten]	[Handwritten]
6	F. [Handwritten]	[Handwritten]	[Handwritten]
7	[Handwritten]	[Handwritten]	[Handwritten]
8	[Handwritten]	[Handwritten]	[Handwritten]
9	K. P. Williams.	Business.	[Handwritten]



Date 22/06/2014

Venue

## Focus Group Discussion

PPC05-Preparation of DPR for Various Roads under TNRSP

SH-41(Rajaplayam-Tirunelveli)

## VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

Name: A. JEYACHANDRAN

Address: President (Kannarpatti, Panchayath)  
1/22B West St Kannarpatti.

Phone No. 9487301317

## Views/Suggestions

சாண்ட விரிவாக்கம் செய்வது கட்டுக்கட்டு  
~~செய்ய~~ கட்டுக்கட்டு நடைமுறை யாகக் கொடுக்க வேண்டும். சாண்டவிரி  
 உள்ம யானவர்கள் விரிவாக்க கட்ட படவேண்டும்  
 கோட்டியை மேலே (அகலி) உள்ம குடிக்க  
 அகற்றப்படவேண்டும், சில சமயங்களில் அகற்ற  
 தேர் கோட்டை # அகலக்க வேண்டும்.  
 கட்டு கட்டு வாகனங்களுக்கு ஏன் வந்த  
 அகலக்க வேண்டும்

இவ்வாறு

A. Jeyachandran  
President, Kannarpatti.





Tamil Nadu Road Sector Project  
Highways Department GoTN



Date 24.06.2017

Venue Manu

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SH-41(Rajaplayam-Tirunelveli)

VIEW OF THE AFFECTED SHOP KEEPERS/SHOP OWNERS/ TENENTS

Name: M. Arumegam  
Address: 410, Church St  
Sankaragad

Phone No. 9487601166.

Views/Suggestions

சாலை கட்டுமானம் மூலமாக சாலை அமைப்பு  
தொடர்பாகவே தான் சாலைகளை மூலம் கட்டு  
பணிகளில் சம்பந்தம் வேண்டும். சாலை கட்டு  
தொடர்பாக சாலை கட்டுமானம் மூலமாக  
கட்டுமானம் மூலமாக சாலை கட்டுமானம்  
கட்டுமானம் மூலமாக சாலை கட்டுமானம்  
கட்டுமானம் மூலமாக சாலை கட்டுமானம்  
கட்டுமானம் மூலமாக சாலை கட்டுமானம்

செய்து  
செய்து  
செய்து



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

### APPENDIX 7.1: SPECIES WISE AND GIRTH WISE DETAILS OF IMPACTED TREES IN CORRIDOR OF IMPACT

#### Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road

(km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44 : Tree >30 cm girth size

LHS							Local Name of Tree	Scientific Namer of Tree	RHS						
Girth Size (cm)									Girth Size (cm)						
30-60	60-90	90-120	120-150	150-180	180-210	Above 210			30-60	60-90	90-120	120-150	150-180	180-210	Above 210
1						1	Aalamaram	<i>Ficus bengalensis</i>					1		
	2		1				Arasu	<i>Ficus religiosa</i>	1				1		
1							Ashoka	<i>Polyalthia longifolia</i>							
		1					Atti	<i>Ficus racemosa</i>							1
							Badam Tree	<i>Terminalia kadappa</i>	1						
		1		2	1		Cotton	<i>Ceiba pentandra</i>							
							Illavan panchi	<i>Ceita petendra</i>		1		1			
	1						Kaju Badam	<i>Anacardium occidentale</i>							
4	5	1					Kodaikaapulli	<i>Inga dulcis</i>		5				1	
							Konnai	<i>Cassia fistula</i>	1		2				
							Konrai	<i>Delonix regia</i>		3	1	3	2		
							Lemon	<i>Citrus sp.</i>	1						
								<i>Morinda tomentosa</i>							
4	3	1					Manjanathi		7	1					
	1						Murungai	<i>Moringa oleifera</i>	1	1					
		1					Naval	<i>Eugenia argentea</i>							
								<i>Azadirachta indica</i>							
38	35	11	9	8	3	5	Neem		18	22	14	18	6	5	3
2		5		1			Neer karuvai	<i>Prosopis juliflora</i>		1		4			
1							Nettalinkam	<i>Polyalthia</i>	4	1					



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

LHS							Local Name of Tree	Scientific Namer of Tree	RHS							
Girth Size (cm)									Girth Size (cm)							
30-60	60-90	90-120	120-150	150-180	180-210	Above 210			30-60	60-90	90-120	120-150	150-180	180-210	Above 210	
								<i>longifolia</i>								
6	18	44	26	21	7	4	Odai	<i>Acacia planiforns</i>	8	30	29	23	15	3	1	
	1	17	27	11	4		Palmyra palm	<i>Borassus flabellifer</i>		8	13	12	3		1	
9	37	71	48	38	22	16	Pulee	<i>Tamarindus indica</i>	9	37	42	39	34	22	16	
5	3	3					Pungan	<i>Pongamia pungan</i>	4	2						
	1						Puvarasu	<i>Thespesia populnea</i>	1		1					
							Savukku	<i>Casurina equisetifolia</i>	1	1						
1							Soundal	<i>Leucaenia leucocaphala</i>								
22	17	4	1				Tekku	<i>Tectona grandis</i>	1							
	21	10	1			1	Thenna Tree	<i>Cocos nucifera</i>		1						
			1				Usil	<i>Albizia amara</i>					1			
4	4	4	1	1	1		Vagai	<i>Albizia lebbeck</i>		3		1	3	1	3	
		1	2				Vatha	<i>Macaranga peltata</i>								
						1	Vatha narayanam	<i>Delonix elata</i>	1							
1							Vilvam	<i>Aegle marmelos</i>								
<b>99</b>	<b>149</b>	<b>175</b>	<b>117</b>	<b>82</b>	<b>38</b>	<b>28</b>			<b>59</b>	<b>117</b>	<b>102</b>	<b>101</b>	<b>66</b>	<b>32</b>	<b>25</b>	
<b>Total no. of trees in LHS</b>							<b>688</b>		<b>Total no. of trees in RHS</b>							<b>502</b>



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### Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road

(km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44: Tree <=30 cm girth size

Up to 10 cm	10 – 30 cm	Local Name of Tree	Scientific Names of Tree	Up to 10 cm	10 – 30 cm
LHS				RHS	
	1	Badam	<i>Terminalia kadappa</i>		
	1	Elanthal Fruit	<i>Ziziphus jujuba</i>		
	2	Kodikapuli	<i>Pithecollobium dulce</i>		
	6	Manjanathi	<i>Morinda tomentosa</i>		7
	1	Mathulai	<i>Punica granatum</i>		
	1	Murungai	<i>Moringa oleifera lank</i>		
		Naaval	<i>Syzygium cumini</i>		1
3	29	Neem	<i>Azadirachta indica</i>		10
	3	Nettalingam	<i>Polyalthia longifolia</i>		
1	15	Poonga	<i>Pongamia pungan</i>	5	18
	1	Poovarasu	<i>Thespesia populnea</i>		1
	6	Tamarind	<i>Tamarindus indica</i>	1	7
	1	Thekku	<i>Tectona grandis</i>		
		Udai	<i>Accacia planiference</i>		1
	2	Vaagai	<i>Albizia labac</i>		
	1	Vasamadaki	<i>Delonix elata</i>		
1	11	Vatha Narayanan	<i>Delonix elata</i>		19
5	81			6	64
86		<b>Total No. of Trees</b>		70	



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**Nanguneri - Bharatavaram Ovari Road upto ECR Junction (km 0/000 to km 35/200), Section of SH 89 : Tree >30 cm girth size**

LHS							Local Name of Tree	Scientific Namer of Tree	RHS						
Girth Size (cm)									Girth Size (cm)						
30-60	60-90	90-120	120-150	150-180	180-210	Above 210			30-60	60-90	90-120	120-150	150-180	180-210	Above 210
1	2	1	1	1	2	1	Aalamaram	<i>Ficus bengalensis</i>	2						
1	1	1	1	1		2	Arasu	<i>Ficus religiosa</i>	1	1					
				1			Atti	<i>Ficus racemosa</i>					1		
1							Chinnapu	<i>Chinnapu</i>							
							Eucalyptus	<i>Eucalyptus alba</i>	5						
							Kaju Badam	<i>Anacardium occidentale</i>	1	2	3				
2							Konnai	<i>Delonix regia</i>	1	2	1	1			
							Konrai	<i>Delonix regia</i>	3	1	2				
3	4						Malai vembu	<i>Melia dubia</i>							
		1					Malaipoovarasu	<i>Biscofia javanica</i>							
1	2						Mango	<i>Mangifera indica</i>							
1	5					1	Manjanathi	<i>Morinda tomentosa</i>	1	2	1				
1							Manjapoo pavazha malli	<i>Nyctanthes arbor-tristis</i>							
2	9	2					Murungai	<i>Moringa oleifera</i>	2						
			1				Naaval Pazham	<i>Syzygium cumini</i>							
2							Nandiavattai	<i>Tabernaemontana divartica</i>							
2		1					Naval	<i>Eugenia argentea</i>	2						
69	46	19	7	3	2	1	Neem	<i>Azadirachta indica</i>	43	37	14	5	1	1	4
1	1					2	Neer karuvai	<i>Prosopis juliflora</i>	17	6	1				
							Nelli	<i>Phyllanthus</i>	1						





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LHS							Local Name of Tree	Scientific Namer of Tree	RHS							
Girth Size (cm)									Girth Size (cm)							
30-60	60-90	90-120	120-150	150-180	180-210	Above 210			30-60	60-90	90-120	120-150	150-180	180-210	Above 210	
								<i>emblica</i>								
	1						Neermarudu	<i>Terminalia arjuna</i>								
3							Nettalinkam	<i>Polyalthia longifolia</i>								
8	1				2	1	Odai	<i>Acacia planiforns</i>	1		2					
	3	15	6	2			Palmyra palm	<i>Borassus flabellifer</i>	1	5	18	24	7	2		
3	2			2			Pulee	<i>Tamarindus indica</i>	2	7	6	1		2	1	
							Pulla	<i>Kydia calycina</i>	1	4						
9	2						Pungan	<i>Pongamia pungan</i>	9	3						
8	13	3	2		1		Puvarasu	<i>Thespesia populnea</i>	6	11	6	3	1			
5				1			Rohida	<i>Tecomella undulata</i>	14	6						
							Savukku	<i>Casurina equisetifolia</i>	2							
3	1					6	Tekku	<i>Tectona grandis</i>		1						
	1	35	14				Thenna Tree	<i>Cocos nucifera</i>			29	17				
2	1	3		1	1	5	Usil	<i>Albizia procera</i>								
							Uthian	<i>Lannea coromandelica</i>	1	2	2	2	1	2	6	
		1	1				Vagai	<i>Albizia labbeck</i>	5	2					4	
3	2		1				Vatha narayanam	<i>Delonix elata</i>	1	2		3				
<b>131</b>	<b>97</b>	<b>82</b>	<b>34</b>	<b>12</b>	<b>11</b>	<b>16</b>			<b>122</b>	<b>94</b>	<b>85</b>	<b>56</b>	<b>11</b>	<b>7</b>	<b>15</b>	
<b>Total no. of trees in LHS</b>							<b>383</b>		<b>Total no. of trees in RHS</b>							<b>390</b>



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**Nanguneri - Bharatavaram - Uvari Road (km 0/000 to km 35/200), Section of SH 89: Tree <=30 cm girth size**

Up to 10 cm	10 – 30 cm	Local Name of Tree	Scientific Name of Tree	Up to 10 cm	10 – 30 cm
LHS	RHS				
	3	Arasas	<i>Ficus religiosa</i>		2
	3	Badam	<i>Terminalia kadappa</i>		2
	1	Baniyan	<i>Ficus benghalensis</i>		
	7	Manjanathi	<i>Morinda tomentosa</i>		2
	1	Murungai	<i>Moringa oleifera Lank</i>		
1	32	Neem	<i>Azadirachta indica</i>		30
	4	Nettalingam	<i>.Polyalthia longifolia</i>		
	1	Poo Maram	<i>Thalpo</i>		
	12	Poonga	<i>Pongamia pungan</i>		3
	6	Poovarasu	<i>Thespesia populnea</i>	1	5
		Sowkku	<i>Casurina equisetifolio</i>		10
	1	Tamarind	<i>Tamarindus indica</i>		1
	3	Thalpo	<i>Thalpo</i>		2
	1	Usil	<i>Albizia amara</i>		
	6	Vasamadaki	<i>Delonix elata</i>		
1	81			1	57
82		<b>Total No. of Trees</b>		58	



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### Rajapalayam - Sankarankoil – Tirunelveli

**(km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41: Trees>30cm girth size**

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	<i>Sesbania grandiflora</i>								
	2	2	1	1	1	11	18	Ala Maram	<i>Ficus bengalensis</i>	2	2	0	3	1	2	18	28
1	1	1					3	Aarasamaram	<i>Ficusr eligiosa</i>	5	3	2	0	2	0	2	14
							0	Arjun	<i>Terminalia arjuna</i>						1	1	2
							0	Athi	<i>Ficus racemosa</i>						1		1
5							5	Badam	<i>Terminalia catappa</i>	2							2
							0	Christmas tree	<i>Picea sp.</i>	1							1
	9						9	Thennai tree	<i>Cocos nucifera</i>		3	3	0	1	1	0	8
	5			1			6	Cotton tree	<i>Ceibapentandra</i>								
1							1	Guava	<i>Psidium guajava</i>	1							1
1							1	Itchu(Flus)									



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

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		2				3	Kakaipalai	<i>Micromelum minutum</i>								
1							1	Kodukkapuli	<i>Murraya koenigii</i>	1	1	1	0	0	0	0	3
30	20	4	5	2		2	63	Malai Vembu	<i>Melia azedarach</i>	1	2						3
						3	3	Mamaram	<i>Mangifera indica</i>								
68	7	1		1		1	78	Manjanathi	<i>Morinda tomentosa</i>	36	15	4	2	0	1	1	59
7	2						9	Murungai	<i>Moringa oleifera Lank</i>	5	3	0	1	0	0	0	9
2							2	Naval	<i>Eugenia argentea</i>	4	2	0	0	0	0	0	6
2							2	Neerkaruvai	<i>Prosopis juliflora</i>	3	5	1	4	0	0	0	13
367	103	46	10	6	9	12	553	Neem	<i>Azadirachta indica</i>	408	186	72	37	17	11	25	756
						1	1	Neermarudhu	<i>Terminalia arjuna</i>								
1							1	nellikai	<i>Phyllanthus emblica</i>								
2							2	Nettalingam	<i>Polyalthia ongifolia</i>								



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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	61	182	27	2	2	0	276	Palmyra palm	<i>Borassus flabellifer</i>	0	61	263	28	3	0	0	355
							0	Pinari	<i>Ailanthus excelsa</i>				1				1
		1					1	Puvarasu	<i>Thespesia populnea</i>	1							1
71	19	9	1	2	0	0	102	Pungan	<i>Pongamia pungan</i>	65	12	4	9	3	7	10	110
1							1	Savukku	<i>Casurina equisetifolia</i>								
20	9	6	6	0	2	3	46	Siridam/Vagai	<i>Albizia lebbek</i>	22	37	23	10	4	5	3	104
37	61	66	50	22	36	101	373	Pulee	<i>Tamarindus indica</i>	35	33	54	40	36	38	104	340
2	1						3	Tekku	<i>Tectona grandis</i>	6	0	0	1	0	0	0	7
25	40	21	4	5	4	0	99	Udai /Odai	<i>Acacia planifrons</i>	7	33	35	18	10	3	2	108
11	8	46	46	15	15	32	173	Usil	<i>Albizia procera</i>	5	13	60	25	15	10	17	145
							0	Vathanarayan	<i>Delonix elata</i>		2	0	1	0	2	0	5
	1						1	vilvam/Velva	<i>Aegle marmelos</i>	2	2						4





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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
								m									
658	350	385	152	57	69	166	1837			612	415	522	180	92	82	183	2086

**Rajapalayam - Sankarankoil – Tirunelveli**

**(km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41: Tree<30cm girth size**

LHS		Local Name	Scientific Name	RHS	
<=10	10-30			10-30	<=10
1	2	Badam			
15	43	Manjanathi		18	8
125	142	Neem		98	32
2		Padam			
19	49	Pungan	<i>Pongamia pungan</i>	28	3
12	10	Pulee	<i>Tamarindus indica</i>	5	
2	2	Vagai	<i>Albizia lebbeck</i>	1	
	1	Usil	<i>Albizia amara</i>		4
	1	Akatthi	<i>Sesbania grandiflora</i>		
	1	Kodukkapuli	<i>Murraya koenigii</i>	1	
	1	Kodukkapuli	<i>Murraya koenigii</i>		
	1	Mala Vagai			
	2	Naval	<i>Eugenia argentea</i>	1	



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LHS		Local Name	Scientific Name	RHS	
<=10	10-30			10-30	<=10
	2	Nettalingam	<i>Polyalthia ongifolia</i>		
	1	nellikai	<i>Phyllanthus emblica</i>		
	2	Palmyra palm	<i>Borassus flabellifer</i>	2	2
	2	Panna poo			
	3	Savukku	<i>Casurina equisetifolia</i>		
	1	Odai	<i>Acacia planifrons</i>	2	
		Teak			1
		Aarasamaram	<i>Ficus religiosa</i>	1	
		Avathi		3	
		Puvarasu	<i>Thespesia populnea</i>	1	
<b>176</b>	<b>266</b>			<b>161</b>	<b>50</b>



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## APPENDIX 8.1: GUIDELINES FOR MONITORING PROGRAM

### 1.1 Environmental Monitoring Plan

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

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

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

#### 1.1.1 Performance Indicators

Physical, biological and environmental management components identified as of particular significance in affecting the environment at critical locations have been suggested as Performance Indicators (PIs). The Performance Indicators shall be evaluated under three heads as:

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

The Performance Indicators and monitoring plans prepared for *Project Implementation* are presented in **Table 1.1**.

**Table 1.1: Performance Indicators for Project Implementation**

Sl. No.	Indicator	Details	Stage	Responsibility
<b>A</b>	<b>Environmental Condition Indicators and Monitoring Plan</b>			
1	Air Quality	The parameters to be monitored, frequency and duration of monitoring as well as the locations to be monitored will be as per the Monitoring Plan prepared ( <b>Refer Table 1.2</b> )	Pre Construction	Contractor through approved monitoring agency
			Construction	
			Operation	TNRSP through approved monitoring agency
2	Noise Levels	The parameters to be monitored, frequency and duration of monitoring as well as the locations to be monitored will be as per the Monitoring Plan prepared ( <b>Refer Table 1.2</b> )	Pre Construction	Contractor through approved monitoring agency
			Construction	
			Operation	TNRSP through



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Sl. No.	Indicator	Details	Stage	Responsibility
				approved monitoring agency
3	Water Quality		Pre Construction	Contractor through approved monitoring agency
			Construction	
			Operation	TNRSP through approved monitoring agency
4	Soil Quality		Pre Construction	Contractor through approved monitoring agency.
			Construction	
			Operation	TNRSP through approved monitoring agency
<b>B</b>	<b>Environmental Management Indicators and Monitoring Plan</b>			
1	Construction Camps	Location of construction camps have to be identified and parameters indicative of environment in the area has to be reported	Pre-construction	Contractor
2	Borrow Areas	Location of borrow areas have to be identified and parameters indicative of environment in the area has to be reported. Refer <b>Guidelines 8.3</b> ( <i>Guidelines for Borrow Areas Management</i> ) for the identified Borrow Areas.	Pre-construction	Contractor
3	Tree Cutting	Progress of tree removal marked for cutting is to be reported	Pre-construction	District Collector to PU
4	Tree Plantation	Progress of measures suggested as part of the strategy is to be reported	Construction	District Collector
<b>C</b>	<b>Management &amp; Operational Performance Indicators</b>			
1	Survival Rate of Trees	The number of trees surviving during each visit will be compared with the number of saplings planted	Operation	District Collector / TNRSP
2	Status Regarding Rehabilitation of Borrow Areas	The PU will undertake site visits to determine how many borrow areas have been rehabilitated in line with the landowner's request and to their full satisfaction.	Operation	The TNRSP will be responsible for a period of three years.
3	Soil Erosion	Visual monitoring and operation inspection of embankments will be carried out once in three months.	Operation	The TNRSP will be responsible for a period of three years.

### 1.1.2 Monitoring Parameters and Standards

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

#### Ambient Air Quality Monitoring (AAQM)

The air quality parameters viz: Sulphur Dioxide (SO<sub>2</sub>), Oxides of Nitrogen (NO<sub>x</sub>), Carbon Monoxide (CO), Particulate Matter (PM<sub>10</sub> & PM<sub>2.5</sub>), shall be regularly monitored at identified locations from the start of the construction activity. The air quality parameters shall be monitored in accordance with the National Ambient Air Quality Standards as given in



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**Appendix 4.2a.** The duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed out in the Environmental Monitoring Plan **Table 1.2** and specific details in chapter on baseline environment.

### **Water Quality Monitoring**

Water quality parameters such as pH, BOD, COD, DO coliform count, total suspended solids, total dissolved solids, Iron, etc. shall be monitored at all identified locations during the construction stage as per standards prescribed by Central Pollution Control Board and Indian Standard Drinking water specifications IS 10500: 2012, presented in **Appendix 4.2b**. The duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed out in the Environmental Monitoring Plan **Table 1.2** and specific details in chapter on baseline environment.

### **Noise Quality Monitoring**

The noise levels shall be monitored at already designated locations in accordance with the Ambient Noise Quality standards given in **Appendix 4.2c**. The duration and the noise pollution parameters to be monitored and the responsible institutional arrangements are detailed in the Environmental Monitoring Plan **Table 1.2** and specific details in chapter on baseline environment.

#### **1.1.3 Monitoring Plans for Environment Condition**

For each of the environmental components, the monitoring plan specifies the parameters to be monitored; location of the monitoring sites; frequency and duration of monitoring. The monitoring plan also specifies the applicable standards, implementation and supervising responsibilities. The monitoring plan for the various environmental condition indicators of the project in construction and operation stages is presented in **Table 1.2**.

Monitoring plan does not include the requirement of arising out of Regulation Provision such as obtaining consent for plant site operation.





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**Table 1.2: Environmental Monitoring Plan**

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
Air	Construction	PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> NO <sub>x</sub> , CO	Sampler to be located 50 m from the plant in the downwind direction. Use method specified by CPCB for analysis	NAAQS, 2009	Four seasons per year for three years	24 hours Sampling	Along the road Hot mix / batching plant	Contractor through NABL approved monitoring agency
	Operation						Along the road	EMU-TNRSP
Water	Construction	All essential characteristics and some of desirable characteristics as decided by the Environmental Specialist of the CSC and TNRSP	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)	Four seasons per year for three years	Grab Sampling	Along the road	Contractor through NABL approved monitoring agency
	Operation						Surface water sources	EMU-TNRSP
Noise	Construction	Noise levels on dB (A) scale	Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement  Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement	Noise Rules, 2000	Four seasons per year for three years	Leq in dB(A) of day time and night time	Along the road Hot mix / batching plant	Contractor through NABL approved monitoring agency
	Operation						Along the road	EMU-TNRSP



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Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
<b>Soil</b>	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	Four seasons per year for three years	Grab Sampling	Along the road Hot mix / batching plant	Contractor through NABL approved monitoring agency
	Operation				Two seasons in a year for two years		Along the road (refer table no 5.3B)	EMU-TNRSP
<b>Borrow Area</b>	Construction	As per Guidelines	Visual Observation	-	Once in a month	-	Borrow area location	Contractor
<b>Tree Plantation</b>	Operation stage	As per Rehabilitation Plan			Quarterly	-	Areas where plantation is being done	EMU-TNRSP



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## ENVIRONMENTAL MONITORING LOCATIONS

In addition of the critical locations selected during design stage, the environmental monitoring will also be done at the construction camp site and any other plant site during construction stage. List of critical locations for carrying out monitoring is presented in **Chapter 4: Baseline Environment**.

## REPORTING PROCEDURES

Mitigation and enhancement measures adopted in the final design have been identified in the contract documents and Bill of quantities so that performance and completion is effective. The periodic site visits of the EO/Engineer/EE of the PU will keep a record of progress as well as the site-specific EMP implementation records. The frequent meeting of the EO/Engineer with the contractors will ensure any information and communication gap with regard to the construction phase environmental management at construction site; labour and construction camps quarry and borrow areas etc. It is necessary that the EO/Engineer should visit the sites for evolving a concept for the Environmental Management with regard to the siting of various construction requirements. The various reporting guidelines and arrangements are presented in Chapter 5 of EMP, Volume VII, Part A (II).



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## APPENDIX 8.2: GUIDELINES FOR AGGREGATE QUARRY MANAGEMENT

The Contractor will finalize the locations from the list given by DPR Consultant's for procuring materials. The Contractor shall establish a new quarry only with the prior consent of the EO only in cases when: (i) Lead from existing quarries is uneconomical and (ii) Alternative material sources are not available. The Contractor shall prepare a Redevelopment Plan for the quarry site and get it approved by the EO/Supervision Consultant.

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

Operation & redevelopment plan (if a new quarry is opened).....

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

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

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

### CONSTRUCTION STAGE

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

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

### QUARRY OPERATIONS INCLUDING SAFETY

- Overburden shall be removed and disposed inline with Guidelines for Debris Disposal Site and management giving in **Appendix-8.4**
- During excavation, slopes shall be flatter than 20 degrees to prevent their sliding. Incases where quarry strata are good and where chances of sliding are less this restriction can be ignored.



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- iii) In case of blasting, procedure and safety measures shall be taken as per The Explosive Rules, 1983
- iv) The contractor shall ensure that all workers related safety measures shall be done as per guidelines for Workers and Safety attached as **Appendix-8.15**
- v) The contractor shall ensure maintenance of crushers regularly as per manufacturer's recommendation.

Topsoil will be excavated and preserved during transportation of the material measures shall be taken to minimize the generation of dust and prevent accidents.

The EO and the Supervision Consultant shall review the quarry site for the management measures during quarry operation, including the compliance to pollution norms.

### **POST CONSTRUCTION STAGE**

The Contractor shall restore all haul roads constructed for transporting the material from the quarries to construction site to their original state.

The EO and the Supervision Consultant shall be entrusted the responsibility of reviewing the quarry site for the progress of implementation of Redevelopment Plan. These shall include the following two cases;

- Redevelopment of quarries opened by the Contractor for the project
- Redevelopment of existing quarries operated by other agencies

In the first case, the Contractor shall be responsible for the Redevelopment Plan prior to completion after five years, during the defect liability period. The EO shall be responsible for reviewing this case of redevelopment prior to the issuing the defect liability certificate.

In the second case, the redevelopment of exhaust quarry shall be the responsibility of the agency providing the permit to ensure the implementation of Redevelopment Plan.





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**Case I-** For each aggregate-cum-quarry sand source, the plan should contain a separate section. If the quarry is an existing one and is managed directly by the Contractor, the plan should contain the following:

Sr. No.	Item	Unit	Details	Remarks by SC/EO, if any
1.	Name / identity of the location			
2.	Nearest project road chainage.			
3.	Name of the owner			
4.	Area involved	Cum		
5.	Arrangement with the owner (agreement with land owner should be attached as an Annexure)			
6.	Quantity of material to be withdrawn vis-à-vis the material available	Cum		
7.	Machinery & equipment to be used			
8.	Copy of the consents to establish and operate should be attached as an Annexure.			
9.	Copy of the license from Mining & Geology, Police & Fire dept.			
10.	Conditions laid down in the clearances / licenses and plans to ensure compliance			
11.	Photographs of the quarry prior to commencing operations.			
12.	Access roads condition and proposed maintenance			
13.	Tree-cutting required, if any, along with compensation measures	No.s		
14.	Information on whether or not the quarry will be closed under this project. If yes, the proposed closure & restoration plan.			
15.	Sketch of the layout of the quarry			
16.	Description of the operating practices to be adopted.			

Attach Photograph of Proposed Site, Location Map, and Agreement with land owner

**REMARKS**

**SUBMITTED**

SIGNATURE .....  
 NAME .....  
 DESIGNATION .....  
 CONTRACTOR

**CHECKED**

SIGNATURE .....  
 NAME .....  
 CONSTRUCTION SUPERVISION  
 CONSULTANT

**APPROVED**

SIGNATURE .....  
 NAME .....  
 EXECUTIVE ENGINEER



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**Case II** -If the quarry is an existing one and is managed directly by a sub-contractor from whom the Contractor is sourcing the materials, the plan should contain the following:

Sr. No.	Item	Unit	Details	Remarks by SC/EO, if any
1.	Name / identity of the location			
2.	Nearest project road chainage.			
3.	Name of the owner			
4.	Area involved			
5.	Arrangement with the owner			
6.	Arrangement with the sub-contractor (agreement with sub-contractor should be attached as an Annexure and should necessarily require the adoption of good quarry management practices – a description of the requirements should be included)			
7.	Quantity of material to be withdrawn vis-à-vis the material available			
8.	Machinery & equipment to be used			
9.	Drainage plans			
10.	Top soil management			
11.	Description of the operating practices			
12.	Health facilities			
13.	Safety provisions made including fire protection systems and the availability of different personal protective equipment such as helmets, ear plugs / muffs and face masks			
14.	Copy of the sub-contractor licenses from PCB, Mining & Geology, Police & Fire Dept.			
15.	Conditions laid down in the clearances / licenses			
16.	Monitoring plans for air quality			
17.	Information on whether or not the quarry will be closed under this project. If yes, the proposed closure & restoration plan.			
18.	Sketch of the layout of the quarry			
19.	Photographs of the quarry before material sourcing for the project			

Attach Photograph of Proposed Site, Location Map, and Agreement with land owner

### REMARKS

#### SUBMITTED

SIGNATURE .....

NAME .....

DESIGNATION .....

CONTRACTOR

#### CHECKED

SIGNATURE .....

NAME .....

CONSTRUCTION SUPERVISION  
CONSULTANT

#### APPROVED

SIGNATURE .....

NAME .....

EXECUTIVE ENGINEER



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**Case III** - If the quarry is a new one and is managed directly by the Contractor from whom the contractor is sourcing the materials, the plan should contain the following:

Sr. No.	Item	Unit	Details	Remarks by SC/EO, if any
1.	Name / identity of the location			
2.	Nearest project road chainage.			
3.	Name of the owner			
4.	Area involved	Sqm		
5.	Existing land use (verification required from land records with revenue department)			
6.	Land use of the area surrounding the proposed site including a map			
7.	Access roads – existing conditions, proposed development and maintenance			
8.	Tree-cutting and vegetation clearance required, if any, along with compensation measures	No.s		
9.	Arrangement with the owner (Agreement should necessarily include commitment of the contractor to adopt good quarry management practices – a description of the requirements should be included - and should indicate proposed restoration plans)			
10.	Quantity of material to be withdrawn vis-à-vis the material available	Cum		
11.	Particular areas to be quarried should be clearly identified			
12.	Pre-establishment activities, e.g. purchase / lease of nearby properties			
13.	Machinery & equipment to be used			
14.	Drainage plans			
15.	Top soil management			
16.	Description of the operating practices			
17.	Health facilities			
18.	Safety provisions made including fire protection systems and the availability of different personal protective equipment such as helmets, ear plugs / muffs and face masks			
19.	Monitoring plans for air quality			
20.	Copy of the sub-contractor licenses from PCB, Mining & Geology, Police & Fire dept.			
21.	Conditions laid down in the clearances / licenses			
22.	Information on whether or not the quarry will be closed under this project. If yes, the proposed closure & restoration plan.			
23.	Sketch of the layout of the quarry			
24.	Concerns of the local people living in the immediate / near vicinity should be identified and appropriate measures should be reflected			
25.	Tree-cutting required, if any, along with compensation measures			
26.	Photographs of the quarry before the project			

Attach Photograph of Proposed Site, Location Map, and Agreement with land owner



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**REMARK**

**SUBMITTED**

SIGNATURE .....

NAME .....

DESIGNATION .....

CONTRACTOR

**CHECKED**

SIGNATURE .....

NAME .....

CONSTRUCTION SUPERVISION  
CONSULTANT

**APPROVED**

SIGNATURE

.....

NAME .....

EXECUTIVE  
ENGINEER



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### APPENDIX 8.3: GUIDELINE FOR BORROW AREAS MANAGEMENT

Borrow areas will be finalized either from the list of locations recommended by DPR consultants or new areas identified by contractor. The finalization of locations identified by DPR consultant or identified by contractor depends upon the formal agreement between landowners and contractor and its suitability from civil engineering as well as environmental consideration. Meeting the guidelines/notifications as stipulated from time to time by the Ministry of Environment and Forests, Government of India, and local bodies, as applicable shall be the sole responsibility of the contractor.

Besides this certain precautions have to be taken to restrict unauthorized borrowing by the contractor. No borrow area shall be opened without permission of the Engineer/EO. The engineer in addition to the established practices, rules and regulation will also consider following criteria before approving the Borrow areas.

- (1) The borrow area should not be located in cultivable land unless unavoidable i.e. no suitable uncultivable land in the vicinity for borrowing or private landowners are willing to allow borrowing in their fields.
- (2) Along the roadside, borrow pits should be located 5m away from the toe line.
- (3) The loss of productive and agriculture soil should be minimum.
- (4) The loss of vegetation is almost nil or minimum.
- (5) Sufficient quality of soil is available.
- (6) The Contractor will ensure that suitable earth is available.

After identification of borrow areas based on guidelines. Contractor will fill reporting format as under and submit the same for approval to the "Engineer" Once approved the contractor will adhere to the recommendation for borrow area to the satisfaction of Engineer.

- (1) In no case the depth of borrow area should exceed 2m from the existing ground level.
- (2) Borrow pits slope should be maintained, no steeper than 1 Vertical: 4 Horizontal.
- (3) In case of cultivable land, top soil (15cm) should be preserved and stockpiled.
- (4) Ridges of not less than 8m width should be left at intervals not exceeding 300m. Small drains to be cut through the ridges to facilitate drainage
- (5) Water pooling to be avoided/managed so that no disease spread due to water stagnation.
- (6) Borrow pits should be located at least 1000m away from settlements.
- (7) Precautionary measures as the covering of vehicles will be taken to avoid spillage during transportation of borrow area.
- (8) The unpaved surfaces used for the haulage of borrow materials should be maintained properly for dust suppression.
- (9) Haulage of material to embankments or other areas of fill shall proceed only when sufficient spreading and compaction facility is operating at the place of deposition, to minimize dust pollution.
- (10) Borrow pits located near settlements will be re-developed immediately after borrowing is completed. If spoils are dumped, that will be covered with a layers of stockpiled topsoil in accordance with compliance requirements with respect MOEF/SPCB guidelines





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- (11) Redevelopment of the borrow areas to mitigate the impact will be the responsibility of the contractor. The contractor shall evolve site-specific redevelopment plans for each borrow area locations, which shall be implemented after the approval of the Engineer.
- (12) Borrow area near to any surface water body will be at least at a distance of 15m from the toe of the bank or high flood level, whichever is maximum.
- (13) During rains appropriate measures to be taken to minimize soil erosion, silt fencing to be provided as directed by Engineer/EO.
- (14) Borrow areas might be used for aquaculture in case landowner wants such development. In that case, such borrow area will be photographed after their post use restoration and Environment Expert of Supervision Consultant will certify the post use redevelopment.

The Contractor will keep record of photographs of various stages i.e., before using materials from the location (pre-project), for the period borrowing activities (construction Phase) and after rehabilitation (post development), to ascertain the pre and post borrowing status of the area.



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### Format EM1: Reporting for Borrow Areas

**(To be Submitted by Contractor for taking consent for opening of Borrow area)**

Construction Stage Report: Date \_\_\_\_ Month \_\_\_\_\_ Year \_\_\_\_\_

Site Layout of Borrow Area and Proposed Borrow Area Redevelopment Plan to be attached with format

Format to be submitted before target date as (decided by PIU) for establishing Borrow Areas

Borrow Area No. BA \_\_\_\_\_

Location of Borrow Area (Km \_\_\_\_\_ Package \_\_\_\_\_)

Sl. No	Item	Unit	Details	Remarks by SC/EO, if any
1	Details of Borrow Area			
a	Date of Borrow Area becoming operational dd/mm/yy			
b	Current Land use			
c	Distance from Nearest Settlement	Km		
d	No of settlements within 200m of Haul Road	No.		
e	No of settlements within 500m of Borrow Area	No.		
f	Total Capacity	cum		
g	No of Trees with girth more than 0.3 m	No.		
h	Length of Haul Road	km		
i	Width of Haul road	m		
j	Type of Haul Road	metal/dirt		
k	Size of Borrow Area	sqkm		
l	Area of Borrow Area	km x km		
m	Quantity Available	cum		
n	Distance of Nearest Water Source	Type/Size/Capacity/Present Use/Ownership		
o	Quantity of top soil removed	cum		
p	Detail of storage of topsoil			
q	Daily/occasional use of the Borrow Area by the community, if any	-		
r	Probable reuse of Borrow pit-ask community	-		
s	Drainage channels/slope/characteristics of the area	-		
2	Enhancement Elements			
a	Quantity of top soil removed	sq.m		
b	Detail of storage of topsoil	sq.m		
c	Adjoining land use/Natural elements			
d	Near by catchment for storing water			
e	Erosion Control Programme			
f	Preventive measures for			
i	Leaching			
ii	Mosquito Breeding			
iii	Water run-off/contamination			



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Sl. No	Item	Unit	Details	Remarks by SC/EO, if any
iv	Any other environmental degradation			
3	Details of workforce			
a	Total No of Labourers	No.		
b	Total no of Male Workers	No.		
c	No of Male Workers below 18 years of age	No.		
d	Total No of Female Workers	No.		
e	No of Female workers below 18 years of age	No.		
4	Details of redevelopment, Plan to be enclosed			
	Certified that the furnished information is correct the quality of work is as per good practice and all relevant information as required is attached			
	<b>Project Engineer</b>			
	<b>(Supervision Consultant)</b>			<b>(Contractor)</b>

Attach Photograph of Proposed Site, Location Map, and Agreement with land owner

#### REHABILITATION PLAN MEASURES

LOCATION 1:

LOCATION 4:

LOCATION 2:

LOCATION 5:

LOCATION 3:

LOCATION 6:

#### REMARKS

**SUBMITTED**

**CHECKED**

**APPROVED**

SIGNATURE .....

SIGNATURE .....

SIGNATURE .....

NAME .....

NAME .....

NAME .....

DESIGNATION .....

CONTRACTOR

CONSTRUCTION SUPERVISION  
CONSULTANT

EXECUTIVE ENGINEER



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

## **APPENDIX 8.( : GUIDELINE FOR DEBRIS DISPOSAL SITES AND MANAGEMENT**

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

- Productive land to be avoided and available wasteland to be given preference.
- Disposal sites to be located at least 1000m away from sensitive locations like settlements, water body, notified forest areas, sanctuaries or any other sensitive locations.
- Should be located in the downwind side of nearest settlement locations.
- Disposal sites do not contaminate any water sources, rivers etc for this, site should be located away from water body, and disposal site should be lined properly to prevent infiltration of water.
- Public perception about the location of debris disposal site has to be obtained before finalizing the location.
- Permission from the villager/local community is to be obtained in writing by contractor for finalising the disposal site identified.
- The Plan must be approved by EO/Supervision Consultant and PIU- TNRSP.

### **PRECAUTIONS TO BE ADOPTED DURING DISPOSAL OF DEBRIS / WASTE MATERIAL**

The contractor shall take the following precautions while disposing off the waste material

- During the site clearance and disposal of debris, the contractor will take full care to ensure that public or private properties are not damaged / affected, there is no dwellings below the dumpsite and that the traffic is not interrupted.
- Contractor will dispose off debris only to the identified places or at other places only with prior permission of Engineer/EO.
- In the event of any spoil or debris from the sites being deposited on any adjacent land, the contractor will immediately remove all such spoil debris and restore the affected area to its original state to the satisfaction of the Engineer/EO.
- The contractor will at all times ensure that the entire existing drains within and adjacent to the site are kept safe and free from any debris.
- Contractor will utilize effective water sprays during the delivery and handling of materials when dust is likely to be created and to dampen stored materials during dry and windy weather.
- 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 tarpaulin in good condition.
- Care should always be taken to maintain the hydrological flow in the area.

### **REHABILITATION OF DISPOSAL SITES**

The dumpsites filled only up to the ground level could be rehabilitated as per guidelines below and to be decided by the engineer and the supervision consultant

- The dumpsites have to be suitably rehabilitated by planting local species of shrubs and other plants. Local species of trees has also to be planted so that the landscape is coherent and is in harmony with its various components.
- In cases where a dumpsite is near to the local village community settlements, it could be converted into a play field by spreading the dump material evenly on the ground. Such playground could be made coherent with the landscape by planting trees all along the periphery of the playground.
- Material excavated for foundation of bridge works should not be dumped in the water course; if same has to be refilled then precaution has to be taken so that the excavated material should not be carried away by flowing/rainy water, thereby silting the water course.
- Care should always be taken to maintain the hydrological flow in the area.



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**Format EM1: Selection of dump site locations**

From \_\_\_\_\_ To \_\_\_\_\_

(Give chainage and nearest settlements from both ends)

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

**Selected Site (tick any one column only)**

Certified that the above information is correct to the best of my knowledge and belief.

(Contractor)

Verified:

Date:

**Recommendation on the suitability of the site**

Signed:

Date:

Name & Designation:

Decision Taken (tick one):

Approved/Not Approved

Signed:

Date:

**Name and Designation of Deciding Authority**

**Enclosures**

(Tick as appropriate)

- 1 Maps of each location
- 2 Photographs
  - a Each dumping location
  - b Each community consultation
- 3 Photocopies of permissions from VCPs

**Name and Designation of**

**Verifier:**





## APPENDIX 8.5: GUIDELINES FOR SITE CLEARANCE AND TREE FELLING

### 1. VEGETATION CLEARANCE

Vegetation clearance shall comprise uprooting of vegetation, grass, brushwood, shrubs, stumps, trees and saplings of girth up to 30 cm. measured at a height of one meter above the ground level. Where only clearance of grass is involved it shall be measured and paid for separately. The procedure/ steps involved for uprooting, skating and felling trees are described below.

#### 1.1 Uprooting of Vegetation

- The roots of trees and saplings shall be removed to a depth of 60 cm below ground level or 30 cm below formation level or 15 cm below sub grade level, whichever is lower.
- All holes or hollows formed due to removal of roots shall be filled up with earth rammed and levelled.
- Trees, shrubs, poles, fences, signs, monuments, pipe lines, cables etc. within or adjacent to the area, which are not required to be disturbed during vegetation clearance shall be properly protected by the contractor at his own cost.

#### 1.2 Staking and Disposal

- All useful materials obtained from clearing and grubbing operation shall be staked in the manner as directed by the Engineer.
- Trunks and branches of trees shall be cleared of limbs and tops stacked properly at the places indicated by the Engineer- in-charge. These materials shall be the property of the Government.
- All unusable materials are disposed off in such a manner that there is no chance of these materials getting mixed up with the materials meant for construction.

#### 1.3 Felling Trees

- *Marking of tress:* Trees, above 30 cm. Girth (measured at a height of one meter above ground level) and below 30cm girth to be cut, shall be approved by the Engineer-in-charge and then marked at the site.
- *Felling of trees:* Felling of trees shall include taking out roots up to 60 cm below ground level or 30 cm below formation level or 15 cm below sub-grade level, whichever is lower.
- *Filling:* All excavations below general ground level arising out of removal of trees, stumps etc. shall be filled with suitable material in 20 cm. layers and compacted thoroughly so that the surface at these points conforms to the surrounding area.
- *Sizing:* The trunks and branches of trees shall be cleared of limbs and tops and cut into suitable pieces as directed by the Engineer-in-charge.
- *Staking:* The serviceable materials shall be staked in the manner as directed by the Environmental specialist of Supervision Consultants/Engineer-in-charge.
- *Disposal:* The material, which cannot be used or auctioned shall be removed from the area and disposed off as per the directions of the Engineer-in-charge. Unsuitable waste materials should not be mixed with construction material during disposal.



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**Format EM4: Tree Felling**

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

**(Signed)**

District Collector



ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

## APPENDIX 8.6: GUIDELINE FOR SITING & LAYOUT OF CONSTRUCTION CAMP

### (A) SITING

The contractor based on the following guidelines shall identify the location of the construction site. The construction site shall be located:

- At least 1000m away from major settlements in downwind direction. The living accommodation and ancillary facilities for labour shall be erected and maintained to standards and scales approved by the resident engineer.
- A minimum 500m away from surface water course or body.
- A minimum 1000m away from Wild life Sanctuary/Ecologically Sensitive Areas.
- Should not be located in cultivable land unless unavoidable.
- All sites used for camps must be adequately drained.
- The camps must be located such that the drainage from and through the camps will not endanger any domestic or public water supply.
- All sites must be graded, ditched and rendered free from depressions such that water may get stagnant and become a nuisance.

### (B) LAYOUT

A conceptual layout of a typical construction site has been presented in Figure below. The Contractor during the progress of work will provide, erect and maintain necessary (temporary) living accommodation and ancillary facilities for labour to standards and scales approved by the engineer. All temporary accommodation must be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking and washing. Safe drinking water should be provided to the dwellers of the construction camps. Adequate washing and bathing places shall be provided, and kept in clean and drained condition. Construction camps are to be sited away from vulnerable people and adequate health care is to be provided for the work force.

**Sanitation Facilities:** Construction camps shall be provided sanitary latrines and urinals. Sewerage drains should be provided for the flow of used water outside the camp. 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. Compliance with the relevant legislation must be strictly adhered to. Garbage bins must be provided in the camp and regularly emptied and the garbage disposed off in a hygienic manner

**Shelter at Workplace:** At every workplace, there shall be provided free of cost, four suitable shelters, two for meals and two others for rest, separately for use of men and women labourers. The height of shelter shall not be less than 3m from floor level to lowest part of the roof. Sheds shall be kept clean and the space provided shall be on the basis of at least 0.5m<sup>2</sup> per head.



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**Canteen Facilities:** A cooked food canteen on a moderate scale shall be provided for the benefit of workers wherever it is considered necessary. The contractor shall conform generally to sanitary requirements of local medical, health and municipal authorities and at all times adopt such precautions as may be necessary to prevent soil pollution of the site.

**First aid facilities:** At every workplace, a readily available first-aid unit including an adequate supply of sterilized dressing materials and appliances will be provided. Workplaces remote and far away from regular hospitals will have indoor health units with two bed facility. Suitable transport will be provided to facilitate taking injured and ill persons to the nearest hospital. At construction camp an ambulance room containing the prescribed equipment and nursing staff will be provided.

**Health Care Facilities:** Health problems of the workers should be taken care of by providing basic health care facilities through health centres temporarily set up for the construction camp. The health centre should have at least a doctor, nurses, 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 provide with regular vaccinations required for children.

**Day Crèche Facilities:** At every construction site, provision of a day crèche shall be worked out so as to enable women to leave behind their children. At construction sites where 20 or more women are ordinarily employed, there shall be provided at least a hut for use of children under the age of 6 years belonging to such women. Huts 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. Huts shall be provided with suitable and sufficient openings for light and ventilation. There shall be adequate provision of sweepers to keep the places clean. There shall be two maidservants (or aayas) in the satisfaction of local medical, health, municipal or cantonment authorities. Where the number of women workers is more than 25 but less than 50, the contractor shall provide with at least one hut and one maidservant to look after the children of women workers. Size of crèches shall vary according to the number of women workers employed.

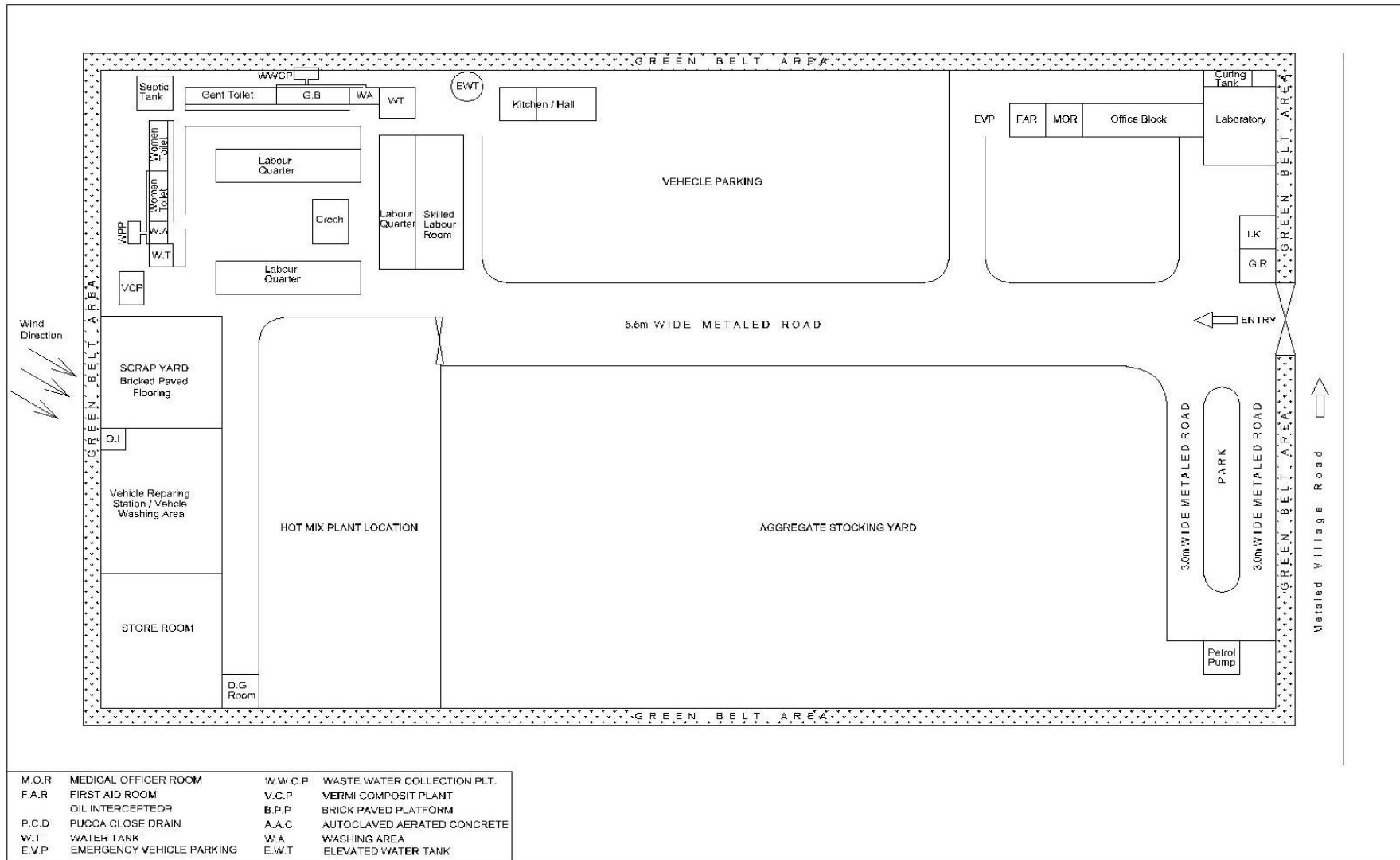


Figure-1: Typical Layout of Construction Camp





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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## APPENDIX 8.7: SOIL EROSION AND SEDIMENTATION CONTROL

All materials shall meet commercial grade standards and shall be approved by the Engineer before being used in the work.

### CONSTRUCTION STAGE

Prior to the start of the relevant construction, the Contractor shall submit to the Engineer for approval, his schedules for carrying out temporary and permanent erosion/sedimentation control works as are applicable for the items of clearing and grubbing, roadway and drainage excavation, embankment/sub-grade construction, bridges and other structures across water courses, pavement courses and shoulders. He shall also submit for approval his proposed method of erosion/sedimentation control on service road and borrow pits and his plan for disposal of waste materials. Work shall not be started until the erosion/sedimentation control schedules and methods of operations for the applicable construction have been approved by the Engineer.

The surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and fill operations shall be limited to the extent practicable. The Contractor may be directed to provide immediate control measures to prevent soil erosion and sedimentation that will adversely affect construction operations, damage adjacent properties, or cause contamination of nearby streams or other watercourses. Such work may involve the construction of temporary berms, dikes, sediment basins, slope drains and use of temporary mulches, fabrics, mats, seeding, or other control devices or methods as necessary to control erosion and sedimentation.

The Contractor shall be required to incorporate all permanent erosion and sedimentation control features into the project at the earliest practicable time as outlined in his accepted schedule to minimize the need for temporary erosion and sedimentation control measures.

Temporary erosion/sedimentation and pollution control measures will be used to control the phenomenon of erosion, sedimentation and pollution that may develop during normal construction practices, but may neither be foreseen during design stage nor associated with permanent control features on the Project.

Where erosion or sedimentation is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion or sedimentation control features can follow immediately thereafter if the project conditions permit; otherwise temporary erosion or sedimentation control measures may be required between successive construction stages. Under no conditions shall a large surface area of erodible earth material be exposed at one time by clearing and grubbing or excavation without prior approval of the EO/Engineer.

The Engineer may limit the area of excavation, borrow and embankment operations in progress, commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding and other such permanent erosion, sedimentation and pollution control measures, in accordance with the accepted schedule.



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Temporary erosion is sometimes caused due to the Contractor's negligence, carelessness or failure to install permanent controls. Sedimentation and pollution control measures then become necessary as a part of the work as scheduled or ordered by the Engineer, and these shall be carried out at the Contractor's own expense. Temporary erosion, sedimentation and pollution control work required, which is not attributed to the Contractor's negligence, carelessness or failure to install permanent controls, will be performed as ordered by the EO/Engineer.

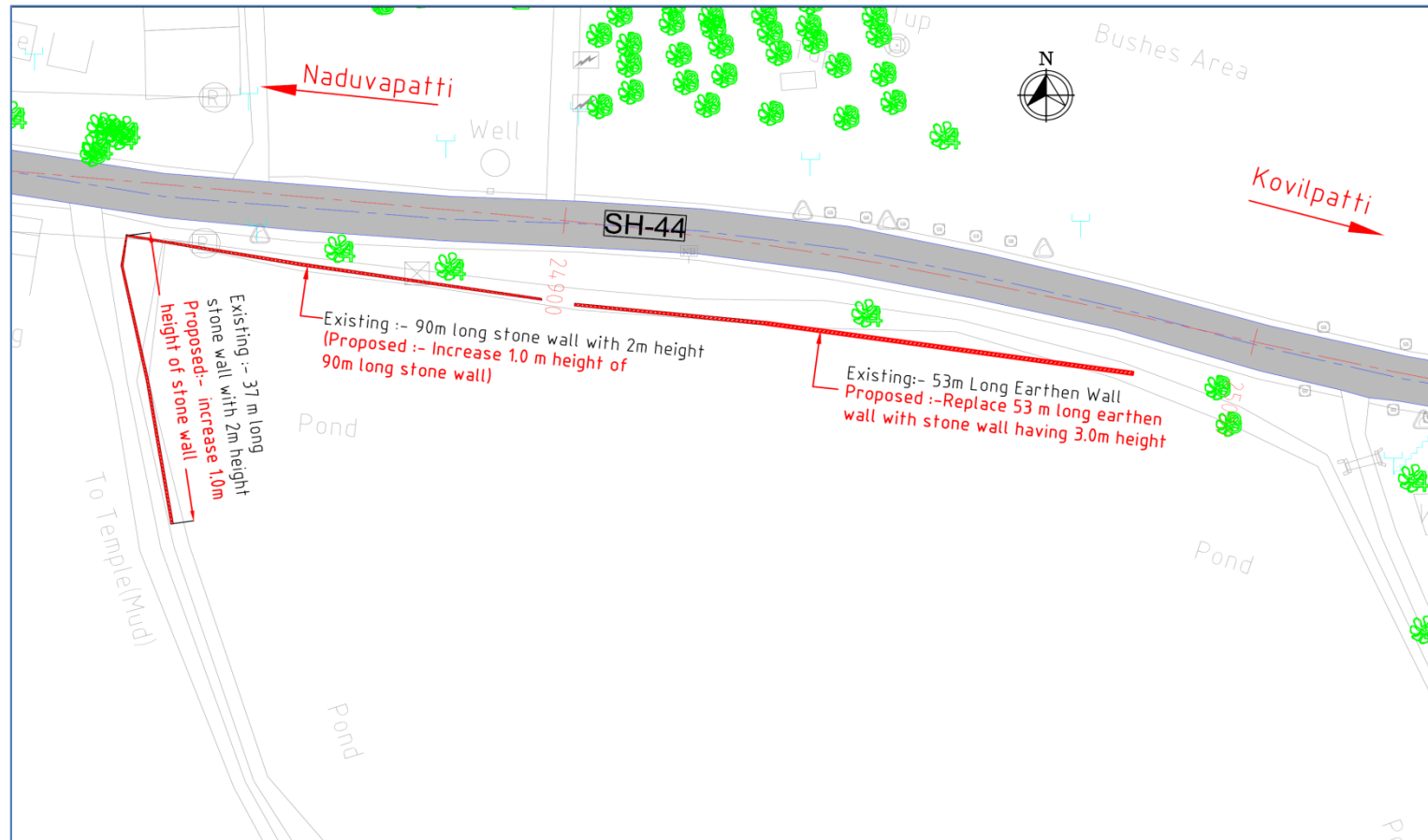
Temporary erosion, sedimentation and pollution control may include construction work outside the right of way where such work is necessary as a result of road construction such as borrow pit operations, service roads and equipment storage sites.

The temporary erosion, sedimentation and pollution control features installed by the Contractor shall be maintained by him till these are needed, unless otherwise agreed by the Engineer.



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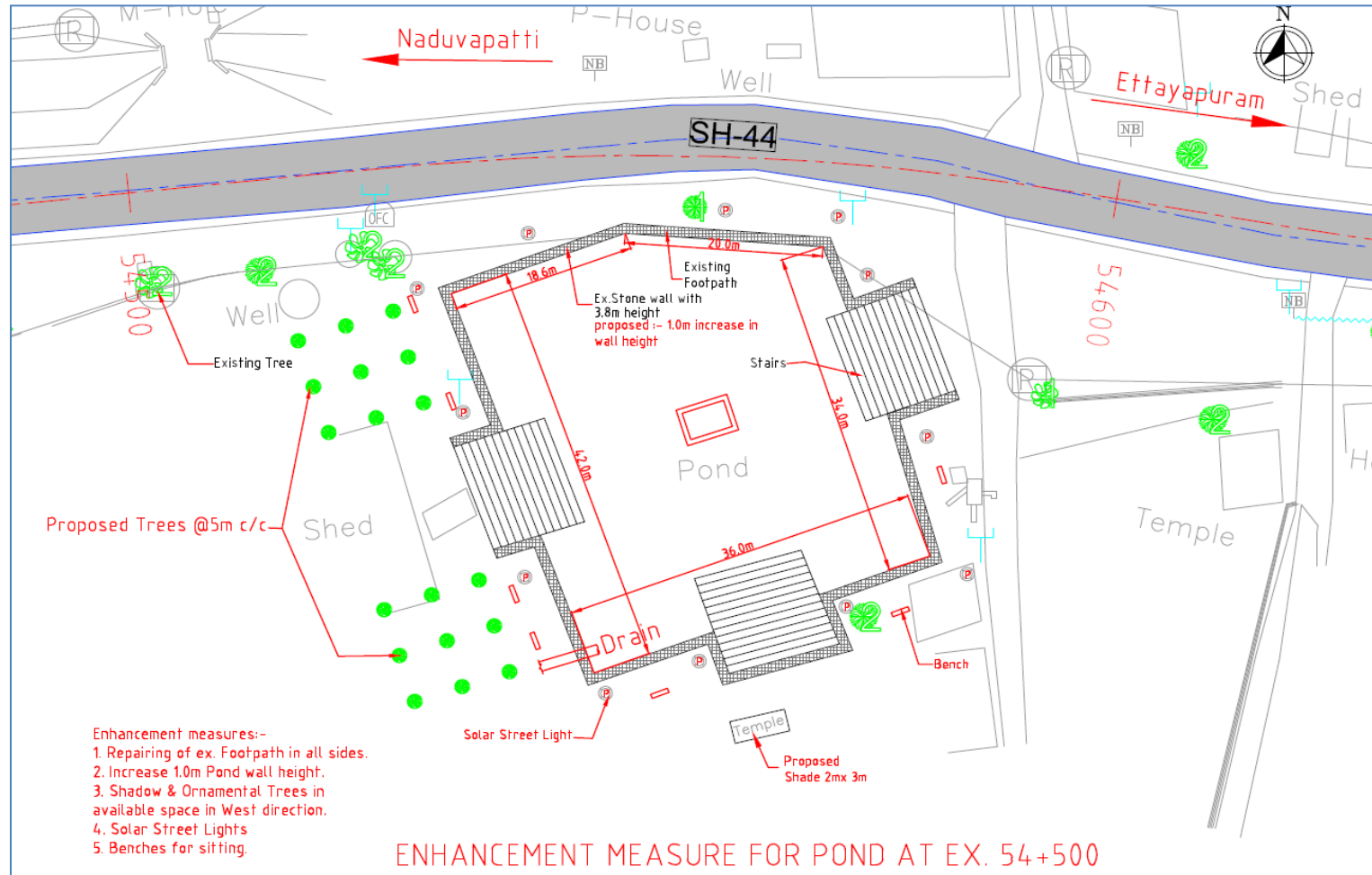
### APPENDIX 8.8: DRAWINGS OF ENVIRONMENTAL ENHANCEMENT MEASURES



Drawing No. 1: Enhancement measures for pond at km 24+750 along Paruvakudi - Kovilpatti - Ettayapuram - Vilathikulam - Vembar Road, Section of SH44



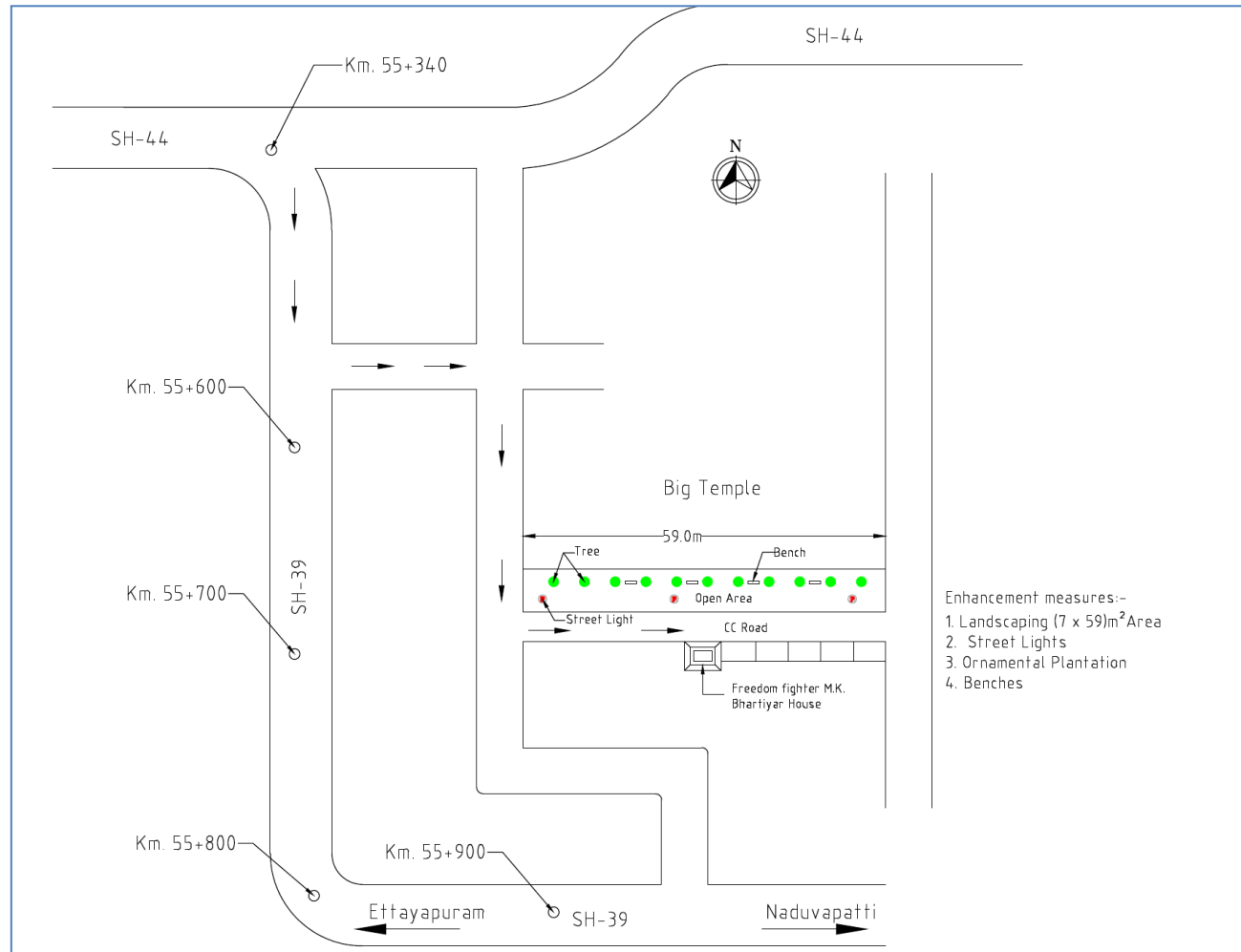
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**Drawing No.2: Enhancement measures for pond at km 54+500 along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44**



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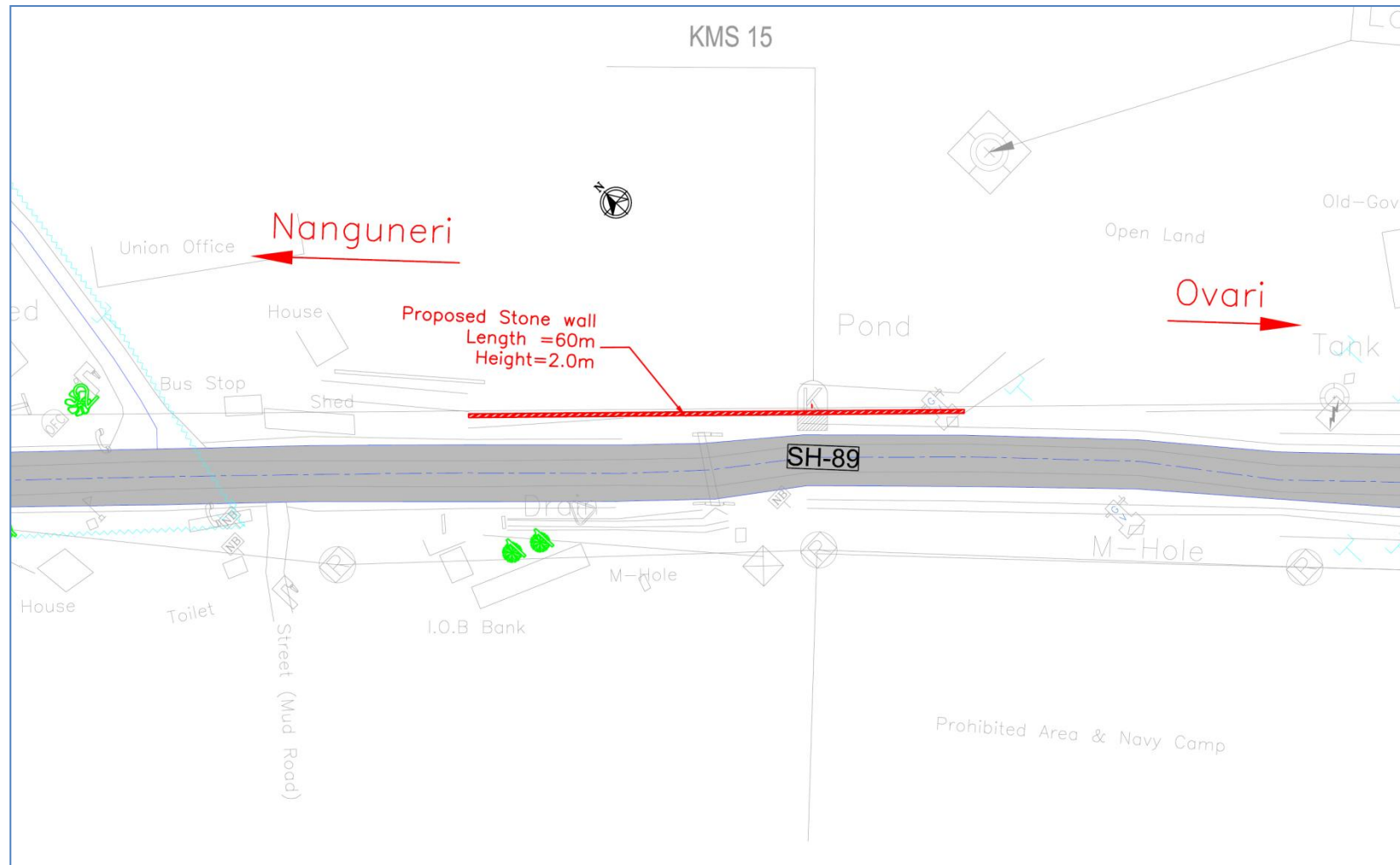


**Drawing No.3: Enhancement Measure for space opposite to Maha Kavi Bharthiyar house along Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road, Section of SH44**





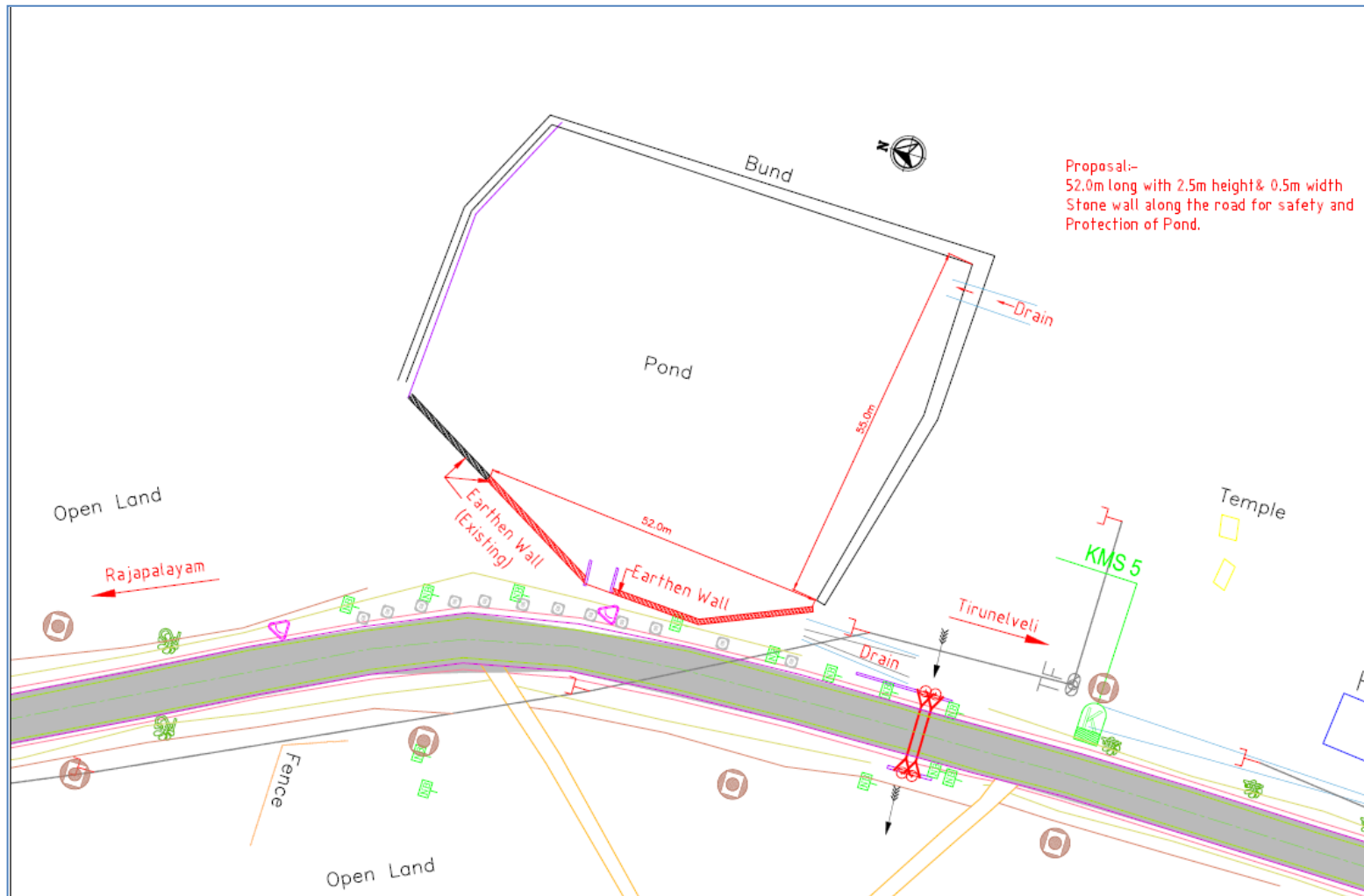
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**Drawing No. 4: Enhancement measures for pond at km 15+000 along Nanguneri - Bharatavaram Ovari Road, Section of SH 89**



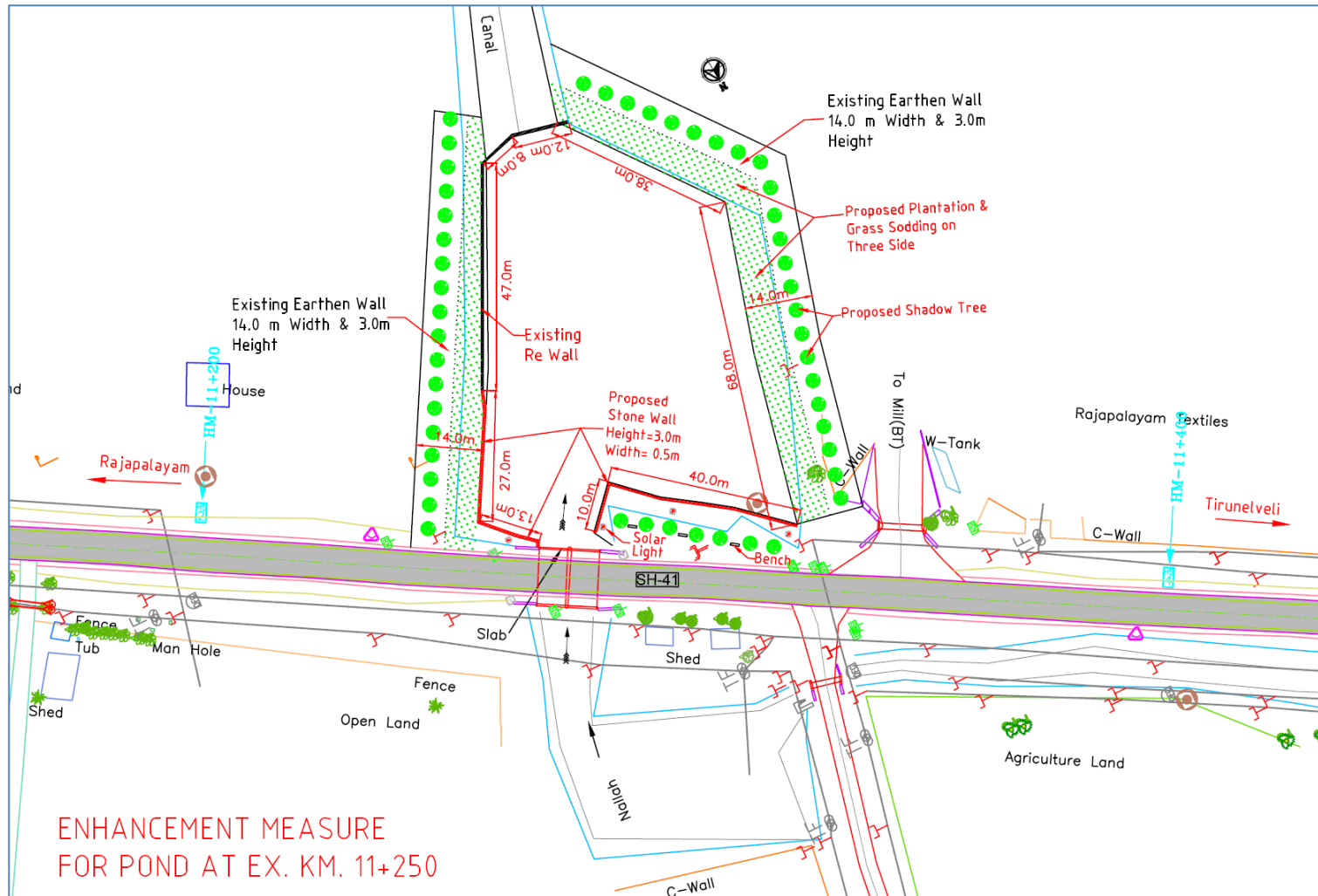
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**Drawing No. 5: Enhancement measures for pond at km 4+980 along Rajapalayam-Sankarankoil-Tirunelveli section of SH-41**



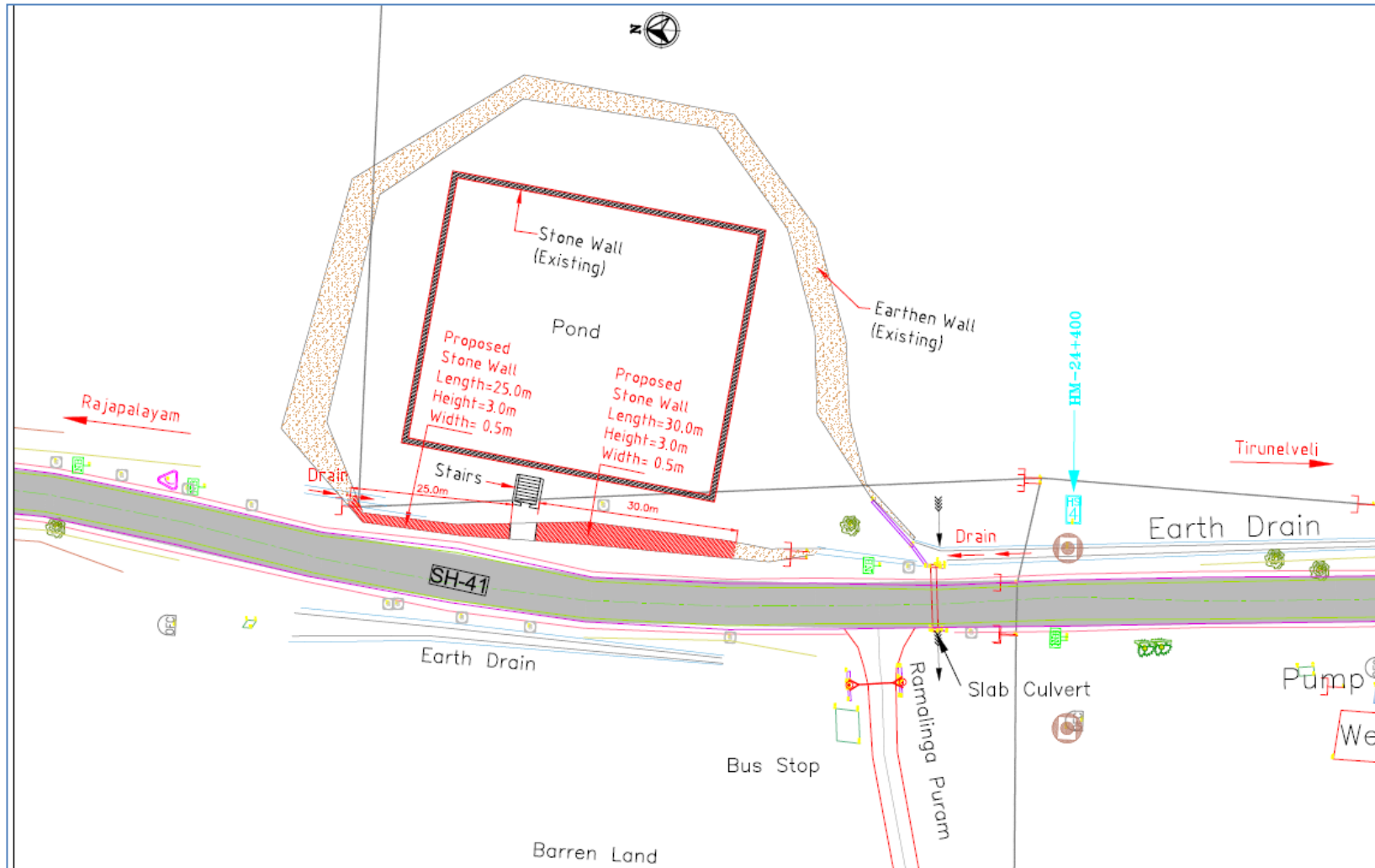
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Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41



**Drawing No. 6: Enhancement measures for pond at km 11+250 along Rajapalayam-Sankarankoil-Tirunelveli section of SH-41**



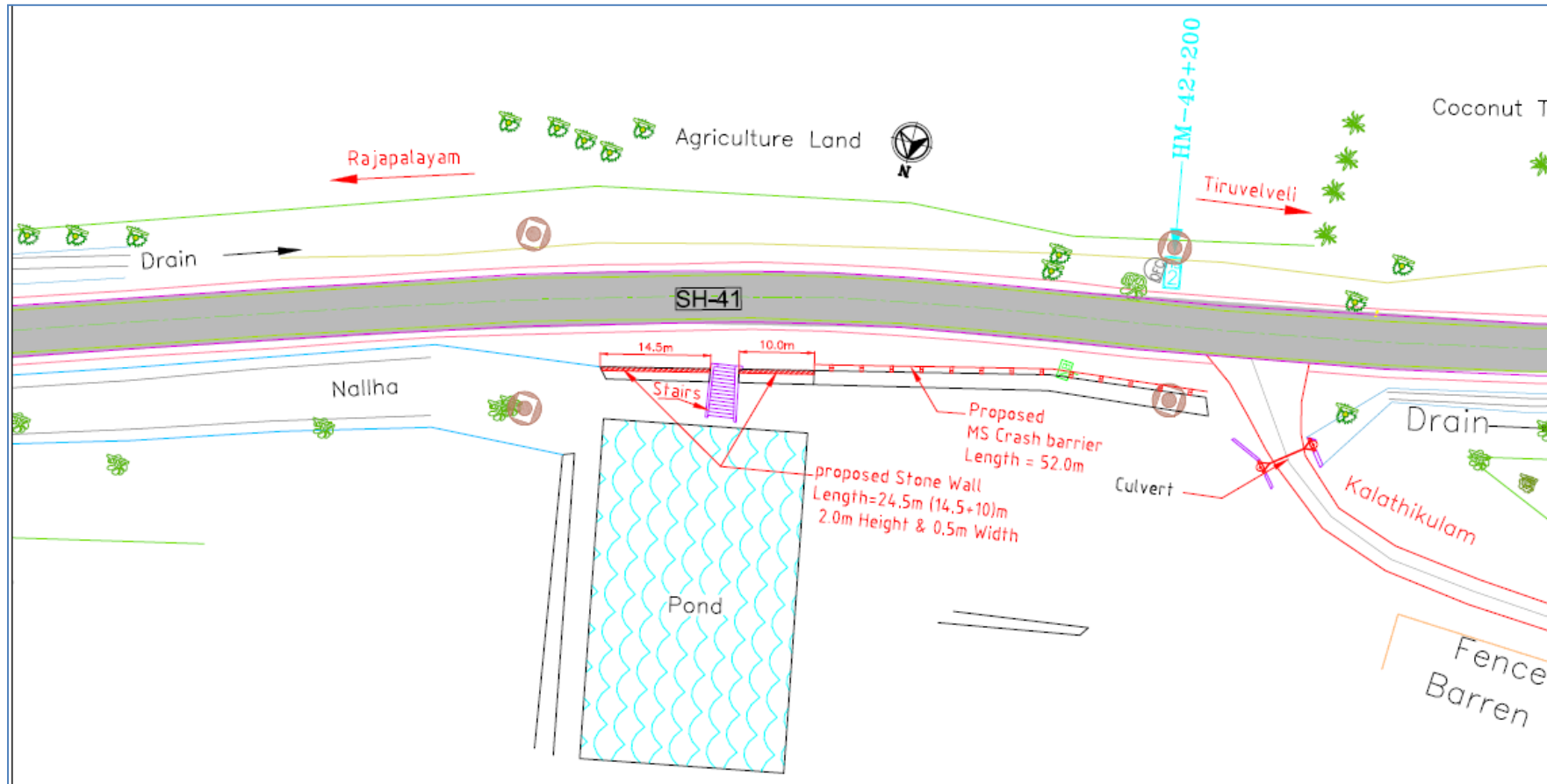
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**Drawing No. 7: Enhancement measures for pond at km 24+380 along Rajapalayam-Sankarankoil-Tirunelveli section of SH-41**



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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**Drawing No. 8: Enhancement measures for pond at km 42+200 along Rajapalayam-Sankarankoil-Tirunelveli section of SH-41**





ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

## APPENDIX 8.9: CHAINAGE AND SPECIES WISE DETAILS OF TREES (GIRTH SIZE <30 CM) FOR TRANSPLANTATION

Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road  
(km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44 (LHS)

Chainage	Local Name	Botanical Name	Girth Size (m)	Approx. Height (m)
22.5-22.6	Neem	<i>Azadirachta indica</i>	0.12	2
22.6-22.7	Vatha Narayanan	<i>Delonix elata</i>	0.12	1.5
22.6-22.7	Tamarind	<i>Tamarindus indica</i>	0.09	1
22.6-22.7	Vatha Narayanan	<i>Delonix elata</i>	0.19	2.5
22.6-22.7	Tamarind	<i>Tamarindus indica</i>	0.14	2
22.6-22.7	Tamarind	<i>Tamarindus indica</i>	0.26	2
22.6-22.7	Neem	<i>Azadirachta indica</i>	0.07	1.5
22.6-22.7	Tamarind	<i>Tamarindus indica</i>	0.06	1.5
22.7-22.8	Tamarind	<i>Tamarindus indica</i>	0.15	2
22.7-22.8	Tamarind	<i>Tamarindus indica</i>	0.14	1.5
22.7-22.8	Tamarind	<i>Tamarindus indica</i>	0.09	1.5
22.7-22.8	Neem	<i>Azadirachta indica</i>	0.05	1.5
22.7-22.8	Tamarind	<i>Tamarindus indica</i>	0.12	2.2
22.8-22.9	Manjanathi	<i>Morinda tomentosa</i>	0.12	1.5
22.8-22.9	Manjanathi	<i>Morinda tomentosa</i>	0.09	1.5
22.8-22.9	Manjanathi	<i>Morinda tomentosa</i>	0.09	1.5
22.8-22.9	Neem	<i>Azadirachta indica</i>	0.25	2.5
22.8-22.9	Tamarind	<i>Tamarindus indica</i>	0.12	2
22.9-23.0	Neem	<i>Azadirachta indica</i>	0.21	2.5
22.9-23.0	Tamarind	<i>Tamarindus indica</i>	0.14	1.5
22.9-23.0	Neem	<i>Azadirachta indica</i>	0.26	2.5
22.9-23.0	Tamarind	<i>Tamarindus indica</i>	0.15	2
22.9-23.0	Manjanathi	<i>Morinda tomentosa</i>	0.09	1.5
22.9-23.0	Tamarind	<i>Tamarindus indica</i>	0.12	2
22.9-23.0	Neem	<i>Azadirachta indica</i>	0.12	1.8
22.9-23.0	Tamarind	<i>Tamarindus indica</i>	0.14	2
22.9-23.0	Tamarind	<i>Tamarindus indica</i>	0.12	2
22.9-23.0	Neem	<i>Azadirachta indica</i>	0.11	2
23.0-23.1	Tamarind	<i>Tamarindus indica</i>	0.07	1
23.0-23.1	Manjanathi	<i>Morinda tomentosa</i>	0.09	1
23.1-23.2	Poonga	<i>Pongamia pinnata</i>	0.08	1
23.1-23.2	Neem	<i>Azadirachta indica</i>	0.07	1.5
23.1-23.2	Manjanathi	<i>Morinda tomentosa</i>	0.08	1.5
23.1-23.2	Manjanathi	<i>Morinda tomentosa</i>	0.2	2
23.1-23.2	Poonga	<i>Pongamia pinnata</i>	0.12	1.5
23.1-23.2	Neem	<i>Azadirachta indica</i>	0.17	2
23.2-23.3	Neem	<i>Azadirachta indica</i>	0.09	1.5
23.3-23.4	Poonga	<i>Pongamia pinnata</i>	0.16	1.8
23.3-23.4	Manjanathi	<i>Morinda tomentosa</i>	0.18	2
23.3-23.4	Manjanathi	<i>Morinda tomentosa</i>	0.11	1.5
23.3-23.4	Poonga	<i>Pongamia pinnata</i>	0.12	1.5
23.3-23.4	Manjanathi	<i>Morinda tomentosa</i>	0.17	2
23.4-23.5	Manjanathi	<i>Morinda tomentosa</i>	0.22	2.5
23.4-23.5	Manjanathi	<i>Morinda tomentosa</i>	0.2	2



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Chainage	Local Name	Botanical Name	Girth Size (m)	Approx. Height (m)
23.4-23.5	Tamarind	<i>Tamarindus indica</i>	0.12	1.8
23.4-23.5	Tamarind	<i>Tamarindus indica</i>	0.15	1.5
23.5-23.6	Tamarind	<i>Tamarindus indica</i>	0.13	2
23.5-23.6	Manjanathi	<i>Morinda tomentosa</i>	0.1	1.5
23.6-23.7	Manjanathi	<i>Morinda tomentosa</i>	0.23	2
23.6-23.7	Manjanathi	<i>Morinda tomentosa</i>	0.26	2
23.6-23.7	Neem	<i>Azadirachta indica</i>	0.09	1.5
23.6-23.7	Poonga	<i>Pongamia pinnata</i>	0.14	2
23.7-23.8	Neem	<i>Azadirachta indica</i>	0.1	1.5
23.7-23.8	Tamarind	<i>Tamarindus Indica</i>	0.12	2
23.8-23.9	Manjanathi	<i>Morinda tomentosa</i>	0.08	1
23.9-24.0	Poonga	<i>Pongamia pinnata</i>	0.1	1.5
24.0-24.1	Tamarind	<i>Tamarindus indica</i>	0.13	1.5
24.0-24.1	Vatha Narayanan	<i>Delonix elata</i>	0.13	2
24.1-24.2	Vatha Narayanan	<i>Delonix elata</i>	0.22	2
24.1-24.2	Manjanathi	<i>Morinda tomentosa</i>	0.15	2
24.2-24.3	Poonga	<i>Pongamia pinnata</i>	0.11	1.5
24.2-24.3	Manjanathi	<i>Morinda tomentosa</i>	0.09	1.5
24.2-24.3	Poonga	<i>Pongamia pinnata</i>	0.12	1.5
27.5-27.6	Manjanathi	<i>Morinda tomentosa</i>	0.2	2
29.1-29.2	Manjanathi	<i>Morinda tomentosa</i>	0.24	2
29.2-29.3	Thekku	<i>Tectona grandis</i>	0.17	3.5
29.3-29.4	Neem	<i>Azadirachta indica</i>	0.13	2.5
29.9-30.0	Thekku	<i>Tectona grandis</i>	0.25	3
31.6-31.7	Poonga	<i>Pongamia pinnata</i>	0.15	1.5
31.7-31.8	Poonga	<i>Pongamia pinnata</i>	0.12	1
34.4-34.5	Manjanathi	<i>Morinda tomentosa</i>	0.12	1.8
37.9-38.0	Thekku	<i>Tectona grandis</i>	0.25	3.5
41.8-41.9	Neem	<i>Azadirachta indica</i>	0.13	2
42.1-42.2	Neem	<i>Azadirachta indica</i>	0.13	2
42.1-42.2	vaagai	<i>Albizia labac</i>	0.18	2.5
42.1-42.2	Poonga	<i>Pongamia pinnata</i>	0.11	1.8
42.2-42.3	Neem	<i>Azadirachta indica</i>	0.12	2
43.3-43.4	Naaval	<i>Syzygium cumini</i>	0.08	1
43.3-43.4	Manjanathi	<i>Morinda tomentosa</i>	0.07	1.5
53.3-53.4	Manjanathi	<i>Morinda tomentosa</i>	0.15	2.5
54.5-54.6	Neem	<i>Azadirachta indica</i>	0.12	2
54.5-54.6	Poonga	<i>Pongamia pinnata</i>	0.15	2
54.5-54.6	Neem	<i>Azadirachta indica</i>	0.1	2
54.6-54.7	Neem	<i>Azadirachta indica</i>	0.12	2
54.6-54.7	Neem	<i>Azadirachta indica</i>	0.15	2.5
55.2-55.3	Neem	<i>Azadirachta indica</i>	0.13	1.5
55.7-55.8	Neem	<i>Azadirachta indica</i>	0.09	1.1
55.7-55.8	Poonga	<i>Pongamia pinnata</i>	0.1	1.5
55.8-55.9	Poovarasu	<i>Thespesia populnea</i>	0.18	2
55.8-55.9	Neem	<i>Azadirachta indica</i>	0.15	2
55.9-56.0	Neem	<i>Azadirachta indica</i>	0.18	2.5



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

**Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road**  
**(km 22/500 to km 38/750 and km 41/300 to km 56/700), Section of SH44 (RHS)**

Chainage	Local Name	Botanical Name	Girth Size (m)	Approx. Height (m)
22.5-22.6	Tamarind	<i>Tamarindus indica</i>	0.12	1.5
22.5-22.6	Vatha Narayanan	<i>Delonix elata</i>	0.24	3
22.5-22.6	Neem	<i>Azadirachta indica</i>	0.2	2
22.6-22.7	Neem	<i>Azadirachta indica</i>	0.18	2
22.6-22.7	Tamarind	<i>Tamarindus indica</i>	0.15	1.5
22.6-22.7	Tamarind	<i>Tamarindus indica</i>	0.11	1.5
22.6-22.7	Neem	<i>Azadirachta indica</i>	0.17	2
22.6-22.7	Neem	<i>Azadirachta indica</i>	0.11	2
22.6-22.7	Tamarind	<i>Tamarindus indica</i>	0.12	2
22.6-22.7	Neem	<i>Azadirachta indica</i>	0.1	1.5
22.6-22.7	Neem	<i>Azadirachta indica</i>	0.12	1.5
22.7-22.8	Tamarind	<i>Tamarindus Indica</i>	0.14	1.5
22.7-22.8	Neem	<i>Azadirachta indica</i>	0.12	2
22.7-22.8	Tamarind	<i>Tamarindus indica</i>	0.14	1.5
22.7-22.8	Neem	<i>Azadirachta indica</i>	0.08	1.5
22.7-22.8	Tamarind	<i>Tamarindus indica</i>	0.07	1.5
22.7-22.8	Tamarind	<i>Tamarindus indica</i>	0.1	1.8
22.7-22.8	Tamarind	<i>Tamarindus indica</i>	0.07	1.5
22.7-22.8	Tamarind	<i>Tamarindus indica</i>	0.07	1.5
22.8-22.9	Neem	<i>Azadirachta indica</i>	0.1	2
22.8-22.9	Tamarind	<i>Tamarindus indica</i>	0.09	1.5
22.8-22.9	Tamarind	<i>Tamarindus indica</i>	0.11	1.5
22.8-22.9	Tamarind	<i>Tamarindus indica</i>	0.1	1.5
22.8-22.9	Tamarind	<i>Tamarindus indica</i>	0.06	1
22.8-22.9	Tamarind	<i>Tamarindus indica</i>	0.12	1.5
22.8-22.9	Tamarind	<i>Tamarindus indica</i>	0.13	2
22.9-23.0	Tamarind	<i>Tamarindus indica</i>	0.15	2
22.9-23.0	Neem	<i>Azadirachta indica</i>	0.12	1.5
22.9-23.0	Manjanathi	<i>Morinda tomentosa</i>	0.18	2
22.9-23.0	Neem	<i>Azadirachta indica</i>	0.12	2
22.9-23.0	Tamarind	<i>Tamarindus indica</i>	0.13	1.8
22.9-23.0	Tamarind	<i>Tamarindus indica</i>	0.13	2
22.9-23.0	Tamarind	<i>Tamarindus indica</i>	0.25	3
22.9-23.0	Neem	<i>Azadirachta indica</i>	0.23	2.5
22.9-23.0	Tamarind	<i>Tamarindus indica</i>	0.08	1.5
23.0-23.1	Vatha Narayanan	<i>Delonix elata</i>	0.1	1.5
23.0-23.1	Poonga	<i>Pongamia pinnata</i>	0.13	2
23.0-23.1	Poonga	<i>Pongamia pinnata</i>	0.09	1.5
23.0-23.1	Tamarind	<i>Tamarindus indica</i>	0.07	1
23.0-23.1	Manjanathi	<i>Morinda tomentosa</i>	0.09	1.5
23.1-23.2	Manjanathi	<i>Morinda tomentosa</i>	0.27	1.8
23.1-23.2	Poonga	<i>Pongamia pinnata</i>	0.12	1.5
23.1-23.2	Manjanathi	<i>Morinda tomentosa</i>	0.17	2.2
23.1-23.2	Manjanathi	<i>Morinda tomentosa</i>	0.16	2.5
23.1-23.2	Poonga	<i>Pongamia pinnata</i>	0.08	1.5
23.1-23.2	Manjanathi	<i>Morinda tomentosa</i>	0.15	1.8



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Chainage	Local Name	Botanical Name	Girth Size (m)	Approx. Height (m)
23.2-23.3	Poonga	<i>Pongamia pinnata</i>	0.13	2
23.2-23.3	Poonga	<i>Pongamia pinnata</i>	0.12	1.8
23.3-23.4	Poonga	<i>Pongamia pinnata</i>	0.16	2.5
23.3-23.4	Poonga	<i>Pongamia pinnata</i>	0.1	1.5
23.3-23.4	Vatha Narayanan	<i>Delonix elata</i>	0.09	1.5
23.4-23.5	Poonga	<i>Pongamia pinnata</i>	0.12	2
23.4-23.5	Poonga	<i>Pongamia pinnata</i>	0.1	1.5
23.4-23.5	Tamarind	<i>Tamarindus indica</i>	0.11	1.5
23.4-23.5	Poonga	<i>Pongamia pinnata</i>	0.14	2.5
23.4-23.5	Poonga	<i>Pongamia pinnata</i>	0.15	2
23.4-23.5	Tamarind	<i>Tamarindus indica</i>	0.08	1.5
23.5-23.6	Poonga	<i>Pongamia pinnata</i>	0.13	1.5
23.5-23.6	Vatha Narayanan	<i>Delonix elata</i>	0.09	1.5
23.5-23.6	Vatha Narayanan	<i>Delonix elata</i>	0.1	2
23.5-23.6	Manjanathi	<i>Morinda tomentosa</i>	0.19	1.5
23.6-23.7	Manjanathi	<i>Morinda tomentosa</i>	0.14	1.5
23.6-23.7	Manjanathi	<i>Morinda tomentosa</i>	0.16	1.5
23.6-23.7	Manjanathi	<i>Morinda tomentosa</i>	0.2	2
23.6-23.7	Poonga	<i>Pongamia pinnata</i>	0.09	1.5
23.6-23.7	Poonga	<i>Pongamia pinnata</i>	0.1	1.5
23.7-23.8	Poonga	<i>Pongamia pinnata</i>	0.09	2
23.7-23.8	Poonga	<i>Pongamia pinnata</i>	0.07	1.5
23.7-23.8	Manjanathi	<i>Morinda tomentosa</i>	0.2	2
23.8-23.9	Poonga	<i>Pongamia pinnata</i>	0.09	1.5
23.8-23.9	Poonga	<i>Pongamia pinnata</i>	0.07	1
23.8-23.9	Poonga	<i>Pongamia pinnata</i>	0.1	1.5
23.8-23.9	Poonga	<i>Pongamia pinnata</i>	0.07	1.5
23.8-23.9	Poonga	<i>Pongamia pinnata</i>	0.1	2
23.8-23.9	Poonga	<i>Pongamia pinnata</i>	0.06	1.5
23.8-23.9	Poonga	<i>Pongamia pinnata</i>	0.19	2.5
23.8-23.9	Poonga	<i>Pongamia pinnata</i>	0.09	1.5
23.8-23.9	Poonga	<i>Pongamia pinnata</i>	0.06	1.5
24.0-24.1	Vatha Narayanan	<i>Delonix elata</i>	0.13	1.5
24.0-24.1	Poonga	<i>Pongamia pinnata</i>	0.07	1.5
24.1-24.2	Poonga	<i>Pongamia pinnata</i>	0.14	1.8
24.1-24.2	Poonga	<i>Pongamia pinnata</i>	0.1	1.5
24.1-24.2	Neem	<i>Azadirachta indica</i>	0.08	1.5
24.1-24.2	Poonga	<i>Pongamia pinnata</i>	0.15	1.8
24.3-24.4	Poonga	<i>Pongamia pinnata</i>	0.09	1.5
27.4-27.5	Neem	<i>Azadirachta indica</i>	0.19	2.5
28.9-29.0	Manjanathi	<i>Morinda tomentosa</i>	0.13	2
33.5-33.6	Manjanathi	<i>Morinda tomentosa</i>	0.23	2
33.5-33.6	Neem	<i>Azadirachta indica</i>	0.11	1.5
34.4-34.5	Manjanathi	<i>Morinda tomentosa</i>	0.13	2
41.6-41.7	.Naaval	<i>Syzygium cumini</i>	0.2	2
41.6-41.7	Neem	<i>Azadirachta indica</i>	0.13	2
41.7-41.8	Poonga	<i>Pongamia pinnata</i>	0.15	2
42.1-42.2	Neem	<i>Azadirachta indica</i>	0.12	2
42.2-42.3	Neem	<i>Azadirachta indica</i>	0.12	2



**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Chainage	Local Name	Botanical Name	Girth Size (m)	Approx. Height (m)
42.2-42.3	Neem	<i>Azadirachta indica</i>	0.14	2.5
42.2-42.3	Poonga	<i>Pongamia pinnata</i>	0.09	1.8
42.3-42.4	Neem	<i>Azadirachta indica</i>	0.19	2
42.5-42.6	Neem	<i>Azadirachta indica</i>	0.11	1.5
42.7-42.8	Neem	<i>Azadirachta indica</i>	0.15	2
43.1-43.2	Neem	<i>Azadirachta indica</i>	0.16	1.8
43.5-43.6	Neem	<i>Azadirachta indica</i>	0.15	2.5
44.2-44.3	.Naaval	<i>Syzygium cumini</i>	0.12	2
44.3-44.4	Tamarind	<i>Tamarindus indica</i>	0.15	1.5
44.3-44.4	Kodikapuli	<i>Pithecollobium dulce</i>	0.09	1.8
44.6-44.7	Tamarind	<i>Tamarindus indica</i>	0.14	1.8
52.4-52.5	Tamarind	<i>Tamarindus indica</i>	0.21	2.5
52.4-52.5	Tamarind	<i>Tamarindus indica</i>	0.18	1.8
54.5-54.6	Neem	<i>Azadirachta indica</i>	0.09	1.5

**Nanguneri - Bharatavaram - Ovari Road**  
**(km 0/000 to km 35/200), Section of SH 89 (LHS)**

Existing Chainage	Local Name	Botanical Name	Girth Size (m)	Approx. Height (m)
0.2-0.3	Manjanathi	<i>Morinda tomentosa</i>	0.15	2
2.0-2.1	Neem	<i>Azadirachta indica</i>	0.17	2
2.0-2.1	Neem	<i>Azadirachta indica</i>	0.12	2
2.0-2.1	Neem	<i>Azadirachta indica</i>	0.19	2
2.0-2.1	Neem	<i>Azadirachta indica</i>	0.22	2.5
2.1-2.2	Neem	<i>Azadirachta indica</i>	0.2	2.5
2.1-2.2	Arasu	<i>Ficus religiosa</i>	0.12	1.5
2.2-2.3	Neem	<i>Azadirachta indica</i>	0.22	2
2.3-2.4	Neem	<i>Azadirachta indica</i>	0.14	2
2.3-2.4	Neem	<i>Azadirachta indica</i>	0.19	2.5
2.3-2.4	Neem	<i>Azadirachta indica</i>	0.22	1
2.3-2.4	Neem	<i>Azadirachta indica</i>	0.27	2.5
2.4-2.5	Pulee	<i>Tamarindus indica</i>	0.27	2.5
2.5-2.6	Neem	<i>Azadirachta indica</i>	0.12	2
3.0-3.1	Neem	<i>Azadirachta indica</i>	0.12	2
4.8-4.9	Pungan	<i>Pongamia pungan</i>	0.14	1.5
4.8-4.9	Manjanathi	<i>Morinda tomentosa</i>	0.2	1.5
4.8-4.9	Manjanathi	<i>Morinda tomentosa</i>	0.22	2
5.1-5.2	Neem	<i>Azadirachta indica</i>	0.12	2
5.6-5.7	Neem	<i>Azadirachta indica</i>	0.17	2.5
5.6-5.7	Neem	<i>Azadirachta indica</i>	0.09	1.5
5.8-5.9	Manjanathi	<i>Morinda tomentosa</i>	0.09	1.5
5.8-5.9	Manjanathi	<i>Morinda tomentosa</i>	0.28	2
5.8-5.9	Manjanathi	<i>Morinda tomentosa</i>	0.12	1.5
5.8-5.9	Manjanathi	<i>Morinda tomentosa</i>	0.16	2
6.0-6.1	Manjanathi	<i>Morinda tomentosa</i>	0.17	2
6.5-6.6	Manjanathi	<i>Morinda tomentosa</i>	0.16	1.5
6.7-6.8	Usil	<i>Albizia procera</i>	0.15	2
7.8-7.9	Neem	<i>Azadirachta indica</i>	0.09	1.5
7.9-8.0	Neem	<i>Azadirachta indica</i>	0.09	1.5





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Existing Chainage	Local Name	Botanical Name	Girth Size (m)	Approx. Height (m)
10.3-10.4	Neem	<i>Azadirachta indica</i>	0.17	2.5
10.4-10.5	Puvarasu	<i>Thespesia populnea</i>	0.18	2.5
10.5-10.6	Neem	<i>Azadirachta indica</i>	0.12	2
12.0-12.1	Puvarasu	<i>Thespesia populnea</i>	0.18	2
12.0-12.1	Puvarasu	<i>Thespesia populnea</i>	0.12	1.5
13.7-13.8	Neem	<i>Azadirachta indica</i>	0.15	2.5
13.7-13.8	Neem	<i>Azadirachta indica</i>	0.15	2
13.7-13.8	Neem	<i>Azadirachta indica</i>	0.08	1.5
20.8-20.9	Neem	<i>Azadirachta indica</i>	0.15	2
21.0-21.1	Neem	<i>Azadirachta indica</i>	0.12	1.5
21.2-21.3	Aalamaram	<i>Ficus bengalensis</i>	0.25	2
22.1-22.2	Aalamaram	<i>Ficus bengalensis</i>	0.24	2
23.0-23.1	Neem	<i>Azadirachta indica</i>	0.1	1.5
23.0-23.1	Manjanathi	<i>Morinda tomentosa</i>	0.12	1.5
23.1-23.2	Neem	<i>Azadirachta indica</i>	0.1	1.8
25.3-25.4	Puvarasu	<i>Thespesia populnea</i>	0.15	2
25.6-25.7	Puvarasu	<i>Thespesia populnea</i>	0.02	2.5
25.6-25.7	Puvarasu	<i>Thespesia populnea</i>	0.22	2.5
26.7-28.8	Neem	<i>Azadirachta indica</i>	0.17	2.5
26.8-26.9	Neem	<i>Azadirachta indica</i>	0.13	2
30.5-30.6	Tekku	<i>Tectona grandis</i>	0.1	1.5
30.5-30.6	Tekku	<i>Tectona grandis</i>	0.09	1.5
31.4-31.5	Neem	<i>Azadirachta indica</i>	0.12	1
31.5-31.6	Vatha narayanam	<i>Delonix elata</i>	0.15	2
31.5-31.6	Poo Maram	<i>Thalpo</i>	0.18	2
31.7-31.8	Poo Maram	<i>Thalpo</i>	0.08	1.5
32.0-32.1	Aalamaram	<i>Ficus bengalensis</i>	0.17	2
32.0-32.1	Poo Maram	<i>Thalpo</i>	0.16	2
34.7-34.8	Neem	<i>Azadirachta indica</i>	0.07	1
34.7-34.8	Neem	<i>Azadirachta indica</i>	0.2	2
34.7-34.8	Neem	<i>Azadirachta indica</i>	0.22	2

**Nanguneri - Bharatavaram - Ovari Road**  
**(km 0/000 to km 35/200), Section of SH 89 (RHS)**

Existing Chainage	Local Name	Botanical Name	Girth Size (m)	Approx. Height (m)
1.0-1.1	Neem	<i>Azadirachta indica</i>	0.2	2
1.0-1.1	Neem	<i>Azadirachta indica</i>	0.19	2
1.5-1.6	Neem	<i>Azadirachta indica</i>	0.09	1.5
1.6-1.7	Neem	<i>Azadirachta indica</i>	0.17	2.5
1.9-2.0	Arasu	<i>Ficus religiosa</i>	0.18	2
2.0-2.1	Vatha narayanam	<i>Delonix elata</i>	0.3	2.5
2.0-2.1	Neem	<i>Azadirachta indica</i>	0.17	1.8
2.0-2.1	Neem	<i>Azadirachta indica</i>	0.15	2.3
2.1-2.2	Arasu	<i>Ficus religiosa</i>	0.16	1.8
2.2-2.3	Pungan	<i>Pongamia pungan</i>	0.09	1.5
2.2-2.3	Pulee	<i>Tamarindus indica</i>	0.24	2
2.2-2.3	Neem	<i>Azadirachta indica</i>	0.13	2
2.2-2.3	Neem	<i>Azadirachta indica</i>	0.12	2



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 Paruvakudi-Kovilpatti-Ettayapuram-Vilathikulam-Vembar Road (Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700), Section of SH44  
 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

Existing Chainage	Local Name	Botanical Name	Girth Size (m)	Approx. Height (m)
2.3-2.4	Neem	<i>Azadirachta indica</i>	0.26	2.5
4.3-4.4	Neem	<i>Azadirachta indica</i>	0.18	1.8
4.3-4.4	Manjanathi	<i>Morinda tomentosa</i>	0.12	1.8
4.9-5.0	Manjanathi	<i>Morinda tomentosa</i>	0.23	2
5.6-5.7	Neem	<i>Azadirachta indica</i>	0.18	2.5
5.7-5.8	Neem	<i>Azadirachta indica</i>	0.12	2
7.5-7.6	Neem	<i>Azadirachta indica</i>	0.11	1.5
7.6-7.7	Neem	<i>Azadirachta indica</i>	0.17	2
8.4-8.5	Neem	<i>Azadirachta indica</i>	0.18	2.5
8.7-8.8	Neem	<i>Azadirachta indica</i>	0.24	2
9.0-9.1	Manjanathi	<i>Morinda tomentosa</i>	0.18	1.5
10.6-10.7	Puvarasu	<i>Thespesia populnea</i>	0.14	1.8
13.6-13.7	Neem	<i>Azadirachta indica</i>	0.12	1
13.6-13.7	Neem	<i>Azadirachta indica</i>	0.12	1.5
14.3-14.4	Neem	<i>Azadirachta indica</i>	0.1	1.8
14.7-14.8	Badan	<i>Terminalia Kadappa</i>	0.12	1.5
14.7-14.8	Neem	<i>Azadirachta indica</i>	0.2	2.5
14.7-14.8	Badan	<i>Terminalia Kadappa</i>	0.12	1.5
14.7-14.8	Pungan	<i>Pongamia pungan</i>	0.13	2
15.9-16.0	Neem	<i>Azadirachta indica</i>	0.12	1.5
16.4-16.5	Neem	<i>Azadirachta indica</i>	0.11	1
16.5-16.6	Aalamaram	<i>Ficus bengalensis</i>	0.15	2
16.5-16.6	Aalamaram	<i>Ficus bengalensis</i>	0.18	2
19.9-20.0	Neem	<i>Azadirachta indica</i>	0.09	1.5
19.9-20.0	Neem	<i>Azadirachta indica</i>	0.12	2
20.7-20.8	Pungan	<i>Pongamia pungan</i>	0.12	1.8
31.1-31.2	Pungan	<i>Pongamia pungan</i>	0.24	2.5
31.1-31.2	Manjanathi	<i>Morinda tomentosa</i>	0.2	2
31.2-31.3	Manjanathi	<i>Morinda tomentosa</i>	0.12	1.5
31.3-31.4	Neem	<i>Azadirachta indica</i>	0.12	1.5
31.5-31.6	Poo Maram	<i>Thalpo</i>	0.15	1.8
32.1-32.2	Poo Maram	<i>Thalpo</i>	0.15	2.5
32.3-32.4	Badam	<i>Terminalia Catappa</i>	0.15	2
32.3-32.4	Pungan	<i>Pongamia pungan</i>	0.17	2.5
34.9-35.0	Puvarasu	<i>Thespesia populnea</i>	0.12	2
34.9-35.0	Puvarasu	<i>Thespesia populnea</i>	0.11	2

**Rajapalayam - Sankarankovil – Tirunelveli**

**(km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41 (LHS)**

S. No.	Tree No.	Chainage	Local Name	Scientific Name	Girth at (m)	Approx Height (m)
1	43	2.6-2.7	Neem	<i>Azadirachta indica</i>	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	<i>Morinda tomentosa</i>	0.14	2.5
7	26	3.5-3.6	Neem	<i>Azadirachta indica</i>	0.12	2.5



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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S. No.	Tree No.	Chainage	Local Name	Scientific Name	Girth at (m)	Approx Height (m)
8	27	3.5-3.6	Manjanathi	<i>Morinda tomentosa</i>	0.12	2.5
9	28	3.5-3.6	Manjanathi	<i>Morinda tomentosa</i>	0.1	2.5
10	8	5.1-5.2	Neem	<i>Azadirachta indica</i>	0.12	2
11	16	5.3-5.4	Malvaagai		0.1	2
12	18	5.4-5.5	Pulee	<i>Tamarindus indica</i>	0.15	2
13	2	6.0-6.1	Manjanathi	<i>Morinda tomentosa</i>	0.09	1.5
14	4	7.2-7.3	Pungan	<i>Pongamia pungan</i>	0.25	2.5
15	7	7.2-7.3	Neem	<i>Azadirachta indica</i>	0.25	2.5
16	13	7.3-7.4	Neem	<i>Azadirachta indica</i>	0.2	2.5
17	22	7.4-7.5	Neem	<i>Azadirachta indica</i>	0.25	2
18	25	7.6-7.7	Neem	<i>Azadirachta indica</i>	0.2	2
19	33	7.7-7.8	Manjanathi	<i>Morinda tomentosa</i>	0.2	1.5
20	66	8.8-8.9	Neem	<i>Azadirachta indica</i>	0.1	1.5
21	74	8.9-9	Neem	<i>Azadirachta indica</i>	0.25	2
22	1	9.1-9.2	Neem	<i>Azadirachta indica</i>	0.1	1.5
23	19	10.5-10.6	Neem	<i>Azadirachta indica</i>	0.2	2
24	6	11.8-11.9	Neem	<i>Azadirachta indica</i>	0.15	2.5
25	10	12.7-12.8	Pungan	<i>Pongamia pungan</i>	0.2	1
26	1	13.0-13.1	Neem	<i>Azadirachta indica</i>	0.1	1
27	6	13.1-13.2	Neem	<i>Azadirachta indica</i>	0.1	1.5
28	17	17.9-18	Manjanathi	<i>Morinda tomentosa</i>	0.1	1
29	5	20.1-20.2	Neem	<i>Azadirachta indica</i>	0.1	2
30	18	20.5-20.6	Neem	<i>Azadirachta indica</i>	0.1	1
31	19	20.6-20.7	Neem	<i>Azadirachta indica</i>	0.1	1
32	20	20.6-20.7	Neem	<i>Azadirachta indica</i>	0.1	1
33	30	26.8-26.9	Neem	<i>Azadirachta indica</i>	0.1	1
34	34	39.3-39.4	Neem	<i>Azadirachta indica</i>	0.1	2
35	38	39.4-39.5	Neem	<i>Azadirachta indica</i>	0.1	2
36	44	39.4-39.5	Neem	<i>Azadirachta indica</i>	0.1	2
37	52	39.5-39.6	Neem	<i>Azadirachta indica</i>	0.15	2
38	58	39.6-39.7	Neem	<i>Azadirachta indica</i>	0.12	2
39	63	39.6-39.7	Pulee	<i>Tamarindus indica</i>	0.25	2
40	68	39.7-39.8	Pulee	<i>Tamarindus indica</i>	0.2	2
41	69	39.7-39.8	Neem	<i>Azadirachta indica</i>	0.18	2.5
42	82	39.9-40	Pulee	<i>Tamarindus indica</i>	0.2	2
43	13	40.0-40.1	Neem	<i>Azadirachta indica</i>	0.12	2
44	21	40.1-40.2	Neem	<i>Azadirachta indica</i>	0.2	2.5
45	29	40.3-40.4	Pulee	<i>Tamarindus indica</i>	0.2	2
46	30	40.3-40.4	Pulee	<i>Tamarindus indica</i>	0.22	2
47	33	40.3-40.4	Pulee	<i>Tamarindus indica</i>	0.25	2
48	34	40.4-40.5	Neem	<i>Azadirachta indica</i>	0.15	1.5
49	38	40.4-40.5	Pulee	<i>Tamarindus indica</i>	0.12	1.5
50	40	40.4-40.5	Pulee	<i>Tamarindus indica</i>	0.24	2
51	41	40.4-40.5	Pulee	<i>Tamarindus indica</i>	0.2	2
52	25	42.8-42.9	Neem	<i>Azadirachta indica</i>	0.12	2
53	29	42.9-43.0	Neem	<i>Azadirachta indica</i>	0.12	1.5
54	34	42.9-43.0	Tekku	<i>Tectona grandis</i>	0.12	2.5
55	30	43.2-43.3	Neem	<i>Azadirachta indica</i>	0.15	2
56	31	43.2-43.3	Neem	<i>Azadirachta indica</i>	0.18	1.5



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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S. No.	Tree No.	Chainage	Local Name	Scientific Name	Girth at (m)	Approx Height (m)
57	36	43.2-43.3	Neem	<i>Azadirachta indica</i>	0.13	1.5
58	53	43.6-43.7	Neem	<i>Azadirachta indica</i>	0.15	2
59	64	43.7-43.8	Neem	<i>Azadirachta indica</i>	0.1	2
60	85	43.9-44.0	Neem	<i>Azadirachta indica</i>	0.15	2
61	86	43.9-44.0	Neem	<i>Azadirachta indica</i>	0.1	2
62	1	44.0-44.1	Neem	<i>Azadirachta indica</i>	0.15	2.5
63	4	44.0-44.1	Neem	<i>Azadirachta indica</i>	0.1	2
64	5	44.0-44.1	Neem	<i>Azadirachta indica</i>	0.07	1.5
65	20	45.0-45.1	Neem	<i>Azadirachta indica</i>	0.1	2
66	9	49.1-49.2	Neem	<i>Azadirachta indica</i>	0.11	2
67	15	49.2-49.3	Neem	<i>Azadirachta indica</i>	0.15	2
68	16	49.2-49.3	Neem	<i>Azadirachta indica</i>	0.1	2
69	18	49.2-49.3	Neem	<i>Azadirachta indica</i>	0.14	2
70	19	49.3-49.4	Neem	<i>Azadirachta indica</i>	0.1	2
71	21	49.3-49.4	Neem	<i>Azadirachta indica</i>	0.12	2
72	22	49.4-49.5	Neem	<i>Azadirachta indica</i>	0.15	2.2
73	26	49.4-49.5	Neem	<i>Azadirachta indica</i>	0.09	1.5
74	32	49.5-49.6	Pulee	<i>Tamarindus indica</i>	0.12	2
75	34	49.6-49.7	Neem	<i>Azadirachta indica</i>	0.1	2
76	35	49.7-49.8	Neem	<i>Azadirachta indica</i>	0.1	1.5
77	37	49.7-49.8	Neem	<i>Azadirachta indica</i>	0.1	2
78	38	49.7-49.8	Neem	<i>Azadirachta indica</i>	0.1	1.5
79	47	49.8-49.9	Neem	<i>Azadirachta indica</i>	0.15	1.5
80	48	49.8-49.9	Neem	<i>Azadirachta indica</i>	0.2	2
81	1	50-50.1	Neem	<i>Azadirachta indica</i>	0.1	1
82	7	50.4-50.5	Neem	<i>Azadirachta indica</i>	0.1	1
83	8	50.4-50.5	Pungan	<i>Pongamia pungan</i>	0.1	1
84	18	54.1-54.2	Neem	<i>Azadirachta indica</i>	0.2	2
85	23	54.2-54.3	Neem	<i>Azadirachta indica</i>	0.15	2
86	27	54.2-54.3	Neem	<i>Azadirachta indica</i>	0.2	2
87	5	55.1-55.2	Neem	<i>Azadirachta indica</i>	0.1	2
88	14	56.5-56.6	Neem	<i>Azadirachta indica</i>	0.1	2
89	15	56.6-56.7	Neem	<i>Azadirachta indica</i>	0.1	2
90	16	56.7-56.8	Neem	<i>Azadirachta indica</i>	0.12	2
91	16	59.7-59.8	Neem	<i>Azadirachta indica</i>	0.1	1
92	17	59.7-59.8	Neem	<i>Azadirachta indica</i>	0.15	1
93	4	61.0-61.1	Neem	<i>Azadirachta indica</i>	0.1	1.5
94	4	62.6-62.7	Neem	<i>Azadirachta indica</i>	0.1	1
95	5	62.6-62.7	Neem	<i>Azadirachta indica</i>	0.1	1
96	21	80.8-80.9	Manjanathi	<i>Morinda tomentosa</i>	0.07	1.5
97	3	80.9-81.0	Manjanathi	<i>Morinda tomentosa</i>	0.09	2
98	4	80.9-81.0	Manjanathi	<i>Morinda tomentosa</i>	0.12	2

**Rajapalayam - Sankarankoil – Tirunelveli**

**(km 1/800 to km 28/000 and km 33/800 to km 82/800), Section of SH41 (RHS)**

S. No.	Tree No.	Chainage	Local Name	Scientific Name	Girth (m)	Approx Height (m)
1	30	2.4-2.5	Neem	<i>Azadirachta indica</i>	0.1	1



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S. No.	Tree No.	Chainage	Local Name	Scientific Name	Girth (m)	Approx Height (m)
2	34	2.5-2.6	Pungan	<i>Pongamia pungan</i>	0.18	1
3	35	2.5-2.6	Pungan	<i>Pongamia pungan</i>	0.12	1
4	37	2.5-2.6	Pungan	<i>Pongamia pungan</i>	0.11	1
5	44	2.7-2.8	Pungan	<i>Pongamia pungan</i>	0.23	1.5
6	4	3.0-3.1	Manjanathi	<i>Morinda tomentosa</i>	0.07	0.5
7	25	3.6-3.7	Manjanathi	<i>Morinda tomentosa</i>	0.09	1
8	35	3.7-3.8	Neem	<i>Azadirachta indica</i>	0.09	1.5
9	41	3.9-4.0	Neem	<i>Azadirachta indica</i>	0.09	1
10	5	4.0-4.1	Aalamaram	<i>Ficus bengalensis</i>	0.22	1
11	25	4.3-4.4	Pungan	<i>Pongamia pungan</i>	0.18	0.5
12	43	4.7-4.8	Neem	<i>Azadirachta indica</i>	0.21	3
13	18	5.2-5.3	Pungan	<i>Pongamia pungan</i>	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	<i>Pongamia pungan</i>	0.1	1
17	33	5.4-5.5	Pungan	<i>Pongamia pungan</i>	0.26	0.6
18	37	5.5-5.6	Pungan	<i>Pongamia pungan</i>	0.14	0.2
19	38	5.5-5.6	Pungan	<i>Pongamia pungan</i>	0.23	0.1
20	74	5.9-6.0	nochi		0.11	2
21	19	6.1-6.2	Neem	<i>Azadirachta indica</i>	0.15	1.15
22	32	6.2-6.3	Neem	<i>Azadirachta indica</i>	0.2	0.8
23	41	6.3-6.4	Pungan	<i>Pongamia pungan</i>	0.25	3
24	49	6.3-6.4	Neem	<i>Azadirachta indica</i>	0.1	2.5
25	53	6.4-6.5	Pungan	<i>Pongamia pungan</i>	0.12	2.6
26	55	6.4-6.5	Neem	<i>Azadirachta indica</i>	0.1	1.5
27	56	6.4-6.5	Neem	<i>Azadirachta indica</i>	0.09	1.5
28	60	6.4-6.5	Neem	<i>Azadirachta indica</i>	0.2	2.5
29	63	6.4-6.5	Neem	<i>Azadirachta indica</i>	0.25	2.5
30	64	6.4-6.5	Manjanathi	<i>Morinda tomentosa</i>	0.1	2
31	73	6.5-6.6	Pungan	<i>Pongamia pungan</i>	0.2	2
32	75	6.5-6.6	Neem	<i>Azadirachta indica</i>	0.1	2.5
33	81	6.7-6.8	Neem	<i>Azadirachta indica</i>	0.12	2
34	82	6.7-6.8	Neem	<i>Azadirachta indica</i>	0.15	2.5
35	84	6.7-6.8	Neem	<i>Azadirachta indica</i>	0.15	2
36	85	6.8-6.9	Neem	<i>Azadirachta indica</i>	0.2	2.5
37	87	6.8-6.9	Neem	<i>Azadirachta indica</i>	0.15	2
38	88	6.8-6.9	Neem	<i>Azadirachta indica</i>	0.22	2
39	89	6.8-6.9	Neem	<i>Azadirachta indica</i>	0.18	2
40	93	6.9-7.0	Neem	<i>Azadirachta indica</i>	0.12	2
41	99	6.9-7.0	Neem	<i>Azadirachta indica</i>	0.12	2
42	5	7.0-7.1	Neem	<i>Azadirachta indica</i>	0.12	2
43	7	7.0-7.1	Neem	<i>Azadirachta indica</i>	0.25	2.5
44	8	7.1-7.2	Neem	<i>Azadirachta indica</i>	0.25	1
45	9	7.1-7.2	Manjanathi	<i>Morinda tomentosa</i>	0.15	2
46	10	7.1-7.2	Neem	<i>Azadirachta indica</i>	0.23	2.5
47	11	7.2-7.3	Neem	<i>Azadirachta indica</i>	0.15	3
48	14	7.2-7.3	Neem	<i>Azadirachta indica</i>	0.18	2.5
49	15	7.2-7.3	Neem	<i>Azadirachta indica</i>	0.15	2.5
50	32	7.3-7.4	Neem	<i>Azadirachta indica</i>	0.12	2





**ENVIRONMENTAL ASSESSMENT REPORT FOR TWO LANE UP-GRADATION WITH PAVED SHOULDERS OF**  
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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S. No.	Tree No.	Chainage	Local Name	Scientific Name	Girth (m)	Approx Height (m)
51	36	7.4-7.5	Manjanathi	<i>Morinda tomentosa</i>	0.14	2
52	39	7.4-7.5	Neem	<i>Azadirachta indica</i>	0.25	3.5
53	46	7.5-7.6	Naval	<i>Eugenia argentea</i>	0.12	1.5
54	47	7.5-7.6	Naval	<i>Eugenia argentea</i>	0.1	2
55	53	7.6-7.7	Neem	<i>Azadirachta indica</i>	0.15	2
56	56	7.7-7.8	Pulee	<i>Tamarindus indica</i>	0.09	1.5
57	58	7.7-7.8	Neem	<i>Azadirachta indica</i>	0.11	2
58	72	8.5-8.6	Murungai	<i>Moringa oleifera</i>	0.25	2
59	75	8.6-8.7	Neem	<i>Azadirachta indica</i>	0.1	2
60	76	8.6-8.7	Neem	<i>Azadirachta indica</i>	0.13	2.5
61	77	8.6-8.7	Neem	<i>Azadirachta indica</i>	0.2	2.5
62	78	8.6-8.7	Manjanathi	<i>Morinda tomentosa</i>	0.25	2.5
63	1	9.0-9.1	Pungan	<i>Pongamia pungan</i>	0.12	2
64	10	10.2-10.3	Manjanathi	<i>Morinda tomentosa</i>	0.13	2
65	13	10.3-10.4	Neem	<i>Azadirachta indica</i>	0.18	2
66	18	10.4-10.5	Neem	<i>Azadirachta indica</i>	0.12	2.5
67	31	10.8-10.9	Naval	<i>Eugenia argentea</i>	0.25	2
68	3	11.2-11.3	Neem	<i>Azadirachta indica</i>	0.1	2
69	10	11.7-11.8	Neem	<i>Azadirachta indica</i>	0.12	2
70	2	12.3-12.4	Neem	<i>Azadirachta indica</i>	0.1	2
71	3	12.3-12.4	Neem	<i>Azadirachta indica</i>	0.07	1.5
72	6	13.1-13.2	Pungan	<i>Pongamia pungan</i>	0.07	1.5
73	7	13.2-13.3	Neem	<i>Azadirachta indica</i>	0.12	2
74	8	13.2-13.3	Neem	<i>Azadirachta indica</i>	0.13	2
75	9	13.3-13.4	Neem	<i>Azadirachta indica</i>	0.12	2
76	12	13.7-13.8	Neem	<i>Azadirachta indica</i>	0.11	2
77	14	13.8-13.9	Pungan	<i>Pongamia pungan</i>	0.15	2
78	16	13.9-14.0	Neem	<i>Azadirachta indica</i>	0.12	2
79	2	14.0-14.1	Neem	<i>Azadirachta indica</i>	0.12	2
80	7	14.1-14.2	Neem	<i>Azadirachta indica</i>	0.12	1.5
81	8	14.3-14.4	Vagai	<i>Albizia labbeck</i>	0.12	2
82	13	14.4-14.5	Neem	<i>Azadirachta indica</i>	0.15	2
83	16	14.4-14.5	Neem	<i>Azadirachta indica</i>	0.12	2
84	17	14.4-14.5	Neem	<i>Azadirachta indica</i>	0.15	2
85	18	14.4-14.5	Neem	<i>Azadirachta indica</i>	0.12	2
86	19	14.5-14.6	Neem	<i>Azadirachta indica</i>	0.09	2
87	23	14.8-14.9	Manjanathi	<i>Morinda tomentosa</i>	0.25	2
88	5	15.3-15.4	Manjanathi	<i>Morinda tomentosa</i>	0.25	2
89	20	15.9-16.0	Manjanathi	<i>Morinda tomentosa</i>	0.25	2
90	14	16.2-16.3	Pulee	<i>Tamarindus indica</i>	0.15	2
91	16	16.2-16.3	Pulee	<i>Tamarindus indica</i>	0.15	2
92	41	16.7-16.8	Neem	<i>Azadirachta indica</i>	0.15	2
93	52	16.8-16.9	Pulee	<i>Tamarindus indica</i>	0.25	2.5
94	4	17.2-17.3	Pulee	<i>Tamarindus indica</i>	0.1	2
95	4	18.0-18.1	Manjanathi	<i>Morinda tomentosa</i>	0.12	2
96	6	18.0-18.1	Aarasamaram	<i>Ficus religiosa</i>	0.25	2
97	8	18.0-18.1	Neem	<i>Azadirachta indica</i>	0.15	2
98	9	18.0-18.1	Neem	<i>Azadirachta indica</i>	0.15	2
99	7	20.1-20.2	Neem	<i>Azadirachta indica</i>	0.15	2.5



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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
 Rajapalayam-Sankarankoil-Tirunelveli (Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800), Section of SH 41

S. No.	Tree No.	Chainage	Local Name	Scientific Name	Girth (m)	Approx Height (m)
100	8	20.1-20.2	Pungan	<i>Pongamia pungan</i>	0.25	2
101	27	20.8-20.9	Neem	<i>Azadirachta indica</i>	0.12	2
102	3	22.0-22.1	Neem	<i>Azadirachta indica</i>	0.22	2
103	6	26.6-26.7	Neem	<i>Azadirachta indica</i>	0.14	2
104	8	26.7-26.8	Neem	<i>Azadirachta indica</i>	0.1	2
105	2	27.1-27.2	Pungan	<i>Pongamia pungan</i>	0.27	2.5
106	5	27.1-27.2	Pungan	<i>Pongamia pungan</i>	0.16	1
107	31	35.9-36.0	Pungan	<i>Pongamia pungan</i>	0.26	1
108	34	35.9-36.0	Pungan	<i>Pongamia pungan</i>	0.25	1.5
109	36	35.9-36.0	Pungan	<i>Pongamia pungan</i>	0.25	1
110	37	35.9-36.0	Pungan	<i>Pongamia pungan</i>	0.2	1.6
111	2	36.0-36.1	Neem	<i>Azadirachta indica</i>	0.25	1.5
112	3	36.0-36.1	Neem	<i>Azadirachta indica</i>	0.2	1.5
113	6	36.0-36.1	Neem	<i>Azadirachta indica</i>	0.1	1.5
114	7	36.0-36.1	Neem	<i>Azadirachta indica</i>	0.15	1.53
115	8	36.0-36.1	Pungan	<i>Pongamia pungan</i>	0.25	1
116	31	36.4-36.5	Neem	<i>Azadirachta indica</i>	0.08	1.5
117	33	36.5-36.6	Neem	<i>Azadirachta indica</i>	0.29	2.2
118	34	36.5-36.6	Neem	<i>Azadirachta indica</i>	0.09	2
119	43	36.6-36.7	Neem	<i>Azadirachta indica</i>	0.22	1.5
120	71	36.9-37.0	Neem	<i>Azadirachta indica</i>	0.09	1.5
121	74	36.9-37.0	Neem	<i>Azadirachta indica</i>	0.07	1
122	6	37.0-37.1	Neem	<i>Azadirachta indica</i>	0.2	2.2
123	51	37.8-37.9	Neem	<i>Azadirachta indica</i>	0.1	2
124	25	39.4-39.5	Pulee	<i>Tamarindus indica</i>	0.29	2
125	29	39.5-39.6	Neem	<i>Azadirachta indica</i>	0.1	1
126	30	39.5-39.6	Neem	<i>Azadirachta indica</i>	0.15	1.2
127	35	39.6-39.7	Neem	<i>Azadirachta indica</i>	0.25	2
128	38	39.6-39.7	Pulee	<i>Tamarindus indica</i>	0.09	1
129	39	39.7-39.8	Neem	<i>Azadirachta indica</i>	0.1	1.5
130	40	39.8-39.9	Neem	<i>Azadirachta indica</i>	0.29	1
131	41	39.8-39.9	Neem	<i>Azadirachta indica</i>	0.29	1
132	42	39.8-39.9	Neem	<i>Azadirachta indica</i>	0.29	1.5
133	1	40.0-40.1	Neem	<i>Azadirachta indica</i>	0.25	0.5
134	2	40.0-40.1	Neem	<i>Azadirachta indica</i>	0.2	0.5
135	3	40.0-40.1	Neem	<i>Azadirachta indica</i>	0.2	0.3
136	6	40.0-40.1	Neem	<i>Azadirachta indica</i>	0.2	2
137	10	40.1-40.2	Neem	<i>Azadirachta indica</i>	0.25	2
138	12	40.1-40.2	Neem	<i>Azadirachta indica</i>	0.25	1.5
139	17	40.2-40.3	Neem	<i>Azadirachta indica</i>	0.29	1
140	21	40.3-40.4	Pulee	<i>Tamarindus indica</i>	0.07	1
141	24	40.4-40.5	Pulee	<i>Tamarindus indica</i>	0.29	1
142	30	40.7-40.8	Neem	<i>Azadirachta indica</i>	0.1	0.5
143	31	40.7-40.8	Neem	<i>Azadirachta indica</i>	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	<i>Azadirachta indica</i>	0.2	1
147	2	44.0-44.1	Neem	<i>Azadirachta indica</i>	0.22	1.5
148	118	44.9-45.0	Neem	<i>Azadirachta indica</i>	0.25	2



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 Nanguneri - Bharatavaram Ovari Road upto ECR Junction (Km 0/000 to Km 35/200), Section of SH 89  
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S. No.	Tree No.	Chainage	Local Name	Scientific Name	Girth (m)	Approx Height (m)
149	85	45.4-45.6	Neem	<i>Azadirachta indica</i>	0.12	2
150	87	45.4-45.6	Neem	<i>Azadirachta indica</i>	0.12	2.5
151	90	45.4-45.6	Neem	<i>Azadirachta indica</i>	0.18	2.5
152	100	45.4-45.6	Neem	<i>Azadirachta indica</i>	0.2	2.5
153	111	45.4-45.6	Neem	<i>Azadirachta indica</i>	0.1	2
154	113	45.4-45.6	Neem	<i>Azadirachta indica</i>	0.09	2
155	4	46.8-46.9	Neem	<i>Azadirachta indica</i>	0.25	2
156	19	46.9-47.0	Neem	<i>Azadirachta indica</i>	0.09	2.5
157	20	46.9-47.0	Neem	<i>Azadirachta indica</i>	0.1	0.5
158	12	47.1-47.2	Neem	<i>Azadirachta indica</i>	0.08	1
159	30	47.3-47.4	Neem	<i>Azadirachta indica</i>	0.08	0.5
160	19	48.2-48.3	Neem	<i>Azadirachta indica</i>	0.18	1.5
161	23	48.3-48.4	Neem	<i>Azadirachta indica</i>	0.18	1.8
162	24	48.3-48.4	Neem	<i>Azadirachta indica</i>	0.25	1
163	25	48.4-48.5	Neem	<i>Azadirachta indica</i>	0.28	1.5
164	29	48.5-48.6	Neem	<i>Azadirachta indica</i>	0.13	1.5
165	30	48.5-48.6	Neem	<i>Azadirachta indica</i>	0.09	1.5
166	35	48.6-48.7	Pulee	<i>Tamarindus indica</i>	0.25	1.5
167	36	48.6-48.7	Neem	<i>Azadirachta indica</i>	0.2	1.5
168	37	48.6-48.7	Neem	<i>Azadirachta indica</i>	0.27	2
169	1	49.0-49.1	Neem	<i>Azadirachta indica</i>	0.1	2
170	6	49.2-49.3	Neem	<i>Azadirachta indica</i>	0.15	2
171	9	49.3-49.4	Neem	<i>Azadirachta indica</i>	0.1	2
172	10	49.3-49.4	Neem	<i>Azadirachta indica</i>	0.09	1.5
173	11	49.3-49.4	Neem	<i>Azadirachta indica</i>	0.09	1.5
174	14	49.4-49.5	Neem	<i>Azadirachta indica</i>	0.1	2
175	16	49.4-49.5	Neem	<i>Azadirachta indica</i>	0.18	2.5
176	20	49.5-49.6	Neem	<i>Azadirachta indica</i>	0.1	1.5
177	34	49.6-49.7	Neem	<i>Azadirachta indica</i>	0.12	2
178	36	49.8-49.9	Neem	<i>Azadirachta indica</i>	0.15	2.5
179	46	49.9-50	Neem	<i>Azadirachta indica</i>	0.15	2
180	47	49.9-50	Pulee	<i>Tamarindus indica</i>	0.2	2
181	1	50.0-50.1	Neem	<i>Azadirachta indica</i>	0.08	1.5
182	2	50.0-50.1	Neem	<i>Azadirachta indica</i>	0.08	1
183	3	50.0-50.1	Pulee	<i>Tamarindus indica</i>	0.23	1
184	4	50.0-50.1	Neem	<i>Azadirachta indica</i>	0.09	2
185	5	50.0-50.1	Neem	<i>Azadirachta indica</i>	0.05	1.8
186	7	50.1-50.2	Neem	<i>Azadirachta indica</i>	0.05	1
187	28	52.5-52.6	Neem	<i>Azadirachta indica</i>	0.08	1.5
188	29	52.6-52.7	Neem	<i>Azadirachta indica</i>	0.08	1
189	29	53.5-53.6	Neem	<i>Azadirachta indica</i>	0.25	1.5
190	31	53.6-53.7	Neem	<i>Azadirachta indica</i>	0.18	0.5
191	32	53.6-53.7	Neem	<i>Azadirachta indica</i>	0.22	1.5
192	35	53.8-53.9	Neem	<i>Azadirachta indica</i>	0.1	1.5
193	1	57.0-57.1	Neem	<i>Azadirachta indica</i>	0.08	0.5
194	25	57.4-57.5	Neem	<i>Azadirachta indica</i>	0.2	2
195	26	57.4-57.5	Neem	<i>Azadirachta indica</i>	0.23	2
196	27	57.4-57.5	Neem	<i>Azadirachta indica</i>	0.23	2.5
197	28	57.4-57.5	Neem	<i>Azadirachta indica</i>	0.2	1.5



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S. No.	Tree No.	Chainage	Local Name	Scientific Name	Girth (m)	Approx Height (m)
198	9	58.1-58.2	Vagai	<i>Albizia labbeck</i>	0.29	2.2
199	27	58.6-58.7	Neem	<i>Azadirachta indica</i>	0.2	1.58
200	42	58.9-59.0	Neem	<i>Azadirachta indica</i>	0.1	1.5
201	1	59.0-59.1	Neem	<i>Azadirachta indica</i>	0.2	2.7
202	9	59.4-59.5	Neem	<i>Azadirachta indica</i>	0.15	1.5
203	13	59.4-59.5	Neem	<i>Azadirachta indica</i>	0.1	1
204	18	59.7-59.8	Neem	<i>Azadirachta indica</i>	0.1	1.5
205	23	59.9-60	Neem	<i>Azadirachta indica</i>	0.2	1.5
206	4	60.6-60.1	Neem	<i>Azadirachta indica</i>	0.25	2.5
207	15	60.5-60.6	arasamaram		0.25	0.7
208	5	61-61.1	Neem	<i>Azadirachta indica</i>	0.29	3.5
209	6	61.4-61.5	Neem	<i>Azadirachta indica</i>	0.1	1.5
210	7	61.4-61.5	Neem	<i>Azadirachta indica</i>	0.1	1.5
211	8	61.4-61.5	Neem	<i>Azadirachta indica</i>	0.1	1
212	9	61.4-61.5	Neem	<i>Azadirachta indica</i>	0.2	1.8
213	10	61.5-61.6	Neem	<i>Azadirachta indica</i>	0.1	1
214	13	65.1-65.2	Neem	<i>Azadirachta indica</i>	0.2	2
215	19	65.2-65.3	Neem	<i>Azadirachta indica</i>	0.25	2
216	3	67.1-67.2	Neem	<i>Azadirachta indica</i>	0.2	1
217	4	67.1-67.2	Neem	<i>Azadirachta indica</i>	0.15	2
218	5	67.8-67.9	Neem	<i>Azadirachta indica</i>	0.15	2
219	19	68.8-68.9	Neem	<i>Azadirachta indica</i>	0.25	1.5
220	21	68.8-68.9	Neem	<i>Azadirachta indica</i>	0.2	1.7
221	23	68.9-69	Neem	<i>Azadirachta indica</i>	0.2	1.5
222	1	69.0-69.1	Neem	<i>Azadirachta indica</i>	0.25	1.5
223	2	71.1-71.2	Neem	<i>Azadirachta indica</i>	0.21	1.5
224	21	72.3-72.4	Manjanathi	<i>Morinda tomentosa</i>	0.29	2.5
225	22	72.3-72.4	Manjanathi	<i>Morinda tomentosa</i>	0.29	2.5
226	23	72.3-72.4	Neem	<i>Azadirachta indica</i>	0.2	2
227		72.3-72.4	Pungan	<i>Pongamia pungan</i>	0.29	1
228	24	72.3-72.4	Manjanathi	<i>Morinda tomentosa</i>	0.25	0.5
229	25	72.4-72.5	Manjanathi	<i>Morinda tomentosa</i>	0.29	2
230	26	72.4-72.5	Pungan	<i>Pongamia pungan</i>	0.29	2
231	28	72.4-72.5	Pungan	<i>Pongamia pungan</i>	0.15	1.5
232	32	72.5-72.6	Pungan	<i>Pongamia pungan</i>	0.2	1.5
233	37	72.5-72.6	Manjanathi	<i>Morinda tomentosa</i>	0.25	2
234	48	72.7-72.8	Pungan	<i>Pongamia pungan</i>	0.29	1.5
235	51	72.7-72.8	Manjanathi	<i>Morinda tomentosa</i>	0.23	2
236	52	72.7-72.8	Manjanathi	<i>Morinda tomentosa</i>	0.23	2
237	54	72.7-72.8	Pungan	<i>Pongamia pungan</i>	0.25	1.5
238	55	72.7-72.8	Manjanathi	<i>Morinda tomentosa</i>	0.29	1.5
239	60	72.8-72.9	Manjanathi	<i>Morinda tomentosa</i>	0.29	1.5
240	61	72.8-72.9	Pungan	<i>Pongamia pungan</i>	0.1	0.5
241	63	72.8-72.9	Akatthi	<i>Sesbania grandiflora</i>	0.1	1
242	64	72.8-72.9	arasamaram		0.1	0.5
243	65	72.8-72.9	Pungan	<i>Pongamia pungan</i>	0.2	1
244	68	72.9-73	Manjanathi	<i>Morinda tomentosa</i>	0.2	1.5
245	1	73.0-73.1	Neem	<i>Azadirachta indica</i>	0.12	2
246	4	73.0-73.1	Vagai	<i>Albizia labbeck</i>	0.12	2



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S. No.	Tree No.	Chainage	Local Name	Scientific Name	Girth (m)	Approx Height (m)
247	8	73.1-73.2	Neem	<i>Azadirachta indica</i>	0.11	2
248	13	73.2-73.3	Vagai	<i>Albizia labbeck</i>	0.14	2
249	15	73.3-73.4	Neem	<i>Azadirachta indica</i>	0.15	2
250	18	73.4-73.5	Neem	<i>Azadirachta indica</i>	0.12	1.5
251	27	73.6-73.7	Neem	<i>Azadirachta indica</i>	0.12	1.5
252	7	74.1-74.2	Neem	<i>Azadirachta indica</i>	0.12	1.5
253	8	74.2-74.3	Neem	<i>Azadirachta indica</i>	0.1	1.5
254	15	74.4-74.5	Neem	<i>Azadirachta indica</i>	0.24	2.5
255	19	74.5-74.6	Neem	<i>Azadirachta indica</i>	0.12	2.5
256	4	75.1-75.2	Neem	<i>Azadirachta indica</i>	0.15	1.5
257	4	76.3-76.4	Neem	<i>Azadirachta indica</i>	0.13	2
258	6	76.4-76.5	Neem	<i>Azadirachta indica</i>	0.12	1.5
259	19	80.8-80.9	Manjanathi	<i>Morinda tomentosa</i>	0.15	4.5
260	14	81.1-81.2	Manjanathi	<i>Morinda tomentosa</i>	0.12	2
261	49	81.5-81.6	Manjanathi	<i>Morinda tomentosa</i>	0.1	1.5
262	52	81.6-81.7	Manjanathi	<i>Morinda tomentosa</i>	0.1	1.5
263	53	81.6-81.7	Manjanathi	<i>Morinda tomentosa</i>	0.1	1.5
264	54	81.6-81.7	Manjanathi	<i>Morinda tomentosa</i>	0.1	1.5

Source: Tree Enumeration at site

**Note:** Above trees have been identified for transplantation along project roads. 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.





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## APPENDIX 8.10: 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 arranged 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.



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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.



## APPENDIX 8.11: ARRANGEMENT FOR COMPENSATORY PLANATION

### REGULATORY FRAMEWORK

- The TNRSP will submit an application to the respective District collector for taking permission regarding tree cutting.
- Permission shall be granted by the District Collector

### FUNDING MECHANISM

- Funding will be done through TNRSP by World Bank

### SELECTION OF TREE SPECIES

- Trees to be selected for planting should be site-specific taking into account the type of soil, features of the planting site e.g for saline and alkaline soils and water logged area will require special attention.
- Browse hardiness, good growth rate, resistance to insects/pests disease and biotic interference etc. should be given appropriate weightage in selection of species.
- Evergreen / semi-evergreen species should be preferred to deciduous species.
- In urban /semi-urban stretches of road, flowering trees should be preferred to add to aesthetics of the surround.
- Trees having large tormentors leaves may be included in stretches where particulates are likely to be high.
- In the matter of selection of species for planting, stakeholders need to be consulted and their views accommodated keeping view the site-specific conditions.

### PLANTING PATTERN

- Monoculture planting should be avoided. Mixed culture of shade-giving, flowering and fruit-bearing species should be preferred.
- The first row may be composed of a mix of species of flowering trees; such mix may consist of trees coming into flowers in different seasons.
- The second row may have representation of middle-sized evergreen and fruit-bearing species.
- The third row wherever feasible should be of broad-leaved evergreen species; the species should be so chosen as to make sure that they grow taller than trees planted in the first and second rows.

### MANAGEMENT AND MONITORING

- Strip plantations should be properly fenced to prevent damages by biotic interference.
- Wherever possible live- hedges may be provided; in such stretches live-hedges need be grown a year ahead of actual planting; such hedges may be reinforced by weaving with split bamboos.
- It may also be explored as to whether communities along the roads can be involved in protection and maintenance of such plantations through a mechanism of sharing of usufructs.
- Local voluntary organizations, sports/youth clubs may also be encouraged for protection of such plantations through provision of incentives.



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## APPENDIX 8.12: 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 <i>eucalyptus</i> has a few other negative environmental impacts.
2	<i>Acacia</i> (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	<i>Ficus bengalensis</i> , <i>Ficus religiosa</i>	The <i>Ficus</i> 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	<i>Azadiracta indica</i> (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 2 <sup>nd</sup> / 3 <sup>rd</sup> row
2	<i>Tamarindus indica</i> (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 2 <sup>nd</sup> / 3 <sup>rd</sup> row
3	<i>Mangifera indica</i> (Mango)	Yield valuable fruit	Recommended for plantation in the 2 <sup>nd</sup> / 3 <sup>rd</sup> row
4	<i>Albizia amara</i> (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 1 <sup>st</sup> row



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S. No.	Trees Name	Characteristics	Remarks
5	<i>Delonix elata</i> (Vatha narayanam), <i>Delonix regia</i> (Konrai)	Flowering species	Recommended for plantation in the 1 <sup>st</sup> / 2 <sup>nd</sup> row
6	<i>Morinda tomentosa</i>	Flowering species with medicinal values. Root, Leaves, Fruits are used	Recommended for plantation in the 1 <sup>st</sup> row
7	<i>Crataeva religiosa</i>	Though it is a flowering tree, fruit of the tree is edible	Recommended for plantation in the 1 <sup>st</sup> / 2 <sup>nd</sup> 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 <sup>2</sup> -d)	Total leaf Area (m <sup>2</sup> /tree)	Mean Dust Collection (g/tree-d)
1	<i>Ficus bengalensis</i>	3.59	107-125	416.44
2	<i>Ficus religiosa</i>	4.15	55-62	242.76
3	<i>Magnifera indica</i>	1.05	60-76	275.40
4	<i>Polyalthia longifolia</i>	4.56	8-12	45.60
5	<i>Tectona grandis</i>	5.35	35-38	195.26
6	<i>Terminalia arjuna</i>	4.49	48-52	224.50

#### 4. Characteristics of major tree species found along project corridor

S No.	Species	Characteristics
1	<b><i>Tamarindus indica</i></b> (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	<b><i>Azadirachta indica</i></b> (Neem)	Category of wood is E. It is dust resistant, gas absorbent. Controls erosion, is drought resistant and supports wildlife. Seeds yield <i>margosa</i> oil, which has medicinal properties including being extremely effective in treatment of leprosy and skin diseases.
3	<b><i>Pongamia pungan</i></b> (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	<b><i>Morinda tomentosa</i></b> (Manjanathi)	Deciduous trees, bark pale brown, thick, vertically fissured and irregularly cracked; blaze turmeric yellow.





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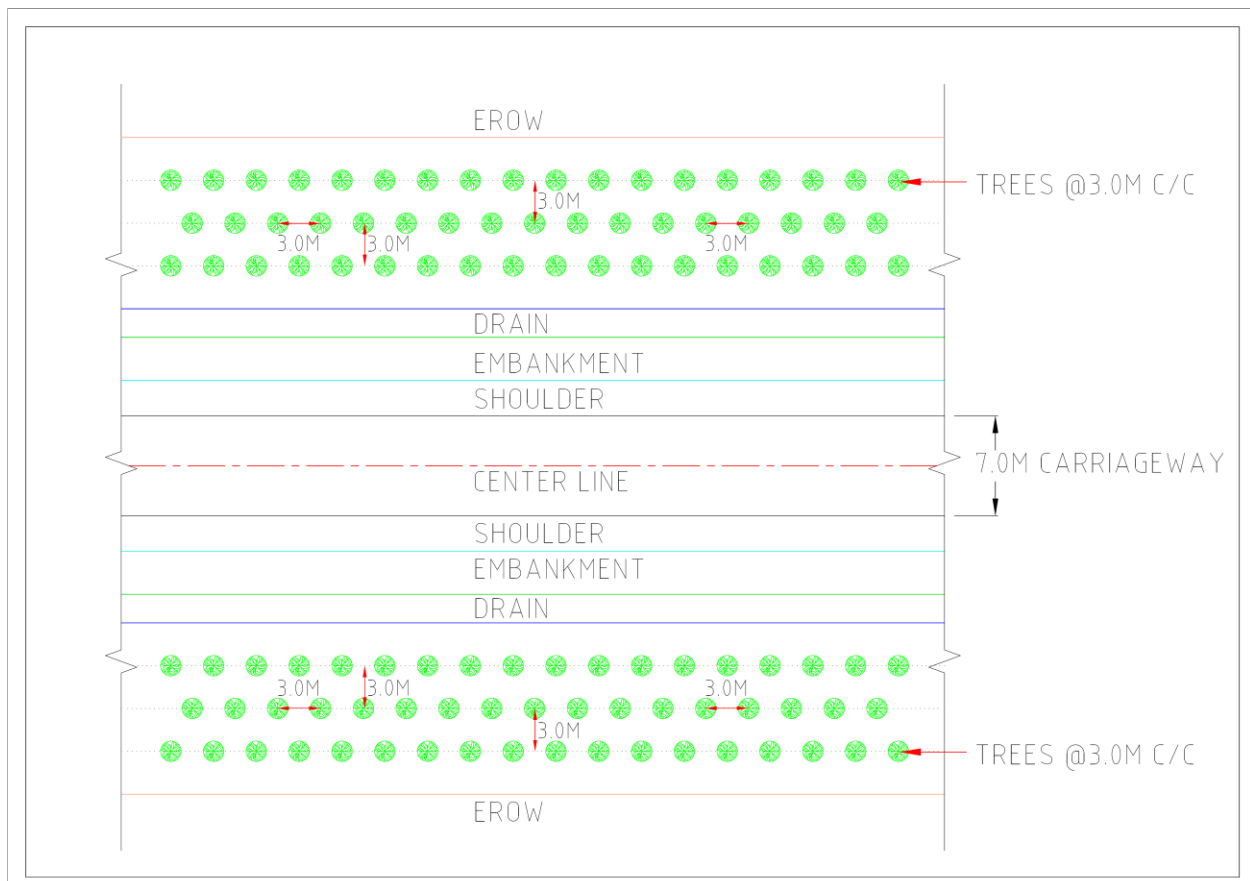
S No.	Species	Characteristics
5	<b><i>Prosopis juliflora</i></b> (Neer karuvai)	The tree has a trunk with a diameter of up to 1.2 metres (3.9 ft). Its leaves are deciduous, bi-pinnate, light green. Flowers shortly after leaf development. A mature plant can produce hundreds of thousands of seeds. The 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	<b><i>Albizia lebbeck</i></b> (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	<b><i>Thespesia populnea</i></b> (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.



## APPENDIX 8.13: GUIDELINE FOR AVENUE PLANTATION

### 1 GENERAL DESCRIPTION

- 1.1 Avenue plantation is suggested all along the rural stretches of the project corridor.
- 1.2 The selections of species agreeing with the general landscaping of the area are suggested/ recommended in **APPENDIX 8.12: GUIDELINES FOR THE SELECTION OF TREE SPECIES.**
- 1.3 Plantation should generally be done at the time of the monsoon in the month of July.
- 1.4 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.
- 1.5 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

- 1.6 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.



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- 1.7 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.
- 1.8 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.
- 1.9 The height of the plants will not be less than 1.5m. and need to be in polythene bags until the planting.
- 1.10 All plants supplied must be planted within three days of removal from the nursery.
- 1.11 The contractor/ agency hired will be required to water the area in case of sufficient rains water after planting.
- 1.12 Size of the pits for planting saplings - 60x60x60 cm
- 1.13 Use of compost of manure - 1/3 of volume of pit mixed with soil, and refilled
- 1.14 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		

1.15 **Table-1: Activities schedule for Plantation along the Road**

Year	Month	S. No.	Activities to be done
1 <sup>st</sup> 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
2 <sup>nd</sup> Year	April to June	1	Purchase of Farm yard manure
		2	Brick/Iron etc. guard for 1 <sup>st</sup> 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



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Year	Month	S. No.	Activities to be done
	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
3 <sup>rd</sup> 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
4 <sup>th</sup> 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, and 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 cm in diameter and 60 cm 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.



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- 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 bio fertilizer 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 contractor's bills.



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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 includes 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.



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- 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.



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Format for the monitoring of the tree plantation and landscaping is given below.

**Format EM7: Tree Plantation and Landscaping**

Construction Stage: Quarterly Report - Date \_\_\_\_ Month \_\_\_\_ Year \_\_\_\_

All landscape works to be as per Landscape Plan

S. No.	Activity	Physical Target					Financial Target			Completion Target		
		Target (Tree/saplings to be planted in Package) for this Quarter			Target Achieved	% of task Completed	Total (lakhs)	Budget Spent	% used	Target Date	Date of Completion/ % completed	Reason for Delay if any
		unit			No. of Trees	Survival Rate (%)						
1	Tree Plantation along roadside	km-km										
2	Landscaping of Road Junctions	Nos.										
3	Plantation at Incidental Spaces	Nos.										
4	Plantation at Locations identified for enhancement	Nos.										
5	Turfing on Embankment	km-km										
6	Saplings on Embankment	km-km										

Certified that the above information is correct

District Collector





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## **APPENDIX 8.14: GUIDELINE FOR ENVIRONMENT FRIENDLY CONSTRUCTION METHODOLOGY**

The contractor shall be deemed to have acquainted himself with the requirements of all the current status, 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.



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- (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, dumpers 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 **Appendix 8.2: Guidelines for Quarry Management** and **Appendix 8.3: Guidelines for Borrow Area Management**.



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### **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-mesh 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.

### **4. 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.

### **5. 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.

### **6. 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.



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- (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-TNRSP 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 reflector 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.

## 7. 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 night.



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- (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.

## 8. 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.

## 9. 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





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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.

## **10. 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.



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## **APPENDIX 8.15: WORKERS SAFETY DURING CONSTRUCTION ACTIVITIES**

### **SAFE LAYOUT IN THE CONSTRUCTION PLANT, CAMP AND QUARRY AREAS**

1. Arrange border to perimeter fencing
2. Ensure good visibility and safe access at site entrances
3. Provide adequate warning signs at the entrance and exit where necessary
4. Provide adequate space/area for loading and unloading, storage of materials, plant and machinery
5. Display emergency procedure and statutory notices at conspicuous location
6. Consider welfare facilities required
7. Provide areas for dumping garbage and other waste materials, and also arrange for their regular clearance.
8. Arrange storage, transport and use of fuel, other flammable materials and explosives in line with the license requirements to be obtained from appropriate authorities
9. Plan emergency assembly points, fire escape routes and locate fire-fighting equipment
10. Provide access roads and plant movement areas within the site.
11. Ensure the availability of first aid facilities and display notices at the various works to show the location of these facilities
12. Provide proper drainage and sewage & drainage facilities

### **HOUSE KEEPING PRACTICES**

1. Maintain washrooms and canteens clean
2. Keep all walkways clear and unobstructed at all times
3. Ensure that spillages of oil and greasy
4. Stack raw materials and finished products clear of walkways or inside roads
5. Do not leave tools on the floor or in any location where they can be easily dislodged
6. Keep windows and light fitting clean
7. Maintain the workplace floors dry and in a non-slippery condition
8. Provide and maintain proper drainage system to prevent water ponding
9. Use metal bins for oily and greasy rags and store all flammable materials in appropriate bins, racks or cabinets. Ensure that the metal bins for storing oily and grease rags should be covered with lids.
10. Ensure that protruding nails in boards or walls are moved or bent over so that they do not constitute a hazard to people
11. 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
12. Display 'no smoking' signs in areas with high fire risks, e.g. paint stores, wood working area and others

### **TREE FELLING**

1. Use hard hats during tree felling
2. Ensure tools such as the axes are in good condition
3. Determine proper foot and body position when using the axe. Do not cut above your head



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4. Wear appropriate foot protection
5. Carry a first aid kit to the site
6. Determine possible hazards in the area, e.g. electrical or telephone or other utility lines
7. Prior to felling, determine the safest direction for the fall
8. Determine the proper hinge size before directing the tree fall.

## NOISE HAZARDS AND ITS CONTROL

1. Note that indications of noise levels are:
  - You have to shout to be heard;
  - Your hearing is dulled just after work;
  - You get head noises or ringing in the ears after work;
  - You have difficulty hearing people while others are talking
2. Use sound level meters to measure. If the sound level exceeds 85 dB(A), then preventive measures should be taken
3. Make personnel aware of noisy areas by using suitable warning signs and insisting that ear protectors should necessarily be worn.
4. Reduce noise at source by improved maintenance, replacing noisy machines, screening with noise absorbing material, making changes to the process/equipment, controlling machine speeds, ensuring that two noise-generating machines are not running at the same time, using cutting oils and hydraulic breakers.
5. Appoint a competent person to carryout a detailed noise assessment of the site, designate ear protection zone, and give instructions on the necessary precautionary measures to be observed by site personnel, including the use of suitable type of ear protections.
6. Wear and maintain ear muffs and ear plugs as required
7. In construction or repair work, noise should be kept to a low-level bearing in mind the disturbance to local residents.

## ROAD WORKS

1. Children will not be employed in any manner that is economically exploitative, or is likely to be hazardous or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. Children under the age of 18 will not be employed in hazardous work. All work of persons under the age of 18 will be subject to an appropriate risk assessment and regular monitoring of health, working conditions, and hours of work.
2. The use of signage is most important to caution the road users of possible unsafe conditions due to the road works.
3. Use the appropriate signage devices as required by the site conditions/situation. The devices include regulatory signs, delineators, barricades, cones, pavement markings, lanterns and traffic control lights.
4. In using signs, make sure that they are (i) simple, easy-to-understand and convey only one message, (ii) luminescent and with reflective properties, and (iii) broad, prominent and of appropriate size.



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5. In using barricades, make sure that you keep traffic away from work areas and you guide the drivers to keep along a safe, alternative path.
6. Ensure that proper personal protective equipment (PPE) is provided to all the workers.
7. Cover existing road signs and install new ones at appropriate locations taking into account the distances that would be required and reaction times.
8. Plan layout and traffic management so that hazard is not created.
9. Deploy flagmen, who control traffic at the work areas. The flag should be 600mm x 600mm fastened to a 1m length staff.
10. Flagmen should wear reflective safety vests along with hard hats
11. If required, use wireless devices for flagmen to co-ordinate from either ends of the road, where works are being carried out.

### **ELECTRICAL HAZARDS IN CONSTRUCTION AREAS**

1. Treat all wires as live wires
2. Never touch dangling wires, but report them to your manager
3. Unless you are a qualified electrician, do not attempt electrical repairs
4. Never use electrical equipment if your hands are wet or you are standing in water
5. If electrical equipment is sparking or smoking, turn the power off and report the condition to your supervisor
6. Never use electrical wires that have physical damage
7. Never allow equipment or traffic to run over electrical wires.

### **USE AND STORAGE OF GAS/LPG**

1. Store filled gas/LPG cylinder in the open area, i.e. outside of the building
2. Transport, store, use and secure cylinders in upright position
3. Ensure proper ventilation at the ground level in locations where gas/LPG is in use
4. Avoid physical damage to the cylinders
5. Never weld or cut on or near the cylinders
6. Store empty cylinders secured and upright
7. Make sure that the cylinder is closed immediately after use
8. Investigate immediately if there is the smell of LPG or gas
9. Never use destenched gas/LPG on site.
10. Make sure that there is no other unrelated fire in the vicinity of the cylinder

### **OPERATION OF EXCAVATORS**

1. Ensure that excavators are operated by authorized persons who have been adequately trained.
2. Prevent unauthorized movement or use of the excavators
3. Check regularly and maintain the machine thoroughly
4. Ensure that all relevant information, including those related to instruction, training, supervision and safe system of work are provided to the operators.
5. Ensure that the operation and maintenance manuals, manufacturer's specifications, inspection and maintenance log books are provided for the use of the mechanics, service



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engineers or other safety personnel during periodic maintenance, inspection and examination.

6. During tipping or running alongside the trenches, excavators must be provided with stop blocks.
7. Excavators must be rested on firm ground during operation
8. Avoid operating the machine too close to an overhang, deep ditch or hole and be alert to potential carving edges, falling rocks and slides, rough terrain and obstacles.
9. Locate and identify underground services by checking with all utility companies before excavations.
10. Ensure that all excavations are supervised by experienced and competent persons.
11. When reversing or in case the operator's view is restricted, adequate supervision and signaling should be provided.
12. 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.
13. Check and report for excessive wear and any breakage of the bucket, blade, edge, tooth and other working tools of the excavator.
14. Check that all linkages/hinges are properly lubricated and ensure that the linkage pins are secured. Never use improper linkage pins.
15. Never dismount or mount a moving machine
16. Work only with adequate ventilation and lighting
17. Ensure that the protective front screen of the driving cabin is fixed in position during excavations to avoid eye injury to the operator.
18. Ensure switch-off of the unattended vehicle.

### **OPERATION OF TRUCKS AND DUMPERS**

1. Ensure that only trained, authorized and licensed drivers operate the vehicles
2. Enlist the help of another worker before reversing the vehicle
3. Switch-off the engine of an unattended vehicle
4. 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.
5. Wear safety boots or shoes to avoid injuries during loading and unloading.
6. Carryout periodic servicing to the manufacturer's requirements. All records of maintenance and repairs should be in writing or kept on site.
7. Keep the vehicle tidy and the cabin free from tools and material, which might obstruct the controls.
8. Keep to speed limits.
9. No passenger should be carried on a dumper except the driver
10. Never drive the vehicle across a slope
11. Provide stop blocks when the vehicle is tipping into or running alongside excavations
12. Do not overload the vehicle.
13. Carry only well secured loads
14. Park only on level ground, in neutral with the parking brake applied
15. Never mount or dismount from a moving vehicle





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## **GAS WELDING**

1. Use the following personal protective equipment during welding
  - Face or hand shield fitted with filters
  - Goggles, particularly when chipping slag
  - Gloves long enough to protect wrists and forearms against heats, sparks, molten metal and radiation
  - High-top boots to prevent sparks from entering footwear.
2. Screen of the work area with sturdy opaque or translucent materials because glare can cause eye injury.
3. Key for opening the acetylene cylinder valve must be one the valve stem while the cylinder is in use so that the cylinder valve may be immediately shut-off in an emergency.
4. Ventilate the workplace using air blowers and exhaust fans to remove poisonous fumes and gases that are given off during welding
5. Take precautions against flying sparks and hot slag where welding is being done near flammable materials and check the area before leaving.
6. Do not weld material degreased with solvents until completely dry.
7. Do not use gas cylinders for supporting work or as rollers
8. Do not use oil grease on oxygen cylinder fittings
9. Do not use cylinders with damaged valves.
10. Do not use too much force if valves are stuck.
11. Replace valve caps after use
12. Search for leaks in equipment by using a solution of soapy water.
13. Shut the cylinder valve if acetylene from a cylinder catches fire at the valve or regulator due to leakage at a connection.
14. Treat all gas cylinders as “full” unless you are sure otherwise.
15. Never attempt to transfer acetylene from one cylinder to another or attempt to refill an acetylene cylinder.
16. Place portable fire extinguishers near the welding area
17. Secure all cylinders against accidental displacement.
18. Always lift gas cylinders. Do not slide them along the ground or drop them from trucks.
19. Keep gas cylinders in vertical position both in storage and when in use
20. Keep the work place dry, secure, free from combustible materials and obstruction.
21. Store the acetylene and oxygen cylinders separately, and in a proper store.
22. Keep the gas cylinders from source of heat, flammable materials, corrosive chemicals and fumes.

## **MANUAL HANDLING AND LIFTING**

1. Use mechanical equipment in lace of manual handling as far as possible.
2. Assess the manpower required to handle or life the load safety and arrange the manpower accordingly.
3. In handling hazardous materials, the workers shall be informed of the hazards and safety precautions.
4. All relevant persons shall be trained in the proper methods of lifting and carrying.



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5. Where team work is required, select the persons whose ages and physical builds are compatible for teaming up. Coordinate the actions of the team members by giving necessary instructions.
6. Always lighten or suitably shape the load for manual handling as far as possible. Keep a look out for splinters, sharp edges, loose banding and nails.
7. Clear path or obstruction and tripping hazards.
8. Stack and secure goods safely on trucks, otherwise they fall off and injure passers-by.
9. Use personal protective equipment such as gloves, safety shoes, etc.
10. Adopt the following procedure when you lift a load:
11. Stand close to the object. Have a firm footing with feet spread on either side of the road.
12. Bend the knees and keep your back as straight as you can
13. Grasp object firmly. Be sure grip will not slip
14. Breathe in and throw the shoulder back wards.
15. Straighten the legs, continuing to keep the back as straight as you can.
16. Hold object firmly close to the body
17. Always lift smoothly. Avoid jerky motions. Turn with feet instead of twisting the back.

## **HANDLING CHEMICALS AND HAZARDOUS SUBSTANCES**

1. Always substitute hazardous chemicals with harmless or less hazardous ones wherever possible.
2. Enclose the process using chemicals or provide other engineering controls such as local exhaust ventilation, a fume cupboard or a safety cabinet.
3. Exercise great care in the storage and use of chemicals because they may be explosive, poisonous, corrosive or combustible.
4. Separate different chemicals physically
5. Store chemicals classified as dangerous goods in a properly constructed and approved goods store. Keep proper records of all chemicals and hazardous substances delivered, stored and used on site.
6. Consider unknown substances and liquids as dangerous until proven otherwise.
7. All containers should be clearly labeled to indicate contents. Never use a wrongly labeled container for chemicals.
8. Prohibit smoking in the vicinity of dangerous chemicals
9. Ensure that you are wearing the correct personal protective equipment before you handle chemicals
10. Maintain the Material Safety Data Sheet of all chemicals for reference on safety precautions to be taken and the use of suitable PPE.
11. When opening containers, hold a rag over the cap or lid, as some volatile liquids tend to spurt up when released.
12. Wash before you eat and do not eat at the work place.
13. If the skin is splashed with a chemical, rinse it immediately with plenty of clean water. Eye should be flushed thoroughly with water followed by immediate medical attention.
14. Eye fountain, emergency shower and breathing apparatus should be available in the vicinity of the workplace.



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15. Safety instructions for handling emergency situations should be displayed prominently at both the storage and use locations.

### **FIRST AID**

1. Provide first aid boxes at every site
2. Ensure that training on the use of the first aid box is provided to a handful of staff working in the site.
3. Display the list of persons who are trained on providing first aid.
4. Ensure that every first aid box is marked plainly "First Aid" in English and local language.
5. The responsible person or first aider should replenish the contents of the first aid box as necessary.

### **PERSONAL PROTECTIVE EQUIPMENT**

#### **General**

1. Consider the provision of personal protective equipment only after all measures for removing or controlling safety hazards have been provided reasonably impractical.
2. Ensure that sufficient personal protective equipment is provided and that they are readily available for every person who may need to use them.
3. The management should ensure that all persons make full and proper use of the personal protective equipment provided.
4. Provide instruction and training in the proper use and care of any specific protective equipment where necessary
5. Do not willfully misuse, interfere with or ill-treat any protective clothing and equipment provided.
6. Ensure that the personal protective equipment are in good condition. Report immediately any damage to the management for replacement. Always keep the personal protective equipment as clean as possible.

#### **Eye protection**

1. Issue eye protection equipment where there is a foreseeable risk of eye injury
2. Ensure an adequate supply of goggles/shields is available.
3. Keep the goggles clean and make sure they are good fit.
4. Do not watch welding operations unless your eyes are protected from the damaging effect of flash.

#### **Head Protection**

1. No person shall enter a construction site unless he is wearing a suitable safety helmet
2. Wear a safety helmet:
  - When there is the risk of being hit by falling objects
  - While on or near a construction site
  - During adverse weather conditions
  - When in any area designated as a "hard hat" area.
3. Provide identification labels to all helmets in some way to prevent random exchange among wearers, with one helmet exclusive to each person.



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4. Inspect helmets for cracks or sign of impact or rough treatment before each usage. Destroy, remove and replace all worn, defective or damaged helmets.

### Hearing Protection

1. Provide ear plugs or ear muffs as required. Use re-usable ear plugs when the reduction required (15-25 dBA) is not excessive. Use ear muffs where a large attenuation of upto 40 dBA is demanded.
2. Do not use dry cotton wool for hearing protection because it cannot provide any.
3. Provide disposable ear plugs for infrequent visitors and ensure that they are never re-used.
4. Provide re-usable ear plugs for those who need to work continuously for a long period in a high noise area.
5. Use ear muffs with replaceable ear cushions because they deteriorate with age or may be damaged in use.
6. Avoid wearing spectacles with ear muffs.
7. Use soap and water or the recommended solvent for cleaning ear muffs.
8. Provide ear muffs for those who may need to get in and out of a high noise area frequently.

### RESPIRATORY PROTECTIVE EQUIPMENT

1. Wear suitable respirable for protection when there is a potential for small particles entering the lungs, e.g. emptying of cement bags.
2. Ensure that the explanatory can provide adequate protection.
3. Provide training to all persons using the respirators for their correct fitting, use, limitations and symptoms of exposure.
4. Clean and inspect all respirators before and after use.
5. Store respirators properly when not in use.

### Safety Footwear

1. Wear suitable footwear for work
2. Use safety footwear on site or in other dangerous areas
3. 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.
4. All safety footwear, including safety shoes, ankle boots and rubber boots, should be fitted with steel toecaps.
5. Avoid wearing flip flops, high heeled shoes, slippers, light sport shoes in situations where there is a risk of foot injury.
6. Keep shoe lace knots tight.

### Hand Protection

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



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## **FIRE PREVENTION, FIGHTING AND EQUIPMENT**

### **Before fire breaks cut**

1. Store flammable material in proper areas having adequate fire protection systems.
2. Display sufficient warning signs.
3. Train selected personnel to use these fire extinguishers
4. Inspect fire extinguishers regularly and replace as necessary
5. Fire escape route should be kept clear at all times and clearly indicated.
6. Know the escape route and assembly point.
7. Display escape route maps prominently on each floor
8. Carryout fire drill regularly. Designate fire officers
9. Install fire alarm wherever required and test regularly.
10. Provide sufficient exit signs at prominent locations for directing people to the escape staircases and routes.

### **When fire breaks out**

1. Alert all persons
2. Put off the fire with appropriate fire extinguishers only when you are sure that you are safe to do so.
3. Escape if you are in danger through the fire escape route to assembly point
4. Fire officers to carryout head count at the assembly point.

### **Incident and accident investigations**

1. Carryout the investigation as quickly as possible.
2. Conduct interviews with as many witnesses as necessary
3. Do not rely on any one sole source of evidence
4. Use the following tools:  
Checklists for obtaining basic and typical information for accidents
  - Notebook
  - Tape records
  - Camera
  - Measuring tape
  - Special equipment for the particular investigation
5. Obtain answers to the following questions:
  - When did the accident occur?
  - Where did it occur?
  - Who was injured and what was damaged?
  - What caused the accident?
  - Why did it occur?
  - How could it have been prevented?
  - How can a recurrence be prevented?
6. Prepare a short but sufficient investigation report that contains the following:
  - A summary of what had happened
  - A summary of events prior to the accident





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- Information gathered during the investigation
- Details of witnesses
- Information on injury or loss sustained
- Conclusions and possible causes of the accident
- Recommendations to prevent recurrence
- Supporting materials (photos, diagrams, etc.)

## WORKERS SAFETY DURING CONSTRUCTION

SI No.	Stage and Nature of Construction Hazard	Safety measures expected to be taken by the Contractors and Site Engineers
1	Excavation in soft loose & slushy soil above 2.00 m depth sliding of earth or collapsing of sides.	The Excavation beyond 1.5 m to 2.00 m to be done in steps of minimum 500 mm offsets as shown in Clause 2.18.2(b) and also planking and strutting should be done as in Clause 2.19.1.
2	Excavation in slippery area (water logged) – The labour may fall or machinery on site may slip.	Try to dewater the area and spread minimum 150 mm thick sand layer to avoid slipping
3	Excavation in Rock where chiseling is involved – The fall of hammer may injure the hand, small rock pieces may injure the eyes and legs.	For hammer work, only experienced and skilled labour should be employed. Chisel should not be allowed to be held by hand, while hammering but chisel holding clamp should be provided. The labour should be provided with goggles and leg cover to protect eyes and legs, from injuries due to small rock pieces.
4	Excavation in Rock where blasting is involved - Careless handling may lead to injury to main worker or a passer by.	The work of blasting should be entrusted to only experienced persons. Provide sufficient length of fuse to give ample margin of time from the time of lighting to the time of explosion. A danger zone at least 180m diameter is to be flagged off 10 minutes before actual firing. All workmen should be sent away from danger zone except the firing man, who should be provided with a whistle.
5	Excavation for drain across road or manhole adjacent to a road – chances of a passer by falling into the excavated portion	The area should be well barricaded & a red lamp provided at night. A watchman should be deputed to prevent any movement of persons, or vehicles.
6	During Excavation or some times even while concreting – Snake bites or Scorpion stings –	In places where the movement of snakes are more the contractor should provide the labour with gum boots, gloves etc. and also make snake antidotes available on site. A particular care that has to be taken on such site is to always keep a vehicle available on site to rush the patient to a doctor. This applies to snake stinged patients as well.
7	Centring (form-work) and scaffolding – Form-work collapse while concreting or just before concreting especially when wooden ballies are used.	Many a times ballies joined together give way due to weak joint. Hence the use of joined ballies should be restricted. Only 2 joined ballies out of 8 ballies should be allowed. In case of double staging for a Slab at a height, utmost care should be taken to see that the top balli rests on the bottom balli. A particular care that should be taken during each concreting operating of slabs and beams is that, one carpenter and two



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SI No.	Stage and Nature of Construction Hazard	Safety measures expected to be taken by the Contractors and Site Engineers
		helpers with spare ballies, nails etc. should be deputed below the slab/beam that is being concreted to watch any disturbance in the supports of the form-work below during concreting and in case of any doubt the concreting should be stopped immediately and the form work strengthened. Never allow bricks below a balli to make up the required height. This is most dangerous.
8	Form-work for beams and slabs: The bottom of beam collapses and many a times brings down the slab as well, injuring the labour and supervision staff.	This case is noticed when slender ballies are used without bracing. In fact, no concreting should be allowed without bracing at 300 mm above ground, and at mid way, in normal beams & slabs. The bracings should be for the support of beams as well as slabs.
9	Form-work for sides of a slab–The labour just rests his foot on the plank and loses balance and falls resulting a fatal accident.	This is noticed when the carpenter fixes the side shuttering of a slab with a plank just tied by binding wire to the steel reinforcements and by wooden pieces nailed in wall and plank. This is so weak a portion that with little pressure the plank gives way.  Hence side shuttering should be done with a direct balli support from ground or floor, and the practice of tying planks with binding wire to the steel reinforcement should be totally avoided. A temporary railing along the periphery of slab will guard the life of labour and supervision staff.
10	Form-work for beams and slabs–Opening the form- work–Accident due to fall of materials during removing the forms.	In fact, this is a most dangerous work. One should be very careful while form-work is removed. Only trained carpenters should be deputed for the work. A safe resting place outside the area of slab as a temporary measure should be constructed from where the Slab can be removed safely. Removal of form-work during night should not be permitted under any circumstances.
11	Scaffolding–Fall of work-man, Supervision Staff, Standing on Chalis not tied properly or tied only at one end. (Chalis mainly made of Bamboos).	This is a very common negligence on the part of labour who do scaffolding work. The Chalis on which they work either span over it's complete length or is tied loosely and many a times at one end only. Hence, care must be taken that the Chali do not span over the full length but some middle support should be provided and also the same is tied properly on both ends.
12	Ladders–Balli or bamboo ladders – The horizontal member breaks and the person falls. Some times the top face just rests on wall and the whole ladder tilts causing an accident.	The ladders should be strong enough to bear the weight of a labour with materials on head. As far as possible a hand rail should be provided at one end. The horizontal member should be preferably fixed with bolt & nuts or strong nails. When the ladder is placed across a wall the top portion should be tied firmly to a strong support so that the ladder does not move laterally.
13	Column Reinforcements–Column reinforcements mainly in independent footings collapses – Injury to persons	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 reinforcement. This method of



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SI No.	Stage and Nature of Construction Hazard	Safety measures expected to be taken by the Contractors and Site Engineers
	working nearby.	supporting the column reinforcements results in a weak support. Hence, the column reinforcements should be supported by strong ballies on all four sides of reinforcements and as far as possible a combined platform should be constructed out of ballies over which the reinforcements can be supported.
14	Concreting chajjas – When chajjas are concreted with out care and on opening the form-work the chajja would collapse, causing injury to labour on top or bottom of chajja.	While concreting chajjas care must be taken that the labour do not stand on the reinforcement and disturb the position. Separate scaffolding must be tied over which the labour can stand and work without disturbing the reinforcements. The main reason is in chajja the steel is placed on top face but if the labour stands on the steel, it will bend and come to bottom face and hence the chajja will fall when form-work is removed, thus, causing injury to labour working on top, or bottom.
15	Dismantling–Dismantled materials may fall on passer by or the person engaged in dismantling work may fall due to slipping. The dismantled materials may fall on persons working below.	When work of demolition is to be taken up the area should be closed for all outsiders. No one should be allowed up to 50 m. from the place of demolition. The workers engaged in demolition should be asked to wear safety belts. Helmets must be worn by all the workers engaged in dismantling work. The place should be strictly guarded at night with red lights at prominent places, and watchman should be posted.
16	Electric-Connections/Cables etc. –High tension/L.T. Electric wire passing near the slab structure- while bending, lifting or tying reinforcements the bar benders may sustain the Electric Shock, causing fatal injury.	The work in such places, should not be allowed to the workers themselves, but in such position the work must be executed under the strict supervision of a responsible Foreman or a Supervisor.
17	Electric Connections/Cables etc. – Cables below ground may get punctured during excavation & thus electrocute the labour working. Similarly when concreting is in progress the punctured cable may prone to be fatal to the labour.	Before taking up the work all available drawings should be studied, local enquiry to be made to know the position of cables and work in such area should be got executed under strict supervision of an experienced Foreman or a Supervisor.
18	Electric Connections/Cables etc. – Temporary Electric lines near damp walls, near joinery stretched on a considerable length – There is every chance that the wire may get cut due to usage and may develop short circuits/leakages etc. and may electrocute the person touching the wire accidentally.	The Electric wires should be maintained by an electrician who should regularly check up the insulation of wires especially placed near steel items & damp areas.  The temporary wiring should be supported properly.  As far as possible a good quality wire should be used which may not get damaged easily?
19	Electric and gas welding work – Drilling, polishing work – Done by temporary cables used on a number of works – Due to the fact that the wires are old & when they come in contact with water	All wiring works to be inspected by experienced electrician. All wires to be properly insulated and fixed at height on temporary poles. No welding work should be permitted near damp area. The welders to be provided with welder's goggles & gloves. As far as



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SI No.	Stage and Nature of Construction Hazard	Safety measures expected to be taken by the Contractors and Site Engineers
	even in the process of curing the surrounding area may get affected due to leakage in the electric current thus causing damage to the workers & supervision staff.	possible machine in good condition should be used.
20	Construction Machinery & Lifts – Concrete Mixers – Safety precautions. A mixer with hopper tried to be operated by an helper could not release brake in time thus causing injury to the person near hopper- some times fatal one.	The Mixers with hopper should be operated by an experienced mixer operator and such mixers should not be allowed to be handled by a helper or a labour.
21	Construction Machinery & Lifts - Lifts - Safety precautions. (1) The lift pit if left unguarded the children of workers may fall in the pit resulting in fatal accident	(1) A brick protection wall of minimum 1.00 m height should be constructed around the Lift Pit, thus, preventing the children going near the pit. A special care should be taken to see that the children are not allowed to come near the machinery.
	(2) The manually operated brakes of the lift failed or the communication between the labour at the top and the liftman failed and thus, the lift was not controlled and resulted in fatal accident.	(2) The condition of the lift must be maintained properly. The lift operator should be well trained. The labour receiving the bucket at top should be smart and active enough to convey the message of stopping & releasing the lift-to-lift operator properly.
22	Water Storage Tank for general use & curing - chances of children of workers falling in the tank with fatal accident.	The water tanks constructed on site should be protected by at least 1.00 m high walls on four sides, so that the children do not fall.
23	Misuse of lift by labour and some times supervision staff The lifts that are meant for lifting materials used by labour to go to upper floors – The labour thus traveling many a times get injured.	No person should be allowed to go to upper floors by lifts that are mainly meant for conveying the building materials. Fatal accidents have taken place due to above action of workers.
24	Site Cleaning–Cleaning top floors of buildings – Upper portion of any structure – Throwing waste materials broken concrete pieces, brick bats, sand etc. straightway from top to ground injuring person below or even a passerby.	This dangerous practice should not be allowed at all. The materials should be brought to the ground with the help of lift or the use of rope over pully with a bucket, thus bringing down materials safely.
25	Bar bending work-Helpers of bar benders to follow short cut method, throw surplus steel pieces from top floors to ground and may cause fatal injuries.	This is a very bad practice. The helpers should bring the rods to ground with the help of lift or rope & pulley.



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## **APPENDIX 8.16: STORAGE, HANDLING, USE AND EMERGENCY RESPONSE FOR HAZARDOUS CHEMICALS**

### **A1. REFUELING/MAINTENANCE PROCEDURE**

- Truck or suitable containers will bring in all fuel and fluids. There will be no storage of fuel, oil or fluids within 100m (or 50m) of the permanent 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.

#### **Emergency Spill Procedure**

Should a spill occur, either through spillage or equipment failure, the applicable emergency spill procedure outlined in sections A-2 to A-4 must followed.

### **A2. SPILL PROCEDURE (INSIDE THE STREAM)**

In the case of a spill, overflow or release 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, then get help.

- **Stop the flow**
  - Stop the release into the stream waterway
  - Shutdown equipment
  - Close valves and pumps
  - Plug hoses
- **Remove Ignition Sources**
  - Shut off vehicles and other engines
  - Do not allow tiger torches, vehicles, smoking or other sources of ignition near the area. Keep a fire extinguisher on hand but keep it a safe distance away from the potential ignition source (if a fire starts, the extinguisher must be easily accessible).
- **Contract the environmental Officer and initiate Emergency Response**
  - Notify the site supervisor and the Contractor's Environmental Officer as soon as possible
  - The Environmental Officer will review the situation and decide if Emergency Services like Fire Brigade are required
  - Appropriate parties to be notified of the spill are
    - The contractor's Project Manager
    - The Engineer through his designated Environmental Officer





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- The Client
- Regulatory Agencies like Pollution Control Board, Municipal Authorities, as applicable.
- Site Safety Officer
- **Cleanup and Disposal**
  - Emergency Services will be engaged for the containment, cleanup and disposal of contamination release into the environment
- **Reporting**
  - The contractor's Environmental Officer will document the event and submit reports to the EO/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....

### **A3. SPILL PROCEDURE (ON LAND)**

In the case of a spill, overflow or release fluid onto land, do what is practical and safety possible to control the situation, and then get help.

- **Stop the flow**
  - Stop the release into the water body
  - Shut down equipment
  - Close valves and pumps
  - Plug hoses
- **Remove Ignition Sources**
  - Shut off vehicles and other engines
  - Do not allow tiger torches, vehicles, smoking or other sources of ignition near the area. Keep a fire extinguisher on hand but keep it a safe distance away from the potential ignition sources (if a fire starts the extinguisher must be easily accessible).
- **Contain the Spill**
  - Dike around the spill to contain the material
  - Spread absorbent or place a spill blanket on the spill
  - Enlist the help of personnel on site
  - Notify your supervisor as soon as possible
- **Notification**
  - Appropriate parties to be notified of the spill are:
    - The Contractor's Project Manager
    - The Engineer through his designated Environmental Officer
    - The Client



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- Regulatory Agencies like Pollution Control Board, Municipal Authorities, as applicable
- Site Safety Coordinator
- **Cleanup and Disposal**
  - The Engineer's Environmental Officer will ensure that a proper cleanup and disposal method is determined.
- **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 are recommend implementation of all required changes.

#### **A4. SPILL PROCEDURE (WITHIN PONDS)**

In the case of a spill, overflow or release fluid due to equipment or hose failure, do what is practical and safely possible to control the situation, and then get help

- **Stop the flow**
  - Stop the release
  - Shut down equipment
  - Close valves and pumps
  - Plug hoses
- **Remove Ignition Sources**
  - Shut off vehicles and other engines
  - Do not allow tiger torches, vehicles, smoking or other sources of ignition near the area. Keep a fire extinguisher on hand but keep it a safe distance away from the potential ignition sources (if a fire starts the extinguisher must be easily accessible).
- **Contain the Spill**
  - Stop any pumps that may be moving the water from the area where the spill occurred
  - Enlist the help of personnel on site
  - Notify your supervisor as soon as possible
- **Notification**
  - Appropriate parties to be notified or the spill are:
    - The Contractor's Project Manager
    - The Engineer through his designated Environmental Officer
    - The Client
    - Regulatory Agencies like Pollution Control Board, Municipal Authorities, as applicable



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- Site Safety Coordinator
- **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.