

# Initial Environmental Examination

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July 2014

## SRI: Northern Road Connectivity Project

MNC028 – Mahilankulam Pallamadhu Road (47+600 km to 59+000 km)

Prepared by Provincial Road Development Department of Northern Province, Government of Sri Lanka for the Asian Development Bank.

## **CURRENCY EQUIVALENTS**

(as of 4 August 2014)

Currency unit	–	Sri Lankan Rupee (SLR)
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\$1.00	=	SLR130.230000

## **ABBREVIATIONS**

ADB	–	Asian Development Bank
ADT	–	Average Daily Traffic
AC	–	Asphalt Concrete
AP	–	Affected Person
BIQ	–	Basic Information Questionnaire
CEA	–	Central Environmental Authority
CEB	–	Ceylon Electricity Board
CSC	–	Construction Supervision Consultant
DA	–	Department of Archaeology
DBST	–	Double Bitumen Surface Treatment
DoAS	–	Department of Agrarian Services
DoF	–	Department of Forestry
DoI	–	Department of Irrigation
DS	–	Divisional Secretary
DSD	–	Divisional Secretariat Division
DWLC	–	Department of Wild Life Conservation
EA	–	Executing Agency
EIA	–	Environmental Impact Assessment
EMP	–	Environmental Management Plan
EMoP	–	Environmental Monitoring Plan
EMS	–	Environment Method Statement
EO	–	Environment Officer
ES	–	Environment Specialist
GN	–	Grama Niladhari
GND	–	Grama Niladhari Divisions
GRC	–	Grievance Redress Committee
GRM	–	Grievance Redress Mechanism
GSMB	–	Geological Survey and Mining Bureau
IEE	–	Initial Environmental Examination
LA	–	Local Authority
MENR	–	Ministry of Environment and Natural Resources
MDSD	–	Manthai West Divisional Secretariat Division
MLGPC	–	Ministry of Local Government and Provincial Councils
MoD	–	Ministry of Defence
MSL	–	Mean Sea Level
NEA	–	National Environmental Act
NP	–	North Province
NPRDD	–	Northern Provincial Road Development Department
PAA	–	Project approving authority
PD	–	Project Director
PDol	–	Provincial Department of Irrigation
PHI	–	Public Health Inspector

PIU	–	Project Implementation Unit
PRDD	–	Provincial Road Development Department
RE	–	Resident Engineer
REA	–	Rapid Environmental Assessment
ROW	–	Right-Of-Way
RPPF	–	Road Project Preparatory Facilities

### **NOTE**

In this report, "\$" refers to US dollars.

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## INTRODUCTION

### *Project Background and Justification*

The Mahilankulam - Pallamadhu Road– MNC028 (11.4km) is one of the C class roads that will be rehabilitated and improved. MNC 028 is located in the Mannar District of the Northern Province. The Northern Province was the worst conflict affected region in Sri Lanka. The armed conflict that prevailed for nearly thirty years in the country has destroyed and damaged the infrastructure, mainly the transport sector of the NP of Sri Lanka.

### *Extent and Scope of the Study*

The Environmental Assessment was carried out as a requirement of the Feasibility Study for a C class provincial road (Mahilankulam - Pallamadhu Road) in the Mannar district of NP. The scope of work includes: field investigation, public consultations, assessment of potential environmental impacts, development of preventive and/or mitigation measures for significant impacts, preparation of Environmental Management and Environmental Monitoring Plans (EMoP & EMP) and finally preparation of a consolidated Initial Environmental Examination (IEE) report.

### *Objective of the IEE Report*

The main objective of the consolidated IEE report is the preparation of a comprehensive account on the environment condition of the project affected area of the Mannar district of NP for the ADB to facilitate decision-making. In detail, the IEE report will address the Physical, Ecological, Economical and Social background settings of the project affected area, anticipated environmental impacts, necessary mitigation measures and obtain public views regarding the project.

### *Methodology*

Field observation of the road located within the Mannar district was carried out during the period from 18<sup>th</sup> July 2014 to 24<sup>th</sup> July 2014. A line transect survey was carried out along the proposed road and direct and indirect observations were made to collect important information. Also secondary information for the report was collected from printed materials and other sources of Government Departments, Authorities, Ministries, Non-Government Organisations (NGOs) and relevant websites.

## DESCRIPTION OF THE PROJECT

### *Category of the project*

Based on the REA Checklist of the ADB classification, This NP road is categorized under environment category B. Therefore potential environment impacts associated with the proposed project are less adverse than category A. Thus the IEE serves as the complete Environment Assessment for the proposed project.

### *Need for the project*

Insufficient maintenance or improvements of the road has further resulted in highly dilapidated conditions. The existing poor road network in the area has resulted in disturbance of access and maintaining the social services in these areas. The dilapidated condition of the road results in high costs of vehicle operation due to long travel time and high transport cost. Therefore, the rehabilitation will contribute to transport efficiency and lead to increased road safety and overall economic, social and cultural developments.

### *Analysis of Alternatives*

The proposed project is considered to be the best option. Further existing road is not located through or

close to any national parks, sanctuaries or any other protected areas demarcated by relevant authorities. Apart from that the project does not require any land acquisition from the road side community or resettlement of people due to proposed construction. Thus, the proposed improvement will be the better option for the existing situation in the area.

### *Size and Magnitude of Operation*

It is proposed that on this road, horizontal alignment will follow the existing road centreline. Where the irrigation canals exist along the road in either LHS/ RHS the centre line should be shifted accordingly. In general, road carriageway widths will be 4.00 m. Shoulder widths will be 1.00 m.

## **DESCRIPTION OF THE ENVIRONMENT**

### *Description of the Road*

The selected road (MNC028: Mahilankulam - Pallamadhu Road) is a gravel road in dilapidated condition.

### *Physical Resources*

#### *Topography, Geology and Soil*

Generally, the land is flat in the Mannar district. However, along the coast, there are sand dunes and towards Giant tank, the land scape is changing to slightly undulating terrain with elevations rising up to 65 m a.m.s.l. The soils are Reddish Brown Earths, Low Humic Gley soils, Red Yellow Latosols, Regosols, Solodized- Solonetz, Solonchaks and Grumosols. Regosol soil is mainly found in the Mannar Island and Red Yellow latosols are found distinctively in coastal regions. The area located in the dry zone lowlands falls under two agro-ecological zones, DL3 and DL4.

#### *Climate*

The district falls in to the low country dry zone and DL2 and DL3 agro ecological region. The Mannar district is located in the arid zone which is classified based on the existing climate condition of the district. The highest rainfall received is about 900-1000mm per annum. The average temperature prevalent is about 30 c° and the highest temperature may vary from 30c° to 40c° depending on hot sunny days.

#### *Water Resources*

There are many major, medium and minor tanks located in the Mannar district. Most of them are perennial which fill with water during heavy rainy seasons. The cultivation in the Mannar district is sustained by 347 minor ancient irrigation reservoirs and three major ancient reservoirs called Giant's Tank, Akathimuripu tank and Viduyakulam tank. Water for drinking is mainly obtained through dug wells and Deep wells are also used for irrigation.

#### *Air Quality and Noise*

At present, major factors contributing to the air quality of the area are vehicular smoke, emanations from several construction activities under the Uthuru Wasanthaya and other development programmes and dust eliminating from deteriorated roads during the dry season. However compared with other districts of the country, the vehicular traffic, emission of contaminants to the air from industries is very low. Therefore, the air quality standards of this area are expected to lie within the national air quality standards levels.

#### *Ecological Resources*

Despite the arid climate, large extent different forest types such as thorn scrub forests, coastal vegetation, mangroves and marshy vegetation are clearly observed in the district. The high biological diversity is still present in most parts of forest areas despite the arid climate and edaphic conditions. Out of different forest types, the large extent of forest area is classified under

the thorny scrub forest which harbours its own peculiar fauna and flora. However, during the past decades, large portions of the forest cover in the Northern part of the country had been severely affected by the civil war.

### *Economic Development*

#### *Land Use and Agriculture*

The land area is mainly consisting of forests, scrublands, paddy fields, home gardens, roads, buildings and bare sandy areas. Apart from those, estuaries, deltas, intertidal mudflats, sand flats, mangrove swamps and forests, sand dunes and beaches can be observed in the coastal areas.

#### *Agriculture*

Agriculture is the major occupation of the population in this district and more than 80% was engaged in this field. However this sector was badly affected due to the war. Among the annual crops paddy is the major crop cultivated in large extents and is cultivated under major, minor and rain fed water schemes. Other than paddy several field crops, fruit crops, vegetables and livestock industry provides a substantial income for farmers.

#### *Fishing*

Fishery is the second largest occupation in the district. People are engaged in both inland and marine fishing as another source of income. The fishing industry had been restrained due to prevailed war condition in the Gulf of Mannar. However, after ending the war, it was decided to lift the restrictions imposed on fishing industry. As well, the number of fishing gears and boats were given to increase the productivity of fishing and further, commercial buildings for sale of fish were also established by the government under the support of foreign assistance.

#### *Infrastructure Facilities*

Infrastructure facilities are in a poor condition in most part of the area because of the war situation that prevailed and the Tsunami disaster. Most of the banks established in the area are government sector banks. Water supply for domestic consumption and industries is mainly through dug wells. There are several A and B class roads running through the district which have also been damaged during war. However several development programmes are now underway to develop the infrastructure facilities in the area.

### *Social and Cultural Development*

#### *Population and Community*

The population of the district was almost entirely Sri Lankan Tamils. Other than that there was a small population of Sinhala and Muslims in the district. The population of the district, like the rest of the North and East has been heavily affected by the Civil War. After the war most of the families has been resettled.

#### *Health and Educational Facilities*

The health and education status of the people in the district was in a very poor condition due to displacement of staff and reluctance of personnel to serve in the conflict affected areas, frequent displacements, physical and psychological disabilities, loss of family members, food insecurity and spread of communicable diseases.

The adequate educational facilities such as well-built school buildings, play grounds, laboratories are not observable in the NP as against the same facilities in other provinces in the country. As per field visits, there are 28 schools in the MDSD while only two schools such as Periyamaduvu MV and Eachchalawakai MV are functioning along the proposed road in the MDSD.



### *Cultural Archaeological and Historical Significance*

There are several locally important Hindu temples, churches, mosques and Buddhist temples located in the project area. However like other sectors in the district, these sites also have been badly affected due to the war.

## **SCREENING OF THE POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES**

### *Environmental Impacts and Mitigation Measures Associated With Construction Period*

#### *Removal of public utilities*

Improvement work will not impact on the public utilities like electricity poles and water supply lines as they are located outside of RoW. Proper coordination along with the use of well-trained experienced machinery operators is needed if such utility facilities are needed to be shifted.

#### *Impacts on temporally use of lands*

An identification of lands for temporary uses may create public inconvenience, soil erosion, waste accumulation and deterioration of scenic beauty of the environment. Land selection should be done in accordance with local laws, regulations and in close consultation with LAs. The adequate compensation/rent should be paid for using the selected sites and as well, the attention should be paid to minimize removal of trees and other green cover vegetation ect.,

#### *Soil Erosion Sedimentation and Siltation*

Soil erosion, sedimentation and siltation in project road can take place during rainy seasons due to construction related activities. Decrease of infiltration of rain water, acceleration of surface runoff, lowering of the river beds and destruction of the river banks are also the main impacts associated with cut and fill operations.

Erosion control measures should be placed to the erodible areas where necessary, turfing work should be done prior to the rainy season; suitable local drainage facilities should be provided. Conducting construction activities in erosion and flood-prone areas during dry season are important to minimize these impacts.

#### *Extraction, Transportation and Storage of Construction Materials*

Soil erosion, lowering of river beds, destruction of river banks, nuisance from dust, noise and vibrations will create environmental health and social disturbance.

Selection of mining and quarrying sites should exclude areas which are close to public sensitive locations such as kovils, churches, schools, hospitals and others. Transportation of construction of materials above the carrying capacity must be avoided and haulage of materials should not take place during peak hours or at night through urban areas. Dust emissions must be controlled by wet spraying and use tarpaulin covers over haulage trucks.

#### *Effect on water resources*

Use of water sources and construction activities close to the water bodies may affect water sources used by local communities and pose several negative effects of these water bodies in numerous ways.

Disposing waste water directly into surrounding water bodies and excavation of beds of any water bodies must be avoided. Proper sanitation arrangements should be provided to the labour camps/ other construction related places. Construction works affecting water bodies and flood plain areas must be undertaken during the dry season are the best practices to avoid or minimize impacts related to the water resources.

### *Temporary floods*

Public inconvenience, change of the water flow direction, impact to road, cultivated lands, other private properties and accidental damage to the public utilities are the main impacts anticipated to occur due to floods.

Thus it is essential to increase the embankment height of the particular sections with construction of cross drainages with sufficient capacity, restriction of construction activities to the dry season around flood plain areas and formation of temporary earth drains as practically as possible can avoid impacts related to temporary floods.

### *Solid Waste Disposal and Sanitation*

Contamination of water bodies with waste water will create significant impact to the aquatic biology and people inhabited in the area. Construction sites and camps may provide favourable habitats for vectors of diseases like mosquitoes, rats and flies. Spreading of communal diseases is also possible due to migrant labourers.

Selection of skilled and unskilled workers from the project influence area, provision of proper solid waste disposal, sanitation and sewage facilities, adequate supply of water to the urinals, toilets and wash rooms are the best practices to avoid or minimize impacts arising due to solid waste and poor sanitation.

### *Disposal of Construction Debris and Spoil*

Improper disposal practices will impact the road side ecology and, impact the public health and scenic beauty in the area as well as causing blockage of natural water flow paths. Selection of disposal sites should exclude areas which are close to public sensitive areas. As well, the materials dumped should not interfere with irrigation canals, water bodies, agricultural lands, coastal habitats or any other environmental sensitive areas. Debris and residual spoil materials generated from construction activities shall be re-used wherever possible for site levelling, back – filling. These measures are necessary to avoid or minimize these impacts.

### *Disruption of Traffic*

Vehicles involved in transportation of construction materials from outside the project area will increase inconvenience to the road side communities and road users. Daily traffic and accidental risks will be increased. There will be delays in travel time and increase in noise and exhaust emissions and disturbance to the pedestrians and public.

Material transportation during rush hours must be avoided and movement of large trucks during off peak traffic hours should be scheduled. Alternate roads, if any, must be used to avoid traffic congestion. Construction work close to the sensitive locations must be avoided and flagmen and/or temporary traffic signs must be used to enhance traffic flow.

### *Personal safety*

Construction related activities both inside and outside of the subproject affected areas could create accidental harm to general public and the workers. Additionally explosive and earth mines that were used during armed conflict can also cause accidental harm to the workers. Proper briefing and training of workers on safety precautions, use of licensed and trained vehicle operators, providing protective wears and first - aid facilities, avoid entering of work force to the un cleared areas or beyond the RoW of road, arranging of regular safety checks, installation of warning signs, speed limits and signals to particular locations are necessary during the construction.

### *Impact from Dust, Noise and Vibration*

Deterioration of air quality, impact to the road side communities, their properties, scenic beauty are the main impacts arising due to dust, noise and vibration. Construction related activities close to public sensitive locations have to be scheduled in coordination with the relevant authorities. Crushers and hot mixed plants should be placed away from public and environmental sensitive areas. Machinery, equipment and vehicles should be maintained in good condition. Dust extraction units, exhaust silencers and noise reduction devices can be fitted to the road side crushers, construction vehicles and hot mixed plants. These measures are needed during the construction stage to avoid or minimize the above impacts.

### *Effect on Flora, Fauna and their habitats*

The activities related to the project can change the usual behaviour of wild animals, their migration patterns and their habitats if project activities are not undertaken properly. Since the proposed construction activities are restricted to the existing RoW, no impact on state forests and forest reserves can be expected. However, removal of trees within the existing RoW may be required during the construction phase.

National Wildlife Act should be enforced in places where some animals especially, mammals living within an expanded home range. Awareness programs should be conducted for the workers to provide necessary instructions about the importance of flora, fauna and different type of aquatic and terrestrial habitats.

### *Biodiversity Conservation and Sustainable Natural Resource Management*

Alteration and modification of existing habitats, introduction of alien species, and impact on wild animals are the impacts associated with construction activities. Organizing awareness programmes to the workforce regarding the existing biodiversity, its conservation, and importance of the natural resources must be done as early as possible.

### *Impact on Socio – Economic condition of the area*

Land acquisition, traffic congestions, disturbance or loss of income generating activities will not take place during the project cycle. Thus no negative social impact can be expected to the community that inhabits the proposed road other than positive social and economic impacts during the operation stage.

### *Environmental Impacts and Mitigation Measures Associated With Operation Period*

#### *Air Quality and Noise*

Due to proposed improvements, the existing dust level in the area is expected to reduce. Proper alignment and surfacing of the road will also allow considerably higher speed for vehicles with minimum accelerations and decelerations which in turn reduce vehicular emissions. This condition will positively impact to the air quality, sound and the human health in the area.

#### *Drainage Congestions*

Improvement of the road drainage facilities through the project is expected to facilitate better water flow, which will result in higher speed flow during the rainy season. This situation will avoid risks to public health from accumulation of stagnant water in drains. However stagnation or blocking of water flow may occur due to sediments, improper disposal of debris or ignorance of public by disposing garbage into side drains. Regular maintenance of drainage system by PRDD will avoid drainage congestions, stagnation of water and temporary inundations.

#### *Safety of Road Users*

Proposed project activities will reduce the number of accidents and risk to smooth vehicle flow through convenient passages. However as resettlement activities and the other on-going development projects will come to an end in parallel to the project, the area will be more populated due to improved access and

other infrastructure facilities.

Thus enforcement of speed limits, traffic rules and regulations, installation of the warning signs, regulatory signs and information signs as well as provision of pedestrian crossings at the appropriate locations are essential to enhance road safety for the people.

### **INSTITUTIONAL ARRANGEMENTS AND GRIEVANCE REDRESS MECHANISM**

The NPRDD as the Implementing Agency (IA) is responsible for implementing the overall EMP. The PIU will be responsible for overall contract administration and the supervision of the contractor regarding the implementation of Environmental Specifications and Special Environmental Provisions included in the Contract Document. The contractors will be responsible for implementation of all mitigation measures associated with construction activities. The CSCs will be responsible for daily supervision of the contractor for implementation of the EMP.

Grievance Redress Mechanism (GRM) provides an effective approach to resolve issues raised by the affected community on environmental impacts arising throughout the project cycle. This mechanism will be established by the project proponent, PRDD to address any grievances presented by Affected Persons (APs). Most of the environmental impacts are construction related. Therefore, managing them is mainly the contractor's responsibility.

However, these grievances could be minimized at the initial stage of the project by careful design, implementation and monitoring of project and also through sound communication & awareness among all the stakeholders including APs regarding the project activities. This mechanism will be executed through a Grievance Redress Committee (GRC).

### **ENVIRONMENTAL MANAGEMENT PLAN**

The EMP includes the potential impact as a result of project activities, proposed mitigation measures, the responsible party for implementation, supervision of those mitigation measures and the feasible cost effective measures to reduce the potential significant adverse impacts at acceptable levels. In addition to the EMP, to ensure that project would not generate any negative impact to the overall environment quality, the Environmental Monitoring Plan (EMoP) has been prepared.

### **PUBLIC CONSULTATION AND INFORMATION DISCLOSURE**

The aim of the public consultation and information disclosure process is to understand the view point of the public about the project and respond to their concerns and suggestions during the early stage of the project. During the individual as well as group discussions, APs were briefed about the proposed improvement works and also, participants generally get the opportunity to express their views about the project in regard to the environmental, social and economic conditions. The road is very essential link to the interior part of Mannar district.

Most of the people in the proposed project area are recently resettled people with lack of infrastructure facilities. Thus improvement of the road with adequate drainage facilities will provide direct access to the rural and urban areas of NP. This will contribute to the social and economic development of the region. Once the road is developed, many of the unutilized lands can be cultivated and industries such as fishing, salt and tourism can be developed.

## 1.1 Project Background and the Justification

The proposed Northern Road Connectivity Project (Provincial Component) - NRCP (PC) is being implemented in the Northern Province for improvement of C class roads that are in dilapidated conditions. However, this IEE is written for one C-grade - Mahilankulam - Pallamadhu Road– MNC028 11.4km road existing in the Manthai west Divisional secretariat in the Mannar District. This road improvement will be financed by the Asian Development Bank (ADB) under the Project called Northern Road Connectivity Project.

The armed conflict prevailed for nearly thirty years in the country has destroyed and damaged the infrastructure, mainly the transport sector of the NP of Sri Lanka. In addition, considerable amount of coastal roads were badly affected by the Tsunami in 2004. Majority of people in the province are engaged in agriculture and marine fishery. The selected road, Mahilankulam - Pallamadhu Road– MNC028 is located in the Manthai West DS of the Mannar District.

This road provides access to schools, rural hospitals and large residential areas that connect to other connecting roads of three districts. Many school students, farmers and fishing folks use this road daily and due to highly damaged condition of the road, people in the area have face a lot of problems which could be resolved through rehabilitation and improvement of the road. Reduction of travel time, transport cost and the vehicle operation cost are the main economic benefits which can be expected through improvement of the project.

## 1.2 Extent and the Scope of the Study

The Environmental Assessment was carried out as a requirement of the Feasibility Study for the Mahilankulam - Pallamadhu Road– MNC028 which is 11.4km long gravel road with many undulating surfaces and needs very urgent repairs considering the difficulties faced by the rural poor of the area and school children.

The scope of work includes: field data collection, preparation of Basic Information Questioners (BIOs) for CEA (Central Environmental Authority) clearance, preparation of Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP), Public Consultations, assessment of Potential Environmental Impacts, development of preventive and/or Mitigation Measures for significant impacts, preparation of Grievance Redress Mechanism for the project and ultimately preparation of consolidated Initial Environmental Examination (IEE) report.

The improvement works are generally envisaged to involve:

- Minor realignment to alleviate small radius curves.
- Upgrading the existing condition of the road with proper surfacing associated with the Asphalt Concrete (AC)
- Provisions to road side drainage, improvement of culverts, bridges and other hydrological structures where necessary.
- Installation of traffic warning signs, provision of pedestrian crossings, bus bays and parking where necessary.

## 1.3 Objective of the IEE Report

The main objective of the IEE report is to present the comprehensive account of the existing environment condition of the project effected area of Mahilankulam - Pallamadhu Road of the Manthai west DS in the

Mannar district to facilitate decision-making of the ADB. In detail, the IEE report will address the Physical, Ecological, Economical and Social background settings of the project affected area, anticipated environmental impacts, mitigation measures and to identify public views regarding the project etc. Furthermore, the IEE Report focuses on preparation of suitable EMoP, EMP and institutional arrangements which are essential to monitor the identified environmental impacts of the project during the construction stage of the Project.

#### 1.4 Applicable Environmental Legislations

A large number of recurrent and non-recurrent activities under road and rail development are presently not covered by the National Environmental Act (NEA). However rehabilitation of existing provincial roads do not fall within the category of "Prescribed Projects" listed in Gazette Extra-ordinary No.772/22 of 241 June 1993 and subsequent amendments, which needs to go through the Environmental Impact Assessment (EIA) process and subsequent Conditional approval from the CEA of the Ministry of Environment and Natural Resource (MENR). There may, however be subjected to an environmental review, if the Project Approving Agency (PM) and the CEA deem it necessary. National laws and regulations that can be relevant to the project are briefly described in the Table below.

Table1.1: Applicable National laws and regulations relevant to the project

	Legislation	Relevance and main content	Authorizing institution
1	Coast Conservation Act No 57 of 1981	This act regulates any un authorized construction within the coastal zone, by making it mandatory to obtain permits for any Development activity falling within the coastal	Coast Conservation and coastal resources management department
2	National environmental protection and quality regulations under Extraordinary gazette notification No. 1534/18 and No. 1533/16 of 2008 under NEA section 32 & 23A, 23B	This regulates the discharge and deposit of any kind of waste or emission into the environment and stipulates requirements for an Environmental Protection License (EPL) depending on the project activity. Examples of activities requiring and EPL are: asphalt processing plant, concrete batching plants, treatment plants, sewerage networks, mechanized mining activities etc.	CEA
3	National Environmental (Protection and Quality) Regulation No. 1 of 1990 published in Gazette Extraordinary No. 595/16 of February,	Provides standards for discharging effluents into inland surface water during proposed project activities.	CEA
4	National Environmental (Ambient Air Quality) Regulations, 1994, published in Gazette Extraordinary, No. 850/4 of December,	Provides standards for emissions to the air during proposed project activities.	CEA
5	National Environmental (Noise Control) Regulations No.1 of 1996 and its amendments	Regulates maximum allowable noise levels for construction activities during proposed project activities	CEA



6	National Environmental (Vehicle Horns) Regulations, No. 1 of 2011	Regulates maximum allowable noise emanating from vehicular horns on a highway or road any motor vehicle use during project construction activities	CEA
7	National Environmental (Municipal Solid Waste) Regulations, No. 1 of 2009	Regulates dumping municipal solid waste along sides of any national highway or at any place other than places designated for such purpose by the relevant local authority during proposed project activities	CEA
8	Fauna and Flora Protection Act (FFPO) No.2 of 1937 amended	The act specifies that any development activity taking place within one mile from the boundary of a National Reserve declared under the act	Department of Wildlife Conservation
9	Forest Act No. 34 of 1951	This act is to consolidate and amend the law relating to the conservation, protection and management of forest and forest resources for the control of felling and transport of timber and Forest and for matters connected therewith or incidental thereto.	Department of Forest
10	Felling of Trees Control Act No. 9 of 1951 as amended through Act No. 30 of 1953	This Act sought to prohibit and control felling of specified trees (mainly intended to stop indiscriminate felling of specified trees) in the country.	Department of Forest Conservation
11	Water Resources Board Act, No. 29 of 1964 and (Amendment) Act, No. 42 of 1999	The act controls and regulates developments (Including conservation and utilization) of water resources; prevention of pollution of rivers, streams and other water resources; formulation of national policies relating to control and use of water resources.	Ministry of Irrigation and Water Resources Management
12	Soil Conservation Act, No. 25 of 1951 and Amended No. 24 of 1996	This Act makes provisions for the enhancement of productive capacity of soil; to restore degraded land for the prevention and mitigation of soil erosion; for the conservation of soil resources and protection of land against damage by floods, salinity, alkalinity, water logging; and to provide for matters connected therewith or incidental thereto	Department of Agriculture
13	Explosives Act No. 36 of 1976	To provide control of explosions and regulations of matters connected with explosive activities related with the project.	Ministry Of Defense
14	Municipal Councils Ordinance No. 29 of 1947, the Urban Councils Ordinance No. 61 of 1939 and the Pradeshiya Sabha Act No. 15 of 1987 as	Regulates and control actions pertaining to Socio-economic development such as roads, culverts, bridges, ferries, waterways and other means of local transport and related site clearance for constructing worker camps, site offices etc. and methods taking place within the command area relevant to government	Ministry Of Local Government And Provincial Council
15	Flood Protection Ordinance No. 04 of 1924, No 22 of 1955	An ordinance for protection of areas subjected to damage from floods. This includes declaration of flood areas, preparation of schemes for flood protection and other rules and regulations regarding flood in the country	Irrigation Department

16	Crown Land Ordinance Act No. 1947	An ordinance to make provision for the grant and disposition of crown lands in Sri Lanka; for the management and control of such lands and the foreshore; for the regulation of the use	Land Commissioners Department
17	Agrarian Development Act No. 46 of 2000 (Section 32)	This act regulates using paddy land for a purpose other than agricultural cultivation without the written permission of the Commissioner General.	Agrarian Services Department
18	Land development statuette No. 7 of 2002 the western province provincial council, amendment No. 1287/26 of 2003	A statute for regularizing utilization of state lands situated within the western province either by state or the provincial council, for regulating the distributing of the aforesaid lands and lands in possession of the provincial council, for augmenting productivity of lands and for matters connected with or incidental to them this statute is in compliance with the crown lands ordinance no. 08 of 1947 (chapter 454) and the land development ordinance no.19 of 1935 chapter 464 as amended by land development (amendment) acts, no. 16 of 1969 no.27 of 1981, no 22 of 1998, no, 22 of 1995 1996. Of divesting of state lands, no. 07 of 1979	Governor _ Western Province Provincial Council And Land Commissioners Department
19	Sri Lanka Land Reclamation and Development Corporation Act 15 of 1968 as amended by Act No 52 of 1982	This act established Sri Lanka Land Reclamation and Development Corporation which grants permission for the public to fill marshy land subject to provision of storm water drainage.	Sri Lanka Land Reclamation and Development Corporation
20	National Thoroughfares Act, No. 40 of 2008	This act is known as RDA act which provide for planning, design construction, development, maintenance and administration an integrated public road network in Sri Lanka.	Road Development Authority
21	Urban Development Authority (UDA) Law No 41 of 1978 and Urban Development Projects (Special Provisions) Act No 2 of 1980	<p>This law provides for the establishment of an UDA to promote integrated planning and implementation of economic, social and physical development of certain areas as may be declared by the minister to be urban development areas and for matters connected with the relevant project activities.</p> <p>Urban Development Projects (Special Provisions) Act No 2 of 1980 is an act to provide for the declaration of lands urgently required for carrying out urban development projects and to provide for matters connected there with relevant project activities.</p>	Urban Development Authority (UDA) under the ministry of Urban Development and Defence
22	Town and country planning ordinance No. 13 of 1946 and The Town & Country Planning (Amendment)	This regulates the National Physical Plan with transport as the main component	National Physical Planning Department (NPPD) under the Ministry of Urban Development



23	Buddhist Temporalities Ordinance No. 19 of 1931	This act provides necessary assistance to administer and protect the property of Viharas, interventions to settle disputes regarding property of Viharas and makes recommendations to release money to be paid as compensation in respect of property of Viharas acquired by government for any development project	Department of Buddhist Affairs
24	Cemeteries and burial grounds ordinance No. 9 of 1899 and amendments	The act regulates any disturbance, removal of burial, monuments and use of such areas for development project	Local Government Authority
25	Antiquities Ordinance No. 9 of 1940 and amendments	The act regulate activities of projects located in close proximity of any archeological reserves	Department of Archaeology

Following table indicates the key clearance and permits that should be obtained for the proposed road project

Table 1.2: Key clearance and permits required for the Project

Project stage	Approvals	Project related activity	Relevant agency
<b>Pre-Construction Stage</b>  Note: Although clearances and approval should be obtained during preconstruction stage it is valid throughout the project cycle. However this should be renewed before expiry date	Environment clearance	Implementation of the project	Central Environment Authority
	Clearance from Coast Conservation and coastal resources management department	Development activities in coastal areas	Coast Conservation and coastal resources management department
	Industrial Mining License (IML)	Operation of quarries, borrow areas and other material extraction sites	Geological Survey and Mines Bureau
	Environmental Protection License (EPL)	Operation of material extraction site including operation of asphalt plants, treatment plants etc.	CEA
	Local Government Authority Trade license and machinery permits	Deciding waste disposal sites, material storage and sites for worker camps and other project stations  Trade license should be obtained for asphalt plants,	Respective Provincial Council, Local authorities and respective Pradeshia Sabha
	Explosive Permits	Blasting activities	Ministry of Defence
	Approval for removal of trees	Road clearance for construction	Forest department, CEA and local authorities
	Disturbance to Paddy Lands	Ground preparation for ROW and side drains	Commissioner of Agrarian Services

Construction stage	Consent from relevant government agencies	Construction of bridges, culverts and other drainage	Department of Irrigation
		systems, land filling, dredging activities	Agrarian services, Local government authority, Land Reclamation and Development Cooperation
	Approval from relevant state /local agencies for the removal/ temporary disturbances for existing utilities	Surfacing, construction of bridges and side drains, embankment filling works	NWSDB for water lines, Ceylon electricity Board for Electric cable/poles, Sri Lanka Telecom for land line telephone cables, poles, Pradeshiya sabha, other local authorities for drainage, sewer systems etc

### 1.5 Methodology

This IEE for about 11.4 km was carried out in compliance with the manuals on environmental and social safeguards compliance which are in line with national environmental and social safeguards acts/ policies and ADB safeguards policy statement, 2009. The field assessments were carried out from 18<sup>th</sup> July to 24<sup>st</sup> of July 2014. In preparation of the assessment, 5m to 10m corridor for both sides from the edge of the road was examined to assess direct environmental impacts. The land use pattern up to 200m or impact influential area on both sides of the center line of the existing road was studied visually by conducting site visits. All crucial environmental parameters and social indicators were recorded for the IEE report.

### 2.1 Type of the Project

The 11.4km long Mahilankulam -Pallamadhu Road was chosen for improvement and rehabilitation purpose in the Manthai west DS in the Mannar district of NP. The existing culverts, minor bridges will be rehabilitated based on the strength of those structures. The carriage way will be 4m with asphalt road surface and where necessary, concrete surface may be considered depending on the level and height of flood as per data and information collected from the survey.

### 2.2 Category of the Project

Based on the REA Checklist of the ADB classification, NP roads are categorized under environment category B. Therefore, potential environment impacts associated with the proposed project are less adverse than category A. Thus, IEE serves as the complete Environment Assessment for the proposed project. The conditional approval for the rehabilitation and upgrading of the proposed road will be granted by CEA after submission of BOQs.

### 2.3 Need for the Project

The conflict prevailed nearly three decades in the country has destroyed and damaged the national, provincial and rural road network of the NP. Insufficient maintenance or improvements of the road in the past due the conflict situation has further resulted in highly dilapidated conditions. The existing poor road network in the area has resulted in disturbing accesses to the residents, visitors and maintaining the social services in the project areas. The dilapidated condition of the road, structurally damage culverts, causeways and bridges etc., contribute to increase high vehicle operation cost resulting long travel time and high transport cost. Therefore, rehabilitation of the particular road is essential for the people and government officers to function as required by different services being rendered to people in the area. The improved road condition will contribute to transport efficiency and lead to increase road safety, investments in fisheries, agriculture and tourism industries and other infrastructure facilities. In addition, improvement of the road network in the area will positively impact to the living standards of the war affected people together with economic, social and cultural values.

### 2.4 Location

The Mahilankulam - Pallamadhu Road, the subproject road identified for the improvement and rehabilitation is located in the Mannar district of NP insure Lanka. The name with starting and end points are indicated in Table 2.1. The general location of the Mannar district and the location maps for the sub project is shown in the figure 2.1.



Figure 2.1: Distribution map of roads in the Mannar District

Table 2.1: Starting and the end point of the sub project road located within Mannar district of NP

Road Number	Name of road	Starting point	End point	Length (km)
MNC 028	Mahilankulam - Pallamadhu Road	Periyamadhu -Junction	Pallamadu - Junction	11.4

## 2.5 Analysis of Alternatives

In general, rehabilitation and improvement of the proposed road is essential due to the present severe dilapidated condition and the proposed economic development that will take place as per the development plans of the NPC and Government of Sri Lanka. The project road identified has links with interior areas of Mannar district and ultimately with many destinations to other districts like Vavuniya and Mullativu. It is important to mention that the existing road has not located close to any sensitive national parks or declared forest reserves as per investigations conducted, analysis and discussion with key government agencies. Apart from that, project doesn't require any land acquisition from the road side community or to resettle the people due to proposed construction. Thus, the proposed improvements will be the better option for the existing situation in the area.

## 2.6 Size and the Magnitude of Operation

Road improvement works for this provincial road under NRCP will involve with repairs, rehabilitation and upgrading as per observations and engineering feasibility report. It is proposed that the road's horizontal alignments will follow the existing road centerlines where the irrigation canals exist along the road either on LHS/ RHS and accordingly, the center line should be shifted. The road carriageway will be 4 m as the proposed project does not intend to widen the road width although sufficient space in both sides (LHS/RHS) is available. Also it does not intend to acquire lands from adjoining areas too.

This is a gravel road running through the semi forest areas, residential areas, paddy fields and Chena cultivation areas. It has been decided to construct earth drains along the road except where line or dished drains are required as per designs. It is required to construct several lead always to drain out storm water resulted due to heavy rains.

Improvements will be carried out to roadside drains, culverts and bridges where existing structures are deemed to be sound. Also, where the condition of culverts and/or bridges is poor, the structures will be replaced.

### 3.1 Description of the Environment

The Mannar region is bounded by 8° 30' N latitude and 80° 30' E longitude (Eriyagama 1961). The Mannar District with total land area of 2002 km<sup>2</sup> extends from the Moderagama Aru in the south to beyond Pali Aru in the North. The Mannar district comprises of five Administrative divisions such as (1) Mannar (2) Mantai west (3) Madhu (4) Musali and (5) Nanadan .

The Mannar district is bounded by Kilinochchi district to the North, Mullativu district to the NE and East, Vavuniya District to the SE, Anuradhapura and Puttalm districts to the South and Indian Ocean to the West. The main town ship in the district is Mannar town while Telamanar, silawathura, Murunkan and Pesali are medium scale townships located in the district. (Abeyasinghe et al, 2010). The majority in Mannar District are Sri Lanka Tamils (51%), followed by 26% Muslims, and 13% Indian Tamils. Sinhalese (8%) and others (2%) constitute the rest.

### 3.2 Description of the Existing Conditions of the Sub Project

The proposed road is 11.4 km long road starting from Periyamadu junction and ending at Pallamadhu junction. At 0.4 km and 9 km, two government schools are located respectively Eachchalawakka MV and Periyamadu MV. At 3.9 km, training army camp is also located on the RHS, a vast extent of paddy field is existent while irrigation canal system is located on the RHS at 0.2 km area. This road runs through a semi forest or disturbed forest areas from 8.9 to 11.4 km, then scrub land forest for next 4.4 to 7.9 km at both sides, and residential area starts from 7km onwards. As a whole, the proposed road is running through abandoned Chena cultivation land areas and residential areas. The road surface is very much undulating with rough surfaces at many locations. Hence, the residents, school children and those who are suffering from ailments also, face untold difficulties in traveling in vehicles and transporting their Agri products to markets. The pipe borne water supply and electricity supply have been provided by the government after dawning the peace in the area. The ample space on both LHS and RHS sides is available from beginning to the end of the road for widening in the future although the proposed road project does not intend for widening.

There are no perennial water sources in the Mannar district and seasonal water ways are observed in the area during the rainy season. The Periyamadu tank located about 2km away from the proposed project caters most of water supply to the agricultural needs of the people. The mainstay of livelihood is slash and burn agriculture while some residents have homes gardens cultivated with vegetables, coconuts and papaya.

### 3.3 Physical Resources

#### *Topography, Geology and Soils*

Generally, the land is flat in the Mannar district. However, along the coast , there are sand dunes and towards Giant tank, the land scape is changing to slightly undulating terrain with elevations rising up to 65 m a.m.s.l. It is vital to mention that there is no perennial river system spread in the Mannar district. Further, the number of main streams is drained through the district at their matured stage and finally discharge to sea within the NW coastal zone of the district between northern boundary zone of Wilpattu National park and Vellankulam (Abeyasinghe et al , 2010).

Most part of Sri Lankan island (90%) consists of rock type called proterozoic high grade metamorphic rocks with Quaternary sediments being restricted to the NW, N, AND NE coastal region as narrow strip (Abeyasinghe et al , 2010). As shown in fig 7& 8, Precambrian basement is divided in to the major

lithotectonic units, namely, highland Complex (HC), Wannu Complex (WC) and Vijayan Complex (VC).

It is important to mention that entire Mannar district lies within the Wannu Complex geologically. However, except for eastern part, the rest of the district is covered by Miocene to Quaternary sediments cover that is resting on the Wannu Complex rocks ((Abeyasinghe et al ,2010).The Wannu Complex is characterized by thick sequences of ortho gneisses which comprise of amphibolites grade, magmatic, granite and granodioritic gneisses in northwest and western sections of the country. Towards the Northwest, Granulite grade variants such as charnockitic rocks and minor granulite grade metasediments are common.

Much of the soils in the Mannar district consist of grayish-brown sandy clay to sandy clay loams with concretions of carbonates of calcium, sodium, and magnesium oxide. The coastal zone strip consists of sands only (Eriyagama, 1961). This fine clay tends to become stony-hard during the drought, making it extremely impervious to water. Murunkan clay has extremely good qualities to support the agriculture. Further towards the inland areas of the Mannar district, reddish –brown soils are observed and widely distributed (Cooray 2003). This type of soils is well drained and ideal for agriculture and forest vegetation. Most of dry arid forest formations popularly known as thorny shrub jungles have grown on this type of soil formation in the Mannar district.

### *Climate*

The Mannar district is located in the arid zone which is classified based on the existing climate condition of the district. The highest rainfall received is about 900-1000mm per annum. This highest rainfall is received from December to February of the year and the driest period prevalent is from April to September. The average temperature prevalent is about 30 c° and the highest temperature may vary from 30c° to 40c° depending on hot sunny days. The forest and other vegetations grown in this region have unique features adaptable to the harsh climatic environment.

### *Water Resources*

The cultivation in Mannar district is sustained by 347 minor ancient irrigation reservoirs and three major ancient reservoirs called Giant's Tank, Akathimuripu tank and Viduyakulam tank (Wijeyamohan et al 2006).It is vital to mention that there is no perennial river system spread in the Mannar district. However, the number of main streams is drained through the district in their matured stages and discharges to sea within the NW coastal zone of the district between northern boundary Zone of Wilpattu National Park and Vellankulam (Abeyasinghe et al 2010).

Most of these streams go on dry during the dry period between July to October of the year. Out of all streams, Aruvi aru (Malwatu Oya ) is a major river as it falls in to the second longest river in the country. Other significant streams in the Mannar district are Kal Aru, Parangi Aru, Pali Aru and Modaragama Aru. The Aruvi Aru flows down across the Mannar district providing water for agriculture and other crops. This Aruvi Aru has a catchment area of 3,284 km<sup>2</sup>. The main water flow of this Aru is seen from December to February each year and main tributary of Aruvi Aru feeds the famous Giant's tank via 22.5 km long inlet channel at the Tekkam Anicut .

During the Maha season, it can provide much of water demand of farmers. According to statistics, around 10,000 hectares of paddy is cultivated in the soil type called grumusols that is relatively impermeable and very slow percolation occurring to underlying aquifers.

In contrast, rapid percolation of rainwater occurs in the eastern part of the District due to favorable characteristics of soil type called latosol. The percolated rain water may collect in isolated clay –lined



villus and further it may go down into underlying alluvial sediments and lime stones where much of water is evaporated during the dry season.

In addition, water quality of the Aruvi Aru goes down severely due to intrusion of sea water along northern bank area close to Silavathura. It should be mentioned that there are no such type of streams within 500m boundary of the proposed road site areas. The nearest water tank located is the Periyamadhu tank which is located 2km away from Periyamadu junction in the Manthai West DS.

The thorny shrub forest areas in the Manthai West areas act as micro catchments areas to the surrounding irrigation tanks including Periyamadu tank. To irrigate the agricultural areas in the Mannar district, well connected irrigation canal systems are in place to provide water from the Giant's tank.

The Miocene limestone in this part of the country provides two quite large aquifers on the mainland to the east and south-east of Manna. The Murunkkan groundwater basin originates about 5 m below ground level and has an average thickness of 162 m and the Kondachchi basin to the south begins at 15 m below ground level and has an average thickness of 45 m (ADB, 2008). Murunkkan is the aquifer that is already used by NWSDB for the present Mannar water supply system.

Irrigation department in collaboration with water resources board had established 130 tubes well in the Mannar –Murunkkan area to provide water for both drinking and cultivations. However, during the dry season, water quality and quantity has gone down due to heavy abstraction of water and consequence of sea water intrusion. As a result, some of the farming land became salanizd and they could not be utilized for farm production (WRB, 2010).

With the financial support from ADB in 2007, a ground water quality study has been conducted in the Murunkkan field area and the results were compared with water quality standard of Sri Lanka water boards and found that high content of Calcium-Chloride is contained with dissolved solids.

### *Air Quality and Noise*

Air pollution can take place from small to moderate magnitude due to emission of smokes and fine particles from vehicles operating in the proposed road construction area. Since there are no settlements, schools and government buildings within first 7 Km along the road, there cannot be any direct health impact due to emission dust and smokes on the people in the immediate neighborhood of the proposed site.

There will not be any rolling traffic condition in the area as no other vehicle movements are generally on these connecting roads. The existing road width is desirable for passing of vehicles on the proposed road.

Due to the war conditions existed over the past few decades in the Northern part of the country, recent data for air quality and noise levels have not been collected and recorded by the concerned agencies for the Mannar district. During the war period, factors such as heavy explosions and emissions from the several war activities contributed to the air and noise pollutions in the area. However, after achieving the peace in the country, the air pollution and noise pollution of the district and the proposed area are assumed to be much less as compared to warring period.

At present, major factors contributing to the air quality of the area are vehicular smoke, emanations from several construction activities under the Uthuru Wasanthaya development programme and dust eliminating from deteriorated roads during the dry season. However, compared with other district of the country, the vehicular traffic in the district seems to be less. There are no large scale industries in the district except very few small scale industries; hence the emission of contaminants to the air from



industries is very low. Therefore, the air quality standards of this area are expected to be within national air quality standards levels.

### 3.4 Ecological Resources

It should be highlighted that the proposed road is running through some scrubland forest areas. However, there are no endemic or endangered forest trees within the proposed road section as per the field visit. The description about the main forest types, trees and faunal diversity is mentioned as to have a better understanding about the ecological environment.

Despite the arid climate, large extent different forest types such as thorn scrub forests, coastal vegetations, mangroves and marshy vegetation are clearly observed in the district. The high biological diversity is still present in most parts of forest areas despite the arid climate and edaphic conditions. Out of different forest types, the large extent of forest area is classified under the thorny scrub forest which harbours its own peculiar fauna and flora.

The Forests in the Manthai west forest areas are classified as thorny scrub lands. The thorny scrub forests provide strong ground cover on the soil against the excessive loss of water due to direct evaporation (Wijeyamohan 2006). Further, this forest vegetation shows remarkable xerophytic characteristics such as thorns and spines to protect from browsers and grassers and to keep the evaporation level to minimum.

This thorny –scrub lands are characterized by three layers, (trees with canopy, understory and ground vegetation), but the canopy does not grow up above 10 m (FD, 2010). The prominent and economically important timber species thriving are Palu (*Manilkara hexandra*), Wira (*Drypetes sepiaria*), Buruta (*Chloroxylon swietenia*), Kohomba (*Azadirachta indica*), Ebony (*Diospyros ebenum*), *Randia dumtorum*, *Dichrostachys cinerea*, *Salvadora persica* (FD, 2010). These taller trees are usually scattered in these forest areas.

The under story generally represents the tree species such as *Ziziphus oenoplia* (Eraminiya), *Tragia plukenetii* (Walkahabiliya), *Cissus quarangularis* (Hiressa), *Sarcostemma brunonianum* (Muwa Kiriya). The ground vegetation is represented by plants like *Acacia eburnea* (Kukul-Katu), *Salvadora persica* (Malitthan) (IUCN 2011) .and further,

Many plants have microphyllous leaves and shrubs growing in the open environment are much branched and formed as dense with lianas and climbers. The ground layer abounds with herbaceous plant species as the direct sunlight reaches the ground. (IUCN 2011) .Most of shrub plants species are well adapted to xerophytic condition that prevails in the Mannar district. These adaptations include thick and small leaves with waxy cuticles, succulent stems (e.g Hiressa (*Cissus quadrangularis*), Muwa-kiriya (*Sarcostemma brunonianum*) and Nawa-Handi (*Euphorbia tirucalli*) for protection against strong sunlight and to minimize transpiration. Other features included are forms of dominant seeds until the rainy season, the ability to withstand heavy structural damage caused by herbivores, drought or wind, and the ability to grow fast during the wet season. The scrubland forest types drop leaves during the peak of the dry season and gives brownish appearance to outside.

People in the Mannar district have several uses from forests. They include collection of firewood, medicinal products, extraction of timber for house construction (IUCN 2011). The important medicinal plants found in the scrubland are Nawa-Handi (*Euphorbia tirucalli*), Rana-wara (*Cassia auriculata*) and *Pupula* (*Sarcostemma brunonianum*).

### *Distribution and density of fauna species*

The Mannar district is also rich in mammalian and avian biodiversity. According to a study conducted by IUCN (1990), more than 30 species of terrestrial mammals have been recorded. The Threatened animal species include the Asian elephant (*Elephas maximus*), sloth bear (*Melursus ursinus*) and leopard (*Panthera pardus*). Variety of herbivores such as the spotted deer (*Axis axis*), sambar (*Cervus unicolor*), barking deer (*Muntiacus muntjak*), mouse deer (*Tragulus meminna*) and wild boar (*Sus scrofa*) are also living in these forests. After ending the war, no significant study on distribution and density fauna in the Mannar district has been conducted.

Mantai West, rich in natural habitats, supports a large number of faunal species. Large mud flats and salt marshes in the Vankalai and Palakamunai areas are feeding grounds for migratory water birds. Due to its importance for migratory birds, Vankalai was declared as a Ramsar wetland in mid 2010. The nearby mangrove vegetations in Vidattaltivu and Palakaimunai also serve as feeding and roosting grounds for native and migratory bird species. Hence, the Department of Wildlife Conservation should consider declaring the Vidattaltivu mangrove habitat also as a sanctuary. One hundred and twenty eight faunal species have been recorded from the area and among them are 106 bird species. Information on other fauna is scanty.

### *Land use and Agriculture*

There is a vast extent of paddy fields located from 10.5 km to 11.4 km on both sides of the road. These paddy fields are cultivated only during the Maha season. It is observed that home gardens are visible in the Periyamadu, Kayanager, and Sannar areas as these areas are mostly occupied by Tamils and Muslims people carrying out agriculture as their mainstay in livelihood. Further, it should be mentioned that these people are facing a difficult situation due to the ongoing drought condition in the area. Although some water tanks are present in the district, there are no such water tanks located within 500km distance from the project area.

After the war, major economic development initiatives implemented by the government of Sri Lanka are developing the irrigation projects for boosting agricultural productivity, granting of fishing nets and boats for the fishing industry and building of hotels to develop the tourism industry. The major irrigation system connected to the Giant's tank and its channel network have been heavily improved and facilitated to flow down the water to far removed areas for enhanced productivity of paddy and other crops growing in the district.

By establishing the agricultural seed production and distribution center at Murunkan in the Mannar district, it was primarily decided to train the farmers for use of hybrid seeds in local agriculture and to apply the modern knowledge base through trainings and awareness programmes.

As per statistics recorded in 2012, the extent of paddy cultivated in the Manthai West was 5154 Ha during the Maha season as against the targeted extent of paddy cultivation during the same season was 5830 Ha. As well, during the Yala season, the extent of paddy cultivated in the Manthai West was 1085 Ha as against the targeted extent of paddy cultivation during the same season was 1228 Ha.

Table 3.1: Irrigation tanks in Manthai West-2012

Minor tanks	Minor to Medium tanks	Medium to Major tanks
136	05	41

Source; Office of Agrarian Development-Mannar

### *Livestock Farming*

Table 3.2: Livestock Population in Manthai West-2012

DS Division	Neat Cattle				Buffalo				Goat	
	Milking cow	Other cows	Bulls	Calves	Milking cow	Other cows	Bulls	Calves	He	She
<b>Manthai west</b>	1100	2680	1900	2000	130	90	190	140	820	980

Table 3.3: Livestock Population in Manthai West-2012

DS Division	Poultry					Ducks	Sheep	Pig	Rabbit	Guinea Fowl
	Cock Bird	Laying Hen	Hen	Chicken	Broilers					
<b>Manthai west</b>	20000	1500	30000	3000	5000	450	-	6	35	20

Table 3.4: Cow Milk collection in Manthai West DSD-2012

DS Division	Liter/Year				
	2008	2009	2010	2011	2012
<b>Manthai west</b>	Nil	4000	10080	21675	88200

Source; Department of Animal production and Health-Mannar

### *Fisheries*

The fishing industry had been restrained due to prevailed war condition in the Gulf of Mannar. However, after ending the war, it was decided to lift the restrictions imposed on fishing industry. As well, the number of fishing gears and boats were given to increase the productivity of fishing and further, commercial buildings for sale of fish were also established by the government under the support of foreign assistance.

As per available statistics recorded in 2012 in the Department of Fisheries and Aquatic Resources, there are 711 active fishermen in the Manthai West DS while fisher families are about 978. The total number of fishery cooperatives operating is 11.

### **3.5 Infrastructure Facilities**

The public water supply scheme manned by NWSDB in the Mannar town can provide only to 30% - 40% of people. The rest of the people in the town area and people in other administrative divisions fulfill most of their water requirement through dug wells and tube wells constructed by UN and other NGOs (ADB, 2008). The water yields of these wells naturally go down during the dry spells and create a difficult situation to the people. However, after ending the war, Government has provided the water supply and electricity supply to the proposed project areas where people enjoy with these facilities.

It is vital to mention that there is no sewerage or waste water disposal system operated by the Mannar urban council or any other state organization. People in the mannar town and other areas use pour –flush

pit latrines that are secure and convenient to the people in rural areas (ADB.2008).

According to the waste management survey conducted by the Ministry of Environment and Natural Resources in 2001, generation of wastes per day has been estimated as 2775 Kgs. 80% of the wastes mainly consisting of organic wastes are disposed to land fill areas by the Mannar urban council. However, the waste collection in the surrounding areas close to the proposed project area does not function as most of the people mostly collect and burn their wastes in their backyards.

Electricity supply to many parts of the Mannar district has been given by the Ceylon Electricity Boards (CEB) like in other parts of the country. However, the supply of electricity is fluctuating and many interruptions are experienced almost every day.

### **Transportation**

The main highway to the Mannar island and consequently to Pesalli and Telemannar is the road running from the Medawachchiya A14 road. This road is in very good condition following the reconstruction after the war. This connects with the Mannar Island through the bridge constructed recently. This road is the main artery infrastructure improved by the government for economic development of the Mannar and rest of the country. In addition to above, provincial roads and roads maintained by the local authorities are used for transport of goods and services in the district. However, the roads maintained by local authorities are gravel and in need of repair.

The total number of roads in the concerned Mantahi west DSD (MDSD) is 123 which consists of 4.3 km of tar roads, 7.5 km of concrete road, 97 km of gravel roads and 25 km of earth roads as per statistics of MDSD in the year 2012.

## **3.6 Social and Cultural Development**

### **Population and Community**

The total population of the Mannar district of Sri Lanka is 95,430 and this as a percentage of the entire Northern Province (NP) is 9.6 as the total population of the NP is 997,754. This shows that population is still very poor compared with rest of the country.

As per the population statistics of Department of Censor and statistics, 2011, break downs have been given below for number of people by their ethnicity in the Mannar district. Accordingly, number of Sinhala, Sri Lankan Tamil, Indian Tamil, Muslims and others living has been mentioned in the table given below. Out of all, Sri Lanka Tamils are the majority group living in the district.

Table 3.5: Population and Ethnicity by district-2011 (Censor and Statistics)

District	Sinhala		Sri Lankan tamil		Indian tamil		Muslim		Other	
	No	%	No	%	No	%	No	%	No	%
Jaffna	746	3.4	560905	60	3550	42.1	1874	5.7	154	37.5
Mannar	455	2.1	77653	8.3	1136	13.5	16130	49.4	56	13.6
Vavuniya	16555	75.7	134709	14.4	1956	23.2	11491	35.2	141	34.3
Mullaitivu	3966	18.1	59540	6.4	596	7.1	2390	7.3	34	8.3
Kilinochhi	138	0.6	101585	10.9	1194	14.2	774	2.4	26	6.3

The five administrative divisions belonging to Mannar district are Mannar town, Manthai West, Madhu, Nanaddan and Musali. The population statistics for these divisions have been given below in the table 3.6. Mannar town has the highest population in the Mannar district.

Table 3.6: Population in administrative divisions in the Mannar District-2011

<b>DS Division</b>	<b>Sinhala</b>	<b>SL tamil</b>	<b>Indian tamil</b>	<b>Muslim</b>	<b>Other</b>
Mannar town	279	38,316	475	8,479	27
Manthai west	40	12,839	106	1,344	6
Madhu	45	6,721	373	486	21
Nanadan	41	16,754	164	700	2
Musali	50	3,023	18	5,121	0

Table 3.7: Population and housing figures -2011

<b>District</b>	<b>Type of living unit</b>			<b>Number of households</b>	<b>Average household size</b>
	<b>Housing</b>	<b>Collective</b>	<b>Non housing</b>		
	<b>Persons</b>	<b>Persons</b>	<b>Persons</b>	<b>Households</b>	<b>Persons</b>
Jaffna	557,715	9,075	439	135,038	4.13
Mannar	92,763	2,500	167	23,117	4.01
Vavuniya	161,229	3,461	162	42,031	3.84
Mullativu	65,042	1,359	125	18,291	3.56
Kilinochchi	102,110	1,456	151	27,217	3.75

The numbers of housing units whether they are individual or collective have been mentioned in the above Table 3.7.

### *Health and Educational Facilities*

There are 4 state medical dispensaries (institutions) functioning in the MDSD. Since the proposed project area is deficient in most required health facilities, some health indicators such as percentage of households who own latrines have been recorded as 66 % and 83.5 % in the rural and urban sectors respectively as per statistics from MDSD 2102. The safe drinking water consumption in households in the same DSD has been recorded as 66% and 83.50 % respectively in the rural and urban sectors.

In regard to the educational facilities in the MDSD as recoded in 2012, there are 28 state schools consisting of 22 Tamil schools and 6 numbers of Muslim schools. The total number of student population recorded as 3919 as per figures in the MDSD (2012).

The adequate educational facilities such as well built school buildings, play grounds, laboratories are not observable in the NP as against the same facilities in other provinces in the country. As per field visits, there are 28 schools in the MDSD while only two schools such as Periyamadu MV and Eachchalawakai MV are functioning along the proposed road in the MDSD.

# SCREENING OF THE POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

## 4.1 Introduction

The proposed works for NRCP (PC) will involve rehabilitating, improving or upgrading of one provincial road located in the Mannar district. The project activities during pre- construction and construction phase include widening, surfacing, excavation and replacement in sub-base and base materials for marginal widening where required, rehabilitation of shoulders I side drains, repair improvement or new construction of culverts I bridges, causeways, localized embankment construction and provision of miscellaneous items e.g. protection works, road safety items (road marking, road signs) etc. These activities will involve removal of road side trees, mining of gravel and sand, quarrying of mettle, establishment of material processing plants, storage yards, labour camps, vehicles and equipment service yards, transportation of construction materials etc. Feasible mitigation measures for anticipated impacts arising out from these activities have been suggested to avoid minimize significant environmental impacts associated with proposed construction activities while enhancing the positive environmental impacts. The potential environmental impacts and feasible mitigation measures are discussed in EMP with the specific locations in each package.

Following section describes Environmental Impacts and Mitigation Measures associate with pre construction, construction and operation stages of the project in general with incorporating road specific details where required.

## 4. 2 Environmental Impacts Associate with Pre Construction and Construction Stages

### *LandAcquisition*

The most important activity before handing over construction works to the contractor is the availability of land for construction related activities. Since the anticipated construction activities are restricted to the existing RoW of the sub project roads, land acquisition will not be required for the proposed project.

### *Removal of public utilities*

In general, road improvement work will impact on the public utilities within the existing RoW . The proposed road is located in the Manthai West DS of Mannar district. The public utilities located along the proposed road are water supply system and electricity poles which will not be damaged or impacted due to implementation of the proposed road project as the government has established them far away from the carriage way keeping ample space for road widening. Therefore, there is not necessity for relocation of public utilities along the road.

### *Impacts on temporally use of lands*

An identification of lands for temporally uses for materials processing plants, storage yards, machinery, equipment and vehicle parks, disposal sites, labour camps within the sub project affected areas for construction related activities are necessary during the pre-construction stage. These should be done carefully to avoid environmental and social impacts. Furthermore selection of these sites should be done in accordance with local laws, regulations and in close consultation with LAs. Furthermore adequate compensation/rent for using the selected sites, official permit from the authorities (if any public utilities will be used) should be obtained while taking actions to minimize removal of trees and other green cover vegetation.

### *Soil Erosion Sedimentation and Siltation*

soil erosion, sedimentation and siltation in sub project road can take place during rainy seasons due to

land clearing, excavation, temporary piling, and filling, removal of existing culverts, cutting trenches, backfilling and construction of earth and line drains. Decrease of infiltration of rain water, acceleration of surface runoff, are also the main impacts associated with the cut and fill operation. This situation can mainly be observed in the areas where the proposed road run through paddy field, and parallel to the irrigation canals. Thus following measures should be considered to mitigate above impacts during the construction stage.

Top soil from construction sites, cut and fill areas, material extraction sites should be stored properly and reuse for turfing and tree planting activities etc. Retaining walls, fiber mates, silt traps and deep-rooted grasses etc. should be placed to the erodible areas, where necessary especially construction sites of causeways, culverts and bridges. Also turfing work should be taken prior to the rainy season. All temporary soil dumps should be removed from site to a suitable disposal place. If temporary soil dumps are left at the site for a long time those dumps should be covered with thick tarpaulin sheet. Clearing and filling areas should be treated against flow acceleration and should be carefully designed to minimize obstruction or destruction to natural drainages. Suitable local drainage facilities should be established properly to drain water in the construction areas. Construction activities including earth work in erosion and flood-prone areas of the sub project road should be conducted during dry season (excluding May to September) as described in EMPs.

#### *Extraction, Transportation and Storage of Construction Materials*

Large quantities of construction materials such as sand, soil and metals extracted from various locations in the Mannar district should be transported to the sub project area (Table 4 .1). Soil erosion, lowering of the river beds, destruction of the river banks, and reduction of sand replenishment of coastal beaches, coastal erosion and intrusion of sea water through river during the dry season are the main consequences of sand mining in rivers or waterways in the manner district.

Extraction and transportation of materials from such sites will cause noise, vibration, dust, induced slope failure, negative visual impacts, creation of mosquito breeding sites and damage to private properties and minor roads. Heavy trucks will be used to transport material to construction sites. Such trucks can potentially cause disturbances to local traffic, damage minor roads, and increase dust and noise nuisance.

This could be mitigated by using quarry and burrow sites approved by Geological Survey and Mines Bureau (GSMB). Spoils should not be dumped along road side and near water bodies. Spoils, top soil and denuded materials could be reused for refilling of burrow sites and transported materials should be covered using polythene or any other suitable material to avoid dust blow. Keeping provisions for repairing and restoration of the roads used for the transportation of construction materials by the contractor in the contract document and use of covers over transported materials to guard against dust blow and water spraying to dampen the surface will mitigate the impacts due to transportation of construction material.

Table 4.1: The identified mettle quarries for the proposed construction of sub project road

Name	Location	Approximate distance from Mannar .(Km)
CEC (Pvt)ltd-Quarry & Crusher AQ 01	Medawachchiya	138
Wickramasinghe Metal crusher. AQ 02	Medawachchiya	140



Source: Compiled by the Geologist of the Project

### *Effect on water resources*

Only two irrigation canals are located along the proposed Pallamadu-Periyamadu road at 11 km point area where vast extent paddy lands are present. During construction stage, water will be required in significant amount for the construction activities. Use of water sources for construction activities and construction close to the water bodies (construction of cause ways, culverts and bridges, surfacing of tank bunds) and sections parallel to the irrigation canals etc, may affect water sources used by local communities in different ways. In addition, construction vehicles, equipment, material storage yards, poor sanitation at work sites and dispersal of solid waste etc, will also pose several negative effects of these water bodies in numerous ways. In order to prevent these impacts, following measures need to be undertaken and should be included to the contract conditions and specification of the works.

Contractor should make employees aware on water conservation, pollution and minimization of water usage as much as possible. Measures should be taken to avoid entering waste water produced at construction sites directly in to water bodies. The nearest water located is the Periyamadu tank about 2km away from the proposed road site.

Vehicles and equipment use for the construction activities should be maintained in good condition, ensuring that no undue leakage of oil or fuel is released to water sources. The upstream and lead-away channels of the bridges and culverts should be cleaned in order to maintain the smooth water flow to the downstream and it should not obstruct or prevent existing flow of water. All toxic and hazardous materials required for construction, including Asphalt, fuel, toxic, hazardous and containing other fine partials would be sited at least 500m away from water bodies.

### *Temporarily floods*

The proposed project road located in the Manthai West of the Mannar district is prone to temporarily flooding and water stagnation as a consequence of its location: in low elevation between the paddy fields. Increase the embankment height of the particular sections with construction of new cross drainages, reconstruction of existing culverts, cause ways and bridges with sufficient capacity will avoid location specific temporary flood. All construction activities should be properly planned & arranged to minimize the flooding conditions as a result of blocked drainage paths. Thus existing drains should be cleaned after site specific construction, excavations, clearing & grubbing to avoid flooding or stagnation of water. Additionally construction should be restricted to the dry season around flood plain areas. Also temporary earth drains should be formed as practically as possible until required lined or earth drains are provided after excavation and other construction activities.

### *Solid Waste Disposal and Sanitation*

Labour camps may need to be established near the road trace or in the vicinity. If improper sanitation, wastewater and solid waste disposal are practiced in labour camps there is a possibility of contaminating surface water sources. And also there is a potential of facilitating formation of breeding mosquitoes places, spreading of communicable diseases from workers to local population and social conflicts may arise due to use of illicit liquor and due to other unpleasant behavior which causes inconvenience to local community.

Labour camps must be located at least 100m away from the water resources. Proper sanitary facilities should be provided to the labour camps and there should be a proper way of disposing any wastewater and other waste matter generated from the camps as agreed with the Public Health Inspector (PHI) of the area.



Recruiting local labour as much as possible, strict labour supervision and labour counseling need to be done to avoid spreading of communicable diseases and any conflicts that could arise due to labour at construction site. Awareness programs should be conducted targeting workers as well as local community in order to minimize and avoid any such conflicts. These mitigation measures need to be incorporated in to the constructor's contract and environmental management plan to minimize the negative impacts.

### *Disposal of construction debris and spoil*

In order to upgrade roads and widen the narrow roads clearing of roadside vegetation near the edge of the existing road, excavation and removal of unsuitable soil, cutting trenches for roadside drains and removal of degraded surface of roads will be required. Such activities may develop temporary piles of soil and debris along the road edge.

All these activities could cause temporary erosion and therefore, siltation of nearby water bodies would occur and if un-compacted earth surfaces or soil dumps are left exposed to rain or if they are placed near water bodies and paddy lands, soil erosion will be possible. Sediments could drift away and get silted up in the side drains, adjoining streams and irrigation canals causing deterioration of water quality.

Following measures should be adopted to mitigate effects of disposal of construction debris and spoil;

- Reuse of soil removed for filling sites if any as much as possible and unsuitable materials can be used to refill borrow pits
- Where earthworks take place adjacent to water bodies, silt traps shall be installed prior to the commencement of earthwork activity
- All temporary unsuitable soil dumps and debris should be removed from site to approved disposal sites
- If temporary soil dumps are left at the site for a long time proper remedial measure to minimize soil erosion should be practiced
- Temporary soil dumps should not be placed near water bodies
- All fills, back fills and slopes should be compacted immediately to reach the specified degree of compaction,
- Suitable local drainage measures should be established to properly drain the water in the construction area to the nearby waterways
- Establishment of suitable mulch to cover the slopes of embankments

### *Disruption of Traffic*

Improvement works on the road pavement and reconstruction of culverts will impede existing traffic flows. The movement of trucks and other construction vehicles may cause accident risks and may damage other roads that they use to bring construction material to the construction sites.

Following measures should be considered to minimize the impacts on existing traffic;

- Providing advance information to the public about the planned construction works,
- Use of flagmen control traffic flows at constricted sites, including safe crossing for pedestrians especially near town areas and schools.

### *Personal safety*

Construction related activities both inside and outside of the sub project affected areas could create accidental damages to general public and the work force. Construction sites including bridges, culverts, cause ways, surfacing, roadway excavation, removal of road side structures, trees, use of hazardous substances, processing and transportation of construction materials are the main causes associated with

accidental risk. Additionally explosive and earth mines that used during armed conflict can also cause accidental damages to the workers. Therefore, contractors should take necessary action to enhance personal safety during the construction through following measures.

Organize awareness programs about personal safety of the workers and general public in the area with proper briefing and training of workers on safety precautions, their responsibilities for the safety of themselves and others. Use of licensed and trained plants and vehicle operators provide protective footwear, helmets, goggles, eye-shields and clothes to workers depending on their duty (mixing asphalt, blasting, handling equipment etc.

### *Impact from Dust, Noise and Vibration*

Earthworks, pavement improvement operations, quarry operations, operation of hot mix plants, operation of construction vehicles and operation of plants during construction period will release aerial contaminants (dust and fumes) by increasing local air pollution.

Heavy machinery used for construction work such as vibrators and compactors and operation of heavy vehicles at higher speeds will create noise and vibration which will cause nuisance to residents in settlements. Since noise and vibration values are generally low in rural areas, the project induced impact could be severe at some locations such as schools, hospitals and places of worship that are particularly vulnerable to nuisance from noise. Buildings located closer to the road trace will have cracks due to construction vibration.

Construction related activities closer to public sensitive locations have to be schedule coordination with the relevant authorities (community leaders, schools' principals, high - priests or other respective officers) to avoid disturbance to the day to day activities. Crushers and hot mixed plants should be placed with the approval of Engineer, CEA, and DOF/DWLC.

The impact of construction noise, vibration and emissions at sensitive areas can be mitigated by;

- Ensuring that construction plant and equipment is maintained to high operable standards with exhaust baffles are fitted and maintained in a high serviceable condition.
- Limiting operations to times when they have least impact on settlement areas, especially near schools and other sensitive locations such as schools and places of worship.
- Vibration should be controlled in agreement of the Engineer at locations where sensitive receptors are found.
- Regular sprinkling of water to dampen the construction surface will reduce the emission of dust.

### *Effect on Flora, fauna and their habitats*

During the construction stage, loss of vegetation is inevitable. During this phase, the loss of vegetation could aggravate the erosive processes especially during the rainy season. Loss of soil moisture especially in the project area is high as it falls within the dry zone area. Loss of trees may also cause economic loss to the owners of the trees.

All construction works should be carried out in a manner that the destruction or disruption of vegetation is minimal. On the other hand, there is no necessity to remove any tree as the sufficient space is available within the ROW. However, the proposed road is traversing through some forest areas which harbor some valuable fauna and flora species that have been identified as mentioned under the Ecological resources.

### *Spread of invasive species*

During the construction stage, soil brought into the project area from outside may contain seeds of alien

invasive species. Also, the construction machinery and vehicles can accidentally introduce seeds of such plants if used without proper cleaning. Temporary facilities such as labour camps, dumping sites, soil storage sites are potential locations where invasive plant species can get established in quick succession. This will negatively affect both the natural and manmade habitats. It is observed that several alien invasive species have been reported from the Northern Province few years back. Hence, it may be possible to transmit seeds of invasive plants to the proposed project area where it can spread to other areas within short period.

Securing soil from locations close to the project area will reduce the chances of transporting any seeds of alien invasive species to the project area. Land area of labour camps, dumping sites and soil storage sites should be frequently checked for any growth of invasive plant species. If found, they should be burnt and destroyed within the premises which they were found.

#### *Adverse impacts on terrestrial fauna*

As explained previously, the proposed road is traversing through forest areas, home gardens and agricultural areas where there are meat cattle, elephants, deer and bird species such as Peacocks. The free movement and natural behavior of animals in the project area will disturb to the work force during the construction stage of the project.

Further poaching and hunting could be carried out by workers if the worker camps are located close to the forest areas. The contract agreement with the contractor must include clauses to prohibit any illegal activities such as hunting and poaching. Strict worker force supervision should be carried out by the contractor when conducting construction work close to these locations.

No solid waste or spoil dumping sites, hot mix plants and worker camps should be located within or close to the forest area. Further, any guidelines given by the DWLC/DoF should be strictly adhered. No solid waste or spoil dumping sites, hot mix plants and worker camps should be located within or close to the protected areas. Restrictions on the daily working hours between daylight and sunset must be enforced in sites near forest areas or wildlife zones.

#### *Biodiversity Conservation and Sustainable Resource Management*

A considerable extent of forest area has covered along the proposed project area with some disturbed Chena cultivation. However, as per observations made, all water canals, ponds and water ways have gone dry due to the dry spells being experienced in this area. Due to implementation of the project, large volume of ground water or surface water needs to be consumed to achieve set targets of the construction works. Therefore, it is required to get water for the construction activities from the Periyamadu tank that has enough water even during the dry season. Therefore, without misuse of water resources, it is needed to utilize water for the target activities.

Further, the proposed project requires the large quantity of metals, sand and gravel from the Mannar district or outside areas. Once, extraction of these natural resources, it is with great concern for taking measures and precautionary not to misuse and waste the resources from the base to the point of delivery. Also, the right quantity and required quality should be obtained after conducting relevant tests being performed at laboratories. This will avoid wastages of resources and lead to sustainable management of resources giving a large saving of costs for both contractor and the client during the construction period.

### ***Impact on socio-Economic condition of the area***

The project will not trigger any negative impacts as a consequence of project implementation as land acquisition and resettlement issues will not crop up due to non- widening of the road. Since this is a rural road, the general problems faced by people in town areas are not faced except minor traffic congestions at few locations. Also, this is not a road for a peak traffic rout as per the observation. It should be mentioned that more positive benefits are attributed to the area due to successful implementation of the proposed project.

Following socio-economic benefits are expected to transfer to the affected populations of the project area.

- Improvements in road connectivity reduce regional disparity, open up new markets, generate employment opportunities and thereby reduce poverty in lagging areas.
- An efficient and convenient transportation system will accelerate the economic growth by facilitating easy and faster mobility of people, goods and services and reducing disparities in regional development.
- The road network improvement in Mannar district will boost economic activities including potential growth in industries, tourism, fisheries and agriculture in lagging areas.
- Good road network will reduce transport cost and travel time leading to increase the profit margin of the small scale farmers. The market expansion increases the marketability of the product.
- The wages of agricultural laborers will be increased when profit margins and sales are increased due to the road development.
- Similarly, better road network will provide access to schools and other services.

In the long term this will improve education level and other associated life values

### ***4.3. Environmental Impacts and Mitigation Measures Associated With Operation Period***

The forecasted impacts during the operation phase for the road are described as follows.

#### ***Air Quality and Noise***

Currently the ambient air quality in the project affected area is definitely within the National Emission Standards. The major air quality pollution factor in the project area at present is dust emission from the gravel and sandy road. Therefore it is expected to reduce by more than 75% of the existing dust after surfacing of the gravel and sandy road. Further proper alignment, widening and surfacing of the road will allow considerably higher speed for vehicles with minimum accelerations and decelerations which in turn reduce the vehicular emissions and sound pollution. This condition will positively impact the air quality and the human health in the area. The tree plantations programme will also help to compensate any impacts arising from air pollution due to vehicular emissions.

#### ***Drainage Congestions***

Improvement of the road drainage facilities (Earth or line drains as well as cross drainages) through the project is expected to facilitate better water flow, which will result in higher speed flow during the rainy season. Stagnation or blocking of water flow may occur due to sediments, improper disposal of debris or ignorance of public by disposing garbage into side drainages. This situation will change the water flow direction. Sometimes water runs along or across the road in numerous locations, and will impact the carriage way, road edges and sometime pavements of the road. Stagnation of water in different locations beside the road provides favourable habitats for vectors (water borne diseases) and temporary inundations will deteriorate the quality of road. Regular maintenance of drainage system by Provincial Road Development Department (PRDD) will avoid drainage congestions, stagnation of water and temporary inundations.

### *Safety of Road Users*

Currently road or sections are not used by the people due to security reasons and dilapidated condition. However if resettlement activities and other on-going development projects will finish parallel to the proposed project, these areas will be more populated due to improved access and other infrastructure facilities. Thus enforcement of speed limits, traffic rules and regulations, installation of the warning signs, regulatory signs and information signs as well as provision of bus bays, pedestrian crossings and payments to the appropriate locations are essential to enhance safety for the road users

### 5.1. Grievance Redress Mechanism

Grievance Redress Mechanism (GRM) provides an effective approach to resolve any issues made by affected community on environmental impacts arising throughout the project cycle. This mechanism will be established by the project proponent, with PRDD to address grievances presented by Affected Persons (APs). Since most of the environmental impacts are construction related complaints (issues related to dust, noise and vibration, effect on land, loss of access, local road network, deteriorating water quality and quantity, soil erosion and safety issues) managing those is mainly the contractor's responsibility.

However, these grievances could be minimized at the initial stage of the project by careful design, implementation and monitoring of project and also through sound communication and awareness among all the stakeholders including APs regarding project activities. Furthermore, adhering to mitigation measures addressed in EMP by contractor (with the help of Environmental Officer) under the careful supervision of CSCs /ES and the representatives of PRDD and CEA will minimise construction related grievances.

#### *Grievance Redress Committee*

This mechanism will be executed through a Grievance Redress Committee (GRC) and consists of following Members;

- A representative from relevant DSD (Divisional Secretary/Additional Divisional Secretary)
- A representative from PRDD
- A representative from community leader/ Grama Niladhari (GN)
- A representative from contractor
- A representative from CSC

Almost all the stakeholders related to the GRM should be aware and instructed by PIU regarding the established grievance process, the requirement of grievance mechanism, goals, benefits, relevant laws and regulations of GRM. They should also be instructed about procedures of taking/ recording complaints, handling of on-the spot resolution of minor problems, taking care of complainant and most excellent response to distressed stakeholders.

The Affected community should especially be made aware of the procedure, venue and the responsible person to contact when making complain.

#### *The Process of Grievance Redress Mechanism*

Complaints of APs can be made as an individual or as a group in verbal or written form through letters/suggestion boxes and telephone conversation. Received complaints will be screened to determine if they are eligible to be addressed by GRM. If the complaint is rejected, the complainant is informed about the decision and the reasons for rejection. If the complaint is accepted, it can be resolved through GRM of the project. Solutions for complaints should be handed over to complainant in written form and actions to be taken to mitigate those impacts should be informed to the responsible institution / individual.

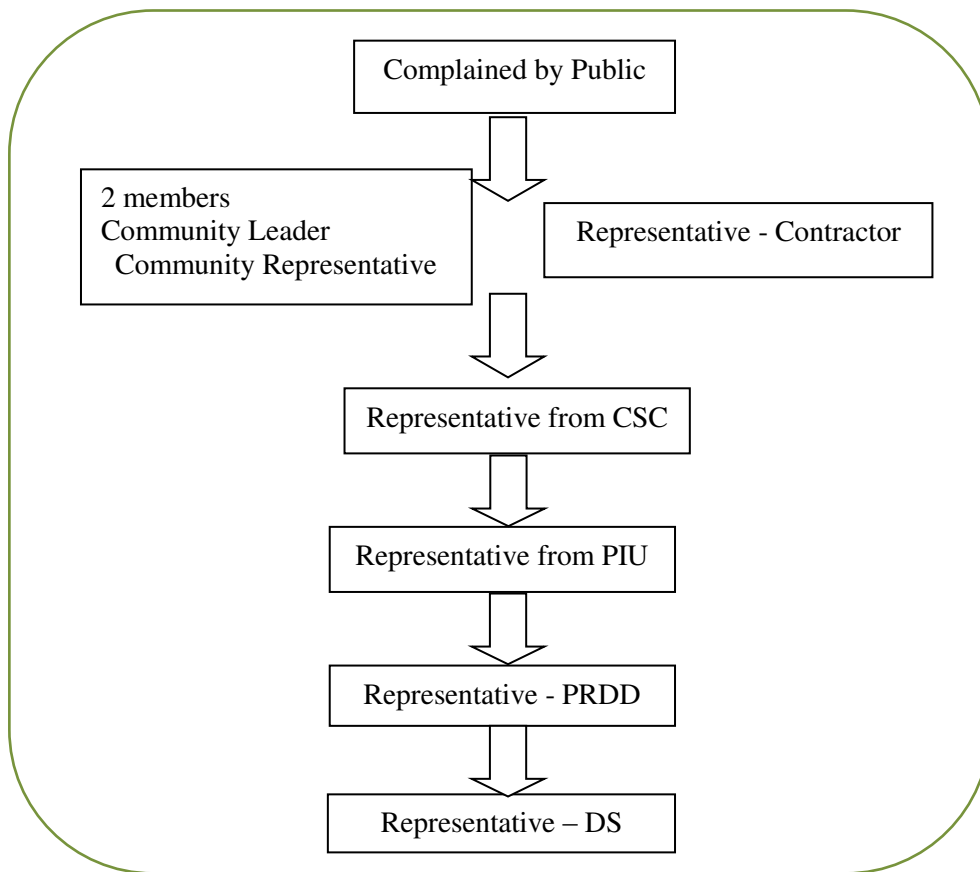


Figure 5.1: Responsibility hierarchy of resolving public complaints

When people encounter an issue, first step is submission of complaint to the Contractor/PM/EO through community leader/GN. If the complaint is simple and the answer is straightforward, it should be directly provided within 2 days to the complainant.

If the reply could not be provided immediately or not within his authority or if the response for the complaint is at an unsatisfactory level for the complainant, it should be forwarded to the Grievance Redress Committee. A GRC meeting must be convened and an answer for the complaint should be provided within 3 weeks to the complainant.

*Note: Refer to Designing and implementing grievance redress mechanisms, a guide for implementers of transport projects in Sri Lanka (2010) by ADB for further details.*

## 6.1. Environmental Management Plan (EMP)

To ensure that the proposed project would not generate any negative impact on the environment, the EMP has been prepared as a matrix and attached as Annex B. This was developed based on best practices for environmental management. The EMP includes the potential impact as a result of project activities, proposed mitigation measures, the responsible party to implement and supervise those and the feasible cost measures to be taken to reduce the potential significant adverse impacts in an acceptable level. The site specific EMPs will be prepared based on the contract packages. This site specific EMPs are essential documents to be incorporated in the relevant Bid documents.

There must be professional expertise with the contractor side to prepare Environment Methods Statement (EMS), based on the EMP which is prepared under the feasibility study. EMS is a document which is prepared by contractor to declare mitigation measures for anticipated environmental impacts during pre-construction and construction phase such as operation of metal quarries, asphalt plants, crusher plants and clearing of land etc. Clearance / permit which need to be taken from Government Departments and Institutions are also included in the comprehensive EMS. It also comprises of measures to be taken for environmental protection, methods for saving energy and reduce wastes and losses, preventing or minimizing pollution, disposing of pollutants comply with the existing stipulations and laws. Also the comprehensive EMS clearly explains that the contractor usually takes action to minimize environmental impacts during project activities. The organization structure of implementing comprehensive EMS comprises an environmental supervision department. Thus environmental protection around the construction site is directly controlled by the technical department which is usually supervised by a Resident Engineer (RE) and ES of the CSC.

## 6.2. Environmental Monitoring Plan (EMoP)

In addition to the EMP, to ensure that the project would not generate any negative impact to the overall environment quality, the Environmental Monitoring Plan (EMoP) has been prepared and attached as Annex C. This includes information on environmental parameters to be monitored, location, time and frequency, cost for sampling and stage of subproject on which the monitoring should be conducted. The EMoP will be a useful tool to monitor the implementation of mitigation measures included to the EMP. Monitoring of the quality of water, air and noise during the construction stage is a responsibility of the contractor by the approved Government Agency. All the monitoring activities such as site supervision, removal of trees, material extraction, verification of permits etc. by the contractor will be supervised by the ES of the CSC. The environmental monitoring report will be submitted to the PIU of PRDD, which will include the result of environmental monitoring into its environmental report that will be reported to the PD at the MLGPC.

The Criteria for selection of sampling locations for the EMoP is as follows.

- Air quality- Semi urban centres, environment and public sensitive areas and places where potential increase of traffic.
- Water quality- Rivers/ stream/tanks/wells and construction sites of bridges where local communities use water for supporting their lives, and those with available water almost all over the year.
- Noise and vibration- Semi urban centres, environment and public sensitive areas that might be affected by the used of heavy equipment.
- Flora - Areas where trees are available within proposed RoW and locations where removal of a large number trees for the proposed activities.



- Fauna - Ecological sensitive areas where species diversity is high and such areas that might be affected by the proposed project activities.

## PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

According to ADB Environmental Guidelines public consultation and information disclosure is the main activity carried out during the initial stage for an IEE. The aim of the process is to understand the view point of the public about the project and respond to their concerns and suggestions during the early stage of the project. Incorporation of the environmental concerns to the decision making process through the public consultation will avoid or minimize conflict situations that can arise during the construction stage.

Providing information at an early stage to the public especially for the APs about objectives, activities, expected outcomes of the project etc. will ensure community awareness and avoid conveying misinformation to the APs.

During the individual as well as group discussions APs were brief about the proposed improvement works including reconstruction of culverts, causeways and bridges; drainage and payment works, surfacing works etc. by the consultants. Participants generally expressed their views about the project including current environmental, social and economic situation of the proposed subproject area.

- At present the road is in a deteriorated condition because of lack of maintenance during past 3 decades. Thus rehabilitation and improvement of the road is essential to create efficient transportation facility for general public and to reduce both vehicle operation and cost of transportation. Also improvement of the road will contribute to the social and economic development of the region.
- Once the road is developed, paddy cultivation and fishing areas will have better access, as well as government servants, students and teachers will be benefitted by saving their precious time. Because of the better access out of the developed roads many of the unutilized lands can be cultivated and industries such as fishing, salt and tourism can be developed.
- The road faces the problem with flowing of water over the road at many locations due to lack of earth or line drains, lower elevation of the road, collapsed causeways, culverts and bridges. Thus necessitating the rising of road level and provide adequate drainage facilities including causeways, reconstruction of culverts and bridges with adequate diameter based on the hydrological studies in the area is required.
- The road proposed under the project is gravel or sandy road. At present dust emanation from the road from vehicle transportation cause inconvenience to the road users as well as road side community. The level of emission will increase during the construction due to different type of construction activities. Also construction materials like metal should be transported to the project area from outside especially from North Central Province. Hence, dust suppression measures are extremely important during the construction phase.
- Most of the people in the proposed project area are recently resettled people with lack of infrastructure facilities including poor road network. Poor riding conditions of the road and lack of a convenient mode of transportation have caused the area to be isolated from the township. With the improvement of the road, people can directly access the town areas to engage in a number of social and economic activities and also new technologies can be transferred from urban areas towards development of the interior parts of this province.
- During last 3 decades many trees have been felled from either side of the road sections for better access or during army operations. Therefore, it is important that fruit bearing, shading and valuable timber tree species are planted at the edges of the road reservation. This will provide long term benefits to the society while compensating the floral loss occurred during the past. Also, this will be useful in demarcating and protecting the road reservation.

## CONCLUSION AND RECOMMENDATIONS

The appropriate category for the road in the Mannar district based on REA checklists of the ADB is under category B. All the construction activities are restricted to the existing RoW. Land acquisition, resettlement activities and reclamation of paddy fields are not involved. This road is not located within national parks, sanctuaries, important biological habitats or wet lands as declared by the relevant authorities. Thus a full EIA for the road is not required according to the ADB Guidelines.

This consolidated IEE report has discussed various environmental aspects of the proposed rehabilitation and development under the NRCP. At present, the road is abandoned and in highly dilapidated condition due to poor surface condition, drains, pavements and road edges. Currently, the people who have been rehabilitated recently in the project affected area suffer from lack of infrastructure facilities specially transport. Therefore, proposed rehabilitation and improvement project is socially acceptable and social support was indicated for the road during the field Environment Assessment stage. Since the road is very essential link road to the interior part of Mannar district of NP, the improvement of the project will create efficient connectivity between rural agricultural and coastal areas with semi urban and urban areas. This will promote social and economic development too. Therefore, this Environmental assessment fully justified that the identified road sections should be upgraded to substandard status.

This study was undertaken in a comprehensive manner using both primary and secondary data. The primary data was based on field work to assess the potential environmental impacts that could occur during preconstruction, construction and operation stages of the project. The proposed road runs through scrublands, paddy fields, uncultivated lands and forested areas with minimum amount of settlements. However proposed construction activities are restricted to the existing RoW of the road, the project will not cause significant environmental impacts to the project affected areas, E.g. land acquisition, resettlement and reclamation of paddy fields. Furthermore, removal of road side trees will be minimal for rehabilitation activities.

The potential environmental impacts that were identified during the study are temporary, manageable and will occur only during pre-construction and construction periods. To mitigate those identified impacts, the EMP and EMoP have been prepared for the project and it is the responsibility of each and every party to implement those activities as indicated in those documents. Anticipated potential negative environmental impact include removal of road side trees, extraction of construction materials, deterioration of water quality, nuisance from dust, noise and vehicle fumes.

Since several forested areas are located along some sections of the road, project activities can affect the normal behaviour of wild animals. The positive impacts of the project are reduction of travel time, transport cost, vehicle operation cost, enhancement of the road safety, reduction of noise and air emissions due to improved road, increase income generating activities, easy transportation of agricultural products and fish, reduction of soil erosion and water pollution due to better drainage facilities.

The major existing environmental problem identified during the study is heavy emanation of dust from the gravel and sandy road due to winds and transportation of vehicles in almost all over the year except the rainy season. The dust causes adverse impacts such as respiratory problems, nuisance to the road users as well as road side communities. Therefore, the construction activities should be designed not to increase the level of dust emission further during the construction phase.

During last 3 decades, many trees have been felled down from either side of the road sections for better access or due to war activities. Therefore, maximum effort should be taken to avoid further removal of roadside trees and any guidelines and recommendations made by the CEA with regard to felling of trees should be strictly followed. Identification of mature roadside trees that will need to be removed should

be removed essentially by the contractor. Apart from that, it is important that fruit bearing, shading and valuable timber tree species have to be planted at the edges of the road reservation or any other suitable location. This will provide long term benefits to the society while compensating the floral loss occurred during the past. This will also be useful in demarcating and protecting the road reservation and local air quality if traffic demand increases up to considerable level in the future.

The present study has revealed that, military operations (use of heavy vehicles, cutting of trenches, blasting of road structures such as culverts and bridges, construction of barriers, removal of road side trees etc.,) and neglected maintenance are the main reason for the rapid and severe deterioration of the road. However, since the war situation has completely ceased from the country, above factors will not be practiced in the future. However, lack of maintenance can lead to deterioration of the road in the future. Therefore, proper maintenance program must be conducted after the proposed rehabilitation project in order to maintain the long-term stability of the road. Also, the road conditions must be periodically assessed and should implement necessary maintenance strategies to sustain the condition of road.

At present, no reliable baseline information is available for water quality, air and noise / vibration in the Mannar district. Therefore, monitoring of above parameters is recommended to carry out during the preconstruction stage to establish the baseline parameters. Establishment of baseline parameters is essential for repeated checking and monitoring changes of the quality of water, air and noise during the construction and operation periods.

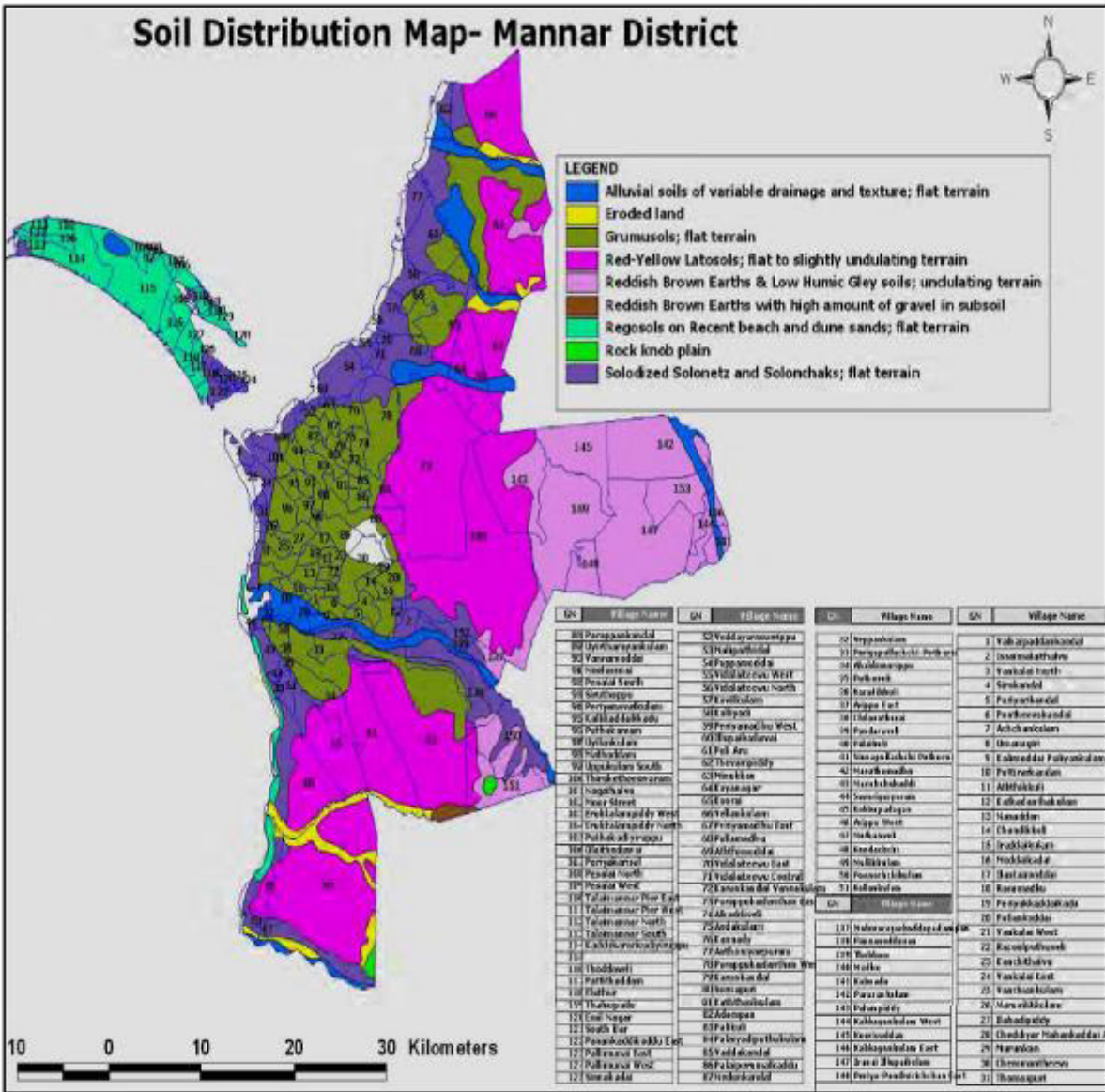
These results should be incorporated with the contract documentation to establish performance action thresholds, pollution limits and contingency plans for the contractor's performance. Adequate budgetary provisions must be ensured to undertake these monitoring activities.

## ROAD NETWORK - MANNAR DISTRICT



## APPENDIX II

### Soil map of Mannar District



**Fig. 3.1: Soil types in the Mannar District**

## APPENDIX III

### Environmental Management Plan

Potential Environmental Impact	Mitigation Action	Approximate Location	Mitigation Cost	Institutional Responsibility		Indicators or Means of Verifications	Standards	Environmental Parameters to be Reflected in the EMoP
				Implementation	Supervision			
Pre-construction and Construction stage								
1. Removal of public utilities	<ul style="list-style-type: none"><li>Advance notice to the public about the time and the duration of the utility disruption</li><li>Use of well trained and experienced machinery operators</li><li>Proper coordination and consent from CEB for the removal of electric posts</li><li>Attention to avoid or minimize impacts regarding the functional purposes</li><li>Reestablishment of the utilities as soon as possible.</li></ul>	Throughout the project road where electric, posts and supply lines need to be shifted.	Cost estimated by CEB	Contractor/ PRDD/ PIU	PRDD / CEB	Damages to the existing utilities, Public complaints	Technical specification	None
2. Impacts on temporary use of lands	<ul style="list-style-type: none"><li>Land selection should be done in accordance with local laws, regulations and in close consultation with LAs</li><li>Identification of lands away from environmental and public sensitive areas</li><li>Minimize removal of trees and other green cover vegetation of selected lands</li></ul>	project road	Cost estimated by the land owners	Contractor	PRDD/ PIU /LAs	Public inconvenience, soil erosion, waste accumulation	Technical specification/ local laws, regulations	Water and air pollution, soil erosion,



3. Soil erosion sedimentation and siltation	<ul style="list-style-type: none"> <li>• Top soil from construction sites should be stored properly and reuse for turfing and tree planting</li> <li>• Placed erosion control measures to erodible areas where necessary and turfing work should be taken prior to the rainy season</li> <li>• construction activities in erosion and flood prone areas should be conducted during dry season (excluding December – February)</li> <li>• Clearing and filling areas should be treated against flow acceleration and slopes of the fills should be compacted to reach the specified degree of compaction</li> <li>• All temporary soil dumps should be removed from site or those dumps should be covered until it is removed from the site</li> <li>• Suitable drainage facilities should be established to drain water in the construction areas</li> </ul>	<p>All vulnerable areas for soil erosion</p> <p>Cut and fill areas</p> <p>Bridge, culvert and causeway construction sites</p> <p>Bridge, construction sites</p>	Engineering and Environmental cost	Contractor	PRDD/PIU/LAs/CSC	Visual inspection (Turbidity and sedimentation)	Technical specification  Soil Conservation Act. No 53 of 1951, Amendment in 1996	Soil erosion, Water pollution
4. Extraction, transportation and storage of construction materials	<ul style="list-style-type: none"> <li>• Environmental requirements and guide lines issued by the CEA, GSMB and LAs should be followed in respect of locating material extraction sites</li> <li>• Material extraction sites should not be located in any environmental and public sensitive areas or close to the cultural sites, religious places etc.</li> <li>• Planning of construction activity to ensure that haulage of materials does not take place during peak traffic hours, or at night through urban areas</li> <li>• Construction materials should not exceed the carrying capacity of the trucks as well as transport loading and unloading of materials should not cause nuisance to the public by way</li> </ul>	<p>Materials extraction sites within the sub project affected areas/ outside area</p> <p><b>Material extraction sites</b> CEC (Pvt) Ltd- Quarry &amp; Crusher AQ 01, Medawachchiya. Wickramasinghe Metal crusher. AQ 02, Medawachchiya. CML-MTD (Pvt) Ltd- Quarry &amp; Crusher AQ 03,</p>	Engineering cost	Contractor	PRDD/CEA/CSCs/LAs/GSMB/PHI	<p>Visual inspection/</p> <p>Increase of vector breeding sites/</p> <p>Public complaints</p>	<p>GSMB Act. Act No 33 of 1992)</p> <p>National Environment Act. No 47 of 1980</p> <p>Laws and regulations of respective LAs</p> <p>National</p>	<p>Water and air quality</p> <p>Noise levels</p>

	<p>of noise, vibration and dust</p> <ul style="list-style-type: none"> <li>• Use of tarpaulin covers over transported materials to guard against dust blow and spraying of water to dampen dust also essential</li> <li>• Sand, rubble, metal bitumen cement etc., should be stored in covered areas to ensure protection from dust emissions</li> <li>• All cement, bitumen, oil and other chemicals should be stored and handled on an impervious surface above ground and adequate ventilation should be kept to avoid accumulation of fumes and offensive odour that could be harmful</li> <li>• Permit from LAs to use local roads for transportation of construction materials, machinery and equipment etc.</li> <li>• Restoration of the material extraction sites specially borrow pits by contractor or sub-contractors once after borrowing</li> </ul>	Roads used for transportation of construction materials/ storage yards.					<p>Emission Standards(1994) and CEA water quality standards</p> <p>National Environmental (Noise Control) Regulations No.1 1996</p>	
5. Effect on water resources	<ul style="list-style-type: none"> <li>• Contractor should make employees aware on water conservation, pollution and minimization of water usage</li> <li>• Prevent discharging waste water directly in to water bodies</li> <li>• Construction works affecting water bodies/flood plain areas have to be undertaken during the dry season</li> <li>• Excavation of beds of any streams, irrigation systems, and other water resources should be avoided or minimised.</li> <li>• The upstream and lead-away channels of cross drainages should be cleaned in order to conduct the water flow smoothly to the downstream</li> <li>• Contractor shall make aware to the</li> </ul>	<p>All streams, tanks, irrigation canals crossing or parallel to the roads.</p> <p>Sub project roads which run over the tank bunds</p> <p>All bridge causeways and culvert construction sites</p>	Engineering cost	Contractor	PRDD/ CSCs PIU/ DoI/ CEA	<p>Visual inspection/ Temporary floods</p> <p>Environmental pollution</p> <p>Public complaints</p> <p>Workers health</p> <p>Soil erosion,</p>	CEA water quality standards	<p>Water quality</p> <p>Soil erosion</p>

	<p>relevant authorities and downstream water users sufficiently in advance when construction activities adversely affect the quantity or quality of water</p> <ul style="list-style-type: none"> <li>• Vehicles and equipment should be maintained in good condition, ensuring no undue leakage of oil or fuel is released to water sources</li> <li>• Contractor should not obstruct or prevent flowing of water when working close to water bodies</li> <li>• Sanitation arrangements will be made at worksites and any accommodation facilities provided for workers, ensuring that no raw sewage is released into drains or water bodies</li> </ul>					sediment load in streams and canals		
6. Temporary floods	<ul style="list-style-type: none"> <li>• Increase the embankment height, construction of new cross drainages or, reconstruction of existing cross drainages with sufficient capacity for relevant locations</li> <li>• Avoid storage of construction materials and disposal of debris around irrigation canals, cross drainage and natural flow paths</li> <li>• All drainage paths have to be appropriately designed and manage by allowing sheath flow without any blockages</li> <li>• Existing drains should be cleaned after site specific construction, excavations, clearing &amp; grubbing</li> <li>• Temporary earth drains should be formed as practically as possible until required line or earth drains are provided after excavation</li> <li>• construction activities in flood-prone areas should be conducted during dry season</li> </ul>	<p>All flood prone areas</p> <p>Bridge, causeway and culvert construction sites.</p>	Environmental cost	Contractor	PRDD/ DoI/ PDoI/ CSCs/	<p>Visual inspection/</p> <p>Public complaint</p> <p>Impact to the public properties</p>	<p>Technical specification</p> <p>Irrigation act. No, 23 Of 1993</p>	Water quality
7. Solid waste disposal and sanitation	<ul style="list-style-type: none"> <li>• Selection of skilled and unskilled workers from the project influence area</li> <li>• Adequate supply of water to the urinals,</li> </ul>	Labor camps, construction sites, offices, disposal sites	Engineering cost	Contractor	PRDD/ CSCs/ LAs/	Visual inspection/	Laws and regulations of	Water and Air quality

	toilets and wash rooms of the worker camps <ul style="list-style-type: none"> <li>Garbage bins should be provided to all workers' camps, construction sites</li> <li>Garbage should be dumped regularly in a hygienic manner</li> <li>Handle and manage waste properly without contaminating the environmental conditions or affecting to public/communities living nearby the sites</li> <li>Proper drainage facilities should be implemented in and around the worker based camp to minimize stagnation of water</li> </ul>	and material storage yards.			PHI/CEA	Environmental pollution/  Public complaints/  Workers health	respective LAs	
8. Disposal of construction debris and spoil	<ul style="list-style-type: none"> <li>Selection of the disposal site by the contractor should exclude areas which are close to environment and public sensitive</li> <li>All debris and residual spoil materials should be disposed only at locations approved by the relevant Engineer and LAs</li> <li>Spoil materials should not be dumped at road embankment, agricultural lands, marsh lands, coastal habitats or any other environmental sensitive locations.</li> <li>Spoil materials should be re used wherever possible for site leveling, back-filling etc with approval of Engineer and CSCs</li> <li>Disposal of debris and spoil material should not obstruct irrigation canals, waterways and drainage paths</li> </ul>	All disposal sites.	Engineering cost	Contractor	PRDD/CSCs/LAs/PIU/PHI/CEA	Visual inspection/  Environmental pollution/  Public complaints/  Workers health	CEA water quality standards  Laws and regulations of respective LAs	Water and air quality
9. Disruption of traffic	<ul style="list-style-type: none"> <li>Provide an advance notice to local communities about the schedule of construction activities</li> <li>Avoid rush hours for material transportation through urban centers and main roads</li> <li>Identification of alternative roads to</li> </ul>	All construction sites, roads which are used for transportation of construction materials.	Engineering cost	Contractor	PRDD/Local police	Traffic congestions/ Public complain/ Accidents	Motor Traffic Act. No 14 of 1995, Amendment Act No: 5 of 1998	None

	<p>avoid traffic congestion around urban centers and main roads</p> <ul style="list-style-type: none"> <li>• Installation of traffic warning signs, temporary traffic lights or flagman at the construction sites</li> <li>• Planning construction activities to minimize disruption and maintaining at least one open lane where there are no viable alternative routes</li> <li>• Provision of safe and convenient passage to vehicles, passengers and livestock from the road side. Specially during construction of cross drainages</li> </ul>							
10. Personal safety	<ul style="list-style-type: none"> <li>• Proper briefing and training of workers on safety precautions, and their responsibilities for the safety of themselves and others</li> <li>• Use experience and well trained operators for handling of machinery, equipment and material processing plants</li> <li>• Arranging provision of first aid facilities and emergency transport to the nearest hospital</li> <li>• Provide protective footwear, helmets, goggles, eye-shields, and clothes to workers depending on their duty (mixing asphalt, blasting, handling equipment etc.)</li> <li>• If the work is carried out in night times, special care should be taken to arrange suitable, safe working environment with necessary lighting arrangement and high visibility jackets</li> <li>• Avoid entering of worker force to the un cleared area or beyond the RoW without approval from the security forces</li> <li>• Arranging regular safety checks of workers, vehicles, plants and allocation of responsibility to the relevant officers</li> </ul>	<p>All construction sites, material extraction sites, <b>(Refer No.4)</b> close to public sensitive locations and roads which are used for transportation of construction materials. public sensitive locations</p>	Engineering cost	Contractor/ Local police	PRDD/ PIU/ Local police CSCs	<p>Number of accidents/</p> <p>Visual inspection/</p> <p>Public complaints</p>	Safety regulations	None

	<ul style="list-style-type: none"> <li>Ensuring that quarry operations and roadway excavations, particularly blasting, are carried out and supervised by trained personnel as well as explosives are stored in a secure location</li> <li>Establishment of road engineering aspects to reduce the likelihood of accidents (warning signs, speed limits markings, breakers and signals to particular locations)</li> </ul>							
11. Impact from dust, noise and vibration	<ul style="list-style-type: none"> <li>Strictly implement National Emission Standards and Noise Control Regulations for all construction vehicles, equipment and material processing plants</li> <li>Prevent bad odour and offensive smell emanating from chemicals, construction material processing or other construction activities</li> <li>Crushers and hot mixed plants should place least 500 m away from public and environmental sensitive areas with the approval of Engineer, CEA &amp; LAs</li> <li>Construction related activities closer to public sensitive locations have to be schedule coordination with the relevant authorities and limit working time for activities that create noise from 6.00 am to 6.00pm</li> <li>Dust emissions should be controlled by wet spraying of quarry / construction sites and roads used for the transportation of construction materials in regular intervals</li> <li>Dust extraction units, exhaust silencers should be fitted to the road side crushers, construction vehicles and hot mix plants</li> <li>Place dust barriers nearby public</li> </ul>	<p>Throughout the road, material extraction sites <b>(Refer No.4)</b> /processing plants/public sensitive locations and built up areas.</p> <p>Locations of extraction, transportation and storage of construction materials.</p>	Environmental cost	Contractor	PRDD/ CEA CSC/ LAs/	Visual inspection/ public complaint	<p>National Emission Standards (1994)</p> <p>Noise Control Regulations by CEA</p>	Dust/ SO <sub>2</sub> , NO <sub>2</sub> , Pb

	<p>sensitive locations and tarpaulin covering are mandatory on trucks / lorries which are used for transporting materials</p> <ul style="list-style-type: none"> <li>• Use construction equipment, machinery and vehicles which are in good condition and with regular maintenance</li> </ul>							
12. Effect on flora, fauna and their habitats	<ul style="list-style-type: none"> <li>• National Wildlife act should be enforced places where some animals especially mammals which have expanded home range and other important environment sensitive locations</li> <li>• Work force should be properly aware regarding conservation of terrestrial and aquatic habitats including flora, fauna and their habitats</li> <li>• Prevent work force from disturbing the flora, fauna including gathering fire wood from surrounding habitats, hunting of animals and fishing in water bodies etc.</li> <li>• Removal of trees should be mainly based on Detailed Engineering Design and mark all road side trees subjected to potential removal and preparation of inventory prior to start clearing.</li> <li>• Obtain permission in writing regarding removal of trees.</li> <li>• Organize tree planting program in comparison at least one tree cut with planting three trees.</li> <li>• To avoid further tree losses, temporary use land for construction related activities should be established without any additional tree cutting.</li> <li>• When removal of trees valuable timber should be properly stacked and handed over to the DoF or tree owners.</li> </ul>	<p>All construction areas throughout the sub project roads</p> <p>Removal of trees throughout the sub project road where necessary. Wherever, available space beside the proposed road or other suitable location in the project affected area.</p>	Environmental cost	Contractor (Under Supervision of PIU)	PRDD/DWLC/CEA/DoF CSCs	<p>Impact to the animals and their migration paths</p> <p>Visual inspection</p>	<p>Fauna and Flora Protection Act (1993).</p> <p>Felling of trees (Amendment Act No:01 of 2000 and Act to Amend felling of trees control)</p>	Loss of faunal and floral habitat



13. Biodiversity conservation and sustainable natural resource management	<ul style="list-style-type: none"> <li>• Avoid clearing of natural habitats and replacement of natural vegetation due to construction related activities</li> <li>• Avoid introduction of invasive plants (intentionally or unintentionally) to the project area</li> <li>• Saplings for the tree planting program should comprise native or endemic species which are suitable to the existing climatic condition of the sub project areas</li> <li>• Periodic assessment about accidental or unintended introduction of invasive alien species and other construction activities that can affect natural ecosystems</li> <li>• Use of natural resources with environment friendly and sustainable manner based on rules and regulations of CEA, GSMB and LAs</li> </ul>	Throughout the sub project roads All material extraction sites <b>(Refer No.4)</b>	Environmental cost	Contractor (Under Supervision of PIU)	PRDD/CSCs	Impact to the habitats  Visual inspection	Fauna and Flora Protection Act (1993).	Loss of faunal and floral habitat
<b>Operation Stage</b>								
14. Air quality and noise	<ul style="list-style-type: none"> <li>• It is expected to reduce existing dust after surfacing of the gravel and sandy roads. Proper alignment and surfacing of the road will allow considerably higher speed for vehicles with minimum accelerations and decelerations which in turn reduce the vehicular emissions.</li> </ul>	Throughout the sub project roads	Maintenance cost determined by the PRDD	PRDD	PRDD	Visual inspection	Technical specification	Air quality and Noise levels
15. Drainage Congestions	<ul style="list-style-type: none"> <li>• Regular maintenance of drainage system will avoid drainage congestions, stagnation of water and temporary inundations.</li> </ul>	Throughout the sub project roads	Maintenance cost determined by the PRDD	PRDD/DoI/P DoI	PRDD/DoI/P DoI	Visual inspection  Temporally flood Increase of vector	Technical specification	Water quality

						breeding sites		
16. Safety of road users	<ul style="list-style-type: none"> <li>Enforcement of speed limits, traffic rules and regulations installation of the warning signs, regulatory signs and information signs etc.</li> <li>Provision of bus bays, pedestrian crossings, payments etc to the appropriate locations</li> </ul>	Particular locations of the sub project roads	Cost, determined by the PRDD	PRDD/ Local police	PRDD/ Local police	Number of road accidents Visual inspection Public complaints	Traffic rules and regulations  Safety regulations	None

## APPENDIX IV

### Environmental Monitoring Plan

Environmental component	Project stage	Parameters to be monitored	Location	Frequency	Standards	Rate (Rs.)	Implementation Cost	Implementation Agency	Supervision
1. Air Quality	A. Pre-Construction stage	SO <sub>2</sub> , NO <sub>2</sub> , CO, Pb, PM10, TSPM	A total of 3 locations – (one location from each category) of sub project affected areas  Semi urban centers, Public and environment sensitive areas Areas of potential increase in traffic	A single time /each location	NAAQS of Sri Lanka	Per sample Rs. 100.000	Rs. 300.000	RRDD by engaging approved monitoring agency (GoSL)	PIU, RRDD , LA (EO)
	B. Construction Stage	Do	Do	Two times/ Year/each location	Do	Per sample Rs. 100.000	Rs. 600.000	Contractor by engaging approved monitoring agency (GoSL)	PIU, RRDD , LA (EO), CSC
	C. Operation Stage	Do	Do	A single time/each location	Do	Per sample Rs. 100.000	Rs. 300.000	PRDD by engaging approved monitoring agency (GoSL)	RRDD , LA (EO)
2. Water Quality	A. Pre-Constructi	EC, TSS,	Three from following locations (1 from	A single time /each	CEA Water Quality	Per sample	Rs. 30.000	PRDD by engaging	PIU, RRDD , LA (EO)

Environmental component	Project stage	Parameters to be monitored	Location	Frequency	Standards	Rate (Rs.)	Implementation Cost	Implementation Agency	Supervision
	on stage	DO, BOD, P <sup>H</sup> Oil and grease, Pb	selected road) based on the availability of water throughout the year	location	Regulations	Rs. 10.000		approved monitoring agency (GoSL)	
	B. Construction Stage	Do	Do	Three times /Year/ each location	Do	Per sample Rs. 10.000	Rs. 90.000	Contractor by engaging approved monitoring agency (GoSL)	PIU, RRDD, LA (EO), CSC
	C. Operation Stage	Do	Do	A single time/each location	Do	Per sample Rs. 10.000	Rs. 30.000	PRDD by engaging approved monitoring agency (GoSL)	RRDD, LA (EO)
3. Noise	A. Pre-Construction stage	Noise level (dB level)	A total of 4 locations – (one location from each category) of sub project affected areas Bridge construction sites, Semi urban centers, Public and environment sensitive areas Areas of potential increase in traffic	A single time/each location  Both during day and night	National Environmental (Noise Control) Regulations,	Per sample Rs. 20.000	Rs. 160.000	PRDD by engaging approved monitoring agency (GoSL)	PIU, RRDD, LA (EO)
	B. Construction	Do	Do	Two times/Year/	Do	Per sample	Rs. 320.000	Contractor by engaging	PIU, PRDD, CSC, LA

Environmental component	Project stage	Parameters to be monitored	Location	Frequency	Standards	Rate (Rs.)	Implementation Cost	Implementation Agency	Supervision
	on Stage			each location Both during day and night		Rs. 20.000		approved monitoring agency (GoSL)	(EO), CSC
	C. Operation Stage	Do	Do	A single time/each location Both during day and night	Do	Per sample Rs. 20.000	Rs. 160.000	PRDD by engaging approved monitoring agency (GoSL)	PRDD, LA (EO)
<b>Total cost</b>	<b>Rs 19,90,000</b>								

1. Abeysinghe, A.M.D.U., De Silva K.T.U.S. and Mayooraan, D.2010.Final Report on the Mineral Resources in the Mannar District (Under the integrated Strategic Environmental Assessment (ISEA) Study of Northern Province.
2. ADB, 2008. Technical Assistance for Dry zone Urban Water and Sanitation Project (DZUWSP)
3. Cooray,P.G. 2003. The Quaternary of Sri Lanka. Geological Survey and Mines Bureau (Centenary Publication 1903-2003).
4. Eriyagama. G.J.1961. the semi-Arid vegetation in Mannar region. The Ceylon Forests 5:66-74
5. FAO and IUCN 2011. Final Report on Biodiversity and Socio-economic Information of Selected Areas of Sri Lankan Side of the Gulf of Mannar.
6. Assessment Report Sri Lanka: Northern Road Connectivity Project P15-20.
7. Ministry of Irrigation and Water Management, Water Resources Board, 2010. Water Resources in Northern Province.
8. National Environmental Act No 47 of 1980 and its amendments/Rules and regulations published in the Extraordinary Gazette Notifications in 1992 and 2006.
9. Wijeyamohan,S., Dissanayake, S.R.B. and Santiapillai,C. 2006. Survey of Elephants in the Mannar District, Sri Lanka.
10. Wijeyamohan,S.,Baheerathi,T.,Luxmy,S.,Prbha,K.,Sajithan,T.M.Sivagini,S.,V.,Theban,S.,Wijesundara, C.& Santiapillai,C. 2002. Diversity of birds in the Giant,s Tank, Wanni region, Sri Lanka.Tigerpaper,29:11-14.
11. Sri Lanka Department of Censor and Satistics-2011