GOVERNMENT OF TAMIL NADU
PUBLIC WORKS DEPARTMENT
WATER RESOURCES ORGANISATION

Environmental & Social Assessment and Preparation of Environmental & Social Management Framework (ESMF) and Environment & Social Management Plans (ESMP) for 66 River Sub Basins in the TN-IAMWARM-2 Project


Environmental and Social Assessment Report


WAPCOS Limited
(A Government of India Undertaking)

Ministry of Water Resources, River Development & Ganga Rejuvenation

March 23, 2017

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ABBREVIATIONS	
AEA	Agro Ecosystem Analysis
AI	Artificial Insemination
APMC	Agricultural Produce Marketing Committee
CCWM	Community Collaborative Water Management
CGWB	Central Ground Water Board
CPCB	Central Pollution Control Board
DLCC	District Level Co ordination Committee
EA	Environmental Assessment
EC	Environmental Cell
ECoP	Environmental Code of Practices
ESA	Environmental and Social Assessment
ESMPs	Environmental and Social Management Plans
ETL	Economic Threshold Levels
FFS	Former Field Schools
FGD	Focus Group Discussions
FPO	Farmer Producer Organization
FPO	Fruit Produce Order
GAP	Gender Action Plan
GHG	Green House Gas
GoTN	Government of Tamil Nadu
GP	Gram Panchayat
GRM	Grievance Redress Mechanism
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IFS	Integrated Farming System
INM	Integrated Nutrient Management
IPM	Integrated Pest Management
IUCN	International Union for the Conservation of Nature and Natural

	Resources
MDPU	Multi Disciplinary Project Unit
M&E	Monitoring and Evaluation
MoEF&CC	Ministry of Environment, Forests and Climate Change
MI	Micro Irrigation
NABARD	National Bank for Agriculture and Rural Development
NDDB	National Dairy Development Board
NTFP	Non-Timber Forest Produce
NREGA	National Rural Employment Guarantee Act
NRSA	National Remote Sensing Agency
PIM	Participatory Irrigation Management
PMU	Project Management Unit
PSC	Project Steering Committee
RBP	Ration Balancing Programme
RPF	Resettlement Policy Framework
R&R	Resettlement and Rehabilitation
SHG	Self-Help Groups
SRI	System of Rice Intensification
SWIKCs	Single Window Information and Knowledge Centers
SWOCA	Strength Weakness, Opportunities, Challenges and Action Plan
TAC	Tribes Advisory Councils
TN-IAMWARM	Tamil Nadu Irrigated Agriculture Modernization and Water Bodies Restoration and Management
TNFMIS	Tamil Nadu Farmers Management of Irrigation Systems
VGD	Vulnerable Group Development
WUA	Water User Associations

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The Government of Tamil Nadu (GoTN), consequent to the successful completion of the Tamil Nadu Irrigated Agriculture Modernization and Water Bodies Restoration and Management (TN-IAMWARM-1) Project, has requested the World Bank's assistance in undertaking the modernization of irrigated agriculture in the remaining sixty six sub-basins of the state not covered by the TN-IAMWARM-1 Project. The aim is to maintain the model of multi departmental co-ordination and convergence, and to follow the general component design of TN-IAMWARM Project.The main objectives of the proposed TN-IAMWARM-2 project areas follows:

- Enhancement of productivity and climate resilience of irrigated agriculture
- Improvement in water management
- To support value-addition for farmers and agro-entrepreneurs in agricultural, horticulture, livestock and fisheries sectors

The proposed project aims to introduce innovative aspects in the design process built on lessons learned from TN-IAMWARM-1 Project and also reflect the evolving needs of the state in the sectors of irrigation, agriculture, horticulture and allied activities, livestock and fisheries. The project interventions are grouped into three main components:

Component A: Irrigation and Water Management

This component intends to address the irrigation and water management in a holistic manner by covering both supply and demand simultaneously. It consists of following four sub-components:

- Institutional Strengthening and Capacity Building for Water Management
- Irrigation Systems Modernization
- Participatory Irrigation Management (PIM)
- Convergence for Improved Service Delivery

Component B: Agriculture Productivity Enhancement, Diversification, Marketing and Value Addition

The component consists of following three sub-components:

- Intensification and diversification of agriculture production systems
- Improving alternative livelihood sources through livestock and inland fisheries
- Agriculture marketing, value-addition and post-harvest management

Component C: Project Management Support

The TN-IAMWARM-2 project shall be implemented by eight line departments and coordinated by MDPU. The MDPU shall report to a Project Steering Committee (PSC) that will be established to review the progress of the TN-IAMWARM-2 at regular intervals and shall provide strategic directions, guidance on policy matters and resolve conflicts, if any, amongst the implementing agencies. The concerned Executive Engineer (EE) of PWD/WRO and Deputy Director of concerned line department in each sub-basin, shall act as Project Implementing Units (PIU's) for all the project activities falling within their domain/responsibility.

Senior Environmental Specialist (WRD) shall be mainly responsible for providing technical inputs on implementation of the different interventions, assessing/screening environmental impacts of projects being undertaken, supervising the implementation of the Environmental Guidelines, coordinating between PIU's of different regions while Senior Social Scientist (WRD)shall be responsible for preparation of Social Management Plans (SMPs), undertaking site visits, assistance in IEC related activities.

ESA study and preparation of ESMF and ESMPs was undertaken with the following objectives:

- To identify any potential, significant, long-term and irreversible environmental and social impacts due to implementation of proposed project activities in the proposed project areas.
- To identify potential opportunities for enhancing environmental and social sustainability of project investments, including reducing Green House Gas (GHG) emissions, where possible.
- To prepare an Environmental and Social Management Framework (ESMF)
- To prepare templates for Environmental and Social Management Plans (ESMPs)
- To suggest process steps for integrating the ESMF and ESMPs

As part of the World Bank procurement policy, project which triggers environmental and social impacts has to mandatorily undergo the process of Environmental and Social Assessment (ESA) before funding. ESA is generally defined as a process to predict, interpret, and communicate possible environmental and related social impacts of the proposed activities which is an effective tool in ensuring an integrated approach to the planning of development projects and programs. A key objective of the ESA process is to ensure the efficient delivery of development projects in a manner that minimizes adverse environmental impacts and respects all relevant legislations. The study addresses the following:

- Description of the environment of the potentially affected area that includes the present relevant baseline information
- Identify and assess the likely impacts of the project in terms of the biological, physical, social, economical, cultural and environmental aspects and suggest appropriate mitigation measures.
- Assessment of institutional capacity to implement and monitor the implementation of the environmental and social mitigation measures
- Review and discussion of environmental and social policies, legal and administrative frameworks, as well as World Bank policies.
- Preparation of an ESMP
- Consultations with key stakeholders on the findings of the ESA assessments

The proposed project will have both positive as well as negative impacts as a result of subproject activities envisaged in the sectors of Agriculture, Irrigation, Livestock and Fisheries during different phases of implementation in the selected sixty six sub-basin areas. The potential positive impacts associated with the proposed project include:

- Efficient and judicious management of water resources.

- Improved crop productivity
- Increasing cropping and irrigation intensities
- Increase in groundwater recharge and reduction in groundwater abstraction
- Increasing vegetal cover
- Reduction in the current water deficit
- Increased dairy and inland fisheries production.
- Reduction in soil erosion rates
- Improvement in employment opportunities, social capital and access to amenities
- Socio-Economic empowerment of women farmers and vulnerable groups
- Impetus to local growth and development of the selected sub-basin areas

The potential negative impacts during construction phase include:

- Construction debris
- Disposal of dredged material
- Increase in vehicular traffic
- Solid waste generation from labour sheds
- Exclusion of vulnerable groups in the new employments created

These impacts can be mitigated through suitable mitigation measures such as using construction debris for levelling of burrow areas, utilization of tank bed material as construction material in the tank bunds, implementation of air, water and noise pollution control measures, proper solid waste management etc and providing employments to the vulnerable groups.

The potential negative impacts during operation phase include:

- Increase in use of agro-chemicals, especially pesticides due to opportunities to increase agriculture and horticulture
- Groundwater resources and quality as a result of higher withdrawals and pollution from agricultural and other non-point sources
- Improper disposal of wastes (organic and other solid wastes) during construction and operation of built infrastructure (irrigation, agriculture marketing and post-harvest management)
- Clearing/conversion of coastal wetlands for construction of fishery ponds
- Domestic sewage, wastewater generated from animal washings, floor cleaning
- Exclusion of small and marginal farmers and women farmers in the project activities

These impacts can be mitigated through suitable mitigation measures such as implementation of IPM, INM, SRI, SSI micro irrigation with fertigation etc which shall help in reducing the use of chemical fertilizers and pesticides, building artificial recharging and rainwater harvesting structures in sub-basin areas where fluoride exceeds the permissible limits to decrease its concentration, prohibiting ponds in areas of particular ecological significance, onsite treatment systems. Creating community based organizations like

WUAs and targeting the small and marginal farmers and women farmers to include in the project activities.

Based on the ESA study, it is evident that sub-project activities under the TN-IAMWARM-2 project will result in agriculture modernization, water-bodies restoration and management and related social benefits to intended beneficiaries as envisaged.

Based on the impacts certain mitigation measures have also been discussed. It has been found that the positive impacts outweigh the negative impacts as the project is beneficial to all the categories of farmers, agriculture labourers and other vulnerable groups.

- The barren area will be brought under agriculture and this will significantly improve the livelihood of the farmers.

- The continuous cropping over barren and mono-cropped land would act as soil binder and reduce the soil erosion rates.

- The proposed project would reduce the dependence on ground water with corresponding reduction in groundwater abstraction. The increased groundwater recharge will also replenish the groundwater resources.

- The proposed project would lead to improvement in water availability, which will manifest into increased cropping and irrigation intensities.

- Enhanced income shall enable beneficiary-households to purchase the necessary new farm implements. This will lead to the increase in agriculture production.

- The area that has been barren will be brought under agriculture and this will significantly improve crop area, mono crop to two crops, crop diversity, intensity and the yield.

- The proposed project would reduce the dependence on ground water with corresponding reduction in groundwater abstraction. The increased groundwater recharge due to irrigation would also replenish the groundwater resources.

- The proposed project would lead to improvement in water availability, which will manifest into increased cropping and irrigation intensities.

- As a part of Environmental Management Framework, appropriate control measures in the form Pest Management Plan, covering IPM and INM measures have been recommended. The project functionaries are proposed to popularize the use of FYM and green manure in the command area being irrigated by the project. These practices are likely to improve the per unit yield with minimal impact on the environment and reduction in the cost of cultivation.

- The project implementation will enhance overall employment opportunities in the project area and reduce the out migration rate. There will also be an increase in the income of agricultural labourers and other vulnerable groups.

- Continuous need based training programmes conducted in the project will increase the skill and capacity of the farmers to adopt sustainable and modern farming practices and become more resilient.

- Enhanced income shall enable beneficiary-households to purchase new farm implements and modernize agriculture. This will lead to the increase in agriculture production and reduction in the input costs.

- Project interventions in livestock management will enhance the milk and meat production, similarly through revival of fish farming in the tanks and farm ponds fish production will go up.

- The formation of community based organization like WUAs, FPOs and collaboration of other existing organizations such as SHGs and Farmers clubs to effectively implement the project will increase collective action among the famers for participatory management of the irrigation system and farmers entering in to direct marketing of the produce.

- Addressing gender concerns and facilitating of the active participation of women farmers in the project activities would enhance the socio economic status of the women farmers.

The brief tasks that are to be carried out by the line departments are as follows.

Agriculture Department	• Implementation of INM and IPM (organic practices). • Distribution of critical inputs in time and farm implements • Need based trainings and demonstrations to men and women farmers and field staff
Water Resources Department,PWD	• Development of good-practice and decision support systems for sustainable water resources management • Strengthening institutions and instruments dealing with water resources management.
Horticulture Department	• Popularization of commercial horticulture techniques for enhanced revenue and crop diversification • Precision farming for horticultural crops and conducting need based trainings
Agriculture Engineering Department	• Introduction and promotion of water saving Micro Irrigation systems like Drip & Sprinkler Irrigation and solar powered pumps • Promotion of water harvesting structures
Agriculture – Marketing	• Development of small scale processing units, Storage godowns, solar cold storage & Solar driers, creating marketing centres

	• Value addition – drying, processing etc • Promotion of agri – entrepreneurs and FPOs
Tamil Nadu Agriculture University (TNAU)	• Development of Precision Farming Techniques, demonstration of SRI method, conducting trainings • Development of price-forecasting information model in Agribusiness • Develop Model Seed Village Concept to generate good quality and hybrid seeds
Animal Husbandry Department	• To ensure total health cover both preventive and curative. • Distribution of mineral mixture • Reduce the gap between the requirement and availability of green fodder through promotion of fodder cultivation
Fisheries Department	• Development of Aquaculture in Farm Ponds • Development of Aquaculture in Irrigation Tanks by establishing Fish Seed Bank, development of Ornamental Fish Culture

The ESMF provides a negative list of activities that the project will not finance, an environment impact identification tool and a screening tool for categorizing the various sub-projects based on risk posed to environment, a mitigation plan, pest management plan, gender and other project specific strategies, monitoring and capacity building plan and a budget for implementing the EMPs and ESMF.

CHAPTER - 1 INTRODUCTION

CHAPTER-I
INTRODUCTION

1.1 General

The Government of Tamil Nadu (GoTN), through the Government of India has applied for a loan of about 318 million USD from the World Bank (WB) for implementation of the proposed Tamil Nadu Irrigated Agriculture Modernization and Water Bodies Restoration and Management (TN-IAMWARM-2) Project. As part of the project, the Public Works Department/Water Resources Organisation (PWD/WRO), GoTN, being the Project Coordination Unit for TN-IAMWARM-2 has engaged WAPCOS Limited,A Government of India Undertaking under the Ministry of Water Resources, River Development and Ganga Rejuvenation as Consultant for conducting Environmental and Social Assessment (ESA) of the TN-IAMWARM-2 Project and Preparation of Management Plans and/or Framework for managing adverse Environmental and Social Impacts, Risks and Benefits.

The state of Tamil Nadu (TN) has 17 major river basins subdivided into 127 sub basins. The GoTN has implemented an earlier TN-IAMWARM-1 Project from the year 2007 to 2015 funded by the World Bank. The main objectives were improvement in irrigation service delivery and productivity of irrigated agriculture with effective integrated water resources management in a river basin / sub basin frame work in 61 sub basins of Tamil Nadu. Consequent to the successful completion of TN-IAMWARM-1 Project, the GoTN has requested the World Bank's assistance in undertaking the modernization of irrigated agriculture in those parts of the state not covered by the TN-IAMWARM-1 Project.

1.2 Lessons Learned from TN-IAMWARM-1 Project

The recent experiences in implementing tank-system rehabilitation projects and agriculture competitiveness projects in Tamil Nadu and other states in India as well as similar projects in other countries which were also supported by relevant studies have been adopted. Some of key lessons learnt from the past experiences incorporated in the project design are as follows:

- The environmental and social risks associated with geographically dispersed investments can be managed and mitigated through regular monitoring.
- Geographically spread investments help reduce any cumulative and long term impacts.
- The lack of irrigation water during the dry season and poor farmers' linkage to markets were identified among the key constraints limiting the productivity increase and cop diversification.
- Strong linkages between agriculture investments and irrigation and drainage investments are critical to improving agricultural productivity.

- Effective embedment of project activities within the operations of line departments, the project acts as a catalyzer in promoting sector-wide policy improvements and reforms (such as mainstreaming of PIM activities into regular functions of WRD, implementing government reforms in agriculture marketing). The critical convergence between eight sectoral agencies especially at the cutting edge, would be transformative bottom up Capacity Building approach.

- Inclusion of Water Users Associations (WUAs) in the design, implementation of system rehabilitation, Operation and Maintenance (O&M) and financial management to strengthen ownership and sustainability.

- Under the Project a total of 2775 WUAs were established. 74% of WUAs had opened a bank account. WUA capacity assessment carried out towards the end of the Project indicated that approximately 50% had achieved a strong level of functionality in accordance with the Tamil Nadu Farmers Management of Irrigation Systems (TNFMIS) Act, about 40% had achieved a middle level of functionality, and 10% were in need of substantial additional capacity building.

- The Project accomplished a great deal with respect to institutional creation and capacity building of the WUAs. However, it should be ensured that capacity development of WUAs occurred early, rather than in the later part to achieve a full level of functionality during implementation, as a prerequisite for other activities like suitable O&M and appropriate design of rehabilitation work.

- Management Information System (MIS) helps improvement of effectiveness and efficiency of officials, provision of improved and cost-effective services to clients, improved access to information, transparency and collaborative working.

1.3 Objectives of TN-IAMWARM-2 Project

The proposed project will underscore the importance of introducing innovative aspects into the design of the new project built on lessons learned from TN-IAMWARM-1 Project and also reflect the evolving needs of the state in the area of agriculture modernization. The development objectives of the proposed TN-IAMWARM-2 project in the selected sixty-six sub-basin areas in Tamil Nadu are as follows:

- Enhancement of productivity and climate resilience of irrigated agriculture
- Improvement in water management
- To support value-addition for farmers and agro entrepreneurs in agricultural, horticulture, livestock and fisheries sectors

1.4 Project Interventions

1.4.1 Project Area

As a part of TN-IAMWARM-2, 66 sub basins, which were not covered under TN-IAMWARM-1 has been selected for development in seven different Agro-Climate Zones of Tamil Nadu.The details of 66 sub basins are given in Table-1.

Table-1: Details of Sub-Basins proposed to be taken up under TN-IAMWARM – 2

Basin No	Basin Name	Sub Basin Name	Agro Climatic Zone
1	Chennai Basin	Gummudipoondi	North Eastern Zone
		Nagariyar	
		Nandhiyar	
		Kovalam	
2	Palar Basin	Upper Palar	
		Malattar	
		Agaramar	
		Vegavathi	
		Cheyyar	
		Lower Palar	
3	Pennaiyar Basin	Chinnar – 1A	North Western Zone
		Chinnar – 1B	
		Pambar	North West& EastZone
		Vaniyar	North Western Zone
		Matturar	North Eastern Zone
		ValayarOdai	North Western Zone
		RamakkalOdai	North Eastern Zone
		Aliyar	
		Muskundanadhi	
		Krishnagiri to Pambar	North Western Zone
		Lower Pennaiyar	North Eastern Zone
4	Vellar Basin	Manimukdhanadhi	
		Lower Vellar	
5	Paravanar Basin	Paravanar	
		Uppanar	
6	Cauvery Basin	Chinnar	North Western Zone
		DoddaHalla	
		Mettur Reservoir to Noyyal Confluence	Western Zone North Western Zone
		PalarTattaHalla	Western Zone
		Moyar	Southern Zone Western Zone
		Upper Bhavani	Southern Zone Western Zone
		Lower Bhavani	Western Zone
		Noyyal	Western Zone Cauvery Delta Zone
		Thirumanimuthar	North Western Zone
		Karaipottanar	North Western Zone Cauvery Delta Zone
		Pungar(Upper Coleroon)	Cauvery Delta Zone
		Ayiaar	Cauvery Delta Zone North Western Zone
		Ponnaniyar	Cauvery Delta Zone

Basin No	Basin Name	Sub Basin Name	Agro Climatic Zone
			Southern Zone
		Nandiyar – Kulaiyar	Cauvery Delta Zone
		Marudaiyar	
		Lower Coleroon	Cauvery Delta Zone North Eastern Zone
		Cauvery Delta	Cauvery Delta Zone Southern Zone
7	Tamiraparani Basin	Walayar	Western Zone
		Sholaiyar	
8	Vaigai Basin	Suruliyar	Southern Zone
		Varahanadhi	
		Manjalar	
		Sirumalaiyar	
		Sathaiyar	
		Uppar	
		Lower Vaigai	
9	Vaippar Basin	Kousiganadhi	
10	Kallar Basin	Kallar	
11	Tamiraparani Basin	Upper Tamiraparani	
		Manimuthar	
		Gadananadhi	
		Pachaiyar	
		Chittar	
		Lower Tamiraparani	
12	Nambiyar Basin	Nambiyar	
13	Kodayar	Pechiparai	High Rainfall Zone
		Chittar (Kodayar)	
		Perunchani	
		Kuzhithuraiyar	
		Valliyar	
		Pazhayar	

1.4.2 Project Components

The TN-IAMWARM-2 project to be taken up in 66 sub-basins includes innovative aspects that build on lessons learned from TN-IAMWARM-1 and various projects regionally and globally to address the modernization needs of irrigated agriculture including horticulture, livestock and fisheries in Tamil Nadu. The location map of the project area is shown in Figure-2. The project interventions are grouped into three main components:

- ***Component A:***Irrigation and Water Management
- ***Component B:***Agriculture Productivity Enhancement, Diversification, Marketing and Value Addition
- ***Component C:***Project Management Support

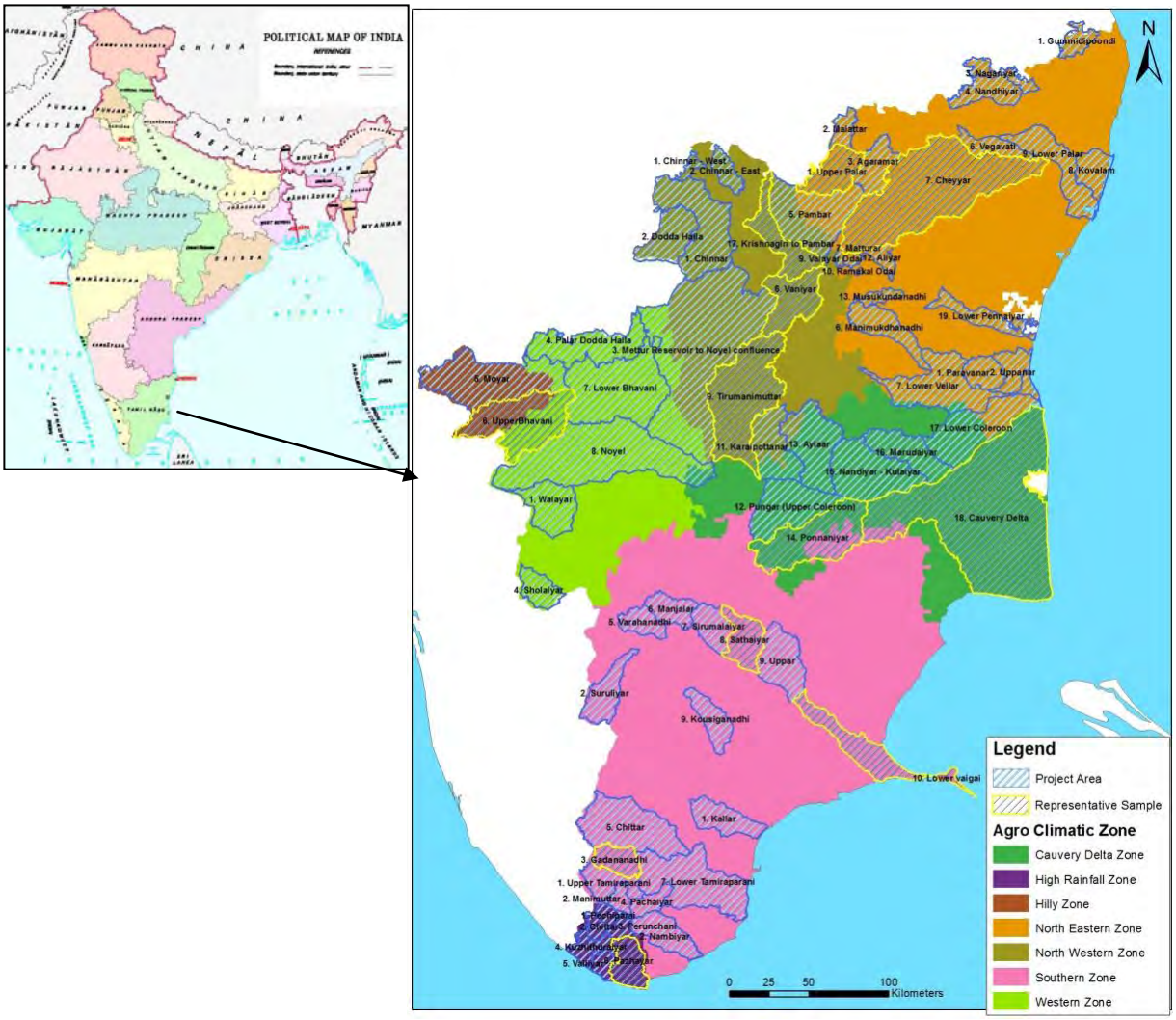

Figure 1: Location map of 66 sub-basins in Tamil Nadu of TN-IAMWARM-2

Component A: **Irrigation and Water Management**

This component would address irrigation and water management in a holistic manner by covering both supply and demand simultaneously. It consists of following four sub-components which are described below:

- Institutional Strengthening and Capacity Building for Water Management;
- Irrigation Systems Modernization;
- Participatory Irrigation Management; and
- Convergence for Improved Service Delivery.

Institutional strengthening and capacity building for water management

This subcomponent aims to assist the GoTN in addressing the need for: (i) integrated water resources planning, decision making, and management in a basin context; (ii)

enhancing knowledge base and instruments; and (iii) improving sustainability of water sector assets. This will be achieved by strengthening Water Resources Department (WRD), and its agencies for enhanced policy analysis, analytical and implementation capacities, knowledge base, studies and related technical & operational support. In conjunction with state programs, IT developments under IAMWARM I, Innovative ICT and new media solutions including GIS, MIS, etc. will also be explored.

Irrigation systems modernization

This subcomponent will rehabilitate and modernize irrigation infrastructure, including 4,800 tanks and 477 anicuts, focusing on improving bulk water delivery to irrigation systems and improving water use efficiency at farm levels covering about 5.43 lakh hectares of land in 66 sub-basins. Subcomponent activities will be based on individual sub-basin development plans for reviving traditional water bodies (tanks), including Supply Channels improvement, Sluice & Weir repairs, bund strengthening by partially borrowing suitable soils from the Tank. Rehabilitation of tanks systems will be supplemented by on farm development (OFD) works, ground water recharge structures to improve availability of water across the system. Irrigation tanks and structures damaged by November-December 2015 floods in Chennai region will be rehabilitated on priority under retroactive financing.

Participatory Irrigation Management (PIM)

This subcomponent aims to improve farmers (water users) involvement in management and operation of irrigation system. Towards this amongst others, the project looks to increase focus and integrate participatory irrigation management (PIM) practices into the operations of Water Resources Department in order to improve management, operation and maintenance of modernized and rehabilitated irrigation infrastructure. The sub-component will assist in establishing and strengthening water users associations (WUAs), including operationalizing WUAs to undertake Operations ,equitable water distribution, targeting routine minor maintenance to ensure free flow of water in the field channels , and associate with asset rehabilitation works with OK cards, within their command areas.

Convergence for improved service delivery

The convergence for service delivery by all departments involved in the water sector is critical and will be promoted by establishing and strengthening Single Window Information and Knowledge Centers (SWIKCs) in select model villages, administrative and operation cost support for the field staff and facilitating Community Collaborative Water Management (CCWM) at village level which was successfully pioneered in IAMWARM I. The CCWM will sensitize the community about the water balance and SMART agriculture in the Model villages and enable them to draw up a community level action plan for sustainable and optimum use of water. Model Villages will be created in each sub basin through the establishment of SWIKCs. Extensive capacity building for officials and community and team building support will be initiated and formalized to ensure sustainable convergence.

Component B: **Agriculture Productivity Enhancement, Diversification, Marketing and Value Addition**

This component will aim for increasing productivity and diversification of agriculture production systems and generate improved value-addition in post-harvest management, while including a value chain approach. The component will provide incentives for capital investments, through unlocking opportunities for crowding-in private sector investments. This component consists of following three sub-components which are described below:

- Sustainable intensification and diversification of agriculture production systems;
- Improving alternative livelihood sources through livestock and inland fisheries; and
- Agriculture marketing, value-addition and post-harvest management

Sustainable intensification and diversification of agriculture production systems

This subcomponent aims to promote climate resilient and sustainable crop production systems through sustainable intensification through a large scale program of demonstrations, awareness building and training activities as well as productivity investments in resource savings technologies on existing Government norms of support Climate risk resilience will be built into agriculture production systems by promoting cultivation of high-yielding, short-duration crop varieties/hybrids and complementary agronomic practices, and enhanced ability to withstand expected adverse climate change impacts.

Sustainable intensification of cropping systems will be achieved through promotion of high productivity and resource conservation technologies including system of rice intensification (SRI) and sustainable sugarcane initiative (SSI), precision farming with micro-irrigation, integrated soil fertility and nutrient management (ISFNM), integrated pest management (IPM), and organic farming techniques. For wide scale adoption of these already proven technologies, the project will ensure the availability of high quality seeds and other critical inputs.

Accelerated diversification from mono crop paddy system to a mix including high value crops (fruits, vegetables, spices), pulses, oilseeds and millets will be achieved through promotion of modern technologies, better linking of farmers to markets, post-harvest management and value addition. Enhanced diversification will lead to higher farmers' income and reduced vulnerability to external shocks such as weather and price volatility. *Climate risk resilience* will be built into agriculture production systems by promoting new crop and agronomic practices suitable for local agro-ecological conditions, farm ponds and ability to withstand biotic and abiotic stress due to climate change.

Improving alternative livelihood sources through livestock and inland fisheries

This subcomponent aims to diversify and enhance farmers' income through livestock production and inland aquaculture (fisheries). In addition to generating supplemental

income for farmers, these activities will also safeguard against potential reductions in yield or crop failure due to climate hazards.

Animal husbandry activities aim at improving production potential of dairy animals through adoption of sustainable and climate resilient animal husbandry technologies; strengthening of input, extension and service delivery systems; infrastructure strengthening and capacity building in breeding and disease surveillance .

Fisheries activities aim at improving fish productivity in tanks and ponds through demonstration of climate resilient modern technology packages; improved tank fisheries management; introduction of suitable formulated fish feed using locally available ingredients; promotion of innovative technologies like cage fish culture and facilitation of better market linkages.

Agriculture marketing, value addition and post-harvest management

This subcomponent focuses on enhancing farmers' linkages to markets through post-harvest management and value addition activities by helping establish commodity groups and farmer producer organizations/companies, integrating commercial value chains, and facilitating public-private partnerships. Specific interventions planned are as follows:

- Rehabilitation and modernization of selected regulated markets/ weekly markets/ farmer markets;
- Setting up of Commodity groups;
- Setting up Farmer Producer Organizations/Companies for undertaking commercial transactions;
- Supporting productive post-harvest management infrastructure;
- Supporting agriculture enterprise development; and
- Supporting Studies, management strengthening and innovations for improved service delivery and results

Component B activities will be supported by innovative ICT applications, which are: (i) use of innovative IEC approaches to support extension services like through video, mobile etc. based peer-to-peer learning, (ii) support to e-Velanmai, crop optimization, geo tagging, etc. to build localized problem solving knowledge services, and (iii) leveraging of subscription based services for market prices information etc.

***Component C:*Project Management Support**

The Multi-Disciplinary Project Unit (MDPU) established under the TN-IAMWARM-1 should serve as the management and coordination unit for the project, with need-based modifications. The MDPU should be coordinating for preparation and catalyzing departments in implementing of respective project budget, sub-basin development plans, and implementation progress reports. The MDPU should provide knowledge support on M&E, social, environmental safeguards, procurement and fiduciary related actions of the

departments/ implementing agencies involved in the project.The various line departments under MDPU are as follows:

- Water Resource Department (WRD), Public Works Department (PWD)
- Agricultural Department
- Agricultural Engineering Department
- Tamil Nadu AgriculturalUniversity
- Agricultural Marketing
- Horticultural Department
- Animal Husbandry Department
- Fisheries Department

The activities of Line departments of TN-IAMWARM-2 are detailed in Annexure-I.

Amongst the three components, some sub-components in components A and B shall have significant environmental and social impacts related to irrigation modernization and intensification & diversification of agriculture production systems. Component C which deals with the capacity development is not envisaged to have impacts. Hence, the applicability of the World Bank safeguard policies and other Government of India safeguard legislations are required.

1.4.3 Applicability and Provisions of ESMF in TN-IAMWARM-2

The interventions proposed under Component A and its four sub-components are likely to have environmental impacts during the construction and operation phases. Given that investments are geographically dispersed, no significant cumulative impacts are envisaged. The ESA has assessed potential impacts and risks and provides Environmental Management Plans and an Environment and Social Management Framework with suitable mitigation measures for the anticipated impacts.The interventions of Component B and its sub-components are likely to have environmental impacts during the operation phases, particularly related to use of agro-chemicals, and accordingly suitable mitigation measures, including a Pest Management Plan has been prepared. Other interventions under Component B are unlikely to result in significant impacts, but to address any unforeseen impacts, an ESMF is provided along with best practice guidelines. Environmental impacts are not anticipated under this Component C, as it is mostly centered on project management. However as part of the capacity building, safeguard training has been proposed at various levels of implementing agencies for implementation of the proposed mitigation.

1.5 Structure of the Environmental and Social Assessment (ESA) Report

The ESA report comprises of nine chapters in sequence as follows:

Executive Summary

The executive summary summarises the outcome of the ESA study of the proposed TN-IAMWARM-2 project.

Chapter – 1 Introduction

This chapter provides brief description of the project, it's objectives, interventions and components.

Chapter – 2 Methodology

This chapter describes the detailed methodology adopted for undertaking the ESA study.

Chapter – 3 Legal and Regulatory Framework

This chapter details the relevant environmental and social rules and regulations that are applicable for this project, which are adopted by the Government of India (GoI) and Government of Tamil Nadu (GoTN). It also highlights the applicable World Bank safeguard policies which have to be adopted during the subproject preparation and implementation.

Chapter – 4 Environmental and Social Baseline Status

This chapter presents the environmental and social baseline status of the project sub-basins based on the primary and secondary data collected for the representative sub-basins selected for the project.

Chapter – 5 Environmental and Social Management Plan

This chapter outlines the Environmental and Social Management Plan (ESMP) integrates the baseline conditions, impacts likely to occur, and the measures which need to be implemented for amelioration of adverse impacts

Chapter – 6 Environmental and Social Management Framework

This Chapter outlines the Environmental and Social Management Framework (ESMF) which is broadly based on the environmental and social baseline conditions, planned project activities and impacts identified and assessed as part of ESA.

Chapter - 7 Project Specific Strategies

This chapter details the various project specific strategies proposed to be implemented for the project.

Chapter - 8 Stakeholders Consultations

This chapter highlights the outcome of the stakeholders consultation conducted in the selected representative sub-basins.

Conclusions

The outcome of the ESA study conducted in the selected representative sub-basins is summarised.

CHAPTER - 2 METHODOLOGY

CHAPTER – 2
METHODOLOGY

2.1 General

This chapter describes the methodology carried out for selection of representative 12 sub basins and for conducting the ESA study for the proposed TN-IAMWARM-2 project. ESA study and preparation of ESMF is undertaken with the following objectives:

- To identify any potential, significant, long-term and irreversible environmental and social impacts due to implementation of proposed project activities in the proposed project areas. This includes identification of induced impacts that may be of short term.
- To identify potential opportunities for enhancing environmental and social sustainability of project investments, including reducing Green House Gas (GHG) emissions, where possible. Environmental sustainability measures may include optimal use of agro-chemicals, increasing water use efficiency etc.
- To prepare an Environmental and Social Management Framework (ESMF) that will act as a guiding tool to manage and mitigate adverse environmental and social impacts and scale up positive impacts.
- To prepare templates for Environmental and Social Management Plans (ESMPs), wherever required, covering activities under all sectors (agriculture, irrigation, canal improvement, tank rehabilitation, fisheries, animal husbandry, etc.) and to prepare at least 2 ESMPs for each sector activities proposed for year 1 investments.
- To suggest process steps for integrating the ESMF and ESMPs in the Sub-Basin Plans to be developed under the proposed project by the Water Resources Department.

2.2 Scope of Work

This consultancy work is intended to provide the required services for environmental and social assessment of the proposed TN-IAMWARM-2 Project covering 66 river sub-basins covering an area of about 5.43 lakhs Ha. The following is the scope of work for this assignment:

- ***Environmental and Social Assessment and Designing of Mitigation Measures:*** To identify the potential environmental and social risks and positive impacts relating to proposed project activities in sectors, such as, agriculture, irrigation systems improvement, horticulture, animal husbandry, agricultural marketing, fisheries, etc. throughout the project life cycle. Once impacts are identified, develop mitigation measures to prevent, reverse, minimize, contain and offset potential adverse impacts. This shall be done through preparation of EMF, EMPs and SMF.
- ***Stakeholder Consultations:*** To conduct periodic stakeholder consultations, as described in the methodology section, for soliciting the perceptions and views of the

key and relevant stakeholders on environmental and social concerns pertaining to the proposed project investments in sub-basins.

- ***Environmental and Social Baseline:*** The consultant will suggest a short list of key and relevant environmental and social parameters and prepare a baseline for the sub-basins in which the assessment is being carried out. The consultants should refer to the Environmental Atlas prepared under the TN-IAMWARM I Project and propose the shortlist of environmental and social parameters in their inception report.

- ***Identification and analysis of other models for participatory and sustainable irrigation management*:** As part of this, efforts will be made to identify *non-WUAs including* CADA and other successful models of water resources management undertaken by community based/interest group/producer group organizations and civil society organizations engaged in sustainable agriculture and agriculture production systems. Analysis of such models would also include SWOC Analysis of these models and recommendation as to whether such models could be replicated in the proposed project to promote climate resilient sustainable agriculture and production systems.

- ***Review of Government's Extension Services and other Service Deliveries/Schemes/Programs*:** This review would identify Agriculture Extension Services, other services provided through Government plans/schemes/programs to promote sustainable agriculture including crop diversification and organic farming and also agriculture production systems – livestock development, dairy and fisheries. Such a review would be a means to prepare a strategy for Converged Service Delivery, structures and processes within WRD and Line Departments to effectively implement the strategy.

- ***Review of existing arrangements for Environment and Social Safeguards/Social Development*:** This review would involve assessment of existing arrangements within WRD and Line Departments and also at regional levels for participatory planning, monitoring and evaluation of environment and social safeguards and social development aspects of the project.

- ***Disclosure:*** Following World Bank Policy on Disclosure, the consultant will guide and support the client in disclosure of the E&SA, EMF, EMPs and SMF. This will include preparing an Executive Summary of the E&SA, translate it in vernacular language (Tamil) and help disclose at the field level in WUA offices, District Collector offices, offices of Block Development Officer, making it available at the line departments and on the website of the Project. Any other disclosure steps may be suggested by the consultant.

2.3 Criteria for Selection of Representative sub-basins for Environmental and Social Assessment

The 12 sub-basins considered as representative of 66 sub-basins under TN-IAMWARM-2 project have been selected based on the following criteria:

- Representation from seven agro climatic zones of Tamil Nadu
- Eco-systems like semi-arid, plain, humid etc
- Geographical terrain like hilly, flat land etc
- Different cropping patterns practiced

2.4 Representative sub-basins for Environmental and Social Assessment

The representative 12 sub-basins have been selected based on the criteria listed under section 2.3. The details of representative 12 sub-basins are given in Table 2 and Figure 2.

Table 2: Details of representative 12 sub-basins

Agro Climatic Zone	Basin	Sub-Basin	Crops	Sub-Basin Districts
North Eastern	Palar	Cheyyar	Paddy, banana, sugar cane, ground nut and Vegetables	Kancheepuram Tiruvannamalai and Vellore
		Upper Palar	Coconut, Rice, Sugarcane and vegetables	Vellore
North Western	Pennaiyar	Krishnagiri to Pambar	Paddy, Millets, Vegetables and pulses	Krishnagiri and Dharmapuri
		Vaniyar	Paddy, Millets, Pulses and vegetables	Dharmapuri and Salem
High Altitude	Tamiraparani	Gadana	Paddy, banana, sugar cane, cotton and Coconut	Tirunelveli
High Rainfall	Kodayar	Pazhayar	Paddy, Coconut, Banana and Rubber	Kanniyakumari
Cauvery Delta	Cauvery	Ponnaniyar	Paddy, maize, cotton, millets and Vegetables	Tiruchirapalli and Pudukottai
		Cauvery delta	Paddy, Sugarcane, Banana and Pulses	Tiruchirapalli, Thanjavur, Tiruvarur and Nagappattinam

Agro Climatic Zone	Basin	Sub-Basin	Crops	Sub-Basin Districts
		Thirumanimuthar	Paddy, Banana, and Sugarcane	Namakkal and Salem
South	Vaigai	Lower Vaigai	Paddy and Chilli	Sivagangai and Ramanathapuram
		Sathiyar Odai	Paddy, Millets, Cotton and Chilli	Dindigul and Madurai
Western	Cauvery	Upper Bhavani	Banana, Coffee, Tea, Arecanut and Coconut	Nilgiris, Coimbatore and Erode

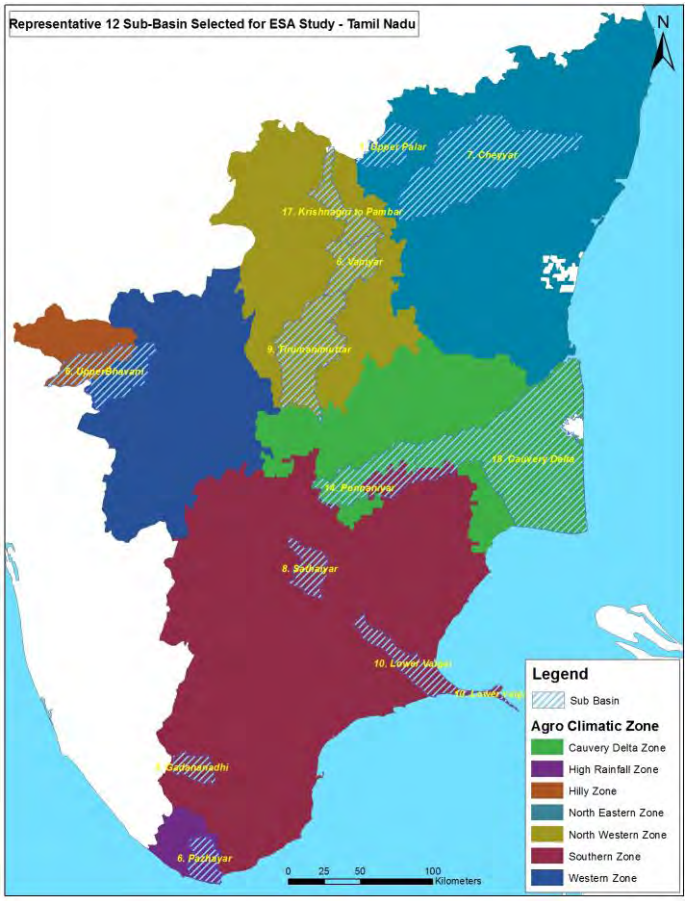

Figure 2: Location map of representative 12 sub-basins

2.5 Methodology

The ESA study for the proposed TN-IAMWARM-2 project has been carried out in accordance with World Bank and national requirements. The study has addressed the following:

- Description of the environment of the potentially affected area that includes the present relevant baseline information collected from various secondary sources

on the most important physical, biological, socio-cultural aspects of the project area.

- Identify and assess the likely impacts of the project in terms of the biological, physical, social, economical and environmental aspects and make proposals for appropriate mitigation measures.
- Assessment of institutional capacity to implement and monitor the implementation of the environmental and social mitigation measures under the proposed project.
- Review and discussion of environmental policy, legal and administrative frameworks, as well as World Bank guidelines.
- Preparation of an ESMP
- Consult with key stakeholders on the findings of the environmental assessments

The summary of key tasks conducted as a part of ESA study is listed as below:

2.5.1 Review of Legal, Regulatory and Policy Framework

The National and State-specific Laws, Acts and Policies applicable to this project, besides the World Bank policies should be reviewed.

2.5.2 Description of Baseline Environmental Setting

The description of environmental setting or baseline environmental status is an integral part of an ESA study. The baseline data of the following aspects of the representative 12 sub basins shall be collected from various secondary sources and available literatures. As a part of the study, a large quantum of related data as available with various agencies should be collected and appropriately utilized. The review of previous project related reports both engineering as well as non-engineering as available with the project proponent was utilized. The various parameters for which data were collected for ESA Study for the proposed project has been classified as below:

- Physico-chemical parameters
- Ecological aspects
- Socio-economic aspects

A. Physico-chemical parameters

Climate

Meteorological aspects like temperature, rainfall and relative humidity are important considerations since they affect water availability, cropping pattern, irrigation & drainage practices, soil erosion, public health, etc. The detailed data on meteorological aspects has been collected from available publications of India Meteorological Department (IMD).

Water Resources

As a part of data collection on water resources, the details of river system and drainage available from various secondary sources have been reviewed.

Water quality

Increasing human activities in the absence of stringent environmental pollution control, contribute to deterioration of water quality. Water samples from the representative 12 sub basins have been collected for analysis of physico-chemical parameters.

Soils

As a part of ESA study, soil samples from the representative 12 sub basins have been collected for analysis of physico-chemical parameters to assess the existing soil quality.

Geology

The geological status i.e. regional geology and geological features of the representative 12 sub-basins districts has been studied using existing literature, maps and data from secondary sources.

Land use pattern

Remote sensing satellite data of Resource Sat- 2 Satellite (LISS--IV) has been procured from National Remote Sensing Agency (NRSA), Hyderabad for assessing the land use pattern of the representative 12 sub basins. The data has been imported and processed in house using sophisticated image processing software ERDAS-Imagine to study the land cover details after classifying the imagery into following land use categories:

- Water Body
- Vegetation
- Scrub
- Agricultural Land
- Settlement
- Barren/Open Land

Ground truth verification has been undertaken to prepare the training set which was used to classify the satellite imagery. While classifying the identity and location of some of the land cover types known prior through a combination of field work, and maps and personal experience. An attempt was made to locate the specific sites in the remotely sensed data that represent homogeneous examples of these known land cover types. These areas are commonly referred to as training sites, because the spectral characteristics of these known areas are used to train the classification algorithm for eventual land cover mapping. Multi-variate statistical parameters (mean, standard deviation, covariance matrices, correlation matrices, etc.) are calculated for each training site. Every pixel within and outside these training sites is then evaluated and assigned to the class of which it has the highest likelihood of being a member. An accuracy assessment has been undertaken to check the accuracy of the classified data with the help of re-verification on the ground and based on past experience in similar settings.

B. Ecological aspects

Forests

The information on the following aspects has been collected through secondary sources:

- Characterization of forest types and cover in the representative 12 sub basins districts

- Presence of dominant floral species in the representative 12 sub basins
- Presence of Rare, Endangered and Threatened floral species as per the categorization by International Union for the Conservation of Nature and Natural Resources (IUCN) in the representative 12 sub-basin districts.

Wildlife

The proposed TN-IAMWARM-2 project does not fall under wildlife conservation areas, like National Park, Sanctuaries, Biosphere Reserves, etc. as per the following data collected:

- Presence of Rare, Endangered and Threatened faunal species as per the categorization of IUCN Red Data list.
- Presence of National Park, Sanctuary, Biosphere, Tiger Reserve, in the representative 12 sub basins

Fisheries

The project can lead to positive impacts on tank ecology including fisheries. The data on prevailing fish species in the representative sub-basin districts were collected from secondary sources.

C. Socio-economic aspects

The analysis of demographic profile in the blocks of the representative 12 sub basins has been carried out with help of available secondary data. The following information has been collected from secondary data sources as a part of data collection for the representative 12 sub basins:

- Area under cultivation
- Cropping pattern
- Intensity of irrigation
- Crop productivity
- Use of agro-chemicals
- Land holding pattern.
- Demography and socio-economic details based on last available census (Year: 2011) data

The major source of the above mentioned data has been from the secondary sources as available with the local offices of the line departments, Census volumes 2011 and Directorate of Economics and Statistics.

Summary of Data Collection

The summary of data collected from various sources as a part of the ESA study for TN-IAMWARM-2 project is outlined in Table-3.

Table-3: Summary of data collection from various sources

Aspect	Mode of Data collection	Parameters monitored	Source(s)
Meteorology	Secondary	Temperature, humidity, rainfall	IMD
Water Resources	Secondary	River System	Secondary sources
Landuse	Primary and secondary	Land use pattern	Ground truth Studies of satellite imagery
Geology	Secondary	Geological characteristics	Secondary Sources
Water Quality	Primary and secondary	Physico-chemical parameters	Field studies and Secondary Sources
Soil Quality	Primary and secondary	Physico-chemical parameters	Field studies and Secondary Sources
Terrestrial Ecology	Secondary	Flora and fauna	Secondary sources
Fisheries	Secondary	Presence and abundance of various species	Fishery Department and literature review
Socio-economic aspects	Primary and secondary	Demographic & socio-economic, Public health cultural	Field studies, reports of line departments, census volumes etc

2.5.3 Assessment of Potential Environmental and Social Impacts

A detailed assessment and evaluation of the positive and negative, direct and indirect, immediate and long term, and permanent and temporary impacts due to the project related activities to be undertaken as part of TN-IAMWARM-2 project has been provided. Impacts have been assessed, either qualitative or quantitative terms, according to their inherent nature to enable predictive analysis to be undertaken. The impacts on various aspects of environment including physical, chemical, ecological and socio-economic aspects has been studied. The list of environmental impacts covered is given in the following sections:

Construction phase

Land Environment

- Improvement in crop productivity
- Change in land use pattern
- Reduction in soil erosion rates

Soil Quality

- Contamination of soil due to oil leakage from machineries

Water Environment

- Impacts on ground water resources
- Increased water requirements
- Impacts due to increased use of fertilizers

Agriculture

- Increased cropping and irrigation intensity
- Increased agricultural productivity due to project intervention
- Impacts on cropping pattern
- Green manure application and organic practices
- Increased use of IPM and INM practices

Socio-Economic Environment

- Improvement in the employment scenario as a result of absorption of locals in the construction activities.
- Incidence of water-borne diseases

Operation phase

Land Environment

- Impacts on soil quality due to greater use of agro-chemical
- Improvement in crop productivity
- Increase in cropping and irrigation intensities
- Reduction in soil erosion rates

Water Environment

- Increased water requirements
- Increase in groundwater recharge
- Reduction in groundwater extraction
- Changes in cropping pattern

Ecology

- Improvement in vegetative cover
- Increased fodder production
- Reduction in dependency on forest for fodder
- Increased incidence of vector borne disease

Social Impacts

- Improvement in employment scenario and reduction of out migration
- Improvement in wage rates
- Improved access to amenities
- Improvement in social capital
- Impacts on vulnerable groups
- Economic empowerment of women farmers
- Improved participation of youths in agriculture
- Formation of local institutions
- Improved communication systems for extension and capacity building

2.5.4 Stakeholder/ Public Consultations

The consultation process has begun with consulting the relevant literature on the socio economic, demographic and environmental aspects through the secondary sources. The

data collected from the secondary sources has been complemented by information gathered through field level consultations conducted by a multidisciplinary team using participatory methods with the different sections of the communities. The team includes experienced social scientists, agriculture and environmental experts. Semi structured interviews have been conducted with the officials of line departments and Open ended interviews with the leaders of local bodies and Water User Associations (WUA), Focus Group Discussions (FGD) with the men and women farmers, women self help groups. Strength Weakness, Opportunities, Challenges and Action Plan (SWOCA) have been conducted with the active WUAs in all representative 12 sub basins. The visiting teams had transect walks in the project sites such as the tank, canal areas or agricultural fields etc with the guidance of a small group of farmers. A detailed check list of points while conducting semi structured interviews and FGD has been prepared before going to the field for consultations.

To ensure gender mainstreaming, it was also planned to conduct exclusive gender analysis with mixed men and women and exclusive women farmers groups in all the representative 12 sub basins. Gender analysis should focus on gender gaps in development outcomes, understanding the level of participation by women farmers, women's role in decision making process, women's access and control over assets and properties etc. Blocks where tribal communities are living have been identified through tribal mapping exercise in the project area in order to facilitate consultation with men and women tribals.

Field consultations has been organised in three stages. The first stage has been with a range of stakeholders like the officials of line departments, technical experts and leaders of CBOs, local bodies and NGOs. During the consultations the scope of the work, objectives and the methodology has been shared with the stakeholders, suggestions and opinions were collected from the stakeholders in the follow up discussion. Also shared a feedback form and collected the details about lessons learned from the past experiences, major needs to be addressed in the sectors and opportunities for mitigating the adverse conditions etc.

The second stage focused on the farming communities; a wide range of topics related to environment and social aspects has been covered. During the visits conducted FGD, SWOCA, transect walks and also semi structured interviews, an exhaustive check list was prepared by the team to conduct the consultations with different social groups like men and women farmers, members and leader of WUAs, SHGs, tribal farmers, local bodies, NGOs, FPOs and officials of line departments.

In the third stage consultations were conducted when the final draft was ready and mitigation measures listed were shared to solicit the feedback in four different sub basins with all stakeholders. Various points emerged during the consultations were appropriately incorporated before finalising the report.

The details of stake holder/public consultations conducted for 12 representative sub basins in three different stages are given in Table-4.

Table-4: Details of stake holder/public consultations conducted

Stage	Sub-basin	Participants	Method
First Stage	Two sub-basins: • Cheyyar • Thirumanimuthar	• Line departments representatives • Water User Associations • Local Civil Society representatives • Panchayats • Technical experts	• Semi structured interview • Key informant interview • Site visit • Consulting the reports by the departments
Second Stage	Six sub-basins: • Upper Palar • Krishnagiri to Pambar • Vaniyar • Gadana • Pazhayar • Ponnaniyar	• Farming communities • Men and Women farmers of different categories like small and marginal, medium and large size holders • Women farmers self help groups • Leaders of WUA, CBOs and Farmer Producer Companies etc	• Transecting in the field • Focus Group Discussion • Key informant interview • SWOCA • Gender analysis • Semi structured interview
Third Stage	Four sub-basins: • Lower Vaigai • Upper Bhavani • Cauvery delta • Sathiyar Odai	• Line departments • Selected number of men and women farmers • Leaders of CBOs and Farmer Producer Companies	• Focus Group Discussion • Key informant interview • SWOCA • Gender analysis • Structured consultation meetings

2.5.5 Environmental and Social Management Plan

The cost-effective mitigation measures to reduce or avoid adverse environmental and social impacts or to enhance beneficial impacts have been suggested. The general and specific protection measures have been incorporated in the ESMP. The proposed mitigation measures shall be consistent with National and World Bank policies.

The ESMP include recommendations as a result of impact assessment phase so as to ameliorate the anticipated adverse impacts on various facets of environment. Some of the aspects for which management measures suggested are given below:

- Environment Awareness plan
- Occupational health and safety requirements for workers
- Project related accidents such as traffic and public safety
- Other critical areas identified during the study

2.5.6 Grievance Redress Mechanism (GRM)

An easily accessible GRM has been developed so that stakeholders and beneficiaries could utilize in case of any complaints or impacts suffered by them on account of project activities. The GRM includes standard processes and timelines for responding to complaints received along with the role and responsibilities of concerned persons mandated to manage the GRM.

2.5.7 Environmental Monitoring Programme

Monitoring becomes essential to ensure that the mitigation measures planned by way of environmental protection function effectively during the entire period of project duration. The ESA is basically an evaluation of future events. It is necessary to continue monitoring certain parameters identified as critical under an Environmental Monitoring Programme. This would anticipate any environmental problem so as to take effective mitigation measures.

CHAPTER - 3

LEGAL AND REGULATORY FRAMEWORK

CHAPTER – 3
LEGAL AND REGULATORY FRAMEWORK

3.1 General

The project investments would be in compliance with the relevant legislations of India (central level) and State (Tamil Nadu) and with the safeguard policies of the World Bank. This chapter, based on the review and analysis of the existing legal and policy environment, highlights the applicable legislations which have a bearing on the design and implementation of the TN-IAMWARM-2.

3.2 Applicable Rule and Regulations of GoI and GoTN

The legislations of GoI and GoTN with respect to environmental and social management applicable to the project components have been reviewed. The relevance of national and state level legislations to the project is presented in Table-5.

Table-5: Relevant Acts, Rules and Policies under GoI and GoTN

Relevant Act/Policies/Rules	Objective	Relevance to project components
Environmental Legislative Framework		
National Policy on Safety, Health and Environment at Workplace	• The policy aims to secure health of strength of employees and ensure humane conditions of work, including maternity relief to women	**Applicable** The provisions will apply to ensure that labor camps and working conditions are safe and humane
National Water Policy, 1987 and subsequent amendments.	• The National Water Policy lays down general guidelines in preparing basin wise master plan, priority for water use, inter basin transfer etc.	**Applicable** Project intervention involves development of river basin; sub-basin plans shall be aligned with provisions of the basin level master plan
Tamil Nadu Water Policy, 1994	• Based on concept of National Water Policy, Government of Tamil Nadu formulated water policy called Tamil Nadu Water Policy to develop a state water plan which will be the blue print for all the water resources development and use in the state.	**Applicable** Project intervention involves development of river basin; the project DPRs should confirm that these are aligned with this policy

Relevant Act/Policies/Rules	Objective	Relevance to project components
Mettur Canal Irrigation Cess Act No.17 of 1953	• The Act provides specific legislation for laying of water charges on certain lands irrigated under the Mettur Canal	**Applicable** Some of the selected sub-basin area comes under TN-IAMWARM-2. The project to clarify whether water charges would be levied as per this Act;
Tamil Nadu Irrigation, levy of betterment contribution Act No.7 of 1955 and its subsequent amendments.	It provides for betterment assessment be made against the land which is significantly benefitted by the completion of certain improvement works.	**Applicable** The project involves irrigation related sub-components; a betterment assessment shall be carried out as per the State Act
Tamil Nadu Irrigation Tanks (Improvement Act. No. 19 of 1949) and its subsequent amendments.	Under this Act the government has authority to improve efficiency and capacity of Government owned and operated tanks regardless of locations.	**Applicable** The project involves irrigation related sub-components
Tamil Nadu irrigation (Voluntary Cess) Act No. 13 of 1942 and subsequent Amendment	This Act pertains to a special Levy against land for Maintenance of certain irrigation and drainage works constructed and maintained by the government	**Applicable** The project involves irrigation related sub-components; the project to confirm whether any special levy would be imposed and how the proceeds would be utilized, either by PWD or through WUAs
Tamil Nadu Irrigation works (Construction of Field Bothies) Act No.25 of 1959 as Amended	As per the Act the District collector is authorised to direct land owners to construct or improve field channels or ditches	**Applicable** The project involves irrigation related sub-components
Tamil Nadu Irrigation Works (Repair Improvement and construction) Act No.18 of 1943 and subsequent amendment	It empowers the Government to repair and improve private irrigation works, supply water from Government facilities to private irrigation systems and construct new irrigation works as defined by the Tamil Nadu estates land Act of 1908	**Applicable** The project involves irrigation related sub-components
Tamil Nadu Land improvement Schemes act No. 31 of 1959 and subsequent Amendments	The purpose of the act is to carry out land improvement schemes in declared areas, public or private, other than forest preserves for conservation and improvement of soil and water resources, prevention and mitigation of soil erosion, protection of land against flood or drought, protection of reservoir from sedimentation and reclamation of waste lands	**Applicable** The project involves agriculture and irrigation modernization; the project should prepare a report at MTR and end of project period outlining how the provisions of this Act have been met

Relevant Act/Policies/Rules	Objective	Relevance to project components
Tamil Nadu Ground Water (Development and Management) Act, 2003	The Act regulates the development and management of the ground water resources of the State.	**Applicable** The project interventions shall have impact on the groundwater resources; the project should highlight how conjunctive use of water resources are promoted under the project
Compendium of Rules and regulations, Part I, Rules for Water regulation, 1984	It contains the technical day to day rules for regulation of reservoirs in 11 river basins in Tamil Nadu and it provides for Legislative Authority to PWD officials to operate and Maintain reservoir and distribution systems	**Applicable** The project involves agriculture and irrigation modernization
The Tamil Nadu Farmers' Management of Irrigation Systems Act, 2000	• It provides for Farmers' participation in the Management of Irrigation Systems • To promote and secure distribution of water among its users, adequate maintenance of the irrigation system, efficient and economical utilization of water to optimize agricultural production	**Applicable** The project shall involve inclusion of WUAs in the design, implementation of system rehabilitation, O&M; the project should ensure early capacity development of WUAs.
Solid Waste Management Rules, 2016	The provisions of the act prevent littering and mandate proper segregation, collection, storage and disposal of municipal solid waste.	**Applicable** The project will have provisions to manage and dispose solid wastes generated through project investments
Construction and Demolition Waste Management Rules, 2016	Rules and regulation for construction & Demolition Waste	**Applicable** The project shall generate construction wastes only and does not envisages any demolition activities leading to generation of demolition wastes.
The Tamil Nadu Protection of Tanks and Eviction of Encroachment Act, 2007	An Act to protect the water bodies from encroachments and for proper use.	**Applicable** The project involves tanks in irrigation related sub-components; project will not take up tanks where there is encroachment and a RPF is prepared
Agriculture and Horticulture		
Other Acts/Rules	The respective Acts, Rules, Orders regulates the items under their	**Applicable** The project intervention

Relevant Act/Policies/Rules	Objective	Relevance to project components
• The Seed Act 1966; • Seed Rules 1968; • Seeds (Control) Order 1983; Insecticide (Control) Order 1985; • Fertilizer Control Order 1985; Fertilizer Movement Control Order 1973; • Essential Commodities Act (Amended - 1986) • Protection of Plant Variety and Farmers Right Act, 2001 (PPVFR Act)	purview.	involves agriculture productivity enhancement and diversification by ensuring availability of high quality seeds; setting up of commodity groups, setting up Farmer Producer Organizations to protect Farmer's rights.
Agricultural Produce (Grading and Marking) Act, 1937 (Act No. 1 of 1937) (as amended up to 1986)	Applicable for the grading and marketing of agricultural and other produce.	**Applicable** The project intervention involves modernization of selected regulated markets; supporting agriculture enterprise development
Fruit Products Order (FPO), 1955	Mandatory for all producers of fruit and vegetable products to obtain a license under this Order.	**Applicable** The project component involves diversification of agriculture production systems, hence the guideline given in the FPO, 1955 shall be applicable
Livestock		
Breeding of and Experiments on Animals (Control and Supervision) Rules, 1998	Applicable to breeding of and experimentation of animals.	**Applicable** The project intervention involves improving the conception and calving rates in bovines; providing training to AI technicians, to adhere to the SOPs (Standard Operating Procedures), which include inter-alia, use of semen straws as per the prevailing breeding policy of the region/ area.
Food Safety and Standards Act, 2006	Applicable for safety standards	**Applicable** The project component

Relevant Act/Policies/Rules	Objective	Relevance to project components
		involves livestock; testing of milk and meat products will be undertaken if project investments are made on these
Fisheries		
Fish Seed Rules 2002	Provides for registration of the seed producers and assurance from them not to indulge in activities that produce inferior quality of fish seeds.	**Applicable** The project component involves fisheries development; project will finance only registered fish seed producers and/or support registration of poor farmers for fish seed promotion
Wetland (Conservation and Management) Rule 2010	To ensure better conservation and management and to prevent degradation of existing wetlands in India.	**Applicable** The project involves rehabilitation of water bodies; The project will ensure that existing and recognized wetlands are not damaged and will include provisions to enhace wetland conservation within the sub-basins
Social Legislative Framework		
Minimum Wages Act, 1948	The Act makes it mandatory for the employer to pay every employee in a scheduled employment under him wages at the rate not less than the minimum rates of wages fixed under the Act.	**Applicable** The project involves labour employment; the project will document and monitor paid wages and as far as possible discourage cash payments
Mahatma Gandhi National Rural Employment Guarantee Act, 2005	The aim of the act to guarantee the right to work and wage employment to enhance the livelihood security of people in the rural areas	**Applicable** The project involves labour employment and shall converge with this Act to leverage additional funds.
National Policy for Empowerment of Women**,** 2001	The policy advocates for equal access to participation and decision making of women in social, political and economic life of the nation and mainstreaming a gender perspective in the development process.	**Applicable** The project shall provide equal access and opportunity to women in employment, remuneration, occupational health and safety, social security etc.; involving in WUAs and promoting opportunities for office bearer positions
Child Labour (Prohibition and	The Act prohibits the engagement of children in certain employments and	**Applicable** To prevent contractor from

Relevant Act/Policies/Rules	Objective	Relevance to project components
Regulation) Act, 1986	to regulate the conditions of work or children in certain other employments.	employing child labour who shall come under the purview of the Act; the project will include relevant privisios in the bid document for complying with this Act

3.3 Applicable World Bank Safeguard Policies

When identifying and designing a project/ subproject, World Bank's operational policies help to assess the possible environmental risks and the impacts (positive or negative) associated with the development interventions proposed for various sectors. During the project implementation, safeguards shall help in defining measures and also the processes to effectively manage risks and enhance positive impacts. The process of applying safeguard policies can be an important opportunity for stakeholder's engagement, enhancing the quality of project proposals and increase in ownership. Various World Bank's applicable operational policies and their implications are listed under Table 6.

Table-6: Applicable World Bank safeguards policies

WB Safeguards Policies	Applicability (Yes/No)	Relevance to the Project
OP 4.01 Environmental Assessment	Yes	Project activities could have an impact on the environment. Similarly the project has a significant impact on social environment with issues around gender and equity of participation.
OP 4.04 Natural Habitat	Yes	The project activities related to tanks rehabilitation involves water bodies which support avi-fauna; tanks themselves support fishes and other biodiversity.
OP 4.09 Pest Management	Yes	Project involves measures to improve the agricultural productivity. This may lead to increased use of agrochemicals especially pesticides. As part of ESMF a PMP with an IPM strategy including soil and nutrient management approaches has been developed.
OP 4.10 Indigenous People	No	As the project interventions shall not involve any Indigenous people (tribal communities in Indian context). Hence, this policy will not be triggered.
OP 4.11 Physical Cultural Resources	No	The project is rehabilitating existing tanks and improving irrigation efficiency in the associated canal systems; other investments are on private farmlands and thus this policy is not applicable.
OP 4.12 Involuntary Resettlement	Yes	The project affirms that there is no likelihood of any encroachment in the tank bunds and any involuntary resettlement.

WB Safeguards Policies	Applicability (Yes/No)	Relevance to the Project
		RPF developed as an abundant caution. Will be followed in case, O.P 4.12 is triggered
OP 4.36 Forests	No	The project investments do not involve any commercial timber felling and will not have any impact on forest management practices in the sub-basins
OP 4.37 Safety of Dams	No	The project interventions involve tanks with earthen embankments not exceeding 10 m in height (Refer Annexure-II); All are existing tanks and the first phase project confirmed that no significant impacts are anticipated from investments made on rehabilitation of these tanks
OP 7.50 Projects on International Waterways	No	No international waterways are involved, hence this policy is not applicable.
OP 7.60 Project in Disputed Areas	No	No disputed areas are involved hence this policy is not covered.
World Bank Access to Information	Yes	Procedures for making information available, process for public disclosure of information and procedure of appeal, if information denied.

CHAPTER - 4

ENVIRONMENT BASELINE STATUS

CHAPTER – 4
ENVIRONMENT BASELINE STATUS

4.1 General

This chapter details the environmental characteristics of the representative 12 sub-basins which fall under different agro-climatic zones of Tamil Nadu. The environmental characteristics described in this Chapter are based on the review of secondary information/ data collected from the respective Government departments, literature/journals, websites. The information obtained during the field visits of expert team to the representative 12 sub-basins has also been presented in this Chapter. The Environmental Fact-Sheets of the representative 12 sub-basins have been presented in Annexure-III.

4.2 Topography

The state of Tamil Nadu has hilly areas with dense vegetation in the western, southern and the north-western parts. Both the Western Ghats and the Eastern Ghats mountain ranges meet at the Nilgiri hills. The fertile coastal plains lies in the eastern parts while the northern parts have a mix of hills and plains. The central and the south-central regions have arid plains. The main physiographic features of the State are:

- Coastal plain on the eastern side stretching from Pulicat lake to Kanyakumari to a length of 1076 km forming major portion of Tamil Nadu
- Central plateau region of slightly elevated plain studded with Javadhu, Shevaroys, Kalrayan, Pachamalai and Kollimalai hills known as Eastern Ghats
- Hilly regions of the Western Ghats on the West.

The categories of slope and its percentage is given in Table-7 and shown in Figure-3.

Table 7: Categories of slope and its percentages

Slope (%)	Slope category
0-1	Nearly level
1-3	Very gently sloping
3-5	Gently sloping
5-10	Moderately sloping

The details of topography for the representative 12 sub-basins selected for the TN-IAMWARM-2 project is given in Table 8.

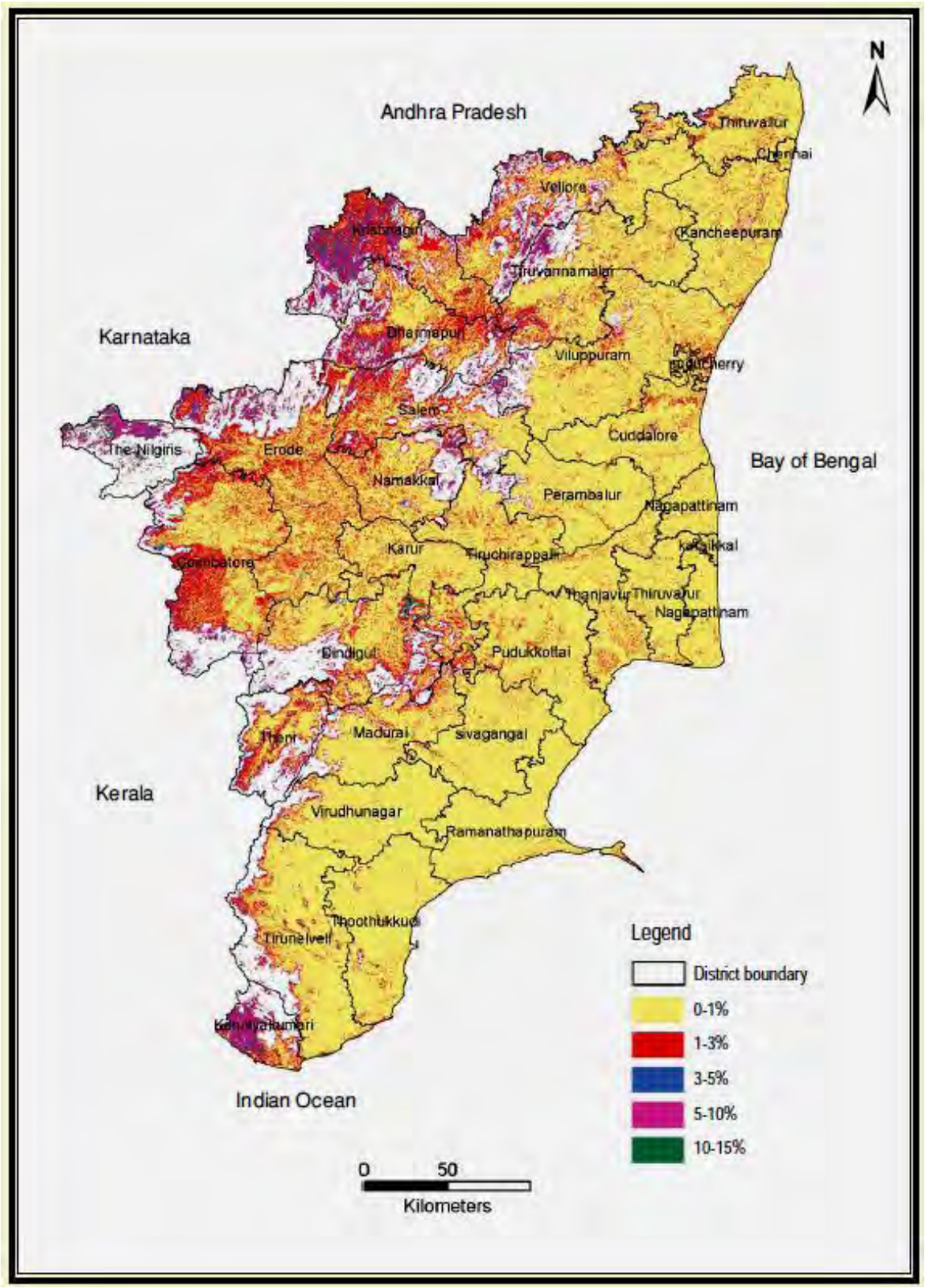

Figure 3: Slope Map of Tamil Nadu

Table 8: Topography for representative sub-basins

S. No	Sub-Basin	Sub-Basin Districts	Topography
1	Cheyyar	Kancheepuram, Tiruvannamalai and Vellore	Almost flat and sloping nature from West to East.
2	Upper Palar	Vellore	Almost plain topography with sloping nature from west to east.
3	Krishnagiri to Pambar	Krishnagiri and Dharmapuri	• Krishnagiri district, generally topography is of mountaineous type • Dharmapuri district, topography is of rolling plains type
4	Vaniyar	Dharmapuri and Salem	• Dharmapuri district, topography is of rolling plains type • Salem district, topography is of hilly ranges and rocks with undulating plain
5	Gadana	Tirunelveli	• Plain terrain with a gentle slope toward East and Southeast
6	Pazhayar	Kanyakumari	• Generally towards the north and north-western side, predominantly occupied by Western Ghats • South and west parts covered by plains • Narrow stretch of beaches and sand dunes found near the coast line
7	Ponnaniyar	Tiruchirapalli and Pudukottai	Undulating topography and general slope towards southeast.
8	Cauvery Delta	Tiruchirapalli, Thanjavur, Tiruvarur and Nagappattinam	Flat topography in lower delta area
9	Thirumanimuthar	Namakkal and Salem	• Hilly ranges and rocks with undulating plains • Southern, western and northern parts in Namakkal district is low lying
10	Lower Vaigai	Sivaganga and Ramanathapuram	Terrain is undulating plains with stray hillocks and slope towards south east

S. No	Sub-Basin	Sub-Basin Districts	Topography
11	Sathiyar Odai	Dindigul and Madurai	Topography is flat surrounded by several mountain spurs
12	Upper Bhavani	Coimbatore, Nilgiris and Erode	• Coimbatore district, topography is hilly in south-western and northern parts in Coimbatore district • Topography is rolling with steep escarpments and about 60% of the cultivable land is slopes in Nilgiris district.

4.3 Soil

Soil is one of the natural resources which has the most direct impact on agricultural development. In an agrarian State like Tamil Nadu, it becomes necessary to take steps for its proper conservation and management. Soil survey provides the nature of soils, their extent and physico-chemical characteristics. The predominant soil types found in the state are Inceptisols, Alfisols, Entisols and Vertisols. Due to different stages of weathering of the parent material, combination of the above soil types are also observed.

In Tamil Nadu ninety four soil families are identified and classified according to soil taxonomy into six orders. Among the six orders, Inceptisol formed 50% of the total geographical area, followed by Alfisols (30%). Soil depth is not a limiting factor for crop growth in Tamil Nadu except shallow soils which occur in 14% of the total geographical area of the state. The dominant texture of soil types in the state are loamy surface soil (53%), Clay surface soil (22%) and sandy surface soil (18%).

The details of soil classification for the representative 12 sub-basins are given in Table 9 and Figures 4 & 5 provide the classification for 66 sub-basins and 12 selected sub-basins respectively.

Table 9: Soil for representative sub-basins

S. No	Sub-Basin	Sub-Basin Districts	Soil Classification (%)
1	Cheyyar	Kancheepuram, Tiruvannamalai and Vellore	Alfisols (25-30), Inceptisols (30-35), Reserve Forest (35-40)
2	Upper Palar	Vellore	Alfisols (30-35), Inceptisols (35-40), Reserve Forest
3	Krishnagiri to Pambar	Krishnagiri and Dharmapuri	Alfisols (35-40), Inceptisols (15-20), Entisol (20-25), Reserve Forest (10-15)& Hill soil (5-10)

4	Vaniyar	Dharmapuri and Salem	Alfisols (30-35), Vertisol (30-35), Entisol (20-25), Reserve Forest (10-15) & Hill soil (5-10)
5	Gadana	Tirunelveli	Alfisols (about 20), Entisol (50-55), Reserve Forest (20-25), Inceptisols (about 10)
6	Pazhayar	Kanyakumari	Alfisols (40-45), Inceptisols (15-20), Reserve Forest (20-25) and Hill Soil (15-20)
7	Ponnaniyar	Tiruchirapalli and Pudukottai	Alfisols (15-20), Inceptisols (20-25), Entisols (10-15), Rockout crop (5-10), Vertisols (0-5)
8	Cauvery Delta	Tiruchirapalli, Thanjavur, Tiruvarur and Nagappattinam	Alfisols (20-25), Inceptisols (10-15), Vertisols (40-50), Entisols (15-20), Swamp (10-15) and Reserve Forest (5-10)
9	Thirumanimuthar	Namakkal and Salem	Alfisols (20-25), Inceptisols (25-30), Vertisols (5-10), Entisols (10-15), Rockout crop (5-10)
10	Lower Vaigai	Sivaganga and Ramanathapuram	Alfisols (20-25), Inceptisols (15-20), Entisols (20-25),Vertisols (40-45)
11	Sathiyar Odai	Dindigul and Madurai	Alfisols (55-60), Reserve Forest (15-20), Rockout Crop (10-15)
12	Upper Bhavani	Coimbatore, Nilgiris and Erode	Alfisols (20-25), Reserve Forest (40-45), Inceptisols (15-20), Entisols (15-20) Hill Soil (10-15)

SOIL QUALITY

As a part of field studies, 30 soil samples have been collected from representative sub-basins and analyzed. The details of sampling location and the results are given in Table-10 and Table-11 (a), (b) and (c) respectively.

Table-10 - Soil sampling locations in the representative sub-basins

Sampling locations	Sub-basin	Village
S 1	Gadana	Melambur
S 2	Gadana	Gadana
S 3	Gadana	Gowthamapuri
S 4	Pazhayar	Thevoor
S 5	Pazhayar	Palkulam
S 6	Pazhayar	Arumanallur
S 7	Krishagiri - Pambar	Anandur
S 8	Krishagiri - Pambar	Barur

Sampling locations	Sub-basin	Village
S 9	Krishagiri - Pambar	Echambadi
S 10	Cheyyar	Kunnathur
S 11	Cheyyar	Edumankulam
S 12	Cheyyar	Kunnathur
S 13	Thirumani Muthar	Minnakkal
S 14	Thirumani Muthar	Pillur
S 15	Thirumani Muthar	Pillur
S 16	Ponaniyar	Gundur
S 17	Ponaniyar	Paganur
S 18	Ponaniyar	Kodamballur
S 19	Lower Vaigai	Karendal Ayacut
S 20	Lower Vaigai	Athiyuthu
S 21	Lower Vaigai	V.Karasalkulam
S 22	Upper Palar	Reddimakuppam
S 23	Upper Palar	Kedandanpatti
S 24	Upper Palar	Nagaleri
S 25	Vanniyar	Vachathi
S 26	Vanniyar	Alapuram
S 27	Vanniyar	Alapuram
S 28	Upper Bhavani	Odankarai
S 29	Upper Bhavani	Pollachi
S 30	Upper Bhavani	Kilsengallur

Table-11 (a) - Soil quality in the representative sub-basins

S.No	Parameters	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
1	pH	7.3	6.92	6.84	7.67	6.86	6.58	7.45	8.18	7.26	7.26
2	Electrical Conductivity, µS/cm	83	80	192	346	76	143	277	156	262	101
3	Bulk density, gm/cc	1.52	1.49	1.37	1.46	1.48	1.38	1.42	1.52	1.37	1.29
4	Sodium, mg/kg	22	20	72	82	18	42	186	102	196	44
5	Available Potassium, mg/kg	1	1	4	5	1	3	13	8	14	3
6	Available Nitrogen as N, mg/kg	187	110	95	149	109	146	141	109	121	178
7	Available Phosphorus, mg/kg	1.37	1.82	1.7	3.5	1.81	2.02	6.86	1.73	3.6	1.52
8	Porosity, %	41	23	25	28	23	24	25	25	23	25
9	Organic Carbon, %	0.74	1.13	0.81	0.79	1.12	2.63	1.35	0.96	0.72	0.92
10	Soil Texture i)Sand,%	8.12	26.35	15.24	11.26	26.14	12.58	34.52	18.26	34.69	45.78
11	Soil Texture ii)Silt, %	11.52	9.4	23.42	15.85	21.25	27.4	10.8	19.65	16.79	21.24
12	Soil Texture iii)Clay,%	80.36	64.25	61.34	72.89	52.61	60.02	54.68	62.09	48.52	32.98

Table-11 (b) - Soil quality in the representative sub-basins

S.No	Parameters	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20
1	pH	7.62	7.46	8	7.26	7.82	7.56	7.32	7.21	7.06	7.8
2	Electrical Conductivity, µS/cm	183	179	136	141	250	296	922	92	240	350
3	Bulk density, gm/cc	1.43	1.4	1.45	1.29	1.23	1.28	1.64	1.26	1.68	1.47
4	Sodium, mg/kg	86	92	48	36	98	110	100	28	40	70
5	Available Potassium, mg/kg	5	5	3	3	6	7	7	3	3	4
6	Available Nitrogen as N, mg/kg	80	76	152	172	90	261	261	186	120	151
7	Available Phosphorus, mg/kg	3.52	3.65	2.13	1.28	3.52	1.24	1.24	1.32	1.8	3.52
8	Porosity, %	25	23	25	23	24	23	23	24	24	25
9	Organic Carbon, %	0.88	0.79	2.31	0.71	0.32	0.14	0.14	0.78	1.16	0.8
10	Soil Texture i)Sand, %	45.62	26.94	62.08	16.54	36.57	28.64	16.52	10.36	20.64	48.42
11	Soil Texture ii)Silt,%	21.51	24.43	15.23	19.09	20.46	8.49	5.03	28.8	12.82	20.73
12	Soil Texture iii)Clay,%	32.87	48.63	22.69	64.37	42.97	62.87	78.45	60.84	66.54	30.85

Table-11 (c) - Soil quality in the representative sub-basins

S.No	Parameters	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30
1	pH	7.36	7.42	6.25	7.26	8.12	7.32	8.12	6.84	6.74	6.82
2	Electrical Conductivity, µS/cm	284	395	168	115	282	120	203	192	180	210
3	Bulk density, gm/cc	1.26	1.25	1.67	1.29	1.63	1.42	1.29	1.52	1.54	1.47
4	Sodium, mg/kg	122	74	32	26	72	24	68	24	66	22
5	Available Potassium, mg/kg	8	6	2	1	5	1	4	1	3	1
6	Available Nitrogen as N, mg/kg	280	180	125	180	129	129	185	132	192	126
7	Available Phosphorus, mg/kg	1.26	30.06	1.72	1.36	1.72	1.72	1.89	1.72	1.92	7.84
8	Porosity, %	24	24	21	25	26	26	25	25	23	24
9	Organic Carbon, %	0.16	0.72	1.16	0.86	1.19	1.19	0.73	1.24	0.99	1.24
10	Soil Texture i)Sand, %	11.64	12.94	32.67	16.57	58.72	58.72	16.84	16.94	24.24	18.54
11	Soil Texture ii)Silt,%	16.3	22.24	14.39	14.48	14.44	14.44	16.34	11.42	11.18	25.12
12	Soil Texture iii)Clay,%	72.06	64.82	52.94	68.95	26.84	26.84	66.82	71.64	64.58	56.34

pH is an important parameter indicative of alkaline or acidic nature of the soil. It greatly affects the microbial population as well as the solubility of metal ions and regulates nutrient availability. pH of the soil in the study area was found neutral to slightly alkaline in reaction having pH in the range of 6.25 to 8.18. Organic matter present in soil influences its physical and chemical properties. It commonly accounts

as one third or more of the cation exchange capacity of the surface soils and is responsible for stability of soil aggregates. Organic carbon, available nitrogen and available phosphorous are found to be in the range of 0.14-2.63 %, 76-280 mg/kg and 1.24-30.06 mg/kg respectively. Soil texture indicates the soil is sandy and clayey in various sub basins.

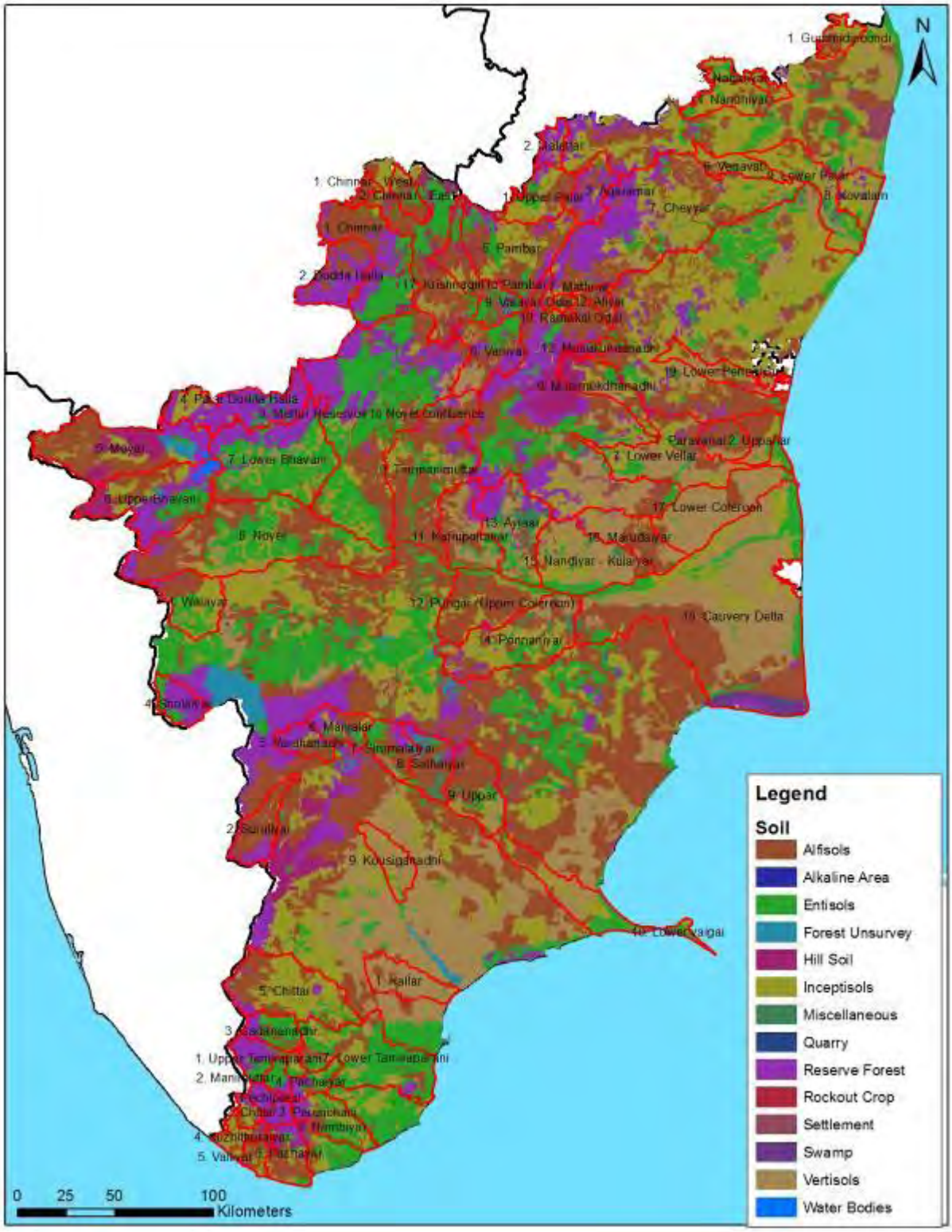

Figure 4: Soil classification for 66 sub-basins

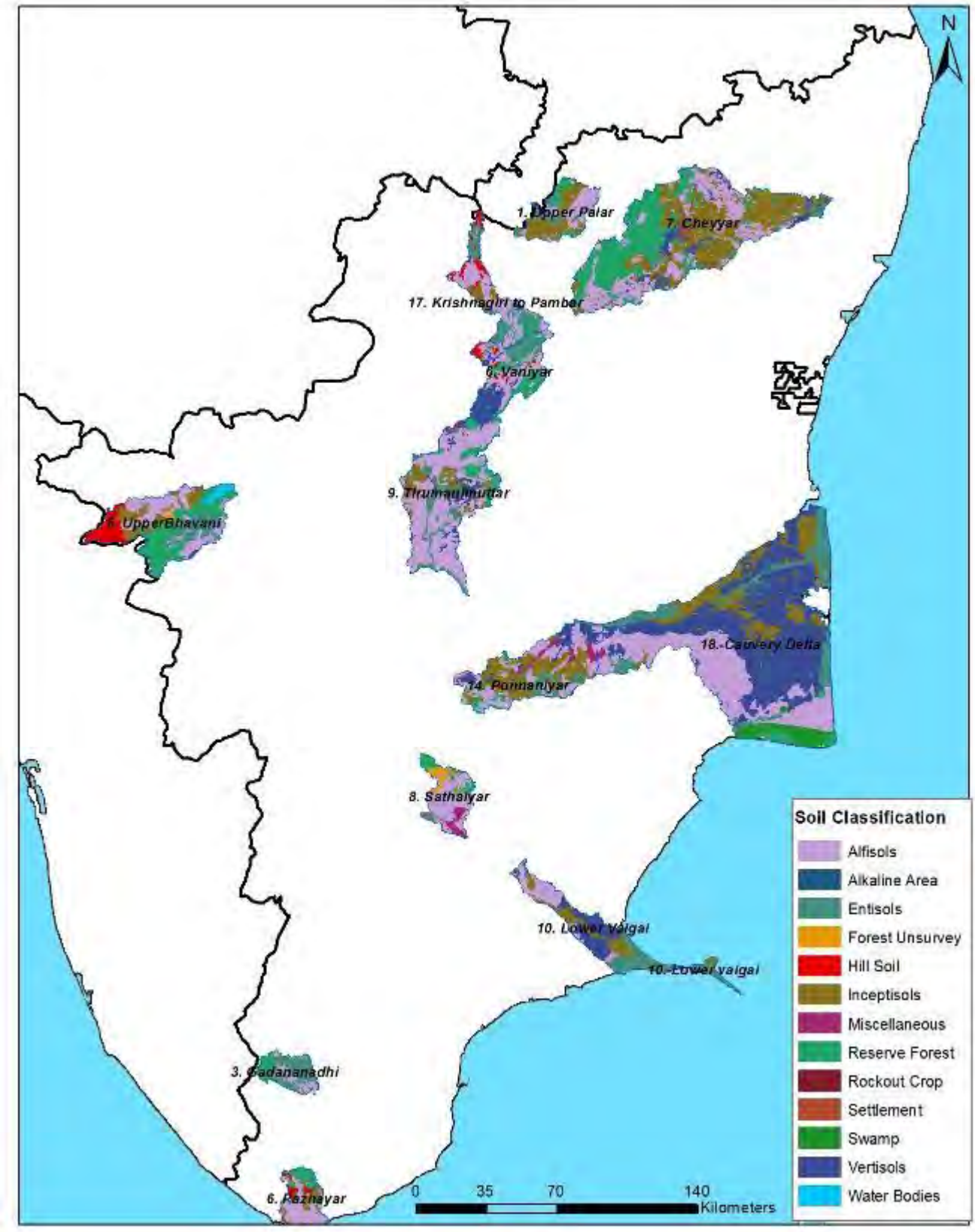

Figure 5: Soil classification for representative 12 sub-basins

4.4 Climate

The climate of the Tamil Nadu state is tropical monsoon type. In the plains, the temperature during winter seldom goes below 18°C while in peak summer it rises to 43°C. Tamil Nadu receives rains from both the northeast and southwest monsoons. Maximum rainfall and occasional cyclones occur during the northeast monsoon. The climatic conditions of the representative sub-basins are given in Table 12.

Table 12: Rainfall data for representative 12 sub-basins

S. No	Sub-Basin	Sub-Basin Districts	Average Temperature (°C)	Average Normal Rainfall (mm)	Average Relative Humidity (%)
1	Cheyyar	Kancheepuram Tiruvannamalai Vellore	28.8	1082.0	82
2	Upper Palar	Vellore	27.5	936.2	61
3	Krishnagiri to Pambar	Krishnagiri Dharmapuri	24.5	876.4	65
4	Vaniyar	Dharmapuri Salem	24.7	950.0	60
5	Gadana	Tirunelveli	28.2	845.1	82
6	Pazhayar	Kanyakumari	28.5	1302.5	65
7	Ponnaniyar	Tiruchirapalli Pudukottai	28.9	1705.4	81
8	Cauvery Delta	Tiruchirapalli Thanjavur Tiruvarur Nagappattinam	30.0	1105.7	78
9	Thirumani-muthar	Namakkal Salem	24.7	895.7	65
10	Lower Vaigai	Sivaganga Ramanathapuram	28.1	840.3	82
11	Sathiyar Odai	Dindigul Madurai	28.0	929.3	55
12	Upper Bhavani	Coimbatore Nilgiris Erode	23.9	1106.0	78

4.5 Agro Climatic Features

The state of Tamil Nadu is classified into seven distinct agro-climatic zones based on rainfall distribution, irrigation pattern, soil characteristics, cropping pattern and other physical, ecological and social characteristics including administrative divisions. The agro-climatic zones are shown in Figure-7. The districts covered in each Agro-Climatic zone are given in Table 13.

Table- 13: Agro Climatic Zones

S. No	Agro Climatic Zones	Districts Covered
1	North Eastern	Kancheepuram, Tiruvallur, Cuddalore, Vellore, Villupuram and Tirunvannamalai
2	North Western	Dharmapuri, Krishnagiri, Salem and Namakkal (Part)
3	Western	Erode, Coimbatore, Tiruppur, Theni, Karur (part), Namakkal (part), Dindigul, Perambalur and Ariyalur (part)
4	Cauvery Delta	Thanjavur, Nagapattinam, Tiruvarur, Trichy and parts of - Karur, Ariyalur, Pudukkottai and Cuddalore
5	Southern	Madurai, Sivagangai, Ramanathapuram, Virudhunagar, Tirunelveli and Thoothukudi
6	High Rainfall	Kanyakumari
7	Hilly	The Nilgiris and Kodaikanal (Dindigul)

Figure 6: Agro Climatic Zones of Tamil Nadu

4.6 River System

In the state of Tamil Nadu, there are 17 major river basins with 61 reservoirs and about 41,948 tanks. There are several rivers, of which Cauvery River, with length of 760 km, is the longest river of Tamil Nadu. The rivers flowing through the representative 12 sub-basins are as follows:

- ✓ **Bhavani River**, mostly fed by the south western monsoon, is one of the main tributaries of the river Cauvery and flowing through the Upper Bhavani sub-basin.
- ✓ **Cheyyar River,** a tributary of river Palar, a major seasonal river that flows through the Cheyyar sub-basin.
- ✓ **Chittar River**, which originates from the Courtallam Hills in the Tirunelveli district, flows through the Gadana sub-basin.
- ✓ **Ponniyar River**, in the Manapparai taluk of Tiruchirapalli district, flows through the Ponnaniyar sub-basin.
- ✓ **Tamirabarani River** originates from the Agastyarkoodam peak of Pothigai hills of the Western Ghats, above Papanasam in the Ambasamudram taluk in Tirunelveli district, flows through the Gadana sub-basin.
- ✓ **Vaigai River**, which originates in Varusanadu hills, located in the Periyar Plateau of the Western Ghats range, passes through Madurai district, and flows through the Lower Vaigai and Sathiyar Odai sub-basins.

The river map of Tamil Nadu is shown in Figure 7 and the drainage map for 66 sub-basins and representative 12 sub-basins is shown Figures 8 and 9 respectively.

Figure 7: River Map of Tamil Nadu

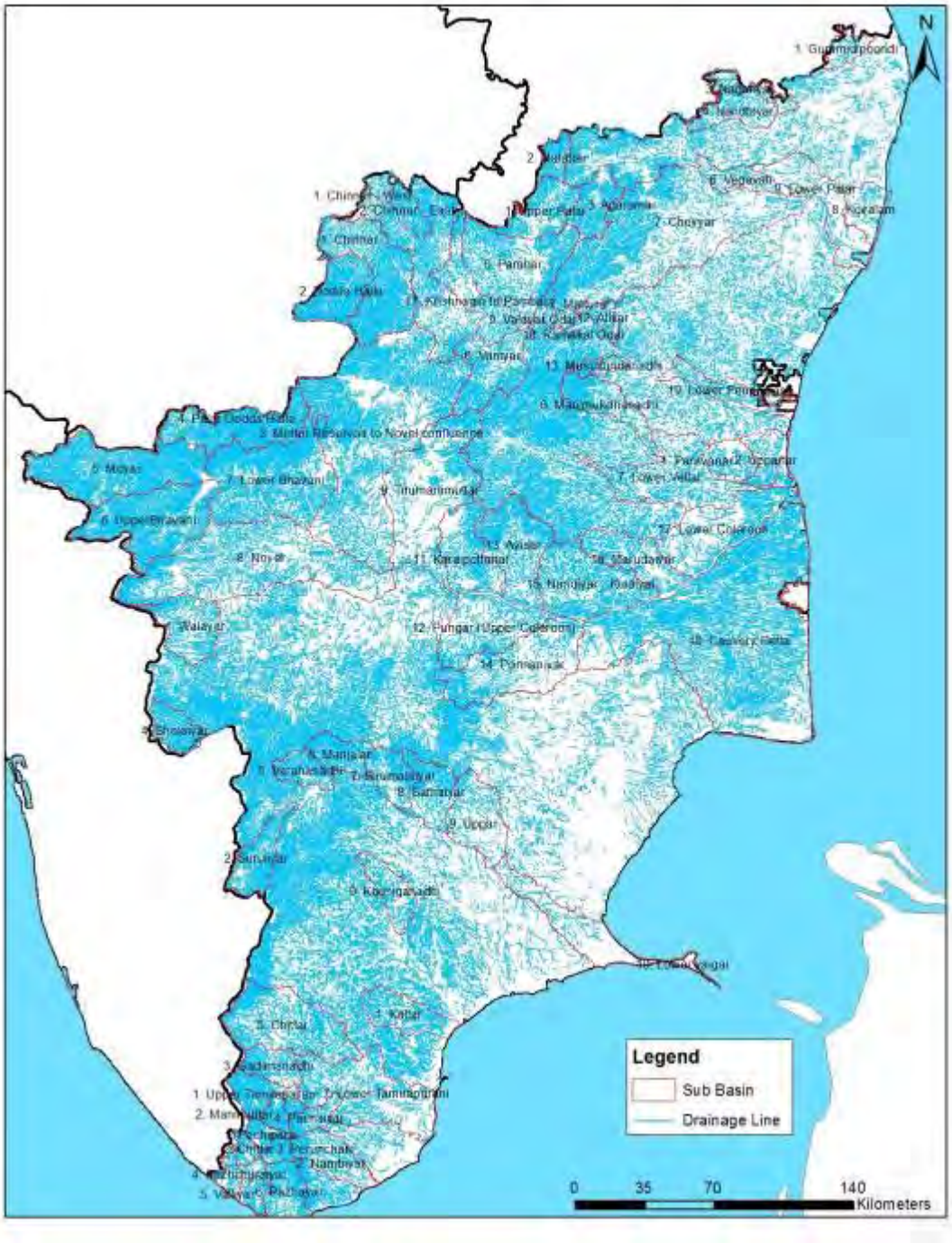

Figure 8: Drainage map for 66 sub-basins

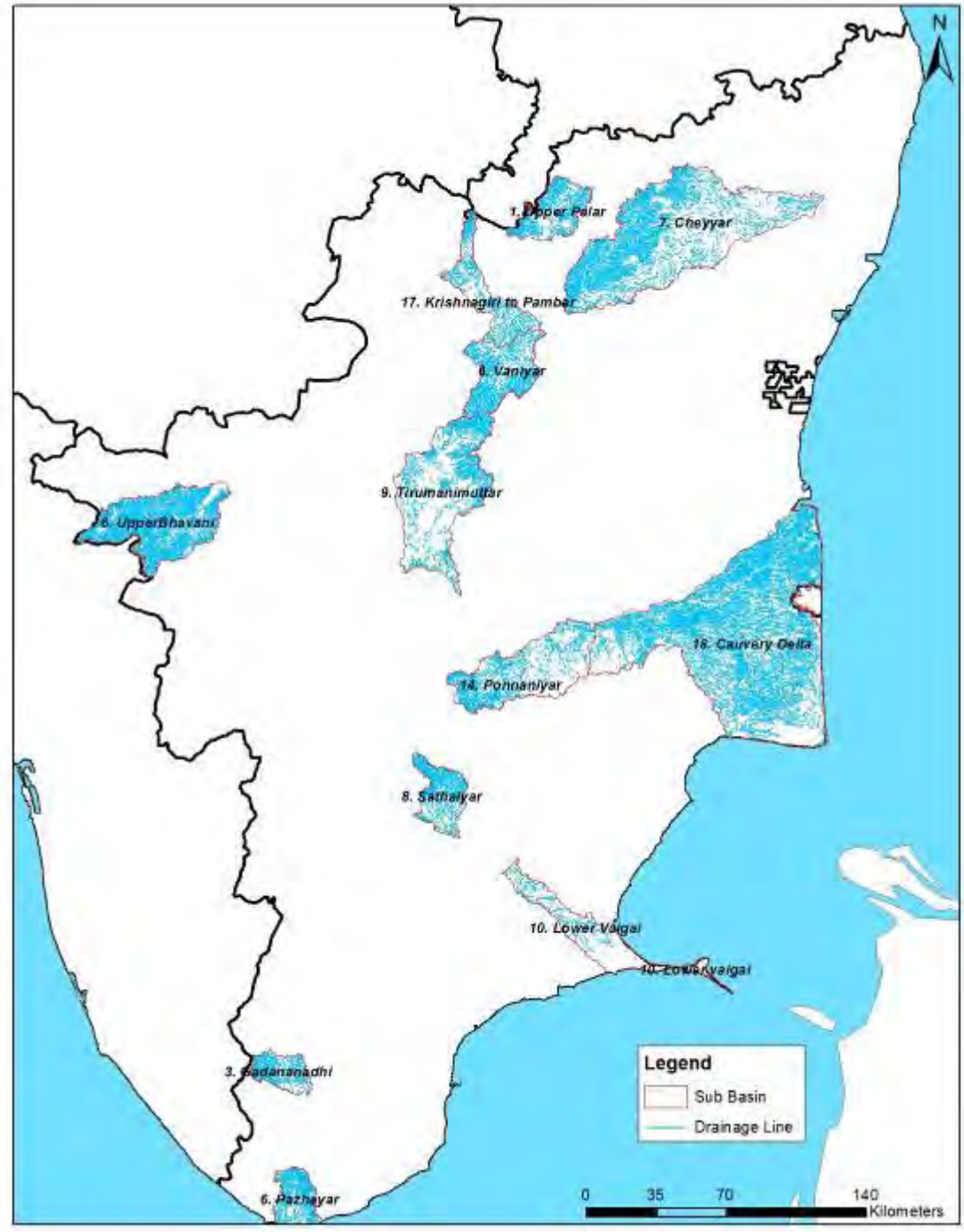

Figure 9: Drainage map for representative 12 sub-basins

4.7 Water Quality

Surface Water Quality

The rivers of Tamil Nadu are mostly non-perennial and receive floodwater only during monsoon and post-monsoon season and during the rest of the year are mostly dry The degradation of the river water quality is mainly due to the increasing population and growing industrialisation.

The Central Pollution Control Board (CPCB) has developed a classification tool stated as "Best - Designated Use" (refer table 14) under the National River Conservation Programme (NRCP).

Table 14: Water Quality Criteria

S. No	Designated Best Use	Class of Water	Criteria
1	Drinking Water Source without conventional treatment but after disinfection	A	▪ Total Coliforms Organism MPN/100ml shall be 50 or less ▪ pH between 6.5 and 8.5 ▪ Dissolved Oxygen 6 mg/l or more ▪ Biochemical Oxygen Demand 5 days 20°C 2mg/l or less
2	Outdoor bathing (Organised)	B	▪ Total Coliforms Organism MPN/100ml shall be 500 or less ▪ pH between 6.5 and 8.5 ▪ Dissolved Oxygen 5mg/l or more ▪ Biochemical Oxygen Demand, 5 days 20°C 3mg/l or less
3	Drinking water source after conventional treatment and disinfection	C	▪ Total Coliforms Organism MPN/100ml shall be 5000 or less ▪ pH between 6 to 9 ▪ Dissolved Oxygen 4mg/l or more ▪ Biochemical Oxygen Demand 5 days 20°C 3mg/l or less
4	Propagation of Wild life and Fisheries	D	▪ pH between 6.5 to 8.5 ▪ Dissolved Oxygen 4mg/l or more ▪ Free Ammonia (as N) 1.2 mg/l or less
5	Irrigation, Industrial Cooling, Controlled Waste disposal	E	▪ pH between 6.0 to 8.5 ▪ Electrical Conductivity at 25°C micro mhos/cm Max.2250 ▪ Sodium absorption Ratio Max.

			26 ▪ Boron Max. 2mg/l
		Below-E	Not Meeting A, B, C, D & E Criteria

The class of river water quality in Tamil Nadu as per CPCB Classification is ranging between levels C and below E. There are pockets of level D in the western parts of Tamil Nadu close to the origin of the rivers (e.g. river Cauvery).

Ground Water

The state of Tamil Nadu has diverse hydrogeological formations, wherein nearly 73% of the state is occupied by hard rocks. The semi consolidated and consolidated formations are mainly confined in the eastern part which is the coastal tract. In the hard rock area, ground water is mainly developed through dug wells and dug cum bore wells tapping the weathered zone.

As per CGWB report, the annual ground water draft in the state of Tamil Nadu is 16.56 BCM and the stage of ground water development is 80%. The status of various blocks in the state vis-à-vis groundwater development are as follows:

Over-Exploited	:	139
Critical	:	33
Semi-Critical	:	39
Safe	:	136
Saline	:	11
Total	:	**386**

Thus, about 35.3% blocks are under safe category and the remaining are under stress on account of over-exploitation or water quality. In the representative 12 sub-basins, 3 sub-basins namely Upper Palar, Krishnagiri to Pambar and Vaniyar are in the over-exploited category while some regions of 5 sub-basins namely Sathiyar Odai, Upper Bhavani, Thirumanimuthar, Cauvery Delta and Cheyyar are over-exploited. The remaining sub-basins namely Gadana, Pazhayar, Ponnaniyar and Lower Vaigai are in safe category.

The proposed project interventions would reduce the dependence on ground water with corresponding reduction in groundwater abstraction. The increased groundwater recharge due to irrigation would also replenish the groundwater resources.

Ground Water Quality

In the representative 12 sub-basins districts, the categorization of the status of groundwater is given in Table 15.

The general observations of the ground water quality in the representative 12 sub-basin districts is as follows:

- Ground water in phreatic aquifers is colourless, odourless and alkaline in nature, in general in all the sub-basin districts.

- Suitable for drinking and domestic uses in all the sub-basin districts in respect of all the parameters except for the following parameters:

    - Total Hardness exceeds the permissible limit in all the sub-basin districts except Tirunelveli, Tiruchirapalli, Sivaganga and Nilgiris sub-basin districts of Gadana, Ponnaniyar, Cauvery Delta, Thirumanimuthar and Upper Bhavani sub-basins respectively.
    - Nitrate exceeds the permissible limit in all the sub-basin districts except Tiruchirapalli and Tiruvarur sub-basin districts of Ponnaniyar and Cauvery Delta sub-basins respectively.
    - Chloride exceeds the permissible limit in the Vellore sub-basin district of Cheyyar and Upper Palar sub-basin.
    - Flouride exceeds the permissible limit of 1.5 mg/l in Krishnagiri, Tiruchirapalli and Namakkal sub-basin district of Krishnagiri to Pambar, Ponnaniyar, Cauvery Delta and Thirumanimuthar sub-basins respectively.
    - Sulphate exceeds the permissible limit in Thanjavur and Namakkal sub-basin district in Cauvery Delta and Thirumanimuthar sub-basins respectively.

- In Vellore district of Upper Palar sub-basin, the pollution from tanneries is the major cause for deterioration of groundwater quality and soil in vast areas.
- In Salem district of Vaniyar and Thirumanimuthar sub-basin, groundwater in general is classified as Highly Saline on the basis of SAR.
- The phreatic aquifer has medium to high salinity in the major parts of the Tiruvarur district of Cauvery Delta sub-basin.
- In the Nilgiris district of Upper Bhavani sub-basin, no salinity or alkali hazard is expected when ground water is used for irrigation purposes.
- The high total hardness is attributed to the composition of litho units and geogenic causes constituting the aquifers in the sub-basin districts.
- The nitrate pollution is most likely due to indiscriminate use of pesticides and fertilizers for agriculture and other improper waste disposal.

- With regard to irrigation suitability based on specific electrical conductance and Sodium Absorption Ratio (SAR), ground water in the phreatic zone may cause high to very high salinity hazard and medium to high alkali hazard when used for irrigation.
- The Electrical conductivity of all the representative sub-basin districts is given in Table 16

Table 15: Categorization of the status of groundwater for representative sub-basins

S. No	Sub-Basin	Sub-Basin Districts	Categorization
1	Cheyyar	Kancheepuram	Safe
		Tiruvannamalai	Semi Critical
		Vellore	Over-exploited
2	Upper Palar	Vellore	Over-exploited
3	Krishnagiri to Pambar	Krishnagiri	Over-exploited
		Dharmapuri	Over-exploited
4	Vaniyar	Dharmapuri	Over-exploited
		Salem	Over-exploited
5	Gadana	Tirunelveli	Safe
6	Pazhayar	Kanyakumari	Safe
7	Ponnaniyar	Tiruchirapalli	Semi-Critical
		Pudukottai	Safe
8	Cauvery Delta	Tiruchirapalli	Semi-Critical
		Thanjavur	Over-exploited
		Tiruvarur	Semi-Critical
		Nagappattinam	Over-exploited
9	Thirumani-muthar	Namakkal	Semi-Critical
		Salem	Over-exploited
10	Lower Vaigai	Sivaganga	Safe
		Ramanatha-puram	Safe
11	Sathiyar Odai	Dindigul	Over-exploited
		Madurai	Safe
12	Upper Bhavani	Coimbatore	Over-exploited
		Nilgiris	Safe
		Erode	Critical

Table-16: Electrical Conductivity for representative sub-basin districts

S. No	Sub-Basin	Sub-Basin Districts	Categorization
1	Cheyyar	Kancheepuram	240 - 4220
		Tiruvannamalai	-
		Vellore	935 - 7920
2	Upper Palar	Vellore	935 - 7920
3	Krishnagiri to Pambar	Krishnagiri	830 - 3030
		Dharmapuri	320 - 6010
4	Vaniyar	Dharmapuri	320 - 6010
		Salem	526 - 6040

5	Gadana	Tirunelveli	510 - 9320
6	Pazhayar	Kanyakumari	150 – 2240
7	Ponnaniyar	Tiruchirapalli	570 - 4550
		Pudukottai	190 - 2100
8	Cauvery Delta	Tiruchirapalli	570 - 4550
		Thanjavur	279 - 2250
		Tiruvarur	620 - 4400
		Nagappattinam	714 - 3640
9	Thirumani-muthar	Namakkal	1300 - 7080
		Salem	526 - 6040
10	Lower Vaigai	Sivaganga	410 - 5110
		Ramanatha-puram	409 - 4350
11	Sathiyar Odai	Dindigul	97 - 4340
		Madurai	632 - 6520
12	Upper Bhavani	Coimbatore	597 - 4810
		Nilgiris	116 - 700
		Erode	660 - 4080

WATER QUALITY

As a part of field studies, 30 water (surface/ground) samples have been collected from representative sub-basins and analyzed. The details of sampling location and the results are given in Table-17 and Table-18 (a), (b) and (c) respectively.

Table-17: Water sampling locations in representative sub-basins

Sample	Sub-basin	Village
GW1	Krishnagiri – Pambar	Chettimarampatti
GW2	Gadana	Melambur
GW3	ThirumaniMuthar	Pillur
GW4	Upper Bhavani	Pellathi
GW5	Upper Bhavani	Nellithurai
GW6	Cheyyar	Idumankulam
GW7	Lower Vaigai	Thiyagavacheri
GW8	Lower Vaigai	Karendal
GW9	Lower Vaigai	Athiyuthi
GW10	Ponaniyar	Sathankulam
GW11	Ponaniyar	Gunthur
GW12	Vanniyar	Vachathi
GW13	Vanniyar	Alapuram
GW14	Vanniyar	Vachathi
GW15	Upper Palar	Echankal
GW16	Krishnagiri - Pambar	KilPaiyur
GW17	ThirumaniMuthar	Minnakkal
GW18	Upper Bhavani	Odanthurai
SW1	Krishnagiri – Pambar	Barur

SW2	Gadana	Gadana
SW3	Pazhayar	Arimanallur
SW4	Pazhayar	Pallakulam
SW5	ThirumaniMuthar	Minnakkal
SW6	Cheyyar	Kunnathur
SW7	Ponaniyar	Ponniyar Dam
SW8	Upper Palar	Kethandapatti
SW9	Upper Palar	Reddymakuppam
SW10	Gadana	Gowthamapuri
SW11	Pazhayar	Nallikulam
SW12	Cheyyar	Kunnathur

Note: GW: Ground Water, SW: Surface Water

Table-18 (a): Surface Water quality status in representative sub-basins

Parameters	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW9	SW10	SW11	SW12
pH	7.68	6.71	7.34	7.41	8.15	8.48	8.04	8.45	7.57	8.49	7.71	7.36
Turbidity, NTU	BDL	BDL	BDL	2	4	2	BDL	BDL	2	BDL	BDL	5
Total Hardness as $CaCO_3$, mg/l	220	6	24	100	240	155	165	85	180	150	68	290
Calcium as Ca, mg/l	52.1	1.2	5.61	28.05	96.19	32.06	38.07	16.03	48.09	28.05	16.03	52.1
Chloride as Cl, mg/l	212.8	2.47	9.9	79.18	484.98	66.81	39.59	54.44	44.54	153.41	14.85	237.54
Magnesium as Mg, mg/l	21.87	0.73	2.43	7.29	72.9	18.23	17.01	10.94	14.58	19.44	6.81	38.88
Total Dissolved Solids, mg/l	598	11	51	242	845	298	271	264	316	458	104	678
Sulphate as SO_4, mg/l	53.79	BDL	4.86	8.51	108.02	36.38	59.84	56.06	129.26	74.41	1.98	22.51
Fluoride, mg/l	0.57	BDL	BDL	0.41	0.66	0.44	0.39	0.41	0.43	0.51	BDL	0.63
Nitrate as NO_3, mg/l	4.02	BDL	1.24	3.22	4.46	3.24	2.98	3.16	3.02	4.02	1.98	4.68
Iron as Fe, mg/l	BDL	BDL	BDL	0.1	0.34	0.08	BDL	BDL	0.18	BDL	BDL	0.78
BOD,3 days @27°C, mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
COD, mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Dissolved oxygen, mg/l	6.1	6.4	6.4	6.2	6.3	6.1	6.4	6.4	6.2	6.1	6.5	6.2

Table-18 (b): Ground water quality status in representative sub-basins

Parameters	GW 1	GW 2	GW 3	GW 4	GW5	GW6	GW7	GW8	GW9
pH	7.98	8.22	7.77	8.37	7.98	7.67	8.54	7.57	8.17
Turbidity, NTU	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Total Hardness as $CaCO_3$, mg/l	580	210	1180	320	420	490	160	340	250
Calcium as Ca, mg/l	112.22	44.08	208.41	60.12	80.16	116.23	32.06	76.15	78.15
Chloride as Cl, mg/l	514.68	22.27	1059.05	84.13	54.44	509.73	217.75	89.08	22.27
Magnesium as Mg, mg/l	72.9	24.3	160.38	41.31	53.46	48.6	19.44	36.45	13.37
Total Dissolved Solids, mg/l	1457	278	2817	457	504	1191	611	521	337
Sulphate as SO_4, mg/l	148.82	20.79	564.66	95.34	100.21	19.15	15.77	15.36	14.57
Fluoride, mg/l	0.63	0.51	0.73	0.58	0.6	0.66	0.51	0.57	0.47
Nitrate as NO_3, mg/l	5.12	3.96	4.26	4.12	4.28	4.32	4.18	4.4	3.41
Iron as Fe, mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
BOD,3 days @27°C, mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
COD, mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Dissolved oxygen, mg/l	6	6.3	6	6.2	6.1	6	6.3	6.2	6.3

Table-18 (c): Ground Water quality status in representative sub-basins

Parameters	GW10	GW11	GW12	GW13	GW14	GW15	GW16	GW17	GW18
pH	7.45	7.38	7.65	7.86	7.58	7.89	8.03	7.21	7.48
Turbidity, NTU	BDL	3	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Total Hardness as $CaCO_3$, mg/l	1600	220	185	430	440	572	530	1854	512
Calcium as Ca, mg/l	288.57	40.08	32.06	112.22	104.2	108.21	140.28	215.2	100.2
Chloride as Cl, mg/l	1741.98	103.93	32.17	89.08	94.03	277.13	489.93	98.5	84.13
Magnesium as Mg, mg/l	213.86	29.16	24.3	36.45	43.75	72.9	43.74	364.5	63.18
Total Dissolved Solids, mg/l	3428	618	326	627	624	1178	1341	2456	604
Sulphate as SO_4, mg/l	35.9	44.37	34.88	91.12	64.77	187.17	138.85	383.58	70.19
Fluoride, mg/l	0.73	0.6	0.46	0.63	0.63	0.69	0.67	0.87	0.61
Nitrate as NO_3, mg/l	4.12	4.42	3.4	4.38	4.51	5.02	5.16	4.01	4.82
Iron as Fe, mg/l	BDL	0.13	BDL	BDL	BDL	BDL	BDL	BDL	BDL
BOD,3 days @27°C, mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
COD, mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Dissolved oxygen, mg/l	5.9	6.1	6.3	6.2	6.1	6.1	6.1	5.8	6.3

Surface water Quality

The pH level indicates that water for various basins are in neutral range (6.71-8.49). The total hardness in various water samples ranged from 6 to 290 mg/l. The total hardness level in samples was well below the permissible limit in most of the sub basins. The TDS level ranged from 11 to 845 mg/l. The concentration of various cations (Calcium, Magnesium, Iron etc.) and anions (Sulphates, Nitrates) were also well below the permissible limit. The concentration of chlorides ranged from 2.47 to 484.98 mg/l. The sulphates level in various seasons ranged from 1.98 to 129.26 mg/l. The sulphates level was well below the permissible limit of 200 mg/l. The fluoride

contents are low. The BOD values are well within the permissible limits, which indicates the absence of organic pollution loading. The dissolved oxygen of water is ranging from 5.8-6.5 mg/l shows the oxygen content is good for aquatic animals.

Ground water Quality

The pH level ranges from 7.21 to 8.54 in various sub basins covered as a part of the study. The high hardness level indicates the presence of magnesium and calcium. Sulphates is one of the major anions occurring in natural water. It is an important parameter because of its cathartic affect, when it is present in higher concentration. The sulphates level ranged from 14.57 to 564.66 mg/l. The BOD values are well within the permissible limits, which indicates the absence of organic pollution loading. The dissolved oxygen of water is ranging from 5.8-6.3 mg/l. Total dissolved solids presence of saline water intrusion in some of the basins.

4.8 Forests

As per the India State of Forest Report 2015, Tamil Nadu state has about 22,877 sq.km of recorded forest area of about 17.59 per cent of the State's geographical area. The distribution of forest cover in Tamil Nadu is as follows:

- Very Dense Forest : 2.30%
- Moderately Dense Forest : 8.05%
- Open Forest : 9.91%
- Scrub : 0.32%
- Non-Forest : 79.42%

The diverse forest types found in Tamil Nadu are Tropical Wet Evergreen Forests, Tropical Semi-Evergreen Forests, Tropical Moist Deciduous Forests, Littoral and Swamp Forests, Tropical Dry Deciduous Forests, Tropical Thorn Forests, Tropical Dry Evergreen Forests, Sub-Tropical Broad Leaved Hill Forests and Montane Wet Temperate Forests. Prominent forest types for representative 12 sub-basins in Table 19 and dominant species in Table 20 respectively. The forest cover map and distribution of forest types of Tamil Nadu are shown in Figure 10 and 11 respectively. The forest classification map of 66 sub-basins and representative 12 sub-basins are given in Figures-12 and 13 respectively. However, the forest areas are not affected by the project as they lie outside the project area.

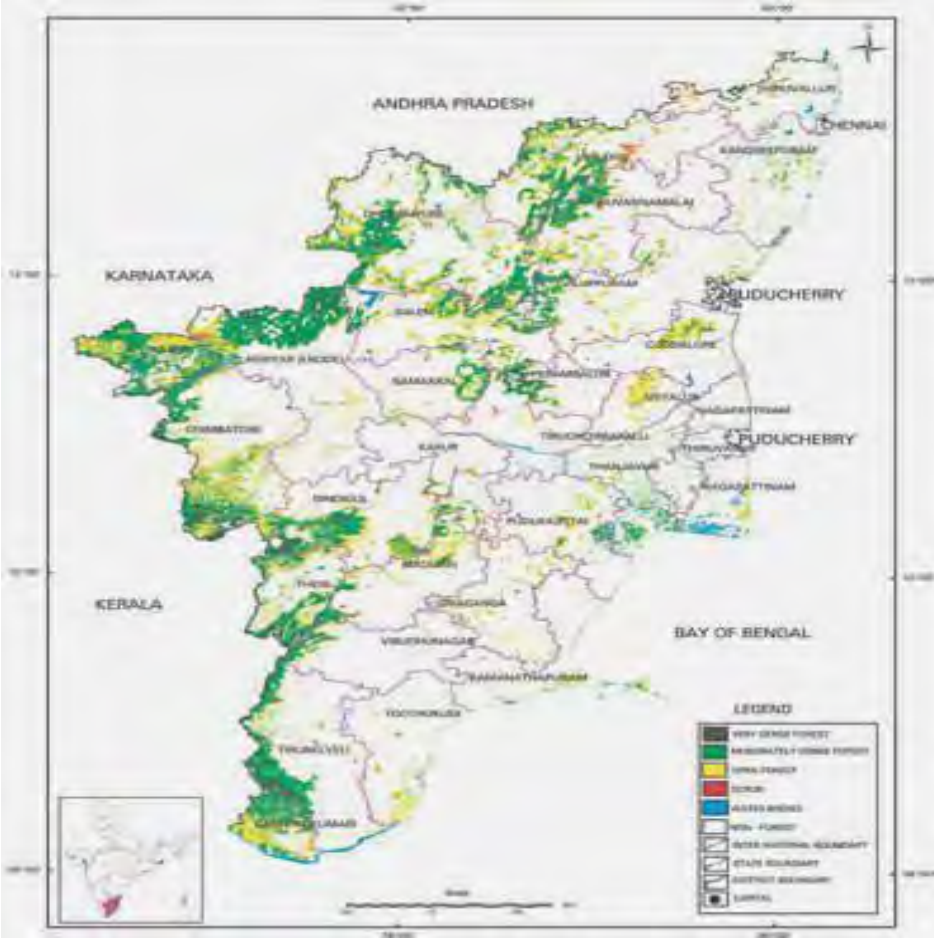

Figure 10: Forest Cover Map of Tamil Nadu

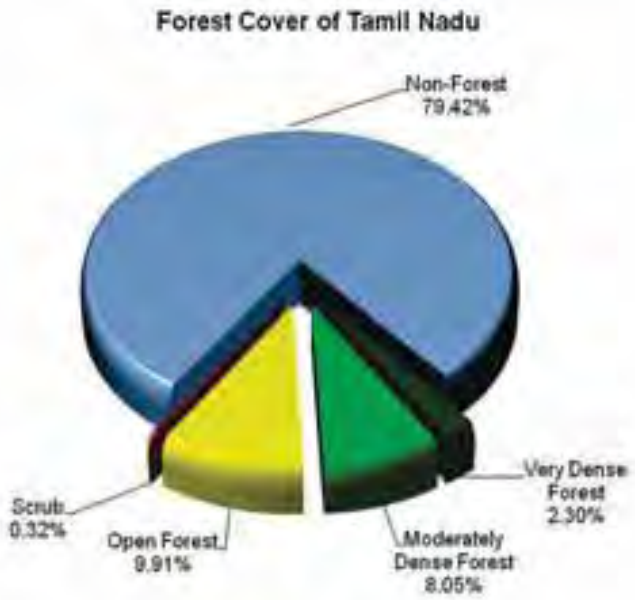

Figure 11: Forest Cover showing distribution of forest types in Tamil Nadu

Table 19: Prominent Forest Types for representative 12 sub-basins

S. No	Sub-Basin	Sub-Basin Districts	Prominent Forest Types
1	Cheyyar	Kancheepuram, Tiruvannamalai and Vellore	Evergreen / Semi evergreen and Deciduous
2	Upper Palar	Vellore	Scrub Forest and Forest Plantation
3	Krishnagiri to Pambar	Krishnagiri and Dharmapuri	Scrub Forest and Forest Plantation
4	Vaniyar	Dharmapuri and Salem	Deciduous
5	Gadana	Tirunelveli	Forest Plantation
6	Pazhayar	Kanyakumari	Deciduous
7	Ponnaniyar	Tiruchirapalli and Pudukottai	Scrub Forest and Deciduous
8	Cauvery Delta	Tiruchirapalli, Thanjavur, Tiruvarur and Nagappattinam	-
9	Thirumanimuthar	Namakkal and Salem	Scrub Forest
10	Lower Vaigai	Sivaganga and Ramanathapuram	-
11	Sathiyar Odai	Dindigul and Madurai	Evergreen / Semi evergreen and Deciduous
12	Upper Bhavani	Coimbatore, Nilgiris and Erode	Evergreen / Semi Evergreen, Deciduous and Scrub Forest

Table 20: Dominant Species for representative 12 sub-basins

Prominent Forest Types	Dominant Species
Evergreen / Semi evergreen	*Manilkara hexandra, Mimus opselengi, Diospyros ebenum, Strychnos nuxvomia, Strychnos potatorum, Diospyros chloroxylon, Drypetes sepiarea, Syzygium cumini, Canthirum decoccum, Ziziphus glaberrima, Acacia leucophloea, Catunare gamspinosa, Buchanania lanzan, Sapindae marginatus, Albizia amara, Albizia lebbek, Tamarindus indica, Azadirachta indica, Memecylonum bellatum* and *Diospyros ferrea*

Prominent Forest Types	Dominant Species
Deciduous	*Anogeisus latifolia, Albizia amara, A. odoratissima, Mangifera indica, Syzygium cumini, Pterocarpus marsupium, Tectona grandis, Acacia pinnata, Grewia tiliaefolia, Phyllanthus emblica etc.*
Forest Plantation	*Tectona grandis, Acacia ferruginea, Syzygium cumini, Pterocarpus marsupium, Acacia planifrons* etc.
Scrub Forest	*Acacia ferruginea*, *Acacia nilotica, Caryotaurens, Acacia chundra, Ziziphus xylopyrus, Borassus flabellifer* and *Tamarindus indica, Albizia amara, Mangifera indica, Eucalyptus* spp*, Albizzia lebbeck*, *Pongammia pinnata*

Cheyyar Sub-Basin

In Cheyyar Sub-Basin, prominent forest types are Evergreen/Semi-evergreen and deciduous forests which covers about 35 to 40% of sub-basin area. These forest patches are localised mostly in the south-western and western part of the sub-basin.

Upper Palar Sub-Basin

In Upper Palar Sub-Basin, prominent forest types are Scrub and Forest Plantation which covers less than 10% of sub-basin area. The forest types are mostly scattered in the central part of the sub-basin.

Krishnagiri to Pambar Sub-Basins

In Krishnagiri to Pambar Sub-Basin, prominent forest types are Scrub and Forest Plantation which covers less than 5% of sub-basin area. The forest types mostly are distributed in the northern and southern part of the sub-basin.

Vaniyar Sub-Basin

In Vaniyar Sub-Basin, prominent forest types are Evergreen/Semi-evergreen and deciduous forests which covers about 30-35% of sub-basin area. The forest types are mostly scattered in the south and eastern part of the sub-basin.

Gadana Sub-Basin

In Gadana Sub-Basin, prominent forest type is Forests plantation which covers about 20% of sub-basin area. The forest type is concentrated towards the western part of the sub-basin.

Pazhayar Sub-Basin

In Pazhayar Sub-Basin, prominent forest type is Deciduous which covers about 15-20% of sub-basin area. The forest type is localised in the north westernand north eastern part of the sub-basin.

Ponnaniyar Sub-Basin

In Ponnaniyar Sub-Basin, prominent forest types are Scrub and deciduous forests which covers less than 5% of sub-basin area and are scattered in the south-western part of the sub-basin.

Cauvery Delta Sub-Basin

In Cauvery Delta Sub-Basin, there are no prominent forest types except few patches of mangroves plantations in the southern part of the sub-basin.

Thirumanimuthar Sub-Basin

In Thirumanimuthar Sub-Basin, prominent forest type is Scrub which covers less than 5% of sub-basin area and is scattered in the north-eastern part of the sub-basin.

Lower Vaigai Sub-Basin

In Lower Vaigai Sub-Basin, forest area is not observed.

Sathiyar Odai Sub-Basin

In Sathiyar Odai Sub-Basin, the prominent forest types are Evergreen/Semi-evergreen and deciduous forests which covers about 20-25% of sub-basin area. The forest types are mostly scattered in the north-western part of the sub-basin.

Upper Bhavani Sub-Basin

The prominent forest types in Upper Bhavani Sub-Basin are Evergreen/Semi-evergreen, deciduous and scrub forests which cover about 55-60% of sub-basin area. This sub-basin has the maximum forest cover which has presence in almost all the areas of the sub-basin except for some parts of the eastern and western region of the sub-basin.

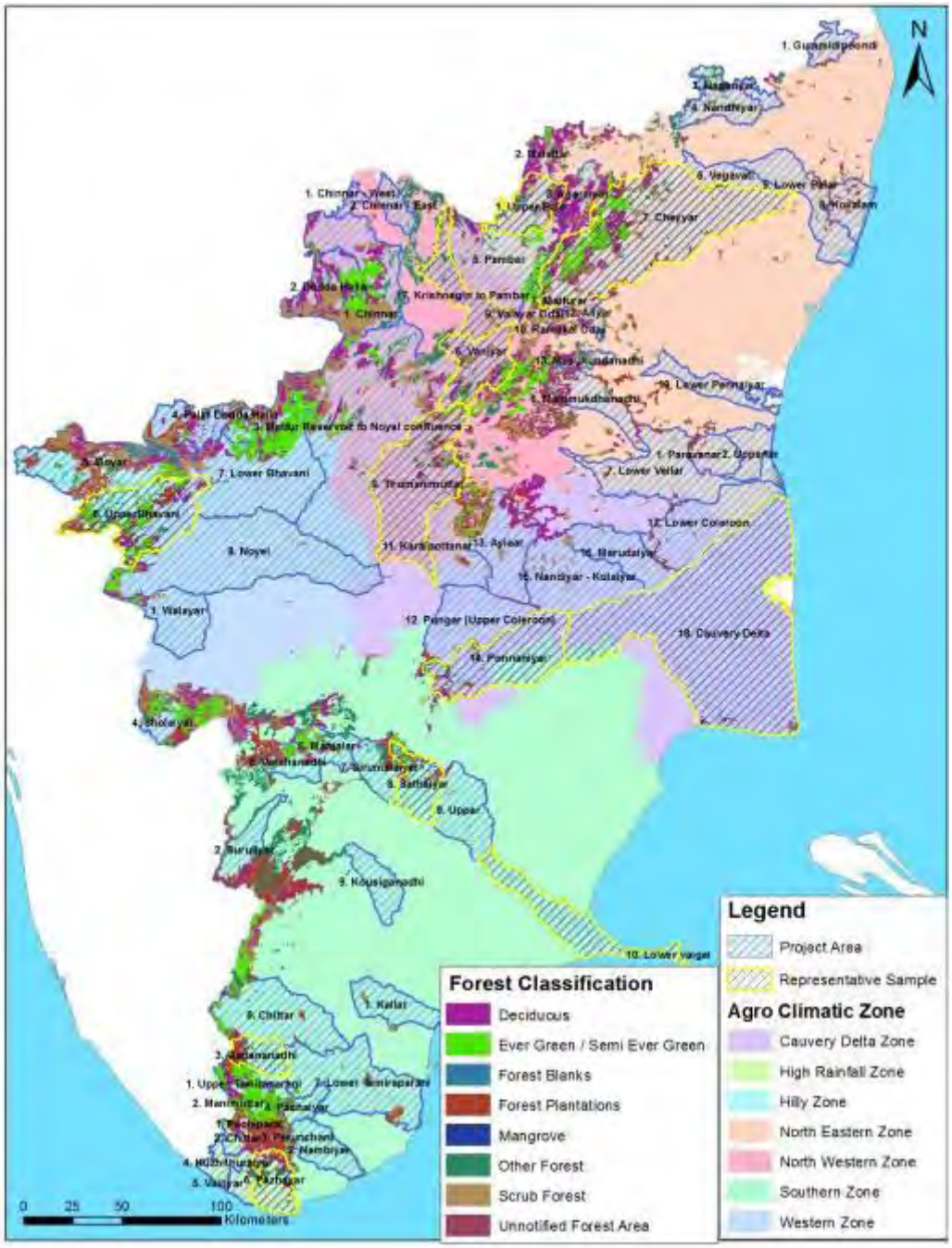

Figure 12: Forest Classification Map of 66 sub-basins

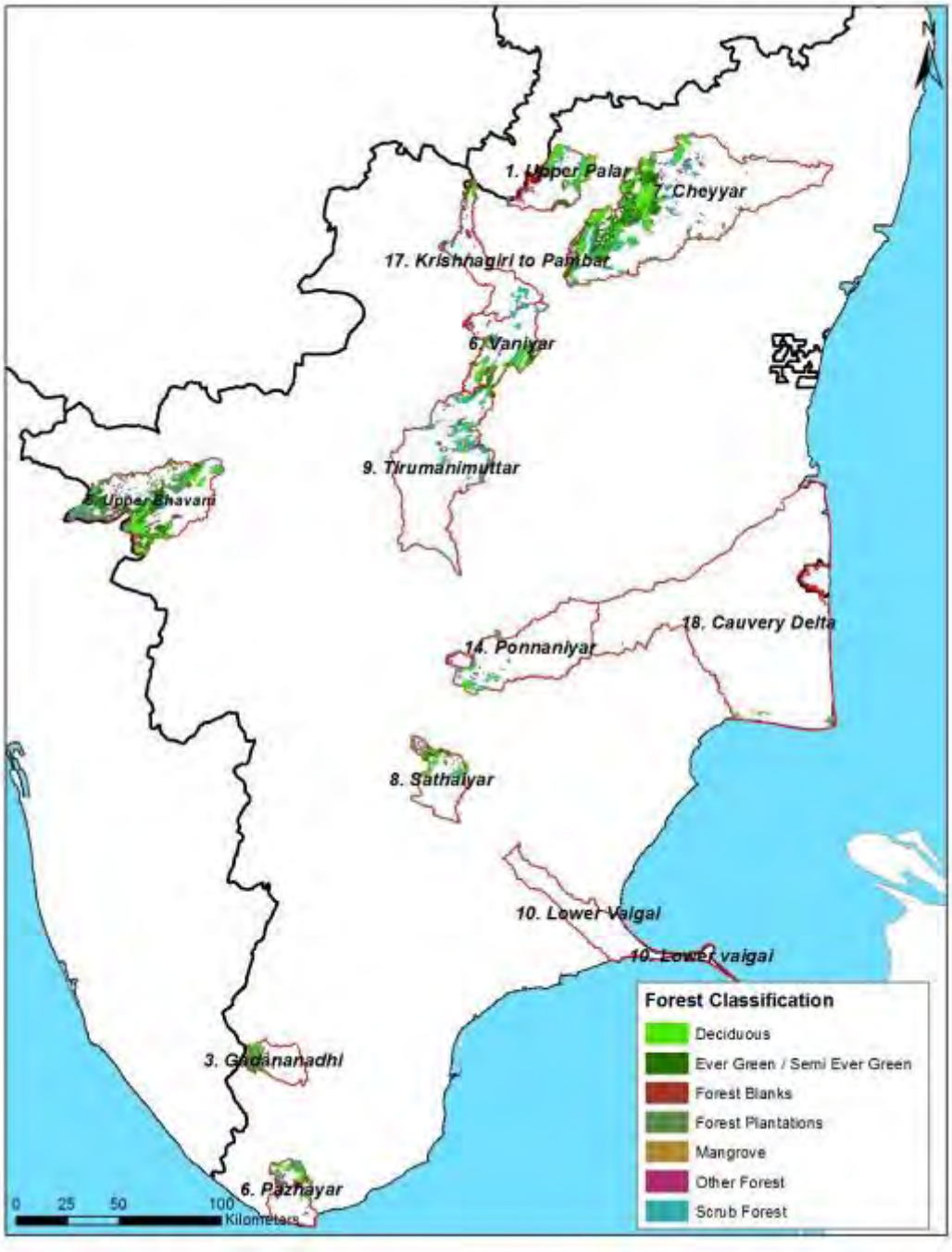

Figure 13: Forest Classification Map of representative 12 sub-basins

Protected Areas

The protected areas namely: Agasthiyarmalai Biosphere reserve and Point Calimere wild life sanctuary only comes within Gadana and Cauvery Delta Sub-Basin area respectively. These protected areas (Wild Life Sancturies) have numerous faunal species which are protected under Wild Life Protection Act 1972.

Reserve Forest areas are present in 6 sub-basins area namely: Cheyyar, Upper Palar, Krishnagiri to Pambar, Vaniyar, Thirumanimuthar, Sathaiyar Odai and Upper Bhavani Sub-Bain. However, the wildlife sanctuary, Biosphere reserve are not affected by the project as they lie outside the project area.

Wetlands

Wetlands are unique ecosystems which provide water and habitat for a diverse range of plants and animals. Natural wetlands occur where surface water collects or where groundwater discharges to the surface. The project interventions related to rehabilitation of tanks involves few water bodies which support avi-fauna especially, in the Pazhayar and Gadana sub-basins.

4.9 Land Use

Tamil Nadu has total geographical area of 13,006 thousand hectares and has the landuse pattern is depicted in Table-21.

Table-21: Land use pattern of Tamil Nadu

Land Use	Area (ha)	Percentage
Forests	2,125,000	16.31
Not available for cultivation	2,672,000	20.50
Culturable wasteland	328,000	2.52
Fallow lands other than current fallows	1,696,000	13.01
Current fallows	1,308,000	10.04
Net area sown	4,544,000	34.87

Source: Landuse Statistics, Ministry of Agriculture, GoI, 2012-13.

The landuse classification for 66 sub-basins and representative 12 sub-basins are given in Figures-14 and 15 respectively.

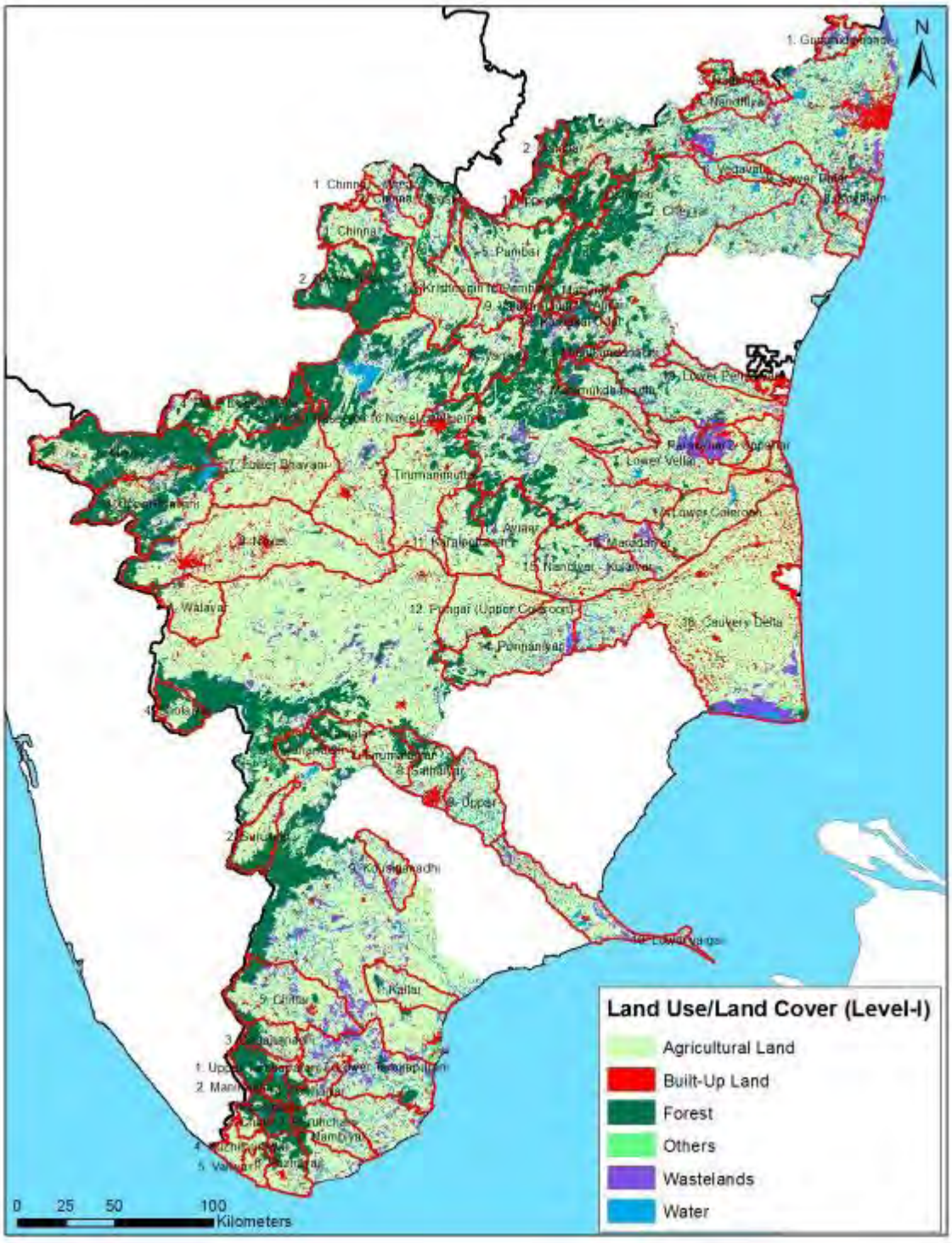

Figure 14: Land Use/Land Cover map for 66 sub-basins

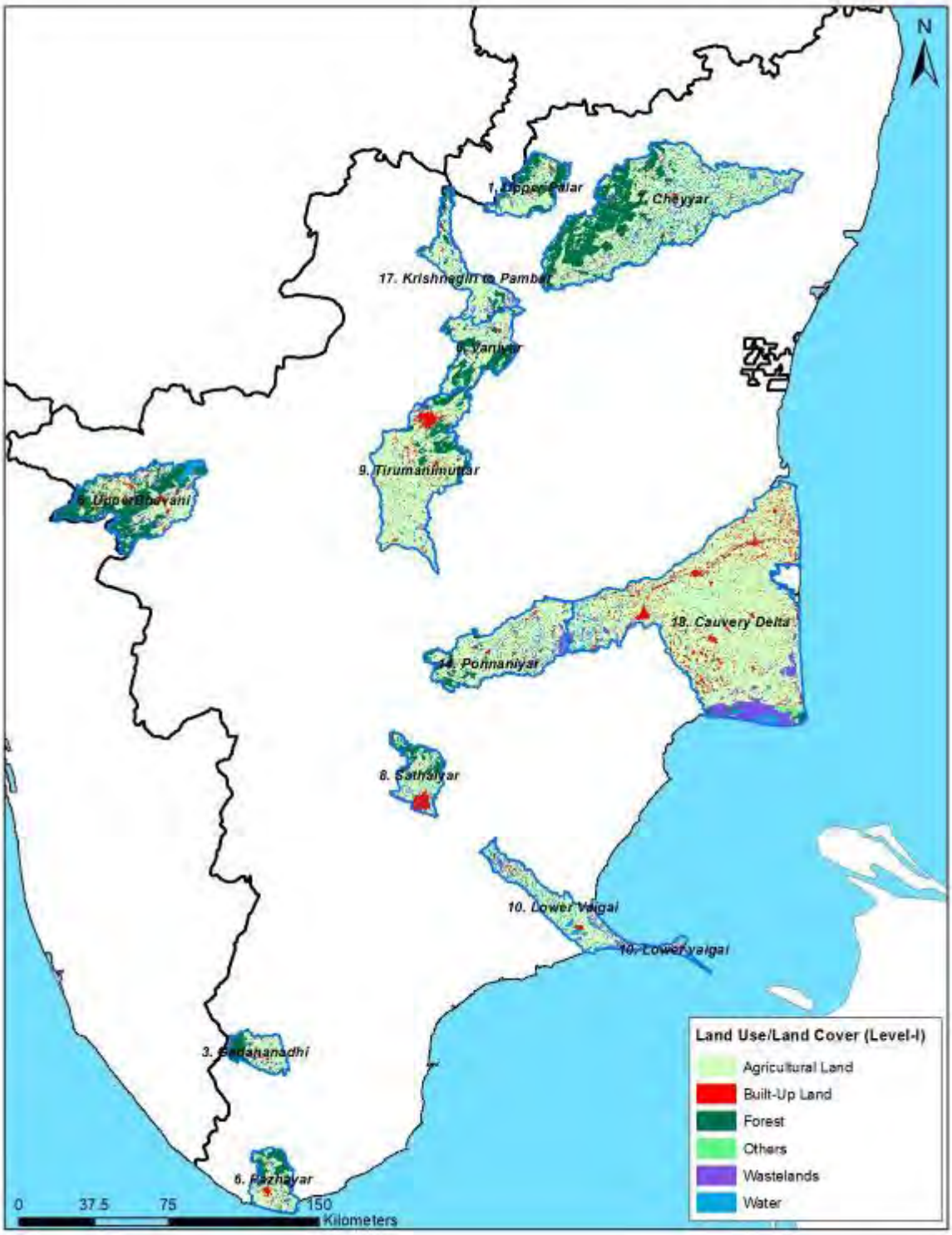

Figure 15: Land Use/Land Cover map for representative 12 sub-basins

Land Use - Cheyyar Sub-basin

The landuse pattern of the Cheyyar sub-basin area has been studied using satellite data. The IRS, 1C-LISS IV digital satellite data has been procured from National Remote Sensing Agency (NRSA), Hyderabad for assessing the landuse pattern of the sub-basin area. The raw satellite imagery has been processed in-house using ERDAS IMAGINE software. The raw and classified satellite imagery are given in **Figure-16** and **Figure-17** respectively. The signals of satellite imagery were verified by performing ground truthing and then final classification of satellite imagery was done. Based on this classification the landuse pattern of the study area was obtained.

It is observed from the Table-22, that the major portion of sub-basin area is occupied by vegetation (49.52%). Area under agriculture and barren land accounts for about 25.68% and 22.31% of the total study area respectively. The area under settlement is about 0.05%.

Table-22: Landuse pattern of the Cheyyar sub-basin

Category	Area (ha)	Area (%)
Water Body	6615	1.52
Vegetation	216141	49.52
Scrub	4027	0.92
Agricultural Land	112087	25.68
Settlement	228	0.05
Barren/Open Land	97376	22.31
Total	**436474**	**100.00**

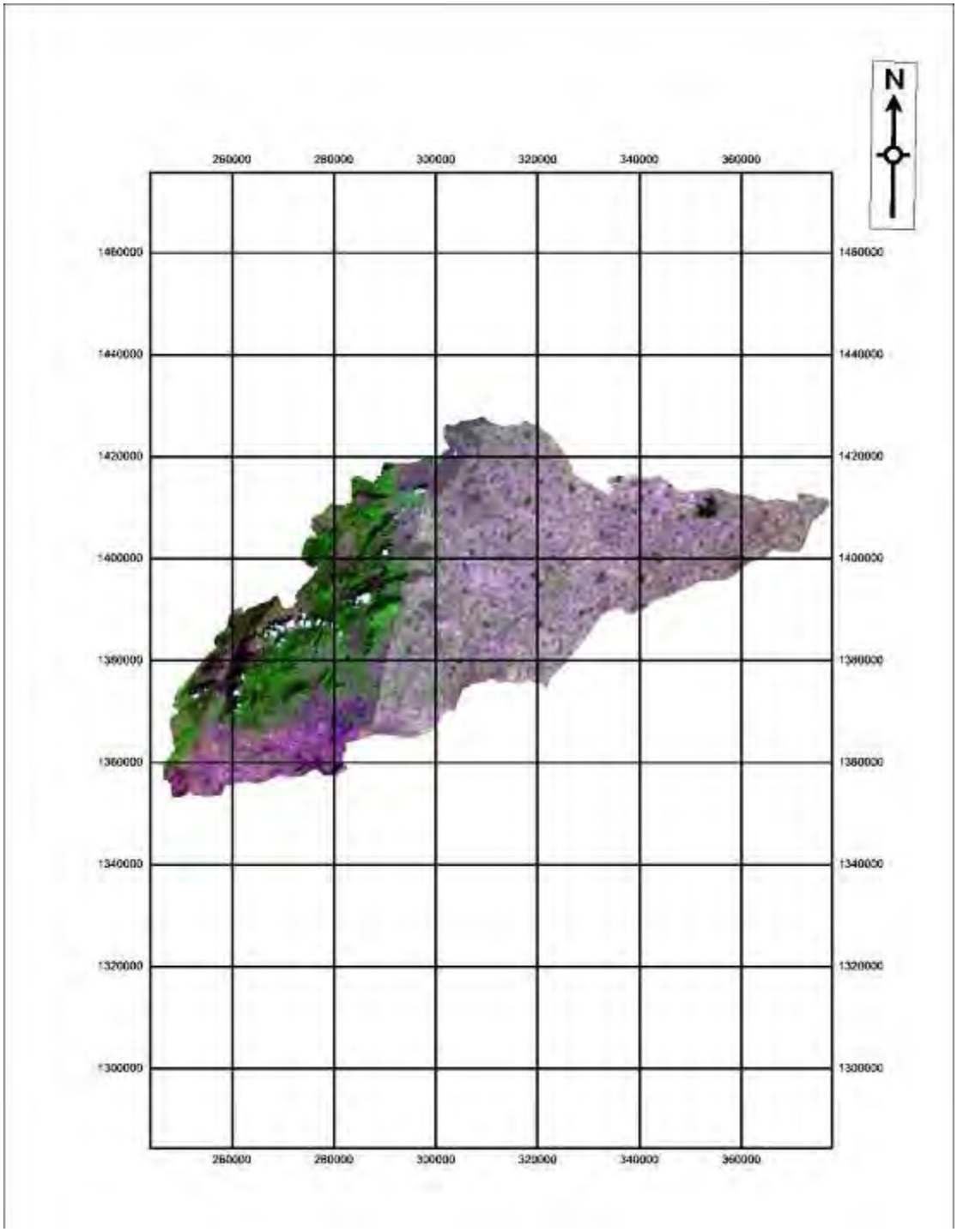

Figure-16: Satellite Imagery (FCC) of Cheyyar Sub-basin area

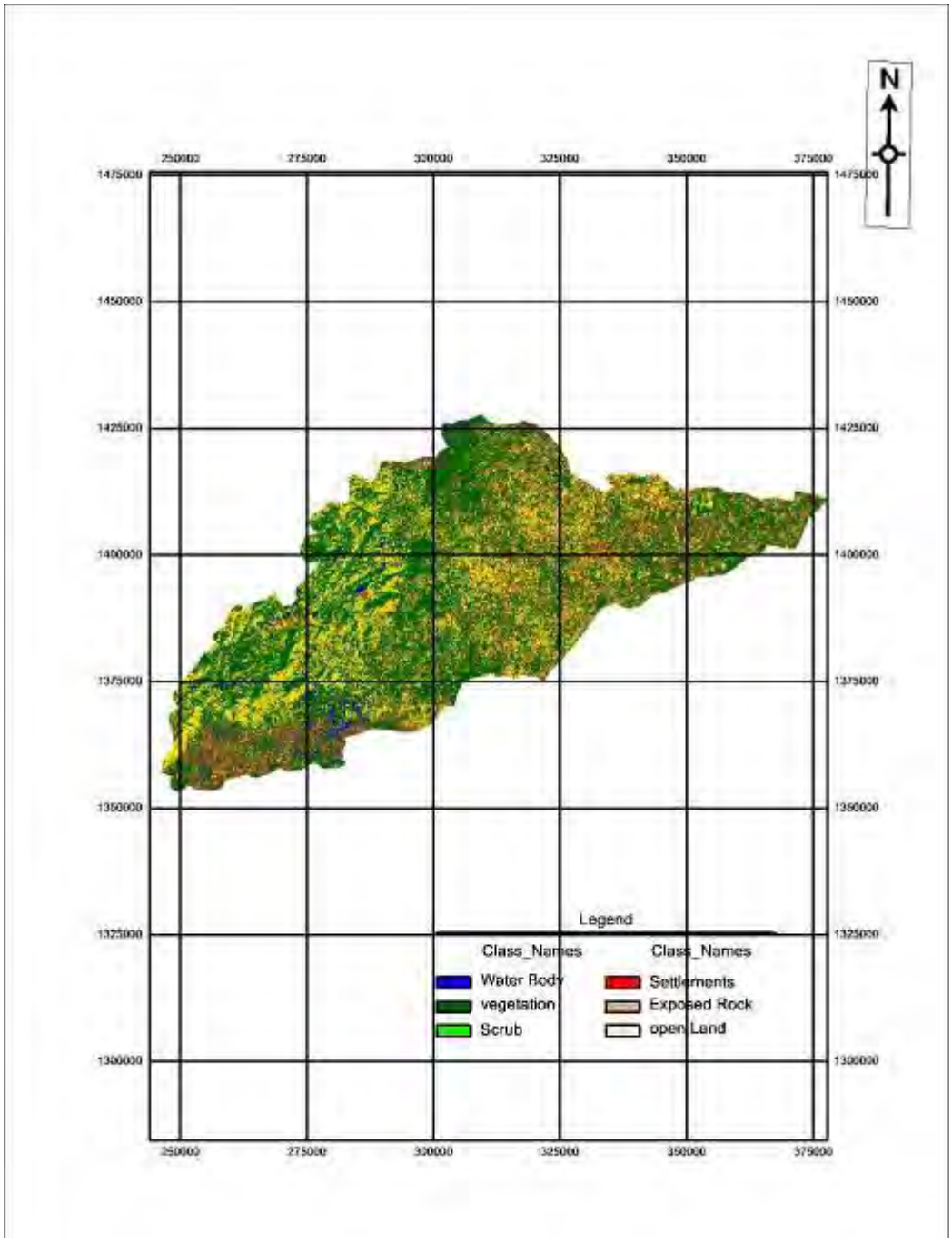

Figure-17: Classified Imagery of Cheyyar Sub-basin area

Land Use – Upper Palar Sub-basin

The landuse pattern of the Upper Palar sub-basin area has been studied using satellite data. The IRS, 1C-LISS IV digital satellite data has been procured from National Remote Sensing Agency (NRSA), Hyderabad for assessing the landuse pattern of the sub-basin area. The raw satellite imagery has been processed in-house using ERDAS IMAGINE software. The raw and classified satellite imagery are given in **Figure-18** and **Figure-19** respectively. The signals of satellite imagery were verified by performing ground truthing and then final classification of satellite imagery was done. Based on this classification the landuse pattern of the study area was obtained.

It is observed from the Table-23, that the major portion of sub-basin area is occupied by vegetation (43.90%). Area under agriculture and barren land accounts for about 12.09% and 25.50% of the total study area respectively. The area under settlement is about 0.05%.

Table -23: Landuse pattern of the Upper Palar sub-basin

Category	Area (ha)	Area (%)
Water Body	253	0.34
Vegetation	32601	43.90
Scrub	12953	17.44
Agricultural Land	8977	12.09
Settlement	543	0.73
Barren/Open Land	18940	25.50
Total	**74267**	**100.00**

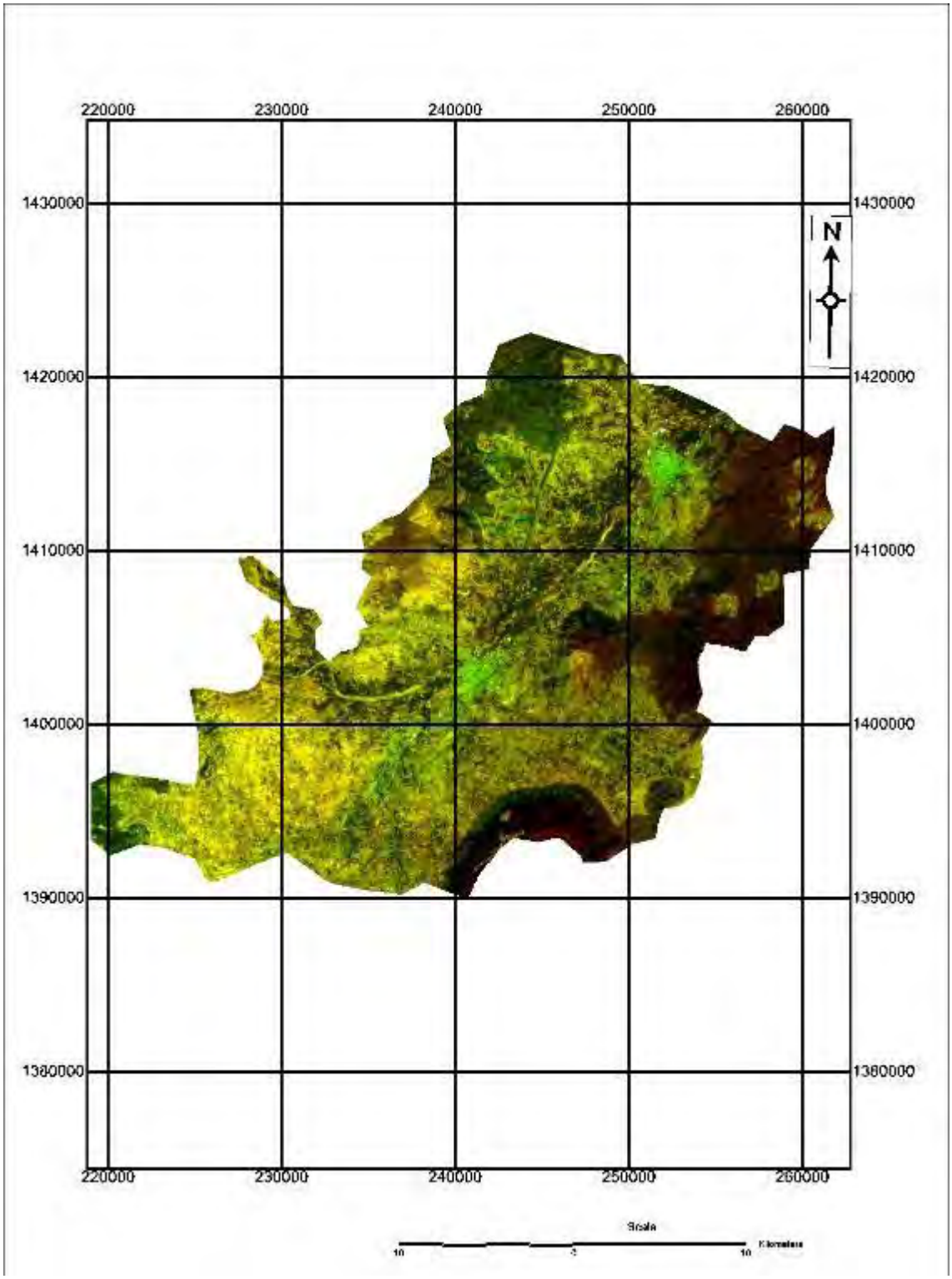

Figure-18: Satellite Imagery (FCC) of Upper Palar Sub-basin area

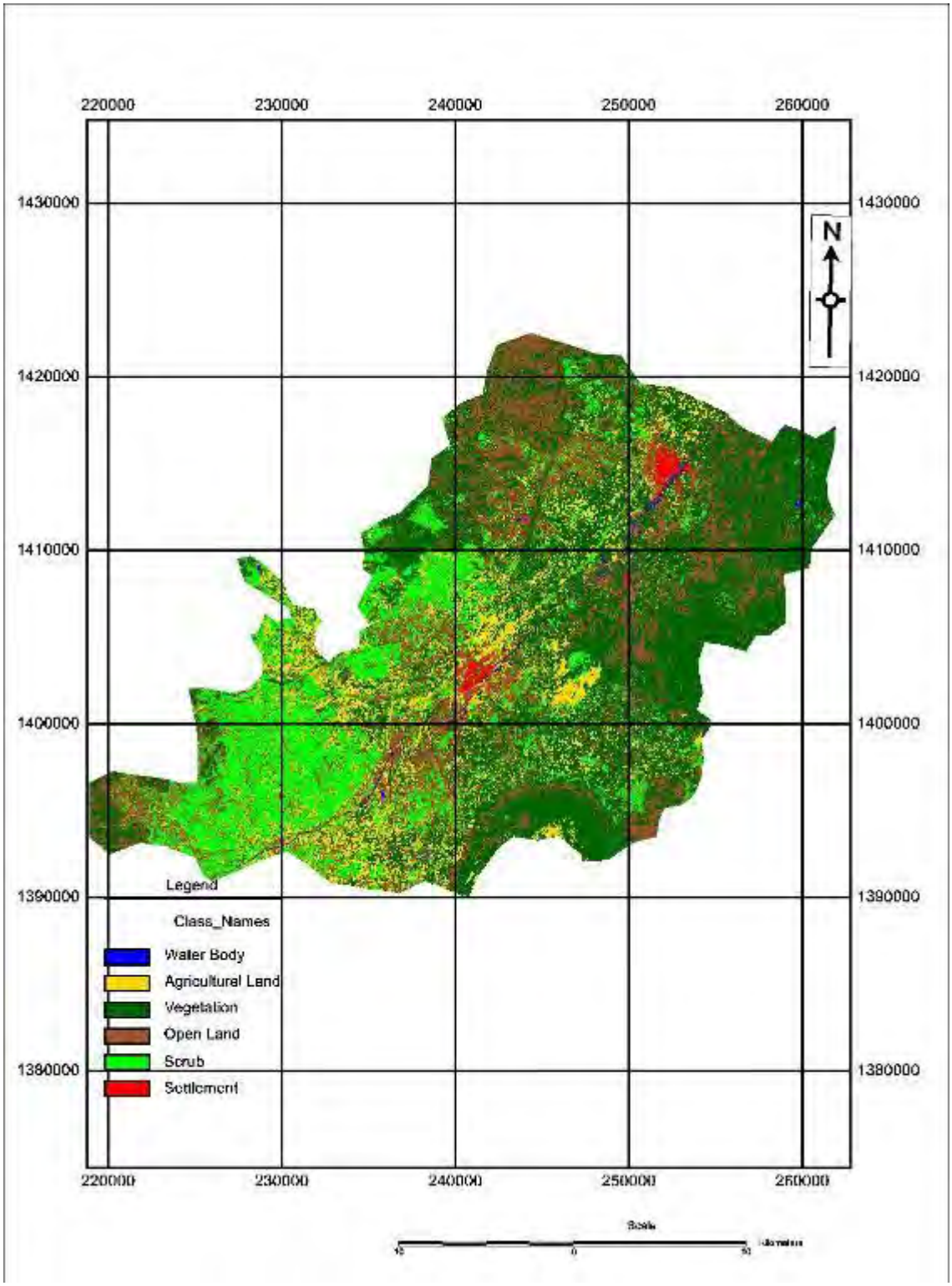

Figure-19: Satellite Imagery (FCC) of Upper Palar Sub-basin area

Land Use – Krishnagiri to Pambar Sub-basin

The landuse pattern of the Krishnagiri to Pambar sub-basin area has been studied using satellite data. The IRS, 1C-LISS IV digital satellite data has been procured from National Remote Sensing Agency (NRSA), Hyderabad for assessing the landuse pattern of the sub-basin area. The raw satellite imagery has been processed in-house using ERDAS IMAGINE software. The raw and classified satellite imagery are given in **Figure-20** and **Figure-21** respectively. The signals of satellite imagery were verified by performing ground truthing and then final classification of satellite imagery was done. Based on this classification the landuse pattern of the study area was obtained.

It is observed from the Table-24, that the major portion of sub-basin area is occupied by vegetation (47.41%). Area under agriculture and waterbodies accounts for about 45.75% and 2.12% of the total study area respectively. The area under settlement is about 0.75%.

Table -24: Landuse pattern of the Krishnagiri to Pambar sub-basin

Category	Area (ha)	Area (%)
Water Body	1937	2.12
Vegetation	43278	47.41
Scrub	1928	2.11
Agricultural Land	41764	45.75
Settlement	681	0.75
Open Land	1701	1.86
Total	**91289**	**100.00**

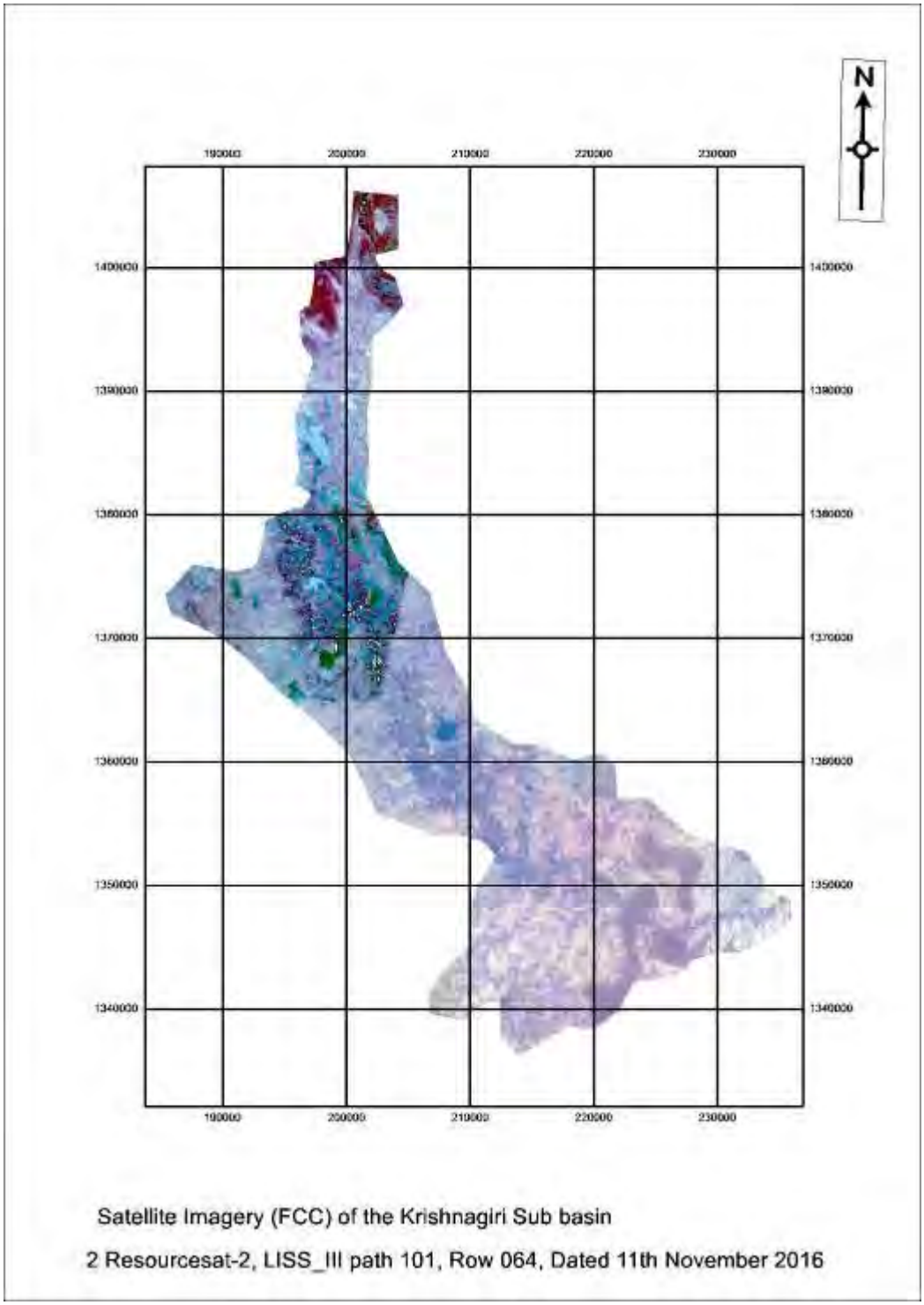

Figure-20: Satellite Imagery (FCC) of Krishnagiri to Pambar Sub-basin area

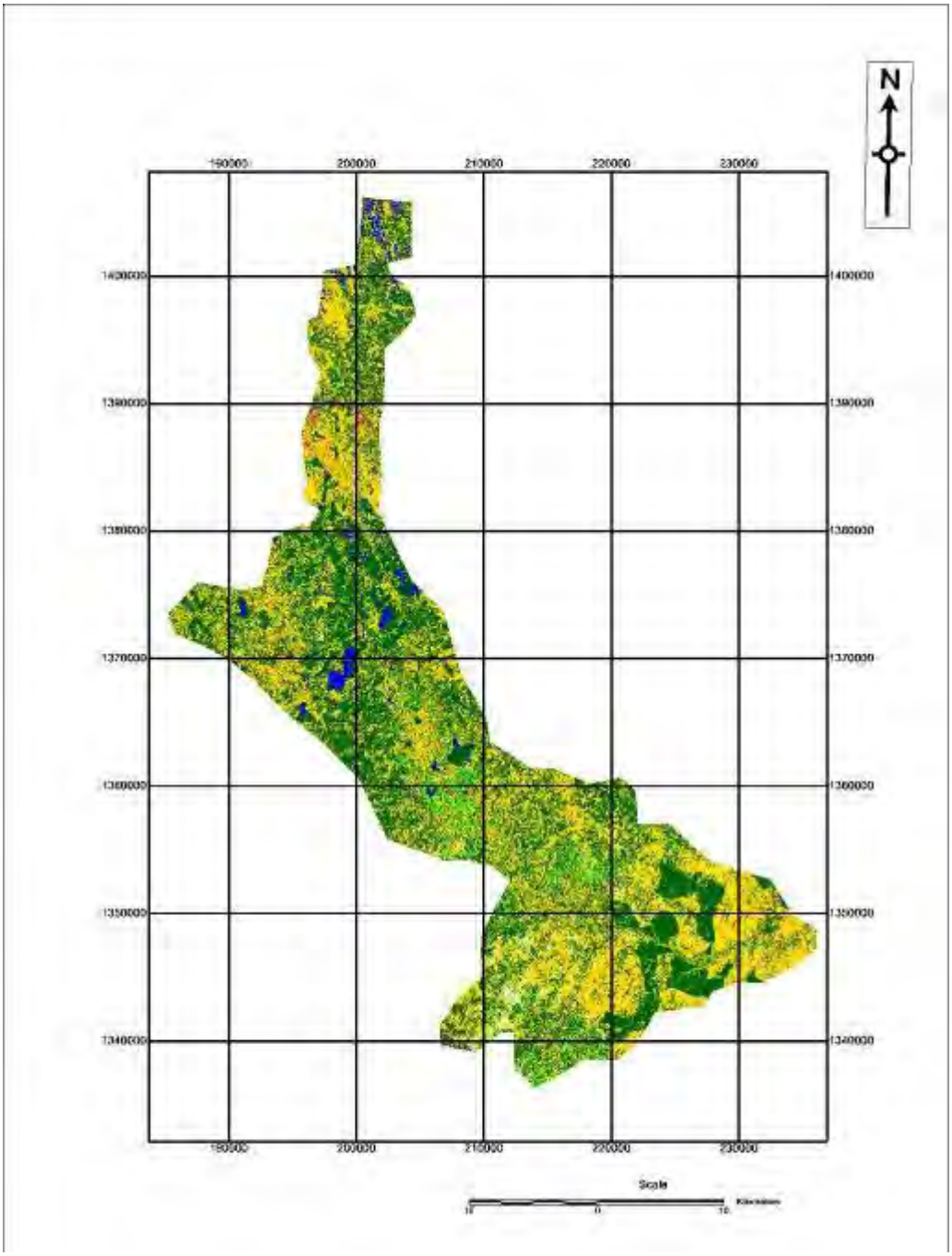

Figure-21: Classified Imagery of Krishnagiri to Pambar Sub-basin area

Land Use – Vaniyar Sub-basin

The landuse pattern of the Krishnagiri to Pambar sub-basin area has been studied using satellite data. The IRS, 1C-LISS IV digital satellite data has been procured from National Remote Sensing Agency (NRSA), Hyderabad for assessing the landuse pattern of the sub-basin area. The raw satellite imagery has been processed in-house using ERDAS IMAGINE software. The raw and classified satellite imagery are given in **Figure-22** and **Figure-23** respectively. The signals of satellite imagery were verified by performing ground truthing and then final classification of satellite imagery was done. Based on this classification the landuse pattern of the study area was obtained.

It is observed from the Table-25, that the major portion of sub-basin area is occupied by vegetation (47.33%). Area under agriculture and barren/open land accounts for about 37.67% and 12.01% of the total study area respectively. The area under settlement is about 0.11%.

Table-25: Landuse pattern of the Vaniyar sub-basin

Category	Area (ha)	Area (%)
Water Body	1058	1.05
Vegetation	47541	47.33
Scrub	1841	1.83
Agricultural Land	37843	37.67
Settlement	108	0.11
Barren/Open Land	12064	12.01
Total	**100455**	**100.00**

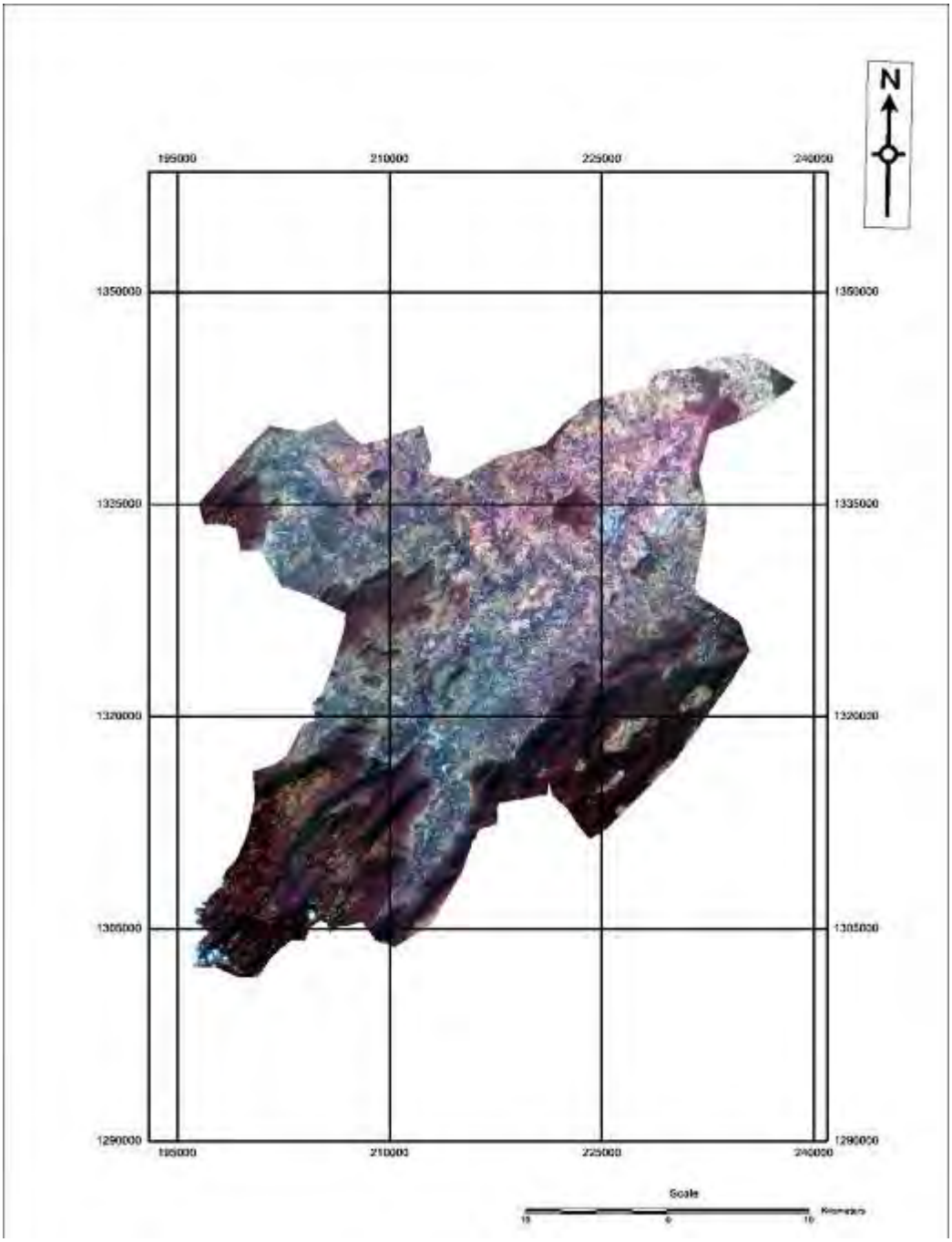

Figure-22: Satellite Imagery (FCC) of Vaniyar Sub-basin area

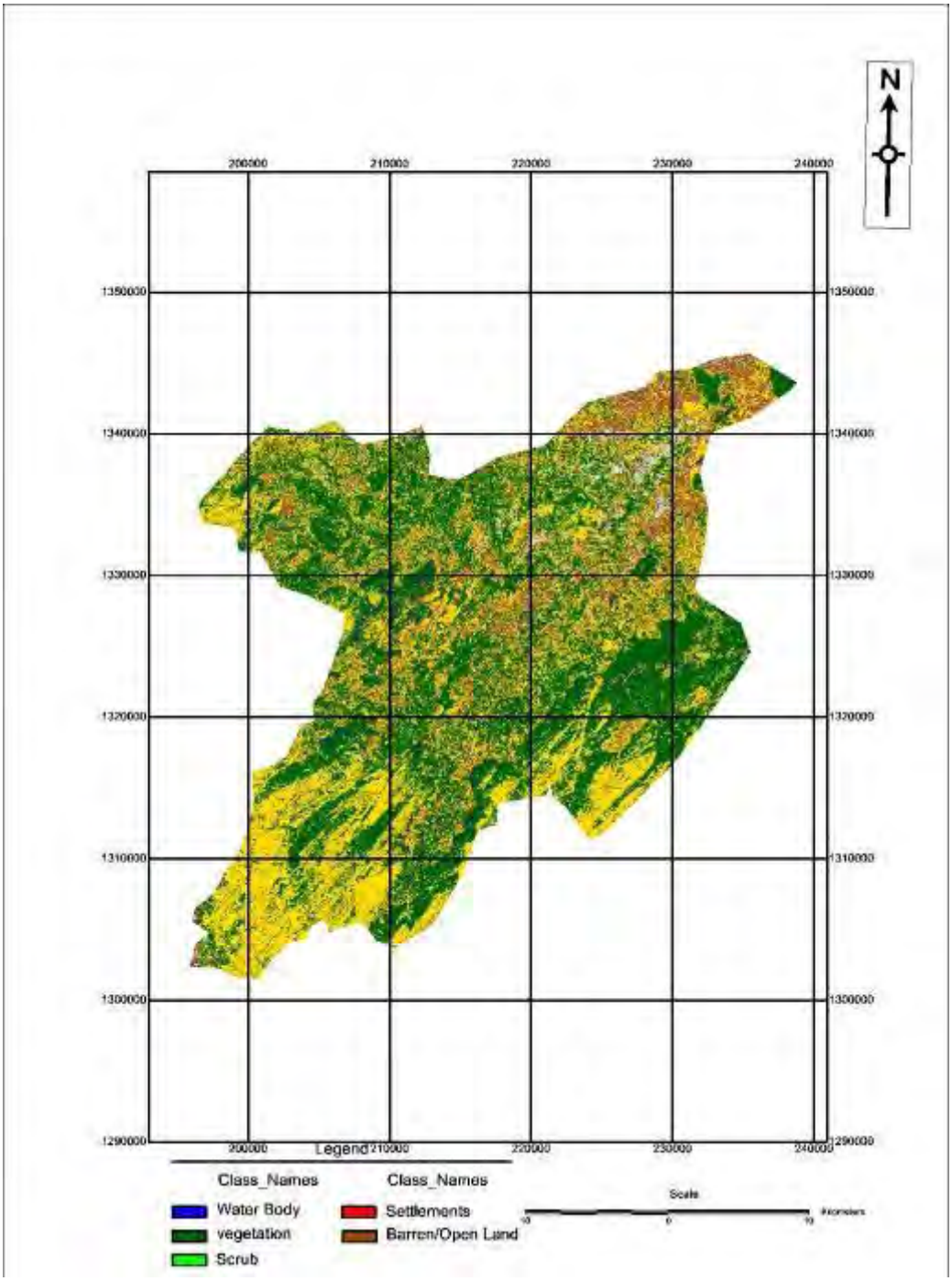

Figure-23: Classified Imagery of Vaniyar Sub-basin area

Land Use – Gadana Sub-basin

The landuse pattern of the Gadana sub-basin area has been studied using satellite data. The IRS, 1C-LISS IV digital satellite data has been procured from National Remote Sensing Agency (NRSA), Hyderabad for assessing the landuse pattern of the sub-basin area. The raw satellite imagery has been processed in-house using ERDAS IMAGINE software. The raw and classified satellite imagery are given in **Figure-24** and **Figure-25** respectively. The signals of satellite imagery were verified by performing ground truthing and then final classification of satellite imagery was done. Based on this classification the landuse pattern of the study area was obtained.

It is observed from the Table-26, that the major portion of sub-basin area is occupied by vegetation (41.96%). Area under scrub and agricultural land accounts for about 27.75% and 24.80% of the total study area respectively. The area under settlement is about 0.72%.

Table-26: Landuse pattern of the Gadana sub-basin

Category	Area (ha)	Area (%)
Water Body	1306	2.88
Vegetation	18999	41.96
Scrub	12568	27.75
Agricultural Land	11229	24.80
Settlement	324	0.72
Exposed Rock	636	1.40
Open Land	221	0.49
Total	**45283**	**100.00**

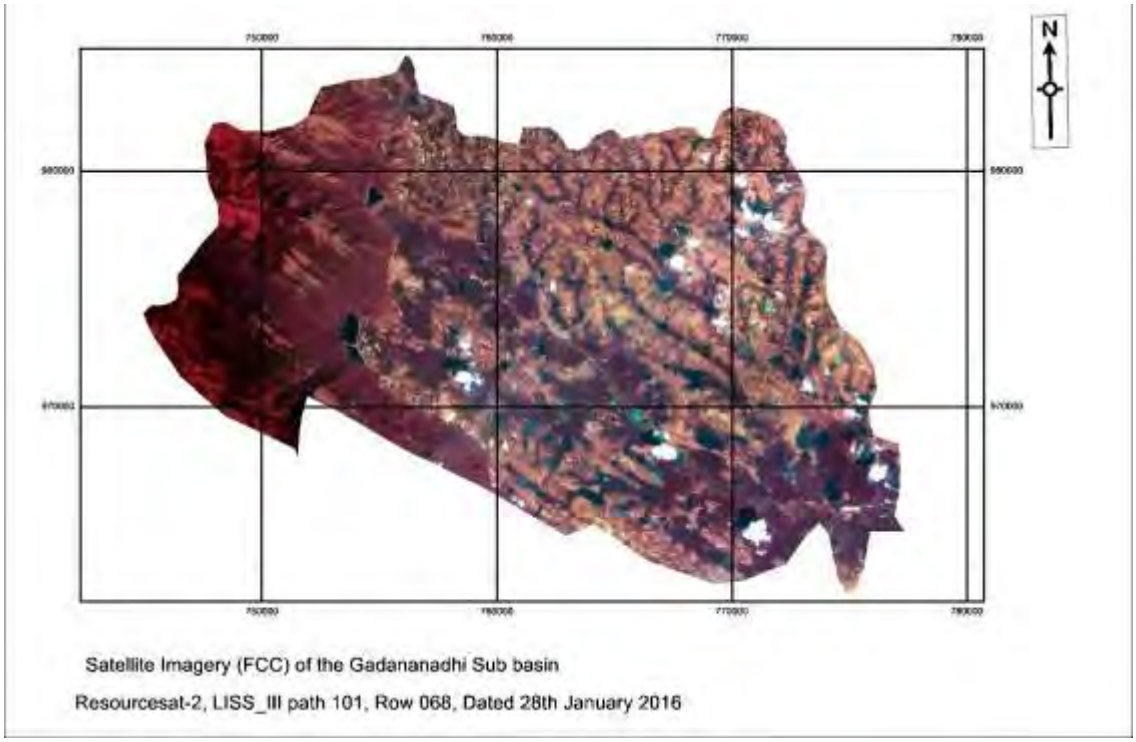

Figure-24: Satellite Imagery (FCC) of Gadana Sub-basin area

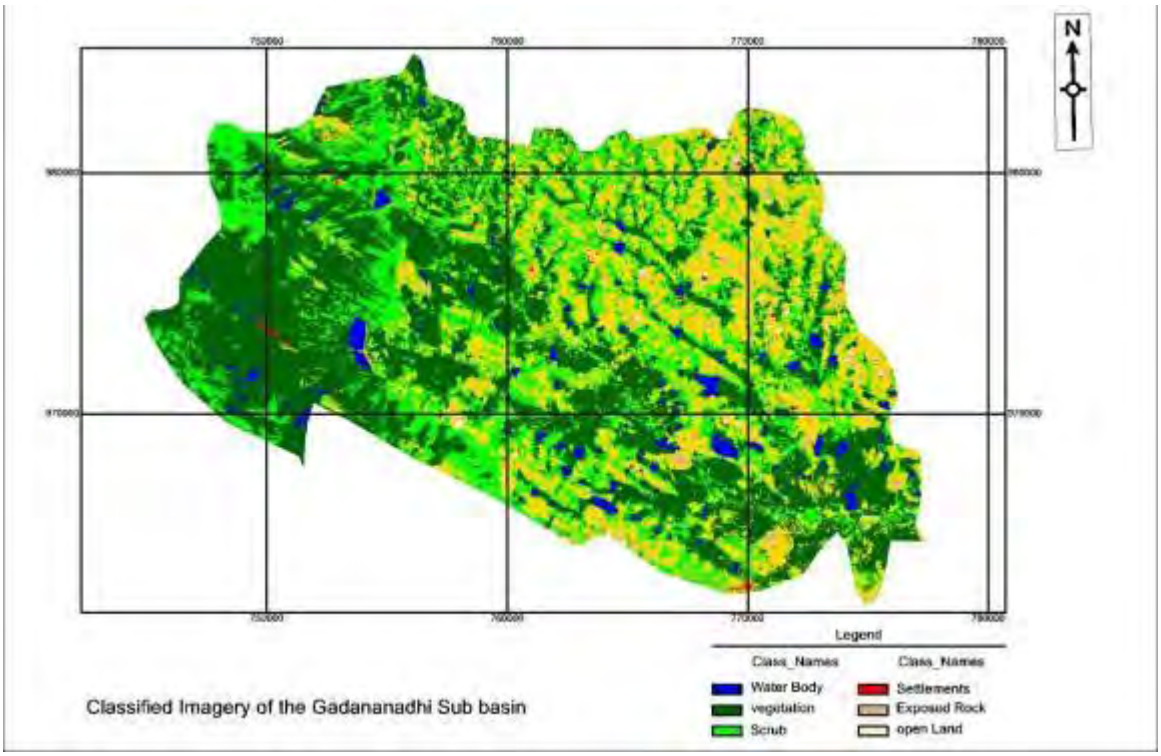

Figure-25: Classified Imagery of Gadana Sub-basin area

Land Use – Pazhayar Sub-basin

The landuse pattern of the Pazhayar sub-basin area has been studied using satellite data. The IRS, 1C-LISS IV digital satellite data has been procured from National Remote Sensing Agency (NRSA), Hyderabad for assessing the landuse pattern of the sub-basin area. The raw satellite imagery has been processed in-house using ERDAS IMAGINE software. The raw and classified satellite imagery are given in **Figure-26** and **Figure-27** respectively. The signals of satellite imagery were verified by performing ground truthing and then final classification of satellite imagery was done. Based on this classification the landuse pattern of the study area was obtained.

It is observed from the Table-27, that the major portion of sub-basin area is occupied by vegetation (37.30%). Area under scrub and exposed rock accounts for about 28.71% and 20.50% of the total study area respectively. The area under settlement is about 1.51%.

Table-27: Landuse pattern of the Pazhayar sub-basin

Category	Area (ha)	Area (%)
Water Body	2479	4.31
Vegetation	21441	37.30
Scrub	16503	28.71
Agricultural Land	3620	6.30
Settlement	867	1.51
Exposed Rock	11786	20.50
Open Land	786	1.37
Total	**57482**	**100.00**

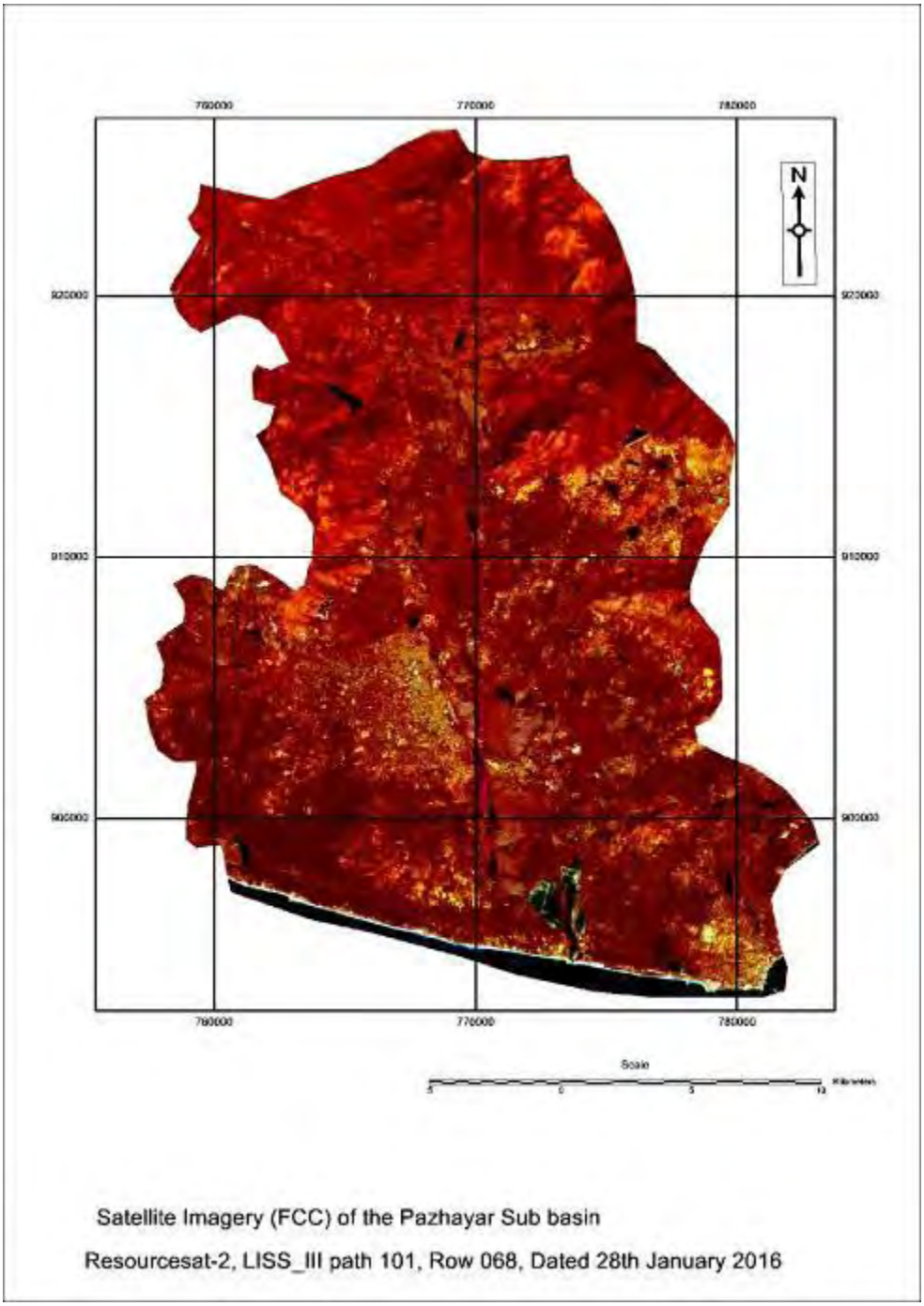

Figure-26: Satellite Imagery (FCC) of Pazhayar Sub-basin area

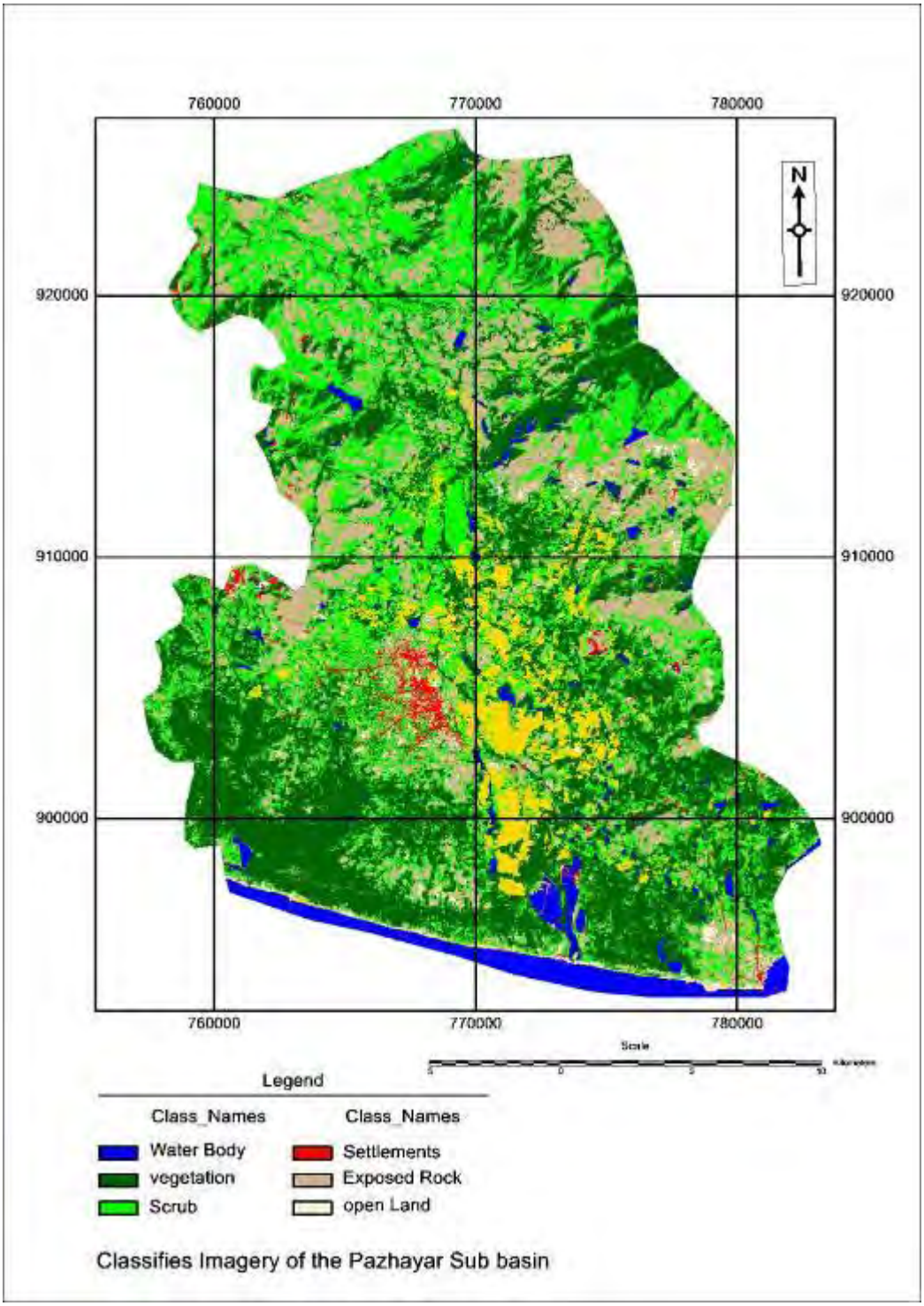

Figure-27: Classified Imagery of Pazhayar Sub-basin area

Land Use – Ponnaniyar Sub-basin

The landuse pattern of the Ponnaniyar sub-basin area has been studied using satellite data. The IRS, 1C-LISS IV digital satellite data has been procured from National Remote Sensing Agency (NRSA), Hyderabad for assessing the landuse pattern of the sub-basin area. The raw satellite imagery has been processed in-house using ERDAS IMAGINE software. The raw and classified satellite imagery are given in **Figure-28** and **Figure-29** respectively. The signals of satellite imagery were verified by performing ground truthing and then final classification of satellite imagery was done. Based on this classification the landuse pattern of the study area was obtained.

It is observed from the Table-28, that the major portion of sub-basin area is occupied by vegetation (44.30%). Area under barren/open land and agricultural land accounts for about 29.41% and 21.94% of the total study area respectively. The area under settlement is about 2.41%.

Table-28: Landuse pattern of the Ponnaniyar sub-basin

Category	Area (ha)	Area (%)
Water Body	2060	1.14
Vegetation	80308	44.30
Scrub	1443	0.80
Agricultural Land	39780	21.94
Settlement	4368	2.41
Barren/Open Land	53322	29.41
Total	**181281**	**100.00**

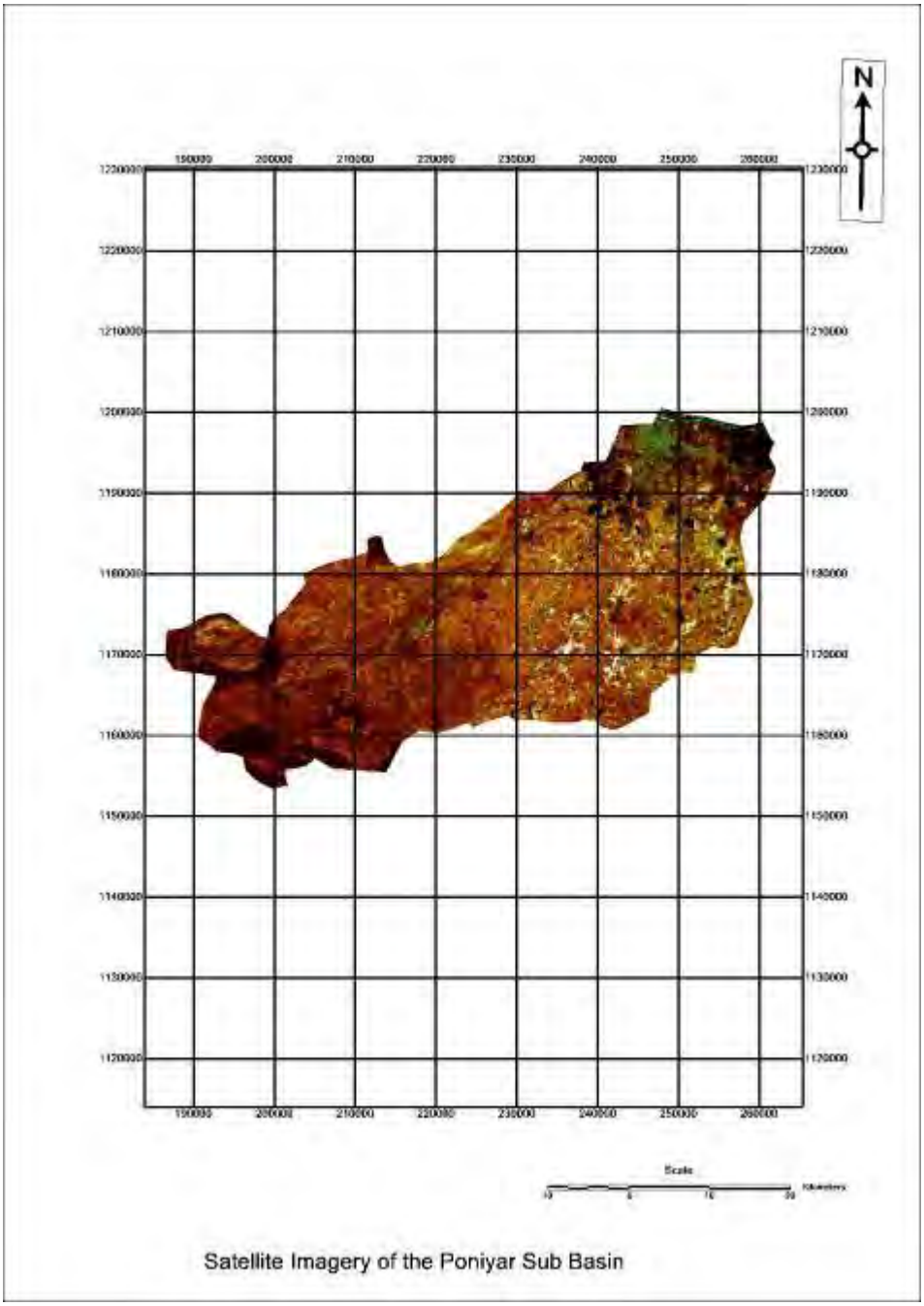

Figure-28: Satellite Imagery (FCC) of Ponnaniyar Sub-basin area

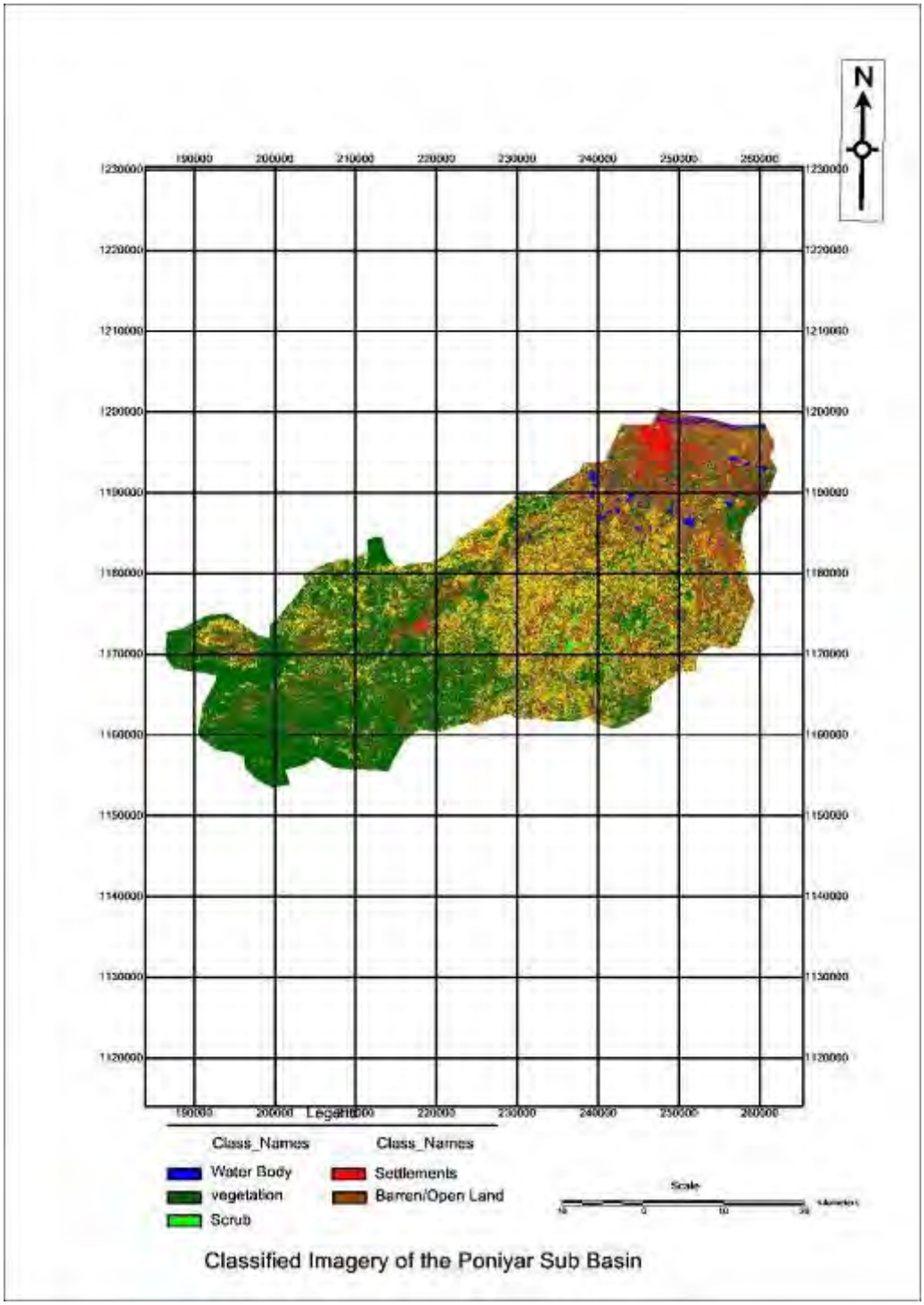

Figure-29: Classified Imagery of Ponnaniyar Sub-basin area

Land Use – Thirumanimuthar Sub-basin

The landuse pattern of the Thirumanimuthar sub-basin area has been studied using satellite data. The IRS, 1C-LISS IV digital satellite data has been procured from National Remote Sensing Agency (NRSA), Hyderabad for assessing the landuse pattern of the sub-basin area. The raw satellite imagery has been processed in-house using ERDAS IMAGINE software. The raw and classified satellite imagery are given in **Figure-30** and **Figure-31** respectively. The signals of satellite imagery were verified by performing ground truthing and then final classification of satellite imagery was done. Based on this classification the landuse pattern of the study area was obtained.

It is observed from the Table-29, that the major portion of sub-basin area is occupied by agricultural land (46.64%). Area under vegetation and scrub accounts for about 24.74% and 15.57% of the total study area respectively. The area under settlement is about 3.78%.

Table-29: Landuse pattern of the Thirumanimuthar sub-basin

Category	Area (ha)	Area (%)
Water Body	1989	0.80
Vegetation	61303	24.74
Scrub	38590	15.57
Agricultural Land	115565	46.64
Settlement	9362	3.78
Barren/Open Land	20961	8.46
Total	**247770**	**100.00**

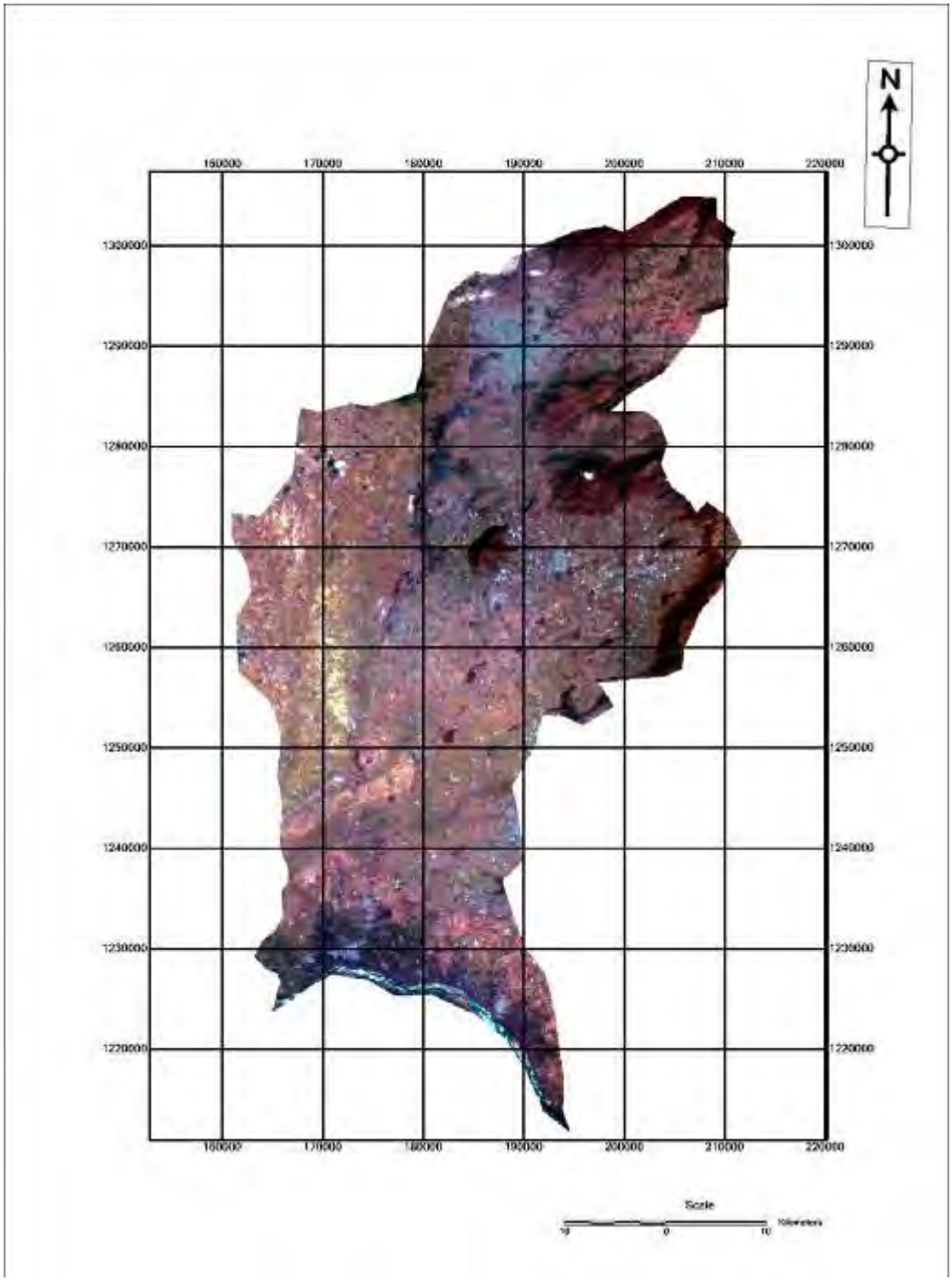

Figure-30: Satellite Imagery (FCC) of Thirumanimuthar Sub-basin area

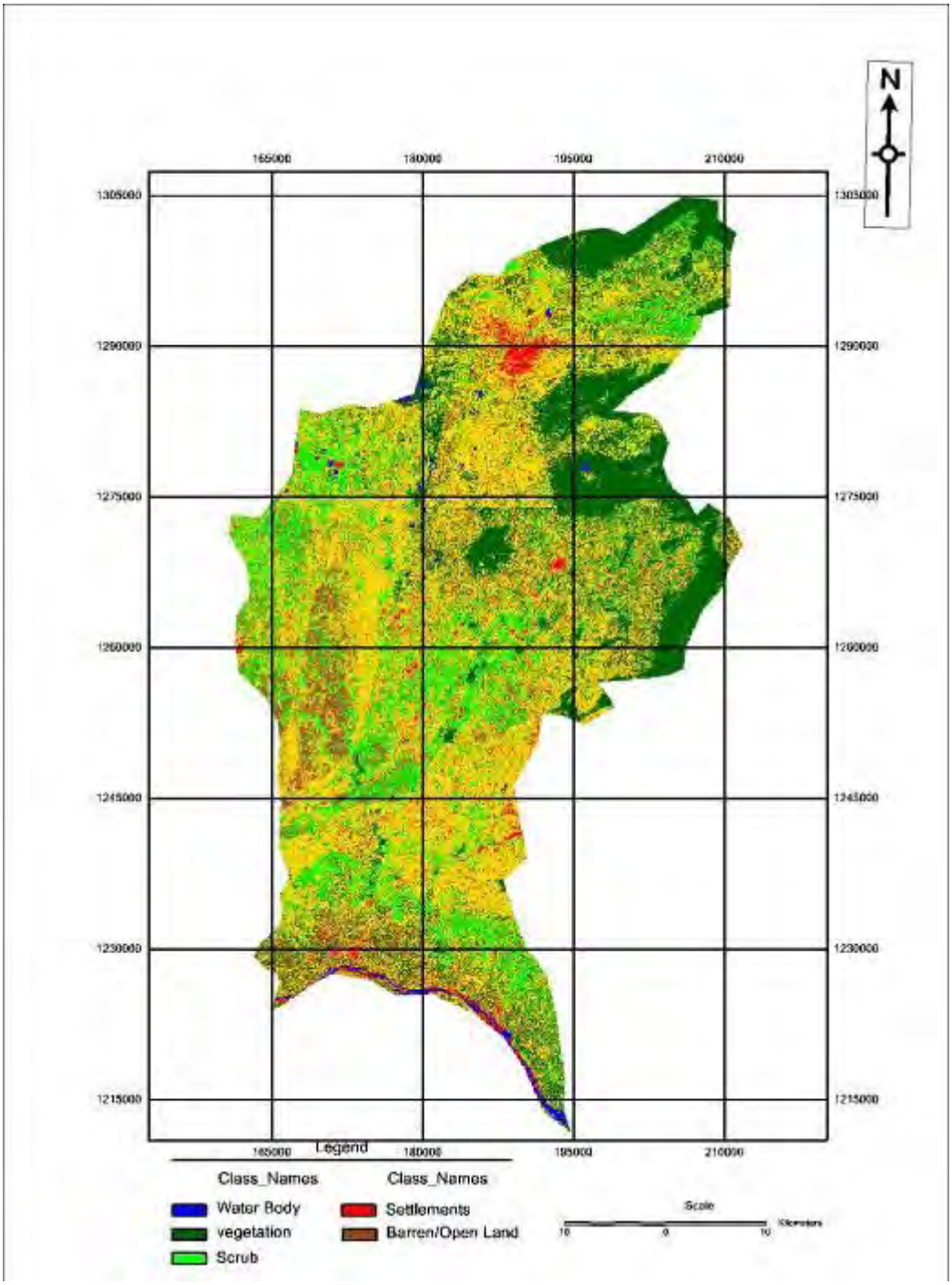

Figure-31: Classified Imagery of Thirumanimuthar Sub-basin area

Land Use – Lower Vaigai Sub-basin

The landuse pattern of the Lower Vaigai sub-basin area has been studied using satellite data. The IRS, 1C-LISS IV digital satellite data has been procured from National Remote Sensing Agency (NRSA), Hyderabad for assessing the landuse pattern of the sub-basin area. The raw satellite imagery has been processed in-house using ERDAS IMAGINE software. The raw and classified satellite imagery are given in **Figure-32** and **Figure-33** respectively. The signals of satellite imagery were verified by performing ground truthing and then final classification of satellite imagery was done. Based on this classification the landuse pattern of the study area was obtained.

It is observed from the Table-30, that the major portion of sub-basin area is occupied by agricultural land (41.28%). Area under vegetation and scrub accounts for about 18.22% and 16.66% of the total study area respectively. The area under settlement is about 1.17%.

Table-30: Landuse pattern of the Lower Vaigai sub-basin

Category	Area (ha)	Area (%)
Water Body	6239	6.48
Vegetation	17553	18.22
Scrub	16050	16.66
Agricultural Land	39772	41.28
Settlement	1124	1.17
Barren/Open Land	15617	16.21
Total	**96355**	**100.00**

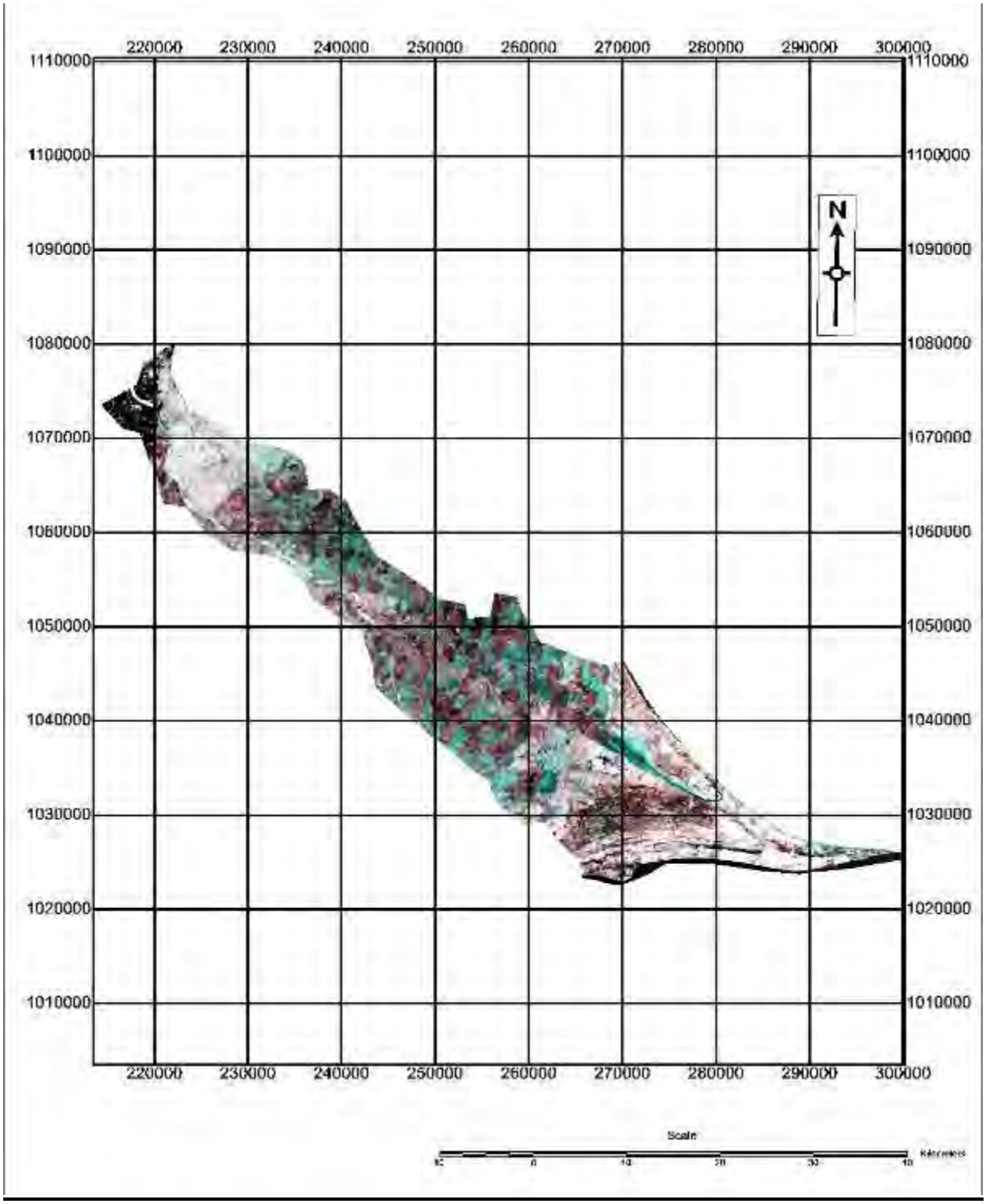

Figure-32: Satellite Imagery (FCC) of Lower Vaigai Sub-basin area

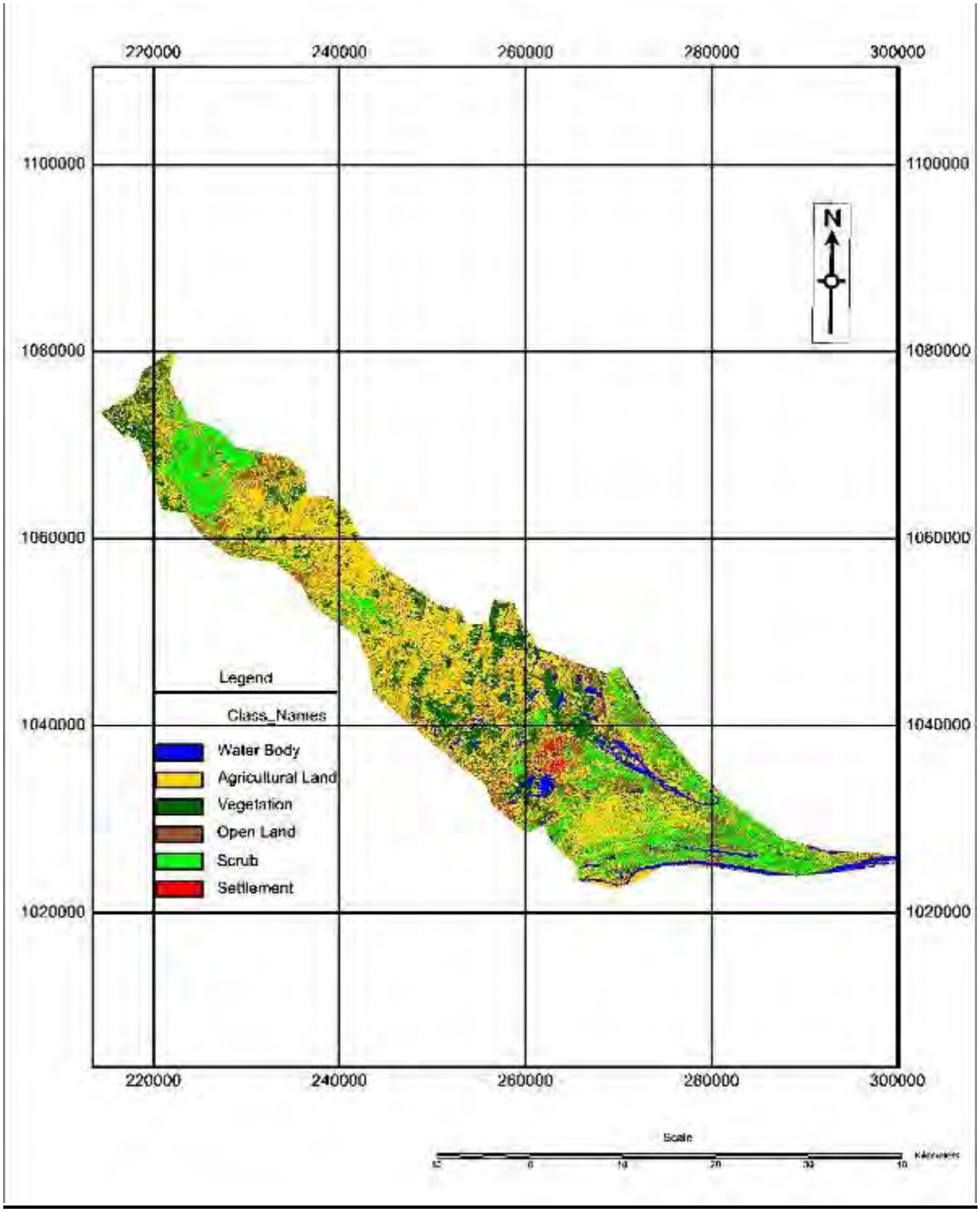

Figure-33: Classified Imagery of Lower Vaigai Sub-basin area

Land Use – Sathiyar Odai Sub-basin

The landuse pattern of the Sathiyar Odai sub-basin area has been studied using satellite data. The IRS, 1C-LISS IV digital satellite data has been procured from National Remote Sensing Agency (NRSA), Hyderabad for assessing the landuse pattern of the sub-basin area. The raw satellite imagery has been processed in-house using ERDAS IMAGINE software. The raw and classified satellite imagery are given in **Figure-34** and **Figure-35** respectively. The signals of satellite imagery were verified by performing ground truthing and then final classification of satellite imagery was done. Based on this classification the landuse pattern of the study area was obtained.

It is observed from the Table-31, that the major portion of sub-basin area is occupied by vegetation (40.16%). Area under agricultural land and barren /open land accounts for about 35.39% and 12.75% of the total study area respectively. The area under settlement is about 4.79%.

Table-31: Landuse pattern of the Sathiyar Odai sub-basin

Category	Area (ha)	Area (%)
Water Body	1451	2.15
Vegetation	27160	40.16
Scrub	3220	4.76
Agricultural Land	23936	35.39
Settlement	3237	4.79
Barren/Open Land	8626	12.75
Total	**67630**	**100.00**

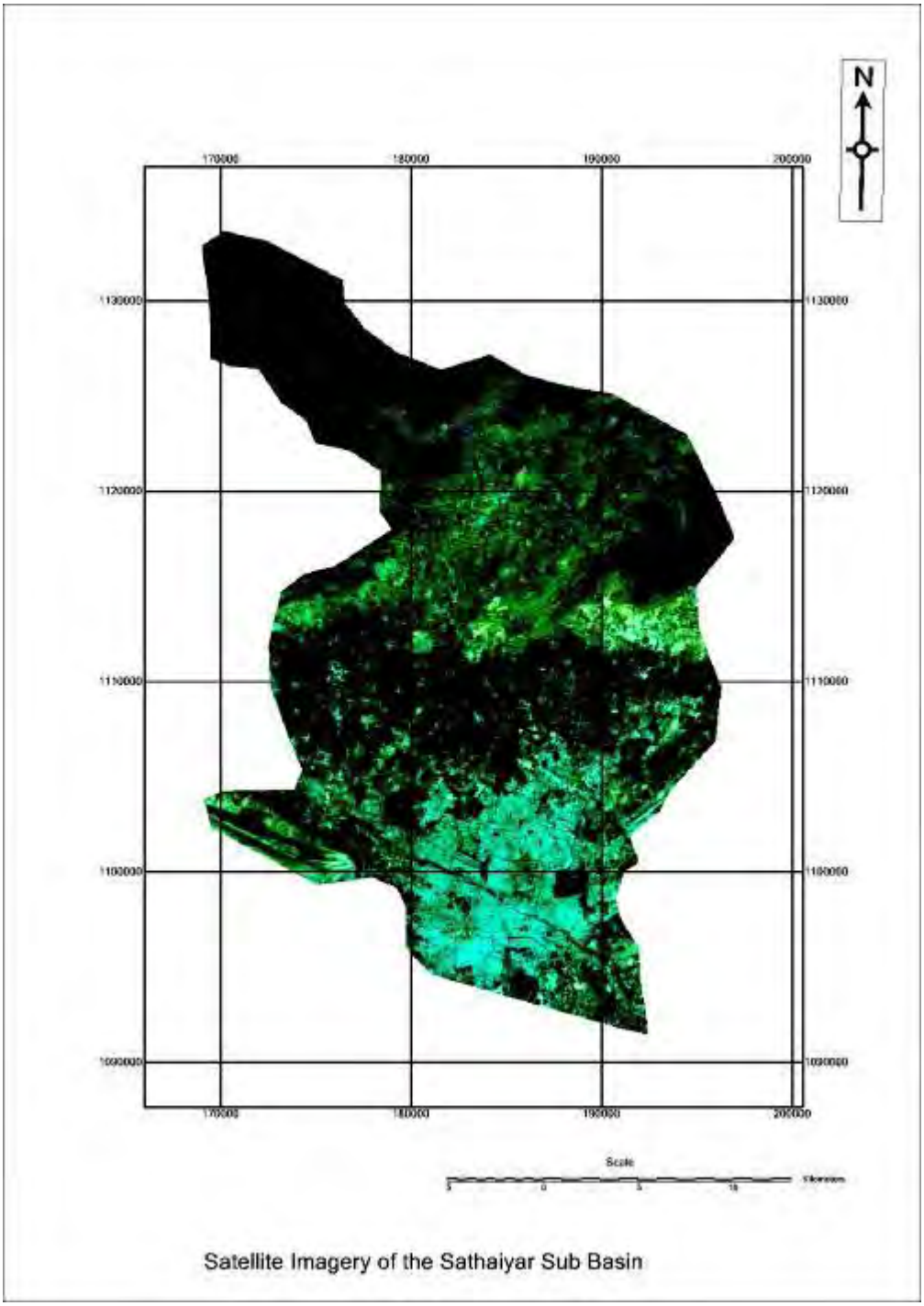

Figure-34: Satellite Imagery of Sathiyar Sub-basin area

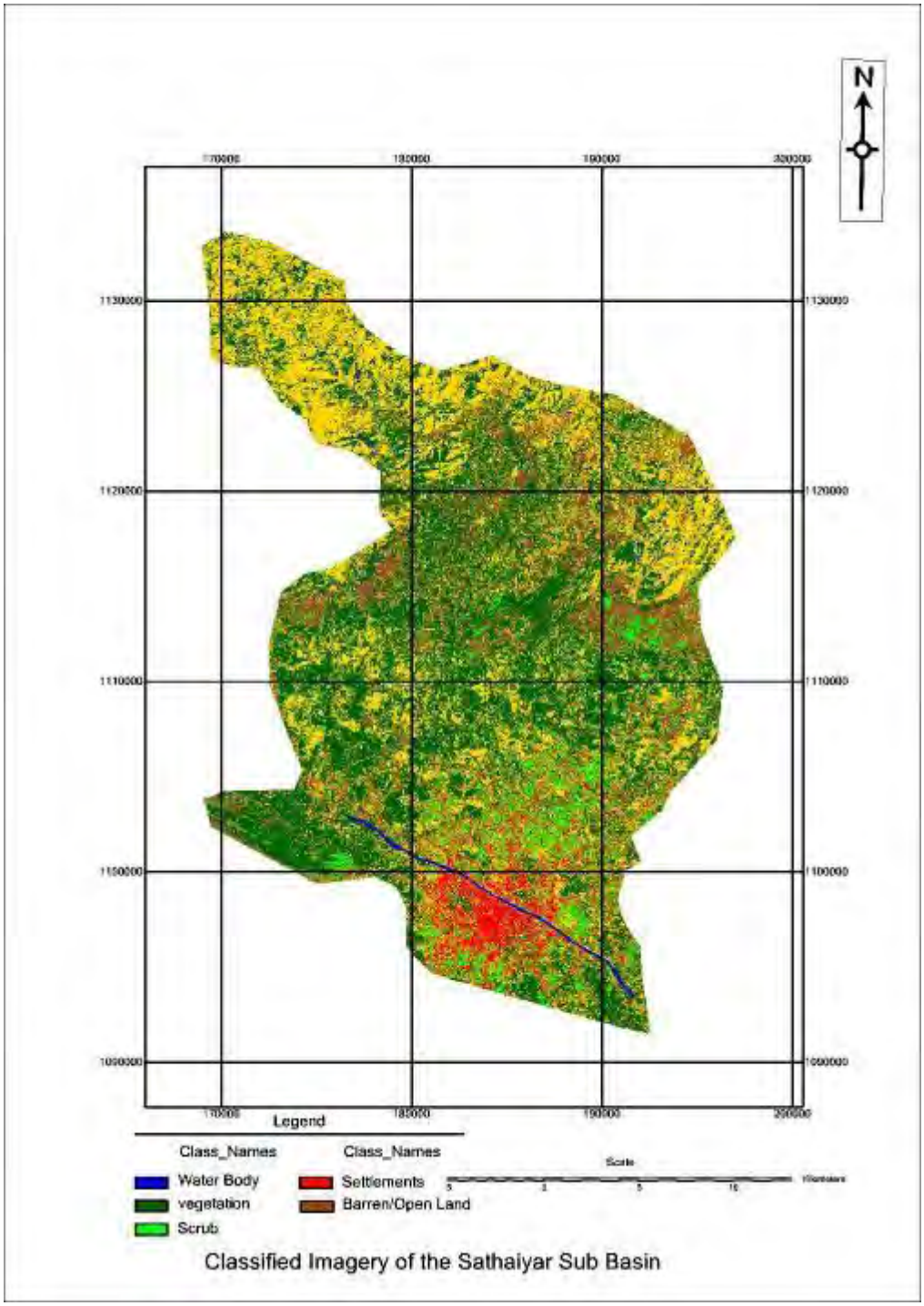

Figure-35: Classified Imagery of Sathiyar Odai Sub-basin area

Land Use – Upper Bhavani Sub-basin

The landuse pattern of the Upper Bhavani sub-basin area has been studied using satellite data. The IRS, 1C-LISS IV digital satellite data has been procured from National Remote Sensing Agency (NRSA), Hyderabad for assessing the landuse pattern of the sub-basin area. The raw satellite imagery has been processed in-house using ERDAS IMAGINE software. The raw and classified satellite imagery are given in **Figure-36** and **Figure-37** respectively. The signals of satellite imagery were verified by performing ground truthing and then final classification of satellite imagery was done. Based on this classification the landuse pattern of the study area was obtained.

It is observed from the Table-32, that the major portion of sub-basin area is occupied by vegetation (37.30%). Area under scrub and exposed rock accounts for about 28.71% and 20.50% of the total study area respectively. The area under settlement is about 1.51%.

Table-32: Landuse pattern of the Upper Bhavani sub-basin

Category	Area (ha)	Area (%)
Water Body	2479	4.31
Vegetation	21441	37.30
Scrub	16503	28.71
Agricultural Land	3620	6.30
Settlement	867	1.51
Exposed Rock	11786	20.50
Open Land	786	1.37
Total	**57482**	**100.00**

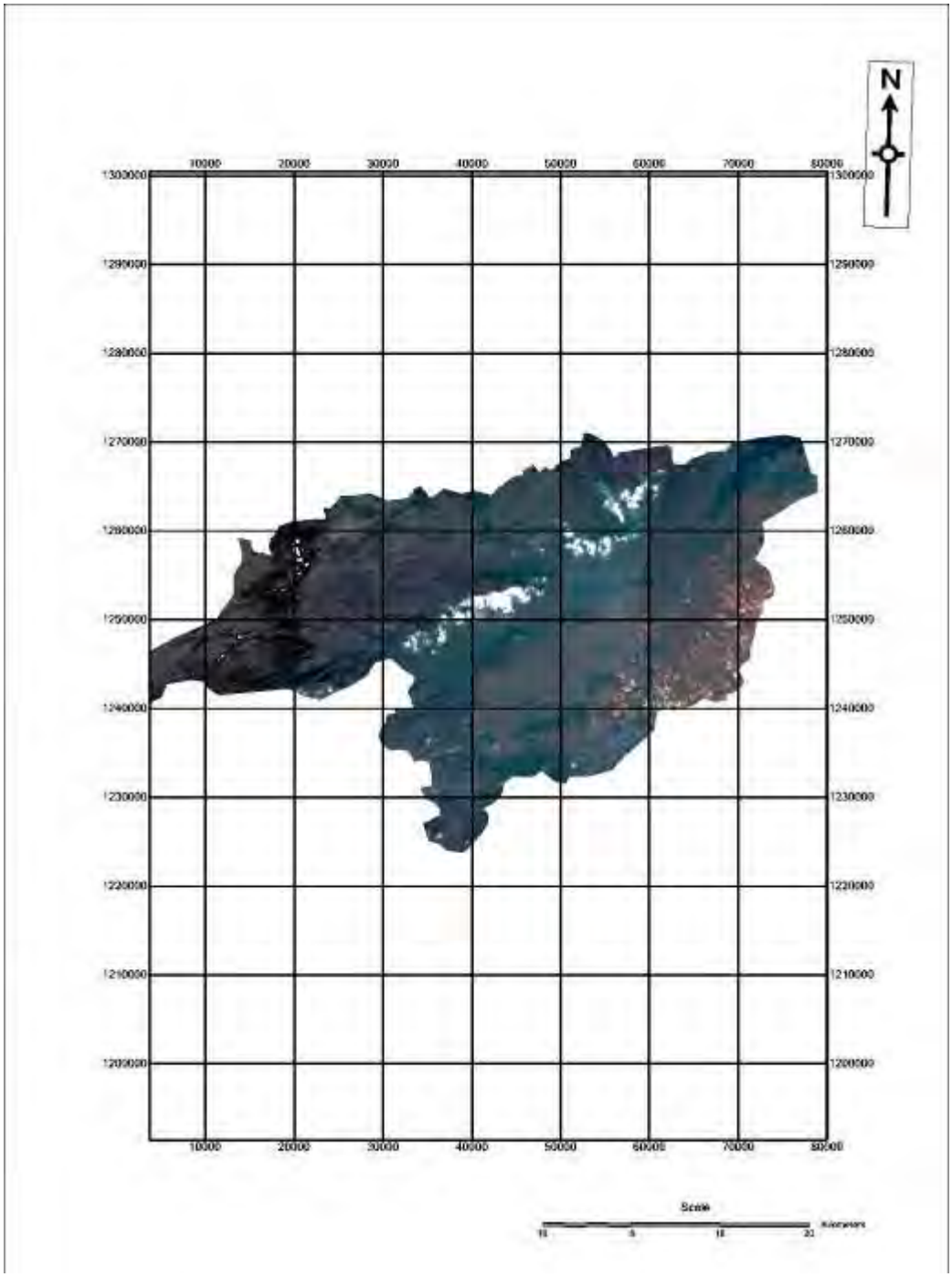

Figure-36: Satellite Imagery (FCC) of Upper Bhavani Sub-basin area

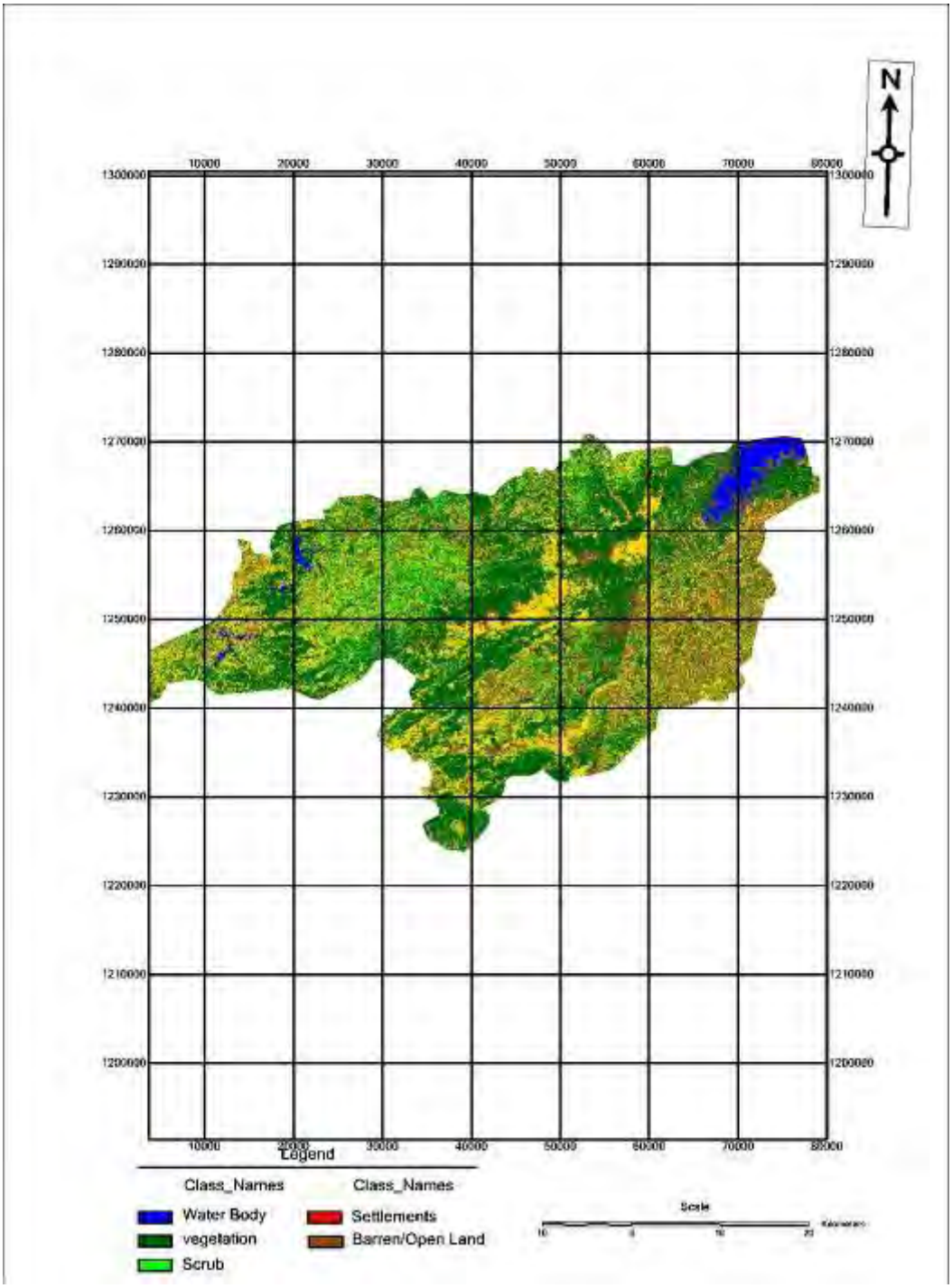

Figure-37: Classified Imagery of Upper Bhavani Sub-basin area

4.10 Natural Calamity

Tamil Nadu is prone to multi-hazards, higher than other States and is frequented by hazards of various nature and different intensities. The vulnerability of the coastal regions became exceedingly evident when Tsunami struck the southern coast of India. Besides Tsunami, the coastal community faces disasters like cyclone and floods periodically. Communities in other hazard prone plains and hilly regions of the State face threats from Landslides, Earthquakes and Floods.

Cyclones, Flood and Tsunami

The eight sub-basin districts, prone to cyclones and floods are Kancheepuram, Nagapattinam, Tiruvarur, Thanjavur, Pudukkotai, Ramanathapuram, Tirunelveli and Kanyakumari owing to their location near the sea coast.

Earthquake

The Tamil Nadu area falls under the Seismic Zones II and III according to Seismic Zoning Map of India (refer Figure 38). The seismic proneness of Tamil Nadu is 73% under Zone II and 27% under Zone III.

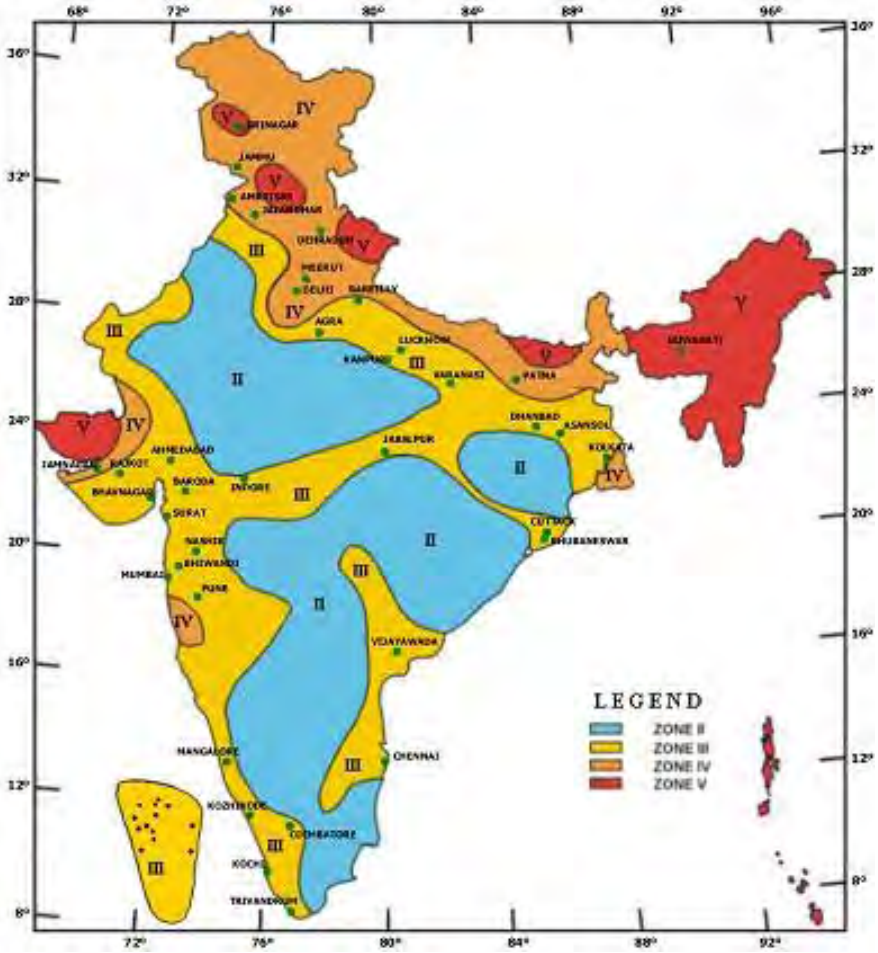

Figure 38: Seismic Zone Map of India

The nine representative sub-basins falling under the Zone II i.e least active classification are Krishnagiri to Pambar, Vaniyar, Gadana, Pazhayar, Ponnaniyar, Cauvery Delta and Thirumanimuthar, Lower Vaigai and Sathiyar Odai.

The three representative sub-basins falling under the Zone III i.e moderate active classification are Cheyyar, Upper Palar and Upper Bhavani.

4.11 Archaeological Sites

There are no important archeological sites in the representative 12 sub-basin area.

4.12 Socio-Economic Aspects

Social, economic and demographic analysis

State level analysis: The state has 32 districts, 385 blocks and 12620 village panchayats. According to 2011 census the total population of the state of Tamil Nadu is 712.47 lakhs, among the total population 3,61,58,871 are males and 3,59,80,087 are females. The sex ratio in the State which was 987 in 2001 has risen by 8 points to 995 in 2011.Population. Population density works out to be 555 showing an increase of 75 points from 2001. The growth rate of population for Tamil Nadu in the last decade was 15.60%. in rural areas 6.49% and urban areas 27.26%. Total number of literate persons in the state 5,24,13,116 (80.33%),males 2,83,14,595 (86.81%)and females 2,40,98,521 (73.86%).

The total population of Scheduled caste is 144.38 lakhs which constitutes 20.01% of the total population. Total persons 1, 44,38,445 (decadal variation: + 21.8%), males 72,04,687 (decadal variation: + 21.4%), females 72,33,758 (decadal variation: + 22.1%). Total Scheduled tribal population of the state is 7.95 lakhs constitutes just 1.10% of the total population of the state. Total persons 7, 94,697 (decadal variation: +22.0%), males 4, 01,068 (decadal variation: + +21.9%), females 3,93,629 (decadal variation: + 22.1%). Both social categories the Scheduled caste and Scheduled tribals are economical and socially backward and marginalized. The lack resources and have limited opportunities for education, employment, and credit facilities. Similarly the literacy rate of Scheduled caste is 73.26% and Scheduled tribe is 54.34% very low compared to the state level literacy level of 80.09%.

As per Census 2011, the total number of workers in the state is 32.9 million. Of this, 21.4 million workers are males and 11.4 million are females. Out of the increase of 5 million workers during the decade 2001-2011, male workers have accounted for 3.3 million and female workers 1.7 million. Out of 32.9 million total workers, 27.9 million are main workers and the remaining 4.9 million are marginal workers.

Poverty

The below poverty line for the state the state of Tamil Nadu (2010-11) in rural areas it has been estimated as 15.83% and urban areas 6.54% and the percentage for the total population is 11.28% (Press note on Poverty Estimates, 2011-12, Government of India, Planning Commission July 2013).

State Economy

In the state, 48 per cent of the population is living in urban areas, stands first in terms of urbanization amongst large States. Slower population growth rate coupled with increasing Gross State Domestic Product (GSDP) contributes significantly to State's higher per capita income as compared to All India average. Between 2004-05 and 2015-16, Gross State Domestic Product (GSDP) expanded at a Compound Annual Growth Rate (CAGR) of 12.31 per cent.

With regard to land utilization details of the state (refer Table 33), nearly one third of the total area of the state is covered under agriculture, shown area 36.2%, land put to non agricultural use comes next 16.3% area is covered under this category, forest is other aspect which covered nearly the same amount of land area 16.3%. The other two categories which covered sizeable area area are other fallow lands 13.2% and current fallow lands 8.6%.

Table-33: Land utilization details of Tamil Nadu

Classification	Area in hec 2013-14	% Share to Total Geographical Area
Total Geographical Area	13033116	
Forests	2125475	16.3
Barren and Unculturable land	488460	3.7
Land put to Non-agricultural uses	2189876	16.8
Culturable Waste	328326	2.5
Permanent Pastures and other grazing lands	109567	0.8
Land under misc. tree crops and groves not included in the net area sown	244678	1.9
Current fallow lands	1115041	8.6
Other fallow lands	1717831	13.2
Net area sown	4713862	36.2

Source: Department of Economics and Statistics, Chennai-6

As per the latest statistical report (agriculture department policy note 2015-16) the Gross Cropped Area of the state is 58.97 L.Ha and the net area sown is 47.14 L.Ha

(36%) when compared to the total geographical area of the state. The state has a gross area of 33.11 L.Ha irrigated land.

The state is undergoing fast urbanization process, 48% of the population is in urban centres. The GSDP has increased 12.31 between 2004-5 to 2014-16. The other factors which contributes the farmers particularly small and marginal holders to lose interest in agriculture are shortage of waters, agricultural labour, deterioration of soil health, decline of organic contents, increase in the cost of cultivation, lack credit support, limited or no extension support etc.

Table 34: Distribution of number of holdings and area operated in Tamil Nadu

Category	Number of holdings - lakhs		Area operated Lakhs – ha		Average size of holdings Ha	
	2005- 06	2010-11	2005-06	2010-11	2005-06	2010-11
Marginal (< 1 hectare)	62.28	62.66	22.92	22.86	0.37	0.37
Small (1 to 2 hectare)	12.34	11.82	16.44	17.21	1.39	1.39
Medium (2 to 10 hectare)	7.12	6.53	24.26	22.03	3.41	3.37
Big (> 10 hectare)	0.19	0.17	3.91	3.50	20.58	20.59
Total	81.93	81.18	68.24	64.88	0.83	0.80

Source: Department of Economics and Statistics, Chennai – 6

With regard to the distribution of land holding the data shows (refer Table 34) majority of the farmers are small and marginal holders. It is observed there is a little increase in the five year difference.

The number of operational land holdings in the State is 81.18 lakh, operating 64.88 L.Ha. Small and Marginal holdings account for 92% of the total holdings operating 61% of the total sown area. The average size of land holding in the State is 0.80 hectare.

Sources of water supply are canals, tube wells and open wells. The total canals in the state which used for irrigation are 2239 and the length of the total number of canals is 9747 kms. The total number of tube wells and other wells which are used for irrigation and other purposes is 385606, open well 1493840, reservoirs 81, and tanks 41127.

Source wise net irrigated area in hectares, canals 653161, tanks 377571, tube wells and other wells 463467, open wells 1178873 and other sources 6024. The crop wise irrigated area in 2013-14 and area, production and productivity of principal crops is given in Table 35 (a) and (b) respectively.

Table 35 (a): Principle crop wise area irrigated 2013-14

Crop	Area (in hectares)		
	Area irrigated	Total area	
Paddy	1612017	1725730	93.4
Cholam (Jawar)	46759	347131	13.5
Cumbu (Bajra)	8405	54412	15.4
Ragi	32696	118699	27.5
Sugar cane	313280	313343	100
Cotton	37161	150963	24.6
Ground nut	137960	336621	41.0
Other crops	1122599	2850573	39.4

Source: Department of Economics and Statistics, Chennai-6

Consumption of chemical fertilizers and pesticides (2013-14) for the entire state shows that the total quantity of NPK used is 1378338 MT, it is distributed through private shops (1108145 MT) and cooperatives societies (270193). Similarly the pesticide consumption by the state in the form dust and liquid shows the total quantity of dust used is 1677 MT and 980.50 litres (Department of Agriculture, Chennai-5). Agriculture department had distributed around 1332 tonnes of micronutrient mixture, the area covered is 97360 ha. and 121700 farmers are benefited (Commissioner of Agriculture, Chennai.5).

In the entire state to support the farmers to provide a fair price, 283 regulated markets are operating in 21 districts. 352 godowns are available as infra structure support for farmers to store their produce before marketing or further processing.

Crop	Area	Production	Productivity	

Table: 35 (b) Area, production and productivity of principal crops 2013-14

		(Hect)	(Tonnes)	(in Kg./Hec.)
A. CEREALS				
1.	Paddy *	1725730	7115195	4123
2.	Cholam(Jowar	347131	513313	1479
3.	Cumbu (Bajra)	54412	117436	2158
4.	Ragi	118699	362343	3053
5.	Maize	380429	2245216	5902
6.	Small Millets	32416	35171	1085
7.	Total Cereals	2658817	10388674	3907
B. PULSES				
8.	Bengal gram	8908	5823	653
9.	Red gram	59643	57666	967
10.	Green gram	195285	151400	775
11.	Black gram	365128	310658	851
12.	Horse gram	88733	56869	641
13.	Other Pulses	98059	31383	320
14.	Total Pulses	815756	613799	752
15.	Total Foodgrains (A+B)	3474573	11002473	3167
C. OIL SEEDS				
16.	Groundnut	336621	915884	2721
17.	Gingelly	56591	33708	596
18.	Coconut @	428538	-	-
19.	Castor	6377	1990	312
20.	Other Oil Seeds	14079	-	-
21.	Total Oil Seeds	842206	-	-
D. OTHER CROPS				
22.	Cotton #	150963	416560	469
23.	Sugarcane **	313343	32454135	104
24.	Tobacco	3725	5691	1525
25.	Chillies	41401	11294	273
26.	All other crops	1071261	-	-
27.	Total (Other Crops)	1580693	-	-
28.	Total Crops (B+C+D)	5897472	-	-

Production & Yield rate
* Paddy - In terms of Rice;
** Sugarcane - In terms of Cane, Yield rate in tonnes per hectare
@ Coconut – Production in lakh nuts, Yield rate in Lakh Nuts per ha
# Cotton – Production in Bales of 170 Kg lint each

Source: Department of Economics and Statistics, Chennai-600 006

Paddy is the grain cultivated in very large area, in pulses Black gram stands first next is green gram and among the oil seeds coconut is first and ground nut comes next.

To encourage Participatory Irrigation Management the state has been promoting the village level Water User Associations, since 1997 onwards through different project and schemes implemented in the state. The main idea is to involve the farmers the primary stakeholder in the decision making and implementing activities related to water sharing and management of the irrigation systems. Till now totally 4309 Water User Associations have been formed in the state. The details of Farmers Council are given in Table 36.

Table 36: Farmers Councils

Sl.No	Water User Associations Formed	Nos.
1	1997 – 2002 (irrigation systems)	1272
2	2001 – 2002 (irrigation tanks)	620
3	2003 – 2004 Under Scheme completion	73
4	TN-IAMWARM – Phase I	2344
	Total	4309

Socio economic analysis of the project area 66 sub basins

The socio economic and demographic analysis for the 66 sub basins selected for the project implementation was done, block level disaggregated data on different social groups, sex ratio, literacy rate, economic categories like workers, marginal workers, cultivators, agricultural labourers etc., are collected from Census of India volumes 2011. Analysis and findings would help to get the quantitative details of the socio economic characteristics of the farming communities including the marginal and vulnerable sections, the main stakeholder of the project and dependency on irrigation infrastructure.

The 66 sub basins identified for the project implementation covers all 32 districts of the state. The total population of the 66 sub basin is 60567384 (males: 30430706, females: 12186007). The number of main farmers involved in agriculture is 5254515 (males: 3413045females: 1841470), and marginal cultivators 520315 (males: 289669 females: 230646). The total number main agricultural labourer is 9081666 (males: 4741214, females: 4340452) and the marginal agricultural labourer count 3199441 (males: 1374687, females: 1824754). With the regard to literacy rate, total number of literates is 40305132 (men: 2235446, females: 17950671).
The total Scheduled caste population in the 66 sub basin is 14178833 (males: 7092669, females: 7086164) and Scheduled tribe is total 1252464 (males: 632962females: 619502).

Socio economic analysis of the 12 sub basins selected for study

The 12 sub basins selected for the study cover 156 blocks in 27 districts of the state. The total population of the 12 sub basins is 16661890 (males: 8449376 and females: 8212514). As shown in Figure 39, the total cultivators enumerated in the 12 sub basins are 2745913, in which the main cultivators are 1432527, (males: 938093, females: 494434) and marginal cultivators are 131386 (males: 78647, females: 52739). The total number of agriculture labour in the 12 sub basins is much higher than the cultivators, 3387453 is the total number in which main agricultural labourers are 2518973 (Males: 1337220, females: 1181753) and marginal agriculture labourers are 868480 (males: 380417, females: 488063). The main agricultural work force is more than three times the marginal agricultural labourers.

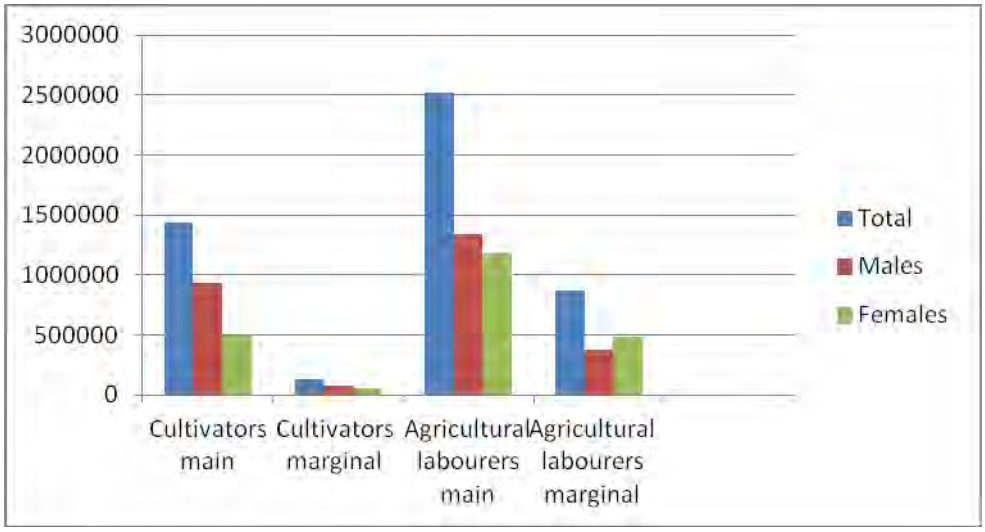

Figure 39: Details of Cultivators and Agricultural labourers in the selected sub-basins

With regard to literacy rate in the 12 sub basins the total number of literate people is 11479281 among total literates males are 6319447 (53.9%) and females are 5159834 (46.1%). As shown in figure 40, as per district census, the total number of Schedule Castes population in the 12 sub basins are 11235443 (males: 5602071, females: 5633372), among the 12 sub-basins Cheyyar has the highest Scheduled caste population the total number is 2373622 and Pazhayar has the least SC population only 74249 members. The total number of Schedule tribe population is 892019 (males: 451147, females: 4408872), maximum number is 28549 in Cauvery Delta and least in Lower Vaigai Just 1895 tribal people.

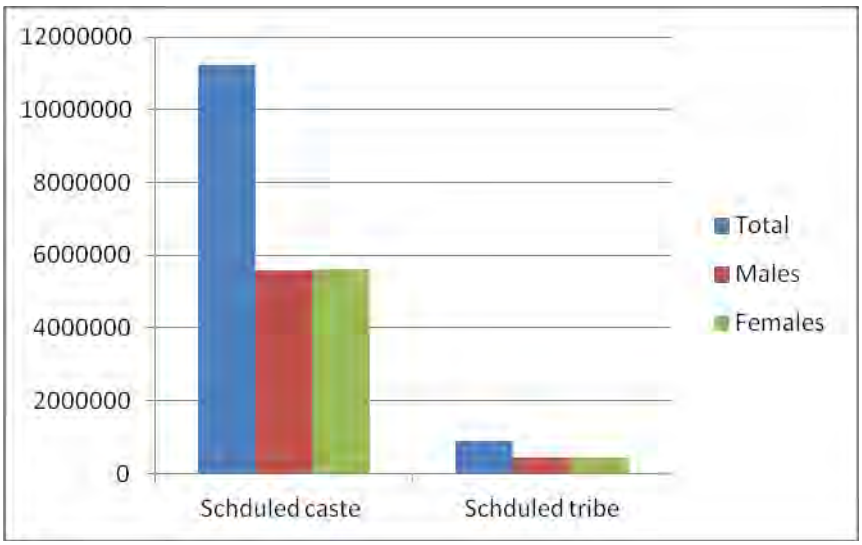

Figure 40: Details of Schedule caste and Schedule tribe population, total, males and females

Tribal mapping exercise

Tribal communities in Tamil Nadu

In Tamil Nadu 36 tribal communities have been notified by the Scheduled Castes and Scheduled Tribes Order (Amendment) Act, 1976. Out of the 36 in the state six tribal communities i.e. Toda, Kota, Kurumba, Irular, Paniyan and Kattunayakan population has neither decreased nor increased and it remains static. Hence, they are known as Particularly Vulnerable Tribal Groups (PVTGs). According to 2011 Census, out of the total population of 721.47 lakhs, in Tamil Nadu, tribal population is 7.95 lakhs and constitutes 1.10% of the total population. Literacy percentage is only 54.34 (males: 61.81 and females: 46.80) literacy rate of tribal women is much lower less than half of the total tribal women population 46.80%.

Tribals are thinly scattered all over the state, out the 32 districts in 20 districts the total population is less than 1%, in six districts it is between 1% to 2%, in only one district tribal population is between 2% to 3% and in three districts between 3% to 2% and the remaining two districts has a little higher between 4% to 5%. None of the district has the tribal population more than 5% in the total population.

It enumerated that the tribal population is more than 10,000 in 18 Districts viz., Salem, Thiruvannamalai, Villupuram, Vellore, Dharmapuri, Namakkal, Tiruvallur, Kancheepuram, The Nilgiris, Coimbatore, Krishnagiri, Erode, Tiruchirappalli, Cuddalore, Madurai, Ariyalur, Tirunelveli and Chennai.

Some of the major problems the tribal communities facing are poor living conditions, lack of basic amenities in hilly terrains, nutritional deficiencies, high drop-out rate in schools, low literacy rate and migration due to degradation of forest resources etc.

The districts covered in the study area - 12 sub basins are shown in Figure 41, the details of total population of the district vis a vis the total tribal population in the district. Three districts located in the 12 sub basins in which more than 10,000 tribal population were identified for field study. Again based on further discussion with the district level officials the following tribal settlements were identified for conducting village level consultation: 1. Vedappaty (Irula) in Krishnagiri to Pambar sub basin 2. Vaachathi (Malayali) Vaniar sub basin and 3. Keel sengalur (Irula), 4.Keel Pillur (Irula) in Karamadai block, 5.Ariyurvattam (Alu Kurumba), in Kotagiri Upper Bhavani sub basin. It is further elaborated that they are in the districts concerned but not in the project foot print. They participated in the field discussions as an abundant good practice. It is ascertained from WRO and project that the livelihoods of tribal people will not be affected because of project interventions.

Among the five settlements the survey team visited it was observed in three settlements the tribals own no lands and do cultivation, work as agricultural labourers to earn their livelihood. The tribal hamlets are not located close to the ayacut. In the remaining two settlements located in the slopes of the Nilgiris, the tribals are doing small scale farming, they do farming primarily to meet their domestic needs and sell very little quantity produce like banana in the local market. According to the tribals they have been doing cultivation in the land for more than three generations but don't have the entitlement for the land they cultivate, as per the record it is part of the forest land.

The tribal mapping exercise as shown in Figure 41 indicates that the tribal pockets are not part of the project foot print. The tiny plots they cultivate is located within the forest territory and owned by the forest department. These lands are not part of the ayacut and located far away from the ayacut. Hence the Scheduled Tribes and other traditional Forest dwellers (Reorganisation of Forest Rights) Act, 2006 does not get triggered.

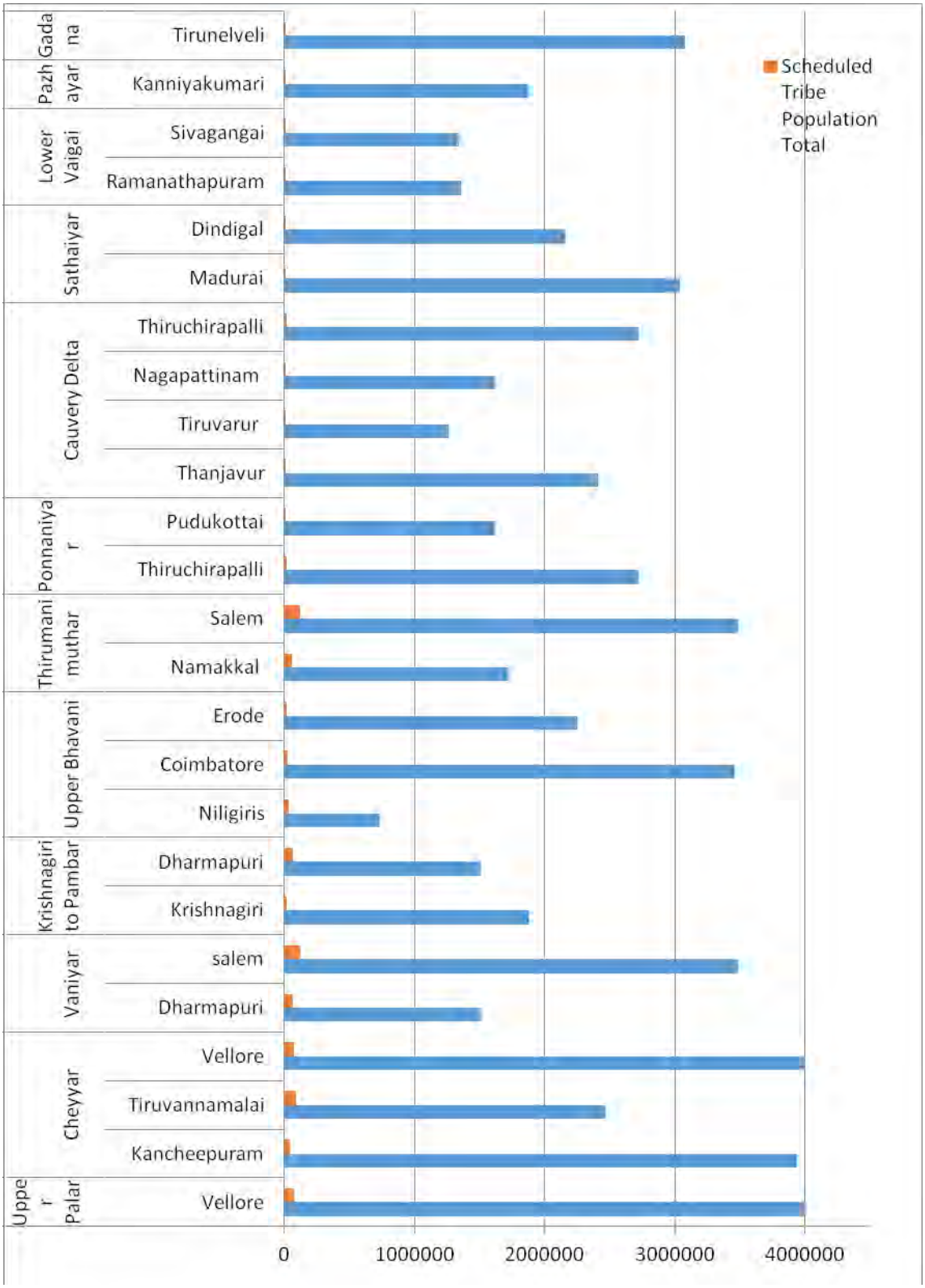

Figure 41: Tribal populations in the districts covered in the 12 sub basins

4.13 Industries

In the representative 12 sub-basins, there are maximum no. of industries in

Thirumanimuthar, Cauvery Delta and Cheyyar sub-basins. The list of industries in the representative 12 sub-basins is given in Table 37.

Table 37: List of industries in the representative 12 sub basins

Sl. No.	Sub-Basin	Name of Industries
1	Cheyyar	M/s Veeraraghava Textiles Pvt Ltd, Uthiramerur.
		M/s Kamatchiamman Coop Spinning Mills Ltd, Kancheepuram
		M/s Presidency Kid Leather Ltd, Kancheepuram
		M/s S.F.S. Footwear International Ltd, Kancheepuram
		M/s Empee Distilleries Ltd, Kancheepuram
		M/s Cheyyar Sugar Mills, Thenthandalam Village
		M/s Lakshmi Saraswathi Textiles (Arni) Ltd, Arni
		M/s Lloyd Insulations (India) Ltd Mattur Mangal Post, Cheyyar Tk
		M/s Lotus Foot Wear Enterprises Ltd,
		M/s Bannariamman Sugars Ltd, Chengam Tk
		M/s Asleyalteams India (P) Ltd, Cheyyar Tk
		M/s Forec India Ltd, Sipcot Industrial Park, Cheyyar
		M/s K.H.Arind Ltd., Vellore
		M/s Althhaf Shoes (P) Ltd.,Vaniyambadi
		M/s Balaji Solvents (P) Ltd., Arcot
		M/s K.H.Road Ltd., Perumugai
		M/s Bhavanai Distilleries & Chemicals, Arcot
		M/s Irbaz Leather Pvt. Ltd., Vaniyambadi
		M/s Sam Co Metals And Alloys (P) Ltd., Kaniyambadi
2	Upper Palar	M/s Shava Engineering Pvt. Ltd, Mela Venkatapuram Village
		M/s Althhaf Shoes (P) Ltd., Vaniyambadi
		M/s Light Alloy Products Pvt., Ltd., Pulivalam Village
		M/s Ssc Shoes (P) Ltd., Ambur
		M/s N.M.Hashim & Co, Ambur
		M/s Farida Prime Tanney Pvt Ltd., Ambur
		M/s Abc Fruits, Krishnagiri Taluk
3	Krishnagiri to Pambar	-
4	Vaniyar	M/s Subramanya Siva Co-Operative Sugar Mills, Pappireddipatty
		M/s.Varalakshmi Sagofactory, Pappireddipatty
		M/s. Thangavelu Spinning Mills Ltd, Pappireddipatty
		M/s. Amman Granites, Harur
		M/s Fidelity Textile P Ltd., Salem
		M/s Sambandam Spinning Mills .Ltd., Udayapatti
		M/s Kandagiri Spinning Mills Ltd., Salem
5	Gadana	M/s Sun Paper Mills Ltd, P.B. No.2, Cheranmadevi
		M/s Gomathi Mills, Tirunelveli
6	Pazhayar	M/s.Indian Rare Earths Ltd.
		M/s.Kanam Latex Industries Pvt. Ltd.

Sl. No.	Sub-Basin	Name of Industries
		M/s.Poabs Granites Products
7	Ponnaniyar	M/s Sri Meenakshi Mills, Usilampatti
		M/s Maris Spinners Limited Unit, Sevaloor Village
		M/s Radha Textiles (P) Ltd., Manapprai Tk.
		M/s Dalmia Cements (Bharath) Ltd., Trichy District
		M/s Kothari Sugar (P) Ltd., Lakgudi Tk
		M/s High Pressure Boiler Plant, Trichy
		M/s Combined Cycle Demonstration Plant, BHEL Complex, Tiruchirappalli
		M/s Cheran Cement Pvt. Ltd., Thogamalai.
8	Cauvery Delta	M/s Thiru Arooran Sugar Mills, Thirumandangudi
		M/s Arignar Anna Sugar Mills, Kurungulam.
		M/s King Chemicals, Vadaseri.
		M/s Modern Rice Mill, Pattukkottai.
		M/s The Thanjavur District Co-Op. Milk Producers Society, Thanjavur.
		M/s Thanjavur Spinning Mill, Thanjavur.
		M/s Nelson Papers Ltd., Cholagampatti.
		M/s Ambika Sugars, Kottur.
		M/s Southern Energy Development Corporation Limited, Nallur, Kottur
		M/s Tneb Power Generation Plant, Kovilkalappal, Kottur Block
		M/s Southern India Edible Oil, Karppur, Thiruvarur District
		M/s Tncsc Modern Rice Mill, Mayiladuthurai.
		M/s Nadippisaipulavar, K.R.Ramasamy Co-Operative Sugar Mills Ltd., Mayiladuthurai.
		M/s Opg Kuptha Steel Plant Maruthur, Mayiladuthurai
		M/s Cauvery Basin Gas Bottling Plan, Mayiladuthurai
		M/s Tneb Kuthalam Gas Turbine Power Station, Mayiladuthurai
		M/s The Chennai Petroleum Corporation Limited, Nagapattinam Taluk
		M/s Dcw Ltd.Salt Factory, Kadinavayal, Vedaranyam Taluk
		M/s Chemical Plastics India Ltd., Vedaranyam Taluk
		M/s Tncsc Modern Rice Mill Erukkur, Sirkali Taluk.
9	Thirumani-muthar	M/s Jayamurugan Textiles, Puduchatram
		M/s Jaihind Spinning Mills P.Ltd., Puduchatram
		M/s Sakthi Iswarya Spinning Mills P.Ltd., Puduchatram
		M/s K.K.P. Textiles Ltd., Mohanur
		M/s Namakkal Cotton Mills P.Ltd., Rasipuram
		M/s Thiruvalluvar Textiles P.Ltd., Rasipuram
		M/s Shervaroys Textiles, Rasipuram

Sl. No.	Sub-Basin	Name of Industries
		M/s Sornalakshmi Spinning Mills P.Ltd., Rasipuram
		M/s Smr Spinning Mills P.Ltd., Namakkal
		M/s Mallur Sidheswara Spinning Mills, Vennandur
		M/s Sambandam Spinning Mills Ltd., Vennandur
		M/s. Karur Srinithi Yarn Mills P.Ltd., Paramathi
		M/s. Mithunam Spinning Mills P.Ltd., Paramathi
		M/s. Sjlt Textile P.Ltd., Paramathi
		M/s. Visaka Industries, Paramathi
		M/s. Visaka Industries, Paramathi
		M/s. Saraswathi Udyog India P. Ltd., Kabilarmalai
		M/s. Subhashiri Bio Energies P.Ltd., Elachipalayam
		M/s. Ksr Textiles Mills P.Ltd., Tiruchengode
		M/s. Kutti Spinners P.Ltd., Tiruchengode
		M/s. Paranthaman Spinning Mills P.Ltd., Tiruchengode
		M/s Sengunthar Mills Ltd., Tiruchengode
		M/s Pullicar Mills Ltd., Tiruchengode
		M/s. Sri Sampoorana Lakshmi Spinning Mills, Tiruchengode
		M/s Lakshmi Saraswathi Spinning Mills, Tiruchengode
		M/s Salem Co-Operative Sugar Mill, Mohanur.
		M/s Fidelity Textile P Ltd., Udayapatti, Attur Main Road, Salem
		M/s Sambandam Spinning Mills .Ltd., Attur Main Road, Udayapatti
		M/s Kandagiri Spinning Mills Ltd., Unit.1 Udayapatti, Salem
10	**Lower Vaigai**	M/s Sakthi Sugars Ltd Sivagangai-Dist
		M/s Sri Kannathal Textiles (P) Ltd, Sivagangai-Dist
		M/s Shree Vadivambigai Textile Mills Ltd, Sivagangai-Dist
		M/s Shree Jaya Soundaram Textile Mills (P) Ltd, Sivagangai-Dist
		M/s Chindhamani Textile Milss, Sivagangai-Dist
		M/s Varadhalakshmi Mills Ltd Rajagambeeram, Sivagangai-Dist
		M/s Indane Gas Filling Station, Sivagangai-Dist
		M/s Spices Park, Sivagangai-Dist
		M/s Pioneer Spinners, Kamuthakudi.
		M/s Platinum Textile, Thiruvadani.
11	**Sathaiyar**	M/s. National Sugar Mills, Mettupatti, Allanganalur,
		M/s. Kothari Bio Chemicals Nagari, Madurai
		M/s.Vijayashree Spinning Mills Ltd., Dindigul
		M/s.Soundaraja Millsltd., S.R.Mills Ltd, Dindigul
		M/s.Mother Meera Finance And Investment Ltd., Dindigul
		M/s.Sri Shanmugavel Ltd., Dindigul
12	**Upper Bhavani**	M/s K.G. Denim Limited, Coimbatore
		M/s KSB PUMPS Limited, Coimbatore
		M/s. Kavikumar Spinning Mills Pvt. Ltd., Coimbatore
		M/s. Durairaj Mills Ltd., Annur
		M/s. Veejay Lakshmi Engg Works Ltd., Coimbatore

Sl. No.	Sub-Basin	Name of Industries
		M/s. Sakthi Synthetic Gems Limited, Mettupalayam
		M/s. TAN India Ltd, Mettupalayam
		M/s. Shiva Distilleries Limited, Coimbatore

4.14 Review of Government's Extension services and other services deliveries/ schemes/programs:

The objective of agricultural extension service is to impart the improved technological training to the men and women farmers in agriculture through village based training and demonstration programmes. Also through adoptive research activity such as soil testing, promotion of organic manure, bio pesticides and manures, plant protection measures etc. Supply of inputs and implements is also included in the extension support and distribution of farm bulletins and newsletters.

The current schemes of the Line Departments and activities covered in each of the schemes are as follows:

Agriculture	
I. Assistance to the Farmers for Quality Seed Production	1. Seed Multiplication Scheme for Paddy, Millets, Pulses and Oilseeds through Tamil Nadu 2. State Seed Development Agency (TANSEDA)
II. Assistance to Farmers for Improving the Soil Health	1. Production and Distribution of Green manure seeds 2. Distribution of Micro Nutrient Mixture 3. Distribution of Biofertilizers 4. Distribution of Blue Green Algae 5. Composting of Farm waste through Pleurotus 6. Soil and Water Sample Analysis
III. Assistance to Farmers for taking up Plant Protection Measures	Biological control of crop pests
IV. Assistance to Farmers for Increasing the Crop Productivity	1. National Mission on Oil Seeds and Oil Palms NMOOP) 2. National Agricultural Development Programme (NADP) 3. National Food Security Mission (NFSM) 4. National Mission on Agricultural Extension and Technology (NMAET) 5. National Mission on Sustainable Agriculture (NMSA) 6. Assistance to Increase Productivity of Coconut 7. Assistance to Increase Productivity of Cotton
V. Assistance to Farmers for Extension, Training and Performance	1. Farmers Training Centres (FTC) 2. Special Awards and Prizes to Farmers

Horticulture and Plantation Crops	
I. Integrated Horticulture Development Scheme (IHDS)	
II. National Agriculture Development Programme (NADP)	1. Productivity Enhancement Programme of Horticulture Crops 2. Onion Development Programme 3. Agro-Eco System Analysis(AESA) based Insect Pest managementin Fruits and Vegetables 4. Enhancing the production of Horticultural crops through Bee keeping 5. Mission for Promoting Potager (Roof top) Gardens 6. Demonstration on raising Turmeric seedlings in Protrays 7. Perimetro Vegetable cluster Development Programme
III. Mission for Integrated Development of Horticulture (MIDH)	1. National Horticultural Mission (NHM) - B. National Agro Forestry and Bamboo Mission (NABM)
IV. Micro Irrigation scheme under Per Drop More Crop component of Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)	
V. National Mission on Sustainable Agriculture (NMSA)	1. Rainfed Area Development (RAD) 2. Paramparagat Krishi Vikas Yojana (PKVY)
Agricultural Engineering	1. Agricultural Mechanisation Programme under National Agriculture Development Programme 2. Agricultural Mechanisation Programme under Sub Mission on Agricultural Mechanisation 3. Land Development Scheme 4. Minor Irrigation Scheme 5. Soil and Water Conservation in River Valley Project 6. Soil conservation Works under Dam Rehabilitation and Improvement Project 7. Deepening of Farm Ponds in Ramanathapuram District 8. National Mission for Sustainable Agriculture (NMSA)- 9. Command Area Development and Water Management under Pradhan Mantri Krishi 10. Sinchayee Yojana 11. Solar Powered Pumping Systems 12. Provision of Solar Driers
Agricultural Marketing and Agri business	1. Agri Marketing activities 2. Agri Business activities
Animal Husbandry	1. Free Distribution of Milch Cows 2. Free Distribution of Goats/Sheep

	3. Poultry Development (SPD) 4. State Fodder Development Scheme (SFDS) 5. Fodder Production Units in Meikkal Poramboke Lands
Inland Fisheries	1. Reservoir Fisheries 2. Fish seed Production / Fish seed Rearing Centres 3. District Fish Farmers Development Agencies (DFFDA) 4. Development of Cold Water Fisheries 5. Fishery Extension and Training 6. Creating employment opportunities to rural women by establishing ornamental fish hubs

Source: Agriculture policy note 2016-2017 http://www.tn.gov.in/department/2

The above exhaustive list of extension supports/programmes and the review of related activities reveal that the line departments implement activities which are very much relevant to address issues related to all major aspects of agriculture, animal husbandry, fisheries and marketing of agricultural products. In the present situation generally projects are implemented with a sectoral approach by the respective departments, the over lapping areas are not identified; no common platform exists to bring the departments together and make a combined effort based on their respective strengths. The communities during the field level consultation also repeatedly insisted the need for the integrating the activities by the different line departments to achieve cost effective results and greater benefits.

Interface with the regular extension supports/programmes implemented by the various line departments which are actively involved in the implementation of TN-IAMWARM – 2 with the activities identified in the TN-IAMWARM – 2 should be considered for the converged delivery and to achieve the optimum results.

Key findings

- The total population of the state is 712.47 lakhs, sex ratio is 995 increased by 8 points from 2001. Growth rate in the last one decade is 15.60 and a big different between rural and urban areas, in the urban areas more than five times compared to the rural areas. Literacy rate is 80.33%, men are ahead nearly 12% more than the women literacy rate.

- Scheduled caste constitutes 20.01% of the total population and Scheduled tribe population is very low just 1.10%. Literacy rate Scheduled caste population is 73.23, nearly seven percent lesser than the state average and the Scheduled tribe is 54.34% a big margin 30% lesser than the state average.

- The total work force of the state is 32.9 million (males 21.4 million and females 11.4). In the last one decade the increase of the work force is five million (males 3.3 million and females 1.7 million)

- The below poverty status of the state is 15.8%, the concentration is more in rural areas (urban 6.54% and rural 11.4).

- Nearly one third of the land area is covered under agriculture. Gross Cropped Area of the state is 58.97 L. Ha and the net area sown is 47.14 L. Ha, and gross irrigated land 33.11 L. Ha. Due to various reasons the cropped area in the state has declined from 33% in 2000-01 to 31% of total land area in 2010-11.

- Majority of the land holders are small and marginal farmers 92%, owning 61% of the total sown area. Average size of land holding is 0.80 hectare. In terms irrigation open wells support the maximum 1178873 hectares and canal irrigation next 65316 hectares.

- Crop wise irrigation area shows that Paddy (93.4%), Sugarcane (100%) and Groundnut (41.0%) are the three crops cover larger irrigated area of the total area sown.

- Total consumption of chemical fertilizer for the year 2013 -14 is 1378338 MT and chemical pesticide is dust 1677 MT and 980.50 litres of liquid.

- To encourage participatory irrigation management, around 4309 WUAs have been formed since 1997 through different schemes implemented.

- To support the farmers in marketing and storage, 283 regulated markets operating and 352 godowns are available to store the produce.

- The socio economic, demographic details show that the total population of 12 sub basins districts selected for conducting the study, the total population is 59614823 (males: 29905053 and females: 29709770). Main cultivators 3371903, (males: 2158637, females: 1213266) form 5.65 % and marginal cultivators are 296079 (males: 165777, females: 130302). Main agricultural labourers are 5988301 (Males: 3126434, females: 2861867) constitutes 10.04% and marginal agriculture labourers are 1758979 (males: 765170, females: 993809).

- Literate people are 42790939 (males: 23179112, females: 19611827) and percentage is 71.77.

- Scheduled caste population 11235443 (males: 5602071, females: 5633372) form 18.84% and Scheduled tribe population 892019 (males: 451147, females: 440872) constitutes 1.49%.

CHAPTER - 5

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

CHAPTER – 5
ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

5.1 General

The Environmental and Social Management Plan (ESMP) integrates the baseline conditions, impacts likely to occur, and the measures which need to be implemented for amelioration of adverse impacts for proposed category-A sub-projects. ESMPs for the proposed category-A sub-projects, including rehabilitation of tanks & canals and increased use of agro-chemicals are presented in this Chapter. The ESMP shall give particular attention to project sustainability issues such as EHS, construction camps and site office, prevention of pollution, user conflicts, etc. This detail is to be included in Bid document and to be implemented by the prospective Contractor.

Environment Code of Practices (ECoPs) and Good Practices provide general guidance on management/ mitigation of potential impacts of project activities which are included in Annexure IV and V respectively. The Environmental and Social Clauses to be included in the Bid document (under Technical Specification) is given in Annexure VI.

5.2 ESMP for Tank and Canal Rehabilitation

The key activities considered under tank and canal rehabilitation are excavation of silt, disposal of silt, strengthening of bund, etc. A generic ESMP for such sub-projects, including mitigation measures and responsible agencies for implementation and monitoring, is provided in Table 38.

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Table 38: Generic ESMP for Sub-projects on Canal and tank Rehabilitation
(applicable for 10% of the total value of the packages in each Phase including packages costing more than Rs. 8.00 Crore)
Only for sites/works selected under Random Sampling can be done

S.No.	Potential Environmental Impacts	Mitigation measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
Pre-construction Phase					
1.	Establishment of Construction Camp and site office (Applicable for site where the number of labour residing exceed 100)	• Should be identified in consultation with the individual owners in case of private lands and Engineer in charge case of government lands. • Layout of construction camp, including indicating various structures to be constructed such as the temporary structures to be put up, site roads, drainage, lighting, equipment storage units and other facilities, should be furnished to the Engineer-in-charge. • Living units of adequate space as prescribed in Labour and Environment Acts with proper ventilation shall be provided for the labour engaged. • Construction camps should have access to Drinking water, Sanitation, first aid and waste disposal facilities.	Prospective Contractor	One time	Department
2.	Construction water	Contractor will make his own necessary arrangement for procuring construction water: • In case of community water source, Contractor should carry out consultations with villages/GPs for use • In case of private source, Contractor should not utilize the water unless written consent is obtained from other owners of the land parcel. • In case of new bore wells, permits should be obtained as per requirements of State Ground Water Board regulations especially for critical and over-exploited blocks • In case of surface water bodies, necessary permission from concerned department or administrative clearances should be obtained.	Prospective Contractor	One time	Department
3.	Storage sites (for large and long time storage)	Contractor shall provide details for storage of: • Petrol/Oil/Lubricants: Brick on edge flooring or sand flooring will be provided at the storage places of Petrol/Oil/Lubricants to avoid soil and water contamination due to spillage. Cement: Damp-proof flooring, as per IS codes	Prospective Contractor	One time	Department
4.	Borrow Areas	Shall be identified by the Engineer during implementation	Department	One time	Department
5.	Disposal sites	• Shall be identified by Engineer during the implementation	Department	One Time	Department

S.No.	Potential Environmental Impacts	Mitigation measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
		• Debris Disposal site will be identified by the Engineer during implementation.			
6.	Waste disposal	• The sewage from the labour camp site shall be disposed off in line with the Environmental (Protection Act) in soak pits			
7.	Site Restoration	Contractor shall restore construction sites and site office to the satisfaction of the Engineer in charge.	Prospective Contractor	One time	Department
8.	Tree Cutting	• Necessary clearance for cutting of trees should be obtained by Engineer in charge.	Department	One time	Department
Construction Phase					
9.	Construction Sites (Applicable for site where the number of labour residing exceed 100)	• It should be kept free of water logging • Protective guards should be provided across the areas where workers may fall or could face an impalement hazard. • Store tools and materials neatly and out of the way in storage bins or lockers and keep flammable or hazardous wastes, if any, in covered, segregated waste containers • Keep form and scrap lumber away from work areas, passageways • No loose material should be allowed to leave unattended, and sites should be properly finished after completing the work	Prospective Contractor	Once in a month	Department
10.	Public Safety	• Warning sign boards should be provided along the construction sites in Tamil/ English	Prospective Contractor	Once in a month	Department
11.	Occupational Health & Safety	• Safe access to the job sites should be provided to all workers • Passage ways, walkways, and ramps should be kept free of materials, scraps or obstructions • First Aid box should be readily available at construction sites • Contact with nearest nursing homes/clinics/primary health centre should be maintained by the Contractor to deal with any emergency at site • A vehicle should be readily available at construction site to meet emergency situation • The contractor should comply with all the precautions as required for the safety of the workmen as per Labour Laws as applicable to this project • The contractor should strictly follow the statutory child labour act • Personal Protective Equipment such as helmets, hand gloves, safety shoes, nose masks, safety goggles should be provided to the workers as per Act.	Prospective Contractor	Once in a month	Department
12.	Water Pollution	• Solid waste shall be disposed at authorized sites identified	Prospective	Quarterly	Department

S.No.	Potential Environmental Impacts	Mitigation measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
	at Labour Camp site	• SW and GW quality to be tested for any fecal contamination	Contractor		
13.	Soil Pollution	• Measures to prevent accidental spills of oils and other lubricants • Disposal of waste and wastewater shall not be done on open land.	Prospective Contractor	once in a month	Department
14.	Air Pollution	• Properly functioning construction equipment to minimize exhaust shall be maintained • Idling of machines and equipment shall be minimized • Cover stockpiled silt and trucks hauling silt, sand, and other loose materials or require trucks to maintain at least two feet of freeboard	Prospective Contractor	Once in a month	Department
15.	Landscape Degradation	• On completion of the works all the temporary structures may be cleared away, all rubbish disposed, excreta and disposal pits or trenches filled in and effectively sealed off and the whole site and shall be handed over to the Department in good condition.	Prospective Contractor	One time	Department

5.3 Use of Agro-Chemicals

Pesticide, fertilizer and other agro-chemical consumption might increase due to increased water availability for irrigation, diversification of crops, intensification of agricultural production and other project activities. To minimize the associated impacts, a Pest Management Plan (PMP) has been prepared that includes an Integrated Pest Management strategy (Annexure VII).

CHAPTER - 6

ENVIRONMENT AND SOCIAL MANAGEMENT FRAMEWORK

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CHAPTER – 6
ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK

6.1 General

This Chapter outlines the Environmental and Social Management Framework (ESMF) which is broadly based on the environmental and social baseline conditions, planned project activities and impacts identified and assessed as part of ESA. For the environmental and social impacts (both positive and negative), ESMF enumerates a set of measures to minimize the adverse impacts and enhance the positive impacts which are intended to be adopted during the project implementation. The most reliable way to ensure the implementation of ESMF is to integrate the management measures in the overall project planning, designing, construction and operation phases. This will not only ensure that ESMF activities are implemented in accordance with the framework and processes but also that there are adequate funds/resources for implementation and supervision of social and environmental management plans.

Assessment made in the process of formulating the ESMF indicated that the nature and scale of environmental and social impacts, their severity, extent and the duration would vary depending on the type, size, and location of activities. ESMF has carefully assessed the potential/anticipated adverse environmental and social impacts that are likely to occur during the implementation of projects.

6.2 Key Social and Environment Concerns

The potential adverse impacts anticipated from the proposed project interventions are presented in Table-39.

Table-39: Summary of Key Social and Environmental Concerns

Social Concerns	Environmental concerns
• Conflicts on water use • Regular O&M and Maintenance of structures • Lack of consultation process • Poor or no participation and involvement of women and vulnerable groups	• Likely use of higher quantities of agro-chemicals, especially pesticides, due to increase in agriculture productivity • Disposal of construction waste could affect water and land quality • Disposal of tank bed material • Disposal of liquid and solid waste from dairy • Pollution impacts on fisheries

6.3 Salient Features of ESMF

The ESMF has been developed to ensure that the projects activities are identified planned and implemented are socially responsive and environmentally sound. These guidelines serve as a tool to guide the project implementers the optimal project interventions required to address social and environmental concerns, prepare mitigation plans, and to ensure complete integration of social and environmental concerns and mitigation measures in the design of the project activities.

The ESMF recognizes the need for an early environmental and social assessment, during pre-planning stage of activities at the field level, to identify any adverse impacts, plan for mitigation measures and help in mainstreaming these aspects throughout the implementation phase.

The ESMF will be applied to all project components, through the different stages of the project cycle. The proposed ESMF interventions are designed on the basis of the current understanding of the social and environmental issues. During project planning and implementation, experience and learnings will be used to alter ESMF, if required.

Negative list

Activities that could lead to irreversible and significant negative impacts will not be financed by the project. A list of these activities is given below as per the ESA undertaken. Further, activities could be added to this list based on actual project implementation experience:

- Activities that will result in land salinization
- Procurement/use of pesticides that are listed in the banned lists published by the World Health Organization and National and/or State lists
- Any activity that is in violation of national and state legal provisions
- Refilling of rehabilitated tanks with groundwater
- Activities that require land acquisition or that of private properties, including voluntary land donation and eviction of encroachments and/or relocation of people
- Establishing new tanks in forest areas, coastal areas, and on existing wetlands and important Birding Areas as well as on mangrove areas
- Major loss of common property resources affecting the livelihood systems of local people
- Activities that restricts access to water and other natural/common property resources for those dependent on these resources, over and above of the existing provisions/regulations in place

6.4 Environmental and Social Screening

In order to facilitate proper identification of potential environmental and social risks and mitigate and manage potential impacts, sub-projects to be financed under the project will be placed into one of the three categories given below. The categories are developed based on

the extent, magnitude and duration of potential adverse impacts. As per categorization of sub-projects, the various safeguard instruments/tools – EMP, ESMF and RPF will be applied.

Category	Screening criteria
Category-I	Sub-projects/Activities that could result into medium term but significant adverse environmental and social impacts; such sub-projects/activities will require a limited impact assessment for preparing the EMP; also those sub-projects/activities that warrant the use of RPF These sub-projects/activities generally relate to investments on irrigation infrastructure involving large-scale movement of earth/sand, storage of hazardous chemicals, involvement of compensation to project affected people etc.
Category-II	Sub-projects/Activities that could result into short term moderate adverse environmental and social impacts; such sub-projects/activities will use the ESMF and apply the mitigation measures as suggested in it These sub-projects/activities generally relate to investments on value chain development where waste material is generated, promotion of horticulture involving change in land use, etc.
Category-III	Sub-projects/Activities that are unlikely to cause any adverse environmental and social impacts; these will not require any formal assessment but may need some environmental and social monitoring during implementation These sub-projects/activities generally include training and capacity building, exposure visits etc.

The Environmental and Social screening shall be done for the sub-projects whose investment is more than 5 crores.

To assist with identification of full range of potential impacts and for managing the risks an Environmental Impact Identification Tool is provided in Annexure-VIII, which will help provide a quick overview of potential impacts. In addition, an Environmental Screening Tool and Forms have been developed and given in Annexure-IX and X respectively. This will help measure potential risks under each component, sub-component and specific kind of sub-projects/activities and accordingly provide an appropriate risk category (1, 2 and 3) and implement the mitigation action.

6.4.2 Screening Processes and Procedure for Approval

Environmental and social requirements are linked with project steps and there are environmental and social requirements at the time of project application. Environmental and social requirements in project steps are given in Table-40.

Table-40: Environmental and social requirements

Sub-project is developed
⇩
✓ Environmental Screening Tool is applied for categorizing the sub-project by the concerned line department ✓ If sub-project in negative list – drop the sub-project • For category 1 sub-projects – undertake an environmental assessment to prepare the EMP following the available templates • For category 2 sub-projects – use the ESMF and follow the ECoPS as well as PMP and other project specific strategies • For category 3 sub-projects – no requirements and proceed for implementation
⇩
✓ Categorized sub-project is screened by Environment Cell in WRO and category endorsed ✓ EC in WRO will ensure that budget and monitoring mechanism is in place while approving sub-projects
⇩
Sub-project approved and enter into implementation
⇩
Regular monitoring to ensure that safeguards provisions/mitigation actions are implemented during sub-project implementation

6.5 Environment and Social Management Framework (ESMF)

The ESMF shall be applied to all proposed project components, through the different stages of the implementation cycle. The proposed ESMF interventions are designed on the basis of the current understanding of social and environmental issues identified and discussed in the previous chapters. As the project planning and implementation gains momentum, more learning shall be generated, and the ESMF will be revised accordingly. The proposed ESMF interventions during the implementation cycle of the project components/activities cycle for irrigation, horticulture, dairy and fisheries are provided as additional guidance in Table-41.

Table 41: Environment and Social Management Framework

Sub-Projects / Activity	Potential Risks & Impacts	Suggested Mitigation Measures
Irrigation and construction related		
Tanks ▪ Strengthening of tank bunds ▪ Removal of vegetation and invasive species from, bund slopes, surrounding areas ▪ Wage and labour opportunities ▪ Movement of heavy vehicles	▪ Silt/sand deposition on agricultural fields, low lying seasonal wetlands, choking of natural draining/water courses ▪ Distribution and use of toxic silt due to non-point pollution sources ▪ Disposal of construction debris on farmland, water courses etc. resulting in blocking natural drainage ▪ Lowering of water quality due to disposal of wastes from fish seed farms, oil from machinery, dumping of construction waste etc. ▪ Impact on ambient air quality due to dust during rehabilitation and noise ▪ Breach of tank bund, overspill due to excess rain etc. ▪ Tree cutting, unauthorized removal of native species along with invasive species ▪ Local vulnerable and poor labour left out from work opportunities ▪ Accidents/disease incidents for workers and in labour camps and lack of amenities ▪ Possibility of engagement of child labour, unequal wages to women workers ▪ Soil compaction on fields/farms due to movement and parking of heavy	▪ Silt is normally not being conveyed out of the tank ▪ Check quality of removed silt and tank bed material before allowing farmers to use it ▪ Ensure that local vulnerable groups and extreme poor have access to employment opportunities as labors ▪ Refer to Environment Management Plan (EMP) related to canal and tank rehabilitation ▪ As far as possible, use silt (if suitable) in strengthening the tank bunds ▪ The debris of the dismantled structures to be used for leveling borrow areas ▪ Ensure compliance with national Act on child labour and minimum wage Act ▪ Ensure first aid and medical support at labour camps and ensure hygiene by providing toilets, waste disposal system etc. ▪ For construction activities, refer to health and safety guidelines, and provide protective equipment (helmets, protective gloves and shoes, welding goggles etc.) as may be needed ▪ Plan heavy vehicle and machine movement route that avoid productive fields; and if soil compaction on farmer's field is unavoidable, compensate

Sub-Projects / Activity	Potential Risks & Impacts	Suggested Mitigation Measures
	machinery ▪ Pollution of tanks due to unregulated dumping of domestic sewage ▪ Incidence of local water logging and stagnation of water leading to increased mosquito breeding and spread of vector borne diseases	economically and also plough field after construction phase is over ▪ Avoid night operation of heavy machinery; provide personal safety gear to workers against noise, dust and other injuries ▪ Prepare heavy machinery maintenance chart and user to ensure safe working of machines ▪ Use phytoremediation approaches for reducing pollution and improve water quality ▪ Ensure that approved anti-mosquito methods are used in case of observance of breeding mosquito population near construction and rehabilitation sites
Silt removal from supply channel and canal lining	▪ Risk of disposal of polluted silt on farmlands ▪ Storage of construction material on farmlands adjacent to canal ▪ Non-working of canal during repair works particularly when irrigation is required as contractual delays can result in extension of contract period ▪ Pollution due to domestic sewage inlet	▪ Prepare the EMP as per the template provided and apply the mitigation accordingly ▪ Ensure that silt is tested before given away to farmers ▪ Silt disposal on farmlands only after consultation reached with either individual farmer or with WUA/Gram Panchayat ▪ Ensure that canal is not closed without consultation during cropping season when irrigation is required; plan repair period and manage contract accordingly
Reconstruction and Repair of sluices and weirs	▪ Dumping of Iron and concrete debris within canal and/or near banks ▪ Sewage and solid waste generation due to congregation of labour population	▪ Identify proper disposal sites/designated landfills and mechanism for debris and cost it as part of vendor contract ▪ Ensure proper monitoring of debris disposal during contract period

Sub-Projects / Activity	Potential Risks & Impacts	Suggested Mitigation Measures
	▪ Air pollution and noise pollution due to increased vehicular movement and construction equipment	▪ Implementation of measures to control air pollution and noise from various sources ▪ Providing ear plugs and other safety equipment to protect workers
Agriculture and Horticulture related		
Agriculture – production and diversity	▪ Crop intensification resulting in change of land use and risk of encroachment of common lands ▪ Soil and water pollution due to increased use of agro-chemicals, particularly pesticides ▪ Increased groundwater extraction for enhancing productivity and from shifting from single crop to multi-cropping ▪ Use of short-duration high yielding varieties that generally result in increased use of agro-chemicals ▪ Bringing new areas under horticulture also pose risk of increased use of pesticides	▪ Ensure that common lands are identified and protected from encroachment; as far as possible the project should work with and support farmers through WUAs ▪ Translate the Pest Management Plan (PMP) and awareness to be increased ▪ Project should assist in prior assessment of pests and crop diseases with help from TNAU ▪ Adopt, apply and monitor the implementation of PMP ▪ Develop IEC material in local language for generating awareness regarding safe use of pesticides ▪ Use extension services for soil testing followed with right dosage of agro-chemicals ▪ Promote wide application of safe and bio-pesticides, wherever possible ▪ Propagate use of sprinkler system, including underground micro-irrigation ▪ Promote expansion of System of Rice Intensification (SRI) to reduce water demand ▪ Work with WUAs in encouraging market based non-water intensive crops where

Sub-Projects / Activity	Potential Risks & Impacts	Suggested Mitigation Measures
		possible and for promoting conjunctive use of water resources ▪ Establish groundwater recharge wells and protect aquifers in semi-critical, critical and over-exploited groundwater blocks ▪ Measure and/or monitor groundwater levels through the project or in association with groundwater department ▪ Demonstrate and scale-up IPM strategy and approach; monitor the adoption rate ▪ Promote wide use of organic inputs, such as, bio-manure, Farm Yard Manure and bio-fertilizers and provide training on production and use of these alternatives ▪ Organize in project areas awareness program on Pest-Agri ▪ Ensure that marginal farmers and poor households are also covered for such demonstrations and training ▪ Encourage that pesticide application is done using proper equipment and in accordance with the available guideline
Agriculture related infrastructure and Marketing		
Rehabilitation and modernization of existing agricultural markets	▪ Lack of civic amenities in new markets developed for sellers and customers ▪ Lack of transparency in weighing and paying systems ▪ Intensive use of energy/electricity due to poor market design, poorly planned loading/unloading decks etc. ▪ Issues with respect to waste disposal ▪ Risk of disturbance to natural areas	▪ Use anti-mosquito sprays/fogging during construction and in labour camps ▪ Market design shall have adequate public conveniences (toilets with septic tanks or connected with sewage system) ▪ Plan exposure visits to Maharashtra where operations of private and APMC markets have been reformed to introduce transparency in transactions

Sub-Projects / Activity	Potential Risks & Impacts	Suggested Mitigation Measures
	(wetlands, streams etc.) in locating new markets	▪ Ensure vermi-composting pits are made to prepare good quality compost from organic wastes of the markets ▪ As far as possible develop design for markets with adequate introduction of green building norms – natural light, cross ventilation, use of solar power of lighting etc. ▪ Sites for establishing any new markets are free from natural features
Value chains and postharvest management, including infrastructure	▪ Generation of waste material – organic waste due to grading and sorting and plastic and other waste due to packaging and marketing ▪ Use of artificial means (chemicals) for ripening and wax for polishing (especially fruits) ▪ Farmer Producer Organizations with little or no representation of poor and marginal farmers – risk of exclusion ▪ Poor gender representation in decision making in farmer groups (and WUAs) ▪ Construction and/or rehabilitation of warehouses ▪ Warehouse construction and increased use of energy/electricity, including promotion of cold storage facilities	▪ Organic waste should be collected and subject to composting (vermi-compost pits) ▪ Plastic and other packaging wastes should be disposed as per existing state rules with proper tie up for disposal; these should be made part of standard operation procedures ▪ Follow the project's gender strategy for ensuring proper representation of women across all levels of decision making ▪ Ensure that right of way is not affected during construction/repair of warehouses ▪ Introduce for warehouses – provisioning of adequate natural light, ventilation and use of solar power of lighting etc. (also for cold stores)
Livestock and Dairy Related		
Livestock rearing and management	▪ Increased possibility of greenhouse gases from livestock	▪ Involve TN Veterinary University for various technical inputs

Sub-Projects / Activity	Potential Risks & Impacts	Suggested Mitigation Measures
	▪ Odour from dairy sites ▪ Spread of contactable diseases ▪ Lowering of water quality due to disposal of solid and liquid wastes from dairy activities ▪ Poor and marginal farmers left out of project benefits ▪ Inability of wage workers to undergo offsite training on livestock management ▪ Depletion of vegetation and forage resources on common property lands resulting in increased soil erosion	▪ Identified community professional if employed should be trained at reputed institutions ▪ Provide livestock management training to a wide range of livestock owners, particularly women who tend to animals – make training available at doorstep as women are often not able to leave homes for offsite training for long duration ▪ Ensure regular animal checkup through extension services and organize animal health camps in project supported sub-basins ▪ Promote stall feeding and provide technical support for developing low cost animal sheds ▪ Work with communities for revival of common pastures and prevent encroaching of common lands – introduce, wherever required, rotational grazing and provision of water at grazing lands to avoid wider degradation of natural vegetation
Fisheries Related		
	▪ Local depletion of larval and juvenile organisms for pond stocking ▪ Clearing/conversion of coastal wetlands for construction of ponds ▪ Use of explosives and poison in tanks for fishing ▪ Unfair selection and award of fishing contracts at tank	▪ Examine of larvae and juveniles in nurseries or hatcheries should be ensured ▪ Examine of ponds in area of particular ecological significance ▪ Prohibition of illegal practices, such as, use of explosives and poison, and enforcement of regulation

Sub-Projects / Activity	Potential Risks & Impacts	Suggested Mitigation Measures
	▪ Restrictions imposed for fishing by poor and marginalized and for those with traditional rights	▪ Ensure community monitoring of fishing in tanks ▪ Fairness in contracting tanks for fishing to private vendors – access to fishing by the poor and marginalized should be ensured
Stakeholder Participation		
Community mobilization	▪ Non-use of publication material, brochures in local language ▪ Few and ill-timed awareness campaigns resulting in inadequate coverage of potential beneficiaries ▪ Non-involvement of PRIs	▪ Ensure that local NGOs, field level officers who are engaged for motivation and awareness building are properly oriented about the scope of the project ▪ Use local language publication material ▪ Involve innovative approaches like street plays, awareness camps. ▪ Attract larger crowds to programs ▪ Inform the communities, including PRIs well in advance through public announcements and posters regarding date, time and place for such events ▪ Promote participatory monitoring by community and introduce social audits for maintenance and other works undertaken by the community
Forming WUA, election and other process	▪ Infiltration of influential farmers for taking benefits from assured irrigation ▪ Non-transparent selection of WUA presidents resulting in early disassociation of WUAs	▪ Implement the process as per the WUA Act and ensure proper awareness and time for adequate participation and representation of various groups
Training of line department staff and community members	▪ Ad hoc approach for training resulting in mismatch of training and demand and low participation of trainees	▪ Undertake Training Needs Assessment ▪ Prepare a training calendar and widely disseminate it

6.5.1 Component Level ESMF Activities

In addition to social and environmental activities at the project component level, the ESMF stipulates assessments and studies required to identify and address the macro level social and environmental aspects of the project intervention. These include provisions for studies to address the issues that may emerge during the project implementation and to suggest approaches for addressing the identified ESMF deficiencies.

Environmental cell under CE (PF) shall coordinate the collection of information on basic social and environmental parameters, as a part of the regular M&E. The relevant social and environmental parameters are presented in the Table 43, which will also be covered by Line Departments Quarterly M&E reports. The ESMF also stipulates integration of the detailed social and environmental auditing with the overall project M&E strategy.

6.6 Institutional Arrangements

The present institutional arrangements in PWD/WRO for implementation of the Environmental and Social Safeguards measures in the 66 sub-basins under TN-IAMWARM-2 has been reviewed and it is felt that the existing arrangements need to be strengthened to meet the requirements of World Bank which includes adequate staff with specialization in social and environmental management and project institutional structure at different levels. If these issues and concerns are not identified and addressed, it may affect the implementation of the planned activities under the project components like tank bund strengthening, desilting of supply channel, reconstruction and repair of sluices, repair of weirs, construction of field channels, demarcation of boundary stones etc.

A community-based approach is proposed in development of various components in 66 sub-basins under the TN-IAMWARM-2 project. To meet this objective, it is essential that from the planning stage i.e. starting from identification process, the community participation is ensured in addressing social and environmental concerns and also are integrated in the overall project framework and plan.

The main objective of the institutional arrangement is to ensure quality assurance and safety structures to apply environmental and social safeguards. The above institutional arrangements for implementation of different project components in 66 sub-basins would be made such that participation of different stakeholder's particularly primary stakeholders and women are ensured. The organization charts (refer figure 42 (a) & 42 (b)) for PWD/WRO and TN-IAMWARM-2 are as follows:

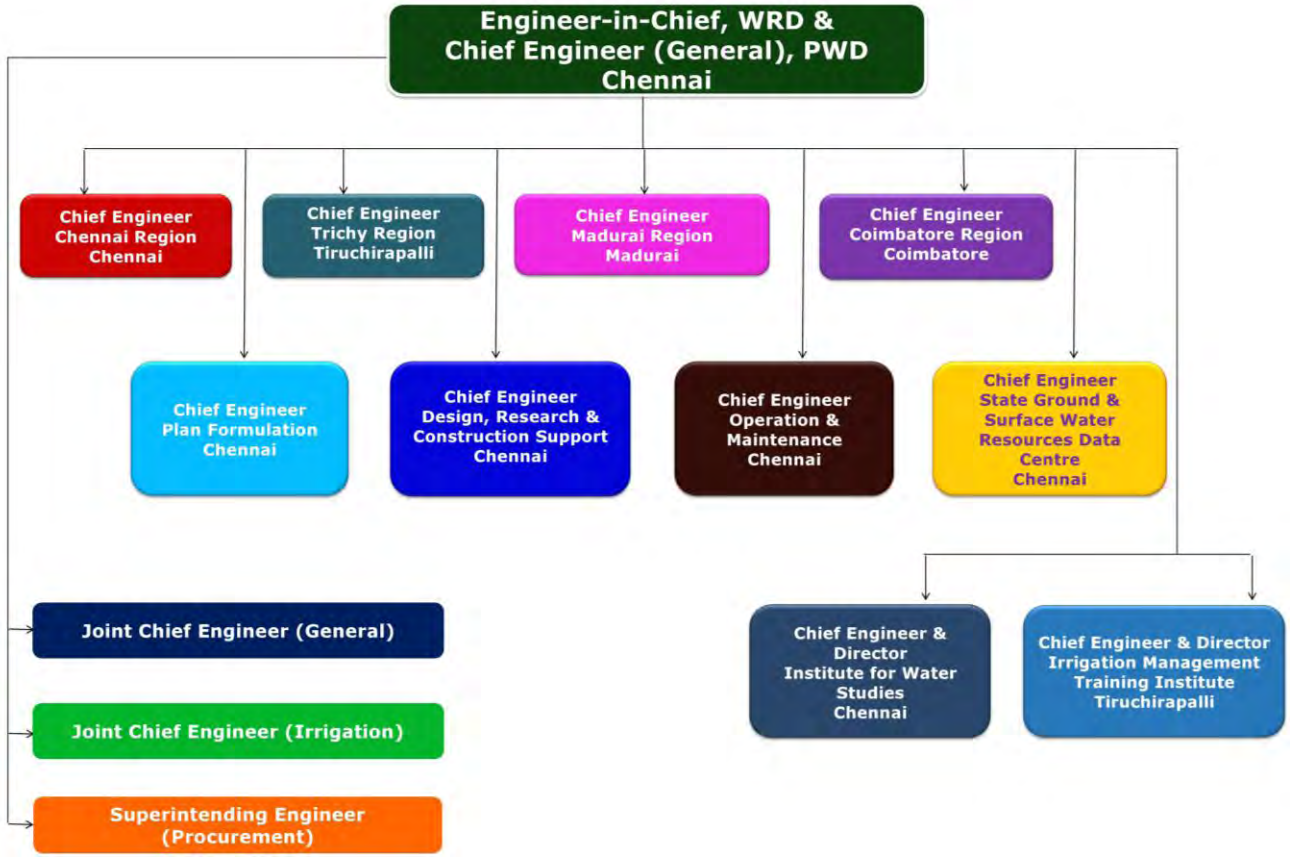


Figure 42 (a): Organization Chart of PWD/WRO

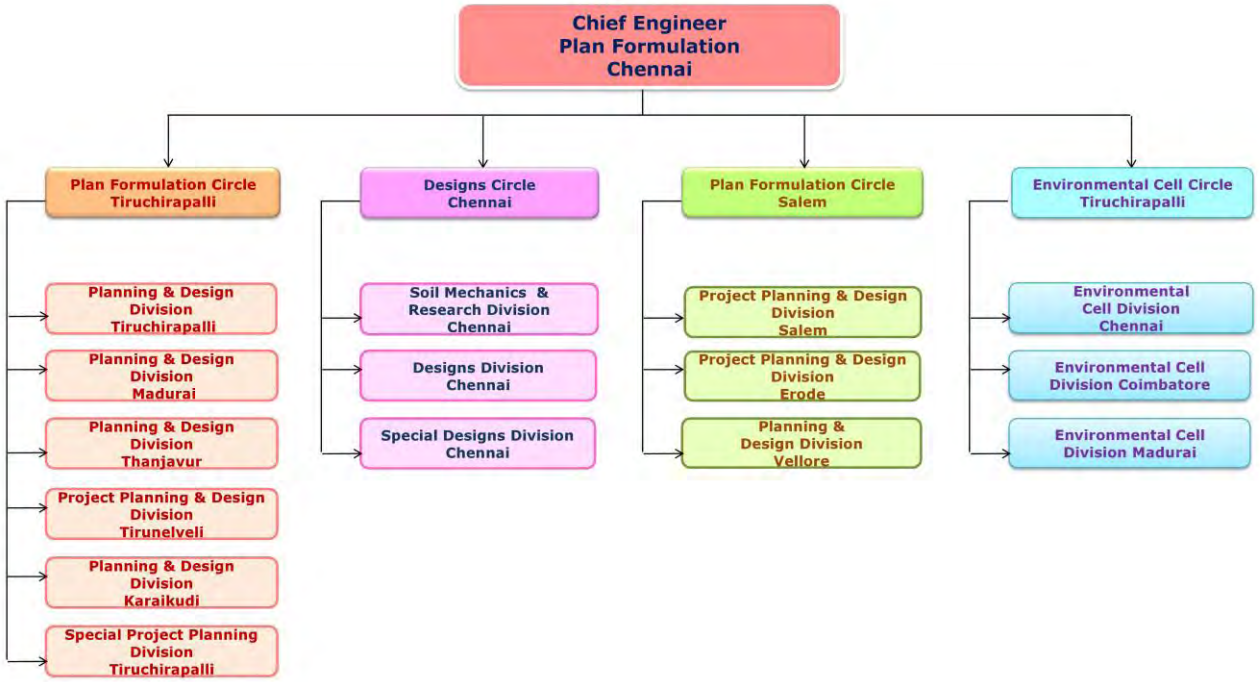


Figure 42 (b): Organization Chart of TN-IAMWARM-2

The TN-IAMWARM-2 project shall be implemented by eight line departments and coordinated by MDPU. The MDPU shall report to a Project Steering Committee (PSC) that will be established to review the progress of the TN-IAMWARM-2 at regular intervals and shall provide strategic directions, guidance on policy matters and resolve conflicts, if any, amongst the implementing agencies. The PSC shall be chaired by the Chief Secretary and comprise of the Secretaries to Government for Finance, Planning and the implementing agencies with the Secretary, PWD as the Member Secretary.

The concerned Executive Engineer (EE) of PWD/WRO and Deputy Director of concerned line department in each sub-basin, shall act as Project Implementing Units (PIU's) for all the project activities falling within their domain/responsibility.

It is suggested that MDPU will hire a qualified environment and social expert. In addition, capacity building training on safeguards will be provided to JE, AE, AEE and EE and their equivalents in charge of implementing project activities. One nodal environmental and social safeguards person will be identified in each line department who will be responsible for monitoring and reporting on the implementation of the safeguards arrangements and mitigation actions. An independent audit of implementation of safeguards provisions will be undertaken at MTR and at end of project. The roles and responsibilities of environment and social experts in MDPU are given in Table-42.

Table-42: Implementation Arrangement – Roles and Responsibilities

Experts	Responsibility
Senior Environmental Specialist (WRD)	• Shall be responsible for providing technical inputs implementation of the different interventions • Shall be responsible for assessing/screening environmer impacts of projects that are being undertaken. • Shall be responsible for supervising the implementation of Environmental Guidelines • Shall be responsible for coordinating training sessions and awareness programs. • Shall provide necessary inputs towards formulating training modules and imparting training. • Shall be responsible for coordinating between PIU's of differ regions for preparing Environment Information Dissemination Brochures for the interventions. • Shall review the Half yearly Environment Monitoring report and sharing it with the World Bank.

Experts	Responsibility
Senior Social scientist (WRD)	• Shall provide necessary inputs on social aspects related to the project • Shall prepare Social Management Plans (SMPs) based on assessments carried out for different interventions. • Shall undertake site visits • Shall provide necessary inputs towards formulating training modules and imparting training. • Shall provide inputs for establishing and strengthening of community based organizations like WUA (PIM) • Shall ensure women's participation and empowerment • Shall assist in conducting workshop and preparing IEC material.

6.7 Monitoring and Evaluation (M&E)

Monitoring of environmental and social issues is an essential component and an important element of ESMF. Actions need to be planned during the various project phases to integrate the monitoring programme within the overall monitoring and evaluation strategy. The monitoring will not only involve the updated progress of mitigation measures implemented, and also highlight important learning from results and outcomes of project interventions on environmental and social issues.

Environmental Monitoring Programme has been designed for the 66 sub-basins with the following objectives:

- Assessment of the changes in environmental conditions, if any, during pre-construction, construction and operation stages of the project.
- Monitoring the effective implementation of mitigation measures.
- Assessment of any significant deterioration in environmental quality so that additional mitigation measures may be undertaken.

The important monitoring parameters for the proposed components in 66 sub-basins are water quality, soil quality, agriculture related issues, socio-economic aspects and project implementation monitoring aspects. Suggested monitoring details are outlined in the following sections.

6.7.1 Monitoring

The monitoring strategy shall cover both internal and external monitoring along with participatory monitoring by beneficiaries as per the safeguard requirements to be done in two levels i.e. Regular and Annual monitoring in each of the sixty-six sub-basins.

- Regular monitoring shall be carried out by WRD through their concerned EE of three environmental cells under SE (Environment). The regular monitoring will be based on the performance of monitoring indicators (Table 43), identified with the help of initial consultations. Regular monitoring will be done.

- Annual monitoring will be done by WRD. The method of monitoring includes monitoring performance indicators (Table 43), literature review, management plan, site visit and stakeholder consultations. The review reports shall be submitted to GoTN and MDPU.

Table-43: Environmental and Social Indicators for Monitoring

Parameters	Monitoring Indicators	Frequency	Responsibility
Soil	• Amount of organic manure used • Ratio of N:P:K use • Soil pH, EC, Organic Matter • Volume of silt/earth extracted and disposed	Annual	WRD and line department
Surface and Ground Water	• Water Quality Monitoring as per the IS:2296 • Key parameters to be monitored are pH, EC, TDS, Chlorides, Sulphates, Boron and SAR • Ground Water level	• Pre monsoon (May) • Post Monsoon (January)	WRD and line department
Desilted material from supply channels	Standard physico-chemical parameters	Once at the time of desilting	WRD
Agro-chemicals	Quantity of Pesticides/Insecticides (Usage as per Integrated Pest Management Plan)	Crop-season	Line department
Vulnerable group and Gender development plan	• Representation in WUA, farmer groups • No of women and vulnerable group members participated in training and capacity building • Agriculture support extended (No. of beneficiaries)	Half yearly	WRD and line department
Communication	• Type and no. of brochures on ESMF distributed • No. of organized orientations/trainings on ESMF	Half yearly	WRD and line department

Parameters	Monitoring Indicators	Frequency	Responsibility
Socio-economic Aspects	Beneficiary profile and socio-economic aspects	At the end of first season and second season	WRD and line department

- **Impact Evaluation**

This will be done as part of impact assessment as part of the project M&E strategy which includes mid-term and end evaluation.

Table-44: Environmental Performance Indicators

Sectors	Environmental Performance Indicators
Agriculture	• Extent of each sub-basin area under sustainable agriculture practices supported by the TN-IAMWARM-2 project in all 66 sub-basins agricultural area supported by the project
Irrigation Infrastructure	• Extent of irrigated areas covered by each sub-basin project components of TN-IAMWARM-2 in all 66 sub-basins

6.7.2 Environmental Audit

Audit shall be performed to assess the impact of the project interventions. Audit should be conducted twice during the project duration i.e. before the mid-term review of the project and before the end of the project.

6.7.3 Environmental and Social Framework Budget

The environmental budget (Table 45) has been proposed as follows other than Government supported funds.

Table 45: Environmental and Social Framework Budget

Head	Details	Cost Estimate (in Rs.)
1. Human Resource		
Environmental Wing Headed by Superintending Engineer and Field Officers in the Rank of 3 Executive Engineers and 12 AEE/AEs	for 5 years (or project period)	*
Environmental Expert in the Rank of EE in MDPU	for 5 years (or project period)	60,00,000
Social Development Specialist (in MDPU)	for 5 years (or project period)	30,00,000
State & Regional level Social Developments Specialists (in EiC & Regional CE)	for 5 years (or project period)	1,50,00,000
Provision for additional consultancies that	Lump sum	50,00, 000

Head	Details	Cost Estimate (in Rs.)
may be required from time to time		
2. Capacity Building – Staff & Beneficiaries		
State level capacity building for nodal officers in line departments on safeguards	2 main training in first year 2 refresher training every year from second year onwards	2,00,000 8,00,000
Beneficiary training (covering all line department's activities, excluding cost of inputs)	Lump sum	50,00,000
Outreach Action & Materials for PMP, Agri-markets, agriculture, horticulture, fisheries, livestock, posters and handbooks, films etc. – designing and printing	Lump sum	60,00,000
3. Monitoring		
Monitoring of environmental parameters (during implementation phase – after construction phase)	Lump sum	60,00,000
Monitoring visits by nodal officers of line department, etc (only local travel)	Lump sum	3,00,000
Total		**4,73,00,000**

* Under State Budget

(ii) Environmental management budget for construction phase:

Head	Unit	Unit Rate	Cost Estimate (in Rs.)
Soil quality analysis (nutrient) At least 50 samples per year and two years of construction phase	100	6,000	6,00,000
Water quality At least 100 samples per year and two years of construction phase	200	6,000	12,00,000
Air quality At least 5 samples per year and two years of construction phase	10	10000	1,00,000
Noise level Random checking during use of heavy machinery	Lump sum	--	1,00,000
Total			**20,00,000**

CHAPTER - 7

PROJECT SPECIFIC STRATEGIES

CHAPTER – 7
PROJECT SPECIFIC STRATEGIES

7.1 General

This chapter outlines strategies and development plans that have been prepared specifically for TN-IAMWARM-2 project to enhance positive environmental impacts due to project interventions and to ensure social inclusion of vulnerable groups, conflict resolution. At the same time, these strategies and plans are aimed at minimising the adverse impacts and mitigate the resultant negative impacts of the project interventions. The following strategies have been developed which are discussed in detail in subsequent sections:

- Capacity Building
- Participatory Irrigation Management (PIM)
- Resettlement and Rehabilitation (R&R)
- Strategies for Development of Vulnerable Groups
- Gender Development Strategy
- Grievance Redress Mechanism (GRM)
- Information, Education And Communication (IEC) Strategy

7.2 Capacity Building

The capacity building program for the officials of PWD/WRD and other line departments shall be as follows:

- An orientation program should be organized at the State level. The workshop shall be organised once in six months during the project implementation phase, one prior to start of the project and then during the mid-term review.
- The next level of training should be arranged for lines depart members and sub-basin district line department representatives. This shall be organized once a year to acquaint all experts with the project with respect to environmental and social sensitivity, monitoring and auditing.

A systematic training needs assessment was done by WAPCOS team during the stakeholder's consultations and later when had the meetings with the line department officials during the field visits to the 12 sub basins. Also list of needs were collected through the feedback forms distributed to the participants from the different line departments in the first two consultations conducted meant for sensitization and sharing of the project objectives and at the end the two more consultations held to share the findings and suggestive measures of the study before the report was finalized.

As part of the Capacity Building Program, the training plan for the target group, implementing and resource organizations of TN-IAMWARM – 2 are given in Table 46 and 47 respectively .

Table-46: Training Plan for the Target Group

Type of Training	Target Group	Training methods	Frequency
Orientation Program at State level	Decision Makers, Officials of PWD/WRO and line departments	• Lectures • Presentation • Case Studies	• One before the start of the project • One during the mid-term review.
Line Department Level Training program	Sub-basin district line department representative	Presentation and Exposure Visits	• Once

Table 47: Implementing organizations, training needs and resource organizations

Organization	Training needs	Resource organization
Specific to department		
PWD	Purpose and components of ESMF for TN-IAMWARM - 2	Shall be identified based on specific requirements
	Environmental Appraisal process – Screening and environmental appraisal	Shall be identified based on specific requirements
	Implementation of Environmental Management Plan Guidelines	Institutions and External Agencies
	Institutional arrangement of ESMF	Shall be identified based on specific requirements
	Key aspects for monitoring of ESMF for TN-IAMWARM – II	Shall be identified based on specific requirements
	Environmental issues concerning waste disposal and solid and liquid waste management	Institutions and External Agencies
Agricultural Engineering Department	Modernization of agriculture like high tech micro irrigation system, solar powered pump sets etc	Shall be identified based on specific requirements
Agricultural Department	Impact of Climate variability on crops, importance of adaptation measures, contingency plan etc	Tamil Nadu Agricultural University, Coimbatore
	Updating skills and knowledge on IPM and INM	Tamil Nadu Agricultural University, Coimbatore
	Organic farming practices	Centre for Sustainable Agriculture, Hyderabad
Agricultural Marketing	Direct marketing and Farmers Producer Organizations	NGOs and other institutions
	Management of cold storage and other infrastructures	Shall be identified based on specific requirements
	Organic certification and Green	Key stone Foundation, Kotagiri

PIM aims to create a sense of ownership of water resources and the irrigation system among the users, improves the service deliveries through better organization and maintenance system. PIM encourages the optimum utilization of available source through proper deliveries. Keeping the principle of achieving equity in the sharing of the water. As a result of judicious use of water increase the production per unit, so as to maximize the incomes, and to encourage collective responsibility among the farmers.

To provide legal backup for implementation of PIM programme, the government of Tamil Nadu enacted the 'Tamil Nadu Farmers Management of Irrigation Systems Act, 2000.

SWOCA (Strength Weakness Opportunity Challenges and Action Plan) Analysis of Water Users Associations

SWOCA analysis helps to understand the strengths – the factors for success and weaknesses which affect of the organization to achieve its objectives, the existing opportunities and challenges for the organization to move ahead and finally the points for preparing a realistic action plan. The team conducted SWOCA in 30 villages in the study area with the members and leaders of the WUA. The main points emerged during discussions were consolidated and given below.

Strengths

- It was observed the success of the association is depending on the committed leaders and the active support they received from the other members.
- Occupation wise the members of WUAs are homogenous; all are farmers from the same village/area, helps to arrive consensus.
- Youths are interested to take up the leadership role and elders are willing to extend their support and guide.
- Famers' realization about the importance of water and willingness to cooperate in the participatory irrigation management.
- Inter departmental convergence to support the WUA to implement project activities related to irrigation and agriculture development.
- The interests shown by the women farmers to become members and participate in WUA.

Weaknesses

- Inter caste conflict – particularly between the dominant and disadvantaged communities in the village.

- Conflict of interest between the head enders and tail enders of the irrigation system – in many cases the tail end often fail to get their apportioned share of water due to this the head and tail end farmers are not working together.

- Leaders not conducting the meetings, involve other members in the decision makings etc, it makes the member to lose interest.

- Lack of leadership skills, the leaders are not oriented and trained properly on how to conduct and manage the association as per the act.

- Lack of participatory approach in the formation of the WUA without any political influence, farmers expect a systematic step by step approach need to be adopted while forming the WUA.

- Generally in the villages women are not the land owners therefore they are unable to become members of WUA.

- WUA lacks financial strength doesn't know ways to generate revenue for the association.

- No encouragement for the participation of young active farmers and get opportunity to become the leaders of the association.

- Lesser role for WUA in the activities implemented by line departments. According to the farmers the project activities implemented at the local level need to be identified in consultation with the WUA.

- Lack clarity on the functions and management of WUA.

Opportunities

- A common platform for the officials and other outsiders to meet the farmer and discuss issues related to irrigation and agriculture

- WUA can be linked with the ongoing government schemes, extension, training and capacity building programmes organized for the farmers at village level.

- It can act as a platform to facilitate and achieve the economy of scale for promoting direct marketing linkage for the agricultural produce. Similarly to buy inputs like seeds, fertilizers and pesticides through bulk order for a lower price from the companies and distribute to the farmers.

- At present it is a common practice, farmers hiring farm machineries from private owners and pay high rate, WUA can invest in farm machineries and act as a renting centre to provide farmers at lower rate.

- Traditionally tanks have been used as a source of fishery, communities get fish for domestic consumption and generated income for the common fund. The practice disappeared in most of the tanks due to various reasons. Now the farming communities want to revive the practice with the support of PWD and fisheries department. This could be a source of regular income for the WUAs.

- It was suggested in the field that like women SHGs, women farmers SHGs can be formed to prepare the women for the active participation in the WUA.

- Many well functioning women SHGs functioning in the villages – well trained women leaders of these SHGs can actively participate in the WUA

Challenges

- Uncertainty of water availability makes the farmers discouraged, uninterested and reluctant to actively participate for managing the system. The department is also sure about the supply of requisite quantity of water to the tank.

- Invasive weeds like *Prosophis* and *Eichhornia* creates a big problem to Lake Environment, the WUA find this as a real challenge to manage the tank environment.

- Fund generation - functioning with limited fund with the support received from the project.

Table. 48: Steps for forming and training the WUA

Awareness creation	• About the Tami Nadu Farmers Management of Irrigation System Act, 2000 (Tamil Nadu Act 7 of 2001) • Needs and functions of WUA • About TN-IAMWARM - 2 project	WRD, line departments with the support of an NGO
Formation of WUA	As per the guide lines in the act	WRD and line departments
Training and Capacity building of the members and leaders	Objectives of the WUA the guidelines for the organizational structures, tasks and responsibilities, and rules and regulations	Suitable training organization/ NGO working in the region
	Group management – leadership, conflict resolution, record management, planning for the association etc.	Suitable training organization/ NGO working in the region
	Exposure visit to the well functioning WUAs	WRD and line departments

Active participation of WUA – including the women members in the project implementation	Consultation about the activities and their feedback Participation in the review meetings Actively involved in the internal monitoring and evaluation	WRD Suitable training organization/ NGO working in the region

Training for the staff of the implementing implementing:

Organize training programs for the staff of the implementing departments on participatory management methods and approach. It is very important for the staff to understand the approach and to collaborate in the field with the WUAs. As a part of the training and capacity building programs, both the staff in the field can be taken for an exposure visit to the well functioning WUAs within the state or in the neighboring states.

7.4 Resettlement Policy Framework (RPF)

The proposed project interventions, do not envisage any new land acquisition/ appropriation and rehabilitation issues. Generally encroachment of common lands appears as topic in the group discussions with people who do surveys and visiting government officials. During the discussions with the survey team farmers mentioned about the likelihood of temporary encroachment in the peripheries of the tanks. Due to increasing water scarcity in the present situation, farmers in the villages are keen on protecting the tanks from any encroachment. Social screening process will be done at the planning stage of the tank rehabilitation which would help to know details of if any likelihood encroachment. The project contemplates fixing boundary stones and empowering WUA (as per TNFMIS Act 2000) to prevent any such action.

Even though, prima facie, there is no major land acquisition or resettlement and rehabilitation expected under the Project, the ESA provides a detailed Resettlement Policy Framework (standalone document) and guidelines for implementation. Further Land Acquisition and Resettlement and Rehabilitation Policies are built on the good practice examples set under TNWRCP. If and when required, this framework shall be used as outlined in the ESMF.

7.5 Strategy for Development of Vulnerable Groups (VG)

The vulnerable groups include socio-economically backward, scheduled castes and tribes, women, minorities, landless families, and marginal and small farmers. These groups, majority of whom are poor, constitute a significant proportion of the overall population of 66 sub-basins who are generally marginalized in the decision making process. As a result, quite often it is observed that they remain at the margin of the development process and do not access benefits at par with others. Therefore, it is important that their issues, in relation to the proposed project interventions, are addressed up-front mainly to enhance their participation in the project and to ensure that they have access to project benefits at par with others.

7.5.1 Dependency of Vulnerable Groups in the project area

Landless households are entirely dependent on agriculture labour and non-farm livelihood sources mainly for wage earning for which now a day they often migrate out of the village away from their family. Many a time, they do not find adequate work opportunities. In addition to this, people of vulnerable groups have no or subdued voice in community decisions.

The project will improve agricultural productivity and income of these households is likely to increase due to project interventions. As a result, the labour population in the village will get more work in the agriculture sector, thus minimising their migration from the village. Various vulnerable groups will also be benefited due to training and capacity building initiatives to be taken under the proposed project.

7.5.2 Opportunities for Vulnerable Groups under the project

The project components provide a number of opportunities to vulnerable communities wherever affected to benefit from project. Some of the specific opportunities are given below:

- *Increased employment opportunities:* Project interventions are likely to increase the demand for labour in the project areas. The project will increase overall cropping intensity in the area leading to higher labour requirement. It will again benefit more to the wage earners, majority of whom belong to vulnerable group.
- *Wage payment:* The project will ensure wages as per the Minimum Wages Act, thus protecting the interests of labourers. Further, there will be no discrimination in wage rates based on gender which will help particularly the women members in getting fair wages in accordance with ‘equal wage for equal work’.

7.5.3 Vulnerable Groups Development (VGD) strategy

The stage-wise development process of the VGD strategy is given in Table-49.

Table-49: Vulnerable Group Development Strategy

Issues	Strategies	Proposed activities	Responsibilities
Lack or low level participation	Educate project staff on involvement of VG	Meetings	WRD and line departments

Issues	Strategies	Proposed activities	Responsibilities
Lack or poor leadership qualities	Training in leadership and organizational development	• Work with groups to communicate the goals, strategies and plans of the project. • Design and organize specific capacity building programs for these groups	WRD and line departments
Low level participation in the improved agricultural development process	Ensure need based agricultural extension and support services	• Facilitate exposure to improved agriculture practices including IPM • Supply of seeds, fertilizers and technical know how in coordination with line departments and credit agencies • Support in periodic soil testing and demonstration of techniques to make the best use of soil conditions. • Organize special training programs/ demonstrations in fields of and VGs • Establish linkages with the agriculture-marketing network, provide logistic support	Line departments
Access institutional credit	Extend support to access institutional credit	• Provide information on various formal credit-lending institutions available in the area • Help the eligible families to complete formalities • Ensure that the credits received are productively used for improving farming	WRD and line departments
Lack of employment opportunities	Inform VG about employment opportunities under the project on preferential basis	• Inform willing workers about the availability of work • Ensure minimum wages and equal wage for equal work	WRD and line departments

The VGD strategy has been made which may be applied during the process of planning and implementing various project components in the 66 sub-basins. This strategy proposes two approaches:

- Detail the ongoing government programmes for the socio-economic development of the vulnerable groups in the sub-basins.
- Specific programmes under the project to help the vulnerable groups.

A provision of Rs.4.00 lakhs is recommended to be earmarked for implementation of strategies towards development of Vulnerable Groups in affected sub-basin.

7.6 Gender Development Strategy

Gender mainstreaming is addressed through identifying the gaps between men and women both in water management practices and agriculture. Specific activities will be suggested in the mitigation measures proposed to narrow down the gaps, voice and participation and decision makings in the new institutions and training and capacity building programmers, opportunities for women in jobs and other benefits, ownership in the new assets created.

To ensure this in the consultation process conducted exclusive gender analysis with mixed men and women and exclusive women farmers groups in all sub basins. Gender analysis will focus on gender gaps in development outcomes, understanding the level of participation by women farmers, women's role in decision making process, women's access and control over assets and properties etc. Women farmers participated in the transect walks, FGDs were conducted with the members of the SHGs discussed topics such as their role in the tank management, their role and decision making in the agriculture, labour opportunities in agriculture, participation in the extension, training and capacity building programmes meant for agriculture development and cattle management, gendered constraints, women's participation and roles in the community based organizations formed at the local level, migration of men and women to other places looking for labour opportunities, and their suggestions for tank management and agriculture development, and finally the opportunities to narrow down and close the gender gaps.

Important observations from the consultations held with women groups of different communities in the representative 12 sub-basins areas are presented below:

- *Low women participation in development programs:* In almost all FGDs held with women groups in the representative 12 sub-basins covered in the study, it came out clearly that women's participation in general is poor in the social and community activities at the village level. Due to less/no participation in the development programs, gender concerns are not adequately addressed and hence women are often deprived of benefits from the development activities.

- *Role of women in Agriculture and other economic activities:* Women play significant role in agriculture and other economic activities besides performing household work. *Access to employment opportunities: The discussion with wom*en groups, it came out clearly that the women have less access to employment opportunities particularly any new opportunities in non agriculture sectors
- *Lack of ownership of agricultural land:* It came out in the field discussions that in majority of cases land ownership lies with men and in only some exceptional cases, it is held by women. As a result, there is relatively very little land holding among women of the project area.
- *Limited access to market:* Women cultivators have problems in accessing markets particularly because of social, economic and cultural constraints in reaching nearby markets.
- One major positive change taking place in the villages in all 12 sub basins is that women from small and marginal holders, land less, tribal households are mobilized as women SHGs. These women group members have access to facilities like credit, training programmes and better mobility to reach out world and also own assets in their names. The negative factor is this new opportunity has also increased the work load and responsibilities of these women.

7.6.1 Guidelines for Implementing Gender Strategy

The guidelines for implementing Gender Strategy are given in Table-50.

Table-50: Guidelines for Implementing Gender Strategy

Stage	Process	Activities	Output
Preparation	Identify gender concerns through participatory consultations	• List issues and prioritize	• Issues identified that need to be be addressed if possible under the project
	Inform about the project activities and benefits	• Organize meetings with the women farmers	Sensitization of women on project objectives and activities
	Sensitize other stakeholders on gende concerns/issues	• Organize workshops on gender sensitization	• Sensitization of other stakeholders on the importance of gender
Implementa-tion	Encourage women participation in project activities	• Work with women Farmers/groups for active participation in the project activities	Active women participation
	Encourage equal wages for equal work in all project works		• Actual wages paid to women

Stage	Process	Activities	Output
Operation	Encourage women participation in WUA	• Organize training for active participation of women in WUA • Encourage more women members to attend meetings of WUA	• No of training organized • No of women attended

A provision of Rs.2.00 lakhs is recommended to be earmarked for implementation of Gender Development Strategy in each sub-basin.

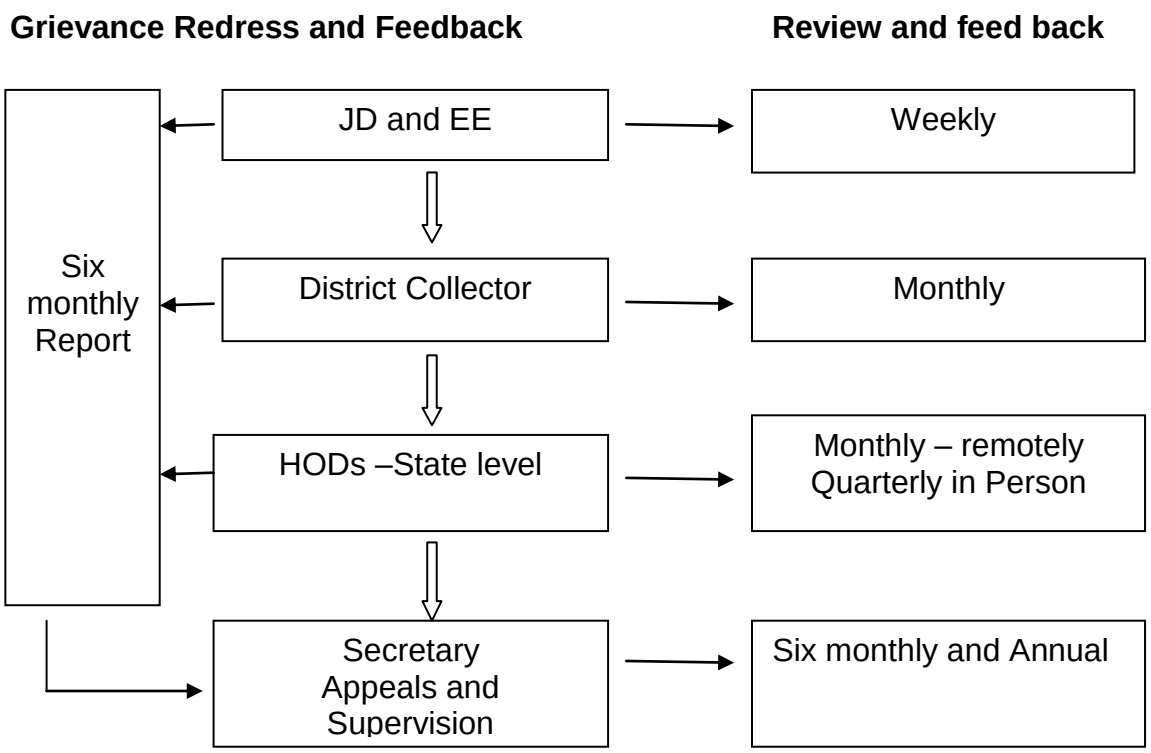
7.7 Grievance Redress Mechanism (GRM)

Grievance Redress Mechanism (GRM) is one of the important tools for project management where major stakeholders are public community having diverse socio-economic status. The TN-IAMWARM-2 project deals with the agricultural resources across the state and hence likely to have grievances in terms of sharing the resources and adaptation to the advances in agricultural diversification, agriculture entrepreneurship, and movement towards climate smart agriculture with relevant agriculture – water related investments. The institutional arrangement proposed in the project needs to ensure the concerns of all the project beneficiaries and stakeholders are addressed and accommodated in a comprehensive manner.

7.7.1 GRM at Project Implementation Unit, TN-IAMWARM-2

GRM is an essential component of any project administration, particularly if the project involves the local communities with diverse socio economic backgrounds as the major stakeholders. The grievance redress process will be a continuous, transparent and participatory process that would be an integral part of the project's accountability and governance agenda.

A project level GRM will be in place for addressing social, environmental and project related grievances. The GRM will have multi level structures and processes. At the district level the committee is made up of respective JDs of line departments and EE, WRD of the sub-basin, this committee meets on weekly basis. This committee will look after the grievances related to irrigation and water management. At the next level the Collector heads the committee and convenes the meetings monthly once. The Collectors will take care of the other grievances related to the project activities. The next level is the HODs at the state level they contact remotely monthly once and organize meetings at every quarterly. Secretary occupies the next level in the structure and in charge of overall appeals and supervision of grievance redress; he calls for a meeting once in six months and annually. For every six months report is prepared at all levels and sent to the Secretary. Quarterly report will be submitted to Vigilance Commission and Disciplinary Proceedings.



Effort will be made to create awareness about GRC mechanism to the beneficiaries through use of flyers and pamphlets at the village, Block and District level. The GRC will receive and redress all complaints and grievances that relate to the Project implementation that are formally brought to the GRC by individuals and group of individuals who have a grievance.

Scope of GRC

The GRC will receive and redress grievances and complaints that are formally brought to the GRC in writing by the persons and/or group of persons who have a grievance because of the Program's adverse impact on him/her and them. The grievance would, among others, relate to payment of compensation and involuntary resettlement assistance to all project affected persons in accordance with the eligibility criteria as set out in this RPF.

Process of GRC

- The GRC will receive all grievances/complaints and enter them in the Grievance Register;
- The GRC will work out a timeframe to redress grievances/complaints if such grievances/complaints are not redressed during the first meeting;
- The GRC will acknowledge receipt of all grievances/complaints, by registered post, within 7 days of receipt;
- The GRC will consider and redress grievances/complaints through public and transparent process in which all those who have lodged their grievances and complaints in order to facilitate transparency and accountability;

- The GRC will communicate its decisions/redress in writing to the complainants within 4 weeks depending on the nature of complaints and
- The GRC decisions are not the final and the grieved and complainants have the right to seek judicial redress if they are not happy with the decisions of GRC. But it should not the paraphrase the constitution fundamental rights.

Name, Office Address, Contact number and email id of each of the SDMs in affected districts shall be communicated to all the beneficiaries. The beneficiaries can register complaints in following ways:

1. Open House at the Block and District levels.
2. By ordinary/registered/speed post addressed to concerned SDM of their area.
3. Online through the portal http://onlinegdp.tn.nic.in/indexe.php

Complaints/Grievances Register will contain (a) Serial Number; (b) Case Number; (c) Name of the Grieved/Complainant; (d) Name of Father/Husband; (e) Gender (f) Age; (g) Full Address; (h) Brief details of grievance/complaint; (i) List of documents, if any, attached; (j) Details of previous grievance/complaint, if any; (k) Date of receipt of grievance/complaint and (l) Date of acknowledgement of grievance/complaint

When closing the complaint, agreement should be made with the complainant on remedy, and both parties sign to their approval of the case being closed and outcome accepted. Copies are kept in both hard copy and electronic (please see documentation of Grievance process) by both parties

Right to seek Legal Redress

- The grieved/complainant will have the right to seek legal redress through the judicial system if he/she or they are not satisfied with the decisions of the GRC. The option of seeking redress through the GRC or *through the judicial system will be explained to project affected persons during the process of public consultation and participation. But it should not paraphrase the constitutional fundamental rights.*

7.7.2 World Bank Grievance Redress Service (GRS)

The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaint to the WB's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the World Bank's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit http://www.worldbank.org/GRS. For information on how

to submit complaints to the World Bank Inspection Panel, please visit www.inspectionpanel.org.

7.8 Information, Education and Communication (IEC) Strategy

In order to ensure effective participation of various stakeholders and for achieving the desired project objectives, there is a need to ensure effective two way knowledge – between the project and project communities. Sharing of information is required at various levels and on different aspects of the project.

The broad objectives of IEC include: awareness generation and motivation, technology dissemination, developing the information system, improving access to project information, and educating the stakeholders. The task of educating and communicating the target people, especially beneficiary farmers, is quite challenging due to their literacy/educational level and access to and use of modern communication sources. Thus, there is a need for the project to evolve suitable IEC strategy and make available required information, in the form and time, which could help project stakeholders. The IEC strategy discussed here intends to cover mainly environmental and social aspects of the project implementation.

7.8.1 Generation of information and knowledge base

The foremost task in the IEC is to generate an information and knowledge base on the basis of which education and communication could be undertaken. The strategy identifies thematic areas for communication and target audience. The strategy also involves the type of information to be communicated and the tools/approaches required to ensure availability of information in the required form and use of media. The suggested strategy and framework is given in Table-51.

Table-51: Suggested strategy and framework for IEC

Thematic area	Target audience	Contents	Form of knowledge Material
Information on social aspects	• Vulnerable groups • Members of WUAs, and other groups	• Project benefits particularly for VG • Project information	• Printed documents along with pictographs • IEC materials
Social conflict resolution mechanisms	• Officials of WRD and line departments • Field staff of the project and line departments • Functionaries & representatives of NGO and others • Members of WUAs and other groups	• Description of social conflicts arising in rural areas including economic, institutional and legal. • Description of existing resolution system in different socio-economic settings	• Printed documents along with pictographs • Pamphlets and booklets • Sharing of information in the meetings of various institutions • IEC materials • Availability if wage employment announced in village meetings and in groups

Thematic area	Target audience	Contents	Form of knowledge Material
		• Applicability of such resolution system in other socio-economic settings • Success and failure stories • Information on project implementation – activities and beneficiaries	
Social risks	• Officials of WRD and line departments • Field staff of the project and line departments • Village institutions – WUAs and other groups • Project beneficiaries	• Description of various social risks to implementation of the project activities • Ways and means to reduce/mitigate such risks • Suggested precautions • Dates of the meetings of various institutions • List of beneficiaries and the type of benefits	• Printed document • IEC materials • Making available information in various meetings
Participatory decision making	• Officials of WRD and line departments • Field staff of the project and line departments • Functionaries/ representatives of Gram Panchayat, NGO and others • General villagers and farming community including women	• Preparation of work breakdown structure for the project components along with delineation of roles and responsibilities of each level of project management • Delineation of primary and secondary implementing responsibilities along with schedule and quality standards • Delineation of activities which are to be implemented through proactive involvement of beneficiaries in planning, implementation and	• Descriptive documents along with matrix of roles and responsibilities • Schematic exhibition of participatory process and participatory structure • IEC materials

Thematic area	Target audience	Contents	Form of knowledge Material
		monitoring and evaluation • Description of participation process for the concerned activities • Expectations from various stakeholders, especially farmers for different activities • Process protocols for various activities	
Environmental awareness	• Officials of WRD and line departments • Field staff of the project and line departments • Functionaries/ representatives of Gram Panchayat, NGO and others • General villagers and farming community including women	• Interaction regarding project activities and the impacts on environment • Positive and negative impacts of the project activities on the environment • Proposed mechanism for monitoring and evaluation of various impacts and measures • Expectations from stakeholder	• Printed material in descriptive form • Project activity wise positive and negative impacts along with proposed measures and implementation responsibility and expectations from stakeholders in form of matrix so that all concerned could easily grasp and internalize the information • Expectations from farmers and general villagers should be straightforward in language and form
Monitoring and Evaluation	• Officials of WRD and line departments • Field staff of the project and line departments • Functionaries/ representatives of Gram Panchayat, NGO and others • General villagers and farming community including women	• Documentation of project activities, targets, timelines, primary and secondary responsibilities for implementation of various measures to improve environmental and social performance of the project and expected output, outcome and impacts • Timelines for monitoring and evaluation • Compliance review mechanism	• Printed material in matrix form

Entire information base suggested above should be preferably generated in a single document so that officers and functionaries of WRD and line departments could access it easily. This should also be made available in the website of TN-IAMWARM-2 project. However, a separate document in form of booklet can be designed and developed for the farmer community. While the knowledge material for officers and functionaries could be in English and Tamil, the material for farmers must be in Tamil language.

7.8.2 Dissemination of information and knowledge

The information and knowledge base generated should be properly communicated to all concerned for educating them about the environmental and social issues/risks, proposed mitigation measures in order to solicit their contribution in reducing negative impacts and enhancing the positive impacts. Moreover, there should be an arrangement for receiving concurrent feedback from various stakeholders about the knowledge base, communication methods and tools and internalising such feedback to improve the knowledge base and communication system.

WRD shall come out with a communication strategy for the TN-IAMWARM-2 project in which environmental and social communication shall be built in. For effective information and communication with all the associated departments and institutions, monthly review meetings should be held at the WRD and line department for providing staff with new information necessary for effective implementation of social and environmental aspects of the project. Officials of WRD and representatives of line departments should participate in these review meetings.

Quarterly meeting should also be held in the office of the MDPU in which all the concerned officials of the WRD and line departments of sub-basin districts should participate to know the instructions, rules framed by World Bank, GoTN, WRD and review the progress of the works.

7.8.3 Strategic Communication

The policymakers and government officials would be a primary audience for the purpose of building support for the project, especially in terms of continued financing after implementation is complete. To fulfill above objectives, the strategy would include regular briefing and updating them through meetings, Newsletters, Brochures, Fact Files and communication materials which they can distribute to the visitors at their respective offices. Beyond policy makers, academia, scientist, technocrats, NGOs and opinion leaders should also be informed, educated and communicated through various tools. Some important tools are as follows:

- *Brochures*: Concise, understandable and attractive brochures will be prepared to provide an overview of the project, summarize project progress, tell the success stories of the project beneficiaries
- *Fact File***:** A fact file containing data of all project activities shall be prepared and circulated to politicians, policymakers and visitors to the project area.

- *Documentaries, TV/Radio interviews*: As the project starts yielding results, documentaries on project impacts showing how multi-lateral funds are changing the lives of farmers to be filmed and shown to all concerned.
- *Case Studies*: The case study based on MIS data will be incredibly powerful ways to communicate non-specialist audience.
- *Technical manuals*: All technical guidelines and procedures will be prepared for WRD in form of technical manuals for the benefits of NGOs, universities scholars, developmental staff etc.

The summary of communication tools planned for use in the project is given below in Table-52.

Table-52: Summary of communication tools planned

Stakeholder Group	Primary Communication Need	Primary Messages	Preferred Tools
Beneficiaries	Operational	• Project rules, roles, responsibilities • Benefits of participation • Right to information • Technical knowledge on land management (agriculture) • Opportunities for income generation (livelihoods) • Other programs that can meet their needs	• Traditional theater • Posters • Village meetings • Radio ads/shows • TV ads • SMS technology (for extension messages)
Policymakers	Strategic	• Project progress • To build ownership • To show project impacts	• Meetings • Brochures • Fact File • Documentaries • TV/radio • Case studies • Technical manuals
Opinion Leaders, Academia	Strategic	• Project progress • To build opinion • To show project impacts	• Meetings • Brochures • Fact File • Documentaries • TV/radio • Case studies
Government officials (practitioners)	Operational	• Project rules, roles, responsibilities • Benefits of participation • Right to information	• Meetings • Circulars • Brochures

Stakeholder Group	Primary Communication Need	Primary Messages	Preferred Tools
		• Technical knowledge on land management related issues	
NGOs	Operational	• Project rules, roles, responsibilities • Benefits of participation • Right to information • Technical knowledge on land management related issues • Awareness' campaign	• Meeting • Extension Literature • Audio/Video • Folk/Cultural media • Wall paintings

CHAPTER - 8

STAKEHOLDER CONSULTATIONS

CHAPTER – 8
STAKEHOLDERS CONSULTATIONS

8.1 General

Stakeholder consultations help to identify the key actors and to assess their knowledge, unique experiences, perspectives, interests, possible partnerships, contributions, and the importance of these aspects in relation for planning and management. The consultations would reveal the capacities of different stakeholders to participate in (and benefit from) the project activity, and the complexity of organizational relationships. Stakeholder identification and interaction is one of the major activities of the project. The key stakeholder for the current project are the number of farming communities in the sub basins, elected local bodies, community based groups like SHGs, Producer organizations, NGOs actively working in the regions, and a number of government organizations responsible for the management of water bodies and development of agriculture, animal husbandry and fisheries.

The consultation process started with consulting the relevant literature on the socio economic, demographic and environmental aspects through the secondary sources. The data collected from the secondary sources would be complemented by information gathered through field level consultations conducted by a WAPCOS team of experts using participatory methods with the different sections of the farming communities. The stakeholder identification and conducting consultations at different levels is one of the important activities of the project. It is mandatory for the state to manage the water resources and promote agriculture development through several state departments and agencies. In the state traditionally huge populations of men and women farmers belonging to diverse social groups are involved in agriculture in different regions. The nongovernmental organizations and other community based organizations also support in the management of water resources and the promote development of agriculture of the local communities. The details of community level consultations conducted and feedback forms are given in Annexure XI and XII respectively.

8.2 Stakeholder analysis matrix

The social assessment entailed discussions with all relevant stakeholders at different levels for each project component. The analysis of different stakeholders TN-IAMWARM-II project, their roles, responsibilities and relationships with the project in planning and implementing project interventions is summarized in the Table-53.

Table 53: Details of stakeholders of the project, characteristics, roles and responsibilities

S.No	Stakeholders	Stake/Characteristics	Expertise, roles and responsibilities
1	Farming communities: Men and women farmers	Traditional users /beneficiaries of the project, collaborators of the water management systems with PWD and other line departments	Traditional farmers groups have rich knowledge of water management and agriculture. Actively collaborate with PWD and other line departments for managing the water resources and infrastructure and development of agriculture
2	PWD and Line departments and training institutions	Legitimate owner of the water bodies, decision making authority, implementing agency, have budget	Implement the project activities, management of water bodies, implementing the government sponsored schemes, provide extension services etc
3.	Non Governmental Organizations	Community mobilization, facilitate building of village level community based institutions, good rapport with the farming communities,	Act as intermediary between the line departments and the communities for the implementation of the project activities Mobilize communities: men and women groups Support and conduct need based training programs
4.	Local bodies	Local level, decision making authority, mobilize budget	Grass root governing systems responsible for local planning. Collaborate with PWD the line departments in implementing and managing the water infrastructures
5.	Community Based Organizations	interest group, primary users of water resources and development of agriculture	Mobilized and trained groups with leaders to support development

S.No	Stakeholders	Stake/Characteristics	Expertise, roles and responsibilities
	such as WUA, SHGs, farmers clubs, Producer groups, Producer organizations etc		activities, act as a good platform for the implementation of the project activities

8.3 Consultation method and time line

The consultation process started with consulting the relevant literature on the socio economic, demographic and environmental aspects through the secondary sources such as census volumes, and reports from government departments. The data collected from the secondary sources complemented the information gathered through field level consultations conducted by a multidisciplinary team using participatory methods with the different sections of the communities. The team included experienced Social scientists, agriculture and environmental experts. Semi structured interviews were conducted with the officials of line departments and Open ended interviews with the leaders of local bodies, Water User Associations (WUA) and other organizations managing water at the village level, Focus Group Discussions (FGD) with the men and women farmers, women self help groups, Strength Weakness, Opportunities, Challenges and Action Plan (SWOCA) were conducted with the WUAs and local farmers groups in all 12 sub basins selected. The visiting teams had transect walks in the project sites such as the tank, canal areas or agricultural fields etc with the guidance of a small group of local farmers and officials from agriculture department and Public Works Department. Detailed checks of list of points need to be covered while conducting semi structured interviews and FGD was used by the team to conduct the consultations in the field.

In each sub basin the team conducted minimum three SWOCA with the WUA/ or local farmers using the water for irrigation of different localities and completed totally 30. FGDs minimum three (one with vulnerable groups like small and marginal farmers or farmers/farm labourer of scheduled caste or tribal community and two with women farmers – SHG members). Tribal population is not there in all sub basins; hence through a mapping exercise blocks and villages were identified and consultations were carried out. The teams conducted transect walks in the sites before conducting SWOCA or FDG. Semi structured interviews were conducted with the officials of the line departments.

Consultation helps to build a common understanding and coordinated approach. Aspects like accountability and transparency are taken care through the process. Since

no single method or process is appropriate for all situations multiple methods were used. The most effective consultations use a variety of techniques to meet the needs of stakeholders and to maximize the efficiency and effectiveness. The methods adopted are mentioned in the table given below. Use of participatory methods will help to level the power differences among the participants.

Field consultations were organization in three stages: The first stage was conducted with a range of stakeholders like the officials of line departments, technical experts and leaders of CBOs, local bodies and NGOs. During the consultations the scope of the work, objectives and the methodology will be shared with the stakeholders. The second staged focused on the farming communities, a wide range of topics related to environment and social aspects will be covered. The third stage was consultation with all stakeholders, major findings identified, and mitigation measures listed were shared and got the feedback and the relevant points discussed was later incorporated in the final report.

8.4 Participatory stakeholder consultations in representative Sub Basins

Cheyyar Sub Basin

Irrigation practices and management

Sharing water is through local arrangements developed by the farming communities, it was remembered there were traditional system of water sharing in the past, now those systems are not functioning any more. In the existing systems no strict procedures and well defined roles and responsibilities in many cases water resource is poorly managed.

Officially the management lies with either PWD or Village panchayat, WUAs were formed in some of the tanks to regulate water sharing and management of tank resources, none of them are really active.

Attitude of the farmers for managing the tank water resource changed after the introduction of free electricity for the pump sets by the government. Farmers are using the water for irrigation from the wells which involves no cost since electricity is provided free of cost. Hence, they are not concerned about storing and carefully using the water from the tank for irrigating the fields.

In the FGD farmers mentioned about encroachment* of public lands in general and also the likelihood in the water bodies a few places along the boundaries.

* Project doesnot expect encroachment because of "Prevention of Encroachment Act in Water Bodies" and also due to multiple Supreme Court and High Court directions

Bunds are reported as weak, sluices are not in use or the shutters not in good condition, farmers also reported that water leakage on both sides of the sluice due to poor quality renovation work done in the recent past. In some cases surplus channels are damaged, hence water flows out before the tanks reach the full storage capacity.

The villagers could not remember when the tank was desilted in the past, assumed more than five or six decades, hence requesting for desilting the tanks

The farmers suggested that planting of trees near borders all around the tank are will help to protect the tank from any encroachment in the future, species like palmyra and bamboo were suggested, to implement it was suggested the active participation of the district forest department.

Agriculture, Livestock and fisheries

Paddy is the main crop, tank water is used for a single season, and those who own wells are cultivating lesser area for the second season and cultivate crops like sugar cane, banana, ground nut and short duration paddy. According to the officials of the agriculture department the area for cultivation of different pulses like chick pea, black gram, green gram etc in the region has reduced drastically, the total area of pulse cultivation is reduced more than 50%.

Farmers need training on suitable alternative crops according to the changing climatic condition, integrated nutrient and integrated pest management, value addition of the agricultural produce, fodder production etc.

Farmers complained about the poor soil quality and believed this is due to over use of chemical fertilizer for every season and the declining use of compost and green leaf manure. Pest attack is reported as a major problem in paddy and spray three times for a single crop. Generally farmers hire a local person to spray pesticide, he brings the sprayer and pesticide and charges according to the area cover.

The traditional practice of removing *Vandal* (silt) from the tank to use in the agricultural field was banned, the practice helped farmers to replenish the soil fertility but now it was told the ban has been lifted and silt can removed from the tank to use non commercial purpose like mixing the silt in the agricultural fields.

Tanks located close to the urban centres are polluted a lot due to the mixing of sewage in the tank (eg. Nathapattu tank located close to Kancheepuram town). This resulted in

salinity in the water, using the saline water for irrigation makes soil saline and unsuitable for cultivating certain crops.

For efficient water management, micro irrigation system is now promoted by the department, awareness level has increased among the farmers about this new methods, more number of farmers are coming forward to adopt micro irrigation systems like drip irrigation.

Farmers are not generally aware of organic practices of agriculture related to nutrient soil management and pest management. They are expecting more support from the agricultural department for training, technology and inputs support to promote suitable organic practices to address the issue of soil, pest and reduce the cost of cultivation for eg. many farmers are interested in learning about vermi compost making.

Use of farm machineries for tilling, harvesting and threshing has become a common practice. Tractors, harvester and threshers are hired for rent, and according to the farmer they need to pay hire rate for the private owners.
Generally marketing of paddy (90% of the farmers) is through middle men, the price is fixed by the middlemen. Now the Department of Agricultural marketing is promoting Farmers Producer Organizations (FPO) to link the farmers for direct marketing of the products. Farmers need to be mobilized as village level Farmers producer groups having 10 to 20 active farmers.
Several farmers expressed that they are not aware of the agricultural development programmes, and said a few farmers who are in contact with the Agricultural officers only benefit through the programmes.

Credit support is through different sources, money lenders are still playing an important role, agricultural credit cooperatives and other commercial banks are also supporting the farmers to some extent.

Invasion of wild boar in the agricultural fields cause extensive crop damage, this reported as a common problem fields located along the forest borders.

According to the local farmers managing milch animal is now an important income generation activity, which provides daily income to the farmers, since agriculture has become more uncertain at present the small and marginal growers prefer to have milch animals to get some income.

Paddy straw and other agricultural crop residues are used as fodder; some of the farmers are cultivating fodder crops. Now there is a demand for green fodder, farmers

need more information about different species green fodder, supply of seeds and slips and also training for production. Marketing of milk is done through private milk collectors; some places farmers sell the milk to Aavin collection centres.

Environmental aspects

Infestation of the canals, channels and lakes by P.Juliforia and other invasive species like ipomea and grass prevents the flow of water. Further the dense growth of the canopy inhibits the growth of any other species beneath them. This also has lead to the loss of the native species that are resistant to draught. Rampant disposal of solid waste in the banks of the canal and lakes not only reduces the water-spread area but also obstructs water flow.

Social aspects

Majority of the farmers using the water for irrigation from tank and canals are small and marginal category belonging to different communities.

According to the local farmers farm investment has increased due to the demand for the farm labour, hiring of farm machineries, increased price of fertilizers and pesticides etc.

The main reasons for the non availability of farm labour is migration of youths from villages to other places looking for better jobs and income and diversion of the entire women labour for NREGA during the agricultural season.

Women farmers play active role in farming activities, in most of the villages women are mobilized as SHGs. They rarely get opportunities to participate in the training programmes, access to development schemes was also very limited. Most of the time in a day they are pre occupied with the household chores and agriculture activities. They were not approached/ encouraged to become members of WUA.

Traditionally agriculture is the only employment opportunity in the villages for women from landless and small and marginal households believe that they get more labour opportunity if more water is stored in the tank.

According to the farmers WUAs were formed many years back in the villages visited, they are not effective at present, no election was held to elect new leaders, it was mentioned that lack of clarity on the functions and capacity to manage an association were the reasons for not the effective functioning of the association, they also mentioned training on managing the association would help the farmers to manage the association properly.

Farmers are expecting more information about the facilities available in the agriculture department, like to know about the officials and their roles and duties, how to approach, their field visit details, schemes the department implements and how to have access to the schemes, training facilities available etc.

Issues and Suggestive Mitigation Measures

Issues discussed	Suggestive measures
Weak and narrow bunds, sluices are not in use and water leakage on the sides in some of the tanks	Repairing the infrastructures
Likelihood of encroachment in a few places along the boundaries was mentioned	Fixing boundary stones, and empowerment of WUA will prevent any encroachment from happening. RPF developed with abundant caution will be followed as mitigation measures, in case of any encroachment related involuntary resettlement
Availability of water for irrigation has reduced due to various reasons, change in the pattern and failure of rain fall, inefficient water management and irrigation methods.	Awareness about efficient water use system such as drip irrigation among the farmers is increasing. The state to continue the scheme and ensure that more number of farmers adopting every year
Soil salinity and land becomes unsuitable for cultivation	Through crop diversification method suitable list of crops can be suggested
Cost of cultivation has increased due to several factors like, fertilizer and pesticide cost, labour cost, seed cost etc	Farmers need more knowledge on soil management, pest and disease management, supply of seed etc. Introduction of Integrated Farming System (IFS) is believed to help to reduce the cost of cultivation. To promote it is suggested to have area/region specific development of IFS models.
Lack labour for agricultural work	Substituting with appropriate farm machineries which can also reduce the cost of cultivation. Farm machineries managed by interested water user association / farmer producer groups
Marketing of agricultural produce	Promotion of FPOs through forming and training of Crop specific farmers producers group with the support of NGO working in the

	area
Defunct water user association	Forming new water user association as per the act with more youth farmers and experienced elders and motivated youths for the well functioning of the association and also having women farmers as association members and leaders
Participation of women farmers in training programmes and water user associations	Encourage women to participate in the training programmers Encourage women farmers with land ownership to become members of the WUA
Juliforia and grass infestation in the lakes	Cutting and deweeding along with desilting of lakes, canals and channels
Sand Mining is prevalent in the river bed areas	Legal action and promote reuse of construction debris for construction aggregates
Solid waste disposal	Solid waste management and training in disposal of MSW

Thirumanimuthar Sub Basin

Irrigation practices and management

The river is enormously polluted due to the mixing of huge amount of sewage discharged from Salem city (which has a population of 829,267 people as per 2011 census) and effluent from textile and silver industries located on the outskirts. The river runs through the city around seven kilometers. The water becomes polluted/saline, and increasing salinity in the river water is badly impacting agriculture and drinking water sources, saline water is not suitable for certain crops, yield is reduced in some of other crops and soil in the agricultural field becomes saline.

At the tail end the river and tanks are dry and choked with *Prosophis* species and other shrubs, farmers requested to clear the prosophis which is a huge task. In this region the water level goes deep, with limited available water farmers finding difficult to manage to irrigate the fields hence the area of crop grown is reducing gradually.

The participants in the meetings mentioned about the likelihood of temporary encroachment in a few places along boundaries of water bodies.

Agriculture, Livestock and fisheries

Farmers very well remembered that in the past they had two seasons of paddy using the river and tank water for irrigation now due to water scarcity it is restricted to a single season, the other problem is soil salinity, to address the problem farmers have shifted to diversification of crops such as paddy to cotton, Sorgam and Ragi. In some places at the tail end farmers are leaving the cultivable land fallow and allow *Prosophis* to grow and every alternative year or once in three years they sell the plants for timber acre ` 10,000/-.

Farmers who are using new technologies such as solar powered pump and micro irrigation system like drip irrigation, SRI method of paddy cultivation and found very useful and these technologies can be successfully replicated to other farmers' field.

Different methods are adopted for marketing the farm produce, but mostly through middle men and local agents and paid lower price. In some places farmers are looking for infrastructure support like godowns to store the grains like paddy and sell later when they good price. The other option is access facility like regulated markets.

Farmers expressed that the extension support is poor or no support is given, the training programmes are mostly with targeted approach based already designed objectives not planned to meet the farmers' needs. And generally women farmers are excluded from the training programmes and development schemes meant for agriculture and animal husbandry.

Tanks were used in the past for fish farming; it helps to get some revenue for the villages and also supply of fish for the local communities. Now due to several reasons like pollution, lack water, issues related to managing the fisheries by the local people and the PWD the practice was completely stopped. Local communities suggest appropriate measures can be taken to revive this practice.

Environmental aspects

There is rampant solid waste disposal along the canals and the lakes. Juliforia and grass and thorny shrubs infestation is found in all the lakes, canals and channels. Silver polishing and ornament making is a cottage industry and the effluent is let out into the river system along the sewers and most of the effluent is let out without any treatment. Treated, untreated and semi treated Salem effluent mixes with the river system from various non point sources. Textile dyeing effluent is also let out into the river. Sand Mining is prevalent in the sub-basin.

Social aspects

Traditional tank water sharing system practiced in the past is not in practice any more in the places the team visited, in some places a new system is in place, managed by the local communities based on consensus (for eg. Minnakkal village) and some places no proper system is in place and the result is very poor management of water sharing.

Socially and economically disadvantaged sections like SC and other poor marginalized sections are traditionally depending agriculture for their livelihood, major changes in agriculture like from two seasons to single season and reduction in the area of cultivation and modernization of farms resulted in reduction of jobs in agriculture and seasonal migration of these people towards cities where they get job opportunities.

SHGs are working in the villages (mostly women SHGs and rarely men SHGs), SHGs started many years back are involved in regular savings and credit management, have group's savings account and good rapport with the local banks. These well mobilized groups, created a new opportunity/method to manage their credit needs either their own savings or loan received from the banks. SHGs with long history are creating good women leaders in the villages.

Women farmers play very active role in agriculture, traditionally carry out several tasks and contribute equally to men farmers, but when farmers get opportunity for training programmes by th government departments they are not included. In general women have very little access to the development schemes meant for agriculture and animal husbandry promotion.

Due to water scarcity, pollution and increase in the cost of cultivation small and marginal holders, particularly young farmers in the villages locate at the tail end of the river are leaving farms and looking for other alternative jobs like driving, masonry etc or leave the villages temporarily to work as wage labourers in the cities.

Issues and Suggestive Mitigation Measures

Issues discussed	Suggestive measures
After the collapse of traditional water sharing method, no proper new method is in place, in exceptional cases good management system is in place developed by the farmers based on consensus	Formation of WUA as per the act with the support of a good NGO functioning in the area
Saline water and soil salinity affected the crops traditionally cultivated like paddy, and reduction in yield in some crop, less or	Promotion of alternate crop according to the suitability of the soil and other parameters, introduction of saline

Issues discussed	Suggestive measures
no profit in agriculture	resistant crops, soil reclamation demo in the farmers fields
Likelihood temporary encroachment of water bodies in a few places along the boundaries was mentioned by the farmers	Fixing boundary stones, and empowerment of WUA will prevent any encroachment from happening. RPF developed with abundant caution will be followed as mitigation measures, in case of any encroachment related involuntary resettlement.
Water scarcity is a major issue at the tail end of the sub basin	Crop selection according to the change and introduction of water saving irrigation system
Lack proper marketing system, infrastructure support to stock the produce or any value addition practice	Promotion of direct marketing, mobilizing formers as producer groups/company and training on crop specific value addition practices
Poor or no extension support, not planned based on the needs of the farmers, of late the visits of the extension officials to the villages is reduced drastically	Farmers need based, gender sensitive extension support Mobile technology can be used to consult the extension officials when ever required
Seasonal migration is a common practice in the villages particularly among the youths due to lack of interest in agriculture and lack job in agriculture	On farm and nonfarm employment generation
Although women play active role in agriculture they are excluded in extension activities and development schemes	Reserve certain percentage for women farmers in any training programmes, and conducting women exclusive training programmes
Fisheries in the tank is not practiced any more for various reasons, local communities perceive this as a source for generating income for the common fund	Revived with the support of the fisheries department
Solid waste disposal	Solid waste management and training in disposal of MSW
Juliforia and grass and thorny shrubs infestation in the lakes, canals and channels.	Cutting and deweeding along with desilting of lakes, canals and channels
Silver polishing and furnace is a cottage	Making the unroganised sector into an

Issues discussed	Suggestive measures
industry and the effluent is let out into the river system.	organised sector and creating awareness on the disposal of waste water from the polishing and manufacturing sources
Treated, untreated and semi treated Salem effluent mixes with the river system	Establishment of common effluent treatment plant under the Salem Municipal limits and plug the non point sources of sewage disposal. Using the sludge as a source of nutrient in agriculture
Textile dyeing effluent is also let out into the river	
Sewage from non point sources	
Sand Mining is prevalent in the river bed areas	Legal action

Gadana Sub Basin

Irrigation practice and management

Farmers have developed local system sharing of waters for irrigation; some cases the village traditional panchayats appoint people for taking care of water sharing and irrigation and the people in charge get the reward in kind. In some cases the local farmers formed WUA like 'Gadana Kangayam Neer pasana Sangam' and Vandankulam Neer pasana sangam etc., but these associations are not actively functioning.

Supply canals from the river meant for irrigation are damaged, shrunken and silted; similarly sluices and tank bunds are not in good conditions for most of the tanks visited. In some cases (eg.Pallakal Periayakulam) solid wastes are dumped in the canals and sewage is also mixed from the neighboring villages.

Possibility of encroachment in a few places in the bunds of the supply canals and tanks was discussed in the meetings. Deposits of silts reported in all tanks visited. As a result reduced water flow and reduced water storage in the tanks.

Agriculture, Livestock and fisheries

In the past farmers in the sub basin had two seasons of paddy cultivation, IR 20 and IR 8 are the preferred varieties, now due to changes particularly availability of water two seasons of paddy is reduced in to single season and started cultivating other crops like banana, sugar cane, ground nut, cotton, and vegetable like Yam, brinjal and bendi in smaller areas in the second season.

Capital support for agriculture is limited from the commercial banks, majority of the small and marginal farmers depend on Primary agricultural cooperative societies and money lenders cum middlemen for money to invest in agriculture, and they pay very high rate of interest. Dependency on money lenders makes the farmers to depend on them for marketing the produce and also lose the bargaining power.

The facility of regulated markets located in the district head quarters where the farmers get fixed price by the state for Paddy is not effectively used by the farmers particularly the small and marginal farmers, they don't take paddy to sell in the regulated markets because it involves additional transportation cost.

Value addition is one area farmers like to learn more for each crop. The simple form of value addition process, this could help them to add value for the produce and get better price for the produce in the market. Farmers need training to do Skill and knowledge about the processing.

Storage facility is a concern expressed by most of the farmers, they need this support to do minimum value addition process and store the produce for certain period till they get better price in the market. For eg. they like to clean and dry paddy and store for a few months and believe they get higher price per after a few months.

Use of chemical fertilizer is increasing every year; farmers are linking this with the declining of cattle population in the region. Encroachment of grazing grounds and lack of other fodder sources are the reasons for the decline of the cattle population.

Extensive use of fertilizer is reported for crops like banana, cotton etc. this practice increases the cost of cultivation and negatively affects the soil health.

Although farmers are interested in organic practices, lack skill and knowledge for practicing in their fields, for eg, farmers are interested in the production of vermin compost, but unable to practice. The other main reason given by some why they do not prefer organic practices is the low yield they get in organic farming when compared to regular farming.

Farmers adding silt in the agricultural fields removed from the tank was a common practice in the past. Now it is banned by the government. According to farmers this practice helped to maintain the fertility of the fields to some extent hence they expect the government to lift the ban and like to revive the practice in the coming years.

In general the practice of livestock management is declining due to reasons like lack of fodder, grazing ground, capital investment etc. Now the farmers are interested to revive

the practice particularly rearing of milch animal and looking for support to buy the milch animal from the banks and sell the milk through cooperatives.

Fish farming was one of the sources of income for the village common fund; but now the practice is stopped in many of the villages. The money was used for repairing the bunds and sluices. Now the farmers are interested to revive the practice again in partnership with PWD. Fish farming auctioned to private owner some time leads to conflict with the local villagers (eg.Vandakulam) and local farmers have apprehension about the feeding system followed by the contractors which sometimes pollute the water.

Environmental aspects

There is abundant weed growth, lotus and Ipomea in the lake. They provide feeding ground for the fishes and the biota. However this is also an indication for the mixing of the nutrient rich water in the lake systems. This is also attributed to the non-point source of sewage that mixes with the canals and lakes. There is dumping of construction debris into tanks in many places.

Social aspects

Majority of the owners of the fields in the ayacut are small and marginal holders.

Some places farmers have formed WUAs and functioning for regulating the irrigation system.

Migration is an issue; farmers find difficulty to labourers to carry out agricultural activities.

Women SHGs are function in the villages, many are working well but some of them are defunct the reasons are lack of training and discipline among the members; SHGs are promoted by NGOs and the village panchayats. Women support agriculture, the well functioning SHG members receive loan up to Rs.30, 000/- and use the money to invest in agriculture.

Traditionally women from land less families work in the agricultural fields as wage labourers, now beedi rolling (women do directly to the companies or through intermediaries) is the main occupation for most of the women particularly the women from Scheduled caste communities.

Issues and Suggestive Mitigation Measures

Issues discussed	Suggestive measures
The WUAs formed by the local farmers are working well, in other villages farmers like to have WUA	Formation of WUA as per the act.
Supply canals are damaged and silted mixing of sewage in the water	Renovation of tank bunds and cleaning of the canals
Farmers reported the likelihood encroachment in a few places in the supply canals and tanks	Fixing boundary stones, and empowerment of WUA will prevent any encroachment from happening. RPF developed with abundant caution will be followed as mitigation measures, in case of any encroachment related involuntary resettlement.
Extensive use of chemical fertilizers, increasing cost of cultivation, non availability of farm yard manure due to declining cattle population, some of the farmers are interested in learning about organic practices	Introduction of IFS model, specific to this region, training the farmers on organic practices
Livestock population is declining, main reason lack of fodder source, now farmers are interested to have milch animals, need capital to buy	Bank linkage for capital support and training on fodder cultivation
Fish farming in the tank was in practice and a source of income for the villages, farmers are interested to revive the practice	Revival of fish farming in collaboration with PWD and Fisheries department
Well functioning women groups are existing in the villages, the members expressed their concern that they need training on income generation activities and want to be informed about the government schemes	Possible training support can be provided
Weed growth, lotus and Ipomea in the lake near the sluices	Deweeding and desilting of the channels and canals
Runoff with high nutrient content from agriculture fields	Optimal use of Fertilizers at the right time and use of bio-pesticides

Issues discussed	Suggestive measures
Domestic Sewage from the municipal areas of is released into river	Establishment of STP at Panchayat level to treat the water and plug the non point sources of sewage disposal. Using the sludge as a source of nutrient in agriculture
Dumping of construction debris into tanks	Legal action /promote reuse of construction debris for construction aggregates

Pazhayar Sub Basin

Irrigation practices and management

Supply canals for irrigation from the river are damaged (eg.Arumainallur) on both sides of the bunds at many points, depth of the lake is reduced due to silt deposits and storage quantity is decreased.

Likelihood of encroachment was mentioned in the group discussion along the supply canals in a few places.

In the past there were traditional systems for sharing of water and managing the irrigation system, these systems are not in practice in the villages any more. The new system works based on the rules and regulations and farmers understanding. WUAs are functioning, need to become more active. Tank and canal irrigation is the common practice, wells and bore well are very rare.

Sewage mixing is common cause for pollution of canal and tank water, mixing of rubber processing effluent is observed in one of the villages visited.

Agriculture, Livestock and fisheries

Paddy (Ambai -16 for the first season, TPS – 3 –for the second season are the common varieties preferred by the farmers) and banana are the two main crops cultivated. Tapiaco is the third crop cultivated in areas where less water is available. Most of the farmers cultivate vegetable crops particularly in the second season to meet the domestic requirement.

In a few places SRI method of rice cultivation has been tried through government schemes in farmers' fields. But farmers are not showing much interest to adopt the method, according to the farmers since water is not an issue farmers are not keen on learning more about the technology. This needs further probing to find out the reasons and plan to take it further.

Extensive use of chemical fertilizers is reported, availability of farm yard manure is very limited due to very less cattle population in the area. According to the farmers low yield is the main reason mentioned for not showing any interest for organic farming. Lack of knowledge and skill about organic practices is another major reason for farmers not keen on practicing organic farming methods.

Marketing is through local agent and middle men lack of access to regulated govt market, transportation cost is one of the main reasons for the small and marginal farmers and rented farmers, medium and big farmers take their produce to the open markets. Moisture content in the paddy is another reason for not selling in the regulated markets; farmers need to dry the paddy for a few days to reduce the moisture content before taking to the regulated market. No drying yard is available in the villages.

Poor awareness about the govt schemes meant for agriculture development among the small and marginal famers. These farmers complained that the extension officers and other agricultural officers meet only the selected big farmers to share the information and link them with the existing schemes.

Small and marginal farmers and share croppers get capital support mainly from the middle men and medium and big farmers with big plantation crops are supported by the commercial banks. This situation leads to the small and marginal farmers to sell the product to the same middle men from whom they borrowed loan.

Labour for agriculture is a major issue in this sub basin. This situation forced the farmers to use more machinery to carry out tasks. Harvesting is still an issue, due to limited harvester farmers need to postpone harvesting some times which may lead to grain loss; cost is also more, after harvesting the fields' women labour is required to harvest the paddy left at the edges of the fields.

Very few families practice livestock management. The reasons for the gradual decreasing of the practices are a few, like reduction of grazing grounds in the area, lack of fodder, farmers are not interested to cultivate fodder crops cultivated in the fields.

Environmental aspects

There is a lot of rubber cultivation in the sub basin. The rubber produced is acid treated and the untreated effluent from the rubber processing units are discharged into the river system at non point sources. There is mixing of Domestic Sewage causes skin related problems. There is sewage from settlements near the canal and lake in the Ootuvalmadam area near the Nagerkoil Railway station that is being directly discharged into the surplus weir that is silted, hence the water flows back to the Pazhayaru Dam. This a one of the major sources of sewage contamination to the river system. There are

a lot of butchering units at Parakkai that lets the wastewater to mix with the canal system in the sub-basin. This waste water has high BOD and nutrient value that allows the over growth of weed. This is added by the high nutrient water discharged from the agricultural fields.

Social aspects

Most of the women agricultural labourers are from Scheduled cast community, they are now get employment in the MNGREA scheme. Prefer to work for MNGERA instead of farmers fields. This lead to labour shortage for agriculture.

Farmers in the region are mobilized as Thennai vivasayigal sangam (Coconut growers association), it helps the farmers to get market support and also inputs supply.

Farmers clubs promoted by NABARD are existing in some villages, which is helping to tie with banks for credit access and help the farmers to have access to different government schemes etc.

Absentee farmer is a common practice in the villages, these farmers rent the land to several small holder. The disadvantage is technically they are not qualified to access the schemes and trainings meant for farmers due to lack of entitlement.

Women are mobilized in to SHGs, particularly the women from land less families and women from SC communities, they are functioning primarily as savings and credit groups, some of them are interested to start enterprises, marketing the products is a major issue, failed in some of their experiments in the past.

Issues and Suggestive Mitigation Measures

Issues discussed	Suggestive measures
Damaged canals and silt deposits	Strengthening the canals
Traditional water sharing system has disappeared new system is in place, WUA is not very active	Strengthening of WUA
Sewage is mixed in the supply canals	Plan for sewage treatment
Likelihood of encroachment in a few places along the supply canals was mentioned in the Group discussion	Fixing boundary stones, and empowerment of WUA will prevent any encroachment from happening. RPF developed with abundant caution will be followed as mitigation measures, in case of any encroachment

Issues discussed	Suggestive measures
	related involuntary resettlement
Small holders and rented farmers are interested to learn about low cost technologies and organic farming practices	IFS introduction of livestock management, and training on organic practices
Middle men exploitation small holders and rented farmers, lack of value addition process, no direct marketing	Mobilize them in to farmers clubs, bank linkage for capital support. Infra structure support for value addition process, promotion of crop specific FPO like paddy, banana and tapiaco
Extension system need to address the issues and needs of the small and marginal farmers, skill development and information about the schemes	Mobilization of small and marginal farmers as farmer clubs it will help the extension officials meet them as groups. Use of modern ICT tools such as mobile phones to contact the officials
Labour for agriculture is a major issue	Introduction of suitable farm machineries
Well functioning SHGs are existing, their effort to manage income generation activities failed mainly due to poor market linkages	Possible support to SHGs
Effluent from the rubber processing units are discharged into the river system	Promoting use of primary treatment to neutralize the water from being acidic and necessary monitoring measures to ensure the surface water quality is not affected.
Mixing of Domestic Sewage causes skin related problems	Establishment of STP at Panchayat level to treat the water and plug the non point sources of sewage disposal. Using the sludge as a source of nutrient in agriculture
Sewage from settlements near the canal and lake in the Ootuvalmadam area near the Nagerkoil Railway station at the Pazhayaru Dam.	
Waste water from butchering units at Parakkai mixes with the supply channel.	Creating awareness among the public and the local administration about the impacts of water borne diseases. Segregation waste and incineration of bio fouling wastes to prevent the spread of diseases.

Issues discussed	Suggestive measures
Weed growth and Siltation of Pazhayaru Dam, lakes and canals	Deweeding and desilting of the channels and canals

Ponnaniyar Sub Basin

Irrigation practices and management

Silt deposit in the canals and tanks, bund damage, sluice are not in good conditions are reported in almost all cases. Due to these problems, water flow restricted, reduced, storage in the tank also reduced and water leakage leads to fast draining of water from the tanks. All these factors cumulatively affect agriculture, not enough water for irrigation and reduced area of cultivation.

In a few villages mixing of sewage pollutes the water (eg. Koothapar village receives the sewage from BHEL, Kundur periakulam receives effluent from tanneries) was observed and reported.

Water sharing is practiced through different methods, like recently formed WUA (earlier traditional system collapsed), continuing the traditional method like appointment of a person called '*Neerani*' who is in charge of irrigating the fields and managing the sluice and bund etc for which he receives traditional reward from all users. WUA helps to sort out smaller issues related to water sharing, some places WUA is not active.

Damaged supply canals (for eg. in the village Kannuthu 13 kms canal) resulted in narrow bunds, it affects the water flow to the tanks. Some of the tanks received no water for quite long period (eg. in Pagalur periakulam tank no water nearly for the last two decades). It was also reported that possibility of encroachment of water bodies.

In the group discussion farmers mentioned about the likelihood of encroachment in a few places in the periphery of the tanks.

The tank is filled with Prosopis species and another invasive species Hypomea, invasion of these plant species has destroyed the grass species therefore increasingly tanks are becoming unsuitable for grazing the livestock population.

Agriculture, Livestock and fisheries

Major crops cultivated are Paddy, Cotton, Sorgam, in the second season vegetables like brinjal, bendi, legumes and gourds. Maize and ground nuts are the other crops cultivated. Due water scarcity, farmers are shifting to coconut plantations, want to learn about water saving irrigation like drip system for coconut plantations.

Using of chemical fertilizer and pesticides to manage different pest and diseases of crops is a very common practice among the farmers. Mostly farmers take the advices of private agro chemical shops. According to the local agricultural officers the farmers apply over doze of fertilizers and pesticides and sometimes use wrong pesticides.

Farmers like to have more support from the agriculture and horticulture departments to tackle the problems they face in the fields. In one village due to the implementation of the a project called 'Clima Adapt' the farmers are aware and got the knowledge about changing climatic conditions and its impact on crops

Cases of solar energy pump sets are reported and farmers are convinced about the benefits of the technology. In another place farmers discussed about the SRI method and the benefits.

Marketing is done through farmers transporting the harvested produce of major crops like paddy and cotton directly to market in Tiruchirappalli city and vegetables generally which are not large in quantities are sold in the nearby weekly markets. But most of the farmers are depending on local middle men for selling the produce and get lower than the market rate. Paddy farmers are interested in forming a crop specific Producer organization. Famers are now aware of the advantages of value addition and Interested to have orientation on value addition process.

Livestock management is a common practice in the area, rearing milch animal (cow and buffalo) is an important income generation activity of the farming and labourer households. But at present declining water availability in the tanks and wells the farmers are finding difficult to manage the cows. No water for fodder crops cultivation. Marketing of milk is not an issue, sold through different agencies like Aavin, Arokia and VK Milk Company. Farmers need training on disease management, farmers expecting the department of animal husbandry to conduct training programmes for increasing the fat content and other extension support.

It was reported in some villages (eg.Kottaikulam, Sentankulam) coconut farmers and other farmers received training on organic manure. Farmers say it is difficult to practice unless have cattle in their farms. Lack of grazing ground, water for irrigation and support for fodder cultivation are some of the main reasons.

In Ponnaniar dam 86 members have registered as fishermen for fishing in the dam with the permission of PWD. These members are from various communities living in the surrounding villages. They catch four species of fishes and sell the market located near the dam. The revenue is shared in the ratio of 1:2 for fisherman and PWD.

Environmental aspects

There is mixing of partially, untreated and treated sewage and effluent from Manaparai municipality is debouched in to the Ponnaniyaru sub basin area. Also non point sources of domestic Sewage from the municipal areas of Trichy is released into river. Sand Mining is prevalent in the riverbed areas and there is dumping of debris into tanks and canals. Over growth of Jatropha, Juliforia infestation in the lakes

Social aspects

Now agriculture is not providing job for the landless round the year, most of the land less are from SC community, they migrate to nearby towns and city to work in spinning mills, construction industry etc. According to the farmers due to the other employment opportunities getting labour for agriculture is difficult at present.

Youths lack interest in agriculture is another concern expressed about the future of agriculture. According to the young farmers agriculture is not a profitable enterprise.

Women SHGs are functioning in the villages, (eg. 15 are functioning in Kallikudi village, 96 SHGs in 30 SHGs in Thiruvalarchipatti village), most of the members value SHGs very much, SHGs support to get credit, amount received from the SHGs are used for agriculture, children's education, meet medical expenses etc. SHGs have started a few enterprises like masala power preparation, mushroom cultivation but marketing is a problem and could not sustain. Training by an NGO called SMART on income generation activities.

A registered organization called Ponnaniar Pasana Sangam is functioning with 40 farmers (from 11 villages in the surrounding area) as members; the organization was registered three years ago. This organization collaborates with the PWD to address issues in the catchment area, and water distribution, prevention encroachment etc.

Water used for domestic consumption in some of the villages is not potable it leads to health problems like skin infection.

Issues and Suggestive Mitigation Measures

Issues	Mitigation measures
Bund, canal damage, sluice not working, reduced water flow, diminished storage	Renovation of bunds and canals and repairing of sluices
In the discussion farmers mentioned about the likelihood of encroachment	Fixing boundary stones, and empowerment of WUA will prevent any encroachment from

Issues	Mitigation measures
a few places in the peripheries of the tanks	happening. RPF developed with abundant caution will be followed as mitigation measures, in case of any encroachment related involuntary resettlement
Tanks infested with Prosopis and hypomea, reduced the grazing area and difficult for cattle to graze in the remaining areas	Removal of these two notorious weeds
Water scarcity is an issue, traditionally paddy is the main crop cultivated, now some of the areas the farmers shifted to maize and coconuts	Promotion of more alternative crops and crop diversification
Extensive use of chemical fertilizer and irrational use of pesticides	IFS model and training on IPM and INM
Farmers are convinced about the new technologies like solar powered pumps and SRI	Replication through demo in the farmers fields to reach more farmers
Middle men exploitation, lack of value addition process, no direct marketing. Paddy farmers want to form Paddy FPO	Infra structure support for value addition process, promotion of crop specific FPO like paddy, banana and tapiaco
Extension system need to address the issues and needs of the small and marginal farmers	Mobilization of small and marginal farmers as farmer clubs it will help the extension officials meet them as groups and use of modern ICT tools such as mobile phones to easily reach the extension officials
Young farmers are not interested in agriculture, it is not a profitable enterprise, hence not interested and looking for other jobs	Inclusion of youths in the awareness and training programmes
WUA is working, helps to sort out smaller issues related to water sharing but need to be more effective in water sharing and management	Strengthening of WUA
Milch animal management is an important income source for small and marginal holders, lack of water for fodder cultivation is an issue now	Promotion of water saving irrigation methods and fodder cultivation

Issues	Mitigation measures
Women participation is very little in the water sharing systems adopted in the villages either newly formed groups like WUA or the earlier traditional systems	Involve women farmers in the consultation process Encourage the women land holders to become the members of WUA Women members of WUA with SHG leadership could be right choice to become the leaders of WUA
Well functioning SHGs started micro enterprises and failed due to market linkage	Right selection of micro enterprises and ensured market linkage
Mixing of sewage and effluent from Manaparai area.	Establishment of common effluent treatment plant under the Thiruchirapally Municipal limits and Manparai Panchayat and plug the non point sources of sewage disposal. Using the sludge as a source of nutrient in agriculture
Domestic Sewage from the municipal areas of Trichy is released into river	
Sand Mining is prevalent in the river bed areas	Legal action /promote reuse of construction debris for construction aggregates
Dumping of debris into tanks	
Jatropha, Juliforia infestation in the lakes	De-weeding and desilting of the channels and canals

Lower Vaigai Sub Basin

Irrigation practices and management

Bunds of supply canals and tanks are weak and damaged; possibility of encroachment is reported in supply canals along the outside of the bunds. Water flow through supply canals form the rivers is very limited

Generally water stored in the tanks is restricted to three or four months, hence farmers find it difficult to cultivate for two seasons, some years face difficulty to irrigate the last few weeks of the first crop.

Cultivation is limited to one crop, area of cultivation is reduced it was mentioned that in some villages nearly 50% of the ayacut area (eg. V.K.Kulam) is left as fallow.

Invasion of Prosophis is a major issue in the tanks; the bunds are covered with Palmyra trees and other trees. The revenue generated from Prosophis cleared from the tank is used for the community festival in the villages.

Farmers mentioned about the possibility of temporary encroachment along the peripheries of the water bodies.

Areas close to salt pans water is saline due mixing of waste water from salt pans in the canal, hence water becomes unsuitable for cultivation particularly during dry season.

Agriculture, Livestock and fisheries

Major crops are Paddy, cotton, Chilly, and ground nut is the other crop cultivated in certain pockets. Millets like ragi and pearl millet and gingely are cultivated as rain fed crops. Due to dearth of water for irrigation farmers are leaving their lands as fallow, allow Prosopis grow, now see this as an opportunity and marketing the timber of Prosopis in the market Rs.20 to 25 thousands after three or four years.

Crop damage due to stray cattle is a major issue, the practice of donating cattle to the God is a common practice and considerable number of cattle are roaming around and feed on the crops in the fields. Peacock population is also damaging the crops. Soil fertility is managed through both using chemical fertilizer and farmyard manure. Farmers mix both, but most of the farmers use more chemical fertilizers.

Farmers are keen on rearing livestock, drought and lack water are major reasons for unable to practice. Declining of agriculture is a major reason for declining of cattle population.

Farmers are trained on SRI method of paddy cultivation. They are convinced believe the other farmers in the villages would follow the method in the coming seasons.

With regard to training and extension support farmers had very limited opportunities. A few farmers in the visited villages mentioned about one or two trainings they undergone a few years back. More support was requested particularly for the small and marginal farmers they are not aware of the training programmes and the schemes implemented by the government departments.

The common practice of marketing the produce is through middlemen; in few cases the farmers transport the produce to the markets in the nearby towns. The harvested produce are sold, no practice of value addition and direct marketing as a group in the villages.

Chilly is one of the main crops, farmers need to dry and sell, proper drying yard is a problem farmers are facing, increasing infrastructure support like drying yard, storage building may help the farmers to holdup marketing their products till get better price in the market.

Most of the families own milch animals an important income generation activity. Mostly milk is sold to private vendors. Goat rearing is the next activity several families practice. According to the farmers fish farming was the practice of the past, not practiced any more due to water scarcity. The revenue generated in the past was used for the common welfare of the villages.

According to local farmer they have inclination towards organic farmers, but not sure about the same yield they get through regular farming. It was also told some of the farmers converted to organic practices failed and reverted back to the regular farming practices.

Environmental aspects

In the lower part of the Lower Vaigai sub-basin near the coastal areas there is mixing of saline water from the saltpans in the Athiyuthu village is a common issue. There are separate channels that feed the lakes with fresh water and the excess water from the saltpans is debouched through a separate channel to the sea. During the heavy rains the canals breach and hence there is mixing of seawater with fresh water. There is Dumping of construction debris in the lakes and canals. There are a few bricklins that are located along the periphery of the rivers and canals that use ground water to a large extent. This results in depletion of ground water during the summer season. Dumping of solid waste from the nearby panchayats and municipals is found in all the parts of the sub basin. There is a lot of non point source of sewage mixing with the canals at many places.

Social aspects

WUAs formed in some of the villages are not active, some cases the members are from more than one village, in such cases coordination itself is difficult. According to the members after forming the association there was no proper follow up like conducting orientation and training on the objectives and the procedures and management etc.

Women SHGs are functioning in the villages for savings and credit are the main activities. In one of the visited villages Killiyur has five SHGs the women told the credit rage for one member is Rs.5000 to Rs.10000.

Women participation is nil in all water sharing systems adopted in the villages either newly formed groups like WUA or the earlier traditional systems.

Issues and Suggestive Mitigation Measures

Issues	Mitigation measures
Bunds of supply canals and tanks bunds are damaged, water flow in the canal is slow	Renovation of bunds and canals
Farmers mentioned about the possibility of temporary encroachment in the water bodies	Fixing boundary stones, and empowerment of WUA will prevent any encroachment from happening. RPF developed with abundant caution will be followed as mitigation measures, in case of any encroachment related involuntary resettlement
Mixing of salt water waste, makes the land near the salt pans saline	Soil reclamation and field demonstration
Water shortage is major issue, have problem to harvest the first season paddy, farmers leave agricultural fields as fallow	Promotion of IFS, alternative crops suitable to the region through crop diversification. Introduction of water saving methods such as drip and sprinkler SRI is water saving cultivation method farmers who adopted are convinced, the experience can be replicated through horizontal transfer – farmer to farmer extension
Marketing of agricultural produce is through middle men and get the price lower than the open market	Identifying the scope for value addition and training for the same. Promotion of direct marketing through forming producer groups, it can be crop specific like 'Chilli Farmers Producers Organization'
SRI is successful more farmers are willing to adopt and increase the area	Plan for horizontal replication of SRI – farmer to farmer learning
Crop raid by stray cattle in 100s donated to God is a major problem	Farmers claim compensation - as per the government of India order for the loss caused by the wild animals
WUAs are working but need to be more effective in water sharing and management	Strengthening of WUAs
Women SHGs are interested in starting micro enterprises to get additional income	Possible training on micro enterprises

Issues	Mitigation measures
Lack of women's participation in management of water sharing systems in the villages	Encourage women land holders to become members of WUA
Mixing of sewage and effluent water in the nearby villages and panchayats	Establishment of STP at Panchayat level to treat the water and plug the non point sources of sewage disposal. Using the sludge as a source of nutrient in agriculture
Dumping of construction debris in the lakes	Legal action /promote reuse of construction debris for construction aggregates
Bricklins in the sub basins	Monitoring by WUA and initiating necessary legal action
Dumping of solid waste from the nearby panchayat and municipals	Solid waste management and training in disposal of MSW
Mixing of saline water from the salt pans in the Athiyuthu village and Sea water intrusion	Construction of separate channels for the salt water from the salt pans and strengthening the bunds of the channel

Krishnagiri to Pambar Sub Basin

Irrigation practices and management

Contamination of water is a major issue discharged in pennaiyar river and Krishnagiri dam, sources are effluents discharged from the factories at Hosur Industrial estate, sewage from the local villages and towns. Bunds and sluices are not good conditions.

According the farmers there were traditional irrigation systems in the villages for sharing tank water. The same system is working very well in one of the villages visited. WUA was formed in 2001 (eg. Malayandahalli Eri). The WUA formed in the past some of the villages is not active and plays no role in water sharing, the stipulated term of five years is over. Some cases the dominant community holds the power of water sharing eg. Barur village.

Now not all ayacut farmers depend on the irrigation tank, the dependency ratio changes many farmers have access to individual sources well and bore waters.

In the discussions farmers mentioned about the likelihood of encroachment in a few places along the outer boundaries of water bodies.

As the canals are with silts and solid wastes, blocks the water flow, the tail end do not get water, in some places like Eachambadi village the land located at the tail end received water five years back.

Agriculture, Livestock and fisheries

The productive of paddy crop has decreased, earlier a farmer could take 40 bags of paddy in one acre but now 20-25 bags only, cost of cultivation increased – labour, fertilizer and pesticides etc and not proportionately the price hence the feeling among the farmers is agriculture is not profitable.

Farmers expressed the opinion that NREGA scheme which employs huge number of women labourers is the main reason for the lack of agricultural labour.

Cattle rearing, particularly milch animal is a common practice, which is considered as a good income generation activity alternative to farming. Further support from the government through schemes and banks support for credit could help the farmers to have more milch animals and increase the annual income. Cattle rearing is a practiced mostly by small and marginal holders.

But there was a disaster in 2014, due to a foot and mouth disease 2344 cattle died in the Kaveripatinam block and more than 350 cattle death reported at Chettimarampatti panchayat alone. As a result now farmers have developed fear for cattle rearing.

The Paruvadha kulam is an inland traditional fishermen community associated with the local water bodies, members of the community has formed Paruvadha kula fishermen society in Kaveripatinam block. It was told that people from other community can also register in the Society; the total number enrolled is around 2000. Every year this society gets the auction of fishing in almost all the tanks and as well in the Dam. It was reported that banned species of fish is being grown in all the tanks. For marketing apart from catering to the local needs the buyer also come from Erode, Salem and Kerala as well.

Environmental aspects

The treated and semi-treated effluent from the paper mill in the upstream is near the dam area. This not only contaminates the dam but also carries the load throughout the system. There is mixing of sewage and industrial effluents in the upstream area and throughout the system. Rampant sand Mining has caused fall in the ground water table. The advent of industries and the mixing of sewage in the river have contaminated the ground water in the area. In addition to the industrial effluent and sewage there is runoff from the agriculture area with high nutrient content. Solid waste is dumped from the adjacent residential areas along the banks of the rivers. Due to the change in cropping

patterns and conversion of forested lands to horticulture farms there is an increase in the soil erosion and hence the canals get silted up.

Socio aspects

Scheduled caste population comprises in considerable numbers in some of the villages, wage labour is their main livelihood. Some of the SC families own little area of lands at the tail end and rarely get water and therefore not actively involved in farming.

Daily and seasonal migration was also reported by the small farming and land less families, move towards the neighboring city like Bangalore and towns for daily wage labour. According to the labourers job in the agriculture is seasonal and now with reduced area of cultivation they do not jobs for most of the months.

Women SHGs are common in the villages, there are 20 women SHGs in Bayralli village. One of these SHGs has saved up to seven lakh rupees. They express their willingness to take up any training on micro enterprises, animal husbandry and start an enterprise.

The traditional inland Fishermen of Kaveripatinam block have formed an association and functioning well. The traditional irrigation institution in Vadamangalam is a good example that is still being practiced by the village community.

Issues and Suggestive Mitigation Measures

Issues	Mitigation measures
Water pollution is a major issue – effluent from Hosur industries and sewage from the towns	Monitoring of effluent discharge and treatment of sewage
Tanks and canals are with silt deposits and dumped with solid waste – blocks water flow	Cleaning of silt and solid waste and prevention of solid waste dumping in the future
Reported in some cases the dominant communities hold power of water sharing	Resolve in the WUA
Farmers in the village told about the likelihood of encroachment of water bodies along boundaries	Fixing boundary stones, and empowerment of WUA will prevent any encroachment from happening. RPF developed with abundant caution will be followed as mitigation measures, in case of any encroachment related involuntary resettlement
According to the farming community productivity in paddy has decreased,	Introduction of IFS model to reduce the cost of cultivation

Issues	Mitigation measures
cost of cultivation increased and not the price, hence agriculture is not profitable	
Labour problem for agriculture	Promotion of suitable farm machineries as alternatives
Managing milch animal is considered as a good alternative to farming, more farmers like to have milch animal need capital support In one block due to foot and mouth disease around 2344 cattle died in one season farmers have fear after that incident	Form as groups and linkage with banks for credit support Vertinerary camps organized by the department to create awareness about the disease
In some villages own little amount of land at the tail end and rarely get water hence not actively involved in agriculture	Water sharing issues resolve in the WUA
Most of the SHGs in the villages are functioning well, savings and lending are the activities, now want to start micro enterprises to enhance the income	Possible training support and market linkage
Mixing of paper mill effluents in the upstream near the dam area	Establishment of CETP and STP at Municipal, block and panchayat level with proper disposal of sludge as manure for the farms
Sand Mining	Legal action
Solid waste disposal	Solid waste management and training in disposal of MSW
Drinking water is contaminated with the industrial effluent	Proper treatment and distribution of drinking water to the public.
Runoff with high nutrient content from agriculture fields	Optimal use of Fertilizers at the right time and use of bio-pesticides
Solid waste disposal	Solid waste management and training in disposal of MSW
Soil erosion due to change in cropping patterns and conversion of forested lands to horticulture farms	Afforestation in the areas that are susceptible for soil erosion and land slides
Excessive use of Fertilizers and	Optimal use of Fertilizers at the right time and

Issues	Mitigation measures
pesticides	use of bio-pesticides

Vaniyar Sub Basin

Irrigation practices and management

The sluices and bunds are damaged and farmers requested to rebuild the bunds and renovate the sluices. This would help the farmers to use the sluice and proper water management. Tail end farmers have the problem of receiving water due to blockages.

In the discussions farmers mentioned about the likelihood of temporary encroachment of water bodies.

Generally farmer cultivate paddy for one season, water insufficiency was mentioned as the reason for not cultivating the second crop. Some cases water is stored in the tanks to ensure water available for drinking instead of using it for irrigation.

No proper system for water sharing is in place, WUA formed in some villages several years back are not active. The WUA needs training to perform as a local institution responsible for the tanks, canal and irrigation for agriculture

Farmers had the practice of taking silt from the tank once in two or three years and mix with the soil in the agricultural fields, but later government banned taking silt from the tank, but farmers have been requesting from then onwards to allow them to take the silt, which is very useful to manage the soil fertility in the fields and reduce the use of fertilizers.

Agriculture, Livestock and fisheries

Paddy, sugarcane, cotton, tapiaco and turmeric are the crops cultivated in the irrigated fields, ragi in dry lands. Most of the ayacut farmers are small and marginal holders.

Crop raid by wild animals, damaging the crops and crop loss to the farmers was reported as an issue, particularly by the wild boar the farmers don’t know how to resolve.

Farmers get loan from different sources to invest in agriculture, primary agriculture cooperative society is one main source, the loan package includes crop insurance, but none of the farmers has claimed crop insurance till now. Default is one of the main reasons why farmers don’t get second loan from the banks.

Women farmers consider cattle rearing is considered as a good source for making additional income, most of the farm families have cows and goats. Lack of veterinary facility is a major issue, farmers have to take the cattle four kilometers to Menasi village to get treatment.

In one of the villages (Marukalampatti) women farmers are keen on learning about organic farming practices, but donor know where to get the support.

Farmer like to learn more about disease management, fodder and increasing the milk yield, no specific training given so far.

In some tanks PWD and State fisheries department manage the fish farming, auction to private contractors. Local farmers are not involved and hence receive no benefits from the activity.

Environmental aspects

There is solid waste disposal in the sub basin. This is one of the main causes for the degradation of the water quality. Runoff with high nutrient content from agriculture fields also contributes to the overgrowth of weeds and other plants.

Social aspects

The Malayali tribe in Vathchati village have land but the entire area is rain fed. Hence, they are not in a position to get benefits from the irrigation system of the village tank. They believe introduction of livestock management or any other suitable income generation activity will help them to improve their livelihood.

Weeding is the main job women do in all fields, they work in in paddy and sugar cane fields get more number of employment days in sugar cane fields.
Labour availability is a problem for land less they migrate particularly men to other places cities like bangalore and nearby towns,
SHGs are present in all the villagers visited in the sub-basin and most of them are functioning well. The activities are monthly savings, internal lending and also have accounts in the bank, deposit the savings amount. Many are in good relationship with the banks, get loan support from the banks. The loan amount is spent on agriculture, children's education and also other household expenses.
Women are interested to have training programmes on income generation activities and followed by capital support to start the activity, otherwise just training alone is not useful.
Women suggested exclusive women participants training programme on IPM and suitable income generation with good marketing opportunities

Issues and Suggestive Mitigation Measures

Issues	Mitigation measures
Bunds, sluices and weirs are not in good condition	Renovation of bunds and weirs and sluices
In the discussions farmers mentioned about the likelihood of temporary encroachment of water bodies in the peripheries	Fixing boundary stones, and empowerment of WUA will prevent any encroachment from happening. RPF developed with abundant caution will be followed as mitigation measures, in case of any encroachment related involuntary resettlement
WUA formed are not effective – no proper system of water sharing in place	Strengthening/Forming of new WUAs
Traditional practice of silt removal by the farmers in the tank is banned	Removal of ban on silt removal by farmers
Farmers get capital support from different sources, mainly from the middlemen this forces them to sell the products to them for lower price	Capital support for the farmers through group based approach to avoid default – Formation of FPO to promote direct marketing and eliminate middle men
According to women farmers, milch animal is the best income generation activity – need more support from the animal husbandry department , vertinery health centres are located three or four kilometers awary	Weekly village visits planned by the department
Fishery resource is managed by PWD and fishery department – farmers want to get involved and benefited	Involvement of WUA in the activity
The Malayali tribals in the sub basin are dry land farmers, not benefitting from the irrigation system, want to know about the tribal development programmes and access	Link with the existing schemes of tribal welfare department
Land less are jobless during the off season, similarly men also –they migrate particularly men to cities and towns	Promotion of on farm and non farm employment opportunities
Members of women SHGs need not only training to start micro enterprises	Possible support to conduct training programmes

Issues	Mitigation measures
also the capital support to start	
Ipomea, Prosophis and grass infestation in the lakes	Cutting and deweeding along with desilting of lakes, canals and channels
Siltation of the lakes and water system.	
Solid waste disposal	Solid waste management and training in disposal of MSW
Runoff with high nutrient content from agriculture fields	Optimal use of Fertilizers at the right time

Upper Palar Sub Basin

Irrigation practices and management

The bunds are damaged and covered with bushes, sluices are not in good condition and weirs are also in damaged condition hence water flows from the tank before reaching the full capacity. Silting of tank beds and inlet canals was reported as an issue.

WAUs formed are not active, the members and leaders are not clear about the functions, roles and responsibilities. In one of the village visited by the team witnessed a well functioning WUA practicing traditional rules and methods for sharing of water.

The farmers participated in the FGD mentioned about the likelihood of temporary encroachment in the water bodies in the peripheries. Tanks and river bed are infested with *prosophis* species.

Effluents from tanneries in Ambur and Vaniambadi region contaminate the Pallar river and tanks, salty water used for irrigation from the tanks leads to soil salinity.

Agriculture, Livestock and fisheries

The main crops cultivated in the region are Paddy, sugar cane, coconut, betel leaf, certain vegetables like tomato and brinjal and pulses.

Water shortage made farmers to change from paddy and sugar cane to alternative crop coconut. Farmers are interested to adopt water saving irrigation methods.

Crop raid by wild boar in the fields close to the forest border is mentioned as a major problem which leads to crop loss. Farmers are very much concerned about this problem.

Marketing of paddy is done mostly through middlemen; some of the farmers take the produce to the regulated market and sell directly. Sugar cane is supplied to the mill. Bettle leaf another major crop cultivated in many villages in certain pockets of the sub basin, local agents buy the leaves from the farmers. Vegetables are directly sold some of the farmers in the weekly farmers market located in Vaniambadi. In the case of sugar cane the sugar mill has not settled for the last harvest till now.

Farmers are interested to adopt organic practices, hence requested to organize training programmes relevant to them.

Agriculture extension service does not reach many, the department officials in the meeting told that reduction of staff in the department is one of the main reasons.

Practice of cattle rearing is very common among the land holders, considered as a good income generation activity. Many farmers said they get better income through cattle rearing than agriculture.

Labour is a major issue, the farmer link the problem with the implementation of NREGA by the village panchayat. Therefore farmers are keen on modernizing the farms, now many activities like tilling, harvesting, threshing are done by machines, for planting also now some farmers use planting machines. But farmers complained about the cost of renting, they need to pay high rate which leads to increased cost of cultivation and more investment.

In one of the villages where the WUA functioning well is willing to buy farm machineries and rent them to the farmers for a lower rate, like to know about the existing schemes and support to get the machineries.

Farmers feel good potential for fish farming, they had the practice of fish farming and got revenue in the past.

Environmental aspects

Siltation and Juliforia and grass infestation in the lakes is the major environmental aspect in the sub basin. Dumping of solid waste and construction debris in the sub basin is also seen in all the parts of the sub basin. There are bricklin in the vicinity of the lakes that use the groundwater and sand from inside the sub basin.

Socio aspects

Traditional Irrigation Institution in Kedanapatty village is working well and farmers are convinced that the same system could continue in the future.

Women are not part of the WUA and men farmers have hesitation to include women as members and select them as leaders of the group.

Women from the villages go to work as labourers in the shoe companies in Ambur and Vaniambadi on daily basis.

Many farmers of small holdings told that they haven't practiced farming nearly for last ten years due to lack of water for irrigation and have shifted to other occupations like carpentry, masonry and other construction works.

The Farmers Producer Organization of Narkani is functioning in Mittur village near Thirupathur town with 580 farmers as shareholders. The company gets support on capacity building from Vrukthi an NGO a resource organization. The company is registered eight months back still in the formative stage, haven't started the business at a large scale. At present the company is helping to get inputs for lower price. The organization is planning for a value added product of the coconut in the future. The company has an objective to motivate youths to involve in agriculture.

Issues and Suggestive Mitigation Measures

Issues discussed	Suggestive measures
Bunds, weirs and sluices are not in good condition. Silting of tank beds	Renovation of bunds, weirs and sluices
Probability of temporary encroachment in water bodies was discussed in the group discussion	Fixing boundary stones, and empowerment of WUA will prevent any encroachment from happening. RPF developed with abundant caution will be followed as mitigation measures, in case of any encroachment related involuntary resettlement
Crop raiding by wild boar is a problem	Farmers claim compensation - as per the government of India order for the loss caused by the wild animals
WUA formed in the past are not active	Strengthening of WUA
Availability of labour is a problem due to various reasons like migration implementation of NREGA etc	Use of suitable farm machineries to address the issue of labour and WUA acting as machinery renting centre for lower charge
Mostly marketing is done through middle men for major crops and paid lesser price	Direct marketing and FPO
Reported that farmers are not getting	Training on organic farming

Issues discussed	Suggestive measures
enough extension support for agriculture and animal husbandry and are interested in organic farming	
Women are not part of WUA and men are not willing to accept the idea	Encourage the land holding women farmers to become the members of WUA Motivating men farmer to accept the idea
Siltation and Juliforia and grass infestation in the lakes	Cutting and deweeding along with desilting of lakes, canals and channels
Solid waste disposal	Solid waste management and training in disposal of MSW
Sand Mining is prevalent in the river bed areas	Legal action /promote reuse of construction debris for construction aggregates
Brick kiln is in the vicinity of the lakes	
Dumping of construction debris	

Upper Bhavani Sub Basin

Irrigation practices and management

Farmers use water from the supply canals to irrigate the lands during the rainy season and the remaining months they use well water.

Farmers made request that the supply canals need to be renovated for saving water. To save excess water during the rainy season farmers suggested to build small reservoir, but PWD engineers told it is not advisable to build in the steep sloppy terrain.

For irrigation there is no proper system in place, according to some of the farmers the water sharing system works in an unplanned manner.

In Annur region the tank visited have not received water for more than 20 years, this has made the farmer to convert the agricultural fields in to real estate plots and migrate to nearby town to work in textile mills. Farmers still doing farming in the area made a request to the government to find a way to get water for the tank.

Agriculture, Livestock and fisheries

Plantation crops like coconut, areca nut, and banana are the major crops in the foot hill, the other crops cultivated in the neighbouring regions are jasmine, curry leaves, and vegetables like brinjal, tomoto, gourds like bottle and bitter gourds. In some areas paddy and sugar cane is also cultivated.

Water is plenty during the rainy season and meet shortage during the off season farmers own wells manage others find difficult to irrigate. The wells become dry during summer months. Awareness about the water saving irrigation system is nil, indeed farmers particularly the big farmers are not concerned about it. But the small and marginal holders in some of the villages are interested to learn about the technology and adopt, also concerned about the investment, requesting the sate to support.

In the past farmers in the Mettupalayam region cultivated paddy, due to the crop raid by wild animals like deer, wild boar and bison the farmer have shifted to coconut and Areca nut and banana plantations. Turmeric and sugar cane is also cultivated in smaller areas.

For pest and disease management and soil management the farmers heavily depend on chemical pesticides and fertilizers. Training on IPM and INM could help the farmers to take right decision and avoid the indiscriminate use.

Marketing is through different methods; regulated markets, direct marketing and also through local agents; the big farmers manage to take the produce to the markets directly. Areca nut is transported to Delhi market through a local farmers association. In the past there was a well functioning farmers market for banana later it was defunct due to mismanagement of some of the leaders.

Irula tribals in Karamadai block are doing small scale farming of horticultural crops like banana for local shops and markets and vegetables for local markets and consumption. Sorgam is another crop cultivated for household consumption. They irrigate the small plots water brought from the stream through pipes supported by forest department. The settlements are located in the remote areas with very limited or no transportation facilities. The main problem the tribals mentioned was transportation of the produce to the market. Goat rearing is a common practice.

In the past The Alu kurumba from Ariyur vattam village had been cultivating millets in around five acres of land, now there is some dispute over the land with the nearby estate owner. For livelihood now they work as labourers in the tea plantations and collect Non Timber Forest Produce like broom stick and honey from the forest.

Key stone foundation is helping the Irula farmers through providing seeds and training on organic practices. They implement some of the practices learned in the trainings, like use of biological products for pest control and soil management. The same NGO is providing seeds of different millets they had cultivated in the past to revive the practice. They never received any extension support from the government.

The Irulas like to have drip irrigation system, but due to lack of land ownership they have difficulty to access the government scheme and enjoy the benefits.

Crop raid by the wild animals' wild boar, bison, deer, and monkey is a main problem. Now Elephants are posing a big problem, if a herd enters they make huge destruction. Some of the farmers have made electric fencing. Elephant trench made by the forest department around few villagers is not useful the farmers wanted to widen it further.

Capital mobilization to carry out agricultural work is a problem for small and marginal farmers. They depend on money lenders or sometimes skip or postpone the activity.

Labour is a problem during certain period of the year, to work in the plantations of coconut, banana and areca nut need more labour hands, around 100 labourers as groups from other districts were brought to complete the tasks

These farmers also complain about the inadequacy of the agriculture and horticulture department's extension activities, particularly to address pest and disease.

Big farmers are not interested in livestock management, but the small and marginal holders and the land less are interested see it as an additional income source. Lack of grazing ground is a major issue. Some of the land less got goats through the government scheme. But in the plains Annur area cattle rearing are a common practice and consider as an important income generation activity.

Environmental aspects

There is excessive growth of Juliforia and grass infestation in the lakes. Rampant disposal of Solid waste from the nearby settlements. There is runoff with high nutrient content from agriculture fields. Solid waste is also dumped in many places in the river and lakes. Soil erosion due to change in cropping patterns and conversion of forested lands to horticulture farms this has lead to the silting of canals and channels and thereby obstructing the flow of water in the canals.

Socio aspects

In Mettupalayam region majority of the farmers in the ayacut are medium and big farmers. Farms are managed by farm managers or rented to others on share crop basis. Tribal farmers are marginal holders cultivate in less than an acre of land.

In the slopes of the Nilgiris several tribal settlements of Irual and Alu kurumaba are located and doing agriculture in their own land or land owned by the forest department. The Irula tribals from the Kallar tribal colony located in the foot hill have no land; working as wage labourers in the plantations, work for the forest department and construction industry.

The villagers appreciate the idea of creating a local platform like WUA and willing to cooperate to form the group and regulate water for irrigation and management.

Women get labour opportunity through NREGA for certain number of days in a year and find it very useful, this help them to get additional income apart from what they traditionally earn as workers in the agricultural fields.

Tribal women are mobilized as women SHGs by the village panchayat and NGOs, the main activity is monthly savings, and the money is deposited in the bank. Village Forest Council is functioning in Kilsenganur Irual tribal village.

Issues and Suggestive Mitigation Measures

Issues discussed	Suggestive measures
No proper system of irrigation in place and according the local farmers the water sharing is happening in an unplanned way	A water sharing system based consensus among the farmers and PWD need to be developed and put in place
Diversified crops are cultivated but most of them are water loving crops, water shortage is a problem during the off season but farmers not aware and concerned about water saving irrigation methods	Introduction water saving methods – motivating some of the farmers to adopt the technology
Inadequate extension support – more support particularly to address pest and disease	Training on IPM and INM
Crop raid by the wild animals is a major problem farmers are concerned	Farmers claim compensation - as per the government of India order for the loss caused by the wild animals
Small and marginal holders and the land less are interested in cattle management. Lack of grazing ground and fodder is a major constrain.	Support the marginal and small holders for cultivating fodder crops, technical and inputs like seed support from the animal husbandry department
Women find NREGA work as a good opportunity, which ensures labour for certain number of days in a year and additional income to manage the	The panchayat and block develop offices should plan the days for employment during the agricultural off season

Issues discussed	Suggestive measures
household budget. But according to the farmers they find extremely difficult to get labourers to work in field after the scheme is introduced	
Farmers in the villages are interested to form group and develop a system to regulate water sharing for irrigation	WUA can be formed with the active participation of the interested farmers
Irula tribals in the slopes cultivate banana for market and vegetables for domestic consumption. Taking banana to the market is a problem, need transportation support. Lack of land ownership is the other constrain they are facing to access the government schemes like drip and other inputs support	The settlements are not located in the project sub basin area
Juliforia and grass infestation in the lakes	Cutting and deweeding along with desilting of lakes, canals and channels
Solid waste disposal	Solid waste management and training in disposal of MSW
Drinking water is contaminated with the industrial effluent	Proper treatment and distribution of drinking water to the public.
Runoff with high nutrient content from agriculture fields	Optimal use of Fertilizers at the right time and use of bio-pesticides
Solid waste disposal	Solid waste management and training in disposal of MSW
Silting of canals and channels	Desilting of the channels and canals
Soil erosion due to change in cropping patterns and conversion of forested lands to horticulture farms	Afforestation in the areas that are susceptible for soil erosion and land slides
Excessive use of Fertilizers and pesticides	Optimal use of Fertilizers at the right time and use of bio-pesticides

Cauvery Delta Sub Basin

Irrigation practices and management

Bunds of supply canals and tanks are damaged; the damage of supply canal leads to leakages and reduced the water flow to the fields.

Flood during the rainy season due drainage problem, this problem is more in the low lying areas, desilting of the drainage canals need to be done. This happens almost every year, desilting of the drainage canals is very important to save the crops in the field.

Farmers are not sure about the water availability and when the season will start. It depends on the date of opening of water in the Mettur dam. It has happens almost every year since the Cauvery issue started.

Invasion of Prosopis is a major issue in the tanks; canal bunds, finding difficult to permanently remove from the water bodies and bunds.

Farmers reported about the likelihood of temporary encroachments in a few places in the bunds of supply canals and the periphery of tanks.

Depletion of ground water was expressed as one of the major concerns; this is due to the increasing number of bore wells and irrational use of water for irrigation. This sub basin is traditionally a paddy cultivating region; hence farmers prefer to paddy not other crops, which need more water.

Agriculture, animal husbandry and fisheries

The major crops cultivated are rice mostly short duration varies like ADT 36, ADT 37, ADT 42 and ADT 43 (either single or double cropped), black gram and green gram (as rice fallows), cotton and gingely (in certain pockets). Some of the major vegetables such as brinjal, chillies are grown during summer months in limited areas.

Farmers reported about the increasing soil salinity due to the seepages of saline water from prawn ponds and salt pans in the coastal region.

In the last few decades due to Cauvery issue, the water availability for irrigation is reduced. To meet the changing conditions alternative cropping pattern is advised, improved technologies were introduced and farmers started practicing some of the the recommended crops and technologies. The other solution provided was technological intervention like promotion of water saving irrigation system. But in some places farmers dropped the practice of drip system due to a few reasons. Now it is recommended that

farmers should become aware of the problems in using drip irrigation devises and practice the method continuously.

Crop damage due to pest attack was mentioned as a major problem and farmers adopt different pest control methods, according to farmers the cost involved to control the pests and disease is very high.

Farmers are trained on SRI method of paddy cultivation, now some of them are practicing. The extension department should plan for scaling up the practice for the entire region.

Farmers are keen on reviving/rearing/strengthening the practice of livestock rearing, lose of grazing ground in the villages, drought and lack water are the reasons for the reduction of the practice. Farmers also requested for training on improved practices of cattle management. To overcome the fodder demand farmers requested training on fodder cultivation and support like supply of fodder slips.

For enhancing the water harvesting systems farmers have shown interest for adopting/reviving the farm pond method. This will create an opportunity for the introduction of fisheries at farm level. Fisheries dept is willing to provide training on fish farming in the farm pond, creating layers for arresting seepage from the ponds and also input support like supply of fingerlings.

Local farmers and also line department officials suggested the idea of converting the numerous abandoned bore wells as water harvesting structures; the idea needs to be further explored and tested in the field.

According to the farmers the training and extension support they receive is very limited and not timely. Farmers suggest to conduct need based training programmes with field demonstrations and increase the number of village visits by the extension officials, more inputs support to small and marginal farmers.

Farmers are concerned about the increasing inputs cost which makes farmers to look for credit and many cases resort to get the loan from the local money lenders. More investment makes the agriculture as little or no profit activity.

The other concern is youths are not interested in agriculture and willing to shift to other occupations and migrate to nearby towns and cities looking for better jobs.

The harvest is sold through regulated markets in the nearby towns or middlemen and generally the value addition of the harvested produce is not in practice. Farmers are interested to learn more about the opportunities for value addition of the farm produce.

Also to store the produce for a short period and sell in the open market when they get higher price, for which there is no enough infrastructure facilities available.

About the price, farmers like to have a fixed price for all crops cultivated in the region. And also like to have the regulated market facilities to all areas covering the entire region of the sub basin.

Availability of labour was mentioned as a major problem, particularly during the harvesting time.

Farmers are adopting regular agriculture, since not sure about the results of organic practices hesitant to change to organic practices. But like to adopt certain practices like use of compost, biofertilizers etc. Farmers demand subsidy for the biological fertilizers and pesticides like the subsidy given to chemical fertilizers, and training for enrichment of farm yard manure.

Farmers suggested, where ever possible the farmers can be encouraged to cultivate traditional varieties of rice and other crops, some of the traditional varieties of paddy is sold for higher price in the market.

Environmental aspects

The main environmental problems in the cauvery basin are the mixing semi-treated and untreated sewage in the upper parts of the river system. The coastal areas are experiencing intrusion of sea water due to the over exploitation of ground water in the inner areas of the river system. Further the input from the canals and channels that are flooded with sea water during the sea water during the high tide also form an important reason in the degradation of the ground water in the coastal areas. There are no major industries that operate in the Sub basin. However the contamination of the surface waters in the lakes and rivers are mainly due to the non point sources of sewage disposal from the local communities. Further the prevention of the mixing of sewage and industrial effluents in the upper part of the cauvery will also help in restoration of the ground water quality.

Social aspects

WUAs formed in the past in some of the villages are not active. The main reason for this situation is lack of proper follow up like conducting orientation and training on the objectives of WUA and the procedures and management etc. No concrete actions were identified for WUAs, how it can collaborate with other agencies to carry out its responsibilities or do independently on their own.

The uncertainty of water availability which is depending on the date of water released from the Meter dam, this is affecting the crop choice and number of seasons etc. In the recent past farmers were not able to start the first season as per the traditional date. Water scarcity is a major issue. The officials are suggesting alternative crops to overcome the crisis instead of cultivating rice and introduction of water saving irrigation methods. Through including suitable horticultural crops it is expected that the labour opportunity for the agriculture labour would increase during the second and third seasons.

Women from the agricultural labour families are organized as SHGs by many NGOs in the sub basin, most of the SHGs are functioning well, savings and credit are the main activities of the SHGs. Now these women want to move from credit management to small enterprise management which could help them to get labour for round the year.

Women participation is poor or nil in WUA and in sharing and management of water for irrigation. Similarly women farmers are neglected or not targeted for the trainings and the extension supports provided through different schemes.

Issues and Suggestive Mitigation Measures

Issues	Mitigation measures
Farmers are not sure about the water availability and when the season would start. It depends on opening of water in the Mettur dam Water scarcity is a major issue Depletion of ground water was expressed as one of the major concerns; this is due to the increasing number of bore wells and lavish use of water for irrigation	Promotion of alternative crops/cropping pattern- through conducting field demonstration Awareness among the farmers about the taking measures to control the exploitation of ground water resources Promotion of water saving irrigation methods Creating more farm ponds as water harvesting structures
Bunds of supply canals and tanks are damaged leakages reduced the water flow to the fields	Renovation of bunds and canals
Flood during the rainy season due drainage problem, the problem is more in the low lying areas.	Regular desilting of the drainage canals
In the group discussions farmers	WUA will be empowered to address if there is

Issues	Mitigation measures
mentioned about the likelihood of temporary encroachments in a few places in the bunds of supply canals and the periphery of tanks	any such issue
Promotion of in land fisheries	Farm ponds will be used for fish farming with the support of fishery department
Mixing of salt water waste, and seepage from prawn farms makes the agricultural land saline	Soil reclamation and field demonstration and use of more green manure
Marketing of agricultural produce is through regulated market and middle men and got very low price and find agriculture not profitable	Promotion of direct marketing through FPOs, can be crop specific or for multiple crops. Also identifying the scope for value addition and training for the same to increase the income
Farmers have accepted SRI as a suitable method for rice cultivation to reduce the resources and cost	Promote – farmer to farmer learning of SRI method
Increasing investment in agriculture due to increasing price for the fertilizer and pesticide and also labour cost and hiring of farm machineries	IFS approach to reduce the use of external inputs, adoption of more organic practices. To avoid the higher cost paid to farm machinery WUA can act as a renting centre of machineries for lower rates
Changes in the cropping pattern, and reduction in the number of agricultural seasons results in the reduction of labour opportunities for the agricultural labour families	Adding suitable horticultural crops in the list of alternative crops for the second and third seasons which could provide labour opportunities in the second and third seasons Promotion of other on farm employment opportunities like creating value addition to the farm produce, strengthening animal husbandry etc
Youths are not interested in agriculture	Adopting new farming practices and making agriculture profitable would attract more youths to involve in agriculture
WUAs are not actively functioning need to be more effective in water sharing and management	Strengthening of WUAs
Poor participation/no participation of women farmers in the management of water sharing systems in the villages	Encourage the women land holders to become members and leaders of WUA

Issues	Mitigation measures
Women from the agricultural labour families are mobilized as SHGs and interested in starting suitable income generation activities which would help them to get occupied particularly during the non agricultural season and add the income	Identification of suitable alternative income generation activities and training

8.5 Key findings:

Farmers had traditional system of water sharing in the past, now those systems are not functioning any more (but working well in exceptional cases, the team observed in two villages during the visit), the existing systems are poorly managed and WUAs formed in the past are inactive.

New WUAs can be formed through participatory process with follow up training programmes. In many places youths are interested to involve and take responsibilities in WUAs and regulate the irrigation system.

Bunds are reported as weak, sluices are not in use, shutters are not in good condition, water seepage on both sides of the sluices, in many cases weirs are damaged, hence repairing of all these structures are essential.

Silt near the sluices, in the tank beds and canals are another common issue reported in all places. Due to this there is reduction in storage. Strengthening of bunds with desilting from the tank bed will improve the storage to certain extent. Increase

Generally encroachment of common lands appears as topic in the group discussion with people who do surveys and govt officials. During the discussions farmers mentioned about the likelihood of temporary encroachment in the bunds of supply canals and peripheries of the tanks. Due to increasing water scarcity, farming communities in the rural villages are keen on protecting the tanks from any encroachment.

Using the silt in their agricultural fields taken from the tanks for soil management is a common traditional practice all over the state. The government has banned the removal of silt and the farmers insist to lift the ban for agriculture use.

Paddy is the main crop everywhere for the first season, the other crops cultivated varies in different sub basins, still many are water loving crops, like sugar cane, banana etc. Now water shortage is an issue everywhere. It is suggested for alternate cropping system with less water requiring crops towards diversification and support for water

saving irrigation systems as well (MI). Introduction of IFS model, specific to the region, SRI, SSI, precision farming and training the farmers on organic practices.

In some areas, due to water shortage farmers allow *Prosophis* in cultivable land and every alternative year or once in three years they will get some revenue.

Farmers need training on suitable alternative crops according to the changing climatic condition, integrated nutrient and integrated pest management, value addition of the agricultural produce, production of fodder crops etc.

Water salinity due to pollution (industrial effluent, sewage from cities and towns and waste water from salt pans) is a major problem in many sub basins. How to address this issue at the source is a challenge, but at the farm level, changing of crops, soil treatments, etc are recommended.

Success stories such as solar energy pumps with drip irrigation system, SRI, SSI, Crop diversification, precision farming, value addition and direct marketing of agricultural produces etc., needs to be replicated. This can be achieved through farmer to farmer extension method – facilitating horizontal transfer of knowledge and skill.
Farmers require infrastructures such as drying yards, godowns, cold storage facility for storage and to carry out some of the value addition process.

Using of chemical fertilizer and pesticides to manage different pest and diseases of crops is a very common practice among the farmers. Few farmers take the advices of private agro chemical shops. According to the local agricultural officers, some of the farmers apply over dose of fertilizers and pesticides and sometimes use wrong pesticides also. This practice increases the cost of cultivation and negatively impacts the soil health.

Although farmers are interested in organic practices, lack of skill and knowledge for practicing in their fields, for eg. farmers are interested in the production of vermi-compost, but unable to practice. The other main reason given is the low yield and the non availability of premium price.

Crop Raids by wild animals such as wild boars, elephants, bisons have been reported in several places particularly areas located close to the forest boundaries. Farmers face some times huge crop loss and unable to manage. As per the government of India order farmers can claim compensation for the loss caused by the wild animals. Farmers are not mostly aware of this information.

Youths lack interest in agriculture is another concern expressed about the future of agriculture. According to the young farmers agriculture is not a profitable enterprise, hence they are moving to other jobs.

Marketing the farm produce is mostly through middle men and local agents and the farmers is paid lower price. The other option is farmers using regulated markets in certain places. Promotion of forming FPOs and training of Crop specific farmers producers group with the support of NGO working in the area, NABARD and Dept of agricultural marketing could help farmers to come out of the clutches of the middlemen.

Capital mobilization to invest in agriculture is a difficult task for the farmers. They need to do this almost every season. Most of the small and marginal farmers in all sub basins are exploited by the middle men, they depend on them for credit due to lack of awareness of other sources. Capital support for the farmers can be obtained from the banks through group based approach such as men SHGs, Farmers clubs and Joint Liability Groups.

Non-availability of agricultural labour was mentioned as one of the problems as youths are migrating to cities and women are diverted to NREGA work. This problem can be addressed to an extent by using appropriate farm machineries. WUA or youth groups can be encouraged to manage machinery custom hiring service centre for lower cost.

According to the local farmers rearing milch animal is an important income generation activity for the poor farmers. Many said they get better income than crop cultivation, but there are issues like in adequate grazing ground, disease management and fodder cultivation. Animal Husbandry Department is expected to support the needs of the farmers.

Extension system support to small and marginal farmers is limited. Mobilization of small and marginal farmers as farmers clubs and producers groups which will help the extension officials meet them as groups and use of modern ICT tool such as mobile phones to easily contact.

Tanks were used in the past for fish farming; it helps to get some revenue for the villages and also supply of fish for the local communities. Now due to several reasons like pollution, lack of water and other issues resulted in poor development of aquaculture. Local communities wish to revive aquaculture.

Socially and economically disadvantaged sections like SC and other poor marginalized sections are traditionally depending on agriculture for their livelihood. Major changes in agriculture, like double crop system to single crop system, reduction in the area of

cultivation and farm mechanisation resulted in reduction of jobs in agriculture and seasonal migration.

In the 12 sub basins, some of the tribal families living in hill slopes or remote areas hold small cultivable lands. However they are not part of the ayacut in the project. They do small scale cultivation to meet domestic needs and sell small quantity of their produce in the nearby markets. The lands they cultivate are in the forest territory and the ownership is with state forest department.

Women farmers play very active role in agriculture, traditionally carry out several tasks and contribute equally to men farmers. Generally less women farmers are included in the training programmes and development schemes.

Women's participation is limited in WUAs formed in the villages either newly formed WUAs or the earlier traditional systems. Land owning women should be encouraged to become the members and leaders of WUAs. To encourage women farmers active participation and efficient functioning, orientation and training can be organized for them.

Most of the SHGs in the villages are functioning well; savings and lending are the two main activities, now the women want to start micro enterprises to enhance their income, and looking training support for enterprise development market linkages.

The most common environmental issue in all the sub basins is the disposal of sewage and industrial effluents in the river system in tanks. Further research studies need to be taken to address this issue.

The other environmental issues include over growth of vegetation like Prosophis, Ipomea, lotus and other waterweeds that block the flow of water. The rampant dumping of solid wastes and construction debris along the lakes, canals and field channels also degrade the quality of water and block the water flow.

CONCLUSIONS

CONCLUSIONS

The ESA Report highlights the findings of various positive and negative impacts due to the proposed TN-IAMWARM-2 project to be implemented in 66 sub-basins covering all districts of Tamil Nadu and recommends suitable mitigation measures for reducing the negative impacts. A comprehensive Monitoring and Evaluation (M&E) strategy is proposed for smooth implementation and co-ordination amongst the various line departments.

The suggestions included in this ESA Report are designed to avoid environmental and social damage and alleviate impacts in accordance with the safeguard policies of the World Bank. The suggested mitigation measures include the best environmental and social management practices. These suggestions have to be diligently implemented by PWD/WRO and various line departments to safeguard the environment of the project sub-basin areas. Based on the findings, it is evident that project components and sub-project activities under the TN-IAMWARM-2 project will result in agriculture modernization, developments in irrigation, restoration of water bodies and better management in livestock and fisheries sectors and social benefits to intended beneficiaries as envisaged.

Based on the project details and the baseline environmental and social status ascertained through data collected from primary and secondary sources, potential impacts as a result of the implementation of project components under the TN-IAMWARM-2 project have been identified. The proposed project is likely to exert both positive as well as negative impacts likely to accrue during various phases of implementation of the proposed project in the study area covering the representative twelve sub basins in twenty one districts of seven Agro-Climatic Zones.

Based on the impacts certain mitigation measures have been discussed in the earlier chapters. Few Potential Positive and negative Impacts and suggested measures of the proposed project are:

- Improved crop productivity
- Increase in groundwater recharge and reduction in groundwater abstraction
- Increase in use of agro-chemicals
- Solid waste generation from labour sheds

These impacts can be mitigated through suitable mitigation measures such as implementation of IPM, INM, SRI, SSI micro irrigation with fertigation etc and proper solid waste management etc.

The brief tasks that are to be carried out by the line departments are as follows.

Agriculture Department	• Implementation of INM and IPM (organic practices).
Water Resources Department,	• Strengthening institutions and instruments dealing with water resources management.

PWD	
Horticulture Department	• Precision farming for horticultural crops and conducting need based trainings
Agriculture Engineering Department	• Introduction and promotion of water saving Micro Irrigation systems like Drip & Sprinkler Irrigation and solar powered pumps
Agriculture – Marketing	• Value addition – drying, processing etc • Promotion of agri – entrepreneurs and FPOs
Tamil Nadu Agriculture University (TNAU)	• Development of Precision Farming Techniques, demonstration of SRI method, conducting trainings • Develop Model Seed Village Concept to generate good quality and hybrid seeds
Animal Husbandry Department	• To ensure total health cover both preventive and curative. • Reduce the gap between the requirement and availability of green fodder through promotion of fodder cultivation
Fisheries Department	• Development of Aquaculture in Irrigation Tanks by establishing Fish Seed Bank, development of Ornamental Fish Culture

It has been found that the positive impacts outweigh the negative impacts as the project is beneficial to all the categories of farmers, agricultural labourers and other vulnerable groups.

- The project considerably focuses on reducing the gap area that will be brought under irrigated agriculture and this will significantly improve climate resilient crop area, diversity, intensity and the yield.

- Increase in the vegetal cover due to increase in irrigation is expected. This will inturn increase the biodiversity in the study area with the reduced GHGs

- The continuous cropping over barren and mono-cropped land would act as soil binder and reduce the soil erosion rates.

- The proposed project will promote conjunctive use reducing the groundwater abstraction. The increased groundwater recharge would also replenish the groundwater resources.

- The proposed project would lead to augmentation of the water resources, which will increase the cropping and irrigation intensities.

- Increased availability of fodder for livestock shall reduce the pressure on the existing forests or vegetation of the area, which is a significant positive impact.

- As a part of Environmental and Social Management Framework, appropriate control measures in the form IPM and INM measures have been recommended. The project functionaries will popularize the use of Farm yard and green manures in the command area being irrigated by the project. These practices are likely to improve the yield with minimal impact on the environment and reduce the cost of cultivation.

- The project implementation will enhance overall employment opportunities in the project area and reduce the out migration rate.

- There will also be an increase in the income for both agricultural labourers and vulnerable groups through enhanced number of employment days and wage rate at which they work.

- Continuous need based training programmes proposed in the project will increase the skill and capacity of the farmers to adopt sustainable and modern farming practices to adopt climate resilient activities.

- Enhanced income shall enable beneficiary households to purchase new farm implements and modernize agriculture. This will increase efficiency in farm operations and reducing the drudgery.

- The formation of community based organizations like WUA, FPOs will encourage collaborative water management for economic and judicious use of scarce water resources. Also it shall lead to effective implementation of the project through collective action, participatory management of the irrigation system and farmers entering in to direct marketing of the produce.

- Addressing gender concerns and facilitating of the active participation of women farmers in the project activities would enhance the socio economic status and empower the women farmers.

ANNEXURES

ANNEXURE I

ACTIVITIESOF LINEDEPARTMENTS OF TN-IAMWARM-2

Sl.No	Department	Activities
1.	**Water Resources Department, PWD**	•Improvingirrigationservice deliveryincludingadaptationofmodern water-savingirrigation technologies and agricultural practices • FormingWUA andinvolving men andwomenfarmers onwater resourcesmanagement • Strengtheninginstitutions andinstrumentsdealingwithwater resources management. • Increasein area(hectares) served byirrigationsystemin66selected sub-basins which are to berehabilitatedandmodernized. •EstablishmentoftheStateWater Resources ManagementAgency (SWaRMA) • Developmentofgood-practiceanddecisionsupport systemsfor sustainablewater resourcesmanagement
2.	**AgricultureDepartment**	•Increasein agriculturalproductivity • LayingDemonstrations(inclusters)for transfer oftechnology(TOT)and tocreateimpact areaaroundthedemonstration plots. • Planning andimplementingtheactivities atthevillagelevel in consultationwith theWUAs •More paddyarea under SRI method •Adoption ofINM andIPM (organic practices). •Distributionofcritical inputsin time •Distributionoffarmimplements&enhancedmechanization. •ConductingIAMWARMfield days. •Needbasedtrainings tomenandwomenfarmers andfieldstaff.

Sl.No	Department	Activities
		•Fieldvisitsto providetherequiredextension supportandfacilitate farmer tofarmer learning •Strengtheninginformationandpublicityawareness •Frequentreviewanddocumentationofreports andsuccessstories
3.	**HorticultureDepartment**	•PopularizationofCommercialhorticulturetechniquesforenhanced revenue • IntroductionandpromotionofwatersavingMicroIrrigationlikeDrip& Sprinkler Irrigation • Increasingthefarmincomethroughcommercialfloriculture,whichhave tremendous potentialfor Export of exotic Products especiallyfruits, flowers andvegetables •Promotingcropdiversificationtoenhancetheincome • Developingeffectiveinfrastructure support inthe areasofproduction, processing,storage,Transportationandmarketing. • Induce privateinvestmentsinthe processingfor manyhigher value products. • Generate newrural non-farmemploymentopportunitiesandcontribute to higher incomes totherural poor. •WiththehelpofWaterUsers Associations (WUAs) smallFarmers' Horticultural Estates canbe promoted. •Promotion ofdirectmarketing andprepare thefarmersformarket-led Horticulture. •Needbasedcapacitybuildingto modernize the horticulturalfarms • Seedproduction,Tissueculturepropagation,Productionofcompost, vermiculture,Bio-fertilizers, Bio-pesticides •Training andhelpingfarmers onE-commerce

Sl.No	Department	Activities
4.	**AgricultureEngineering Department**	•Promotinginnovative,novel implements,thedrudgeryoffarmlabour •Needbasedtrainings tofarmers andfieldstaff. • Fieldvisitsto providetherequiredextension support andfacilitate farmer tofarmer learning •Strengtheninginformationandpublicityawarenessactivities. • ConstructionofFarmPondsinthefarmer'sfieldtoharvesttheexcess runoffwater inputwillbeaugmented/supplementedthroughOpen/ Tubewells.
5.	**Agriculture–Marketing**	•Developmentofsmallscaleprocessingunits,Storagegodowns,solar coldstorage &Solar driers • CreationofDiversifiedCroppingpattern,Transport,Gradingofproduce, Storage,Marketing–centres, etc. •Marketingintelligence–ratesof produces atdifferentcentres •DevelopmentofPostharvestTechnology •Value addition–drying, processing etc. •Ensuringremunerative farmincomewith better marketingstrategy. •PromotingAgri-entrepreneurs •Promotion ofFarmersProducer Organizations (FPO)
6.	**TamilNaduAgriculture University(TNAU)**	•DevelopmentofPrecisionFarmingTechniquesinfruitandvegetable crops. • DevelopmentofCropDiversificationwithlesswaterandmoremarket access crops. •Demonstrationon SRImethod. •DripFertigationinBanana,SugarcaneandCoconut. •Developmentof price-forecastinginformationmodel inAgribusiness •Develop Model Seed Village Concept to generate good quality and

Sl.No	Department	Activities
		hybridseeds •Needbasedtrainings tofarmers andfieldstaff.
7.	**AnimalHusbandryDepartment**	•Improvetheconception andcalvingratein bovines. •Establishing VeterinaryUnit •Toensure totalhealthcover both preventive andcurative. •DistributionofMineralMixture • Reduce the gap between the requirement and availability of green fodderthrough promotionoffodder cultivation
8.	**FisheriesDepartment**	•DevelopmentofAquaculture inFarmPonds •Development of Aquaculture in Irrigation Tanks byestablishingFish SeedBank •DevelopmentofFishseedrearingincages •DevelopmentofOrnamental FishCulture •ImprovementofGovernmentFishSeedFarm •SupplyofFishing Implements

ANNEXUREII
LIST OF TANKS PROPOSED FOR REHABILITATION

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
GADANANADHI SUB BASIN		
1	Sengulam	4.51
2	Shenbagaramaperikulam	3.86
3	Idyankulam	2.83
4	Sambankulam	3.00
5	Kollankulam	3.62
6	Thiruvembalaperi kulam	3.25
7	Parai kulam @ Vannan kulam	3.65
8	Pandara kulam	5.00
9	Pattaraikattikulam	4.27
10	Melapathukulam	5.86
11	Vadapathukulam	5.80
12	Kuthalampillaikulam	4.60
13	Kuttikulam	4.05
14	Ayyampillaikulam	3.45
15	Paramananthakulam	3.60
16	Nainarkulam	3.60
17	Marthandaperikulam	3.30
18	Sanakaraperikulam	2.52
19	Pillaikulam	5.50
20	Sirupillaikulam	2.98
21	Sivasailaperikulam	3.20
22	Pudhu kulam	3.02
23	Korandikulam	3.15
24	Nanalkulam	2.95
25	Veppankulam	2.65
26	Vagaikulam	4.43
27	Therkkukurunthudaiyarkulam	6.97
28	Vadakukurunthudaiyarkulam	5.45
29	Sambankulam	6.73
30	Villathikulam	5.02
31	Nambiyathikulam	5.05
32	Vadakkukulam	3.45
33	Achankulam	5.50
34	Udappankulam	5.75
35	Chokkankulam	2.25
36	Thondamankulam	3.46
37	Valathakulam	4.99
38	Malaiyankulam	3.30

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
39	Adaichani big tank	6.91
40	Veepankulam	3.30
41	Sambankulam	4.05
42	Kalkurichikulam	4.65
43	Chekkadikulam	2.20
44	Melaparaiyankulam	3.15
45	Keelaparaiyankulam	2.35
46	Pattakulam	4.65
47	Peramanikulam	2.80
48	Kuravankulam	3.00
49	Tuppakkudi periyakulam	5.55
50	Nanalkulam	3.05
51	Devarkulam	3.75
52	Rowthaperikulam	6.40
53	Chettikulam	5.04
54	Kallathikulam	4.25
55	Manjalodaikulam	4.64
56	Achankulam	3.57
57	Pudhukulam	4.26
58	Kaverikutankulam	3.13
59	Pudhuparaiyankulam	3.45
60	Punaipillaikulam	4.43
61	Madavarayankulam	3.94
62	Kovankulam	3.43
63	Pacherikulam	6.77
64	Nallakulam	2.92
65	Sembiliyankulam	3.05
66	Ayyankulam	2.43
67	Shenbagaramaperikulam	5.83
68	Porttamaraikulam	4.40
69	Karkulam	5.33
70	Nedunkulam	2.61
71	Poonjadikulam	3.10
72	Kaluthaipulikulam	3.54
73	Mela Araikulam	3.53
74	Keela Araikulam	3.84
75	Vadamalaisamudram	4.44
76	Nedungundu kulam	5.01
77	Sundaranainarkulam	3.30
78	Gangai Alwar kulam	3.42
79	Pattarkulam	4.20
80	Ayyanarkulam	8.32

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
81	Puliyankulam	4.86
82	Valimarichankulam	4.77
83	Sirakulam	4.29
84	Irankollikulam	3.33
85	Mullaipallikulam	3.11
86	Urankulam	2.99
87	Kurukkalkulam	2.48
88	Parayankulam	2.63
89	Pillaikulam	3.05
90	Elandakulam	3.21
91	Vandankulam	3.08
92	Pudukulam	2.91
93	Sripathankulam	2.71
94	Gnapattarkulam	2.96
95	Vagaikulam	4.09
96	Arasadikulam	3.51
97	Sungankulam	1.68
98	Ananthankulam	4.13
99	Sumaithangi Kulam	3.66
100	Pallakal peria kulam	4.00
101	Pettai kulam	4.00
102	Thiruneelakandar kulam	4.00
103	Abisekaperi kulam	3.10
104	Pettai kulam	4.30
105	Uradi kulam	3.70
106	Pudu kulam	4.00
107	Sirukulam	3.70
108	Rengasamuthram kulam	3.70
109	Valudur kulam	4.00
110	Iluppaikurichi kulam	4.00
111	Muriyan kulam	3.10
112	Saral kulam	4.00
113	Karungkulam	4.15
114	Neelamelaalagian kulam	4.00
115	Pappankulam	3.10
116	Oorvalainthan kulam	4.00
117	Pettai kulam	2.80
118	Thamarai kulam	4.00
119	Abraham kulam	4.00
120	Koran kulam	3.10
121	Pudu kulam	4.00
LOWER PALAR SUB BASIN		

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
1	Thaipakkam Puderi	3.29
2	Thaipakkam Tank	3.29
3	Melbangaram Tank	3.98
4	Muttavakkam Tank	5.17
5	Vadhiyur Chitheri	3.24
6	Vadhiyur Tank	4.20
7	Sirunai Tank	4.52
8	Kooram Big Tank	5.71
9	Kooram Chitheri	3.76
10	Ariyaperumbakkam Tank & Thangal	6.61
11	Keelambi Vadavandai Tank	4.88
12	Sembarambakkam Mani Eri	2.57
13	Sembarambakkam Tank	4.39
14	Erivakkam Tank	4.11
15	Konnerikuppam Tank	5.30
16	Nathapettai Tank	6.65
17	Peria Karumbur Malattu Thangal	5.20
18	Injambakkam Chitheri	3.49
19	Injambakkam Tank	3.18
20	Siruvakkam Big Tank	5.85
21	Siruvakkam Chitheri	4.65
22	Siruvakkam Sudaleri Thangal	3.20
23	Enadur Tank	7.63
24	Karai Tank	5.56
25	Andi Siruvellore Chitheri	4.13
26	Andi Siruvellore Big Tank	4.60
27	Seeyati Tank	4.97
28	Koothirambakkam Mari Thangal	3.69
29	Semmanthangal	3.92
30	Vedal Tank (99)	5.40
31	Illuppapattu Mananthangal	3.04
32	Illuppapattu Tank	4.02
33	Koothirambakkam Senji Thangal	2.32
34	Kuthirambakkam Tank	5.54
35	Thandalam Tank	3.77
36	Nelvoy Naga Thangal	2.70
37	Nelvoy Tank	5.44
38	Nelvoy Kallipatttu	4.05
39	Podavoor Vadathangal	4.01
40	Podavur Arasan Thangal	2.97
41	Ariyambakam Tank & Thangal	5.62
42	Thodur Thangal	4.20

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
43	Podavoor Melthangal	4.54
44	Podavoor Kil Thangal	4.59
45	Thodur Tank	5.35
46	Nirvalur Tank	5.64
47	Attuputhur Peria Eri	5.09
48	Attuputhur Chitheri	2.75
49	Kovalavedu Tank	5.42
50	Elakkai Mangalam Tank	5.25
51	Kunnavakkam Tank	6.21
52	Venbakkam Tank	5.87
53	Ullavur Chitheri	2.58
54	Ullavur Peria Eri	4.77
55	Ullavur Maduvu Eri	3.81
56	Varadapuram Tank	5.17
57	Pulliyambakkam Tank	3.92
58	Nathanallur Tank	5.19
59	Vallapakkam Tank	2.66
60	Keelottivakkam Tank	3.97
61	Puthagaram Tank	3.90
62	Poosivakkam chittheri	5.04
63	Poosivakkam Tank	4.68
64	Thenneri Hissa Tank	8.43
65	Kattavakkam Tank	3.97
66	Sinnivakkam Tank	4.44
67	Singadivakkam Tank	5.09
68	Alappakkam Tank	3.81
69	Athivakkam Tank	4.29
70	Siruvedal Tank	4.93
71	Athivakkam Retti Thangal	2.62
72	Athivakkam Vadaku Thangal	2.83
73	Vaiyavur Tank	5.05
74	Kaliyanur Peria Eri	4.15
75	Olaiyur Tank	4.21
76	Olaiyur Retteri	3.17
77	Karur Peria Eri	6.12
78	Sitiambakkam Tank	4.11
79	Sekankulam Tank	4.09
80	Singalpaditank	3.42
81	Singalapadiroyan	3.12
82	Singalapadi Thanglam	3.85
83	Kodamanallure Tank	4.91
84	Melmaduranmangalam	4.48

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
85	Madurammanagalatank	4.31
86	Madurammanagalapalavaneri	3.83
87	Madurammanagalammaveri	3.54
88	Sivankoodal	4.02
89	Ramanujapuram	3.97
90	Keeranallore	3.17
91	Selvalimangalamtank	3.56
92	Sendamanglam Arasan	2.66
93	Kilpodavaoor	6.63
94	Sendhamangalam Booderi	6.46
95	Pappankuli Large Tank	5.26
96	Nandhimedu Tank	3.43
97	Santhavelloreperia Eri	5.31
98	Chithoor Pillai Karanai	3.30
99	Sirumangadu Tank	8.30
100	Echur Peria Eri	5.97
101	Echur Venneri	4.78
102	Kunnan vadagal tank	4.78
103	Kunnam Mungil Thangal	5.12
104	Panurtti Peria Eri	6.13
105	Panurtti Pudhu Eri	4.10
106	Oragadam Vadagal	2.83
107	Oragadam Peria Eri	4.82
108	Panaiyur Tank	4.25
109	Vadakupattu Tank	6.04
110	Valayakkaranai Tank	4.91
111	Elichur Tank	5.72
112	Senthamangalam Periya Eri	4.26
113	Guruvaanmedu Tank	4.66
114	Kolathur Tank	6.65
115	Venbakkam Thangal	4.80
116	Appur Anjur Thangal	2.20
117	Appur Tank	5.79
118	Palur Chitheri And Peria Eri	8.87
119	Villiambakkam Tank	2.84
120	Athur Vadapathy Tank	4.52
121	Athur Thenpathy Tank	2.51
122	Kandalur Peria Eri	3.70
123	Sithamanur Tank	4.45
124	Sengundram Tank	5.74
125	Katchadimangalam Peria Eri	4.20
126	Veerapuram tank	4.32

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
127	Anjur Tank	5.95
128	Hanumanthai Tank & thangal	5.21
129	Kunnavakkam Peria Eri	4.13
130	Echangaranai Tank	3.76
131	Chengalpatttu Kolvoy Tank	6.49
132	Gundur	4.07
133	Ammanambakkam Tank	3.51
134	Vallam Tank	6.10
135	Nenmeli Peria Eri	6.28
136	Nenmeli Chitheri	3.40
137	Kilavedu Tank	4.34
138	Thunjam Tank	4.76
139	Thirumani Peria Eri	4.93
140	Mossivakkam Peria Eri	4.93
141	Manapakkam Tank	3.80
142	Udhayambakkam Tank	4.65
143	Korapattu Tank	3.85
144	Venpakkam Tank	4.79
145	Pandur Peria Eri	3.18
146	Vellappanthal Tank	3.45
147	Thalambedu Tank	4.38
148	Edaiyur Peria Eri	4.32
149	Edaiyur Thangal	2.53
150	Salur Thangal	2.43
151	Ponpadirkudam Tank	5.50
152	Narapakkam Tank	3.95
153	Thathalur Big Tank	5.26
154	Mudaiyur Thangal (Combained ayacut with Mudaiyur Periya Eri)	1.07
155	Muthigai Nallankuppam Peria Eri	3.94
156	Muthigai Nallankuppam Chitheri	3.65
157	Soorakuppam Thangal	3.40
158	Soorakuppam Peria Eri	3.70
159	Ichan Karanai Peria Eri	2.83
160	Ichan Karanai Thangal	3.17
161	Kunnavakkam Peria Eri	4.05
162	Kunnavakkam Chitheri	3.30
163	Naduvakkarai Tank	4.70
164	Naduvakkarai Malapattu Tank	3.41
165	Pattarai Kazhani Tank	5.20
166	Sooradimangalam Peria Eri	3.10
167	Merkandai Tank	2.40

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
168	Vitalapuram Tank	3.79
169	Chitlambakkam Tank	2.85
170	Pakkam Tank	3.60
171	Nerumbur Peria Eri	3.20
172	Nerumbur Thangal	3.40
173	Bommarajapuram Tank	2.88
174	Ayapakkam Peria Eri	2.49
175	Ayapakkam Chitheri	3.10
176	Ayapakkam Kokorai Odai	3.65
177	Vasuvasamuthiram Tank	2.20
178	Vayalur Tank	3.00
179	Pudupatinam Kondanganeri	3.70
180	Irumbuli Cheri Tank	3.27
181	Aminjikarai Tank	3.71
182	Aminjikarai Thangal	2.85
183	Perumbakkam Maduvu	3.70
184	Perumbakkam Thangal	3.70
185	Perumbakkam Tank	3.30
186	Melperumalcheri Tank	3.17
187	KarumKarumarapakkam Thangal	2.90
188	Karumarapakkam Periya Eri	4.70
189	Veerapuram Thangal (Combained ayacut with Veerapuram Perya Eri)	3.16
190	Mullikolathur Mulleri	3.98
191	Arambakkam Kalar Eri	2.71
192	Kunnathur Iyyan Thangal	3.17
193	Neikuppi Peria Eri	5.17
194	Vengampakkam Peria Eri	3.51
195	Meyyur Tank	2.69
196	Acharavakkam Tank	4.13
197	Patti Kadu Tank	3.58
198	Pulikundram Peria Eri (Combained Ayacut with Pulikundram Chitteri)	3.92
199	Echoor Tank	3.30
200	Puliyur Tank	4.25
201	Puliyur Chitheri	3.30
202	Kuzhipanthandalam Tank	5.00
203	Nallanpettral Peria Eri	5.25
204	Nallanpettral Chitheri	2.70
205	Kadumbadi Tank	6.19
206	Perumaleri Peria Eri	4.09
207	Vazhuvadur Tank	5.40

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
208	Neelamangalam Tank	5.44
209	Punnammai Tank	4.81
210	Seevadi Peria Eri	4.00
211	Viluthamangalam Tank	4.37
212	Pavinjur Tank	5.40
213	Lathur Tank	5.12
214	Agaram Tank	5.65
215	Thandamanallur Tank	4.72
216	Thattampattu Big	3.00
217	Nerkunapattu	3.00
218	Nelvoypalayam	3.00
219	Pachayambakkam Tank	4.34
LOWER VELLAR SUB BASIN		
1	V.Mamandur Tank	4.80
2	Pu.Mambakkam	3.90
3	A.Mazhavaranaur	5.23
4	Asanur Tank	4.84
5	Kattunemili Tank	4.73
6	Pali Tank	4.00
7	Pa.Killanur	3.58
8	Pullur Tank	2.82
9	Orangur Tank	2.63
10	Thatchur Tank	3.63
11	Eluthur Tank	3.63
12	Niramani Tank	3.80
13	Ma. Pudaiyur Tank	4.63
14	Paravalur Tank	4.00
15	Thoravalur Tank	4.05
16	Kodukkur Tank	3.20
17	Kodukkur Chittheri	2.46
18	Ramasamy Udaiyan Thangal	3.28
19	Vridhachalam Pillai Thangal	4.44
20	Chinnakutti Udaiyan Thangal	3.17
21	Perambalur Tank	3.60
22	Komangalam Tank	3.97
23	Mugundha nallur	4.31
24	Sathukudal Tank	4.35
25	Manavalanallur	3.79
26	Alichikudi Tank	3.04
27	Elamangalam Tank	2.50
28	Vridhachalam Kaspa	3.58
29	Mangalam Pettai	3.50

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
30	Mu.Agaram Tank	3.70
31	Roopanarayana Nallur Tank	3.27
32	Karnatham tank	4.90
33	Mugasa Parur Tank	4.17
34	Mathur Tank	4.21
35	Ko.Pavalangudi	3.90
36	Ko.Mavidanthal	4.50
37	Kumaraman galam	3.65
38	Sathapadi Tank	2.76
39	Gopalapuram Vannathi Eri	3.50
40	U.Adhanur Tank	3.48
41	Kathalai Tank	3.28
42	Vilakapadi Tank	4.76
43	Thurinjikollai Tank	3.70
44	Chinnaner kunam	2.30
45	Ukkadai Tank	3.00
46	Soodamani Tank	2.55
47	Keelacheruvai	4.18
48	Akkanur Tank	2.47
49	Palayam Tank	2.47
50	Vagaiyur Tank	2.37
51	Arangur Tank	2.60
52	Vaiyankudi Tank	2.02
53	Perumualai Tank	2.67
54	Sirumulai Tank	2.91
55	Adhamangalam	2.15
56	Arugeri	2.63
57	Narasingamnagalam	2.63
58	Konur Tank	2.40
59	Marungur Tank	3.10
60	Kavanur Tank	2.63
61	O.Keeranur	2.70
62	P.Poovanur	3.00
63	Karaiyur	3.00
64	Ariyaravi	3.38
65	Kuppudiyan	3.13
66	Muthupudaiyan	2.75
67	Moopanar Tank	2.75
68	Kurumban Kuttai	2.30
69	Alagapillai Tank	2.95
70	Nallaperumal Tank	3.00
71	Karmangudi	2.20

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
72	C.Keeranur	3.20
73	Sathiyavadi Tank	3.35
74	Chandrahasan Eri (Nemam)	2.50
75	Thuraiyur	2.60
76	Dheevalur Tank	3.51
77	Rajendiram Pattinam	3.28
78	T.V.Puthur	3.04
79	Kokkarasan pettai	2.30
80	Ananthakudi	2.77
81	Gunamangalam	4.80
82	Nagarapadi Tank	2.20
83	Melapuliankudi	3.30
84	Srivakkaramari	3.14
85	Sriputhur Tank	3.10
86	Selavizhi Tank	3.30
87	Kaliyankuppam Tank	2.45
88	Sir Nedunjeri	4.10
89	Kanur Tank	3.33
90	Palayankottai Tank	3.00
91	Poovan Tank	2.90
92	Pandiyan Large	2.60
93	Pandiyan Small	2.82
94	Kalinganeri	3.05
95	P.Adhanur Tank	2.15
96	Agara Alambadi Tank	2.98
97	Peraiyur Tank	4.22
98	Keeranur Tank	6.56
99	Pennakonam Tank	4.02
100	Ogalur Tank	6.29
101	Athiyur Tank	5.28
102	Agaramsigoor Tank	3.21
KRISHNAGIRI TO PAMBAR SUB BASIN		
1	Chinnagoundan Eri	2.70
2	Mohammad Ghouse Tank	3.75
3	Thimmapuram Tank	4.25
4	Malaiyandahalli Tank	3.55
5	Thalihalli Tank	3.90
6	Anankuttai Tank	3.25
7	Pudu Eri	3.80
8	Kurumpatti	4.25
9	Gopala Joshiyar Kuttai	2.50
10	Mittahalli Tank	3.00

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
11	Ellukuttai	3.10
12	Suriyanarayanan Tank	2.90
13	Senguttai	3.30
14	Mitchukan Kuttai Tank	2.85
15	Mallappan Tank	3.60
16	Gollappatti Tank	3.15
17	Oddankutai	2.70
18	Errahalli Tank	3.00
19	Kalleri Tank	2.90
20	Nadu Eri	2.95
21	Manikanoor Eri	2.90
22	Kottaiyur Eri	2.90
23	Pappan Eri	2.40
24	Paiyur Eri	4.25
25	Alamarathu Kuttai Tank	2.35
26	Nedungal Tank	4.93
27	Achukuttai Tank	4.85
28	Deveerahalli Tank	4.09
29	Pannandur Tank	3.20
30	Vadmangalam Tank	3.42
31	Maruderi Tank	3.96
32	Vilangamudi Tank	4.12
33	Barur Big Tank	7.50
34	Barur Small Tank	3.68
35	Thippanankuttai Tank	2.55
36	Puliyur Jamberi Tank	3.41
37	Kottappatti Tank	3.57
NAGARIYAR SUB BASIN		
1	Sanakuppam Tank	4.51
2	Karimbedu Tank	6.90
3	Athimanjeripet Tank	7.45
4	Pandravedu Tank	7.47
5	Perumanallur Tank	6.28
6	Mathikettan Odai Tank	8.40
7	Nedungal Tank	4.13
8	Santhanagopalapuram Tank	4.90
9	Nemili Tank	5.20
10	Nallatur Tank	5.30
11	Chivada Tank	5.90
PONNANIYAR SUB BASIN		

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
1	Pappankulam	2.69
2	Punganur tank	4.65
3	Kallikudi tank	3.52
4	Kothamanagalam big tank	4.13
5	Kothamanagalam small tank	3.08
6	Malaipatti tank	3.37
7	Suriyur Pudukulam	3.83
8	Narkadalkudikulam	3.62
9	Kinginikulam	3.70
10	Paganur Periyakulam	4.72
11	Alundur Periyakulam	3.90
12	Kolukkattaikudi Periyakulam	3.94
13	Thorakkudi Periyakulam	4.57
14	Koothapar kulam	4.07
15	Krishnasamudram tank	3.64
16	Navab kulam	3.81
17	Agarapatti Vaduthakulam	4.38
18	Kodumbalur Periyakulam	4.17
19	Kodumbalur Thalakulam	4.06
20	Mathirapatti Mathirakulam	4.19
21	Boothakudy Periyakualm	3.91
22	Kalkudi Periyakualm	3.69
23	Mela Boothakudy Periyakulam	3.74
24	Kothirapatti (Malaikudipatti) Malaikudikulam	4.98
25	Kothirapatti Malaierikulam	3.59
26	Eswarankoil Neivasal kulam	3.89
27	Vittamapatti Periyakulam	2.84
28	Rajagiri Periyakulam	5.04
29	Idaiyankulam	3.04
30	Viralur Periyakulam	4.81
31	Rajagiri Kakkakudikulam	3.00
32	Velur Chinnakulam	3.83
33	Velur Periyakulam	3.70
34	Kattakudi Periyakulam	5.16
35	Thirunallur Periyakulam	5.38
36	Thennambadi Periyakulam	4.09
37	Theravoor Therakulam	3.38
38	Mullaiyur Periyakulam	3.61
39	Sooriyur Eradikulam	3.45

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
40	Sooriyur Pudukulam	3.83
41	Madhayanipatti Madhayanikulam	3.98
42	Malaierikulam	4.03
43	Soliyakudi kulam	3.49
44	Kathallur Periyakulam	4.82
45	Kidavankudikulam	4.04
46	Avoor Periyakulam	3.19
47	Kalimangalam Periyakualm	3.49
48	Kunnathur Navakulam	2.49
49	Pakkudy Periyakulam	4.36
50	Maruthampatti Adanakulam	3.40
51	Perambur Periyakulam	4.88
52	Punginipatti Kalampur kulam	4.59
53	Vemmani Periyakulam	2.77
54	Vemmani Periyakulam	3.55
55	Vilappatti Themmakulam	3.53
56	Kumaramangalam Periyakulam	4.30
57	Mathur Periyakulam	4.25
58	Sengalakudy Periyakulam	4.56
59	Arasikulam	4.23
60	Avvaiyarpatti Periyakulam	4.02
61	Neerpalani Periyakulam	4.23
62	Sembattukuruchikulam	3.49
63	Nallikulam	3.48
64	Regunathasamudiram kulam	3.70
65	Manapparaikulam	4.37
66	Pinnathur tank	6.16
67	Pichampatty Tank	4.78
68	Kottaikulam	3.54
69	Aravakudi tank	3.23
70	Poongudi tank	4.09
71	Isanapatti tank	2.45
72	Kollankulam tank	3.12
73	Manikandam big tank	4.37
74	Manikandam small tank	4.49
75	Mela Panjapur tank	4.28
76	Senguruchi tank	3.18
77	Mangalam tank	3.35

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
78	Melakulam tank	3.00
79	Kanakkan kulam	3.51
80	Sathanur Tank	3.68
81	Sengulam tank	2.91
82	Sempattu big tank	4.58
83	Gundur Tank	4.96
84	Puthur Small tank	3.42
85	Puthur Big tank	3.58
86	Rayappanudayan tank	3.08
87	Thamaraikulam	4.74
CAUVERY DELTA SUB BASIN		
1	Achan Eri	3.40
2	Kadhatti Eri	3.98
3	Kattini Eri	3.55
4	Kittinichi Eri	2.80
5	Munian Eri	4.00
6	Nagiah Eri	3.10
7	Sukkudi Eri	3.32
8	Aravakurichi Eri	3.35
9	Erna kulam	3.41
10	Nilamuthi kulam	3.51
11	Palanganankudi kulam	3.00
12	Palantheneer kulam	3.22
13	Porani kulam	3.70
14	Theneer patti kulam	4.03
15	Thuvakkudi Periya kulam	3.94
16	Ulunthuni kulam	4.22
17	Velakulam	3.24
18	Venga kulam	4.05
19	Vattali Eri	3.44
20	Raja eri	2.87
21	Vadavali eri	3.36
22	Pulithi eri	3.06
23	Thiruvilapatti Eri	3.50
24	Pukkudi Eri	3.65
25	Pala eri	3.66
26	Vellamundan eri	4.05
27	Nallanna eri	3.12
28	Nangi eri	3.61
29	pathalan eri	4.26

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
30	Karamba eri	1.85
31	Ela eri	4.22
32	Periyapaduthan eri	3.23
33	Chinnapaduthan eri	2.38
34	Pallan Eri	3.12
35	Pudu Eri	4.50
36	Visagadevan eri	3.44
37	Periyanaikan eri	2.60
38	Chinna anaikan eri	3.09
39	Valambakudi eri	3.37
40	Pannangudi eri	3.22
41	Kada eri	4.22
42	Elachi eri	4.27
43	Kalar eri	3.31
44	Maruthuri eri	3.77
45	Palachilamban eri	3.17
46	Rayaran eri	3.69
47	Andal eri	3.18
48	Sanura eri	3.57
49	Aramundan eri	4.13
50	Uppukuli eri	2.86
51	Nathaman eri	2.92
52	Mylandan eri	3.05
53	Kuruchi eri	3.61
54	Kamachi eri	3.56
55	Serampadi eri	3.42
56	Aramboondan Eri	3.36
57	Kotra eri	4.10
58	Semburan eri	2.96
59	Moongiladi eri	3.03
60	Kadambakudi eri	4.46
61	Kumman eri	3.46
62	Marichikatti eri	1.93
63	Sembiyan eri	3.18
64	Anaikulam	2.70
65	Pagadakudi eri	3.13
66	Muthukaruppan eri	2.72
67	Santhamathiran eri	3.90
68	Pudu eri	2.65
69	Maruthakudi eri	2.89

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
70	Thatchan eri	3.66
71	Pethamathiran eri	3.73
72	Kodiyathal eri	3.37
73	Muthudayan Eri	2.80
74	Rengupaillai eri	4.81
75	Uyyakondan eri	3.95
76	Irruvenkettan eri	3.67
77	Bakiyaudaiyan eri	3.33
78	Murugappaudaiyan eri.	2.04
79	Pidari eri	2.27
80	Alagapettai eri	3.89
81	Kamathu eri	3.29
82	Kamathu Pudu eri	2.95
83	Maruvathi tank	3.42
84	Nedungulam	3.24
85	Neppi tank	3.44
86	Odai eri	2.29
87	Olamuthu tank	4.01
88	Saliperi eri	3.87
89	Santhan eri	3.21
90	Sayakudi eri	3.90
91	Serandi eri	3.55
92	Sorakudipatti eri	4.54
93	Velamathuran eri	3.49
94	Vendayampatti tank	4.07
95	Vetti eri	3.25
96	Ayyampatti tank	3.78
97	Chettiyarpatti kulam	2.71
98	Devarayan eri	4.49
99	Karamuthu tank	3.21
100	Koothakudi eri	3.04
101	Kottarapatti	3.87
102	Mangavanam tank	2.99
103	Pathalapettai keela kulam	3.75
104	Pathalapettai melakulam	3.31
105	Thirunedungulam tank	2.95
106	Thondamanpatti tank	4.59
107	Valavandhankottai	4.65
108	Vilangulam eri	3.17
109	Kiliyur tank	3.63

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
110	Vellathandankulam	3.72
111	Perunganikulam	3.76
112	Vadakki Pudukkulam	5.92
113	Raya samudiramkulam	4.14
114	Chettikulam	2.72
115	Vennamangalam Periyakulam	3.75
116	Kannankudi Periyakulam	4.60
117	Kunnathikulam	5.27
118	Senganikanmoi	4.39
119	Visalikanmoi	5.54
120	Karuppattikanmoi	5.36
121	Kattukkottai kulam	3.13
122	Kalakkudikulam	3.09
123	Thiruvali Tank	3.84
124	Perunthottam Tank	3.33
125	Udayamarathandapuram	2.80
126	Budharayanallur Tank	1.97
127	Panaveli Tank	2.70
128	Ponnankanni Eri	3.60
129	Minnel Eri	3.61
130	Kattakudi Eri	3.30
131	Valandhan Eri	2.65
132	Konnaiyadi Eri	2.80
133	Olaya kunnam Eri	2.77
134	Puthur Periya Eri	2.29
135	Puliyakudi Eri	2.55
136	Mudavan Eri	1.37
137	Moovanallur Eri	2.55
138	Vadakku Eri	2.20
139	Mangal Eri	2.03
140	Raman kottagam Eri	2.50
141	Puliyakudi Eri	2.41
142	Sundaram Eri	2.75
143	Chitheri Eri	2.96
144	Kudithangi Eri	3.02
145	Valakulam Eri	2.99
146	Vatteesmangalam Eri	3.01
147	Paruthikottai Eri	4.51
148	Ayyampettai Eri	3.01
149	Thamaraiyal Eri	3.05

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
150	Kamanar Eri	3.22
151	Sengalodai Eri	2.99
152	Semman gulam Eri	3.87
153	Vaduvur	4.47
154	Nemmeli eri	3.17
LOWER BHAVANI SUB BASIN		
Sl. No.	**Tank Name**	**MAXIMUM HEIGHT OF BUND (M)**
1.	Ananthasagaram tank	5.29
2.	Kolappalur Tank	6.80
3.	MottanamTank	5.47
4.	Kanuvaikombupallam Tank	9.22
5.	KovilpudurTank	5.87
6.	VemandampalayamTank	6.18
7.	VarathampayamTank	5.90
8.	Sanjeevarayan Tank	4.50
9.	Gettisamudram Tank	6.96
10.	Anthiyur	7.89
11.	Brammadesam	5.08
12.	Vembathy	6.04
13.	Appakoodal	4.45
UPPER BHAVANI SUB BASIN		
NIL		
GOWSIGANADHI SUB BASIN		
1	Thevankurichi tank	4.10
2	Kadaneri tank	4.11
3	Nakkaneri tank	3.93
4	Vaiyur Karisalkulam tank	4.90
5	Kunnathur Karisalkulam tank	3.96
6	Villur Periyakulam tank	3.60
7	Villur Ovari tank	4.61
8	Thennavanallur Periya sevalkulam tank	3.94
9	Alangulam tank	4.00
10	Chittur Periyakulam tank	4.95
SATHIYAR SUB BASIN		
1	Budagudi Tank	3.49
2	Venkadasamudram Tank	2.87
3	Vadugapatti Tank	3.90
4	Veppankulam tank	4.71
5	Keelapanangadi Tank	2.49

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
6	Vilangudi Tank	3.61
7	Melapanangadi Tank	2.84
8	Anaiyur Tank	1.70
9	Kurunthankulam tank	2.59
10	Kovilpatti NavalkulamTank	5.50
11	Alagapuri NanalkulamTank	4.83
12	Kuravankulam Pudukulam Tank	5.27
13	Adhanur Kattiyakaran kanmoi Tank	3.98
14	Sambakulam Tank	3.73
15	Silayaneri Tank	3.89
16	Karisalkulam Tank	3.25
17	Vagaikulam Tank	3.11
18	Kumaram Tank	3.69
19	Parali Tank	3.46
20	Vellaiyampatti Periyakanmoi	4.59
21	Devaseri Kanmoi	4.44
22	Oorseri Kanmoi	3.57
23	Muduvarpatti Pudukulam Tank	4.49
24	Podhumbu west	3.72
25	Athalai Tank	5.52
26	Siruvalai East Tank	3.84
27	Ambalathadi Tank	3.13
28	Pillayarnatham Tank	2.46
29	Ariyur Melakanmoi Tank	3.67
30	Ariyur Keelakanmoi Tank	3.31
31	Pattakurichi Tank	2.56
32	Koil Pappakudi Tank	4.95
33	Kesaneri Tank	1.34
34	Thodaneri	4.08
35	Paravai	6.27
36	Vittankulam	2.45
37	Moolakurichi	1.98
38	Vagankulam	3.10
39	Arasankulam	2.35
40	Anaikulam	1.95
41	Thattankulam	1.70
42	Kodimangalam	5.01
43	Melamathur	4.36
44	Sevalkulam	2.59
45	Mathikatten	2.59
46	Keelamathur Tank	3.79
47	Silaiman Tank	3.23

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
48	Panaiyur Tank	3.79
49	Chinthamani tank	3.86
50	Maranavaryendal Tank	2.75
51	Variyendal Tank	2.85
52	Kodikulam Tank	2.65
53	Parapatti Pudukulam Tank	3.35
54	Erukkalainatham	2.90
55	Poonari Tank	2.00
56	Veepankulam Tank	2.85
57	Kodimangalam Tank	2.90
58	Veerpandi Tank	3.75
59	Kuruthankulam Tank	2.35
60	Sakkrapandi Tank	2.90
61	Karuvanoor Periya Tank	3.55
62	Achampatti tank	3.45
63	Pannaikudi Tank	2.15
64	Koundan Tank	1.75
65	Thavettanpatti Tank	2.15
66	Vannankulam Tank	2.15
67	Pethampatti Tank	2.35
68	KaruvanoorChinna Tank	2.55
69	Manthikulam Tank	2.85
70	Palayampatti Tank	2.65
71	Kanjarampatti Tank	2.80
72	Merkkunarayankudi Tank	2.60
73	Kavanur Tank	3.00
74	Meenakshipuram	2.90
75	Koolapandi Tank	3.05
76	Usilampatti Tank	2.90
77	Sengulam tank	1.50
78	Chettiyendal Chinna & Periya kanmoi	2.30
79	Pudupatti Periya & Chinna kanmoi	3.72
80	Sembiyanendal kanmoi	2.21
81	Parukkan kulam tank	4.20
82	Kannimarkulam tank	2.10
83	Periya Amandur tank	5.50
84	Vappikkan tank	2.50
85	Shanmuganathi tank	2.65
86	Pillayarkulam tank	2.30
87	Poovakudi tank	1.90
88	Chinna Nagini tank	2.90
89	Kallandiri tank	2.00

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
90	Periya Nagini tank	2.90
91	Savalakarayan tank	1.40
92	Pulluseri tank	3.00
93	Sengulam tank	3.32
94	Paraikulam tank	4.37
95	Poondi Chinnakanmoi	3.30
96	Odaikulam Tank	2.60
97	Iraniyam Periyakanmoi	3.76
98	Thuyyaneri Chinnakanmoi	2.90
99	Vadakondam kanmoi	1.78
100	Poondi Periyakanmoi	2.91
101	Mathur Keelakanmoi	2.90
102	Pirakudi tank	2.09
103	Andaman tank	2.10
104	Thuyyaneri periya kanmoi	2.20
105	Thattankulam tank	1.70
106	Mathur Melakanmoi	2.10
107	Vagaikulam tank	2.60
108	Manthikulam tank	1.90
109	G.Pappankulam tank	2.00
110	Navakulam tank	2.40
111	Appanthirupathi tank	2.60
112	Mudathaliyendal tank	1.90
113	K,pappankulam Tank	2.30
114	Tharmathu patti Tank	2.10
115	Andaneri Tank	3.13
116	Kathakinaru Tank	2.30
117	Arunachalam Pudu Tank	1.93
118	Ilandaikulam Tank	2.75
119	Thattankulam Tank	2.70
120	Mangalakudi Tank	2.87
121	Narasingam Tank	1.97
122	Parayankulam Periya & Chinna Tank	2.40
123	Sirupulyendal Tan k	2.40
124	Kunduchettyendal Tank	1.46
125	Mathikettan Yendal Tank	2.48
126	Ponnankulam Tank	2.60
127	Thethankulam Periya & Chinna Kanmoi	2.80
128	Puliyankulam	3.38
SIRUMALAIYAR SUB BASIN		
1	Kongar Kulam	4.88
2	Mannavarathy	5.32

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
3	Pappan kulam	3.48
4	Avarampatti Kulam	5.55
5	Eraman Kulam	5.33
6	Agaram kulam	6.24
7	Mavoor Tank	11.89
8	Pulamasi Tank	5.46
9	Dhathan Kulam	4.97
10	Nachikulam Tank	4.38
11	Reddi Kanmoi	3.80
12	Vadugar Kanmoi	4.44
13	Vadakarai Tank	7.32
14	Kattakulam Tank	5.27
15	Nedunkulam Periyakulam Tank	2.62
16	Nedunkulam Pudukulam Tank	2.49
17	Thiruvalavaya Nallur Tank	4.07
18	Thanichiyam Tank	4.37
19	Nagari Pudukulum Tank	2.52
20	Thenur Periya Tank	4.37
21	Thenur Pudukulam Tank	3.99
VARAHANADHI SUB BASIN		
Sl. No.	**Tank Name**	**MAXIMUM HEIGHT OF BUND (M)**
1	Naranankulam	3.57
2	Ottankulam	3.07
3	Sirukulam (Gullapuram)	3.78
4	Koraikulam	3.11
5	Chettikulam	4.68
6	Chinnapoolankulam	3.43
7	Ramanaickenkulam	3.05
8	Aandikulam	2.28
9	Pottaikulam	4.94
10	Kaikilankulam tank	4.15
11	Velankulam tank	2.74
12	Balappanaickenkulam tank	3.38
13	Sirukulam	5.42
14	Kadampankulam	3.75
15	Pattathikulam tank	4.50
16	Manakkattukulam	3.52
17	Uruttikulam	3.48
18	Pudukulam (Jeyamangalam)	6.43

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
KALLAR SUB BASIN		
Sl. No.	**Tank Name**	**MAXIMUM HEIGHT OF BUND (M)**
1	Panchanthangi tank	3.40
2	Kulathur South tank	4.27
SURULIYAR SUB BASIN		
Sl. No.	**Tank Name**	**MAXIMUM HEIGHT OF BUND (M)**
1	Maithalamannadikulam Tank	7.30
2	Periyakulam Tank	3.77
3	Odapadikulam Tank	3.99
4	Ottukulam Tank	4.20
5	Veerappanaikenkulam	4.99
6	Kuppuchettikulam Tank	4.98
7	Kattathiammankulam Tank	2.50
8	Kaluneerkulam Tank	4.27
9	ThamaraiKulam Tank	4.95
10	Karunkattankulam Tank	5.71
11	Udayakulam Tank	5.35
12	Sengulam Tank	4.74
13	Sundakayankulam Tank	3.38
14	Karuvalankulam Tank	3.84
15	Sengulam Tank	4.04
16	Valasamudram Tank	4.75
17	Thonthimalayan Tank	3.29
18	Vayalpattikulam Tank	3.41
19	Kannimarkulam Tank	4.46
20	Kesava Puram Tank	4.24
MANJALAR SUB BASIN		
Sl. No.	**Tank Name**	**MAXIMUM HEIGHT OF BUND (M)**
1	Patchilainatchiamman tank	5.75
2	Veerankulam tank	5.80
3	Vedakulam tank	4.67
4	Kunnavarayankottai tank	5.26
5	Alangulam	4.74
6	Sirukulam	4.25
7	Thamaraikulam	6.92
8	Karunkulam	5.92
9	Rengasamudram	4.94

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
10	Sottankulam	4.60
11	Gopalasamudram	5.64
12	Siruvankulam	6.00
13	Puliyankulam	5.47
14	Narasingapuram -Thamaraikulam	4.67
LOWER VAIGAI SUB BASIN		
1	Nathaporakki	3.20
2	Manambakki	3.10
3	Vethiyarendal	3.10
4	Athanur	3.20
5	V.Karisalkulam	3.20
6	Pidaranendal	3.26
7	Vallam	3.25
8	Pagaventri	3.30
9	Kalladiendal	3.20
10	Soriyankulam	3.30
11	Siragikottai	3.29
12	Akkiramesi	3.20
13	Chithanendal	3.20
14	Arasadivandal	3.30
15	Manichiendal	3.30
16	Sadurvedhamangalam	3.10
17	Kiliyur	3.30
18	P.Kodikulam	3.30
19	Pandiyur	3.30
20	Mummidisathan	3.15
21	Nagachi	3.15
22	Therthangal	3.25
23	Thiyagavenseri	3.30
24	Thurathiendal	3.70
25	Vaniyavalllam	3.25
26	Kadambur	3.30
27	Pudhukulam	3.25
28	Seathukal	3.25
29	Perungalur	3.30
30	Averandal	3.20
31	Ganapathyendal	3.10
32	Sembathiendal	3.10
33	Pethanendal	3.10
34	Alagia perumanendal	3.10

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
35	Parambakkulam	4.10
36	Erumaiparalai	3.25
37	Ilanthaikulam	3.10
38	Karendal	3.97
39	Kavanur	4.11
40	Karukudi	3.87
41	Sakkankudi	2.72
42	Vannivayal	3.00
43	Chithur	3.87
44	Kooriyur	3.44
45	Nochivayal	2.55
46	Puthendal	3.59
47	Kumariyendal	3.89
48	Peruvayal	4.12
49	Sakkaravalanallur	2.98
50	Pullankudi	4.19
51	Chitharkottai	2.97
52	Athiyuthu	2.97
53	Therbogi	3.25
54	Kavarankulam	2.49
55	Pappakudi	3.89
56	Kalathavur	3.36
57	Othapanai	3.64
58	Peravoor	3.43
59	Sakkarakottai	4.67
Lower Tamiraparani Sub Basin		
Sl NO.	**Name of the Tank**	**MAXIMUM HEIGHT OF BUND (M)**
1	Ellandaikulam	2.90
2	Kandiaperikulam	4.09
3	Krishnaperi kulam	3.23
4	Mullikulam	3.35
5	Narasinganallur kulam	3.23
6	Pettai periyakulam	3.61
7	Suthamalli pudukulam	3.53
8	Thamaraikulam	3.35
9	Chatram pudukulam	5.42
10	Chettikulam	3.84
11	Mankulam	3.23
12	Nathankulam	4.11

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
13	Oppanaikulam	2.26
14	Ottankulam	4.43
15	Seeniappan thiruthu kulam	3.57
16	Thennerkulam	3.43
17	Alaganeri (Near Alaganeri)	3.43
18	Alangaraperi	4.12
19	Kalkurichi	4.52
20	Kattalaikurichi	3.68
21	Kattampuli	4.04
22	Kuppakurichi pudukulam	3.35
23	Kuppakurichi kulam	5.40
24	Munampuli	3.57
25	Nainarkulam	4.31
26	Palamadai	4.57
27	Sambankulam	3.22
28	Sendimangalam	3.43
29	Udayaneri	4.45
30	Udayarpatti kulam	3.35
31	Arugankulam	3.64
32	Karaiyiruppu Kulam	3.74
33	Kumilankulam	2.90
34	Musandipudukulam	3.35
35	Musandikulam	3.18
36	Pirayankulam	3.06
37	Rajavallipuram	4.68
38	Undali	3.96
39	Vannanpacherikulam	4.15
40	Alaganeri(Near Udayaneri)	4.40
41	Maranthai kulam	5.50
42	Vagaikulam	3.35
43	Velarkulam Tank	4.96
44	Thalaiyuthu Tank	6.75
45	Puthur pananji	4.45
46	Thiruppanikarisalkulam	4.96
47	Melakallur Pudhukulam	5.37
48	Vellalankulam	4.04
49	Thulukkarkulam	5.20
50	Pee kulam	3.40
51	Vannan kulam	4.00
52	Maran kulam	5.20

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
53	Irisi kulam	3.10
54	Arasan kulam	4.05
55	Kollan kulam	4.25
56	Sivanthipatti	4.00
57	Kandankattalai kulam	3.685
58	Amirthankulam	3.345
59	Pottaikulam	3.355
60	Udayarkulam	3.425
61	Arasankulakm	2.505
62	Alangulam	2.440
63	Sirukulam	2.135
64	Ponpathukulam	3.055
65	Pandarakulam	3.590
66	Vagaikulam	4.270
67	Udayarkulam	3.150
68	Alwanerikulam	3.095
69	Seethappaneri kulam	3.690
70	Puthunerikulam	4.270
71	Pottalkulam	1.515
72	Velankulam (Single Crop)	3.505
73	Uthirasankulam	3.530
74	Karunagaraperi kualm (Single Crop)	2.590
75	Paraikulam	3.960
76	Koraikandikulam	3.285
77	Mannar Kulam	2.835
78	Kumaranerikulam (Single Crop)	2.295
79	Ariyakulam	4.235
80	MelaSirukulam	2.340
81	Uthamapandian kulam (Single Crop)	3.960
82	Kuthuparai kulam (Single Crop)	3.505
83	Nochikulam	4.260
84	Shanankulam	2.440
85	Mulikulam	2.435
86	Kuthiraikattalai kulam	2.825
87	Ammankovil kulam	3.030
88	Pottaikulam	2.920
89	Murikulam	3.120
90	Keelanatham pudukulam	3.475
91	Kalladaikulam	3.050
92	Sivanaperikulam	2.890

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
93	Manapadai Pudu kulam	4.125
94	Varadacheri kulam	2.105
95	Melapattam pudukulam	3.745
96	Kotarapatta kulam	3.455
97	Thamaraikulam	3.350
98	Melapattam - Pacherikulam	3.185
99	Ramanerikulam	3.050
100	Krishnaperi kulam	2.445
101	Edayankulam	2.940
102	Kilapattakeela kulam	3.330
103	Kolukattayar kulam	2.575
104	Marudur vadak ku kulam	4.400
105	Kansapuram nochikulam	3.085
106	Nambikulam	3.170
107	Marudur Therkkukulam	3.710
108	Kalmadaikulam	3.515
109	Arampannaiar kulam	3.360
110	Sambanthan kulam	3.045
111	Veppankulam	2.875
112	Virsurkulam	3.050
113	Krishnaperi	2.665
114	Idayankulam	2.805
115	Kadavarayaperi	2.750
116	Kurippankulam	3.050
117	Melathatchan kulam	2.775
118	Nainarkulam	3.260
119	Keelathatchan kulam	2.785
120	Nambineri	4.125
121	Vagaikulam	3.175
122	Velankulam	3.815
123	Kothankulam	2.925
124	Nandupidithan kulam	3.735
125	Senkulam	3.940
126	Pirancherikulam	4.540
127	Aladikulam	2.76

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
128	Poongudaiyar kulam	5.72
129	Puthukulam	3.29
130	Achankulam	3.71
131	Idayankulam	3.00
132	Narayana ayyarkulam	1.92
133	Kuruvankulam	2.84
134	Melamarichikatti kulam	2.84
135	Narayanaperi kulam	3.26
136	Veppakulam	4.79
137	Therkuperi kulam	3.80
138	Vayalnambi kulam	3.26
139	Arasankulam	2.98
140	Chithanarkulam	3.03
141	Easwarankulam	3.54
142	Kanganarkulam	5.75
143	Karisalpattikulam	3.84
144	Keelathalaimalai kulam	3.93
145	Maravankulam	4.27
146	Melapothaikulam	3.20
147	Melathalaimalai kulam	3.61
148	Nanalkulam	3.21
149	Nochikulam	4.24
150	Panaikulam	3.60
151	Periyapudukulam	3.82
152	Pillaikulam	4.01
153	Pirayankulam	4.04
154	Aradappankulam	3.90
155	Nayakkankulam	3.26
156	Neivilakupuram kulam	4.30
157	Poolankulam	3.26
158	Punnaikulam	4.33
159	Senaikumithan kulam	4.20
160	Sengalmadai kulam	3.66
161	Manavalankulam	3.62
162	Pallankulam	3.18
163	Parachipathi kulam	3.32
164	Parayankulam	3.48
165	Parayankulam	3.19
166	Pettaikulam	3.00
167	Puliyanarkulam	4.30
168	Ragunathasubramania ayyar kulam	4.27
169	Sandaikulam	4.14

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
170	Sellinikulam	5.19
171	Sirukulam	3.60
172	Thamanpothai kulam	2.06
173	Vemanampoli kulam	4.07
174	Uppukulam	1.71
175	Vagaikulam	4.33
176	Vanian kulam	4.84
177	Veethiruthan kulam	2.43
178	Vellaparai kulam	1.91
179	Vilvarayankulam	2.83
180	Pappankulam	4.06
181	Srigovindaperikulam	3.30
182	Vaduvarpatti kulam	3.33
183	Ilandikulam	4.58
184	Adaimethiappan-kulam	3.87
185	Alankulam	4.47
186	Alwaneri periyakulam	4.35
187	Alwaneri vadakukulam	2.38
188	Ambooranikulam	5.08
189	Ariyanayagipuramkulam	3.78
190	Athiuthukulam	3.66
191	Ayanerikulam	4.67
192	Ayankulam	4.05
193	Deivendraperikulam	3.81
194	Itteriperiyakulam	4.65
195	Iyyanarpattikulam	5.28
196	Kadambankulam	3.44
197	Kadambankulam	3.24
198	Kaippankulam	3.80
199	Karuppukattiperiyakulam	4.55
200	Kodikulam	4.59
201	Kollankulam	3.45
202	Konganthaparaikulam	4.06
203	Kovaikulam	3.41
204	Kuthukalkulam	5.30
205	Mallakulam	3.55
206	Marudhakulam	4.15
207	Mayanerikulam	3.19
208	Meiyalankulam	3.40
209	Moondradiappu Periyakulam	5.20
210	Nallavarayankulam	4.07

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
211	Mudalaikulam	3.52
212	Muthoorperiyakulam	4.31
213	Neduchankulam	5.57
214	Pallavarankulam	3.44
215	Paniyankulam	3.12
216	Paruthipadukulam	3.66
217	Periya Puthukulam	2.93
218	Pettaikulam	3.10
219	Ponnakudi Periyakulam	5.68
220	Poolam Periyakulam	4.78
221	Pudukulam	4.12
222	Pulipatankulam	3.42
223	Puliyankulam	3.55
224	Puthukurichikulam	3.00
225	Sathankulam	4.12
226	Sendankulam	4.01
227	Sivanthipatti Periyakulam	4.27
228	Sriramankulam	2.87
229	Sundamparaikulam	2.93
230	Suralikulam	3.91
231	Thamaraiselvikulam	4.21
232	Thennarkulam	4.40
233	Therkupathiniparaikulam	3.26
234	Thottakudi Periyakulam	4.41
235	Vadaku pathiniparaikulam	4.00
236	Vadakuarasankulam	4.65
237	Vallatharkulam	3.76
238	Veerlaperumselvikulam	3.28
239	Veppankulam	3.60
240	Achampadukulam	3.69
241	Aramboondakulam	3.72
242	Arasanarkulam	4.00
243	Arasankulam	4.13
244	Ariyakulam	4.04
245	Chettiappankulam	3.19
246	Chinnakulam	3.83
247	Chinnamoolakarai Kulam	4.29
248	Chinthamani mela & Keelakulam	4.34
249	Devanamperikulam	2.76
250	Danarkulam	3.43

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
251	Idayalankulam	3.16
252	Ilupaikulam	3.65
253	Kadambankulam	3.72
254	Kallathikulam	3.45
255	Kondanerikulam	4.84
256	Kovaikulam	3.27
257	Kurippankulam	4.02
258	Lattikulam	4.06
259	Melamallakulam	3.86
260	Nagalkulam	4.00
261	Nambikulam	3.31
262	Nemmanikulam	2.51
263	Periyakulam & Sengulam	4.08
264	Pettaikulam	3.64
265	Pillayarkulam	4.13
266	Pillayarkulam	3.33
267	Pudukulam	3.20
268	Santhirankutikulam	3.77
269	Sathanerikulam	3.59
270	Sundamparaikulam	3.53
271	Serakulam	4.29
272	Thanthonikulam	3.55
273	Thirattikulam	4.39
274	Thiruvaranganerikulam	4.93
275	Thiruvarulnerikulam	4.31
276	Udayanerikulam	3.25
277	Vagaikulam	4.23
278	Vallakulam	5.16
279	Veerakeralaperi	3.56
280	Veppankulam	3.53
281	Vettikulam	3.22
282	Muthalankurichi Tank	3.19
283	Kuttaikal Tank	4.01
284	Kollivaikkalkulam	3.32
285	Nattarkulam	3.63
286	Seidunganallur	4.32
287	Thoothukuzhi	4.14
288	Karungulam	4.93
289	Pottaikulam	4.30
290	Kalvai	4.32
291	Vellur	6.38

Sl. No.	Tank Name	MAXIMUM HEIGHT OF BUND (M)
292	Thenkarai	6.97
293	Nochikulam	3.73
294	Keelaputhukulam	3.90
295	Muthalamozhi Tank	3.61
296	Vellarikkaioorani Tank	4.51
297	Themmankulam Tank	3.19
298	Battarkulam	4.03
299	Chenthila npannai	3.50
300	Dharmaneri	3.08
301	Esakkankulam	3.67
302	Kailasaperi	3.15
303	Kasba	5.59
304	Nedunkulam	3.10
305	Padmanabamangala Keelakulam	3.76
306	Padmanabamangala Melakulam	3.32
307	Pattakulam	3.22
308	Peerkankulam	2.53
309	Perur	5.28
310	Perungulam	5.41
311	Renganathan Puthukulam	4.21
312	Sivagalai	4.57
313	Arumuga mangalam	5.50
314	Palayakayal	3.13
315	Vallakulam	3.91

ANNEXUREIII
FACT SHEET–ENVIRONMENTAL BASELINEREPORT

CheyyarSub-Basin
Location • The Cheyyar sub-basin lies in twentyblocks i.e. Uthiramerur, Kancheepuram, Vembakkam,Cheyyar,Anakkavur,Pernamallur, Chepet,Pudupalayam,Kalasapakkam, Polur, WestArani,Arani,Thimiri,JavaduHills,Alangayam,Anaicut,Vellore, Thurinjapuram,ArcotandKanniyambadiblocksinthreedistrictsi.e. Kancheepuram, Thiruvannamalai andVellore.
Topography •Almost flatand slopingnaturefromWest to East.
Soil • The major soil typesare Claysoil andRedloamysoil
Agroclimaticzone • Thesub-basin liesin theNorth EasternAgro Climatic Zone andhassemi-arid plainagro eco-system andthemajorcropsgrown beingVegetables,Paddy etc.
SurfaceWater •Suitablefor drinkinganddomestic uses
Groundwater • AsperCentralGroundWaterBoard(CGWB),thesub-basindistrictsofKancheepuram, Tiruvannamalai andVellorehavebeencategorised asSafe,Semi critical and Over-exploited.
Climate • Thesub-basinareahasaveragetemperatureof28.8°C,averageannualnormalrainfall of1082 mmand averagerelative humidityof82%.
Biodiversityand Forests <u>Forests</u> • Thesub-basindistrictshaveforestcoverofabout35to40%ofsub-basinarealocalised mostlyinthesouth-westernandwesternpart ofthesub-basin. <u>Floraand Fauna</u> •ProminentforesttypesareEvergreen/Semi-evergreenand deciduousforests • Theavi-faunaobservedintheprotectedareasunder thesub-basindistrictsare Flamingoes,ducks,osprey,avocet,cormorants,herons,spoonbills,gullsandother migratorybirds
NaturalHazardand Calamities • Thesub-basindistrictsexceptKancheepuramarenotpronetonaturalhazardsand calamities. •Thesub-basindistrictofKancheepuram isproneto natural hazardsandcalamities. •FallsunderSeismicZoneIII.

Upper Palar Sub-Basin
Location • The Upper Palar sub-basin lies in seven blocks i.e. Pernambut, Madhanur, Alangayam,Natrampalli, Jolarpetai, TiruppatturandBagurblocksinVelloredistrict. •It lies between12°55'Nand12°25'Nlatitudesand79°35'Eand80°15'Elongitudes.
Topography •Almostplaintopographywith slopingnaturefromwesttoeast.
Soil • Themajor soiltypesareSandysoil,Sandy loam,Red loam,Clay,Clay loam, Black cottonsoil
Agroclimaticzone • Thesub-basin liesin theNorth EasternAgro Climatic Zone andthemajor cropsgrown beingPaddy,Coconut, Sugarcaneetc.
SurfaceWater •Suitablefor drinkinganddomestic usesaftertreatment.
Groundwater • AsperCGWB,thesub-basindistricthasbeencategorisedasover-exploitedandare not to beconsideredfor anyfurtherdevelopmentofgroundwater. •Pollutionfromtanneriesisthemajorcausefordeteriorationof groundwaterqualityandsoil invastareas.
Climate • The sub-basin area has average temperature of 27.5°C, average annual normal rainfall of936mmandaveragerelative humidityof61%.
Biodiversityand Forests <u>Forests</u> • Thesub-basindistrictshaveforestcoverlessthan10%ofsub-basinareamostly scatteredinthecentral part ofthesub-basin. <u>Floraand Fauna</u> •TheprominentforesttypesareScruband Forest Plantation.
NaturalHazardand Calamities •Thesub-basindistrictsare notpronetonaturalhazardsandcalamities. •FallsunderSeismicZoneIII

KrishnagiriToPambar Sub-Basin
Location • TheKrishnagiritoPambarsub-basinliesinnineblocksi.e.Kaveripatnam,Krishnagiri, Veppanapalli,Kelamangalam,Bargur,Uthangarai,Mathur,Harurand Morappurintwo districts i.e.KrishnagiriandDharmapuridistricts. •Itliesbetween 12°05'Nand12°40'N latitudesand 78°05'E and78°35'Elongitudes.
Topography • Thetopographyofthesub-basinfallingundertheKrishnagiridistrictisgenerallyof mountaineous typewhileundertheDharmapuri district, itisofrollingplainstypes.
Soil • Themajor soiltypesareBlacksoil,SandysoilandLoamy soil.
AgroClimaticZone • Thesub-basin liesin theNorthWestern AgroClimatic Zoneof TamilNaduand hasarid slopingagri ecosystemwiththemajor cropsgrown
SurfaceWater •Suitablefor drinkinganddomesticuses
Groundwater • Asper CGWB, thesub-basin districtsofKrishnagiri and Dharmapuri havebeen categorisedas Over-exploited. •Flourideexceedsthepermissible limitof1.5 mg/lin Krishnagirisub-basindistrict.
Climate •Thesub-basinareahasaveragetemperatureof24.5°C,averageannualnormalrainfall of876mmandaveragerelative humidityof65%.
Biodiversityand Forests <u>Forests</u> • The sub-basin districts have forest cover less than 5% of sub-basin area mostly distributed inthenorthern and southernpartofthe sub-basin. <u>Floraand Fauna</u> •Theprominentforesttypesare Scruband Forest Plantation
NaturalHazardand Calamities •Thesub-basindistrictsare notpronetonaturalhazardsandcalamities. •FallsunderSeismicZoneII.

VaniyarSub-Basin
Location • TheVaniyarsub-basinlies insevenblocksi.e.Morappur,Harur,Pappireddipatti, Karimangalam, Yercaud , Valappadi andAyothipattinam,intwo districts i.e. DharmapuriandSalem districts. •Itliesbetween 11°45'Nand12°10'N latitudesand 78˚10'E and78°45'Elongitudes.
Topography •ThetopographyofDharmapuri sub-basindistrict,isofrollingplainstypewhereasin Salemsub-basin district,topographyisofhillyrangesandrockswith undulatingplains
Soil •Themajor soil typesareRed soil andBlacksoil.
AgroClimaticZone • Thesub-basin liesin theNorthWestern AgroClimatic Zone andhassemiarid plain agri ecosystemwiththemajorcropsgrown beingPaddy,Millets,Pulsesetc.
SurfaceWater •Suitablefor drinkinganddomestic uses
Groundwater •AsperCGWB, thesub-basin districtsofDharmapuri andSalemhave been categorisedasOver-exploited. •In Salem districtofVaniyarsub-basin,generalclassificationisHigh Salinityon the basisofSAR.
Climate • The sub-basin area has average temperature of 24.7°C, average annual normal rainfall of950mmandaveragerelative humidityof60%.
Biodiversityand Forests <u>Forests</u> • Thesub-basindistrictshaveforestcoverofabout30-35%ofsub-basinareamostly scatteredinthesouthand easternpart ofthesub-basin. <u>Floraand Fauna</u> •TheprominentforesttypesareEvergreen/Semi-evergreenand deciduousforests
NaturalHazardand Calamities •Thesub-basindistrictsare notpronetonaturalhazardsandcalamities. •FallsunderSeismicZone II

GadanaSub-Basin
Location • TheGadanasub-basin lies insix blocks i.e.Pappakudi,Kadayam, Ambasamudram, Cheranmadevi, Thenkasi,KeezhapavurinTirunelveli district. •It lies between08°45'Nand08°55'Nlatitudesand77˚15'Eand77°35'Elongitudes.
Topography •The topography ofthesub-basingenerallyhasplainterrainwithagentle slopetoward EastandSoutheast.
Soil • ThemajorsoiltypesareDeepRed soil,BlackCotton Soil,Red SandySoil,Saline Coastal Alluviumand RiverAlluvium.
AgroClimaticzone • Thesub-basin liesin theHighAltitudeAgroClimaticZoneof Tamil Naduandhaswet andslopy agroecosystemwiththemajorcropsgrown beingPaddy,Coconutetc.
SurfaceWater •Suitablefor drinkinganddomestic uses
Groundwater •Asper CGWB,thesub-basin district of Tirunelvelihasbeencategorisedas Safe.
Climate • Thesub-basinareahasaveragetemperatureof28.2°C,averageannualnormal rainfall of845mmandaveragerelative humidityof82%.
Biodiversityand Forests <u>Forest</u> • Thesub-basindistricthasforestcoverofabout20%ofsub-basinareaconcentrated towardsthewestern part ofthesub-basin. <u>Floraand Fauna</u> •TheprominentforesttypeisForestsplantation • Thefaunaobservedintheprotectedareaunderthesub-basindistrictsareTiger, Bonnet Macaque, Langurs, Slender Loris, Sloth Bear, Sambar, Chital,Wild Dog Elephant,Panther etc.
NaturalHazardand Calamities •Thesub-basindistrictisproneto cyclonesandfloods. •FallsunderSeismicZoneII.

PazhayarSub-Basin
Location • ThePazhayarsub-basinlies insixblocksi.e.Thovala,Agasteeswaram, Rajakkamangalam,Thiruvattur, KurunthancodeandThuckalayinKanyakumari district.
Topography • Generallytowardsthenorthandnorthwesternside,predominantlyoccupiedbyWestern Ghatswiththesouthandwestpartsbeingcoveredby plainsandnarrow stretchof beachesand sand dunesarefoundnearthecoastline
Soil • Themajorsoil typesareRedsoil, Lateriticsoil,Clayeysoil,RiverAlluvium, CoastalAlluvium.
Agroclimaticzone • Thesub-basin liesin theHighRainfall AgroClimaticZoneof Tamil Naduandhumid, slopyagroecosystem with themajorcropsgrown beingPaddy,Coconut, Banana Rubberetc.
SurfaceWater •Suitablefor drinkinganddomestic uses
Groundwater •Asper CGWB,thesub-basin district ofKanyakumari hasbeencategorisedasSafe.
Climate • Thesub-basinareahasaveragetemperatureof 28.5°C, averageannualnormalrainfall of1303mmandaveragerelative humidityof65%.
Biodiversityand Forests <u>Forests</u> • Thesub-basindistrictshaveforest coverofabout 15-20%ofsub-basinarealocalisedin thenorthwestern andnortheastern partsofthesub-basin. <u>Floraand Fauna</u> •TheprominentforesttypeisDeciduous • Thefaunaobservedintheprotectedareaunderthesub-basindistrictsareElephant, Gaur,Sambar,Chital, Panther, Tiger,Birds, Reptiles,Slothbear,Wildboar
NaturalHazardand Calamities •Thesub-basindistrictisnotpronetonatural hazards andcalamities. •FallsunderSeismicZone II

PonnaniyarSub-Basin
Location • ThePonnaniyarsub-basin lies insixblocks i.e. Tiruverambur, Manapparai, Vaiyampatti,Manikandam, AndanallurandViralimalai intwo districtsi.e.Tiruchirapalli and Pudukottaidistricts. •Itliesbetween 10°23'Nand10°50'N latitudesand 78°09'E and78°52'Elongitudes.
Topography •Undulatingtopography and thegeneralslopeistowardssoutheast.
Soil • The major soil types present are Black, Red,Alluvial soils.
Agroclimaticzone • Thesub-basin liesin theCauvery delta Agro Climatic Zone andhassemiarid,plain agroecosystemwiththemajorcropsbeinggrownarePaddy,Millets,Vegetables etc.
SurfaceWater •Suitablefor drinkinganddomestic uses
Groundwater • Asper CGWB, thesub-basin district of Tiruchirapalli and Pudukottaihasbeen categorisedassemi-critical and saferespectively. •Flourideexceedsthepermissible limitof1.5 mg/linTiruchirapallisub-basindistrict.
Climate • The sub-basin area has average temperature of 28.9°C, average annual normal rainfall of1705mm andaveragerelative humidityof81%.
Biodiversityand Forests <u>Forests</u> • Thesub-basindistrictshaveforestcoverlessthan 5%ofsub-basinareaandscattered inthesouth-westernpart ofthesub-basin. <u>Floraand Fauna</u> •TheprominentforesttypesareScruband deciduousforests.
NaturalHazardand Calamities •Thesub-basindistrictof Tiruchirapalli isnotpronetonatural hazardsandcalamities. •Thesub-basindistrictof Pudukkotai isprone tonatural hazardsand calamities. •FallsunderSeismicZone II

CauveryDeltaSub-Basin
Location • TheCauvery Deltasub-basin lies in thirtynineblocks i.e. KunnantharKoil, Viralimalai, Gandarvakottai,Thiruverumbur,Lalgudi, Pullambadi,Budalur,Thanjavur,Thiruvaiyaru, Papanasam,Ammapettai,Kumbakonam,Thiruvidaimaruthur, Pattukkotai,Madukkur, Orattanadu, Thiruvonam,Thirupandal, Kudavasal,Koradacheri,Nannilam, Thiruvarur Valangaiman,Thiruthuraipoondi,Muthupetai, Mannargudi,Kottur, Needamangalam, Kutthalam,Thirupanandu,Mayiladuyharai,Sembanarkoil,Sirkazhi,Kollidam, Thirumarugal, Nagapattinam, Kilvelur,Thalanayar,andVedaranyam infourdistricts
Topography •Flattopographyinlowerdelta area
Soil • Themajorsoiltypesareclayeysoilsandsandysoils
Agro climatic zone • Thesub-basin liesin theCauvery delta Agro Climatic Zoneandhaswet,plain agro ecosystemwiththemajorcropsgrown beingpaddy,sugarcane,bananaandpulses.
Surface Water •Suitablefor drinkinganddomestic uses
Groundwater •As per CGWB, the sub-basin districts of Tiruchirapalli &Tiruvarur, Thanjavur &Nagappattinam have been categorised as Semi-critical and Over-exploited respectively. •Flourideexceedsthepermissible limitof1.5 mg/linTiruchirapallisub-basindistrict
Climate •The sub-basin area has average temperature of 30.0°C, average annual normalrainfall of1106mm andaveragerelative humidityof78%.
Biodiversityand Forests <u>Forests</u> • Fewpatchesofmangrovesplantationsareobservedinthesouthernpartofthesub- basin. <u>Floraand Fauna</u> •No prominent forest types • Thefaunaobservedinthe protectedareaunder thesub-basindistrictsare BlackBuck, BonnetMacaque,WildBoar, Flamingoes, varietyofbirdssuchasTeals, Gulls
NaturalHazard and Calamities •Thesub-basindistricthasnorecordedhistoryofnaturalhazardsand calamities. •FallsunderSeismicZoneII

ThirumanimutharSub-Basin
Location • TheThirumanimutharsub-basinliesintwentyblocksi.e.Yercaud,Salem,Veerapandi, Panamarathupatti,Ayothiapattanam,Vennandur,Rasipuram, Mallasamudram, Puduchatram,ElachipalayamParamathi,Namakkal,Mohanur, Kabilarmalai,Mohanur, Sendamangalam,Kollimalai,Namagiripettai,Magudanchavadi andTiruchengodein two districts i.e.Namakkal and Salemdistricts. •Itliesbetween 10°57'Nand11°44'N latitudesand 77˚48'E and 78°19'Elongitudes.
Topography •Hillyrangesandrockswith undulating plains •Southern, westernandnorthernparts inNamakkal district islowlying
Soil Alfisols(20-25),Inceptisols (25-30),Vertisols(5-10), Entisols(10-15),Rockoutcrop(5-10)
Agro climatic zone • Thesub-basin liesin theCauvery deltaAgroClimatic Zoneandhassemiaridagro ecosystemwiththemajorcropsgrown beingBanana,SugarcaneandPaddy.
Surface Water •Suitablefor drinkinganddomestic uses
Groundwater •AsperCGWB,thesub-basindistrictsofNamakkalandSalemhavebeencategorisedasSemi-criticalandOver-exploited. •SulphateexceedsthepermissiblelimitinNamakkal sub-basindistrict •Fluorideexceedsthepermissible limitof1.5 mg/lin Namakkalsub-basindistrict
Climate • Thesub-basinareahasaveragetemperatureof24.7°C,averageannualnormalrainfall of895.7mmand average relative humidityof65%.
Biodiversityand Forests <u>Forests</u> • The sub-basin districts have forest cover of less than 5% of sub-basin area and scatteredinthenorth-easternpartofthesub-basin. <u>Floraand Fauna</u> •TheprominentforesttypeisScrubforests
NaturalHazard and Calamities •Thesub-basindistrictsare notpronetonatural hazardsandcalamities. •FallsunderSeismicZone II

Lower VaigaiSub-Basin
Location • The Lower Vaigai sub-basin lies in nine blocks i.e. Manamadurai, Sivagangai, Ilayangudi,Nainarkoil, Bogalur,Ramanathapuram,Paramakudi,Mandapam,and Tirupullaniintwo districts i.e. SivagangaandRamanathapuramdistricts. •Itliesbetween 09°10'Nand09°43'N latitudesand 78°22'E and 79°29'Elongitudes.
Topography •Terrain isundulatingplainswith strayhillocksandslopetowardssoutheast
Soil • The majorsoiltypesareRed and BlackSoils
Agro climatic zone • Thesub-basin liesin theSouthAgro ClimaticZoneandhas aridplain agro ecosystemwith paddybeingthemajor cropgrown
Surface Water •Suitablefor drinkinganddomestic uses
Groundwater •AsperCGWB,thesub-basindistrictsofSivagangaandRamanathapuramhavebeencategorisedasSafe.
Climate • Thesub-basinareahasaveragetemperatureof28.1°C,averageannualnormal rainfall of840.3mmandaveragerelative humidityof82%.
Biodiversityand Forests Forests •There isnopresenceofforestarea.
NaturalHazard and Calamities •The Sivagangasub-basin districtisnotprone tonatural hazardsandcalamities •The Ramanathapuramsub-basin districtisproneto naturalhazardsandcalamities. •FallsunderSeismicZone II

SathiyarOdaiSub-Basin
Location • TheSathiyarOdaisub-basin lies innineblocksi.e. Dindigul,Sanarpatti,Natham, MaduraiWest,MaduraiEast,Tiruparankundrani, Melur,Vadipatti andAlanganallur lies inDindigul andMadurai district. •Itliesbetween 09°49'Nand10°13'N latitudesand 77˚58'E and78°14'Elongitudes.
Topography •Flatsurroundedbyseveral mountainspurs
Soil •Themajor soil typesareRedsoil,Blacksoil &Sandysoil
Agroclimaticzone • Thesub-basin liesin theSouthAgro ClimaticZone and has aridplain agro ecosystemwiththemajorcropsgrown arePaddy,Millets,Cotton,Chilliesetc.
SurfaceWater •Suitablefor drinkinganddomestic uses
Groundwater • AsperCGWB,thesub-basindistrictofDindigulhasbeencategorisedasover-exploitedandMadurai hasbeencategorisedasSaferespectively.
Climate • Thesub-basinareahasaveragetemperatureof28.0°C,averageannualnormal rainfall of929.3mmandaveragerelative humidityof55%.
Biodiversityand Forests <u>Forests</u> •Thesub-basindistrictshaveforestcoverofabout20-25%ofsub-basinareaandaremostlyscatteredinthenorth-westernpartofthesub-basin. <u>Floraand Fauna</u> •TheprominentforesttypesareEvergreen/Semi-evergreenand deciduousforests • ThefaunaobservedareGrizzled GiantSquirrel, FlyingSquirrel,NilgiriTahr, Elephant,LionTailedMacaque,Panther,Slothbear,Wildboar
NaturalHazardand Calamities •Thesub-basindistrictsare notpronetonaturalhazardsandcalamities. •FallsunderSeismicZone II

Upper BhavaniSub-Basin
Location • TheUpperBhavanisub-basinliesinnineblocksi.e. Perianaichenpalayam, Karamadai, Coonoor, Kotagiri, Udhagamandalam, Thalavadi, Bhavanisagar, Annur and Sarkarsamakulaminthree districtsi.e. Coimbatore,NilgirisandErodedistricts. •Itliesbetween 11°04'Nand11°28'N latitudesand 76˚25'E and77°06'Elongitudes.
Topography •Thetopographyinsub-basin district Coimbatore,ishilly in south-westernand northernparts. •Thetopography insub-basindistrictNilgiris,isrollingwithsteepescarpmentswithabout60% ofthecultivable landasslopes.
Soil • The majorsoiltypesareRedcalcareoussoil,Rednoncalcareous soil,Blacksoil,Alluvial andColluvial soils,Brown soil and Forestsoil.
Agroclimaticzone • Thesub-basin liesin theWesternAgro ClimaticZone andhas humidslopyagroecosystem with major cropsgrown are Banana,
SurfaceWater •Suitablefor drinkinganddomesticuses
Groundwater • AsperCGWB,thesub-basindistrictofCoimbatorehasbeencategorisedasover-exploited, whereasNilgirisasSafeand Erodeascriticalrespectively. •No salinityoralkali hazardisexpectedwhengroundwaterisusedforirrigationpurposes.
Climate •Thesub-basinareahasaveragetemperatureof28.0°C,averageannualnormalrainfallof929mmandav
Biodiversityand Forests <u>Forests</u> • Thesub-basindistrictshaveforestcoverofabout55-60%andhasthemaximumforest coverincomparisonto all sub-basins comparedunder TN-IAMWARM–2project. <u>Floraand Fauna</u> •Theprominentforesttypesare Evergreen/Semi-evergreen,deciduousandscrubforests. • Thefaunaobservedintheprotectedareaunderthesub-basindistrictsareElephant,Gaur, Sambar,Chital, Panther,Tiger, Birds, Reptiles, Slothbear,Wildboar
NaturalHazardand Calamities •Thesub-basindistrictsare notpronetonaturalhazardsandcalamities. •FallsunderSeismicZoneIII

Version - 10

ANNEXURE-IV
ENVIRONMENTAL CODE OF PRACTICES

(Applicable for 10% of the total value of the packages in each Phase including packages costing more than Rs.8.00 Crore)

Only for sites/works selected under Random Sampling can be done

1. Construction Camps and Site offices (Applicable for site where the number of labour residing exceed 100)

The following measures are recommended for planning and maintaining of construction camps and site offices:

- The site for construction camp shall be identified in consultation with the individual owners in case of private lands and Engineer-in-Charge in case of government lands.
- Layout of construction camp, including indicating various structures to be constructed including the temporary structures to be put up, site roads, drainage, lighting, equipment storage units and other facilities, should be furnished to the Engineer. The following documents shall be part of the plan:

    - Written No-objection certificate of the owner/cultivator
    - Extent of land required and duration of the agreement

- Living units of adequate space as prescribed in Labour and Environmental Acts with proper ventilation shall be provided
- Construction camps should have access to Drinking water, Sanitation, first aid and waste disposal facilities.
- Water and Sanitation facilities

    - Provide for a sufficient supply of potable water. Identify suitable community water sources such as hand pumps, stand posts, etc., for procuring drinking water, in consultation with the Gram Panchayat.
    - In the event of non-availability of other sources of potable water, the Contractor shall obtain water from an unprotected source, after the testing for its potability.
    - Every water supply or storage shall be at a distance of not less than 15m from any wastewater / sewage drain or other source of pollution.
    - Every site shall be provided with adequate and suitable facilities for washing clothes and utensils,

- Separate and adequate bathing facilities shall be provided for the use of male and female workers. Such facilities shall be conveniently accessible and shall be kept in clean and hygienic conditions.
- Sanitary arrangements, latrines and urinals shall be provided in every work place on the following scale:
  - For female workers: there shall be at least one latrine for every 25 females or part thereof.
  - For male workers: there shall be at least one latrine for every 25 males or part thereof.
- Every latrine shall be under cover and so partitioned off as to secure privacy, and shall have a proper door and fastenings.
- Where workers of both sexes are employed, there shall be displayed outside each block of latrine and urinal, a notice in the language understood by the majority of the workers "For Men Only" or "For Women Only" as the case may be.
- The latrines and urinals shall be adequately lighted and shall be maintained in a clean sanitary condition at all times and
- Water shall be provided in or near the latrines and urinals by storage in drums.

➢ Arrangements for Waste Disposal

- Disposal of sanitary wastes and excreta shall be into soak pits.
- Grey water from campsites will be discharged and disposed in a kitchen sump located at least 15 meters from any body of water. Sump capacity should be at least 1.3 times the maximum volume of wastewater discharged per day. The bottom of the pit should be filled with coarse gravel and the sides shored up with board, etc. to prevent erosion and collapse of the pit.
- Solid wastes generated in the construction site shall be reused if recyclable or disposed off in land fill sites.

2. Construction Site (Applicable for site where the number of labour residing exceed 100)

- It should be kept free of water logging
- Protective guards should be provided across the areas where workers may fall or could face an impalement hazard.
- Store tools and materials neatly and out of the way in storage bins or lockers and keep flammable or hazardous wastes, if any, in covered, segregated waste containers
- Keep form and scrap lumber away from work areas, passageways
- No loose material should be allowed to leave unattended, and sites should be properly finished after completing the work

- Good housekeeping should be maintained at construction sites
- The Contractor shall undertake measures to minimize the dust generation, emissions, noise, oil spills, residual waste and accidents at the plant site as well as during transportation of material to construction site.
  - During site clearance, all cut and grubbed materials shall be kept at a secured location so that it does not raise any safety concerns.
  - During excavation, water sprinkling shall be done to minimize dust generation
  - Frequent water sprinkling shall be done on the haul roads to minimize dust generation.
  - In case of loose soils, compaction shall be done prior to water sprinkling.
- Cautionary and informatory sign shall be provided at all locations specifyingthe type of operation in progress.
- The construction waste generated shall be disposed as per guidelines for "Waste Management Plan".
- The equipment's, which are required to move forward and backward, shall be equipped with alarm for backward movement. It shall be ensure that the workers shall remain away from the working areas at such times.

3. Storage Sites (for large and longtime storage)

Contractor shall provide details for storage of:

- Petrol/Oil/Lubricants: Brick on edge flooring or sand flooring will be provided at the storage places of Petrol/Oil/Lubricants to avoid soil and water contamination due to spillage.
- Cement: Damp-proof flooring, as per IS codes

4. Identification of Borrow areas

- Embankment fill material is to be procured from borrow areas designated for the purpose. Scope of this ECoP extends to measures that need to be incorporated during borrow area location, material extraction and rehabilitation.
- Design measures for reduction in quantity of earth work need to be undertaken to reduce the quantity of material extracted and consequently decrease the borrow area requirement. Following shall be considered during identification of Borrow areas:

- The arrangements to be worked out with land owner / community for the site. Borrow area shall be identified in consultation with the individual owners in case of private lands and Engineer-in-Charge in case of government lands.. This is to be done after assessing the suitability of the material.

- The Engineers will approve the borrow area after inspection of the site to verify its suitability with the contractor and landowner.

5. Environment, Health and Safety

- Safe access to the job sites should be provided to all workers
- Passage ways, walkways, and ramps should be kept free of materials, scraps or obstructions
- First Aid box should be readily available at construction sites
- Contact with nearest nursing homes/clinics/primary health centre should be maintained by the Contractor to deal with any emergency at site
- A vehicle should be readily available at construction site to meet emergency situation
- The contractor should comply with all the precautions as required for the safety of the workmen as per Labour Laws as far as those applicable to this project
- The contractor should strictly follow the statutory child labour act
- Personal Protective Equipment such as helmets, hand gloves, safety shoes, nose masks, safety goggles should be provided to the workers.

6. Public Safety

- Warning sign boards should be provided along the construction sites in Tamil/English.

7. Waste Management

- Finalize design to minimize waste generation through balancing of cut and fill operations and minimizing excess cuts requiring disposal.
- Identify the type of wastes as well as sources of waste during construction and suggest options for possible reuse

8. Storage of Construction material

- All construction materials should be stored in secured places and following good housekeeping practices
- No hazardous material should be allowed to store near the construction sites.

9. Water pollution

- Solid waste shall be disposed at authorized sites as identified
- Waste water shall be discharged through soak pits.
- SW and GW quality to be tested regularly for any fecal contamination

10. **Soil pollution**

- Measures to prevent accidental spills of oils and oth**er lubricants**
- **D**isposal of waste and wastewater shall not be done on open land.

11. Air pollution

Air quality impacts will be caused by emissions from construction vehicles, equipment and DG sets, and emissions from transportation traffic. Frequent truck trips will be required during the construction period for removal of excavated material and other equipment and materials. The following measures are recommended to control air pollution:

- Contractor will be responsible for maintaining properly functioning construction equipment to minimize exhaust.
- Construction equipment and vehicles will be turned off when not used for extended periods of time.
- Unnecessary idling of construction vehicles to be prohibited.
- When practical, excavated spoils will be removed as the contractor proceeds along the length of the activity.
- Contractors will be required to cover stockpiled soils and trucks hauling soil, sand, and other loose materials or require trucks to maintain at least two feet of freeboard.

12. Landscape degradation

- On completion of the works all the temporary structures may be cleared away, all rubbish disposed, excreta and disposal pits or trenches filled in and effectively sealed off and the whole site and shall be handed over to the department in good condition.

13. Impacts on groundwater resources and quality

Irrigation would increase in the irrigated areas, resulting in increased groundwater recharge. Canal rehabilitation would improve water efficiency in conveyance. In areas vulnerable to waterlogging, conjunctive use of ground and surface water needs to be introduced. The other measures could be deficit irrigation, change in cropping patterns, etc.

- Abstraction of groundwater in notified blocks of the country to be regulated as per the norms of Central Ground Water Board or State Ground Water Authority Artificial recharging structures can be built in suitable places which will decrease its concentration.
- Rainwater harvesting through existing wells can be adopted to reduce the groundwater fluoride concentration

- In the sub-basins affected with high fluoride concentration, the hand pumps may be painted with a suitable colour for easy identification by the local people so as to avoid using it for drinking water purpose.
- In the selected sub-basins where flourides and nitrates are above the permissible limits, it is recommended that the groundwater samples should be tested at regular intervals by the concerned line department.

14. Use of chemical fertilizer and pesticides

- Conduct trainings/ workshops to the farmers about the health hazards with respect to the use of chemicals/ pesticides, the bio-accumulation process in the fish and its implications.
- Promote use of bio manure, bio food for agriculture practices and use of traditional fish feed like Mustard Oil cake, by-products of polished rice etc.
- Promote Integrated farming practices so as to encourage the use of farm waste, livestock manure in fish farming which acts as a fertilizer.
- Use of agriculture by-products such as rice bran and coconut oil cake in the ratio of 70:30 at 2-3% of the body weight of fishes can be provided.

ANNEXURE-V
GOOD PRACTICES

A. Health and Safety

The Health, Safety and Environment (HSE) management system is an effective means of ensuring that proper attention is paid to the health and safety of individuals working in the project site as well as the protection of the environment from the environmental impacts associated with proposed construction activities. This system should be adequately documented within a HSE Manual and should be effective in implementing the aims and objectives of the HSE Policy.

The system should cover the following:

- Incorporate measures to demonstrate that all workers/labourers are medically fit and competent to perform their tasks safely;
- Ensure that all personnel are conversant with the working conditions at the worksite, the rules and standards related to the working environment and the HSE hazards and risks associated with the work programme.
- Provide means whereby hazards have been identified, assessed and eliminated where possible, or are being controlled / mitigated through formal planning methods and procedures.
- Allow for periodic review triggered by site or system changes that may affect the HSE risk of the work programme.
- Ensure that all contractors understand the principles and requirements of the system.
- Require contractors to have an equivalent HSE standard.
- Contain a written HSE plan

Contractor and MDPU/Line Departments management should make all personnel fully aware that they are empowered, and expected, to bring all health, safety and environmental risks which they believe not to be under adequate control to the immediate notice of their Supervisor so that prompt action may be taken to prevent injuries or other losses and provide a safe and healthy workplace.

1. Safety practices during construction phase

The Contractor is required to comply with all the precautions as far as possible for safety of the workers. The contractor shall comply with all regulation regarding, working platforms, excavations, trenches and safe means of entry and egress.

In order to guarantee construction safety, efficient lighting and safety signs shall be installed on temporary roads during construction and adequate traffic regulations shall be adopted and implemented for temporary roads.

The following aspects to be implemented:

- Provision of personal protective equipment to the labourers.
- The contractor shall provide, if required, erect and maintain necessary (temporary) living accommodation and ancillary facilities during the progress of work for labour to standards and scales approved by the Engineer- in-charge.
- Contractor shall follow all relevant provisions of the Factories Act, 1948 and the Building & other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction & maintenance of labour camp.
- Construction camps shall not be proposed within 1000 m or sufficiently away from nearest habitation to avoid conflicts and stress over the infrastructure facilities, with the local community. The location, layout and basic facility provision of each labour camp shall be submitted to Engineer prior to their construction.
- Sanitation facility should be provided in the labour camp. Uncontaminated water shall be supplied to the construction workers at labour camps.
- The contractor shall arrange for a readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone, availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital
- Always maintain a fully equipped first aid box in the construction camp.

The important safety sign boards to be displayed at construction site are as follows:

2. Fire protection in labour camp

It should be planned that all facilities to be constructed shall be fully equipped with the fire protection equipments as per IS standards. The analysis of fire hazard in the construction of labour camps, colonies and other facilities alongwith management measures is summarized in the following table:

Analysis of fire hazards in the construction of labour camps and other facilities

Stage	Potential hazard	Remedial Measures
Construction Camp/colony	• Fire prevention and fire fighting not considered in design • Inadequate fire protection measures during construction	**WRD/Line Departments** • The Line Departments shall provide the fire prote system as per IS Standards for Fire code. • Proper housekeeping should also be ensured and maintained during these facilities to protect them from any fire related incidents. **Contractors** • Clear terms of reference should be given to contractor at tendering stage for incorporating fire code as per IS Standard. • Fire fighting equipments should be placed a common places

During construction, there should be an environmental officer who may be nominated by WRD/Line Departments and shall be responsible to take care of the adequacy of Fire Safety measures set up in all facilities created either by WRD/Line Departments or any of its Contractors.

B. Sustainable Construction Practices

During the construction phase, to avoid and minimize the negative impacts from the proposed activities, WRD/Line Departments are advised to prepare strict guidelines as follows:

- Strict restrictions shall be imposed on the workers at project sites to ensure that they do not harvest any species/produce from the vegetation in the area forests and cause any danger or harm to the animals and birds in the wild.
- Fuel wood to the labourers shall be provided by the project proponents so that there is no pressure for cutting of trees to meet fuelwood requirements.
- Interference of human population should be kept to a minimum in the adjacent forest areas and it should be ensured that the contractors do not set up labour colonies/camps in the vicinity of forests and wilderness areas.
- Only well maintained/new equipment that produce lesser noise should be installed at the work sites.
- Best way to control the noise is at source. Certain equipment that needs to be placed permanently at one place like generators, etc. would be housed in enclosed structures to cut off the noise.
- The heavy equipment like rotating or impacting machines will be mounted on anti-vibration mountings.
- Wherever combustion engines are required they will be fitted with silencers.
- The traffic (trucks, etc.) used by the project works will be managed to produce a smooth flow instead of a noise producing stop and start flow. Necessary training/orientation will be provided to the traffic operators/drivers. Sounding of loud horns, etc. in the forested areas should be banned.
- Project authorities will use water sprinklers on the road to avoid the dust from construction activities.

1. Traffic management during construction phase

Detailed Traffic Control Plans shall be prepared for traffic diversion. The traffic control plans shall contain details of temporary diversions, traffic arrangement after cessation of every day's work and safety measures for transport of hazardous material.

The Contractor should ensure that the diversion is always maintained in working condition, particularly during the monsoons to avoid disruption to traffic flow. Local community should be informed of the changes to traffic routes, conditions and pedestrian access arrangements. The temporary traffic diversions should be kept free of dust by frequent application of water.

2. Control of Emissions

Minor air quality impacts will be caused by emissions from construction vehicles, equipment and DG sets, and emissions from transportation traffic. Frequent truck trips will be required during the construction period for removal of excavated material and delivery of select concrete and other equipment and materials. The following measures are recommended to control air pollution:

- The contractor shall be responsible for maintaining properly functioning construction equipments to minimize exhaust.
- Construction equipment and vehicles will be turned off when not used for extended periods of time.
- Unnecessary idling of construction vehicles to be prohibited.
- Effective traffic management to be undertaken to avoid significant delays in and around the project area.
- Road damage caused by sub-project activities will be promptly attended to with proper road repair and maintenance work.

3. Dust Control

The WRD/Line Departments will work closely with representatives from the community living in the vicinity of project area to identify areas of concern and to mitigate dust-related impacts effectively (e.g., through direct meetings, utilization of construction management and inspection program, and/or through the complaint response program). To minimize issues related to the generation of dust during the construction phase of the project, the following measures should be implemented:

- When practical, excavated spoils will be removed as the contractor proceeds along the length of the activity.
- When necessary, stockpiling of excavated material will be covered or staged offsite location with muck being delivered as needed during the course of construction.
- Excessive soil on paved areas will be sprayed (wet) and/or swept and unpaved areas will be sprayed and/or mulched. The use of petroleum products or similar products for such activities will be strictly prohibited.
- Contractor shall be required to cover stockpiled soils and trucks hauling soil, sand, and other loose materials.
- Contractor shall ensure that there is effective traffic management at site. The number of trucks/vehicles to move at various construction sites to be fixed.
- The construction area and vicinity (access roads, and working areas) shall be swept with water sweepers on a daily basis or as necessary to ensure there is no visible dust.

4. Noise control from construction equipment

The contractor should be required to maintain properly functioning equipment which shall cover the following aspects:

- The construction equipment shall be required to be fitted with noise suppression devices and properly maintained mufflers.
- Staging of construction equipment and unnecessary idling of equipment within noise sensitive areas to be avoided whenever possible.

5. Identification of borrow pits and quarry area

- The Borrow pits for earth should be selected away from residential area, sensitive location, and local roads. Before selection of borrow area, the contractor should take written consent from the environmental officer of WRD/Line Departments. Selection of sand, stone and other quarry materials should be from only government approved sites.
- Borrow areas shall be atleast 500m from schools and village access roads
- Planning of haul roads for accessing borrow materials shall be undertaken during this stage. The haul roads shall be routed to avoid agricultural areas. In case agricultural land is disturbed, the contractor shall rehabilitate as approved by the WRD/Line Departments and pay compensation for loss of cultivation to the users as per terms and conditions.
- Operation and Rehabilitation of borrow area as per the Madras Detailed Standard Specification and Environmental Code of Practices
- Arrangement for locating the source of supply of material for embankment and sub-grade as well as compliance to environmental requirements, as applicable shall be the sole responsibility of the contractor. The environmental personnel attached to environmental cell shall be required to inspect every borrow area location prior to approval.
- Such measures shall include, but not limited to, frequent sprinkling of water, repairing of the road, road safety provisions and ensuring covering of loaded vehicles by waterproof tarpaulin; consultation with public and special precautions are required when measures are implemented near schools, health centers and settlement areas.
- All borrow areas whether in private, community or government land shall be restored either to the original condition or as approved by WRD/Line Departments.

C. Disposal of Construction Wastes

The disposal of construction wastes shall be in accordance with the Construction and Demolition Waste Management Rules, 2016 by MoEF&CC. While planning or executing excavation the contractor shall take all adequate precautions against soil erosion, water pollution etc and take appropriate drainage measures to keep the site free of water, through use of mulches, grasses, slope drains and other devices. The contractor shall take adequate protective measures to see that excavation operations do not affect or damage adjoining structures, agricultural areas and water bodies.

The recommended measures are as below:

- Ensure unobstructed natural drainage through proper drainage channels/ structures.
- Dispose surplus excavated earth at identified sites and ensure minimum hindrance to locals.
- All excavations will be done in such a manner that the suitable materials available from excavation are satisfactorily utilized as decided upon beforehand. The excavations shall conform to the lines, grades, side slopes and levels as per the drawings.

D. Use of Agro-Chemicals

Good Practices for usage of agro-chemicals can help control and decrease negative impacts on the environment. The recommended practices are as follows:

- Stormwater that falls on the work area should be contained for proper disposal
- The work area should be lined with an impermeable material such as concrete
- Application equipment should be checked to ensure that it operates satisfactorily without leaking or spilling and is calibrated for the necessary application rates.
- To check the protective clothing and other safety equipment including breathing apparatus, if required, is complete, is of the correct quality and is in good condition.
- To check the weather conditions are satisfactory, particularly to avoid excessive wind speeds and consequent spray drift.
- To ensure the safe disposal of empty containers, tank washings and surplus pesticides.
- To avoid blow-back from granule or powdered materials when transferring container contents into the application unit. A slow, steady release causes least disturbance of air and reduces the risk of particles becoming airborne and being inhaled.

- To handle containers carefully to prevent gurgling or spillage during pouring into an applicator. Pour correctly from large containers with the spout uppermost so as to allow air to flow into the container at the same rate as the contents flow out.

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ANNEXURE-VI

Environmental and Social Clauses to be included in the Bid document under Technical Specification (wherever applicable and specified)[1]

Definitions:

"Debris Disposal Plan" a set of measures to be implemented by the Contractor for disposal of debris and wastewater at designated sites, without causing any adverse impact to the environment, and to the satisfaction of the Engineer and of any authority or person with an interest in land into which water and waste products may be discharged, without limitation to the Contractor's general obligations.

"Environmental Code of Practices" means the guidelines to be followed by the Contractor as set out in Environmental Management Framework, towards environmental management in performing the Services or Works.

"Environmental Screening Format" is set of basic information collected on environmental aspects of the proposed scheme during planning stage by the Engineer, through field survey and community consultation, to identify potential environmental risks associated with performing the contract.

'Environment Management Framework' sets out the principles, rules, guidelines and procedures to assess the environmental impacts. It contains measures and plans to reduce, mitigate and/or offset adverse impacts and enhance positive impacts, provisions for estimating and budgeting the costs of such measures, and information on the agency or agencies responsible for addressing project impacts**.**

'Environmental Management Plan (EMP)' – A set of mitigation measures identified by the Engineer during the planning stage, and to be implemented by the Contractor during the contract period as per the Environmental Management Framework.

"Silt Disposal Plan" a set of measures to be implemented by the Contractor for disposal of silt at designated sites, without causing any adverse impact to the environment, and to the satisfaction of the Engineer and of any authority or person with an interest in land into which silt may be discharged, without limitation to the Contractor's general obligations.

Conditions of Contract:

Where Specified,

1. The Contractor shall prepare and include Debris Disposal Plan, Silt Disposal Plan and Environmental Management Plan (EMP) in Contract Document, endorsed by the Engineer and follow Environment Management Framework, and follow Environmental Code of Practices as per Indian legislation the World Bank guidelines agreed in the project.

[1] (for projects Rs.8 crore and 10% of packages, covering 20% of sites randomly sampled)

2. The Engineer shall be responsible for providing complete and approved Environmental Screening Format along with categorization of works.

3. The Contractor shall be responsible for preparing and submitting the Debris Disposal Plan, Silt Disposal Plan and Environmental Management Plan as part of the Contract works execution document at the start of Works.

4. The Engineer shall be responsible for reviewing and approving the Debris Disposal Plan, Silt Disposal Plan and Environmental Management Plan submitted by the Contractor before start of Works.

5. In cases where mandated as per law, the Engineer shall be responsible for necessary environmental clearances as per Environment (Protection) Act, 1986, of MoEFCC, section 3, sub-section (ii). Environmental clearances are required from Central Government in MoEFCC for all Category A/Category 1 projects and at the State level from State Environmental Impact Assessment Authority (SEIAA) for matters falling under Category B/Category 2 as per the Schedule. The necessary clearances are included in Schedule 1.

6. The Engineer shall be responsible to provide the Contractor the list of authorized borrow pits, silt disposal sites and waste disposal sites. The list is included in Schedule 1.

7. The Contractor shall be responsible for providing the list and permits for all heavy equipment and machinery to be deployed on site to the Engineer before start of Works. It shall be the responsibility of the Contractor to ensure that the permits are not expired for the entire duration of the Contract.

Compliance withLabour Regulations:

During continuance of the contract, the Contractor and his sub-contractors shall abide at all times by all existing labour enactments and rules made thereunder, regulations, notifications and bye laws of the State or Central Government or local authority and any other labour law (including rules), regulations, bye laws that may be passed or notification that may be issued under any labour law in future either by the State or the Central Government or the local authority. Salient features of some of the major labour laws that are applicable to construction industry are given below. The Contractor shall keep the Employer indemnified in case any action is taken against the Employer by the competent authority on account of contravention of any of the provisions of any Act or rules made thereunder, regulations or notifications including amendments. If the Employer is caused to pay or reimburse, such amounts as may be necessary to cause or observe, or for non-observance of the provisions stipulated in the notifications/bye laws/Acts/Rules/regulations including amendments, if any, on the part of the Contractor, the Engineer/Employer shall have the right to deduct any money due to the Contractor including his amount of performance security. The Employer/Engineer shall also have right to recover from the Contractor any sum required or estimated to be required for making good the loss or damage suffered by the Employer.

The employees of the Contractor and the Sub-Contractor in no case shall be treated as the employees of the Employer at any point of time. In addition to the compliance of labour laws in

force, the Contractor shall also be responsible for ensuring that the applicable code of conduct for workers is followed at working place and camps.

Code of Conduct for Labour Population

As a part of Code of Conduct prescribed for labour population involved in construction activities, the following norms are to be followed:

- There should not be any adverse interaction of the labour with the local community.
- Labour population shall not extract any resources from the village without the concurrence of the community, outside the project area.
- Project area shall be completely and effectively demarcated.
- It shall be ensured that no labour, other than people from local community, are allowed to enter the villages , if objected to by the villagers, outside the project area by any means unless he/she is permitted by the competent authority designated by the project for this purpose.
- No such permission shall be granted unless the person is proceeding on bonafide work relating to the project activities or essential living functions.
- Essential interaction with the local population will take place only with the consultation of local administration, panchayat leaders and such movements regulated.
- All workers / officers shall be provided with the identity card.
- Strict action shall be taken against the worker not adhering the norms and regulations.
- Contractor shall be responsible for the implementation of the aforesaid policy.
- A committee with participant of local leaders/prominent person shall be constituted to deal with the problems arising due to any illegal activities by the workers.

Salient Features of Some Major Labour Laws Applicable to Establishments Engaged in Building and Other Construction Work

(The law as current on the date of bid opening will apply)

- Workmen Compensation Act 1923.
- Payment of Gratuity Act 1972.
- Employees P.F. and Miscellaneous Provision Act 1952 *(since amended)*.
- Maternity Benefit Act 1951.
- Contract Labour (Regulation & Abolition) Act 1970.
- Minimum Wages Act 1948.
- Payment of Wages Act 1936.

- Equal Remuneration Act 1979.
- Payment of Bonus Act 1965.
- Industrial Disputes Act 1947.
- Industrial Employment (Standing Orders) Act 1946.
- Trade Unions Act 1926.
- Child Labour (Prohibition & Regulation) Act 1986.
- Inter-State Migrant workmen's (Regulation of Employment & Conditions of Service) Act 1979.
- The Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act 1996 and the Cess Act of 1996.
- Factories Act 1948

Protection of Environment:

The Contractor shall take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of his methods of operation, including adopting working practices that prevent or minimize the transfer of any pollutant off-site; maintaining the access roads in good repair; using appropriate dust suppressant methods; restricting trucking and loud machinery and equipment use to daylight hours; using mufflers, silencers and other appropriate methods to minimize the noise of the construction; using "silt fencing", hay bales, silt traps or other methods to minimize soil erosion and prevent the contamination of surface water and the transportation of soil and sediment off-site onto adjacent properties; and maintaining clean sites that are free of garbage and debris, except the disposal area. The Contractor shall, at all times during the Contract, ensure that the Environment Management Framework and/or Environmental Management Plan is followed.

The Contractor shall ensure that execution of the Contract does not cause loss or degradation of natural habitats, forests, wetlands, wildlife or protected areas.

The Contractor shall use borrow pits identified/approved by the Engineer. The Contractor shall be responsible for the rehabilitation of the borrow area. Debris resulting from the works undertaken under the Contract shall be disposed at sites identified by the Engineer in the Environmental Screening Format and Schedule 1.

During continuance of the contract, the contractor and his sub-contractors shall abide at all times by all existing enactments on environmental protection and rules made thereunder, regulations, notifications and bye-laws of the State or Central Government, or local authorities and any other law, bye-law, regulations that may be passed or notification that may be issued in this respect in future by the State or Central Government or the local authority.

Some of the applicable major laws are given below:

- The Water (Prevention and Control of Pollution) Act, 1974

- The Air (Prevention and Control of Pollution) Act, 1981
- The Environment (Protection) Act, 1986
- The Public Liability Insurance Act, 1991
- The Forest Conservation Act, 1980
- Wildlife (Protection) Act, 1972
- Wetland (Conservation and Management) Rules 2010

Disposal of silt

In cases of large scale silt disposal,The Contractor shall be responsible for submitting Silt Disposal Plan. The Silt Disposal Plan shall include, but not limited to, the section details of earthwork for every kilometer of earthwork; quantities of earthwork in cut, fill and disposal; schedule for testing and disposal of dredged silt; ensure that in no way the eco-sensitive zone is disturbed if the Works are in such a zone; and follow ECoPs.

In case of wet river dredging ,The Contractor shall ensure that:
The Contractor shall ensure that:

(i) Dredgings are not deposited on different inland water or deposit dredgings from any other waters so as to prevent spread of contaminations or invasive non-native species.
(ii) Dredgings that are of hazardous waste are not deposited on any inland waters.
(iii) Dredgings are treated other than by screening or removing water.
(iv) Not more than 50 cubic meter of silt is treated or deposited for each meter length of land on which waste is deposited.
(v) The silt shall be disposed on sites as close as possible to the dredging site. The dredgings must be removed from the waterway and deposited mechanically on one operation. The dredgings shall not be deposited on the bank then moved further to disposal sites.

Contractor to Construct for the Works

In case the camp on the site exceeds 90 days,The Contractor shall assure the following facilities and conditions on site for the duration of the Contract:

(i) Submit a detailed layout plan for development of the construction camp, indicating the various structures to be constructed including the temporary structures to be put up, site roads, drainage, lighting and other facilities. The layout plan shall be approved by the Engineer.
(ii) Provide potable water for construction site personnel and general cleaning in addition to any required for the construction, testing and completion of the Contract.
(iii) Install, operate, maintain and subsequently remove temporary supplies in addition to supplies required for testing and completion the Works.
(iv) Erect, construct, maintain and subsequently remove all temporary accommodation necessary to for the efficient conduct and self-supervision of the Contract.
(v) Install, operate, maintain and subsequently remove temporary electricity supplies in addition to supplies required for testing and completion the Works.
(vi) Before starting work, instruct all employees the necessity for pollution prevention and following environmental, health & safety laws and practices. Any employee or Contractor's representative polluting or fouling the Site shall be immediately dismissed and removed from the Site. No medically unsuitable persons may be

employed in or around Site. Arrangements for employees to be examined and tested in the manner approved by the Employer's medical officer shall be made as necessary.

Safety

The Contractor shall be responsible for the health and safety of its employees and sub-contractors working on the Site. During the Contract Period, the Contractor shall develop and implement a comprehensive occupational health and safety program for the protection of the Contractor's Personnel and all other persons who may attend at the project areas in guidance with, but not limited to, ECoPs. The program shall include a description of how the Contractor will:

a. carry out all occupational health and safety responsibilities in respect of the Project as required under the Applicable Law and the World Bank Group's Health & Safety standards;
b. develop and manage all required occupational health and safety reporting procedures; and
c. manage all occupational health and safety claims.

Any accidents or deaths on the site need to be reported to the Engineer along with the incident report within 24 hours. The victims shall be provided immediate medical care and compensation as per the applicable labor laws.

Physical and Cultural Property:

Anything of historical or other interest or of significant value unexpectedly discovered on the Site is the property of the Archeological Survey of India. The Contractor is to notify the Engineer of such discoveries and carry out the Engineer's instructions for dealing with them.

The Contractor shall take reasonable precautions to prevent its employees, agents, representatives, Sub-contractors, or other persons from removing or damaging any fossils, coins, articles of antiquity, and structures and other remains or things of religious, geological or archaeological interest at the Site. The Contractor shall, immediately upon discovery of such article or thing, shall inform the Engineer, the Employer and Archaeological Survey of India. The Engineer may issue instructions for dealing with the findings. All fossils, coins, articles of value or antiquity, and structures and other remains or things of religious, geological or archaeological interest discovered on the Site shall be the property of Archaeological Survey of India. Any such findings shall be managed as per the Ancient Monuments and Archaeological Sites and Remains Act 1958.

If the Contractor suffers delay or incurs any damages or costs in following any instructions of the Engineer for dealing with the findings, the Contractor shall give notice to the Engineer, with a copy to the Employer. After receipt of such notice, the Engineer shall determine if the Contractor is entitled to any extension of time or any compensation for such damages or costs and shall notify the Contractor accordingly.

Schedule 1

1. **Approved Environmental Screening Format –** ***to be inserted by Engineer***
2. **List of authorized borrow pits along with necessary permits -** ***to be inserted by Engineer***
3. **List of silt disposal sites along with necessary permits -** ***to be inserted by Engineer***
4. **List of debris disposal sites along with necessary permits -** ***to be inserted by Engineer***
5. **Environmental Code of Practices (ECoPs) – applicable ECoPs -*****to be inserted by Engineer***

ANNEXURE-VII
PEST MANAGEMENT PLAN

1. Introduction

The project investments may increase the use of higher pesticides and other chemical inputs by promoting improved management practices in agriculture and horticulture as well as through increasing crop intensification due to improved access to water resources and area under irrigation. While such improvements on one hand will augment the production and income of the farmers, on the other hand due to its excessive and inappropriate use it would affect the natural resources, environmental services and food systems. In order to protect the environment and its services the project will promote the adoption of Integrated Pest Management approach. As part of the ethical practices, the project will not recommend or use pesticides which are banned, refused registration and restricted in use by the Central Insecticides Board as on October 2015 in any of its demonstrations and promotion.

Main pests and diseases: The main crops grown in project area are paddy, sugarcane, coconut, banana, pulses and vegetables. The major risks due to the breakout of pests and diseases in paddy crop especially in Cauvery delta zone are yellow stem borer (*Scirpophaga incertulas*), leaf folder (*Cnaphalocrocis medinalis*) and brown plant hopper (*Nilaparvata lugens*) and blast and blight during the main growing seasons[i] (TNAU, 2017) at moderate to severe intensity. Some of the pests like thrips, gall midge, earhead bug and whorl maggot have emerged as major pests in paddy. During 2009 onwards, certain new insects like rice leaf mite (*Oilgonychus oryzae*) attained the pest status and occurring at the intensity of light to moderate. Similarly in sugarcane, early shoot borer (*Chilo infescatellus*) and root grub *(Holotrachia serrata)* have emerged as main pests. Black headed caterpillar (*Opisina arenosella*) in Coconut, blister beetle *(Mylabris pustulata)* in redgram and Fusarium wilt in Banana have also become important pests.

Awareness and current practices: The field visits in the consultation process as well as Focus Group Discussions with men and women farmers in the 12 sub basins indicates that the main reason for the indiscriminate use of chemical pesticides are lack of sufficient knowledge in identification pest and diseases, its symptoms, mode of infection and integrated management practices. Hence farmers perceive the practice of pest and disease management as a routine cultivation practice similar to tillage and weeding. As a result of 4-5 rounds of indiscriminate usage of chemical spraying are adopted by vegetable growers. At present, farmers access to information on pest management is largely restricted to input dealers and support from Dept of agricultural extension services are limited. Due to vested interests and company's push input dealers are marketing chemicals to farmers without considering its adverse impacts.

2. Status of current use of agro-chemicals in the state

The particulars on pesticides consumption in the State over a period from 1982-83 to 2014-15 is provided in table 1. It clearly shows that there is a drastic reduction in the consumption of chemical pesticides since 1982-83 to till last year, however, the pesticide consumption within the last two decades indicated an increasing trend.

Table 1. Details of pesticide consumption in the state from 1982-83 to 2014-15

No	year	Consumed (Technical Grade in MT)
1	1982-83	7437
2	1983-84	10367
3	1984-85	10926
4	1985-86	8667
5	1986-87	8642
6	1987-88	8237
7	1988-89	8594
8	1989-1990	9970
9	1990-1991	3923
10	1991-92	4840
11	1992-93	4890
12	1993-94	5010
13	1994-95	3394
14	1995-96	2080
15	1996-97	1851
16	1997-98	1809
17	1998-99	1730
18	1999-2000	1685
19	2000-01	1663
20	2001-02	1577
21	2002-03	1605
22	2003-04	1434
23	2004-05	2466
24	2014-15	2096

Source: Tamil Nadu An Economic Appraisal – 2005-06, Evaluation and Applied Research Department, Government of Tamil Nadu, Chennai and For the year 2014-15 – 12th Five year plan of Tamil Nadu, 2012-17, Volume I, Government of Tamil Nadu

The reasons attributed to the reduction in the use of pesticides from 1982-83 to 2014-15 is due to the adoption of Integrated Pest Management practices. But at same time, it is important to note that there is an increasing trend was observed in the use of bio-pesticides, since 1997-98 as could be seen from the following table 2.

Table. 2. Bio-pesticides Distribution in Tamil Nadu

Year	Quantities distributed	
	Dust in MT	Liquid in Lts
1997-98	16.80	103986
1998-99	18.30	98890
1999-2000	23.00	90320
2000-2001	23.60	87400
2001-2002	22666	72736
2002-2003	23301	72736
2003-2004	22507	67006
2004-2005	20682	63593
Recent data is not available		

Source: Tamil Nadu an Economic Appraisal – 2005-06, Evaluation and Applied Research Department, Government of Tamil Nadu, Chennai.

3. Major crops and pests

The major pests and diseases occurring in the main crops grown in project areas, its time of occurrence as well as stages of crop in which its impact was more are given in table 3.

Table 3. Important pests and diseases – major crops

S. No.	Major Crop	Key Pests	Disease(s) caused	Time of occurrence and duration of attack
1	Paddy	✓ Leaf folder (*Cnapholocrocis medinalis*) ✓ Stem borer (*Scirpophaga incertulas*) ✓ Thrips (*Stenchaetothrips biformis*) ✓ Brown plant hopper(*Nilaparvata lugens*) ✓ Leaf mite (*Oilgonychus oryzae*) ✓ Ear head bug(Leptocorisa oratorius)	✓Sheath Blight(*Rhizoctonia solani*) ✓ Leaf and neck blast(*Pyricularia grisea*)	Leaf folder, stem borer, ear head bug and thrips attack can be seen throughout the crop stages as well as irrespective of the seasons whereas brown plant hopper attack is more in samba season when humidity is more and leaf mite attack is more in first and summer season from vegetative to flowering stage Sheath blight infection is more during samba season during panicle development phase of the crop, Leaf and neck blast infection will be more in both June- July and Oct-Nov planting seasons at the stage of active tillering and flowering phases

2	Sugarcane	Early shoot borer(*Chilo infescatellus*) Root grub *(Holotrachia serrata)*	Red rot (*Colletotrichum falcatum*)	Early shoot borer attack is more upto 15-90 DAP and late shoot borer upto 90 – 120 DAP, crops grown in the special season (june-sep) are more prone to this attack, rootgrub attack is more in ratoon crops as well as during drier season due to inadequate soil moisture Red rot disease occurs at all stages of the crop,
3	Ground nut	Aphids*(Aphis craccivora)* Red hairy caterpillar(*Amsacta albistriga)*		Aphids attack is more in vegetative and drier part of the growing season and red hairy caterpillar incidence will be more in the time of onset of monsoon
4	Redgram	Pod borer (Heliothis armigera) Blister beetle*(Mylabris pustulata)*	Root wilt(*Fusarium sp)*	Wilt occurs 4 to 6 weeks after sowing and blister beetle attack is more during flowering period and pod borer at the time of pod setting to maturity
5	Coconut	Rhinocerous beetle (*Oryctes rhinoceros*) Red palm weevil (*Rhynchophorus ferrugineus*) Black headed caterpillar(*Opisina arenosella*)	Ganoderma wilt *(Ganoderma lucidum)*	All the three pests attack the grown up trees which are bearing the nuts are most affected and wilt also affect the tree in all stages of the crop
6	Banana	Nematode (*Radopholus similis*) Stem weevil (*Cosmopolites sordidus*)	Bunchy top virus Root rot (Fusarium sp)	Stem weevil infection more in pre flowering phase and nematode at different stages of the crop, bunchy top virus and fusarium wilt at the early stages of growth
7	Jasmine	Bud worm(*Hendecasis duplifascialis*) Red spider Mite attack (*Tetranychus urticae*)	-	Bud work during the flowering stage of the crop and mite at all stages especially during drier period and summer months it multiplies quickly
8	Turmeric	-	Rhizome rot (*Pythium graminicolum)*	During early stages of rhizome formation to maturity when soil moisture is high
9	Chillies	Fruit borer (*Helicoverpa*	-	During the fruiting stage when its started forming

		armigera)		
10	Pulses – black gram and greengram	Pod borer (*Helicoverpa armigera*)	Powdery mildew(*Erysiphe polygoni*)	During the pod formation stage and powdry mildew during the vegetative to flowering phase and infection multiply faster in late kharif and early rabi season

4. Step-wise PMP and Strategies

4(a). Details of PMP with its strategies

PMP		
Negative list of pesticides	The project will not finance procurement of these pesticides	See table Table 4 (banned pesticides) and also a list of CIA, 1968 approved pesticides crop wise can be referred in weblink http://cibrc.nic.in/
IPM – key PMP strategy	Project will finance demonstration, procurement of, training on available IPM packages	Refer table 5 for proposed IPM principles and see Annexure for the detailed pests and IPM packages for specific crops at Sub basin levels
Recommended list of pesticides and/or suggested alternatives	The project will generate awareness on procurement of these alternatives	Lists of registered biopesticides are given in table 8 and 9
Training and Capacity Building	lists/locations/approximate season and potential target beneficiaries to be covered under training which includes raining on handling, safe use and disposal	Training calendar is provided

As indicated above, the project will not finance or recommend the procurement of any of these pesticides or formulations. The List of banned pesticides in India as per Central Insecticides Act, 1968 was given in Table 4. The list also has the details related to pesticides which are refused for registration and restricted in use in India.

Table 4. LIST OF PESTICIDES WHICH ARE BANNED, REFUSED REGISTRATION AND RESTRICTED IN USE by CENTRAL INSECTICIDES BOARD (As on 20th October 2015)

I. **PESTICIDES / FORMULATIONS BANNED IN INDIA**

Pesticides Banned for manufacture, import and use

1. Aldicarb (vide S.O. 682 (E) dated 17th July 2001)
2. Aldrin
3. Benzene Hexachloride
4. Calcium Cyanide
5. Chlorbenzilate (vide S.O. 682 (E) dated 17th July 2001)
6. Chlordane
7. Chlorofenvinphos
8. Copper Acetoarsenite
9. Dibromochloropropane (DBCP) (vide S.O. 569 (E) dated 25th July 1989)
10. Dieldrin (vide S.O. 682 (E) dated 17th July 2001)
11. Endrin
12. Ethyl Mercury Chloride
13. Ethyl Parathion
14. Ethylene Dibromide (EDB) (vide S.O. 682 (E) dated 17th July 2001)
15. Heptachlor
16. Lindane (Gamma-HCH)
17. Maleic Hydrazide (vide S.O. 682 (E) dated 17th July 2001)
18. Menazon
19. Metoxuron
20. Nitrofen
21. Paraquat Dimethyl Sulphate
22. Pentachloro Nitrobenzene (PCNB) (vide S.O. 569 (E) dated 25th July 1989)
23. Pentachlorophenol
24. Phenyl Mercury Acetate
25. Sodium Methane Arsonate
26. Tetradifon
27. Toxaphene(Camphechlor) (vide S.O. 569 (E) dated 25th July 1989)
28. Trichloro acetic acid (TCA) (vide S.O. 682 (E) dated 17th July 2001)

Pesticide formulations banned for import, manufacture and use

1. Carbofuron 50% SP (vide S.O. 678 (E) dated 17th July 2001)
2. Methomyl 12.5% L
3. Methomyl 24% formulation

4. Phosphamidon 85% SL

Pesticide / Pesticide formulations banned for use but continued to manufacture for export

1. Captafol 80% Powder (vide S.O. 679 (E) dated 17th July 2001)
2. Nicotin Sulfate

Pesticides Withdrawn

(Withdrawal may become inoperative as soon as required complete data as per the guidelines is generated and submitted by the Pesticides Industry to the Government and accepted by the Registration Committee. (S.O 915(E) dated 15th Jun,2006)

1. Dalapon
2. Ferbam
3. Formothion
4. Nickel Chloride
5. Paradichlorobenzene (PDCB)
6. Simazine
7. Sirmate (S.O. 2485 (E) dated 24th September 2014)
8. Warfarin (vide S.O. 915 (E) dated 15th June 2006)

II.PESTICIDES REFUSED REGISTRATION

S.No.	Name of Pesticides
1	2,4, 5-T
2	Ammonium Sulphamate
3	Azinphos Ethyl
4	Azinphos Methyl
5	Binapacryl
6	Calcium Arsenate
7	Carbophenothion
8	Chinomethionate (Morestan)
9	Dicrotophos
10	EPN
11	Fentin Acetate
12	Fentin Hydroxide
13	Lead Arsenate
14	Leptophos (Phosvel)
15	Mephosfolan

16	Mevinphos (Phosdrin)
17	Thiodemeton / Disulfoton
18	Vamidothion

III. PESTICIDES RESTRICTED FOR USE IN THE COUNTRY

S.No.	Name of Pesticides	Details of Restrictions
1.	Aluminium Phosphide	The Pest Control Operations with Aluminium Phosphide may be undertaken only by Govt./Govt. undertakings / Govt. Organizations / pest control operators under the strict supervision of Govt. Experts or experts whose expertise is approved by the Plant Protection Advisor to Govt. of India except [1]Aluminium Phosphide 15 % 12 g tablet and [2]Aluminum Phosphide 6 % tablet. *[RC decision circular F No. 14-11(2)-CIR-II (Vol. II) dated 21-09-1984 and G.S.R. 371(E) dated 20th may 1999]. [1]Decision of 282nd RC held on 02-11-2007 and, [2]Decision of 326th RC held on 15-02-2012.* The production, marketing and use of Aluminium Phosphide tube packs with a capacity of 10 and 20 tablets of 3 g each of Aluminium Phosphide are banned completely. (S.O.677 (E) dated 17thJuly, 2001)
2.	Captafol	The use of Captafol as foliar spray is banned. Captafol shall be used only as seed dresser. (S.O.569 (E) dated 25thJuly, 1989) The manufacture of Captafol 80 % powder for dry seed treatment (DS) is banned for use in the country except manufacture for export. (S.O.679 (E) dated 17thJuly, 2001)
3.	Cypermethrin	Cypermethrin 3 % Smoke Generator, is to be used only through Pest Control Operators and not allowed to be used by the General Public. [Order of Hon,ble High Court of Delhi in WP(C) 10052 of 2009 dated 14-07-2009 and LPA-429/2009 dated 08-09-2009]
4.	Dazomet	The use of Dazomet is not permitted on Tea. (S.O.3006 (E) dated 31st Dec, 2008)
5.	Diazinon	Diazinon is banned for use in agriculture except for household use. (S.O.45 (E) dated 08th Jan, 2008)
6.	Dichloro Diphenyl Trichloroethane (DDT)	The use of DDT for the domestic Public Health Programme is restricted up to 10,000 Metric Tonnes per annum, except in case of any major outbreak of epidemic. M/s Hindustan Insecticides Ltd., the sole manufacturer of DDT in the country may manufacture DDT for export to other countries for use in vector control for public health purpose. The export of DDT to Parties and State non-Parties shall be strictly in accordance with the paragraph 2(b) article 3 of the Stockholm Convention on Persistent Organic Pollutants (POPs). (S.O.295 (E) dated 8th March, 2006) Use of DDT in Agriculture is withdrawn. In very special circumstances warranting the use of DDT for plant protection work, the state or central Govt. may purchase it directly from M/s Hindustan Insecticides Ltd. to be used under expert Governmental supervision. (S.O.378 (E) dated 26thMay, 1989)
7.	Fenitrothion	The use of Fenitrothion is banned in Agriculture except for locust

		control in scheduled desert area and public health. (S.O.706 (E) dated 03rdMay, 2007
8.	Fenthion	The use of Fenthion is banned in Agriculture except for locust control, household and public health. (S.O.46 (E) dated 08th Jan, 2008)
9.	Methoxy Ethyl Mercuric Chloride (MEMC)	The use of MEMC is banned completely except for seed treatment of potato and sugarcane. (S.O.681 (E) dated 17thJuly, 2001)
10.	Methyl Bromide	Methyl Bromide may be used only by Govt./Govt. undertakings/Govt. Organizations / Pest control operators under the strict supervision of Govt. Experts or Experts whose expertise is approved by the Plant Protection Advisor to Govt. of India. [G.S.R.371 (E) dated 20thMay, 1999 and earlier RC decision]
11.	Methyl Parathion	Methyl Parathion 50 % EC and 2% DP formulations are banned for use on fruits and vegetables. (S.O.680 (E) dated 17thJuly, 2001) The use of Methyl Parathion is permitted only on those crops approved by the Registration Committee where honeybees are not acting as a pollinators. (S.O.658 (E) dated 04th Sep., 1992.)
12.	Monocrotophos	Monocrotophos is banned for use on vegetables. (S.O.1482 (E) dated 10thOct, 2005)
13.	Sodium Cyanide	The use of Sodium Cyanide shall be restricted for Fumigation of Cotton bales under expert supervision approved by the Plant Protection Advisor to Govt. of India. (S.O.569(E) dated 25thJuly, 1989)

source: http://www.cibrc.nic.in/list_pest_bann.htm

Integrated Pest Management

The details of IPM – the available and recommended IPM measures for key crops of project areas are given sub basin wise. The following are the broad components and strategy of IPM in increasing order of complexity.

Table 5. Key components of IPM approach

IPM Component	Notified Component Practices
Cultural practices	• Preparation of nurseries or main fields free from pest infestation by removing plant debris, trimming of bunds, treating of soil and deep summer ploughing which kills various stages of pests. • Proper drainage system in field be adopted. • Testing of soil for nutrients deficiencies on the basis of which fertilizers should be applied. • Selection of certified seeds and treating seeds with fungicide or biopesticides before sowing for seed borne disease control. • Selection of seeds of relatively pest resistant/tolerant varieties which play a

IPM Component	Notified Component Practices
	significant role in pest suppression. • Adjustment of time of sowing and harvesting to escape peak season of pest attack. • Rotation of crops with non-host crops. It helps in reduction of incidence of soil borne diseases. • Proper plant spacing which makes plants more healthy and less susceptible to pests. • Optimum use of fertilizer. Use of FYM and biofertilizers to be encouraged. • Proper water management (alternate wetting and drying to avoid water stagnation) as the high moisture in soil for prolonged period is conducive for development of pests especially soil borne diseases. • Proper weed management. • Root dip or seedling treatment in pest infested area. • Inter-cropping or multiple cropping wherever possible. All the crops are not preferred by each pest species and certain crops act as repellents, thus keeping the pest species away from preferred crops resulting in reduction of pest incidence. • Harvesting as close as to ground level. This is because certain developmental stages of insect pests/diseases remain on the plant parts which act as primary inoculums for the next crop season. Hence, harvesting crops at ground level will lessen the incidence of pests in next season. • Before planting, nursery plants be sprayed/dipped in copper fungicide/biopesticide solutions to protect the plants from soil borne diseases. • Keeping bee hives or placing flower bouquets of pollinizer cultivars facilitate better pollination and subsequent fruit set.
Mechanical practices	• Removal and destruction of egg masses, larvae, pupae and adults of insect pests and diseased parts of plants wherever possible. • Installation of bamboo cage cum bird perchers in the field and placing parasitized egg masses inside them for conservation of natural enemies and withholding of pest species wherever possible. • Use of light traps and destruction of trapped insects. • Installation of bird scarer in the field where required. • Installation of bird perches in the field for allowing birds to sit and feed on insects and their immature stages viz., eggs, larvae and pupae. • Use of pheromone traps for monitoring and suppression of pest population. • Use of pheromone traps for mass trapping.
Biological practices	• Biocontrol is use of living organisms to control unwanted living organisms (pests). It involves deliberate use of parasitoids, predators and pathogens to maintain pest population at level blow those causing economic loss either by introducing a new bioagent into the environment of pest or by increasing effectiveness of those already preset in the field. Different kinds of bioagents are biopesticides or bio-parasitoids , bio-fungicides, bio-nematicides etc
Chemical practices	• Use of chemical pesticides is the last resort when all other methods fail to keep the pest population below economic loss. Although there is a great advancement in pest management research, yet pesticides would continue to play an important role in crop protection in view of complexity of pest

IPM Component	Notified Component Practices
	problems. Therefore, use of pesticides should be need based, judicious, based on pest surveillance and economic threshold level (ETL) to minimise not only the cost involved, but also to reduce associated problems, following aspects need to be considered: • ETL and pest defender ratio must be observed • Relatively safer pesticides should be selected • If pest is present in strips or isolated patches, whole field should not be sprayed.

5. Strategies for implementation

Farmer Field school method adopting AEA approach: Agro-Ecosystem Analysis (AEA) approach is recommended to facilitate the holistic understanding and knowledge building on pest and diseases considering the soil conditions, plant growth, weather parameters, stage of crop etc. The approach promotes field observation and group discussion which leads to discussion among farmers and take a collective decision to manage the pests. This AEA approach can be facilitated adopting Farmer Field School method of building the capacity of men and women farmers. Since the IPM strategy is a knowledge intensive process and activity, improving women and men farmer's capacity on pest and diseases and its management by understanding its life cycle and skills to identify pests and diseases is necessary.

Plant Clinic Approach: The second potential strategy planned to promote is facilitating 'Plant Clinics' that is promoted by CABI international at the village level to provide technical inputs in identifying pests, monitoring the extend of damage and effective control measures. It provides an array of technological solutions for crop issues along with cultural, biological and chemical for enhancing plant health and economic benefits. The Plant Clinic is equipped with digital microscope, tablet and laptop with qualified agriculture expert as plant doctor. It will be regularly conducted during the cropping season at the interval of 15 days. Both men and women farmers are encouraged to visit the clinic with samples of the affected crops and discuss the potential solutions. The farmers will collect the recommendations for affected crops immediately in face to face and also get it in their mobile phone as SMS for keeping that message for input preparation or purchase. The plant doctors also spread awareness about judicious use of pesticides and recommend locally available cultural, biological, and chemical field inputs.

Suggested methods for the implementation of IPM

Activity	Suggested Methods
Awareness building	▪ Cover at least 30% farmers per village in first year from project start ▪ Cover the remaining 70% by the end of second year (in both cases 40% are women farmers)
Identification of potential farmers and organizing Farmer Field Schools	▪ Identify 30 interested women and men farmers according to the project norm in each village (which have been selected under the project) within 15 days of awareness building and promote Farmer Field Schools(FFS) for the major crops
Capacity building	▪ Staff and line department training completed in 1st year ▪ One FFS/season /village facilitated for two years – 30 farmers per FFS with 40% - women farmers ▪ Training for other interested farmers completed after FFS through Training of Trainers approach (TOT) – one farmer to ten farmer – Horizontal transfer of knowledge on IPM and totally reaching 300 farmers in a season on IPM methods per village with 40% women farmers
Facilitating Plant Clinics	▪ Promote the practice of IPM package by organizing Plant Clinic sessions in the villages (one plant clinic per 750-1000 households) ▪ 50% of the farmers in each village practice IPM in atleast one acre per farmer per season to observe results and link it with learning
Use of Bio-fertilizers/bio-pesticides	▪ At least 10% reduction in use of chemical fertilizers achieved every year ▪ At least 25% increase in the use of biopesticides achieved every year ▪ 50% reduction achieved in use of chemical fertilizers and pesticides after 5 years
Monitoring and Evaluation	▪ Formation of joint monitoring team (staff and community) within one year from project start ▪ Monitoring schedule for each half-yearly prepared and implemented ▪ Monitoring reports be prepared for each monitoring visit and compiled annually to show progress
Process documentation	▪ Annual progress reports on IPM status prepared giving coverage, replication and sustainability ▪ Knowledge, practice and coverage change documented

IPM measures for Sub basins

Among all the basins studied, the commonly cultivated crops among most of the sub-basins are paddy, coconut, banana, vegetables and sugarcane. Invariably in almost all the pests and diseases farmers have been practicing only chemical pesticides application as a main control measures. In many cases they are not in a position to describe about the pests or disease infection. They have been receiving information from agriculture input dealers and invariably they apply two to three sprays of pesticides irrespective of the pest problems based on crop stages.

The following table provides the crops grown, type of pests occurring in the field as well as adopted control measures, these information were collected during the consultations which should be revisited again

Cheyyar sub basin

Commonly cultivated crops	Commonly occurring pests and diseases	Control measures currently adopted
Paddy	Leaf folder Blast	Following two sprays of chemical pesticides based on the technical guidance of input dealers Two sprays of fungicide
Sugarcane	Early shoot borer Root grub	3 sprays of pesticides
Groundnut	Leaf minor Leaf spot	Two sprays – could not specify the name of the chemicals used

Uppar Palar sub basin

Commonly cultivated crops	Commonly occurring pests and diseases	Control measures currently adopted
Paddy	Leaf folder	Following two sprays of chemical pesticides based on the technical guidance of input dealers
Sugarcane	Early and late shoot borer	3 sprays of pesticides
Groundnut	-	-
Redgram	Pod borer	One spray of pesticides
Vegetables	Fruit borer and sucking pests	Two sprays of pesticides

Upper Bhavani sub basin

Commonly cultivated crops	Commonly occurring pests and diseases	Control measures currently adopted

Coconut	Rhinocerous beetle Red palm weevil	-
Banana	Nematode Bunchy top virus Stem borer	Application of nematicide – one round - Application of pesticides – 2 times depending upon the infestation

Krishnagiri to Pambar

Commonly cultivated crops	Commonly occurring pests and diseases	Control measures currently adopted
Paddy	Stem borer Leaf folder Thrips Green hopper Brown plant hopper	Following two sprays of chemical pesticides based on the technical guidance of input dealers
Sugarcane	Internode borer Early shoot borer	One or two depending on the degree of infestation
Vegetables		-
Jasmine	Bud worm Mite attack	-
Coconut	Black headed caterpillar	-
Fingermillet	-	-
horsegram	-	-

Vaniyar sub basin

Commonly cultivated crops	Commonly occurring pests and diseases	Control measures currently adopted

Paddy	Leaf folder Stem borer	one or two prays of chemical pesticides
Sugarcane	Early shoot Borer Root grub	-
Turmeric	Rhizome weevil	Three sprays of chemical fungicides

Ponnaiyar sub basin

Commonly cultivated crops	**Commonly occurring pests and diseases**	**Control measures currently adopted**
Paddy	Leaf folder Stem borer	Three sprays of chemical pesticides
Vegetables	-	-
Maize	-	-

Lower Vaigai Sub basin

Commonly cultivated crops	**Commonly occurring pests and diseases**	**Control measures currently adopted**
Paddy	Leaf folder Stem borer	Two sprays of chemicals
Chillies	Fruit borer	-
Seasmum	Phyllody	-

Pazayaru Sub basin

Commonly cultivated crops	**Commonly occurring pests and diseases**	**Control measures currently adopted**
Paddy	Stem borer	2 sprays of chemical pesticides
Coconut	-	-

banana	-	-
Rubber	-	-
Vegetables	-	-

Gadana sub basin

Commonly cultivated crops	Commonly occurring pests and diseases	Control measures currently adopted
Paddy	Leaf and sheath blast Stem borer	3 times chemical pesticide spraying
Vegetables	-	

Thirumanimuthar sub basin

Commonly cultivated crops	Commonly occurring pests and diseases	Control measures currently adopted
Paddy	Leaf folder	Following two sprays of chemical pesticides based on the technical guidance of input dealers
Sugarcane	Early shoot borer	-
Groundnut	-	-
Coconut	Rhinocerous beetle Ganoderma wilt	-
Cotton	-	-

The specific IPM measures suggested for the commonly occurring pests are as follows

1. **Paddy – Stem borer (*Scirpophagaincertulas*)**
   The ETL of stem borer attack is 2 egg mass per M2 or 10% dead heart or one moth per m2 or 25 moths per trap per week.
   - Practice of destruction of stubbles after the harvest break the life cycle of the pests and reduce the carry over load to next crop

- Removing the tip of the seedlings while transplanting the seedlings because the adults lay eggs on the leave tips.
- Reduce the use of nitrogenous fertilizers and practice split application of fertilizers – three to four times helps to avoid the over growth
- Recommended to harvest the straw close to the ground level
- Setting up of bird perches using wooden sticks and ropes @ 20-25/ha
- Setting up of pheromone traps for yellow stem borer @ 20-25/
- Biopesticide release such as Egg parasitoid namely *Trichogrammajaponicum, T. chilonis* an @ 50,000 –1,00,000 adult/ ha by tying the cards in the field ha starting from 15 days after planting at 7-10 days intervals 5-6 times
- Spraying of *Beauveriabassiana* product @ 1kg/ha or *Bacillus thuringiensis* @1kg or 1lit/ha
- When the infestation is above ETL safer/less toxic/easily bio degradable chemical pesticides are recommended

2. **Paddy – Brown Plant Hopper (*Nilaparvatalugens*)**

The ETL of BPH is 10-15 hoppers per hill

- Plant early in the season and plan for synchronous planting
- Wider spacing between plants and rows are recommended since its multiplication is more under high humidity conditions
- Reduce the application of chemical nitrogenous fertilizers and split the application during different stages of the crop growth
- Avoid water stagnation in the field at the time of pest infestation, field should be dry and enough aeration should be facilitated by titling the plants on the borders
- Alternate wetting and drying practice of cultivation can be adopted in the prone areas
- Control the population of myrid bugs by physical means as it helps to transmit the eggs and nympal stages of the hopper to other plants
- Early maturing varieties as well as crop rotation with non-rice crops helps to break the cycles
- Setting up of yellow sticky traps to attract and kill hoppers
- Pour kerosene in the flooded fields and drag a rope to dislodge the plants, during this stage insects fall in to water and drain the water after six hours
- Foliar application of Neem Seed Kernal Extract @5% or neem oil 0.5%
- When the infestation is above ETL safer/less toxic/easily bio degradable chemical pesticides are recommended

3. **Paddy – Leaf folder (*Cnaphalocrocismedinalis*)**

The ETL of the pest is 2 damaged leaves with larva per hill

- Early planting of paddy seedlings
- Providing wide spacing between plants and rows helps to get more sunlight and aeration which prohibits its growth
- Reduced application of nitrogenous fertilizers since the fresh green growth invites female flies to lay eggs which should be avoided to pest population surge

- Practice crop rotation with pulses and oil seeds
- Setting up of light traps to attract and kill adults.
- Keeping the bunds without much grass growth helps to avoid the pests survival
- Shade around the field should be avoided because shading provides conducive atmosphere for its multiplication
- The infected leaves can be mechanically removed and larvae can be destroyed manually
- Dragging a rope across the field to dislodge larvae of leaf-folder to kerosenized water in the field
- Release of egg parasotoid*Trichogrammachilonis* @ 1 lakh / ha starting from 15 Days after planting for 2-3 times at 7-10 days intervals.
- Spray biopesticides like *Bacillus thuringiensis* @1kg or 1lit/ha twice at 7-10 days
- When the infestation is above ETL chemical pesticides are recommended intervals in the evening hours. Foliar spray of NSKE @5% or neem oil 0.5%

4. Ear Head bug – (*Leptocorisaacuta)*

The ETL level is one bug/hill

- Bait - place fermented parts of either rotten frog or snail or crab or dry fish as bait in 20-25 places in a ha to attract and divert pests from sucking milk of rice grain
- Spray theextract of 2.5kg garlic + 500g tobacco leaves with wetting agent in one ha field at the time of milky stage
- When infestation crosses the ETL use safer/less toxic/easily bio degradable.

5. Blast (*Pyriculariagrisea*)

- Practice summer ploughing to reduce the load of fungal spores
- Cultivate tolerant or resistant varieties wherever suitable
- Plan for early planting
- Seed treatment with *Trichodermaviridii* @ 4g /kg of seeds before sowing
- Apply balanced fertilizers and less amount of nitrogenous fertilizers
- Keep the fields free from weeds that acts as an alternate hosts
- Destroy crop residues of last crop to eradicate the source of spores
- Spray leaf extract of tulsi @ 250g in 10 litres of water for two times at 10 days interval

6. Sugarcane: Early shoot Borer(C*hiloinfescatellus)*

ETL for the pest is 15% dead hearts

- Early planting of setts during Dec- Jan helps to avoid the insect infestation
- Locally suitable resistant varieties can be cultivated depending upon the sugar mills preferences. (eg. CO 312, CO 421, CO 661, CO 917 and CO 853)
- Mulching with crop residues or trashes on the ridges helps to reduce the space for the insects to infest.
- Intercultural operations and hand weeding helps to disturb the soil

- Earthing up the soil around the base of the plant 45 days after plating minimize the damage
- Removal and destroy the dead hearts from the field
- Growing onion/coriander as an intercrop in the early stage of planting
- Use pheromone traps @ 4 nos. /ac helps to monitor the pests and the lure should be changed once in a month
- Installation of light traps one per acre to cover the adult moths
- Use of biopesticides like the release 125 gravid females of *Sturmiopsisinferens* a tachinid parasite per acre helps to reduce the growth of the pests or release of Trichogrammachilonis @ 20,000 per acre at ten days interval for two times
- When the infestation is above ETL safer/less toxic/easily bio degradable are recommended

7. Sugarcane – Root grub (*Holotrichiaconsanguinea*)

ETL level is detection of 2 to 3 live larvae per 100 sampled stalks

- Crop rotation with other crops like pulses, paddy break the pest build up in the soil
- Summer ploughing with deeper depths helps to expose the pupa and other forms
- Avoiding rationing in the affected field of the pests and
- Maintaining field capacity to saturation point of soil moisture through irrigation helps to affect the insect growth

8. Coconut Rhinozerous beetle (*Oryctesnasicornis*)

- Mechanically remove the different life stages of the beetle from the attacked palms using beetle hook and destroy it.
- Set up pheromone trap for rhinoceros beetle @ 1 trap/10 trees by fixing it to the plant at 0.6 to 1 m height to trap and kill the beetles.
- Soak castor cake at 1 Kg in 5 litres of water in small mud pots and keep them in the coconut gardens to attract and kill the adults.
- Apply mixture of neem seed powder + sand (1: 2) @ 150 g/palm or neem seed kernel powder + sand (1: 2) @ 150 g/palm in the base of the 3 inner most leaves in the crown or Place medium size naphthalene balls in the leaf axils in the top and cover it with fine sand.
- Use of biocontrol agents like green muscardine fungus (*Metarrizhiumanisopliae*) by spraying 250ml mixed with 750ml water in manure pits and other breeding sites of the beetle. Or release of *Baculovirusoryctes* inoculated adult rhinoceros beetle @ 6 beetles/acre reduces the leaf and crown damage caused by this beetle.

- Maintain the coconut garden should be clean without tree residues

9. Coconut – Red Palm weevil *(Rhynchophorusferrugineus*)

- Avoid the cutting of green leaves.
- Place pheromone trap @ 1 trap/10 trees by fixing it to the plant at 0.6 to 1 m height to trap and kill the beetles.
- Set up of attractant traps (mud pots) containing sugarcane molasses 2½ Kg or toddy 2½ l (or pineapple or sugarcane activated with yeast or molasses) + acetic acid 5 ml + yeast 5 g + longitudinally split tender coconut stem/ logs of green petiole of leaves of 30 numbers in one acre to trap adult red palm weevils in large numbers

10. Turmeric – Rhizome rot (*Pythiumgraminicolum*)

- It is a soil borne fungus and spread through infected rhizomes and care should be taken while selecting the planting materials
- Treat rhizomes with 3g Mancozeb mixed in one litre of water for one hour and shade dry before planting
- Select field with light soils like red and loamy soils to avoid water stagnation since the infestation will be more under moist conditions
- Advised to grow disease tolerant varieties like Suguna and Sudarshan and promote intercropping with maize or pearl millet
- Crop rotation with pulses are advised to break pest build up in the field
- Advised to do summer ploughing and burn the infected crop residues
- The infected plants in the field should be moved out and drench the field with chemical fungicides like Trichodermaviridie

11. Budworm in Jasmine - *Hendecasisduplifascialis*

- Cleaning: regular pruning and hygienic maintenance of bushes
- Physically picking and destroying the affected buds with larvae
- Place light trap in the field to attract the adult moths
- Spray 5% neem seed kernel extract and
- In extreme cases spray safer/less toxic/easily bio degradable during evening times when flowers opens

12. Stem borer in Banana - *Odoiporuslongicollis*

- Keep the field clean by uprooting and removing the affected plants and old leaves
- place banana stem traps (longitudinal) around the field to monitor the weevil activity

- On the cut surface of the traps apply 20 g Beauveriabassiana, Matarhiziumanisopliae and keep the traps near the banana plant facing cut surface to soil
- Spray Azadirachtin @ (5 ml/litre) for two or three times at three weekly intervals.

Training and capacity building programmes: The training and capacity building programmes for both the agriculture officers and men and women farmers will be conducted by focusing on the following two main themes:

A) IPM demonstrations – recommend and set targets for covering project areas with IPM demonstrations and
B) providing pesticide handling training to potential project beneficiaries, including demonstration and use of proper equipment for spraying of pesticides

Table 6. Training calendar

Content	Target group	Resource organizations
IPM demonstrations		
i). Awareness building	Women and men farmers in the villages of selected sub basins	-
ii). Social mobilization	Department of Agriculture officers	Dhan foundation and M.S.Swaminathan Research Foundation (MSSRF), Chennai
iii) Agro Ecosystem Analysis (AEA)	Agriculture officers to conduct FFS for five days	Centre for Plant Protection Studies, TNAU, Coimbatore
iv) Different IPM technologies	Agriculture officers	Centre for Plant Protection Studies, TNAU, Coimbatore
v) Plant clinics - organizing Plant clinics at the village level –	Agriculture department	CABI, New Delhi, MSSRF, Chennai in partnership with CPPS, TNAU, Coimbatore
vi) Demonstrations and use of proper equipment for spraying pesticides	Men and women farmers	Agriculture officers
vii) Facilitation skills on Farmer Field school – communication and monitoring	Agriculture officers	LEISA network, Tamil Nadu
viii) conducting demonstrations and facilitating FFS	Men and women farmers	Agriculture officers

ix) Biopesticides and other bioproducts	Men and women farmers	Centre for Sustainable agriculture, Hyderabad and LEISA network,
x) Conducting Plant Clinics at the village level	Men and women farmers	MSSRF

Safe handling measures: Safe handling of the pesticides play an equal importance to ensure the safety issues while using it. Hence training programme will give due importance to promote best practices on Safe Practices on Procurements, Storage, Handling, Use and Disposal of pesticides by user groups. The programme will make an attempt to address the following measures (Table 7).

Table 7. Do's and Don'ts in safe use of pesticides by the farmers while purchasing and using

Areas	Do's	Don'ts
While Purchasing	▪ Purchase pesticides/biopesticides only from Registered pesticide dealers having valid Licence. ▪ Purchase only just required quantity of pesticides for single operation in a specified area. ▪ See approved labels on the containers/packets of pesticides. ▪ See Batch No., Registration Number, Date of Manufacture/ Expiry on the labels. ▪ Purchase pesticides well packed in containers.	▪ Do not purchase pesticides from foot path dealers or from un-licenced person ▪ Do not purchase pesticide in bulk for whole season ▪ Do not purchase pesticides without approved label on the containers ▪ Never purchase expired pesticide ▪ Do not purchase pesticides whose containers are leaking/loose/ unsealed
During Storage	▪ Store the pesticides away from house premises. ▪ Keep pesticides in original containers. ▪ Pesticides/weedicides must be stored separately. ▪ Where pesticides have been stored,area should be marked with warning signs. ▪ Pesticides be stored away from the reach of the children and live stocks. ▪ Storage place should be well protected from direct sunlight and rain	▪ Never store pesticide in house premises. ▪ Never transfer pesticides from original to another containers. ▪ Do not store insecticides with weedicides. ▪ Do not allow children to enter the storage place. ▪ Do not allow children to enter the storage place. ▪ Pesticides should not be exposed to sunlight or rain water
While handling	▪ Keep pesticides separate during transportation.	▪ Never carry/transport pesticides along with

	▪ Bulk pesticides should be carried tactfully to the site of application.	food/fodder/other eatable articles. ▪ Never carry bulk pesticides on head, shoulder or on the back.
While preparing spray solution	▪ Always use clean water. ▪ Use protective clothings viz., hand gloves, face masks, cap, apron, full trouser, etc. to cover whole body. ▪ Always protect your nose, eyes, ears, hands, etc. from spill of spray solution ▪ Read instructions on pesticide container label carefully before use. ▪ Prepare the solution as per requirement. ▪ Granular pesticides should be used as such. ▪ Avoid spilling of pesticides solutions while filling the spray tank. ▪ Always use recommended dosage of pesticide. ▪ No activities should be carried out which may affect your health	▪ Do not use muddy or stagnant water. v Never prepare spray solution ▪ Without wearing protective clothings. Do not allow the pesticide/its solution to fall on any body parts. ▪ Never avoid reading instructions on container's label for use. ▪ Never use left out spray solution after 24 hours of its preparation. ▪ Do not mix granules with water. ▪ Do not smell the spray tank. ▪ Do not use overdose which may affect plant health and environment. ▪ Do not eat, drink, smoke or chew during whole operation of pesticides.
Selection of Equipments	▪ Select right kind of equipments. ▪ Select right sized nozzles. ▪ Use separate sprayer for insecticides and weedicides.	▪ Do not use leaky or defective equipments. ▪ Do not use defective/non-recommended nozzles. ▪ Do not blow/clean clogged nozzles with mouth. Instead use tooth brush tied with sprayer. ▪ Never use same sprayer for both weedicides and insecticides.

Sources: Farmer's portal - http://farmer.gov.in/IpmDoDont.aspx

Promotion of Biopesticides: There are several beneficial microbial and botanical extracts are function as suitable safe alternatives are available in the state. Efforts will be made to identify the suitable products and project will make special efforts and design strategies to promote the use at the farmer level. Following are the list of

registered Biopesticides under CIA, 1968 (Table 8). The potential sources to purchase the above products in Tamil Nadu are given in Table 9.

Table 8. List of Approved biopesticides – alternatives to chemical pesticides

No.	Name of the Biopesticide
1.	*Bacillus thuringiensis var. israelensis*
2.	*Bacillus thuringiensis var. kurstaki*
3.	*Bacillus thuringiensis var. galleriae*
4.	*Bacillus sphaericus*
5.	*Trichoderma viride*
6.	*Trichoderma harzianum*
7.	*Pseudomonas fluoresens*
8.	*Beauveria bassiana*
9.	NPV of *Helicoverpa armigera*
10.	NPV of *Spodoptera litura*
11.	*Neem based pesticides*
12.	Cymbopogan
13	*Verticilium lecanii*
14	*Metarhizium anisopliae*
15	*Ampelomyces quisqualis*
16	*Hirsutella thompsonii*

Source: http://cibrc.nic.in/

Table 9. List of firms producing Bio-pesticides and approved by TNAU for purchase

Department of Agricultural Microbiology, Agriculture College and Research Institute, Tamil Nadu Agricultural University Prof and Head MADURAI-625 104 (0452-422956 fax: 422785 e-mail: s_anthoniraj@yahoo.com	Biofertilizer Production Unit, Department of Agriculture, Govt. of Tamil Nadu Gundusalai Road, Sommandalam, CUDDALORE-607 001 (TN)
Biofertilizer Production Unit, Department of Agriculture, Govt. of Tamil Nadu Agricultural Chemist Sakkottai, THANTAVUR-612 401 (TN)	Biofertilizer Production Unit, Department of Agriculture, Govt. of Tamil Nadu Jamal Mohd. College Post, Khajamalai, TRICHY-620 020 (TN)
KRIBHCO Sidco Garment Complex, Thiruvika Industrial Estate, Guindy, CHENNAI-32	Regional Research Station Tamil Nadu Agricultural University, PIYUR-635 112 Via-Kaveripattinam Dharmapuri District (04343-50043

Monarch Bio-Fertilisers and Research Centre 12, SIDCO Industrial Estate, Thirumazhisai, CHENNAI-602 107 (TN) (6272780	Lakshmi Bio-Tech Nellikuppam Road, Thottapattu, CUDDALORE-607 109 (TN) (04142-210136
Biofertilizer Production Unit Agricultural Chemist, Biofertilizer Production Unit, Seelanaickenpatty, SALEM-636 201 (TN)	Tamil Nadu Agricultural University Prof. & Head Dept. of Agricultural Microbiology, COIMBATORE-3 (TN) (431222 ext. 294 Fax: 0422-431672 e-mail: vctnau@vsnl.com
T Stanes & Company Limited 8/23-24, Race Course Road, COIMBATORE-641 018 (TN) (0422-211514, 213515 Fax: 217432 e-mail: tstanes@vsnl.com	The SIMA Cotton Development and Research Association Shanmukha Manram, Post Box No. 3871, Race Course, COIMBATORE-641 018 (TN) (0422-211391 Tele-Fax: 0422-216798
Southern Petrochemical Industries Corporation Limited, SPIC Ltd. Biotechnology Division, Chettiar Agaram Road, Gandhi Nagar, Porur, CHENNAI-600 116 (TN) (044-4768064 Tele-Fax: 044-4767347 e-mail: biotech.por@spic.co.in	Biofertiliser Unit-Manali, Madras Fertilizers Limited Chief Manager –Bioproducts Commercial Group, Madras Fertilizers Ltd., Manali, CHENNAI-600 068 (TN) (044-5941001 ext. 2750 Fax: 5941010 e-mail: edcomm@mfl.tn.nic.in
Main Biocontrol Research Laboratory (Unit of Tamilnadu Cooperative Sugar Federation) 2E/1, Rajeshwari Vedhachalam Street, CHENGALPATTU-603 001 (TN) (04114-431393	Biofertilizer Production Unit, Agricultural Chemist, Biofertilizer Production Unit, KUDUMIAMALAI-622 104 Distt. Pudukkottai

Source: http://agritech.tnau.ac.in/org_farm/orgfarm_biofertilizertechnology.html#List

ANNEXURE-VIII
ENVIRONMENTAL IMPACTS IDENTIFICATION TOOL

Environmental Parameter		Tank Bund Strengt h-ening	Reconstruct lon and repair of sluices	Repair of Weirs	Desilting of supply channels			Cropping			Demarc-ation of Boundary
					Level-ing	Bunding	Scraping	Crop Cycle	Fertilis ers & Pestic ides	Irrigation	
Surface Water	Physical										
	Chemical										
Ground Water	Physical										
	Chemical										
Soil Environment	Physical										
	Chemical										
Land Environment	Landuse										
Air pollution	SPM										
	SO_2										
Noise	L_{eq}Day										
	L_{eq}Night										
Biodiversity	Flora										
	Fauna										

Annexure IX
Environmental Screening Tool

Guidance:

a) The Format needs to be filled for each individual sub-project
b) If any criteria in category 1,2 or 3, the sub-project will be categorized respectively
c) Negative list of activities available in ESMF and those sub-projects will not to be undertaken by the project

Component A1: Irrigation systems modernization

1. GENERAL			
1.1. Name of Canal		1.1. Name of Tank	
1.2. Chainage (from/to)		1.2. Area of tank (hectares)	
1.3. Length (m)		1.3. Height of tank embankment (m)	
1.4. Average annual rainfall in command area (mm)			
1.5. Soil type in command area			
	Category 1	***Category 2***	***Category 3***
1.6. Command area (ha)	More than 10,000 ha	100 – 10,000 ha	Less than 100 ha
1.7. Command area under cultivation (ha / %)			
1.8. Depth of ground water table in command area (m)	☐Deep aquifer (10-20m) ☐Very Deep aquifer (below 20m)	☐Shallow (0-5m) ☐Moderate (5-10m)	
1.9. Ground water zone classification as per CGWB	☐Over-exploited ☐Saline	☐Semi-critical ☐Critical	☐Safe
1.10. Command area of canal/tank (list name of villages)	(i) (ii) (iii)		
1.11. Existing Water User Associations (list)	(i) (ii) (iii)		
1.12. Structures damaged during 2015 floods	☐ Tank	☐ Canal	☐None
1.13. Is the proposed project likely to contaminate water due to use of heavy machinery, human waste	☐ Yes	☐ No	

discharge, solid waste dumping, use of agro chemicals (Fertilizers, pesticides etc?) 1.14. If yes, whether appropriate safeguards are proposed? (write a note)	
1.15. Works to be undertaken	☐ Rehabilitation of cannal ☐ Revival of tank ☐ Tank bund strengthening ☐ Rehabilitation of regulators
1.16. Is the proposed project likely to affect any natural habitats/ cultural properties/ wetlands? 1.17. If yes, whether appropriate safeguards are proposed? (Write note)	☐ Yes ☐ No
2. Rehabilitation of canal:	
2.1. Desilting of canal (i) Volume of silt to be dredged (cum) (ii) Volume of dredged silt to be used in embankment strengthening (cum) (iii) Volume of dredged silt to be disposed (cum)	
2.2. Identified burrow pits site(s) along with distance from the work site	
2.3. Identified silt testing laboratory along with distance from the work site	
2.4. Identified silt disposal site(s) along with distance from the work site	
3. Tank – Revival and bund strengthening	
3.1. Is tank in an eco-sensitive area?	☐ Yes ☐ No
3.2. Identified disposal site for waste from tanks	
3.3. Earthwork: (i) Volume of silt to be dredged	

(cum) (ii) Volume of dredged silt to be used in embankment strengthening (cum) (iii) Volume of dredged silt to be disposed (cum)	
3.4. Identified burrow pits site(s) along with distance from the work site	
3.5. Identified silt testing laboratory along with distance from the work site	
3.6. Identified silt disposal site(s) along with distance from the work site	
4. Rehabilitation of regulators	
4.1. Replacement of regulators proposed?	☐ Yes ☐ No
4.2. Identified site(s) for disposal of waste along with distance from work site	
5. Rain-water harvesting structure	
5.1. RWH proposed?	☐ Yes ☐ No
5.2. Type of RWH proposed	
5.3. Area of proposed RWH (ha)	
5.4. Expected average rainfall to be captured (mm)	
5.5. Is proposed RWH expected to recharge ground water?	☐ Yes ☐ No
6. Equipment/machinery to be deployed	
6.1. Hot mix plant	☐ Yes (____nos) ☐ None
6.2. Concrete mixture with heavy pumps	☐ Yes (____nos) ☐ None
6.3. DG set	☐ Yes (____nos) ☐ None
6.4. Any other machinery/equipment (list with nos.)	

Component B: Agriculture Productivity Enhancement, Diversification, Improved Livelihoods, Marketing and Value Addition

1. General	
1.1. Name of village	

1.2. Population			
1.3. Village falls under command area of	☐ Tank (name) ☐ Canal (name)		
1.4. Area under irrigation (ha)			
2. Agriculture			
2.1. Crops with yield	☐Rice (yield) ☐Maize (yield) ☐Pulses (yield) ☐Sugarcane (yield) ☐Oilseeds (yield) ☐Millets (yield) ☐Spices (yield) ☐Fruits(yield)		
2.2. Cropping pattern	☐Mono-crop ☐Crop-rotation		
2.3. Whether license under Fruits Products Order (FPO), 1955 obtained	☐Yes ☐No		
3. Irrigation systems			
3.1. Source of water (percentage)	☐Ground water ☐Canal water ☐Tank ☐Farm ponds		
3.2. Field channels	☐Existing – non-functional ☐Existing - functional ☐New required		
3.3. Current irrigation systems in practice	☐Traditional ☐Micro-irrigation systems		
3.4. Water User Associations (i) Existing (ii) Functional (iii) No. of members	☐Yes ☐No ☐Yes ☐No		
3.5. Pesticides currently in use (list with quantities)			
3.6. Provision of training for safe use of pesticides exists? 3.7. If yes, briefly mention the training program	☐Yes ☐No		
3.8. Fertilizers currently in use (list with quantities)			
3.9. Cultivated area under organic farming (ha)			
	Category 1	***Category 2***	***Category 3***
3.10. Proposed activities under the project	☐Procurement of pesticides ☐Other	☐Promotion of new crop and agronomic practices	☐Training in safe use of pesticides ☐Training on

	interventions (list)	☐Farm ponds ☐Promotion of modern technologies ☐Promotion of high value crop using micro-irrigation system ☐Rehabilitation of existing/ new field channels ☐Other interventions (list)	organic farming ☐Creation of WUAs ☐Other interventions (list)
4. Livestock			
4.1. Population of livestock	☐Cattle - _____nos. ☐Goat - _____nos. ☐Sheep - _____nos.		
4.2. Source of fodder			
4.3. Existing animal diseases (list)			
4.4. Veterinary facilities existing within 5 km of village	☐Yes ☐No		
4.5. Provisions for disposal of animal waste exist?	☐Yes ☐No		
4.6. Provisions for disposal of bio-medical waste exist?	☐Yes ☐No		
4.7. Provisions for training on livestock research in animal management and disease control exist? 4.8. If yes, briefly mention the training program	☐Yes ☐No		
4.9. Is there existing provision for animal health camps			
	Category 1	***Category 2***	***Category 3***
4.10. Proposed activities under the project		☐Strengthening of breeding programs ☐Strengthening AI network ☐Fodder development and preservation	☐Training on livestock research in animal management and disease control ☐Disease surveillance

		☐Other interventions (list)	☐Mastitis control ☐Other interventions (list)
5. Fisheries			
5.1. Type of fish/breeding months/fishing months/yield of catch (list)			
5.2. Fishing areas	☐Canal	☐Tank	☐Farm ponds
5.3. Current fishing technologies in practice (list)			
5.4. Provisions of waste disposal exist?	☐Yes	☐No	
5.5. Provision for training on fisheries research in fish breeding and technology management exists? 5.6. If yes, briefly mention the training program	☐Yes	☐No	
	Category 1	***Category 2***	***Category 3***
5.7. Proposed activities under the project		☐Improving fish productivity ☐Promotion of innovative technologies for fishing	☐Research in fish breeding and technology management ☐Establishing better market linkages
5.8. Whether registered under Fish Seed Rules 2002	☐Yes	☐No	

Submitted by: Approved by: Reviewed by:

_____ _____ _____

AE/JE Executive Engineer Environment Specialist, MDPU

ANNEXURE-X
SUB-PROJECTSCREENINGFORMSFOR ESMF

I. Form ES1: Sub-projectscreening at identificationstage

Form to befilledby	Submittedto	When
Executive Engineer	CE,WRD	Along with the sub-project proposal

Sr. No.	Question	Yes	No
1.	Will the project interventions adversely impact surroundingnatural habitats includingconversion ofhabitat		
2.	Will the project implementation at the site result in physicaldisplacementof anyperson/family/household in selecting the siteforimplementing theproject		

Signature	:	
Nameofpersonfillingform	:	
Designation	:	
ForuseofWRD	:	
Signature	:	
Nameofpersonverifyingform atWRD	:	
Designation	:	

II.FormES2:Project pre-planninglevelstage

Thisform needsto besubmittedbeforethelaunchofthepreparationstageofthesub-project.

Form to befilledby	Submittedto	When
Executive Engineer	CE,WRD	Before start of preparation stage

S. No.	Question	Yes	No	NA*
1.	Is any ofthe project activity affecting the ecologically sensitive site, i.e., national park, wildlife sanctuary?			
2.	Will the project affect any wetland?			
3.	Is the project located along designated wildlife migratory route?			
4	Have thebeneficiariesbeen identified?			
5	IstheWUAwilling totake upactivities under theproject?			
6	DoestheprojectproposalhasGenderActionPlanandVulnerable GroupDevelopment Planprepared?			
7	Arethedocuments,booksandaccountsbyWUAbeingMaintained?			

Signature	:	
Nameofpersonfillingform	:	
Designation	:	
ForuseofWRD	:	
Signature	:	
Nameofpersonscreeningform atWRD	:	
Designation	:	

III. Form ES3: Planningstagescreening

Thisformneedstobesubmittedaftertheprojectpreparationstageandbeforethelaunchofthe implementation/constructionstage of thesub-project.

Form to befilledby	Submittedto	When
Executive Engineer	CE,WRD	Beforestartof implementation stage

S. No.	Question	Yes	No	NA*
1.	If pest and soil nutrient management plan involved, whether appropriate amount budgetedforimplementation?			
2.	Whether stakeholderconsultations were organized for finalizingtheplan?			
3.	Whethertank bed sediment samples collectedfor testing?			
4.	Civilworksbycontractor implemented			
5.	OFDworksineach WUAincludinglinkdrainconstructionReviewed			
6.	Has thequality beenassuredthrough agreed mechanismand reporting			
7.	Trainings (WUA management / livelihood / financialmanagement/O&M/M&E/watermanagement, etc.)carriedout			

Signature	:	
Nameofpersonfillingform	:	
Designation	:	
ForuseofWRD	:	
Signature	:	
Nameofpersonscreeningform atWRD	:	
Designation	:	

IV.FormES4: Operation stageenvironmentaland social monitoring

Thisform needsto besubmittedonaquarterlybasisduringoperationstageofthe sub-project.

Form to befilledby	Submittedto	When
Project Implementing Unit at field level	Line Department HoDs	Frequency – Quarterly during operationstage

S. No.	Question	Yes	No	NA
1.	Does theproject involveland acquisition?			
2.	IstheIPMplanoperational in thecommunity?			
3.	Isthereactiveinvolvementofvulnerablegroupsinpost implementation?			
4.	Are contractors paid only after certifying that construction related environment and social?			

S. No.	Question	Targetasper plan	Actual achieved
1.	Does theproject involveany land acquisition?		
2.	NumberofIPMrelatedtraining/awarenesscampaigns held inthecommunity		
3.	Proportionamong theservice user farmers		
	-Farmersfromvulnerable communities		
	-Womenfarmers		
4.	RepresentationinWUA		
	-Farmersfromvulnerable communities		
	-Womenfarmers		

Signature	:	
Nameofpersonfillingform	:	
Designation	:	
ForuseofWRD/LineDepartment	:	
Signature	:	
Name of person screening form atWRD/LineDepartment	:	
Designation	:	

V.FormES5: Social Screening for Vulnerable Tanks

Details of Irrigation Tank

Name of the Region	
Name of Sub Basin	
Name of the Village/Gram Panchayat	
Name of Irrigation Tank, if any	
Category as per ESMF	

Details of Encroachments and pollution – tick appropriate column

Is there Encroachment	Yes	No
If yes, where	Tank Bunds	Fore-Shore
Use of Encroached Land	Residence	Agriculture
	Commercial	Others

Participants in Social Screening

Name of Participant	Name of Organization	Designation

Placeof Social Screening

Name of Social Screening Place	
Date of Social Screening	
Time of Social Screening	

This is to certify that on the basis of above Social Screening that this irrigation tank is categorized as Category _____ in accordance with the ESMF.

Signature	:	
Nameofpersonfillingform	:	
Designation	:	
ForuseofWRD	:	
Signature	:	
Nameofpersonverifyingform atWRD	:	
Designation	:	

ANNEXURE XI Details of Community Level Consultations Conducted

Subbasin	Date of Consultation	District	Block	Village
Cheyyar	19.11.2016	T.V.Malai	Arni	Kunathur
	19.11.2016	T.V.Malai	Polur	Parvathiagaram
Thirumanimuthar	22.11.2016	Namakkal	paramathi	Pillurvillage
	22.11.2016	Namakkal	Vennandur	Minnakkal
Krishnagiri – Pambar	28.11.2016	Krishnagiri	Kaveripattinam	Setimarampatti
	28.11.2016	Krishnagiri	Krishnagiri	Nerkundhi
	28.11.2016	Krishnagiri	Kaveripattinam	Thalihalli
	28.11.2016	Krishnagiri	Kaveripattinam	Paiyur
	29.11.2016	Krishnagiri	Kaveripattinam	Beruhalli
	29.11.2016	Krishnagiri	Kaveripattinam	Barur
	29.11.2016	Krishnagiri	Mattur	Anandhur
	29.11.2016	Krishnagiri	Kaveripattinam	Vadamangalam
	30.11.2016	Dharmapuri	Morrapur	Echambadi Annaikattu
	30.11.2016	Dharmapuri	Morrapur	Agraharam
Vaniyar	01.12.2016	Krishnagiri	Uthankarai	Vedapatti
	30.11.2016	Dharmapuri	Pappiretipatti	Pappireddipatti
	01.12.2016	Dharmapuri	Pappiretipatti	Allapuram
	01.12.2016	Dharmapuri	Arur	Vacchathi
Upperbhavani	08.12.2016	Coimbatore	Nellithurai	Nellithurai
	09.12.2016	Coimbatore	Kilpillur	Kilpillur
	09.12.2016	Coimbatore	Karamadai	odandurai
	09.12.2016	Coimbatore	Karamadai	Kilchangalur
	10.12.2016	Coimbatore	Karamadai	Pelathi
	10.12.2016	Coimbatore	Annur	Annur
	10.12.2016	Niligiris	Araiyur	Kunjapannai panchayat
UpperPalar	15.12.2016	Vellore	Jowlarpet	Kedandapatti
	15.12.2016	Vellore	Pernambet	Reddymakuppam
	15.12.2016	Vellore	Madhanur	Periyankulam
	17.12.2016	Vellore	Alangayam	Echangkal
Gadana	14.12.2016	Tirunelveli	Pappakudi	Pappakudi
	14.12.2016	Tirunelveli	Pappakudi	Nanthanthattai
	14.12.2016	Tirunelveli	Pappakudi	Pallakkalpudukudi
	15.12.2016	Tirunelveli	Ambasamudram	Piramadesam
	15.12.2016	Tirunelveli	Kadayam	Alwarkurichi
	15.12.2016	Tirunelveli	Kadayam	TherkkuKadayam
	16.12.2016	Tirunelveli	Kadayam	Govinthaperi
	16.12.2016	Tirunelveli	Kadayam	Sivasailam
	16.12.2016	Tirunelveli	Kadayam	MelaAmbur
Pazhayar	08.12.2016	Kanyakumari	Thovai	Arumanallur
	08.12.2016	Kanyakumari	Thovai	Esanthimangalam
	08.12.2016	Kanyakumari	Thovai	Erachakulam
	09.12.2016	Kanyakumari	Thovalai	Tirupathisaram

Subbasin	Date of Consultation	District	Block	Village
	09.12.2016	Kanyakumari	Thovalai	Theraikalpudur
	09.12.2016	Kanyakumari	Agastheeswaram	Theroor
	10.12.2016	Kanyakumari	Agastheeswaram	Suchindram
	10.12.2016	Kanyakumari	Agastheeswaram	Parakkai
	10.12.2016	Kanyakumari	Agastheeswaram	Thengampudur
Lowervaigai	01.12.2016	Ramanathapuram	Nainarkovil	Kiliyar
	01.12.2016	Ramanathapuram	Nainarkovil	Tyagavanchery
	01.12.2016	Ramanathapuram	Nainarkovil	Saduvademangalam
	02.12.2016	Sivagangai	Manamadurai	V.Karisalkulam
	02.12.2016	Ramanathapuram	Nainarkovil	MumundiSathan Tank
	03.12.2016	Ramanathapuram	Ramanathapuram	Puthandal
	03.12.2016	Ramanathapuram	Ramanathapuram	Athiyuthu
	03.12.2016	Ramanathapuram	Ramanathapuram	Karendhal
Ponaniyar	28.11.2016	Karur	Kadavur	
	28.11.2016	Thiruchirapalli	Vaiyampatti	Ayyanreddyapatti
	28.11.2016	Thiruchirapalli	Manapparai	Chithantham
	28.11.2016	Thiruchirapalli	Manikandam	Paganur
	29.11.2016	Thiruchirapalli	Manikandam	Kallikudi
	29.11.2016	Thiruchirapalli	Manikandam	Thayanaur
	29.11.2016	Thiruchirapalli	Thiruberumbur	Koothapar
	29.11.2016	Thiruchirapalli	Thiruberumbur	Gundur
	30.11.2016	Pudukottai	Viralimalai	Kodumbalur
	30.11.2016	Pudukottai	Viralimalai	Thannambadi
	30.11.2016	Pudukottai	Viralimalai	Neepelani
SathaiyarOdai and Cavery Delta	29.12.2016 30.12.2016	Thanjavur Madurai	- -	- -

ANNEXURE XII

Feedback Form

Environment and Social Management Plans (ESMP) for 66 River Sub Basins in the TN-IAMWARM- II Project–Consultation with the line departments, Sub basin,Date

Name	
Designation	
Department	
Official addresswithmobilenumber	
Majorissuesneedtobeaddressed inthesector	
Listofongoingmajoractivitiesinthesector	
LessonsyouwanttosharefromthePastexperiences	
Successstoriesormodelsdeveloped if any	

Opportunities if any you could Suggest for mitigatingthe adverse conditions	
How the department can contribute for TN-IAMWARM-2 project	
Any other points or suggestions	

திட்ட அறிக்கையின் சுருக்கம்

தமிழக அரசு உலக வங்கி நிதியுதவியுடன் செயல்படுத்திய நீர்வள நிலவளத் திட்டம் சிறப்பான முறையில் செயல்பட்டு வெற்றி கண்டதையடுத்து, இந்த திட்டத்தின் கீழ் வராத மேலும் அறுபத்தாறு துணைபடுகைகளில் விவசாயத்துக்கான பாசனமுறையை நவீனமயமாக்க உலக வங்கியின் உதவியை நாடியுள்ளது. இம்மாதிரியின் குறிக்கோள் பலதுறை ஒருங்கிணைப்பு மற்றும் பிணைப்பு மற்றும் நீர்வள நிலவளத் திட்டத்தின் பொதுவான அங்கங்களை பின்பற்றுவதும் ஆகும். தநா– நீர்வள நிலவள –2 திட்டத்தின் கீழ் வருவன :

- உற்பத்தியை அதிகரித்தல் மற்றும் அனைத்துவித பருவநிலை மாற்றங்களின்போதும் நீர்ப்பாசன வசதிக்கு வழிசெய்தல்.

- நீர் மேலாண்மைக்கான திட்டங்களை புதுப்பித்தல்.

- உழவர் மற்றும் உழவு சார்ந்த தொழில்களில் ஈடுபட்டுள்ளோரின் முன்னேற்றத்துக்காக விவசாயம் மட்டுமின்றி, தோட்டவளர்ப்பு, கால்நடை வளர்ப்பு மற்றும் மீன்வளர்ப்பு போன்றவற்றில் அவர்களை ஊக்குவிப்பது.

மேற்கண்ட திட்டம் தமிழ்நாடு நீர்வள நிலவளத் திட்டத்தில் கற்றுக்கொண்ட பாடங்களைக்கொண்டு மாறும் சூழலுக்கு ஏற்பவும், தேவைகளுக்கு ஏற்பவும் மாநிலத்தின் நீர்பாசனம், விவசாயம், தோட்டவளர்ப்பு மற்றும் அதைச் சார்ந்த பணிகள், கால்நடை மற்றும் மீன்வளர்பு உள்ளிட்ட பகுதிகளில் இந்த புதியவடிவத்தின் கீழ் இயங்க உள்ளது. இத்திட்டம் மூன்று முக்கிய அம்சங்களாக பகுக்கப்பட்டுள்ளது.

அம்சம் அ : நீர்பாசனம் மற்றும் நீர் மேலாண்மை

இதன் கீழ் முழுமையான அளவில் நீர்ப்பாசனம் மற்றும் மேம்பாடு விளக்கப்படுவதுடன் நீர்வளத் தேவை மற்றும் அதை ஈடு செய்வதற்கான வழிகள் ஆராயப்படும். இவை நான்கு விதமாக பகிரப்பட்டுள்ளன :

- குழுவை வலுப்படுத்துதல் மற்றும் நீர்வள மேம்பாட்டிற்கான திறனை உருவாக்கல்

- நீர்ப்பாசன முறைகளை நவீனமயமாக்கல்

- பங்கேற்புடன் நீர்ப்பாசன மேம்பாடு

- மேலாண்மையான சேவையை வழங்க ஒருங்கிணைத்தல்

அம்சம் ஆ: விவசாய உற்பத்தியை விரிவாக்குதல், பண்முகத்தன்மையுடன் இருத்தல், மதிப்புக்கூட்டல் மற்றும் சந்தைப்படுத்துதல்

- தீவிர விவசாயம் மற்றும் விவசாய பொருட்களில் பன்முகத்தன்மை.

- கால்நடை வளர்ப்பு மற்றும் மீன் வளர்ப்பு மூலம் வாழ்வாதாரத்தை சீரமைத்தல்.

- விவசாயப் பொருட்களை சந்தைப்படுத்துதல், அவற்றுக்கு மதிப்புக் கூட்டுதல் மற்றும் அறுவடைக்கு பிறகான மேம்பாடு.

அம்சம் இ : திட்ட மேலாண்மை ஆதரவு

இந்த தநா நீர்வள நிலவளத் திட்டம்–2 செயல்பாட்டுக்கு கொண்டுவர எட்டு துறைகள் பல்துறை திட்டக்குழுவின் கீழ் இயங்கும். இந்த பல்துறை திட்டக்குழுவுக்கு, வழிகாட்டும் திட்டக் குழு (பிஎஸ்சி) தநா. நீர்வள நிலவளத்திட்டம்–2 திட்டத்தின் செயல்பாடுகளை குறிப்பிட்ட இடைவேளைகளில் கவனித்து சிறப்பாக செயல்படுவதற்காக ஆலோசனைகளை வழங்கும். நீர்வள ஆதாரத்துறையின் சம்மந்தப்பட்ட செயற்பொறியாளர் மற்றும் குறிப்பிட்ட துறையின் சம்பந்தப்பட்ட துணை இயக்குனர் தமக்கு கீழ் வரும் ஒவ்வொரு துணை படுகைகளிலும் பகுதிவாரியாக திட்டத்தை செயல்படுத்தும் குழுவாக செயல்படுவர்.

நீர்வள ஆதாரத் துறையின் மூத்த சுற்றுச்சூழல் நிபுணர் திட்டத்திற்கான தொழில்நுட்ப உதவிகளை பல்வேறு தளங்களிலிருந்து வழங்குவார். மேலும், இந்தத் திட்டத்தால் சுற்றுச்சூழலில் ஏற்படும் தாக்கத்தை அறிவதுடன், சுற்றுச்சூழல் சார்ந்த வழிகாட்டுதல்களுடன் திட்டத்தை அமலாக்குவதும், மேற்பார்வையிடுவதும், பல்வேறு பகுதிகளில் உள்ள திட்டத்தை செயல்படுத்தும் குழுக்களுக்கிடையே ஒருங்கிணைப்பை ஏற்படுத்துவதும் இவரது பொறுப்பாக இருக்கும். அத்துடன், தொடர்ந்து திட்டங்கள் செயல்படுத்தப்படும் பகுதிகளை பார்வையிட்டு IEC - க்கு உதவிகரமாக இருப்பதும், சமூக மேம்பாட்டு திட்டங்களை உருவாக்குவதும் இந்த மூத்த சுற்றுச்சூழல் நிபுணரின் பணியாக இருக்கும்.

இதுபோன்ற ஒவ்வொரு முன்னேற்றத் திட்டத்திலும் இஎஸ்ஏ–வின் பங்கு அதன் வெற்றியை கணித்து, விளக்குவது, திட்டம் சிறப்பான முறையில் செயல்படுவதற்கு ஏற்ப பாதகமான சூழலை குறைப்பது மற்றும் குறிப்பிட்ட பகுதியில் உள்ள சட்டதிட்டங்களின் கீழ் செயல்படுவதை உறுதிசெய்வது, சுற்றுச்சூழல் மற்றும் சமூக மதிப்பீடு ஆய்வு மற்றும் சுற்றுச்சூழல் மற்றும் சமூக மேலாண்மை கட்டமைப்பு பின்வரும் நோக்கங்களை உள்ளடக்கியுள்ளது :

- இந்த திட்டம் செயல்படுத்தப்படும்போது குறிப்பிடப்பட்ட பகுதிகளில் சுற்றுச்சூழல் மற்றும் சமூக அளவில் சாத்தியமான, குறிப்பிடத்தக்க, நீண்டகால மற்றும் மீள இயலாத அளவிலான மாற்றங்களை அடையாளம் காண்பது

- சுற்றுச்சூழலை சிறப்பாக்க ஏற்ற சாத்தியமான வாய்ப்புகளை அறியவும் மற்றும் திட்டத்துக்காக செய்யப்படும் முதலீடுகளால் சமூக நிலைமை நிலையடையவும், பசுமைக்குடில் வாயு வெளிப்பாட்டைக் கட்டுப்படுத்தவும் முறையான வழிகளை அடையாளம் காண்பது.

- சுற்றுச்சூழல் மற்றும் சமூக மேலாண்மை கட்டமைப்பை உருவாக்குதல்.

- சுற்றுச்சூழல் மற்றும் சமூக மேலாண்மை திட்டங்களுக்கான கையேடுகளைத் தயார் செய்தல்

- சுற்றுச்சூழல் மற்றும் சமூக மேலாண்மை கட்டமைப்பு மற்றும் சுற்றுச்சூழல் மற்றும் சமூக மேலாண்மை திட்டத்தை ஒருங்கிணைத்து படிப்படியான செயல்பாடுகளை பரிந்துரைப்பது.

இந்த முன்மொழியப்பட்ட திட்டத்தின் தாக்கம் பல்வேறு விதமானதாக அமையலாம் : செயல்பாட்டின் பல்வேறு தளங்களில் (எ.கா.) கட்டுமானத்துக்கு முன்னர், கட்டுமானத்தின்போது அல்லது இயக்கத்தின் போது மாறலாம். இந்த திட்டத்தின் சிறப்பான பின்விளைவுகள் பின்வருமாறு :

- இந்த திட்டத்தின் மூலம் பயிர்களின் உற்பத்தி கூடும்.

- இந்த திட்டத்தின் மூலம் பயிர் உற்பத்தி கூடுவதால் நீர்பாசன அடர்த்தியும் அதிகரிக்கும்.

- இந்த திட்டத்தின் மூலம் நிலத்தடி நீர் சேமிக்கப்படும் மற்றும் அதிகரிக்கும்

- இந்த திட்டத்தின் மூலம் காய்கறிகளும் பாதுகாக்கப்படும்

- இந்த திட்டம் நாட்டின் தற்போதைய தண்ணீர் தட்டுப்பாட்டைப் போக்கி நல்ல சூழலை உருவாக்கி பொருளாதார வளர்ச்சியடையவும் உதவும்.

- இந்த திட்டம் நடைமுறைப்படுத்தப்படும்போது மண்ணரிப்பின் அளவு கட்டுக்குள் வரும்.

- இதனால் வேலை வாய்ப்பு அதிகரிப்பதுடன், சமூக மூலதனம் மற்றும் தேவைகள் பூர்த்தியடைய வழிபிறக்கும்.

- பெண்கள், விவசாயிகள் மற்றும் பலவீனமான நிலையில் உள்ள குழுக்கள் போன்றோரின் சமூக பொருளாதார நிலை மேம்படும்.

- உள்ளூரின் வளர்ச்சி மற்றும் மேம்பாடு துணைப் படுகையிலும் உத்வேகத்துடன் எதிரொலிக்கும்.

இந்தத் திட்டத்தின் கட்டுமான அளவில் ஏற்படலாம் என கணிக்கப்படும் எதிர்மறையான பக்கவிளைவுகள் பின்வருமாறு :

- மண்ணரிப்பு.
- வாகன போக்குவரத்து சற்றே அதிகரிப்பு.
- தொழிலாளர் குடியிருப்பின் திட கழிவு அதிகரிப்பு.
- நீரோடை வண்டலாகுவது அதிகரிக்கலாம்.
- கட்டுமான சிதைவு

மேற்கண்ட எதிர்மறை விளைவுகள் பின்வருவனவற்றை கட்டுபடுத்தினால் மட்டுப்படுத்தப்படலாம்.

பூச்சிக்கொள்ளி / உரத்தின் அதீத பயன்பாடு :

துணைப் படுகைகளில் ஏற்கனவே இருக்கும் பூச்சி மற்றும் களைகளைப் பற்றி தெரிந்துகொள்ளவேண்டும். பூச்சிகளைக் கட்டுப்படுத்துவதற்கான தொழில் நுட்பம் மற்றும் நடைமுறையில் இயற்கையான உரம் (மண்புழு உரம் போன்றவை) பயன்படுத்தப்படவேண்டும். மண்ணின் தரத்தைத் தெரிந்துகொண்டு அதற்கேற்ற வகையில் குறைந்த அளவிலான விவசாய ரசாயனங்களை உபயோகிக்கவேண்டும். கடற்கரை சார்ந்த ஈரநிலப்பகுதிகளை மீன்வளர்ப்பு பகுதிகளாக மாற்றுவது வீட்டுப்புற கழிவுநீர், கால்நடைகளை கழுவுவதால் நீர் மாசுபாடு, தரைகளை சுத்தப்படுத்துதல்.

இஎஸ்ஏ–வின் ஆய்வறிக்கைப்படி தநா–நீர்வள நிலவள–2 திட்டத்தில் விவசாய நவீனமயமாக்கல் மற்றும் நீர்வளம் மீட்பு மற்றும் மேலாண்மை மேலும் இவை சம்பந்தமான சமூக நலன்கள் போன்றவற்றை அடைய ஏதுவான கூறுகள் மற்றும் செயல்முறைகள் சிறப்பான முறையில் உள்ளன என்பதில் ஏதும் ஐயமில்லை.

முந்தைய பகுதிகளில் குறிப்பிட்டுள்ளபடி இந்தத் திட்டத்தில் நேர்மறை தாக்கத்துக்கான வாய்ப்புகளே அதிகம். இத்திட்டத்தினால் ஏற்படும் நன்மைகள் அனைத்து விதமான விவசாயிகள், விவசாய கூலியாட்கள் மற்றும் அது சார்ந்த பணியில் உள்ள அனைவருக்கும் கிடைக்கப்பெறும்.

- குறிப்பிட்ட பகுதியில் தரிசாக இருக்கும் நிலமும், விவசாயத்துக்கு ஏதுவானதாக மாறி அவர்களின் வாழ்வாதாரத்தை ஊக்குவிக்கும் என தெளிவாகின்றது. நீர்பாசனத்தால் காய்கறி மற்றும் மரங்களின் வளர்ச்சி கூடும் என எதிர்பார்க்கப்படுகின்றது. ஆகவே, குறிப்பிடப்பட்ட பகுதியின் பல்லுயிர்களும் அதிகரிக்கும்.

- தரிசு நிலங்கள் மற்றும் தனிப்பயிர்கள் விதைக்கப்படும் நிலங்கள் தொடர்ச்சியாக பயிரிடப்படுவதால் அவை மண் சேர்ப்பானாக செயல்பட்டு மண்ணரிப்பை சிறிது சிறிதாக குறைக்கும்.

- இந்த குறிப்பிட்ட திட்டம் நிலத்தடி நீரின் பயன்பாட்டை குறைக்க உதவும். நீர்பாசன மேம்பாட்டினால், நிலத்தடி நீர் பாதுகாக்கப்பட்டு அதிகரிக்கவும் உதவும்.

- தண்ணீர் தட்டுபாடு என்ற நிலை மாறி அதிகரித்த நிலத்தடி நீரால் மேற்படி விவசாயம் வளரவும், நீர்பாசனம் மேம்படவும் காரணியாகும்.

- சுற்றுச்சூழல் மற்றும் சமூக மேம்பாட்டு கட்டமைப்பின்படி கட்டுப்பாட்டு அளவைகள் ஐபிஎம் மற்றும் ஐஎன்எம் அளவீடுகள் தீர்மானிக்கப்படும் அத்துடன் நீர்பாசனப் பகுதிகளில் எஃப் ஒய்எம் மற்றும் இயற்கை உரத்தை பயன்படுத்துவதன் நன்மை குறித்து பறைசாற்றப்படும். இம்முறையான செயல்பாடுகள் உற்பத்தியை அதிகரிப்பதுடன் சுற்றுச்சூழல் மீது குறைந்த அளவிலான பாதிப்பையே ஏற்படுததும்.

- இத் திட்டம் நடைமுறைப்படுத்தப்படும் பகுதிகளில் வேலைவாய்ப்பு அதிகரிப்பதால் நகரம் நோக்கி பயணிக்கும் மக்களின் எண்ணிக்கை நாளடைவில குறையும். விவசாயக் கூலிகள் மற்றும் பலவீனமான குழுக்களைச் சார்ந்தோருக்கு பணிக்கான வாய்ப்புகள் அதிகரிப்பதால் அவர்களின் வருமானமும் கூடும்.

- தொடர்ந்து தேவை சார்ந்த பயிற்சி வகுப்புகள் இத்திட்டத்தின் மூலம் நடத்தப்படுவதால் விவசாயிகள் புதிய வகை விவசாய முறையில் சிறப்பாக செயலாற்றவும் மீண்டும் நலிவடையாமல் இருக்கவும் இயலும்,

- இந்த திட்டத்தினால் விவசாயிகளின் வருமானம் அதிகரிப்பதால் வீட்டுச்செலவுகள் போக மீதிப் பணத்தில் விவசாயத்துக்கான மூலக்கூறுகளை வழங்கவும், நவீனமயமான விவசாயத்தில் பங்கெடுக்கவும் முடியும். இதனால் செலவு போக உற்பத்தித்திறன் அதிகரித்து, வருமானம் ஈட்ட உதவும்.

- இத்தகைய விவசாயிகளை பகுதிசார்ந்த குழுவாக இணைக்கும்போது திட்டத்தை வழிநடத்த சிறப்பான ஒருங்கினைப்பைப் பெறலாம். இது நீர்பாசன மேம்பாடு மற்றும் விவசாயிகளே தமது உற்பத்திப் பொருட்களை நேரடியாக சந்தைப்படுத்தல் ஆகியவற்றுக்கும் ஒத்துழைப்புடன் செயலாற்ற உதவும்.
- இந்த திட்டத்தின் மூலம் பாலினம் சார்ந்த அக்கறையுடன் பெண் விவசாயிகளையும் சிறப்பாக செயலாற்ற வைத்தால், அவர்களது சமூக பொருளாதார நிலை சீரடைய உதவ முடியும்.

நீர்வள நிலவளத் திட்டம்–2ல் பிறதுறைகளின் பணிகள் கீழே தொகுக்கப்பட்டுள்ளன.

வேளாண் துறை	• இயற்கை வேளாண்மை (INM மற்றும் IPM) நடைமுறைப்படுத்துதல் • வேளாண் இடுபொருட்களையும் கருவிகளையும் உரிய காலத்தில் வழங்குதல் • ஆண்கள் பெண்களுக்குத் தேவையான பயிற்சி அளித்தல்

நீர்வள ஆதாரத்துறை / பொதுப்பணித்துறை	• நீடித்த நீர்வள மேலாண்மைக்கான நல்ல செயல்களையும் முடிவெடுக்க துணைபுரியும் அமைப்பையும் வளர்த்தல் • நீர்வள மேலாண்மைப் பணியாற்றும் நிறுவனங்களை செழுமைப்படுத்துதல்
தோட்டக்கலைத் துறை	• வருவாயை அதிகரிக்கவும் மாற்றுப் பயிர்களைப் பயிரிடுவதற்குமான தோட்டக்கலை தொழில் நுட்பங்களை பிரபலப்படுத்துதல் • தோட்டக்கலைப் பயிர்களுக்கான மிகச் சரியான வேளாண் முறையைப் பிரபலப்படுத்துதல் மற்றும் அதற்கான பயிற்சியை வழங்குதல்
வேளாண்பொறியியல் துறை	• சொட்டு நீர்ப்பாசனம், தெளிப்பு நீர் பாசனம், சூரிய வெப்ப சக்தியில் இயங்கும் இரவைகள் போன்ற நீரைச் சேமிக்கும் பாசன முறைகளைக் கண்டறிந்து விவசாயிகளுக்கு அறிமுகப்படுத்துதல். • மழைநீர் சேகரிப்பு முறைகளைப் பிரபலப்படுத்துதல்
வேளாண்விற்பனைத்துறை	• சிறிய அளவு பதப்படுத்தும் அலகுகள், சேமிப்புக் கிட்டங்கிகள, சூ ரிய சக்தியில் இயங்கும் உலர் கருவிகள், விற்பனை மையங்கள் போன்றவற்றினை உருவாக்குதல். • உலர்த்துதல், பதனிடுதல் மூலம் மதிப்புக்கூட்டுதல். • வேளாண் தொழில் முனைவோர்களை உருவாக்குதல்

தமிழ்நாடு விவசாயப் பல்கலைக் கழகம்	• மிகச் சரியான விவசாய முறைகளை மேம்படுத்துதல், SRI முறை நெல் பயிரிடும் முறையை செய்முறைப் பயிற்சியின் மூலம் பரவலாக்குதல், பயிற்சி வழங்குதல் • விலையை முன் கூட்டியே கண்டறியும் தொழில்நுட்பத்தை உருவாக்குதல் • மாதிரி விதை கிராமத்தை உருவாக்கி அதன் மூலம் தரமான கலப்பின விதைகளைப் பெருக்குதல்
கால்நடைத்துறை	• கால்நடைகளின் உடல்நலத்தைப் பேணுதல் • கனிமக் கலவையை பகிர்ந்தளித்தல் • பசுந்தீவனத்தின் தேவை மற்றும் இருப்பு ஆகியவற்றிற்கிடையே உள்ள இடைவெளியைக் குறித்தல்
மீன் வளத்துறை	• பண்ணைக் குட்டைகளில் மீன் வளத்தைப் பெருக்குதல் மீன் குஞ்சு வங்கி மற்றும் அலங்கார மீன்களை அதிகப்படுத்துதல், விவசாயக் குளங்களில் மீன் வளத்தைப் பெருக்குதல்

இந்த திட்டத்தில் எதிர்மறை பட்டியலில் உள்ள செயல்பாடுகளுக்கு வங்கி கடனுதவி தராது. சுற்றுச் சூழல் மற்றும் சமூக பாதிப்புகளை அறிய உதவவே இத்திட்டம். மேலும் வகைப்படுத்தித் தேர்வு செய்யும் கருவியாகவும் பயன்படும். வேளாண்மைக்கு நேரும் இடர், அதைத் தடுப்பதற்கான திட்டம், பூச்சி மேலாண்மைத்திட்டம், பாலின சமத்துவம் போன்றவையும் கணக்கில் கொள்ளும். தவிர, திட்ட செயல்பாடுகளை கண்காணித்தல், திறன் மேம்பாட்டிற்கான பயிற்சித் திட்டம், இத்திட்டத்தினை நடைமுறைப்படுத்துவதற்கான வரவு செலவு கணக்கையும் கொண்டிருக்கிறது.

PHOTO GALLERY

Sub basin: Cheyyar

Cheiyar: Structured Consultation with Officials and Farmers

Kunnathur: FDG with Farmers

Kunnathur Tank: Tansect Walk

ParvathiAgaram Tank: November 2016

ParvathiAgaram Tank: Transect walk

ParvathiAgaram: Paddy field in the Tank Ayacut

ParvathiAgaram: FGD with Women SHG

Sub basin: Thirumanimuthar

Namakal: Structured consultation with Farmers and Official

Idumankulam tank: December 2016

Pillur: FGD with Farmer

Idumankulam: Discussion with VAO

BairojiAnicut: Transect walk

Minnakkal: Supply Channel for the tank

MadiyampattiAnicut: Transect walk

Sub Basin: Gadananadhi

Pappakudi: Transecting in the tank

Pappakudi: FGD with Women group

Nanthanthattai: FGD with Water Users

PallakalPuddukudi Tank: Dumped Solid waste

Piramadesam: Discussion with local farmers

Alwarkuruchi Tank: Algae in the water surface

Melaambur: Edible yam crop

PallakalPuddukudi: FGD with women SHGs

Sub Basin: Pazhayar

Erachikulam: Farmers' Association building

Tirupathisaram: SWOCA with Famers

Theroor: FGD with Women SHGs

Arumanallur: FGD with Farmers

Parakkai: FGD with Farmers

Thengampudur: Sewage in supply canal

Suchindram: Farmers Interaction with officials

Parakkai: FGD with Women SHG.

Sub Basin: Ponnaniyar

Ponnaniyar Dam site: Discussion with Public

Paganur: FGD with Farmers

Kallikudi: Farmers interaction with Officials

Kallikudi: Farmers using weeder.

Thayanur Lake: November 2016

Gundur: FGD with women SHG

Neerpalani: FGD with Farmers

Kodunbalur: FGD with women SHG

Sub Basin: Lower Vaigai

V.Karisalkulam: FGD with Farmers

Karendhal: SWOCA with Farmers

Karisalkulam: FGD with women SHG

Athiyuthu: FGD with Farmers

Puthendhal Tank: Grazing of goats

Athiyuthu: Salt pans

Chithanendhal: FGD with Farmers

Mummudisathan: FGD with Farmers

Sub Basin: Krishnagiri to Pambar

Keelpaiyur: SWOCA with farmers

Bayiralli: FGD with women SHGs

Agraharam: Line Dept officials interacting with farmers

Echambadi LMC at Agraharam: present condition

Vedapatti : Discussion with IrulaTribes

Barur Tank: Fish loading

Vaadamangalam: FGD with Farmers

Barur: SWOCA with WUA

Sub Basin: Vaniyar

Papireddipatti: SWOCA WUA LMC & RMC

Allapuram lake: December 2016

Allapuram: FGD with Farmers

Marukalampatti: FGD with Women SHG

Vaachathi: FGD with Malayali Farmers

Vaachathi: FGD with women SHG- Malayali tribe

Vaniyar Dam

Agraharam: Minor Irrigation Tank

Sub Basin: Upper Palar

Kandhaneri: Solar panel for pump set

Reddimanguppam tank: December 2016

Kethandapatti: Field channel and WUA building

Kethandapatti: SWOCA with WUA

Mittur: NarkaniFarmers Production Company:

Nagaleri: FGD with Farmers

Nagaleri: encroachment – Brick kiln

Nagaleri: Transect walk

Sub Basin: Upper Bhavani

Nellithurai: Irrigation Channel at Nellithurai

Oddandurai: SWOCA with Farmers

Keel sengalur: Interview with Irula Farmers

Kilpillur:Irula farming land

Belathi tank: Transect walk

Belathi: FGD with Farmers

Bellathi: Crops in the Ayacut

Ariyurvattam: Interview with Pal Kurumba tribe

Sub basin: Sathiyar Odai

Madurai: Structured consultation with line department officials and farmer for the feedback on the study

Madurai: Structured consultation with line department officials and farmer for the feedback on the study

Sub basin: Cauvery Delta

Tanjavur: Structured consultation with line department officials and farmer for the feedback on the study

Tanjavur: Structured consultation with line department officials and farmer for the feedback on the study

Organization	Training needs	Resource organization
	business opportunities	NGOs and other institutions
	Packaging and Branding	Indian institute for crop processing and technology, Thanjavur
Horticultural Department	Impact of Climate variability on crops, importance of adaptation measures, contingency plan etc	Tamil Nadu Agricultural University
	Updating skills and knowledge on IPM and INM	Tamil Nadu Agricultural University
	Organic farming practices	Centre for Sustainable Agriculture, Hyderabad
Fisheries Department	Fish farming in farm ponds and value addition of fishery products	Shall be identified based on specific requirements
Common training needs		
	Community mobilization and grass root institution building such as WUA	M.S.Swaminathan Research Foundation, Chennai, NGOs and other institutions
	Mainstreaming gender in irrigation and agriculture	M.S.Swaminathan Research Foundation, Chennai, NGOs and other institutions
	Participatory Irrigation Management and WUA	NGOs and other institutions

7.3 Participatory Irrigation Management (PIM)

To meet the requirement of increasing human as well as animal population it is essential to constantly enhance the agricultural production. Irrigated farming meets the maximum need, and in the present unfavourable climatic and weather conditions, it is very important to judiciously use the available water through a proper management system. Farming community is the primary stakeholder; therefore their genuine involvement in the management is unavoidable in managing the water bodies. To ensure this participatory Irrigation Management method was proposed and to provide sound framework at national and state levels acts were enacted. The legal framework provides the provision for creation of village level WUAs.

The idea of PIM has a long history, in the year 1938 Visveshwarayya Committee recommended entrusting irrigation to a group of farmers if they are willing to cooperate and manage the irrigation system. Later in 1974 The Command Area Development Programme envisaged the active participation of farmers in the irrigation management. Subsequently the fifth and sixth plans and, The National Water Policy 1987 emphasized the need for the participation of farmers in the management of irrigation.

The National water policy 2002 paved way for the formation of WUA. The policy stressed the participation of water users would definitely help for better management and the optimal utilization of water for irrigation.

WAPCOS Limited
(A Government of India Undertaking)

Ministry of Water Resources, River Development & Ganga Rejuvenation

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March 23, 2017

GOVERNMENT OF TAMIL NADU
PUBLIC WORKS DEPARTMENT
WATER RESOURCES ORGANISATION

Environmental & Social Assessment and Preparation of Environmental & Social Management Framework (ESMF) and Environment & Social Management Plans (ESMP) for 66 River Sub Basins in the TN-IAMWARM-2 Project


Resettlement Policy Framework


WAPCOS Limited
(A Government of India Undertaking)

Ministry of Water Resources, River Development & Ganga Rejuvenation

March 23, 2017

Version - 10

Resettlement Policy Framework

Introduction

The Government of Tamil Nadu (GoTN), through the Government of India has applied for a loan of about 318 million USD from the World Bank (WB) for implementation of the proposed Tamil Nadu Irrigated Agriculture Modernization and Water Bodies Restoration and Management (TN-IAMWARM-2) Project, which is currently under preparatory stage. As part of the project, the Public Works Department/Water Resources Organization (PWD/WRO), GoTN, being the Project Coordination Unit for TN-IAMWARM-2 has engaged WAPCOS Limited, A Government of India Undertaking under the Ministry of Water Resources, River Development and Ganga Rejuvenation as Consultant for conducting Environmental and Social Assessment (ESA) of the TN-IAMWARM-2 Project and Preparation of Management Plans and/or Framework for managing adverse Environmental and Social Impacts, Risks and Benefits.

The proposed project will underscore the importance of introducing innovative aspects into the design of the new project built on lessons learned from TN-IAMWARM-1 Project and also reflect the evolving needs of the state in the area of agriculture modernization. The development objectives of the proposed TN-IAMWARM-2 project in the selected sixty-six sub-basin areas in Tamil Nadu are as follows:

- Enhancement of productivity and climate resilience of irrigated agriculture
- Improvement in water management
- To support value-addition for farmers and agro entrepreneurs in agricultural, horticulture, livestock and fisheries sectors

The 66 sub basins, which were not covered under TN-IAMWARM-1 has been selected for development in seven different Agro-Climate Zones of Tamil Nadu.

The project interventions are grouped into three main components:

- ***Component A:***Irrigation and Water Management
- ***Component B:***Agriculture Productivity Enhancement, Diversification, Marketing and Value Addition
- ***Component C:***Project Management Support

The proposed project interventions, do not envisage any new land acquisition/ appropriation and R&R issues.

During the discussions with the survey team some farmers mentioned about the likelihood of temporary encroachment in the peripheries of the tanks. Due to increasing water scarcity in the present situation, farmers in the villages are keen on protecting the tanks from any encroachment.

Even though, prima facie, there is no major land acquisition or resettlement and rehabilitation expected under the Project, the ESA provides a detailed framework and guidelines for implementing. Further Land Acquisition and Resettlement and Rehabilitation Policies are built on the good practice examples set under TNWRCP. If and when required, this framework shall be used as outlined in the ESA and SEMF.

Project Principles for Land Use

For implementation of components that require land, TNIAMP will not resort to acquisition of private Patta/Titled land and other assets under the provisions of RFCTLAR&R Act. The project will also not resort to removal of encroachments in irrigation tanks to be used for modernization The project for modernization of irrigation will only use sites that are available free of any use, encumbrances, claims etc.

World Bank's Social Safeguards Policies

OP 4.10 on **Indigenous Peoples** is not triggered in this project as the project will not require any land on which the Scheduled Tribes/Indigenous Peoples depend to meet their social, economic and cultural needs. This is because such lands are not located in the Sub-Basins where the project will be implemented. This means, the project will not have any adverse impacts on Scheduled Tribes. Though there are scattered families of Scheduled Tribes living in areas adjoining sub-basins, whose sources of livelihood is fishing in the rivers, they will not be affected by the project as the project does not have any connection with rivers and flow of water in them. In view of this, the project does not trigger OP 4.10 on Indigenous Peoples.

OP 4.12 on **Involuntary Resettlement** is triggered in spite of the project's principles for land use. This is to cover an unlikely eventuality of encroachments in water-bodies/irrigation tanks as identified in the ESIA. Social Screening will be undertaken to identify irrigation tanks as the basis of including and/or excluding such sites for use.

The project will only use work sites in irrigation tanks that are available free of any encroachments so that the inclusion of such sites in irrigation tanks will not cause any adverse social risks resulting in involuntary resettlement.

Resettlement Policy Framework (RPF)

TN IAMWARM, the predecessor of TN IAMP, had prepared Guidelines for Implementing Land Acquisition and Resettlement and Rehabilitation built on the Good Practice under TN Water Resources Consolidation Project (TNWRCP). The preparation of Guidelines was in spite of the fact that TN IAM WARM did not cause any adverse social risks of those with title and those without title resulting in involuntary resettlement. Continuing with Good Practice, TN IAMP is also preparing this Resettlement Policy Framework (RPF).

The World Bank's Social Safeguard Policy consists of OP 4-12 – Involuntary Resettlement and OP 4.10 – Indigenous Peoples. The OP on Involuntary Resettlement has clearly stated policy

objectives, impacts covered, mitigation measures and eligibility criteria. It also has guidelines for preparing Resettlement Policy Framework and this RPF is in accordance with these guidelines. The RPF applies to all components and sub-components of the project.

OBJECTIVES OF RESETTLEMENT POLICY FRAMEWORK

The social safeguard policy objectives of Tamil Nadu Irrigated Agriculture Modernization and Water Bodies Restoration and Management (TN-IAMWARM-2) Project are the following and are in accordance with Bank's social safeguard policy requirement:

- To avoid involuntary resettlement where feasible, or minimized, exploring all viable alternative project designs;
- To plan resettlement activities as sustainable development program where it is not feasible to avoid resettlement by allocating sufficient resources to enable the persons affected to share in project benefits
- To assist the affected to improve their livelihoods and standards of living or at least to restore them to pre-displacement levels
- To see whether or not the affected persons are self-identified as members of a distinct cultural group with collective attachment to distinct places and to natural resources in the project area

Social Safeguard Screening

The TN-IAMWARM-2 will screen each vulnerable tank listed for rehabilitation work to promote Irrigation and Water Management. The screening is to identify whether there is any encroachment necesscitating involuntary resettlement. Social Safeguard Screening (SSS) will be done separately for each vulnerable tank in the list meant for rehabilitation.

Social Impact Assessment (SIA) including socio-economic survey will be undertaken once the SSS indicates that the Bank's policy on involuntary resettlement is triggered in a sub-basin and if the project decides to undertake project activities in the sub-basin. This will be followed by the preparation Rehabilitation Action Plan (RAP) - full or abbreviated as required.

Adverse Impacts Covered

The RPF covers adverse social and economic impacts caused by involuntary taking of land under different tenure systems resulting in loss of shelter leading to relocation, loss of assets or access to assets on which people depend for their social, economic and cultural needs and loss of income sources or means of livelihood whether or not the affected persons need to be relocated. Some of the adverse impacts covered are:

- **Loss of shelter/homestead** resulting in displacement and involuntary resettlement caused by acquisition of private *patta*land and/or transfer of Government land under different tenure systems. Loss of shelter/homestead will also include such temporary loss faced by tenants and lease holders;

- **Loss of land** used for residential, agricultural and commercial/small business purposes;
- **Loss of other structures** such as those used for commercial and/or small business purposes resulting in loss of business and income;
- **Loss of agricultural income** and this includes loss of crops, trees etc.;
- **Loss of assets or access to assets** including those accessed by community to meet their communal needs such as firewood and fodder; and
- **Loss of income or means of livelihood** caused by land acquisition and/or transfer of Government land under different tenure

The losses mentioned above could be converted into adverse impacts such as (i) Loss of land; (ii) loss of structures, both residential and commercial; (iii) Loss of sources of income or means of livelihood; (iv) Loss of public infrastructure and (v) Loss of access to common resources/properties.

Criteria for Eligibility

This RPF recognizes Project Affected Persons (PAPs) as belonging to one of the following three groups;

1. Those with formal legal rights to the land and other rights recognized by Indian legal framework;
2. Those without formal legal rights to land at the time of census socio-economic survey but have a claim to such land or assets under Indian legal framework or becomes recognized through a process identified in the Resettlement Plan and
3. Those without recognizable legal right or claim to the land they are occupying.

To achieve the objectives of this RPF, particular attention will be paid to the needs of vulnerable groups among the affected especially those living Below the Poverty Line (BPL), the landless, the elderly, women and children.The Entitlement Matrix that is a part of this RPF has provisions for compensation and resettlement assistance to all Project Affected Persons as categorized above in broad terms. Some of the terms used in the Entitlement Matrix are defined below.

Project Affected Person is the one affected byinvoluntary resettlement and who stands to lose all or part of their physical assets such as productive land, commercial/business structure, access to common properties and sources/means of livelihood and income;

Project Displaced Person is the one who has lost homestead/shelter and or commercial/business structure and has to be relocated. A Project Displaced Person is generally a Project Affected Person also;

Titleholder is a person who has legal title/*Patta*/document to support his/her claim/right towards ownership of land and all assets on the land – residential, commercial/business, crops, trees etc.

Squatter, a non-title holder, is a person who has settled on Government/public land without permission and has built residential and/or commercial structure, or has illegally occupied Government/public structures prior to the Cut-Off-Date;

Encroacher is a person who has trespassed into Government/public land adjacent to his/her own land and using it for residential, rental, commercial and business purposes and deriving income prior to the Cut-Off-Date; and

Cut-Off-Date is the date on which notification for acquisition of private land is issued under The Right to Fair Compensation and Transparency in Land Acquisition, Resettlement and Rehabilitation Act (RFCTLAR&R) Act, 2013 for acquisition of private titled land. For those without title, the Cut-Off Date shall be the date on which census socio-economic survey is being undertaken

PRINCIPLES FOR COMPENSATION AND RESETTLEMENT ASSISTANCE

The payment of compensation for all acquired land, structures, both residential and commercial, and other assets will be paid at replacement costs to title holders in accordance with the provisions of RFCTLAR&R Act. In addition to compensation, they will also be paid resettlement assistance that includes assistance for relocation where necessary.

As far as those without title to the land they are occupying and are considered as “non-title holders” are concerned, they are not entitled for compensation for the land they illegally occupy but eligible for the structures they have built and grown on the land in addition to resettlement assistance. Cut-off date for non-title holders to become eligible for resettlement assistance will be the date on which the census socio-economic survey is done. Any non-title holders who illegally occupy the public land will not be eligible for any resettlement assistance.

Payment of compensation and resettlement assistance to all project affected persons irrespective of their legal status will be on the basis of entitlements as set out in the Entitlement Matrix that is attached as given below.

Entitlement Matrix		
Impact type	**Entitled entity**	**Entitlement based on The Right to Fair Compensation and Transparency in Land Acquisition and Resettlement Act 2013**
1. Loss of Land (Titleholders)		
1A. Loss of Agricultural Land	Affected Family (Titleholder)	▸ Cash compensation at replacement cost as determined according to The Right to Fair Compensation and Transparency in Land Acquisition and Resettlement Act 2013 or replacement of land if available. ▸ If the residual plot is not viable and PAP becomes a marginal farmer, then any of the following three options are to be given to the PAP, subject to PAP's acceptance: • Acquire the required land and pay compensation and assistance for the same. • If PAP so wishes acquire the remaining portion of the plot and pay compensation and assistance for the entire plot including residual part. • If PAP is from vulnerable group, compensation for the entire land by means of land for land will be provided, if PAP wants so, provided that land of equal productive value is available. • If the land for land option is exercised, then an additional INR 50,000/- per acre will be paid for land preparation. • An amount of INR 25,000/- will be provided for each PAP towards building a cattle shed etc. ▸ If the PAP wishes to buy land with the compensation amount, then an additional INR 50,000/- per acre will be paid for land preparation.

		▸ Subsistence Grant of INR 50,000/- ▸ One time resettlement allowance of INR 50,000/- ▸ All fees, stamp duties, taxes and other charges, as applicable under the relevant laws, incurred in the relocation and rehabilitation process, are to be borne by the IA.
1B. Loss of Residential/ Commercial land	Affected Family (Titleholder)	▸ Cash compensation at replacement cost as determined according to The Right to Fair Compensation and Transparency in Land Acquisition and Resettlement Act 2013 or replacement of land if available. ▸ Subsistence Grant of INR 50,000/- ▸ One time resettlement allowance of INR 50,000/- ▸ All fees, stamp duties, taxes and other charges, as applicable under the relevant laws, incurred in the relocation and rehabilitation process, are to be borne by the IA.
2. Loss of Structures (Titleholders)		
2A. Loss of Residential Structures	Affected Family (Titleholder)	▸ Compensation of structure will be paid at the replacement cost to be calculated as per latest prevailing Basic Schedule of Rates (BSR) without depreciation. ▸ Assistance of INR 30,000/- towards temporary accommodation or Rental assistance as per the prevalent rate in the form of grant to cover maximum six month rentals, whichever is higher. ▸ Subsistence Grant of INR 50,000/- ▸ Transportation assistance of INR 50,000/- ▸ One time resettlement allowance of INR 50,000/ ▸ Relocation assistance under existing Government schemes/programs ▸ Right to salvage material from demolished structure and frontage etc.

2B. Loss of Rental Accommodation (Residential/ Commercial	Tenants	▸ Rental assistance for both residential & commercial tenants: Assistance of INR 30,000/- towards temporary accommodation or Rental assistance as per the prevalent rate in the form of grant to cover maximum six month rentals, whichever is higher. ▸ Additional structures erected by tenants will also be compensated separately directly to the tenants. ▸ Transport/ Shifting assistance based on type of house and household assets, subject to a minimum of INR 50,000/-. ▸ Any advance deposited by the tenants will be refunded from owners total compensation package to the tenant on submission of documentary evidence. ▸ Right to salvage material from demolished structure and frontage etc. erected by tenants.
3. Loss of Structures Residential/Commercial (Non-Titleholders)		
3A. Loss of Immovable and Pucca Structures (Residential/ Commercial)	Squatters/ Encroachers	▸ Squatters and Encroachers will be notified and given one month time to remove their assets or enough time to harvest their present crops. ▸ Compensation for loss of structures at replacement cost. All asset/structures impacted will be compensated irrespective of the notice time. ▸ Subsistence Grant of INR 50,000/- ▸ Transport/ Shifting assistance of INR 50,000/-. ▸ One time resettlement allowance of INR 50,000/- ▸ Relocation assistance under existing Government schemes/programs ▸ For Squatters and Encroachers right to salvage material from the demolished structure.
4. Loss of Crops	▸ Titleholders ▸ Share	▸ Advance notice to all to harvest crops, fruits and remove trees.

and Trees	Croppers ▸ Lease Holders ▸ Non-title holders	▸ In case of standing crops, cash compensation at current market prices for mature crops based on average production. ▸ For fruit bearing trees compensation at average fruit production for next 15 years to be computed at current market value. ▸ For timber trees compensation at market price based on kind of trees.
4. Loss of livelihood		
4A. Loss of Primary Source of Income/ Livelihood	▸ Titleholders ▸ Non-Titleholders ▸ Agricultural Labourers ▸ Share Croppers	▸ Subsistence Grant of INR 50,000/- ▸ INR 25,000/- for cattle shed or petty shop ▸ One time grant of INR 25,000/- to artisans, small traders and certain others ▸ Employment opportunity for PAPS in the sub-project construction work, if available and if so desired by them. ▸ National/State level job card under National Rural Employment Guarantee Program. ▸ Income generation skill upgrading vocational training of their choice at a rate of INR 10,000/- ▸ For Agricultural Labourers and Share Croppers an assistance of 500 days of wages at prevailing minimum wage rate ▸ One time resettlement allowance of INR 50,000/-
5. Common Property Resources		
5A. Loss of Common Property Resources	Community	▸ Reconstruction as per latest norms and guidelines, Commissioning and handing over to concerned departments/ community of all affected community property resources with community consultation and participation

6. Vulnerable		
6A. Vulnerable PAPs	Women headed households, Widows, STs, Chronically ill, old persons etc.	▸ A onetime assistance of INR 50,000/- over and above other entitlements. ▸ Handholding for ensured access to other government subsidies, schemes and services
7. Other Unforeseen/ Unanticipated Impacts		
7A. Unforeseen/ Unanticipated Impacts		▸ Any unforeseen/ unanticipated impacts due to the sub-projects will be documented and mitigated based on the spirit of the principle agreed upon in this framework.

MITIGATION PRINCIPLES

In case it is not possible to avoid adverse impacts, the TN-IAMWARM-II will mitigate them in accordance with the following principles.

- The TN-IAMWARM-II will follow the process of resettlement, as set out in the following section, to identify potential social safeguard issues and will also plan and implement mitigation measures consistent with social safeguard policies of World Bank and RFCTLAR&R Act;
- Resettlement of project affected/displaced persons will be planned and implemented as a sustainable development program as an integral part of TN-IAMWARM-II;
- Lack of legal title to illegally occupied Government/public land and structures will not be considered a bar to resettlement assistance;
- Homestead losers, including those who are squatting on Government/public land without authority/title will also be assisted with physical relocation;
- Commercial/business structure losers will also be provided with appropriate alternative structures such as shops irrespective of their legal status;
- Vulnerable sections of project affected/displaced persons such as those living Below the Poverty Line, the aged, vulnerable sections of the society such as destitutes, female-headed families, those belonging to scheduled tribes/castes will be identified through resettlement process and mitigated through targeted support for capacity building and income generation;
- Construction activities/civil works related to the project will be appropriately linked with resettlement process ensuring that all affected/displaced persons are provided with compensation and resettlement assistance, and also relocated where necessary;

- The process of resettlement will be monitored through independent third party consultant to ensure identify and address issues affecting the process of resettlement and also to ensure social safeguard compliance and;
- The TN-IAMWARM-IIwill undertake transparent and informed public consultations with multi-level stakeholders and will also meet all disclosure requirements at National and State levels in addition to placing all relevant documents at Bank's InfoShop

The Process of Involuntary Resettlement

The structure of involuntary resettlement to mitigate adverse impacts involves the following processes:

- Undertaking of Social Safeguard Screening to determine whether or not this Program will trigger social safeguard policies – Involuntary Resettlement
- Undertaking of Social Impact Assessment (SIA) including census socio-economic survey to identify and categorize all project affected persons irrespective of their legal status;
- Preparation of Involuntary Resettlement Action Plan

If Social Screening indicates, there is a need to prepare Resettlement Action Plan (RAP) a Social Impact Assessment as explained below will be undertaken prior to preparing RAPs.

Process of Social Impact Assessment (SIA)

The Social Impact Assessment (SIA) will focus on the following in case the process of social screening indicates that there are adverse impacts to be addressed:

1. Review of the patterns of use of land under different tenure systems – what category of land under tenure systems, who/how many used each type of land, for what purpose – agricultural and other means of income/sources of livelihood;
2. Assess their adverse socio-economic on those who depended on them along with patterns of use, type of adverse impact, the number of persons affected by such a transfer of public land;
3. Undertake a census socio-economic survey of all affected by the type of loss, adverse social and economic impacts;
4. Formulate a strategy to consult them through a prior and informed participatory process that is also transparent;
5. Assess whether all those who were to be paid compensation for land had been compensated and confirm that no claims for compensation are pending;
6. Assess whether the loss of access to/claims over common properties for social and economic needs had been compensated and that no claims are pending for claims and access rights;
7. Identification of the patterns of use of tank area for agricultural or as any other means of income/livelihood
8. Identification of vulnerable groups among the affected for targeted attention to help them with additional assistance; and

9. Based on the assessment, entitlement for compensation shall be in accordance with the Entitlement Matrix.

In addition to the Social Screening Format that is attached asAnnexure-I, the guidelines for the preparation of Involuntary Resettlement Action Plans, both full and abbreviated are attached as Annexure II to the RPF. A full Involuntary Resettlement Action Plan (RAP) will be prepared if the total number of Project Affected Persons, affected both by acquisition of private land and transfer of Government/public land exceed 200 or more. An abbreviated Resettlement Action Plan (ARAP) will be prepared if the number of Project Affected Persons is less than 200.

Multi Level Consultation and Participation

The IAMWARM -2 will undertake multi-level stakeholder's analysis as part of its policy of preparing the Program through a process of prior, transparent and informed consultation. In addition to this, the IAMWARM -2 will also undertake stakeholder's analysis and consultations with particular focus on project affected persons and communities. The process of consultation and participation will provide an opportunity to all affected persons; community based organizations, interest groups, NGOs/CSOs to express their concerns related to likely adverse impacts of the Program and plans to mitigate them.

The process of consultation and participation will also include separate focus group discussions with groups of women and other vulnerable sections of society.

This process will also provide an opportunity for the Program to explain, among others, the IAMWARM-2 criteria for selection of tanks that would avoid adverse social, economic and cultural impacts, plans to mitigate them in case such adverse impacts occur and also the benefits of the Program. All key issues and concerns expressed will be documented to facilitate necessary actions

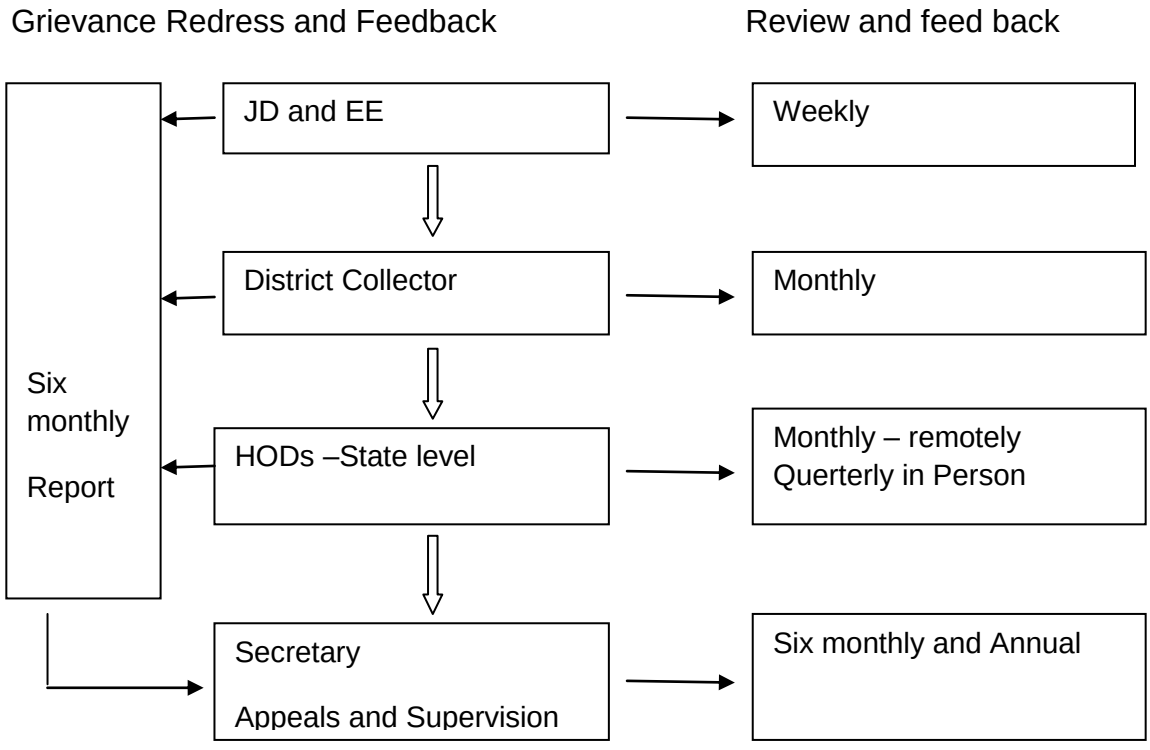
GRIEVANCE REDRESS MECHANISM

Grievance Redress Mechanism (GRM) is one of the important tools for project management where major stakeholders are public community having diverse socio-economic status. The TN-IAMWARM-2 project deals with the agricultural resources across the state and hence likely to have grievances in terms of sharing the resources and adaptation to the advances in agricultural diversification, agriculture entrepreneurship, and movement towards climate smart agriculture with relevant agriculture – water related investments. The institutional arrangement proposed in the project needs to ensure the concerns of all the project beneficiaries and stakeholders are addressed and accommodated in a comprehensive manner.

The Grievance Redress Committee (GRC)

GRM is an essential component of any project administration, particularly if the project involves the local communities with diverse socio economic backgrounds as the major stakeholders. The grievance redress process will be a continuous, transparent and participatory process that would be an integral part of the project's accountability and governance agenda.

A project level GRM will be in place for addressing social, environmental and project related grievances. The GRM will have multi level structures and processes. At the district level the committee is made up of respective JDs of line departments and EE, WRD of the sub-basin, this committee meets on weekly basis. This committee will look after the grievances related to irrigation and water management. At the next level the Collector heads the committee and convenes the meetings monthly once. The Collectors will take care of the other grievances related to the project activities. The next level is the HODs at the state level they contact remotely monthly once and organize meetings at every quarterly. Secretary occupies the next level in the structure and in charge of overall appeals and supervision of grievance redress; he calls for a meeting once in six months and annually. For every six months report is prepared at all levels and sent to the Secretary.



Effort will be made to create awareness about GRC mechanism to the beneficiaries through use of flyers and pamphlets at the village, Block and District level. The GRC will receive and redress

all complaints and grievances that relate to the Project implementation that are formally brought to the GRC by individuals and group of individuals who have a grievance.

Scope of GRC

The GRC will receive and redress grievances and complaints that are formally brought to the GRC in writing by the persons and/or group of persons who have a grievance because of the Program's adverse impact on him/her and them. The grievance would, among others, relate to payment of compensation and involuntary resettlement assistance to all project affected persons in accordance with the eligibility criteria as set out in this RPF.

Process of GRC

- The GRC will receive all grievances/complaints and enter them in the Grievance Register;
- The GRC will work out a timeframe to redress grievances/complaints if such grievances/complaints are not redressed during the first meeting;
- The GRC will acknowledge receipt of all grievances/complaints, by registered post, within 7 days of receipt;
- The GRC will consider and redress grievances/complaints through public and transparent process in which all those who have lodged their grievances and complaints in order to facilitate transparency and accountability;
- The GRC will communicate its decisions/redress in writing to the complainants within 4 weeks depending on the nature of complaints and
- The GRC decisions are not the final and the grieved and complainants have the right to seek judicial redress if they are not happy with the decisions of GRC. But it should not paraphrase the constitutional fundamental rights.

Name, Office Address, Contact number and email id of each of the SDMs in affected districts shall be communicated to all the beneficiaries. The beneficiaries can register complaints in following ways:

1. Open House at the Block and District levels.
2. By ordinary/registered/speed post addressed to concerned SDM of their area.
3. Online through the portal http://onlinegdp.tn.nic.in/indexe.php

When closing the complaint, agreement should be made with the complainant onremedy, and both parties sign to their approval of the case being closed and outcome accepted. Copies are kept in both hard copy and electronic (please see documentation of Grievance process) by both parties

Documentation of the Grievance Redress Process

The process of grievance redress will be a regular, transparent and participatory one and is an important and integral part of governance and social accountability agenda. GRC will keep a

separate *Case File* for each grievance/complaint received in which all related documents and record of discussions are kept. GRC will also maintain the following three Registers. GRC will prepare a six-monthly report and send it to Secretary.

Complaints/Grievances Register will contain (a) Serial Number; (b) Case Number; (c) Name of the Grieved/Complainant; (d) Name of Father/Husband; (e) Gender (f) Age; (g) Full Address; (h) Brief details of grievance/complaint; (i) List of documents, if any, attached; (j) Details of previous grievance/complaint, if any; (k) Date of receipt of grievance/complaint and (l) Date of acknowledgement of grievance/complaint.

Resolution Register will have details of (1) Serial Number; (2) Case Number; (3) Name of the Grieved/Complainant; (4) Details of grievance/complaint (5) Field visit, if any, and findings; (6) Date of public hearing; (7) GRC's decision; (8) Details of decisions – redressed, pending or rejected and (9) Agreement reached/Commitment made.

Closing Register will contain details of (i) Serial Number; (ii) Case Number; (iii) Name of the Grieved/Complainant; (iv) Date of Hearing; (v) GRC's decision; (vi) GRC's decision – whether or not accepted; (vii) Whether the grieved/complainant seeking legal redress; (viii) Date, medium and mode of communication to the grieved/complainant and (ix) Date of closing of grievance/complaint.

Right to seek Legal Redress

- The grieved/complainant will have the right to seek legal redress through the judicial system if he/she or they are not satisfied with the decisions of the GRC. The option of seeking redress through the GRC or through the judicial system will be explained to project affected persons during the process of public consultation and participation. But it should not paraphrase the constitutional fundamental rights.

World Bank Grievance Redress Service (GRS)

The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaint to the WB's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the World Bank's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit http://www.worldbank.org/GRS. For information on how to submit complaints to the World Bank Inspection Panel, please visit www.inspectionpanel.org.

MULTI-LEVEL PUBLIC DISCLOSURES

GRC will disclose the SMF and related social safeguard documents/instruments at three levels, at the level of (i) District Collector; (ii) Secretary and (iii) World Bank.

At the level of theSecretary, the SMF and all social safeguard elated documents, including Resettlement Policy Framework and Resettlement Instruments including Entitlement Matrix and Resettlement Action Plans willbe separately identified and uploaded in the Governement of Tamil Nadu Website in English and in Tamil as the Program covers a number of Districts in Tamil Nadu.

At the level of District Collector, the SMF and social safeguard related documents/instruments such as the SMF, Resettlement Policy Framework including the Entitlement Matrix; Resettlement Action Plans etcwill be separately identified and disclosed in the website of each District in English and Tamil language.

At the level of the World Bank, the Bank will disclose this SMF and its RPF and any other future social safeguard instruments such as the reports of SIA and resultant Resettlement Instruments at the ***Infoshop***for downloading and reference by interested stakeholders.

Annexure-I

Social Screening for Vulnerable Tanks

Details of Irrigation Tank

Name of the Region	
Name of Sub Basin	
Name of the Village/Gram Panchayat	
Name of Irrigation Tank, if any	
Category as per ESMF	

Details of Encroachments and pollution – tick appropriate column

Is there Encroachment	Yes	No
If yes, where	Tank Bunds	Fore-Shore
Use of Encroached Land	Residence	Agriculture
	Commercial	Others

Participants in Social Screening

Name of Participant	Name of Organization	Designation

Place of Social Screening

Name of Social Screening Place	
Date of Social Screening	
Time of Social Screening	

This is to certify that on the basis of above Social Screening that this irrigation tank is categorized as Category _____ in accordance with the ESMF.

Signature	:	
Nameofpersonfillingform	:	
Designation	:	
ForuseofWRD	:	
Signature	:	
NameofpersonverifyingformatWRD	:	
Designation	:	

Annexure-II

Guidelines for preparing Involuntary Resettlement Action Plans

- Details/categories of land handed over for expansion or establishment– type of land – private/patta land and Government/public land under different tenure systems in hectares;
- Details of patterns of use of the land when private land was acquired and Government/public land were transferred:
    - Residential;
    - Residential-cum-commercial;
    - Agricultural and other sources of income/livelihood
    - Access to common properties/natural resources for firewood, fodder, sources of income/livelihood, cultural properties etc.
- Details/number of affected persons whose use and access to common properties as listed above had been adversely affected;
- Details of compensation paid, if any; number of patta holders paid and number of patta holders to be paid;
- Details/number of affected persons who had been paid of compensation for assets lost on Government/public land and resettlement assistance provided to compensate loss of access to common properties and details of those yet to be compensated both in terms of income and access to common properties;
- Details of vulnerable groups of persons from among such affected;
- Census socio-economic survey of all project affected persons irrespective of their legal status;
- Details of prior, informed and transparent process of consultation
- Detail of Grievance Redress Process
- Resettlement Action Plan – compensation to be paid, payment of entitlement in accordance with the Entitlement Matrix, special assistance to vulnerable group of affected persons; budget, time frame, institutional arrangements for planning, monitoring and evaluation

WAPCOS Limited
(A Government of India Undertaking)

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March 23, 2017