E1341
vol. 2

ENVIRONMENTAL AND SOCIAL ASSESSMENT FOR RIVER BASINS IN TAMIL NADU – IAMWARM PROJECT

Draft Final Report

Submitted to
The Chief Engineer (Plan Formulation),
WRO, PWD – Chennai

by

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FOREWORD

Farm sector has been an important contributor to the Gross State Domestic Product (GSDP) of different states. However, over the years there is a perceptible decline in the farm sector contribution to GSDP. The decline is in a way linked to the absence of modern irrigation practices and water resource management. Given this context, the Irrigated Agriculture Modernization and Water Resource Management (IAMWARM) of the Tamil Nadu Government is a pioneering effort and could indeed be a trendsetter for other States.

The success of a pioneering initiative such as IAMWARM Project is naturally dependant on a thorough understanding of aspects such as modern agriculture, crop diversification, agriculture marketing, Rural IT Kiosks, livestock management, organic farming etc.

This report takes a close look at the Water Resources Consolidation Project (WRCP) which is the precursor of IAMWARM Project and makes a detailed presentation on the IAMWARM Project institutional framework, ESA approach to the study area, SEMF, Institutional strengthening and the key environmental and social issues of the river basins.

We earnestly believe that this report would contribute in the furtherance of productive agricultural practices and effective water resource management in the State of Tamil Nadu and contribute to enhance level of individual productivity and prosperity of the farmers in the State.

Further, we trust the report will prove to be a rallying force in our quest for a better environment and sustainable development.

Ms Gayathri Ramachandran, IAS
Director General, EPTRI &
Ex-officio Special Chief Secretary to
Government of Andhra Pradesh

Hyderabad
March, 2006

ACKNOWLEDGEMENT

We would like to thank the following officials and organizations for sharing their valuable time and inputs to carry out this study.

- Sri Vibhu Nair, IAS, Project Director, MDPU, Chennai
- The Chief Engineer (Plan Formulation), WRO, PWD, Senior Officers, Officers and Staff of WRO, PWD Chepauk.
- Sri Nagaraja Rao Harshdeep, Senior Environmental Specialist, South Asia Region, World Bank.
- Sri Rajagopalan, IAMWARM Project Consultant, WRO, Chennai
- The Director, Senior Officers, Officers and Staff of IWS
- The Director, Senior Officers, Officers and Staff of State Ground and Surface Water Resources Data Centre
- The Director, Department of Environment, Government of Tamil Nadu
- Officers and Staff of Environment Cell Division of Chief Engineer (PF), WRO, PWD and Environment Cells of IWS.
- GAIA International Organization, Thiruvanmiyur, Chennai.
- Several citizen groups, farmers, social workers and activists who have shown great interest in the study. Their inputs during the stakeholders' consultative workshops were extremely useful.
- Special thanks to Mr. Rajagopalan, IAMWARM Project Consultant, WRO, PWD, Sri Nagaraja Rao Harshdeep, Senior Environmental Specialist, South Asia Region, World Bank for their guidance and support for facilitating the study.

DIRECTOR GENERAL

Environment Protection Training & Research Institute (EPTRI)

CONTENTS

ANNEXURES

LIST OF TABLES

ABBREVIATIONS

ADD	Acute Diarrhea Disease
APWALTA	Andhra Pradesh Water, Land and Trees Act
BEES	Battelle Environment Evolution System
BMP	Basin Management Plan
BOD	Biological Oxygen Demand
BPL	Below Poverty Line
CAD	Computer Aided Drafting
CDM	Clean Development Mechanism
CE	Chief Engineer
CETP	Common Effluent Treatment Plant
CWC	Central Water Commission
DANIDA	Danish International Development Assistance
DFO	Divisional Forest Officer
DPR	Detailed Project Report
DSS	Decision Support System
DVMS	Data Base Management System
DWACRA	Development of Women and Child in Rural Areas
EAP	Environment Action Plan
EC	Electrical Conductivity
EIA	Environment Impact Assessment
EPTRI	Environment Protection Training and Research Institute
ESA	Environmental and Social Assessment
ESG	Environmental and Social Guidelines
ESR	Engineer Survey Report
ETI	Environment Training Institute
FOT	Farmers Organizations Turnover
FYM	Farm Yard Manure
GDI	Gender Development Index
GDP	Gross Domestic Product

GHG	Green House Gases
GIS	Geographic Information System
GoAP	Government of Andhra Pradesh
GoI	Government of India
GoTN	Government of Tamil Nadu
HADP	Hill Area Development Programme
HCWC	Horizontal Continuum Work Culture
HDI	Human Development Index
HDR	Human Development Report
HHL	House Hold Latrines
HYV	High Yielding Varieties
IAM	Impact Assessment Matrix
IAMWARM	Irrigated Agricultural Modernization and Water Resource Management
ICAR	Indian Council of Agriculture Research
ICR	Implementation Completion Report
ICID	International Commission for Irrigation and Drainage
IEC	Information Education and Communication
IES	Integrated Environment Strategies
IGA	Income Generating Activities
IIT	Indian Institute of Technology
IMTI	Irrigation Management and Training Institute
IMY	Indira Mahila Yojana
INM	Integrated Nutrient Management
IPDP	Indigenous Peoples' Development Plan
IPLS	Integrated Plant Nutrient Supply
IPM	Integrated Pest Management
IRDP	Integrated Rural Development Project
ISDI	Inter State Development Index
ITDA	Integrated Tribal Development Agency
IWRM	Integrated Water Resources Management
IWS	Institute of Water Studies
JFM	Joint Forest Management

KIWSS	Karnataka Integrated Water Supply and Sanitation
KLBC	Kodhaiar Left Bank Canal
LA	Land Acquisition
LPCD	Liters Percapita Per Day
M&E	Monitoring & Evolution
MCC	Municipal Corporation of Chennai
MDPP	Multi Disciplinary Project Preparation Panel
MDT	Multi Disciplinary Teams
MFP	Minor Forest Product
MIS	Management Information System
MNP	Minimum Needs Programme
MoEF	Ministry of Environment and Forests
MoU	Memorandum of Understanding
NA	Not Available
NDWM	National Drinking Water Mission
NGO	Non Governmental Organisation
NOC	No Objection Certificate
NRSA	National Remote Sensing Agency
O&M	Operation and Maintenance
OBC	Other Backward Caste
OHT	Over Head Tank
PACT	Project Appraisal Core Team
PAF	Project Affected Family
PAP	Project Affected Person
PC	Project Committee
PESA	Panchayats Extension to Scheduled Areas
PF	Plan Formulation
PFA	Prevention of Food Adulteration
PFC	Plan Formulation Circle
PHC	Private Household Connection
PHED	Public Health Engineering Department
PIM	Participatory Irrigation Management

PPC	Plant Protection Chemicals
PPTT	Project Planning Task Team
PRA	Participatory Research Appraisal
PSP	Public Stand Post
PWD	Public Works Department
QA	Quality Assurance
R&D	Research and Development
R&R	Rehabilitation and Resettlement
RAP	Resettlement Action Plan
RD	Rural Development
RP	Resettlement Plan
SAR	Sodium Absorption Ratio
SEMF	Social and Environmental Management Framework
SHG	Self Help Groups
SG&SWRDC	State Ground and Surface Water Resources Data Center
SPCB	State Pollution Control Board
SPOR	State Policy on Rehabilitation
TANWA	Tamil Nadu Women in Agriculture
TBO	Tree Borne Oil
TC	Territorial Committee
TDS	Total Dissolved Solids
TN	Tamil Nadu
TNIIN	Tamil Nadu Irrigation Information Network
TNPCB	Tamil Nadu Pollution Control Board
TNWRCP	Tamil Nadu Water Resources Consolidation Project
TOR	Terms of Reference
TWADB	Tamil Nadu Water and Drainage Board
UNEP	United Nations Environment Programme
UTM	Universal Transverse Mercator
VWSC	Village Water Supply Committee
WB	World Bank
WHC	Water Holding Capacity

WRCP	Water Resources Consolidation Project
WRCRC	Water Resources Control and Review Council
WRO	Water Resources Organization
WUA	Water User Association
WRRF	Water Resources Research Fund
WRM	Water Resources Management
ZPG	Zero Population Growth

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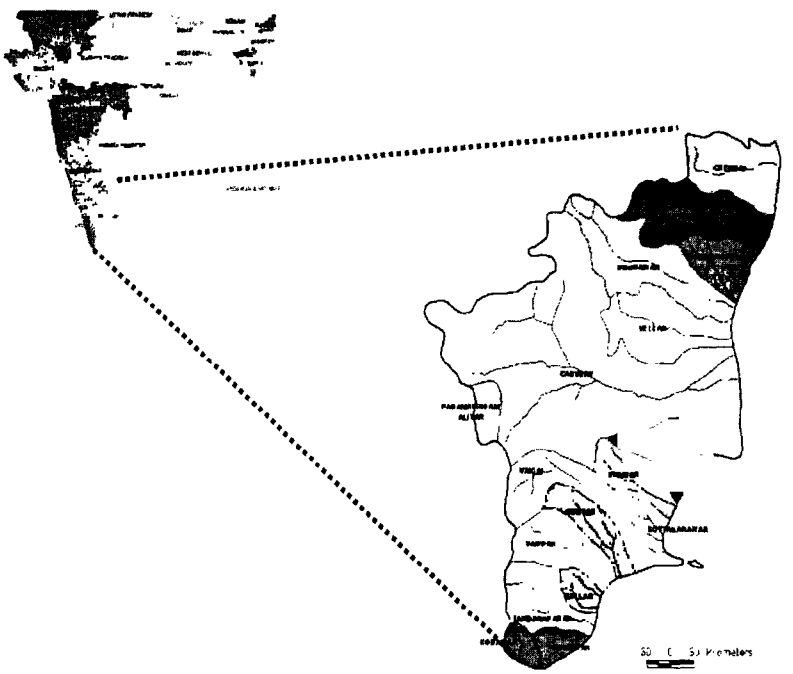
EXECUTIVE SUMMARY

Introduction

Tamil Nadu, the southern most State of the Indian peninsula is, spread over 1,30,058 km^2 and lies between 08° 05"N and 13° 35" N and 76° 15" E and 80° 20" E. It is surrounded by the States of Andhra Pradesh in the north, Kerala in the west, Karnataka on the Northwest, Indian Ocean on the south and the Bay of Bengal on the east. The population of Tamil Nadu is 6,21,10,839 as per 2001 Census. The rural population is entirely depending on agriculture.



Water Resources of Tamil Nadu

There are 17 river basin groups in Tamil Nadu, a majority of which are water-stressed. There are 61 major reservoirs, about 40,000 tanks and about 3.0 million wells, that heavily utilize the available surface water (17.5 BCM) and groundwater (15.3 BCM). Agriculture is the single largest consumer of water in the state, using 75% of the states water. Irrigation through a combination of canals, wells and tanks increases the reliability and availability of water for farming and is essential for cultivating crops in much of the state. About 30% of the net irrigated area is watered by canals, 21% by tanks and 49% is fed by wells. The remaining area is irrigated by other sources such as streams and springs. Rain fed agriculture employing about 25% of farmers accounts for 46% of the net sown area of 5.5 million hectares. The percapita availability of water resources in Tamil Nadu is 900 cubic meters a year as against 2200 cubic meters for all India.

Project Description

Tamil Nadu has implemented a World Bank financed Water Resources Consolidation Project (WRCP) from 1995-2004. The WRCP project has contributed to improving the environment by developing a State Environmental Planning Framework, by creating an Environmental Cell (EC) in the office of Chief Engineer (Plan Formulation), formation of three WRO EC divisions as focal points for environmental activities in the WRO, creating and strengthening an environmental wing at the Institute of Water Studies (IWS). A special unit in the PWD Secretariat has been created for Land Acquisition and Economic Rehabilitation (LAER). Water Resources Research Fund (WRRF) capitalizing on the success of the WRRF established in the TN WRCP, this investment would expand the activities undertaken using the fund for targeted studies, awareness raising and applied research on key water and irrigated agriculture issues (including related environmental and social development issues) facing the state.

The IAMWARM project is a successor to the recently-completed TN WRCP. The WRCP supported the state in a wide range of physical investments and institutional development that the IAMWARM project seeks to deepen. The key focus areas for IAMWARM are on irrigated agriculture modernization and on integrated water resources management to improve the productivity of water.

Proposed Project Development Objective: The proposed project development objective is to improve and sustain irrigation service delivery and productivity of irrigated agriculture with effective integrated water resources management in a river basin/sub-basin framework in Tamil Nadu.

The capacity-building activities would be state-wide in scope but the physical investments (rehabilitation of existing irrigation/water assets and support for agricultural diversification and improved livestock and fisheries management) under the project would be located in selected riverbasins/sub-basins throughout the State of Tamil Nadu, India.

The above objectives are to be achieved through investments for modernizing irrigation infrastructure (including systems rehabilitation, on-farm works, technical and managerial upgrading of institutions involved in irrigation development, operation and management, diversification of agriculture with appropriate extension measures and market linkages, promoting public-private partnerships, piloting innovative irrigation infrastructure development and management options) and re-orienting and strengthening institutions and instruments required for integrated effective water resources management in the State (including unbundling resource management from service delivery institutions).

The proposed project would consist of the following two key components:

- Irrigated Agriculture Modernization
- Water Resource Management

Irrigated Agriculture Modernization: Irrigation systems modernization in a sub-basin framework (including participatory and sustainable modernization of any water storages and

related irrigation infrastructure including system/non-system/rainfed tanks, pump set efficiency; measurement and monitoring covering about one million hectares expanding on the experience of the Hanuman Nadhi pilot. It is expected that this would be initiated in the Palar, Parambikulam Aliyar, Thambiraparani, Vaigai and Kodayar Basins and extended to other basins.

Institutional Modernization for Irrigated Agriculture (targeted modernization and improved asset inventory and management plans (for instance, dams, tanks, irrigation infrastructure, agricultural, horticultural, fisheries data) technical and managerial upgrading of irrigation development and service delivery institutions, modernization of manuals/procedures, computerization, LAN and WAN, knowledge management software, information management and sharing, public interaction, closer integration of WRO/PWD and Agriculture, Horticulture, Agricultural Engineering, Livestock/Fisheries Departments. Sustainable Agriculture modernization (cropping systems diversification and management to improve water conservation and farmer returns, integrated pest and nutrient management, public private Partnerships for extension, post-processing, certification, marketing)

An integrated Sub-basin Development and Management Plan would be developed for each sub-basin to provide a shared vision planning of proposed investments and capacity-building under the project.

Water Resources Management: This component is intended to strengthen the policy and institutional framework for improved sustainable management of water resources in the State. These activities would include:

State-level (converting the WRCRC to a State Water Council, amalgamating the associated sub-committees and upgrading the Institute of Water Studies (IWS) and the Surface and Groundwater Data Center (SGDC) to a State Water Resources Agency, establishment of a Water Regulator, development of appropriate policy and institutional arrangements, instruments, and information tools to promote flexible water resources management)

Basin-level (Strengthening, empowering and expanding Basin Development and Management Boards, development of basin analytical decision support systems targeted to support key policy and investment decisions, drought/flood preparedness, participatory structured consultations including strategic social and environmental assessments to systematically develop sub-basin development and management plans, demonstration pilots)

Environmental & Social Assessment (ESA)

The ESA has been carried out to provide input into the IAMWARM Project in accordance with the World Bank operational guidelines. The primary objective of the ESA is to identify the key environmental and social issues in 41 sub-basins relating to agriculture (irrigation systems improvement, agriculture, horticulture, fisheries, etc,). A wide range of data has been collected pertaining to environmental and social issues and prepared SEMF.

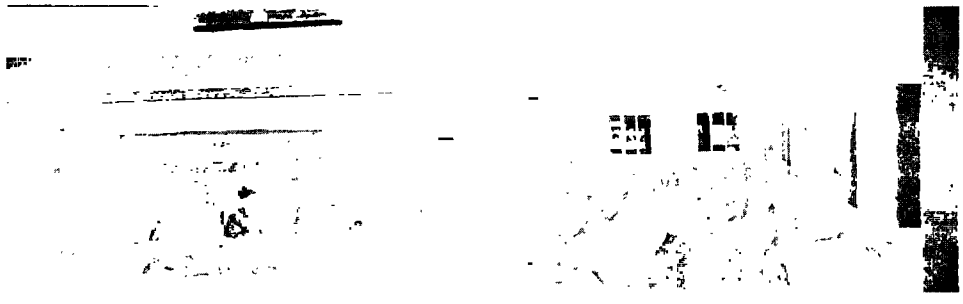
Study Area

The IAMWARM project is for the entire State of Tamil Nadu covering 117 sub-basins in 17 river basins of Chennai, Palar, Varahanadi, Ponnaiyar, Paravanar, Vellar, Agniyar, Pambar & Kottakaraiyar, Vaigai, Gundar, Vaippar, Kallar, Tamirabarani, Nambiyar, Kothaiar, Parambikulam & Aliyar Project. In the first year 41 sub basins are proposed under this project. The methodology adopted for this study includes stakeholders consultations, field visits, secondary data collection, compilation and interpretation.

Stakeholders Consultations

Stakeholder consultation is an important aspect in this project to obtain the perception and views of the stakeholders on social and environmental concerns pertaining to the local areas. The objective of stakeholders consultation is to minimize the negative impacts in the area and make them feel that they are the ultimate beneficiaries of the project in this process the views ascertained from the stakeholders is analyzed and incorporated in the project document. The ESA study initially obtain the opinions of the stakeholders and the same has been analyzed and incorporated at the sub basin level.

The stakeholder views from various stakeholders consultative workshops are as follows:



River Basin	Stakeholder views
Pollachi (PAP)	• Sprinkler and drip irrigation should be introduced in the entire canal instead of selected area. • Live stock development should be encouraged. • Dairy activities should be encouraged.
Thiruvannamalai (Ponnaiyar River Basin)	• Drip irrigation • Introducing of modern agriculture practices • Alternative cropping

	pattern in draught prone areas • Market linkage
Krishnagiri (Ponniyar River Basin)	• Construction of check dams • Cold storage facilities • Training of Vermicomposting and organic farming
Atthur (Vellar River Basin)	• Information should reach to tailend farmers • Setting up of water and sewage treatment plants • Embryo transplantation techniques should require

Pudukkottai (Agniar River Basin)	• Awareness cultivation of herbal plantations • Mobile veterinary van should provide • Construction of percolation ponds
Vaigai Basin, Madurai	• Separate news letter should published to disseminate modern agriculture techniques • Environmental awareness programmes should conduct
Vaipar River Basin, Srivalluputhur	• Protection of wild life sanctuary • Improve and implementation of rainwater harvesting pits • Sustainable drinking water facilities • Old pump set motors should replace
Tamirabarani, Thirunelveli	• Cooperative milk society should establish • Marketing arrangement for bio-fuel • Restoration of ecological balance through resource conservation
Kothaiyar, Nagerkovil	• Better irrigation facilities should provide • Awareness should be created on eco tourism concept • Better market price for agriculture products
Valliyoor (Nambiyur River basin)	• Disiltation of tanks should taken up • Horticulture crops should promote • Better marketing accessibility with information technology
Palar River Bain, Cheyyar Sub Bain, Kancheepuram	• Disilting of tank and supply channels

	• Promotion of drip and sprinkler irrigation methods • Land reclamation
Tindivanam (Varahanadhi River Basin):	• Training in crop diversification, cropping practices and waste water use in agriculture • Application of gypsum as soil conditioner to improve soil fertility • Training on integrated pest management techniques
Vaigai Basin, Paramakudi	• Promotion of SHGs • Facilities for seed marketing technology • Training programmes on vermicompost, honeybee cultivation and fish culture
Gundar Basin, Aruppukottai	• Revenue from sand mining should distribute equally • Solid waste must be disposed hygienically • Fish stocking in irrigation tanks • Fish seed should promote • Marketing facilities for agriculture products
Velar Basin, Perambalur	• Separate website should be created to know the market price and to know the new technologies available in field of agriculture and horticulture • Prevent dumping of plastic and solid waste into the tanks • Water borne diseases must prevent • Milk chilling facility should require

Kosasthalaiyar Sub Basin, Thiruvallur	• Integrated pest management and organic farming should be practiced • Awareness programmes to the farmers to use modern agriculture implements • Disiltation of tanks • Catchment degradation should address • Crop diversification information should provide

Application of World Bank Safeguard Policies

Policy	Applicability	Comments
Environmental Assessment (OP/BP 4.01)	Yes	Significant adverse social or environmental impacts are not expected as all significant physical investments are expected to be in the nature of rehabilitation of existing assets. However, an integrated Environmental and Social Assessment (ESA) with an Environmental and Social Management Plan (ESMP) to both manage risks and maximize environmental and social opportunities will be finalized based on earlier work and experiences of the TN WRCP project and consideration of new activities proposed in the TN IAMWARM project.
Natural Habitats (OP/BP 4.04)	No	No adverse impacts on natural habitats expected, but this issue will be further tracked during the ESA implementation
Forests (OP/BP 4.36)	No	No proposed activities would trigger this policy.
Pest Management (OP 4.09)	Yes	No pesticides and fertilizers are expected to be financed directly by the project; however, there may be induced impacts of increased fertilizer and pesticide use due to improved agricultural intensification and diversification. The project will support scaling-up state-wide Integrated Pest Management and Integrated Nutrient Management efforts and support for safer and organic food production and marketing.

		A pest management plan will be proposed as part of the ESA and ESMP.
Cultural Property (OPN 11.03)	Yes	No significant adverse impacts on cultural property expected, but this issue will be examined during the ESA (particularly in relation to proper management of any religious and other physical cultural property associated with tanks during rehabilitation).
Indigenous Peoples (OD 4.20)	No	No adverse impacts on tribals are expected, but the project will examine ways to improve benefits to tribals, women, and other vulnerable groups as part of the ESA.
Involuntary Resettlement (OP/BP 4.12)	Yes	No significant resettlement expected – but these will be examined further as preparation proceeds. The successful arrangements adopted under the previous TN WRCP project will also be adopted as required.
Safety of Dams (OP/BP 4.37)	Yes	The project will support safety of dams associated with the project areas (unless already addressed under other parallel projects). The project will also support safety improvement of tank systems as part of tank rehabilitation.
Projects on International Waterways (OP/BP 7.50)	No	No project activities in international waterways.
Projects in Disputed Areas (OP/BP 7.60)	No	No project activities in disputed areas.

Key Environmental issues in the river basins

The distinct environmental issues confronting the river basins essentially relate to groundwater depletion, excess fluoride and nitrate concentration in groundwater. Further, it has been noticed that the surface water is polluted due to untreated industrial effluents. There is also the problem of sea water intrusion and soil erosion. Consequent to the rapid urbanization, there is increase in sand mining resulting in catchment area degradation. It has been noticed that there is growth of Juliflora and aquatic weeds. The key issue that emerges from the study is the need for extensive promotion of organic farming, vermicomposting and bio-fertilizers.

Key social issues in the river basins

There are distinct social fallouts, significant among them being the aspect relating to migration. There is a discernable decline in livestock population. It has emerged from the study that there is a need for adoption of modern agricultural practices, as also the need for training women in post harvesting technologies. More significantly the emphasis ought to be on local specific rural enterprise development and vocational training programmes for the adolescent boys and girls. There is a need to strengthen the existing agriculture markets and introduce the IT based agri-marketing initiatives. There is also need for strengthening of rural health, sanitation and infrastructure.

While the above are key environmental and social issues at random, an effort has been made to establish the environmental and social issues specific to the sub-basin which is tabulated below. However, it is pertinent to point out that there is not much of a variation in the environmental and social concerns of the different sub-basins. It is just that there may be a variation in the intensity and magnitude of the problem.

Sub basin wise Environmental and social issues:

S.No	Main River Basin	Sub Basin	Environmental Issues	Social Issues
1	Chennai	1. Kosasthalaiyar	• Industrial Pollution • Sea water intrusion reduced the quality of groundwater • Sand Mining is prevalent in the river bed areas • Siltation • Coastal erosion • Weed growth • Industrial effluents released into river • Domestic Sewage released into river • Over exploitation of ground water • Dumping of debris into tanks	• Encroachment in the river and tank beds • Poor sanitary conditions • Skin allergies • Mosquito breeding due to water stagnation and • Elephantiasis
2	Palar	2. Cheyyar	• Ground water contamination • Dying Effluents In Arni Taluk • Water contamination due to Kattamanku • Sand mining seen in the river bed areas • Domestic Sewage of Arni town and Thiruvathipuram • Water weeds	• Poor literacy levels • Anthrax disease in cattle • Provide good linkage for marketing

		3. Kliyar	• Sand mining seen in the river bed areas • Ground water depletion due to industries • Solid waste problem in Vandavasi Municipality • Sea water intrusion near Vayalur • Sugar mill effluents in Padalam • Water weeds • Lack of sewage treatment plant Vandavasi and Madurantagam Municipalities	• Seasonal migration due to unemployment • Poor marketing facilities and poor value addition • Poor literacy levels leading to migration • Poor sanitary conditions and unhygienic conditions • Diseases surveillance due to mosquitoes and pigs
3	Pennaiyar	4. Chinnar 1 a	• Domestic sewage • Poor solid waste management • Drinking water pollution due to drainage water. • Sand mining seen in the river bed areas • Soil erosion seen in the river and tank beds • Water weeds	• Livestock reduction with unidentified diseases • Poor sanitary conditions • Poor literacy levels • Water borne diseases in this river basin

		5. Chinnar 1 b	• Sand mining seen in the river bed areas • Water contamination • Domestic sewage led into rivers • Water weeds • Textile effluents	• Seasonal migration due to poor literacy levels • Livestock reduction with unidentified diseases • Poor sanitary conditions and sanitation programmes are not properly implemented. • Health problems due to mosquitoes and stagnation of water
		6. Pennaiyar to Krishnagiri	• Water pollution due to industries • Mango processing effluents released into tank leading to water contamination and algal blooms • Sand mining is very high in the river bed area • Poor solid waste management • Soil erosion seen in the river and tank beds	• Health problems due to industrial water pollution • Livestock diseases and decrease in the trend of livestock. • Encroachment of river and tank beds
		7. Pambar	• Lack of solid waste disposal method • Sago industrial effluents a major problem • Water weeds	• Seasonal migration due to poor literacy levels • Livestock reduction due to diseases • Poor sanitary conditions leading to diseases • Encroachment of irrigation canals

		8. Vaniyar	• Lack of solid waste disposal method • Sago industrial effluents led into the river • Sand mining is seen in the riverbed areas.	• Seasonal migration due to poor literacy levels • Livestock reduction due to diseases • Poor sanitary conditions in the residential areas
		9. Musukundanadhi	• Municipal sewage letting out into rivers • Sand mining in the river bed areas • Lack of sewage treatment plant	• Seasonal migration due to poor literacy levels • Livestock reduction due to unidentified diseases • Poor sanitary conditions in the residential areas
4	Varahanadhi	10. Varahanadhi	• Mining of rocks • Municipal sewage letting out into rivers • Sand mining in the river bed areas • Water weeds	• Seasonal migration due to poor literacy levels • Livestock reduction due to unidentified diseases • Lack of awareness in solid waste minimization and management
5	Vellar	11.Manimuthanadhi	• Coconut trees are affected due to water pollution • Sand mining is prevalent in the river beds • Over exploitation of ground water	• Social conflicts in water utilization • Inadequate school teachers leading low literacy levels • Anthrax diseases in cattle
		12. Kil Vellar	• Municipal sewage letting out into rivers • Effluents from sugar industries released into river • Lack of sewage treatment plants	• Seasonal migration due to lack of employment • Livestock reduction due to diseases • Poor drinking water supply and sanitation

		13. Upper Vellar	• Sago industrial effluents released into river • Sand mining leading to depletion in ground water level	• Seasonal migration due to lack of employment • Livestock reduction due to diseases • Poor drinking water supply and sanitation • No marketing facilities
		14. Swethanadhi	• Ground water pollution • Sand mining in the river beds • Air pollution due to cement factory	• Seasonal migration due to lack of employment • Livestock reduction due to diseases in cattle • Poor drinking water supply and sanitation • No marketing facilities • Problem of mosquitoes leading to malaria
		15. Chinnar	• Ground water pollution • Sand mining in the river bed areas	• Seasonal migration due to lack of employment • Livestock reduction due to unidentified diseases. • Poor drinking water supply and sanitation • Females affected by cancer
		16. Anivari	• Ground water pollution • Sand mining prevalent the river beds • No proper solid waste management	• Seasonal migration due to unemployment • Livestock reduction due to lack of veterinary hospitals • Poor drinking water supply and sanitation

6	Agniar	17. Agniar	• Excessive nitrate concentration in ground water • Poor solid waste management • Soil erosion seen in river and tank beds • Excessive use of chemical fertilizers polluting the surface a well as ground water.	• Seasonal migration due to poverty • Reduction in grassing land and livestock • Low literacy rate due to poverty • Poor marketing facilities • Poor sanitary conditions leading to several diseases.
		18. Ambuliar	• Juliflora growth is predominant • Sand mining seen in the river beds • Excessive use of chemical fertilizers polluting the ground waters	• Seasonal migration due to unemployment • Women empowerment through SHGs • School drop outs due to lack of teachers • Poor sanitary conditions leading to several diseases.
		19. South Vellar	• Juliflora growth is predominant • Sand mining seen in the river beds • Over exploitation of ground water	• Seasonal migration due to lack of employment • Women empowerment through SHGs • No health care centers
7	Parambikulam Aliyar Project	20. Parambikulam Aliyar	• Soil erosion seen in the river and tank beds • Siltation and deforestation • Sand mining leading to depletion of water level. • Pollution due to coir industries • Excess fluoride and nitrate concentration	• Improved livelihood due to coir industries • Decrease in livestock due to diseases • Women empowerment through SHGs • Water borne diseases due to unhygienic conditions

		21. Palar	• Soil infertility due to salinity • Ground water pollution • Catchment area degradation	• Improved livelihood due to coir industries • Decrease in livestock due to unidentified diseases • Women empowerment through SHGs
8	Kottakaraiyar	22. Kottakaraiyar	• Juliflora and Ipomea growth • Soil alkalinity and erosion • Sand mining seen in the river beds • Chlorides in ground water • Sewage discharge into water bodies • Solid waste disposal • Water logging in coastal areas • Respiratory disorder in RS Mangalam area	• Seasonal migration due to lack of employment • Skin diseases and health problems due to poor sanitary conditions • Lack of small scale industries in the areas
		23. Saruganiar	• Juliflora and Ipomea growth • Soil alkalinity • Sewage discharge into water bodies • Lack of solid waste disposal method • Respiratory disorder in Vellalore areas	• Migration due to lack of employment • Skin diseases and health problems due to poor sanitary conditions • Lack of teachers in primary schools

9	Pambar	24. Pambar	• Juliflora growth • Ground water depletion due to exploitation • Lack of Sewage & Solid waste disposal method • Water weeds • Water logging in coastal areas • Industrial effluents into water bodies • Siltation in tanks • Dumping granite quarry waste along the road	• Migration due to lack of employment • Livestock reduction due to lack of vetenary hospitals • Encroachment in irrigation canals, river beds
10	Vaigai	25. Varaganadhi	• Sand mining in the river beds • Siltation seen in tanks • Reduction in fish population due to sewage	• Out seasonal migration due to lack of employment • Reduction in livestock due to lack of vetenary hospitals • Social conflicts in distribution of water for the tail end farmers • Lack of water storage facilities • No storage facilities for food grains • Prone to drought and floods
		26. Sathaiyar	• Juliflora and Ipomea growth • Sand mining in the river beds • Soil erosion in river and tank beds • Air pollution due to flour mills • Mixing of sewage into tanks	• Out seasonal migration due to lack of employment • Reduction in livestock due to diseases • Social conflicts in distribution of water for the tail end farmers • Encroachments in river beds and tanks • Poor marketing facilities • Health problems due to sewage

		27.Varattar – Nagalar	• Juliflora growth • Soil erosion seen in river and tank beds • Poor solid waste management	• Out seasonal migration due to lack of employment • Reduction in livestock due to unidentified diseases • Social conflicts in water distribution • Health problems due to indiscriminate dumping of solid waste
		28. Manjalar	• Juliflora and Ipomea growth • Sand mining and soil erosion in the river beds • Siltation leading to depletion in water level • Mixing of sewage into tanks	• Out seasonal migration due to lack of employment • Reduction in livestock due to unidentified diseases • Social conflicts in water distribution
		29. Lower Vaigai	• Juliflora growth • Sand mining and soil erosion in the river beds • Salt water intrusion in the surrounding areas thereby making the water unfit for drinking • Ground water salinity	• Out seasonal migration due to lack of employment • Reduction in livestock due to unidentified diseases • Social conflicts in distribution of water • No electricity connections • Problem of pigs and mosquitoes leading to diseases
11	Gundar	30. Upper Gundar	• Juliflora growth • Sand mining and soil erosion in the river beds • Lack of water supply in the entire basin • Lack of Sewage disposal and Garbage disposal method	• Encroachment in river beds • Dry land agriculture reduction in livestock • Poor marketing and transportation facilities

		31. Terkkar	• Juliflora growth predominant • Sand mining seen in the river bed • Lack of Sewage & solid waste disposal method	• Encroachment of catchment area • Dry land agriculture • Reduction in livestock due to diseases
		32.Paralaiar	• Juliflora growth • Sand mining seen in the river bed • Water borne diseases due to unhygienic conditions • Sewage & solid waste disposal method • Air pollution due to brick kilns	• Drought prone area • Seasonal Migration due to unemployment • No marketing facility • No organized cattle farm • Reduction in livestock due to diseases
12	Vaippar	33. Nichabanadhi	• Soil erosion seen in the river bed • Siltation depleting the water level • Poor solid waste management • Dye industry effluents letting out directly into the river. • Lack of Sewage disposal method	• Dry land agriculture • Reduction in livestock due to diseases • Women empowerment through SHGs • Inadequacy of teachers in schools • Prevalence of child labour due to poverty
		34. Kalingalar	• Sugar industrial effluent letting out directly into the river. • Ground water contamination • Lack of Solid waste disposal method • Untreated sewage let into river	• Dry land agriculture • Reduction in livestock due to diseases • Women empowerment through SHGs

		35. Arjuna Nadhi	• Soil erosion and Sand mining in the river bed • Effluent disposal from match, fireworks, printing & willow industries • High TDS, magnesium, bicarbonates & chlorides • Lack of Solid waste disposal method • Untreated sewage let into water bodies	• Dry land agriculture • Reduction in livestock due to diseases • Women empowerment through SHGs • No cold storage facilities
		36. Sindapalli Odai	• Sedimentation found in tanks • Soil erosion and Sand mining in the river bed • Dumping of solid waste in water bodies • Sewage pollution • Effluent disposal from match, fireworks, printing & willow industries	• Dry land agriculture • Reduction in livestock due to diseases • Women empowerment through SHGs
		37. Senkottaiyar	• Drought prone sub basin • Sewage disposal into water bodies • Lack of Solid waste disposal method	• Dry land agriculture • Reduction in livestock due to diseases • Women empowerment through SHGs

13	Tamiraparani	38. Manimuthar	• Sewage pollution • Encroachment of canal • Soil erosion in the river and tank beds	• Seasonal migration due to unemployment • Reduction in livestock due to diseases • Lack of marketing facilities • Encroachment of irrigation canals, tanks • Lack of cooperative milk society
		39. Chittar	• Sewage pollution • Solid waste dumping into water bodies • Sand mining and weed growth. • Siltation leading to decrease in water level • Industrial effluents directly led into river	• Seasonal migration due to unemployment • Poor sanitary and sewage conditions leading several health disorders • Malaria and other diseases due to indiscriminate dumping of solid wastes and mosquitoes
		40.Lower Tamiraparani	• Sewage pollution • Solid waste dumping into water bodies • Sand mining and weed growth • Sea water intrusion into the coastal areas • Industrial effluents directly led into river	• Seasonal migration due to unemployment • Poor drinking water facilities • Health problems due to unhygienic conditions • Lack of veterinary hospital

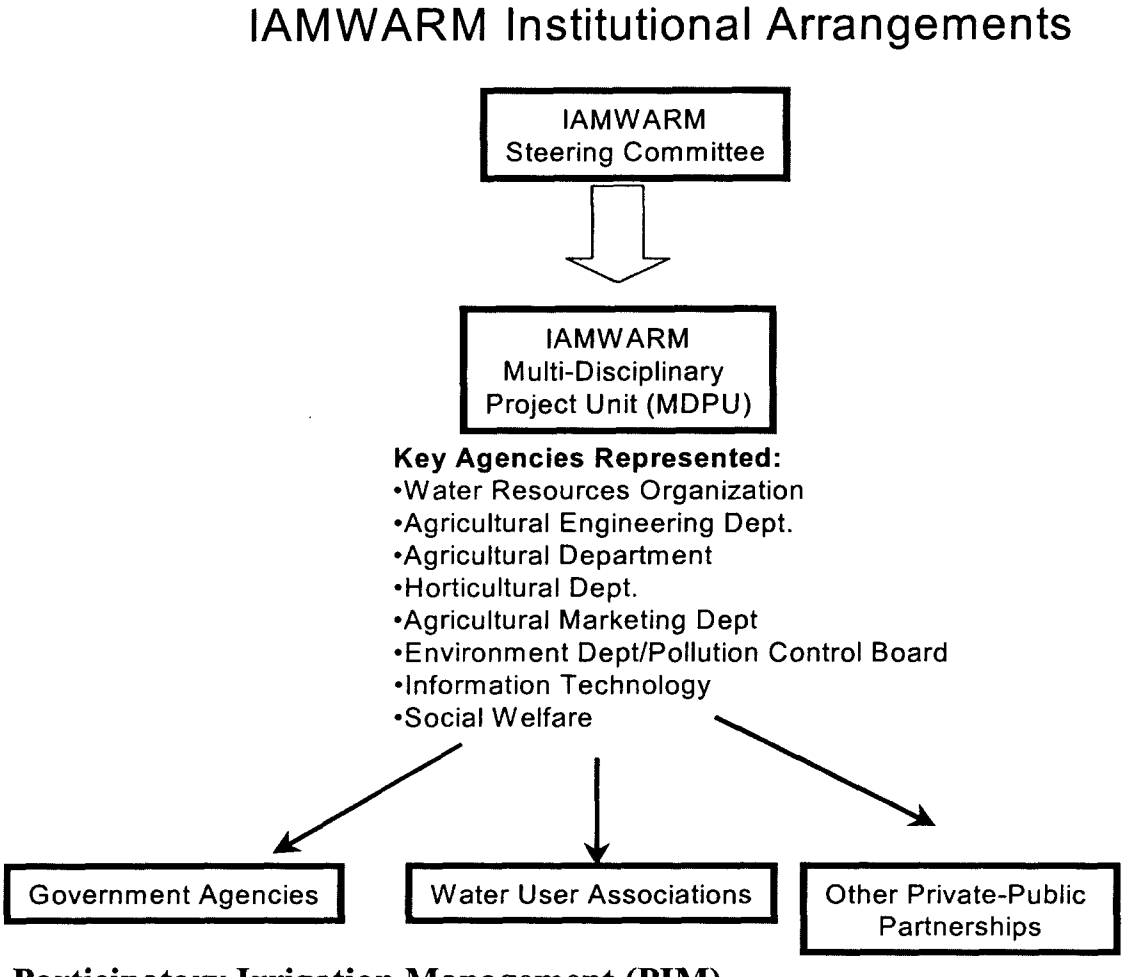
14	Kothaiyar	41. Pazhayar	• Salinity and alkalinity • Soil erosion in the river and tank beds • Poor solid waste management at tourist spots • Water weeds • Entry of untreated effluents into water bodies • Agro industry effluents • Sea water intrusion in coastal areas • Increased use of chemical fertilizers in the fields pollution ground as well as surface waters • Ground water depletion due to excessive with drawl by Pepsi and Coke companies • Fluoride in ground water in Anjugramam, Azhuppapapuram and Kattuvilai	• Migration due to lack of employment • Reduction in livestock due to diseases • Women empowerment through SHGs • Poor sanitation and drinking water facilities, • Encroachment of river banks, tanks etc • Poor marketing facilities • High transportation costs

15	Nambiyar	42. Nambiyar	• Sand mining leading to decrease in water level • Dumping of solid and agricultural wastes • Sea water intrusion in coastal areas • Soil erosion in the river and tank beds • River bed degradation and instability of stream course	• Seasonal migration due to lack of employment • Reduction in livestock due to diseases • Women empowerment through SHGs • Poor sanitation and drinking water facilities • Agricultural labour scarcity • Water borne diseases like malaria & diarrhea

Institutional Framework

Institutional strengthening and reform is a continuous process and will be continued. Special efforts is made to bring about the changes among the departments who are involved in the project for proper infrastructure development, strengthening, reorganization, training and orientation of human resources. The key entity in the institutional framework is to set up a management cell in the WRO and to expand environmental and social development cells.

- Orientation and motivation towards participatory approach in development and management.
- Induce professionalism and accountability.
- Develop work norms and culture.
- Develop a system for addressing public grievances effectively and timely.
- Ensuring quality assurance and safety structures.



Participatory Irrigation Management (PIM)

The government of Tamil Nadu introduced the concept of farmers participation in irrigation management in the State through implementation of the Tamil Nadu Farmers Management of Irrigation Systems Act. 1566 WUAs were formed in 6.00 lakhs ha covering 20 out of 30 districts in the State under WRCP. All the above associations have elected Presidents and Members constituting the managing committees of the WUAs, taken over the O&M responsibilities and functioning. The same concept is proposed to be extended to cover the remaining area of about 15.00 lakhs ha under this project.

Social and Environmental Management Framework (SEMF)

SEMF will be prepared for use in this project and this can be applied to all the remaining river sub basins. There are several stakeholder groups will have direct and indirect stakes in the project. Each of these groups will have different levels of influence as well as interest in it. The important stakeholders include the relative government departments, regulatory bodies, agricultural universities, research institutions, NGOs, farmer's and individual (agriculture and allied activities), Panchayats and other representative bodies, private sector and donor agencies. A detailed stakeholder analysis has been provided in the SEMF.

The SEMF is the outcome of the ESA study, prepared in line with the standard Environmental and Social Management plan. This has to be applied by the Project Implementing Agency and their staff to all proposed sub-project activities through all stages of the project cycle for incorporation of environmental and social management measures. It also contains Framework and Action Plans for various key issues like Dam Safety, Pest Management, Cultural Property Management, Resettlement & Rehabilitation, Tribal Issues, Gender Issues and Community Sensitization that need to be addressed through the project. The SEMF will be further modified based on the lessons learnt from the first year projects.

IAMWARM Sub-Basin Project Cycle

Stage	Key Activities
Pre-Planning	• Collation of knowledge base for sub-basin (sub-basin data, previous, ongoing and proposed projects of relevance) • Preparation of thematic Atlas for sub-basin • Consultations (initial) and identification of key stakeholders
Planning	• Consultations to identify key relevant issues and options in sub-basin • Development of Sub-basin Development and Management Plans and procurement documents • Draft MOU between MDPU, sector agencies and WUAs
Appraisal	*–Environmental and Social* *–Economic/Financial* *–Technical* *–Procurement*
Implementation	• Contracting • Monitoring/Supervision/Quality Control/Community Book-keeping
Post-Implementation	• Establish linkages and identify further work to improve effectiveness and sustainability • Implementation Completion Report for each sub-basin

IAMWARM Sub-Basin Project Cycle:

Environmental and Social Aspects

Stage	Environmental and Social Implications
Pre-Planning	• Collation of available social and environmental information (incl. on demography, water uses, pollution, resource management, sand mining, etc.) • Preparation of thematic maps on environmental and social issues • Initial consultations with various groups to determine key project stakeholders
Planning	• Consultations on issues and options (ensuring participation of all key stakeholders) • Participatory development (with analytical input) of Sub-basin Development and Management Plans and procurement documents • Facilitation of participatory drafting of MOU
Appraisal	*–Gender* *–Tribal Development* *–Pest Management* *–Natural Habitats* *-Land acquisition/R&R* *-Participatory Irrigation Management* *–Construction-related*
Implementation	• Community contracting • Community supervision • Monitoring any unforeseen environmental or social impacts
Post-Implementation	• Identify linkages and further work to improve social and environmental sustainability • Reflect environmental and social issues in the Implementation Completion Report for the Sub-basin

Monitoring & Evaluation Mechanism

Monitoring and Evaluation Indicators have been developed to ensure implementation of environmental and social elements that have been built into all the stages of the project namely:

- Area (ha), production (tons) and value (Rs) of higher-value crops
- Productivity of water (Rs/m3)
- Livestock (% stall fed)
- Fisheries (water spread area in ha by type, production in tons/yr, value in Rs/yr)
- Adoption of improved technologies (e.g. drip/sprinkler area, etc.)
- Reliability of irrigation
- IT adoption (WRO and MDPU MIS, # of e-kiosks, cell services, web portal use, etc.)
- GIS/Remote sensing/Management Information system should be made use
- PIM (No. of WUAs, # of meetings held, attendance at meetings, O&M money collected by WUAs, # disputes settled by WUAs)
- Income to farmers (survey on Rs/household/yr from farm and non-farm activities – baseline, mid-term and end of project) and migration patterns
- Process (Sub-basin development and management plans prepared, appraised, Implementation Completion Reports completed, Social and Environment Management Frameworks applied, IRR)
- Marketing (Marketing sites/access, modernization of existing centers, new centers, arrivals, post-processing equipment and centers, Public-Private Partnerships, etc.)
- Training (# of people trained in state, national and inter-national – line agency and WUAs, farmers, etc.)
- Institutional linkages

Training and Capacity Building

The need for training and capacity building of all stakeholders is imperative towards ensuring adequate appreciation and addressing environmental and social issues associated with the project. Training programmes for farmer's is suitably designed to update them to use the modern agricultural implements for obtaining higher yield and quality product. Training modules are designed for the line department representatives for better coordination and timely implementation of the projects designed. Training locations and the language selection for training should be customized to suit the convenience of the trainees. Where the turnouts of villagers is low, decentralized training locations close to the villages of the trainees, with the involvement of NGOs (if required) shall help achieve the desired results.

Principal aspects of training required for various stakeholders are as follows

S.No	Levels	Trainees	Principal aspects to be covered
1	State Level	MDPU, Officials involved in IAMWARM,	GIS based environmental & social planning Analysis of monitoring & stakeholder feedback
2	Basin Level	Line Departments, Bureaucracy and Politicians	Sensitization about of environmental & social issues
3	Project Level	Project Officials, Govt. Officials of Tamil Nadu	Sensitization about importance of environmental & social issues Methods to record impact monitoring & project evaluation indicators
4	Project Level	NGOs WUA, Farmers, Livestock farmers, Fisherfolk, Women, Self Help Groups	Sensitization about importance environmental & social issues Ways to address such issues in the project
5	Village level	Rural youth, Landless labourers, Shopkeepers/Vendors/Traders, General Public	Sensitization about environmental & social issues Mitigation & monitoring measures to address environmental & social issues

Tribal Development

Tribals are a vulnerable community and are prone to exploration and marginalisation. The need for Tribal Plan shall be triggered by presence of significant tribal population in the sub-project area. Special measures shall be undertaken for upliftment of the tribal communities residing in each sub-project area which include:

- Designing the sub-projects on a participatory framework where consultation with tribal stakeholders at every stage remains the main focus of project activity.
- Provision of access to local resources like ponds for fisheries, grazing grounds for livestock development, minor forest produce for economic returns, handicrafts, etc.
- Where existing schemes of the government are operational effective linkages with the programmes shall be established to maximize project benefits to the tribals.

Separate inclusion mechanisms for adequate representation into Local Decision making bodies like Panchayats, WUAs, etc.

Gender Strategy

Women are vulnerable in the project area owing to their comparative backwardness in terms of health, education, income, decision-making, access to and control over resources (as identified during consultations). Gender Action Plan is needed in all sub-projects. Broad principles for the Gender Action Plan shall be:

- Women's participation to be ensured in the planning of intervention measures
- Provisions within the sub-project to empower women for sustainable income generation on their own
- Training and creating alternative livelihoods for women through the project
- Social justice and protection measures should be devised for oppressed women.

In irrigated agriculture, detailed activities in irrigation as well as the allied sectors including lessons drawn from the Hanuman Nadi sub basin. Modernization plans have been developed for facilitating coordination between the line departments for all physical investments. Lessons drawn from DANIDA Women in Agriculture and similar projects for up scaling the IAMWARM project are also incorporated in the report.

Dam Safety

Safety of dams is also important for safeguarding the investments being made in the command area through this project. The MDPU/Sub basin project team shall identify the necessity of a dam safety plan based on a checklist approved by the Dam Safety Panel. Synergies with the proposed dam rehabilitation, improvement and ongoing hydrology to project will be strengthened. The broad procedures and components of the Dam Safety Plan shall be:

- Assessment of condition of dams and appurtenant works in the overall context of site accessibility, catchment runoff, rainfall intensity, downstream habitations, past incidents, etc.
- Conducting necessary surveys and field investigations to substantiate identified problems,
- Risk analysis of possible scenarios,
- Planning of remedial measures and proposing structural / non-structural and operational procedures for safety of the dam.

All details of dams shall be incorporated into the Knowledge Base and used for planning allocation of investments related to dam safety. This information shall be supplied in a simplified with easily identifiable indicators to the people at risk as a part of

information disclosure. This information shall be maintained at the WUA and sub-project WRO offices. The contents shall include:

- General details and Status of the Dam in terms of safety,
- Indicators to identify safety hazards,
- The responsible people with addresses and phone numbers to be contacted in case of any eventuality, and
- Emergency plan in case of a dam break.

Pest Management Strategy

The incidence of insect pests and disease problems as well as other problem manifestations (weed pressure, nutrient disorder, etc. are likely to intensify with increased agricultural intensification in terms of enhanced cropping intensity and crop diversification with inclusion of fruits, vegetables and other high-value plants. Pest Management Plan shall be required for all sub-projects. Linkages with other applicable projects will be strengthened. The plan should include the following:

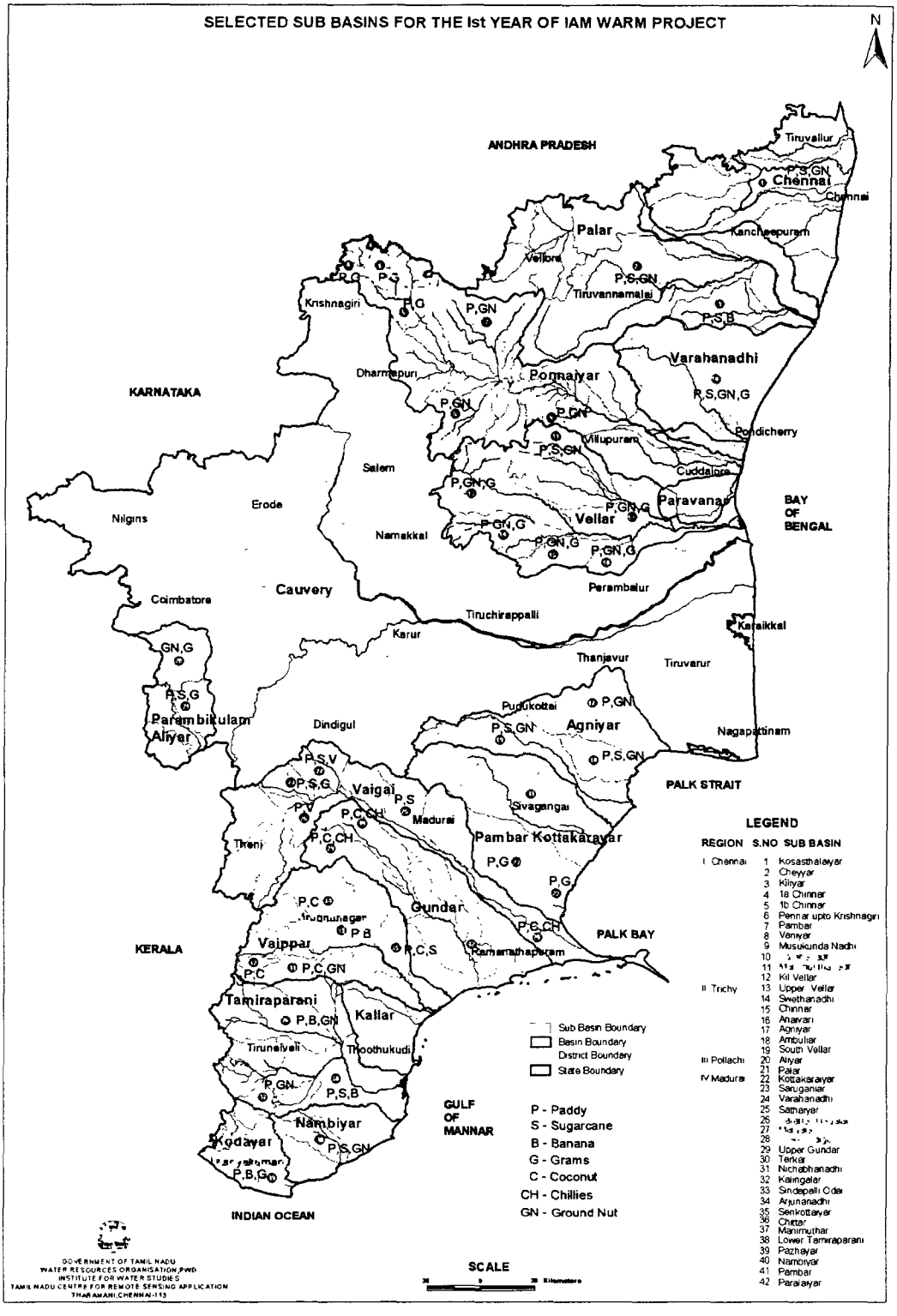
- Integrated Pest Management (IPM) and Integrated Nutrient Management (INM) systems with the overarching purpose of developing the project areas as organic – based production model.
- Identification of issues for Technical training of farmers and NGOs and for field demonstrations by Extension agencies.
- Monitoring and forewarning mechanisms to farmers of pest and disease situations.
- Identifying means to providing subsidies and price premiums on agricultural produces based on IPM & INM technologies.
- Identifying institutional arrangements for IPM and INM enforcement.
- Issues for information dissemination through Mass Media such as TV and Vernacular News.
- Social and environmental management framework has been developed based on social and environmental indicators, out puts of impact assessment and compilation and analysis of the secondary data.

Suggested Mitigation Strategies

Environment has a direct bearing on rural livelihoods and rural the people directly depend on environment for their livelihoods. Therefore, to improve sustainable rural livelihoods, the following measures have been suggested for mitigation of environmental degradation.

- Regulation of groundwater exploitation;
- Conservation of soil and water;
- Regulation of water usage;
- Implementation of watershed management programmes;
- Recycling of wastewater;
- Restoration of water bodies;
- Removal of encroachments in the water bodies;
- Construction of check dams to arrest soil erosion;
- Restoration of degraded forests areas;
- Wasteland development through energy plantation;
- Disposal of tannery effluents after treatment;
- Installation of sewage treatment plants;
- Alternative cropping pattern;
- Sensitization of farmers to go for crops which consumes less water and have market potential for value addition;
- Promotion of organic manures and bio-fertilizers;
- Promotion of bio-gas plants using waterweeds;
- Implementation of zero-waste-management for MSW;
- Strengthening the sanitation and protected water supply infrastructure;
- Strengthening rural health infrastructure;
- Promotion of alternative energy technologies; and
- Promotion of integrated micro-enterprise development for women.

Appropriate institutional arrangements have been identified to ensure effective implementation of ESA. The budget for ESA implementation would be mainstreamed into the project cost.


SELECTED SUB BASINS FOR THE Ist YEAR OF IAM WARM PROJECT
N
ANDHRA PRADESH
KARNATAKA
KERALA
BAY OF BENGAL
PALK STRAIT
PALK BAY
GULF OF MANNAR
INDIAN OCEAN
Tiruvallur
Chennai
Palar
Kancheepuram
Vellore
Tiruvannamalai
Krishnagiri
Dharmapuri
Varahanadhi
Ponnaiyar
Pondicherry
Villupuram
Cuddalore
Salem
Paravanar
Vellar
Erode
Nilgiris
Namakkal
Perambalur
Cauvery
Coimbatore
Tiruchirappalli
Karur
Karaikkal
Thanjavur
Tiruvarur
Pudukottai
Agniyar
Nagapattinam
Dindigul
Parambikulam Aliyer
Vaigai
Madurai
Sivagangai
Theni
Pambar Kottakarayar
Gundar
Virudhunagar
Ramanathapuram
Vaippar
Tamiraparani
Kallar
Tirunelveli
Thoothukudi
Nambiyar
Kodayar
Sub Basin Boundary
Basin Boundary
District Boundary
State Boundary
P - Paddy
S - Sugarcane
B - Banana
G - Grams
C - Coconut
CH - Chillies
GN - Ground Nut
LEGEND
REGION S.NO SUB BASIN
I Chennai
1 Kosasthalaiyar
2 Cheyyar
3 Kiliyar
4 1a Chinnar
5 1b Chinnar
6 Pennar upto Krishnagiri
7 Pambar
8 Vennyar
9 Musukunda Nadhi
11 Kil Vellar
II Trichy
12 Upper Vellar
13 Swethanadhi
14 Chinnar
15 Anaiyari
16 Agniyar
17 Ambuliar
18 South Vellar
III Pollachi
19 Aliyar
20 Palar
IV Madurai
21 Kottakarayar
22 Saruganiar
23 Varahanadhi
24 Sathiyar
25
26
27
28
29 Upper Gundar
30 Terkar
31 Nichabhanadhi
32 Kalingalar
33 Sindapalli Odai
34 Arjunanadhi
35 Senkottayar
36 Chittar
37 Manimuthar
38 Lower Tamiraparani
39 Pazhayar
40 Nambiyar
41 Pambar
42 Paralayar
SCALE
GOVERNMENT OF TAMIL NADU
WATER RESOURCES ORGANISATION,PWD
INSTITUTE FOR WATER STUDIES
TAMIL NADU CENTRE FOR REMOTE SENSING APPLICATION
THARAMANI,CHENNAI-113

1 INTRODUCTION

Tamil Nadu, the Southern State of the Indian peninsula is, spread over 1,30,058 km^2 and lies between 08° 05" N and13° 35" N and 76° 15" E and 80° 20" E. It is surrounded by the States of Andhra Pradesh in the north, Kerala in the west, Karnataka on the Northwest, Indian Ocean on the south and the Bay of Bengal on the east. The population of Tamil Nadu is 6,21,10,839 as per 2001 Census. The rural population is predominantly dependant on agriculture.

1.1 Water Resources

Water is an important natural resource. Today every aspect of economic endeavor impinges on the availability of water, be it agriculture, industry, power generation, expanding trade and commerce and growing demands of the urban population for drinking water, all these are dependent on adequate availability of water. While this is the un-disputed reality, there is also the problem of declining availability of water. Working for a balance between the need and the availability and constantly evolving better and workable practices in the direction of water conservation and management is the need of the hour. In a way the thrust of our report is in the direction of identifying the problems confronting water availability and the means to overcome this problem. Given the fact, Tamil Nadu has a perennial problem of inadequate water availability. The productive management of river basins and sub-basins would go a long way in mitigating the problem to a considerable extent. The IAMWARM project is an appropriate initiative and could turnout to be a path breaking effort.

There are 17 river basin groups in Tamil Nadu, a majority of which are water stressed. There are 61 major reservoirs, about 40,000 tanks and about 3.0 million wells that heavily utilize the available surface water (17.5 BCM). Agriculture is the single largest consumer of water in the state, using 75% of the states water. Irrigation through a combination of canals, wells and tanks increases the reliability and availability of water for farming and is essential for cultivating crops in much of the state. About 30% of the net irrigated area is watered by canals, 21% by tanks and 49% is fed by wells. The remaining area is irrigated by other sources such as streams and springs. Rainfed agriculture employing about 25% of farmers accounts for 46% of the net sown area of 5.5 million hectares. The per capita availability of water resources in Tamil Nadu is 900 cubic meters a year as against 2200 cubic meters for all India.

1.2 Irrigated Agriculture

The predominant feature of Tamil Nadu's economy is the fact that agriculture has been and continuous to be the prime mover of the state's economy supporting as it does 60% of the population and contributing 13% of the state's income (2004 – 05). Though the agriculture sector has seen some form of restructuring, what is visible is the gradual shrinkage in the area under cultivation. Further, there is also fragmentation of holdings. All these factors have impacted in some form of the other the environment not merely ecological terms but also in social aspects and thus calling for improved irrigated agricultural modernization and water resource management. This is the focus of this report.

Irrigation systems modernization in a sub-basin framework (including participatory and sustainable modernization of any water storages and related irrigation infrastructure including system/non-system/rainfed tanks, pump set efficiency; measurement and monitoring covering about one million hectares expanding on the experience of the Hanuman Nadhi pilot. Irrigation systems need to be rehabilitated in the resent IAMWARM project.

1.3 Tank Systems

As per minor irrigation census carried out in 1987, there are about 1.5 million tanks in various States. The States of Andhra Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Tamil Nadu and West Bengal have greater density. In spite of addition of new tanks during the period 1962-63 to 1985-86, the area under irrigation came down from 4.8 to 3.1 m.ha. It clearly indicates that maintenance of the tanks has been neglected and their capacity has been reduced due to siltation. It has been estimated that about 1.7 m.ha of net area has been lost under tank irrigation due to drying up of tanks and encroachment of the foreshore area. Rehabilitation and modernization of the tanks is under active consideration of the Government of India.

In Tamil Nadu, there are around 40,000 irrigation tanks and about 3 million wells, that heavily utilize the available surface water (17.5 BCM) and ground water (15.3 BCM). About 30% of the net irrigated area of 3 million hectares is watered by canals and 21% by tanks, while 49% is fed by wells. About 0.63 million ha of paddy fields are being irrigated by these tank systems. Whatever, the shortcoming at their creation, existing irrigation tanks remain as an asset to the sustainability of paddy agriculture in Tamilnadu, provided their live storage is not reduced and the related irrigation facilities are not deteriorated to serve the purpose. Past experiences show that availability of surface water resources are not always reliable, which has turned the paddy farmer's attention to the exploitation of ground water on a very much larger but manageable scale.

The tanks have been traditionally managed by the local communities and declined over time owing to interventions, which reduced the local communities' role. A major reason for this decline is poor operation, maintenance, lack of investment on the old tank infrastructure and growth in alternate system of irrigation through groundwater. The maintenance and repairs of many structural components of the tanks are poor. Almost all the tanks require repairs either in tank itself or in their components. Most of the irrigation tanks were constructed long time ago. After the declination of traditional maintenance system, no proper maintenance was implemented for the tank facilities including catchment treatment by farmers. The water distribution system, especially sluices, is not properly operated because of poor maintenance and poor water storage in tank.

The improvements of the tank system are critical to enhance the utility of these tanks, particularly in dry areas for supplementary irrigation and to meet drinking water and livestock requirements. As a part of the tank system improvement, active involvement of various types of stakeholders is required at all stages from planning to execution and its sustainability. This tank system improvement needs a substantial paradigm shift in the institutional, policy and legal frameworks, both at the State and grassroots levels.

There is no clear policy on tank system improvement. However, there have been a few adhoc projects over the last decades, which have not resulted in building up sustainable

community involvement in tank system management. In recent years, the State has shown keen interest in formulating an enabling policy and legal framework to rehabilitate tanks through community-based and demand-driven approaches. As a part of the general policy of decentralized governance of natural resources management of the State, participatory management of tank systems is being introduced both at major and medium irrigation and also minor irrigation. Currently, the tanks are administered by various institutional entities.

The multiple Government agencies like departments of Fisheries, Forestry, Mines & Geology, Revenue, Agriculture and Horticulture still have a role in tank systems, particularly so in the tanks having a command area above four hectares. These agencies are mostly administering the tank physical structure maintenance and improvements. Owing to a severe growing financial crunch, these tank structures are poorly maintained, leading to sub-optimal water use and under utilization of tank systems. The involvement of the users in these tank systems is currently very minimal. Over time, the poor financial allocations for tank improvement activities has also led to poor irrigation conditions and associated poor revenue generation. This situation has also led to lower dependence on the tank systems by the poor and vulnerable groups in the village communities. The problem is also attributed to lack of better approaches and the mono-discipline nature and inadequate capacity both at the State and local government level (Zillah and Taluk Panchayats). The existing institutional arrangements have led to poor coordination and lack of accountability.

Tank irrigation is a profitable technology in economic, environment and social terms; but under present conditions of management it is deteriorating rapidly. Extent as well as reliability of this technology is decreasing. Because of potentials for additional rice cultivation for about 16 million ha under tank irrigation, it is important to select holistic improvement strategies that fully exploit the potentials of tank irrigation.

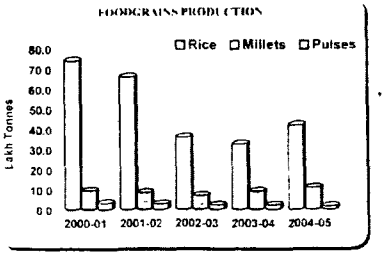
In general, sustainable crop production requires better performance of these small-scale irrigation structures tanks, which needs

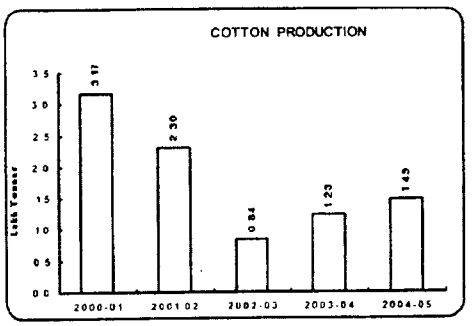
(i) Modernization of physical structures
(ii) Efficient distribution of water to and in farm fields as well as among the farmers
(iii) Proper maintenance of tank system after the modernization through farmer's participation.

1.4 Overall Economy

The agriculture sector had witnessed vast restructuring through time. The net area sown has been on the decrease because of pressure of growth in population which results in conversion of agricultural land for non-agricultural purposes. Fragmentation of holdings is also visible. The Agricultural Census data shows that the number of marginal and small farmers has been on the increase resulting in high man-land ratio, casualisation and marginalization of labour.

The principal food and non-food crops such as paddy, millets, pulses and oilseeds, cotton and sugarcane are being cultivated in the State.





Paddy, a staple food crop, is grown extensively in the rice bowl districts viz. Thanjavur, Thiruvarur and Nagapattinam. Agriculture which suffered extensively during 2001 – 02, 2002 – 03, 2003 – 04 due to severe drought, experienced an appreciable revival fortunes during 2004 – 05. There was improvement in the area, production and productivity of various crops during 2004 – 05.

A final Forecast Estimate figure shows that area under paddy increased to 19.09 lakh ha during 2004 – 05 compared to 13.97 lakh ha in the preceding year. Area under millets and pulses also registered increases. Total area under food grains rose to 34.55 lakh ha against 28.37 lakh ha during 2003 – 04. Appreciable increase in area is also noticed in respect of oilseeds and cotton during 2004-05. In respect of cotton, increases in the area could be partly attributed to extension efforts backed with supply of quality inputs. Farmers are motivated to go in for short duration varieties which is remunerative alternative crop for rice fallow pulses.

Total food grains production during 2004-05 was expected to be of the order of 66.66 lakh tonnes compared to 43.12 lakh tonnes and 44.60 lakh tonnes during the preceding years. Total paddy production rose to 53.02 lakh tonnes during 2004 – 05, up from 32.23 lakh tonnes in 2003 – 04 and 35.77 lakh tonnes in 2002 – 03. About three-fourth of the total food grains production is contributed by paddy. Oilseed production is estimated at 13.20 lakh tonnes, improving from 9.64 lakh tonnes in 2003 – 04. Similarly, sugarcane production is estimated to increase to 23.40 lakh tonnes against 17.66 lakh tonnes in the preceding year.

Improvement in the productivity of crops plays major role in enhancing the production during the year. Yield rate of paddy rose from 2308 kg/ha in 2003-04 to 2777 kg/ha in 2004-05. In respect of millets per hectare yield rose from 983 to 1170 kgs and for pulses the increase is from 375 to 397 kgs.

1.4.1 Growth rate as compared to Government of India

Gross State Domestic Product (GSDP) has been growing at 4.73% per annum during 1994 – 95 and 2004 – 05. Disaggregated picture shows that the secondary sector is growing at 4.575 per annum while the service sector is growing at 8.41%. In contrast the primary sector has exhibited a negligible trend growth of 0.63%. During the last decade, the primary sector experienced a negative growth on five occasions during 1995 – 96, 1996 – 97, 1999 – 2000, 2002 – 03 and 2003 – 04.

Table 1.1 Growth in Gross Domestic Product (1993-94) Prices
A Trend Analysis

(Percentage Change)

Year	Primary Sector	Secondary Sector	Tertiary Sector	GSDP
1994-95	11.25	15.71	10.82	12.57
1995-96	(-) 12.56	8.84	8.49	3.45
1996-97	(-) 0.84	1.96	10.28	4.95
1997-98	8.53	1.93	12.99	8.20
1998-99	9.00	0.62	5.86	4.73
1999-2000	(-) 4.77	10.81	7.62	6.11
2000-01	4.54	7.94	8.54	7.61
2001-02	0.08	(-) 9.60	2.07	(-) 2.20
2002-03	(-) 20.98	9.29	7.81	3.03
2003-04	(-) 1.63	(-) 2.36	8.58	3.55
2004-05	14.31	5.13	9.40	8.73
AAGR	**0.63**	**4.57**	**8.41**	**4.73**

Source: Department of Economics and Statistics, Chennai – 6

Table 1.2 National Income (GDP) vis-à-vis State Income
(GSDP) and Per capita Income at Constant (1993-94) Prices

Year	All-India		Tamil Nadu	
	GDP (Rs. Crores)	Per Capita (Rupees)	GSDP (Rs. Crores)	Per Capita (Rupees)
1993-94	781345	7690	57549	8955
1994-95	838031 (7.25)	8070 (4.94)	64784 (12.57)	9932 (10.91)
1995-96	899563 (7.34)	8489 (5.19)	67021 (3.45)	10147 (2.16)
1996-97	970082 (7.84)	9007 (6.10)	70336 (4.95)	10451 (3.00)
1997-98	1016595 (4.79)	9244 (2.63)	76105 (8.20)	11260 (7.74)
1998-99	1082747 (6.51)	9650 (4.39)	79703 (4.73)	11592 (2.95)
1999-2000	1148367 (6.06)	10071 (4.36)	84575 (6.11)	12167 (4.96)
2000-01	1198592 (4.37)	10308 (2.35)	91011 (7.61)	12994 (6.80)
2001-02	1267945 (5.79)	10754 (4.33)	89011 (-)2.20	12484 (-) 3.92
2002-03	1318362 (3.98)	11013 (2.41)	91703 (3.03)	12696 (1.70)
2003-04	1430548 (8.51)	11799 (7.14)	94960 (3.55)	12976 (2.21)
2004-05	1529408 (6.91)	12416 (5.21)	103248 (8.73)	13999 (7.88)
AAGR	**6.24**	**4.46**	**4.73**	**4.22**

Source: 1. National Accounts Statistics, CSO, New Delhi & Economic Survey 2004-05, Go I 2. Department of Economics and Statistics, Chennai -6

1.5 Tamil Nadu Water Resources Consolidation Project (TNWRCP)

Tamil Nadu Water Resources Consolidation Project (Phase I) was taken up in 1995 with the financial assistance of World Bank at an estimated cost of Rs.11433 million and the project was completed on 30.9.2004.

The core objectives of the Project are:

- To introduce Water Resource Planning by river basins across all users of water
- To improve agricultural productivity through modernization and completion of irrigation system, upgraded water management and farmers participation
- To assure sustainability of water infrastructure and the environment and
- To improve Institutional and Technical Capacity for managing the State Water Resources

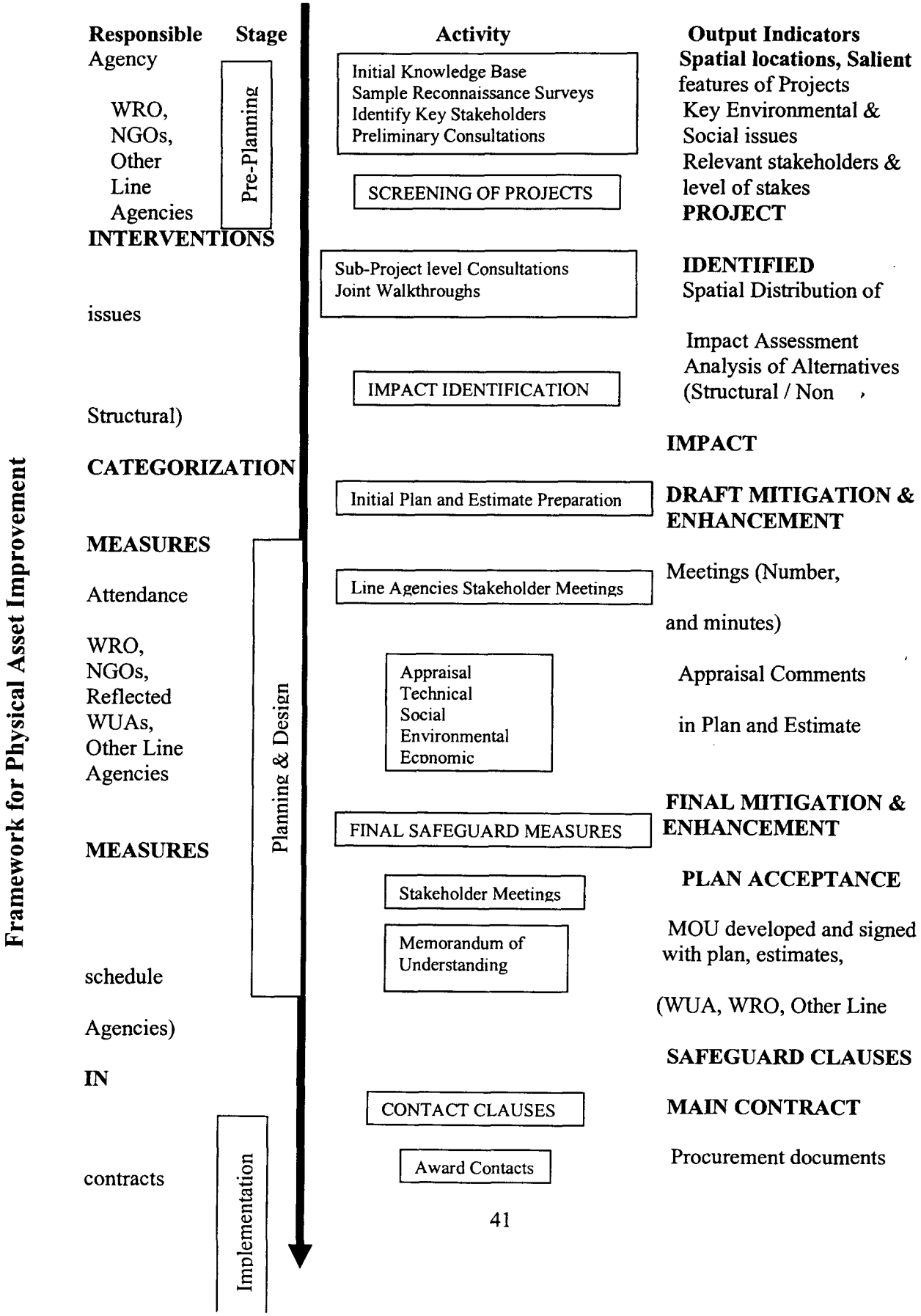
The TNWRCP project has contributed to improving the environment by developing a State Environmental Planning Framework, by creating an Environmental Cell (EC) in the office of Chief Engineer (Plan Formulation), formation of three WRO EC divisions as focal points for environmental activities in the WRO, creating and strengthening an environmental wing at the Institute of Water Studies (IWS). A special unit in the PWD Secretariat has been created for Land Acquisition and Economic Rehabilitation (LAER). Water Resources Research Fund (WRRF) capitalizing on the success of the WRRF established in the TN WRCP, this investment would expand the activities undertaken using the fund for targeted studies, awareness raising and applied research on key water and irrigated agriculture issues (including related environmental and social development issues) facing the state. The environmental performance was found to be highly satisfactory.

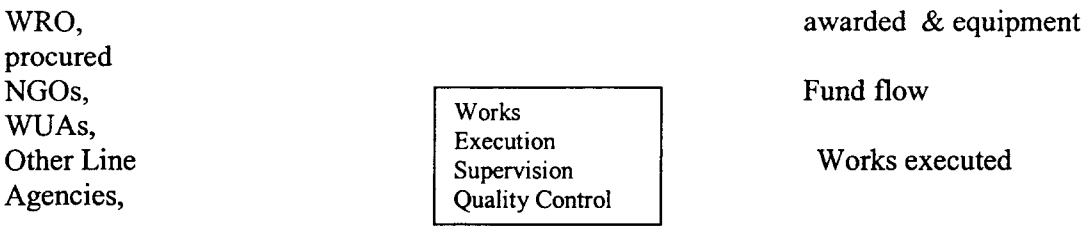
1.6 Context for ESA

As a part of the project, an ESA study was undertaken to provide inputs into the IAMWARM project in accordance with the World Bank Operational Guidelines, through identification of key environmental and social issues related to the project and devise opportunities to enhance the benefits and mitigate potential concerns. The integration of such issues within the project planning and implementation processes is to help minimize post design mitigation measures. The SEMF is the outcome of this study and has to be applied to all the proposed sub-project activities through various stages of the entire project cycle. Broad objectives of these stages are as follows:

Pre-Planning Stage	:	Building up Environmental and Social Knowledge Base and inclusion of Initial Broad Stakeholder views
Planning and Design Stage	:	Plan effective and sustainable activities in a participatory manner that is technically, socially, environmentally and economically sound and agree on an Memorandum of Understanding with all key stakeholders
Implementation Stage	:	Implement activities and build capacity within the Stakeholders Departments and Water User Associations
Post Implementation Stage	:	Withdraw gradually by building sustainability into the sub-project.

The project cycle for Physical Asset Improvement and the SEMF activities to be undertaken:


Framework for Physical Asset Improvement
Responsible Agency
Stage
Activity
Output Indicators
Pre-Planning
WRO, NGOs, Other Line Agencies
INTERVENTIONS
issues
Structural)
CATEGORIZATION
MEASURES
Attendance
WRO, NGOs, Reflected WUAs, Other Line Agencies
MEASURES
schedule
Agencies)
IN
contracts
Planning & Design
Implementation
Initial Knowledge Base
Sample Reconnaissance Surveys
Identify Key Stakeholders
Preliminary Consultations
SCREENING OF PROJECTS
Sub-Project level Consultations
Joint Walkthroughs
IMPACT IDENTIFICATION
Initial Plan and Estimate Preparation
Line Agencies Stakeholder Meetings
Appraisal
Technical
Social
Environmental
Economic
FINAL SAFEGUARD MEASURES
Stakeholder Meetings
Memorandum of Understanding
CONTACT CLAUSES
Award Contacts
Spatial locations, Salient features of Projects
Key Environmental & Social issues
Relevant stakeholders & level of stakes
PROJECT
IDENTIFIED
Spatial Distribution of
Impact Assessment
Analysis of Alternatives
(Structural / Non
IMPACT
DRAFT MITIGATION & ENHANCEMENT
Meetings (Number,
and minutes)
Appraisal Comments
in Plan and Estimate
FINAL MITIGATION & ENHANCEMENT
PLAN ACCEPTANCE
MOU developed and signed with plan, estimates,
(WUA, WRO, Other Line
SAFEGUARD CLAUSES
MAIN CONTRACT
Procurement documents



The ESA has been carried out to provide input into the IAMWARM Project in accordance with the World Bank operational guidelines. The primary objective of the ESA is to identify the key environmental and social issues in 41 sub-basins relating to agriculture (irrigation systems improvement, agriculture, horticulture, fisheries, etc,). A wide range of data has been collected pertaining to environmental and social issues and prepared SEMF.

1.7 IAMARM Project Description

The IAMWARM project is a successor to the recently-completed Tamil Nadu Water Resources Consolidation Project (TN WRCP) that was financed by the World Bank. The WRCP supported the state in a wide range of physical investments and institutional development that the IAMWARM project seeks to deepen. The key focus areas for IAMWARM are on irrigated agriculture modernization and on integrated water resources management to improve the productivity of water.

The proposed project development objective is to improve and sustain irrigation service delivery and productivity of irrigated agriculture with effective integrated water resources management in a river basin/sub-basin framework in Tamil Nadu.

The capacity-building activities would be state-wide in scope but the physical investments (rehabilitation of existing irrigation/water assets and support for agricultural diversification and improved livestock and fisheries management) under the project would be located in selected river basins/sub-basins throughout the State of Tamil Nadu, India.

The above objective is to be achieved through investments for modernizing irrigation infrastructure (including systems rehabilitation, on-farm works, technical and managerial upgrading of institutions involved in irrigation development, operation and management, diversification of agriculture with appropriate extension measures and market linkages, promoting public-private partnerships, piloting innovative irrigation infrastructure development and management options) and re-orienting and strengthening institutions and instruments required for integrated effective water resources management in the State (including unbundling resource management from service delivery institutions).

The proposed project would consist of the following two primary components:

- Irrigated Agriculture Modernisation
- Water Resource Management

1.7.1 Irrigated Agriculture Modernisation

This component is intended to improve the productivity of irrigated agriculture. These activities would include:

Irrigation systems modernization in a sub-basin framework (including participatory and sustainable modernization of any water storages and related irrigation infrastructure including system/non-system/rainfed tanks, pump set efficiency; measurement and monitoring covering about one million hectares expanding on the experience of the Hanuman Nadhi pilot. It is expected that this would be initiated in the Palar, Parambikulam Aliyar, Thambiraparani, Vaigai and Kodayar Basins and extended to other basins.

Institutional Modernization for Irrigated Agriculture (targeted modernization and improved asset inventory and management plans (for instance, dams, tanks, irrigation infrastructure, agricultural, horticultural, fisheries data) technical and managerial upgrading of irrigation development and service delivery institutions, modernization of manuals/procedures, computerization, LAN and WAN, knowledge management software, information management and sharing, public interaction, closer integration of WRO/PWD and Agriculture, Horticulture, Agricultural Engineering, Livestock/Fisheries Departments. Sustainable Agriculture modernization (cropping systems diversification and management to improve water conservation and farmer returns, integrated pest and nutrient management, public private Partnerships for extension, post-processing, certification, marketing)

An integrated Sub-basin Development and Management Plan would be developed for each sub-basin to provide a shared vision planning of proposed investments and capacity-building under the project.

1.7.2 Water Resource Management

This component is intended to strengthen the policy and institutional framework for improved sustainable management of water resources in the State. These activities would include:

State-level (converting the WRCRC to a State Water Council, amalgamating the associated sub-committees and upgrading the Institute of Water Studies (IWS) and the Surface and Groundwater Data Center (SGDC) to a State Water Resources Agency, establishment of a Water Regulator, development of appropriate policy and institutional arrangements, instruments, and information tools to promote flexible water resources management)

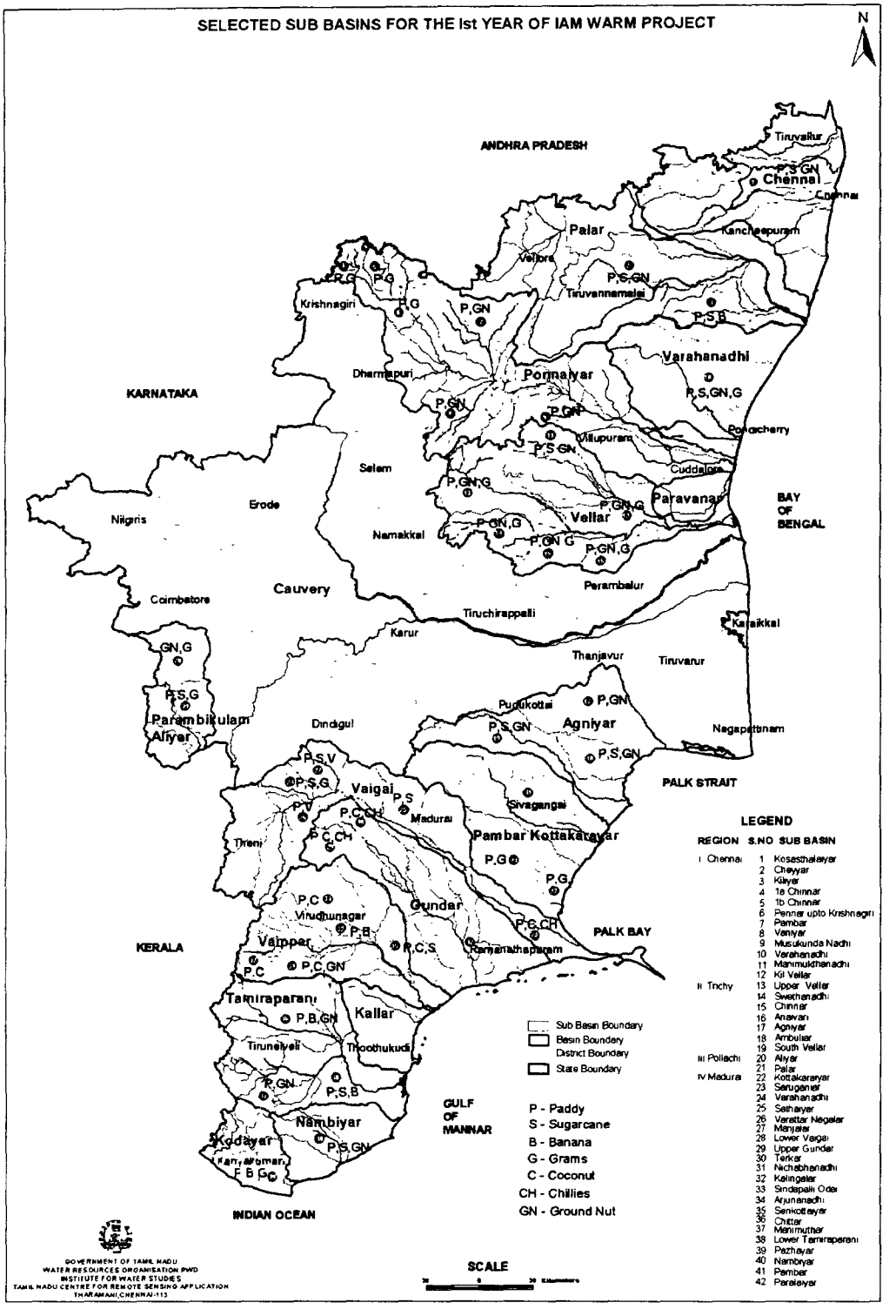
Basin-level (Strengthening, empowering and expanding Basin Development and Management Boards, development of basin analytical decision support systems targeted to support key policy and investment decisions, drought/flood preparedness, participatory structured consultations including strategic social and environmental assessments to systematically develop sub-basin development and management plans, demonstration pilots)

Capitalizing on the success of the WRRF established in the TN WRCP, this investment would expand the activities undertaken using the fund for targeted studies, awareness raising and applied research on key water and irrigated agricultural issues facing the State.

1.7.3 Study Area

The IAMWARM project is for the entire State of Tamil Nadu covering 117 sub-basins in 17 river basins of Chennai, Palar, Varahanadi, Ponnaiyar, Paravanar, Vellar, Agniyar, Pambar & Kottakaraiyar, Vaigai, Gundar, Vaippar, Kallar, Tamirabarani, Nambiyar, Kothaiar, Parambikulam & Aliyar Project. In the first year 41 sub basins are proposed under this project. The methodology adopted for this study includes stakeholders consultations, field visits, secondary data collection, compilation and interpretation.

The Policies and Acts related to Water resources and Irrigated Agriculture and the institutional set up are detailed in the next chapter.


SELECTED SUB BASINS FOR THE Ist YEAR OF IAM WARM PROJECT
N
ANDHRA PRADESH
KARNATAKA
KERALA
BAY OF BENGAL
PALK STRAIT
PALK BAY
GULF OF MANNAR
INDIAN OCEAN
Tiruvallur
Chennai
Kancheepuram
Palar
Vellore
Tiruvannamalai
Krishnagiri
Dharmapuri
Pennaiyar
Varahanadhi
Pondicherry
Villupuram
Cuddalore
Paravanar
Salem
Erode
Nilgiris
Namakkal
Vellar
Perambalur
Cauvery
Coimbatore
Tiruchirappalli
Karaikkal
Karur
Thanjavur
Tiruvarur
Parambikulam Aliyer
Dindigul
Pudukottai
Agniyar
Nagapattinam
Vaigai
Madurai
Sivagangai
Pambar Kottakaraiyar
Theni
Virudhunagar
Gundar
Ramanathapuram
Vaippar
Tamiraparani
Kallar
Tirunelveli
Thoothukudi
Nambiyar
Kodayar
Kanyakumari
Sub Basin Boundary
Basin Boundary
District Boundary
State Boundary
P - Paddy
S - Sugarcane
B - Banana
G - Grams
C - Coconut
CH - Chillies
GN - Ground Nut
SCALE
LEGEND
REGION S.NO SUB BASIN
I Chennai 1 Kosasthalaiyar
2 Cheyyar
3 Kiliyar
4 1a Chinnar
5 1b Chinnar
6 Pennar upto Krishnagiri
7 Pambar
8 Vaniyar
9 Musukunda Nadhi
10 Varahanadhi
11 Manimukthanadhi
12 Kil Vellar
II Trichy 13 Upper Vellar
14 Swethanadhi
15 Chinnar
16 Anaiyari
17 Agniyar
18 Ambuliar
19 South Vellar
III Pollachi 20 Aliyar
IV Madurai 21 Palar
22 Kottakaraiyar
23 Saruganiar
24 Varshanadhi
25 Sathaiyar
26 Varattar Negalar
27 Manjalar
28 Lower Vaigai
29 Upper Gundar
30 Tenkar
31 Nichabhanadhi
32 Kalingalar
33 Sindapalli Odai
34 Arjunanadhi
35 Senkottaiyar
36 Chitter
37 Manimuthar
38 Lower Tamiraparani
39 Pazhayar
40 Nambiyar
41 Pamber
42 Paralaiyar
GOVERNMENT OF TAMIL NADU
WATER RESOURCES ORGANISATION PWD
INSTITUTE FOR WATER STUDIES
TAMIL NADU CENTRE FOR REMOTE SENSING APPLICATION
THARAMANI,CHENNAI-113

1.7.4 PIM activities proposed for the IAMWARM

Completion of balance of tasks related to WRCP, by end of March 2006

- Finalise the proposals for:
  - appointment of Competent Authorities to the WUAs
  - delineation of the Distributory and Project Committee Areas.
- Obtain Government approval for the above two proposals.
- Up-date the assessment of vacant posts of President and Members of the Managing Committee of the WUAs formed under WRCP, to be filled up by fresh election.
- Obtain Government approval with necessary Budget provision for funds for distribution to District Collectors for the conduct of fresh elections to fill up the vacant posts.
- Conduct "One Day Seminar" inviting the elected presidents and members of the Managing Committee of WUAs **in batches** with due representation to the systems and regions of WRO. The objective of this Seminar is to obtain necessary **"Feed Back"** from the elected c presidents and members on:
  - the level of effective functioning of the Associations after taking over the (O&M) responsibilities of the distribution systems from WRO.
  - their excitements and experiences in handling the new responsibilities.
  - suggestions on "remedial measures" for overcoming certain problems encountered in carrying out the new responsibilities.
  - suggestions on amending the TNFMIS Act, Rules and Election Rules to remove the practical difficulties experienced in the preparation and conduct of the elections.
  - a comparison on the pre-WRCP project and post WRCP project conditions in terms of benefits accrued and problems encountered.
  - providing information on the level of interaction between the officials of WRO and the president and members of the Managing Committees of the Associations.
  - any other information, which will enhance the effective functioning of the Farmers Associations and interaction between the farmers and officials.
- The elected presidents and members of the Managing Committee of the WUAs felt that the one-day training already provided by IMTI is not adequate to undertake various responsibilities related to (O&M) operation of the systems. The "training needs" has already been assessed by the Senior Consultant (PIM) and discussions held with the Director and Faculty Members of the Institute. Follow up action is required from both ends to design and organize **intensive training to** cover all the WUAs. Necessary funds are to be received from the Government and then transferred to IMTI.

- Government orders issued earlier brought the TNFMIS Act into force in 20 Districts other than the 9 Districts of Cauvery Basin. Hence orders of the Government is now to be obtained to bring into force the TNFMIS Act in the balance 9 Districts.

- However, the Government has earlier ordered to implement the TNFMIS Act only in the command area covered by WRCP. It is now therefore necessary to get the orders of the Government to implement the TNFMIS Act in the entire command area maintained by the WRO, in the State.
- The officials of the Chennai, Madurai and Pollachi Regions have partially completed the preparation of the **draft documents** for the WUAs. These documents require scrutiny by the officials of the FOT cell in Chief Engineer ((O&M and ISW)) office at Chennai and the Senior Consultant (PIM). This work will be initiated and continued **beyond March 2006.**
- Organize **Awareness Creation Programme** on the TNFMIS Act, Rules and Election Rules and the process of its implementation to the benefit of the officials and farmers of Trichy Region.
- Arrange to commence the collection of information from all possible sources for amending the TNFMIS Act, Rules and Election Rules.

Project Year -1 (2006-2007)

Tasks to be performed for completing the implementation of PIM in Tamil Nadu including Cauvery basin area under "IAMWARM PROJECT" (2006 to 2011)

- Complete, elections to constitute the Managing Committees of the DCs and PCs in WRCP command area.

- Arrange to commence and continue fresh elections for filling up the vacant posts of WUAs formed under WRCP.

- Conduct training programmes for the elected Presidents, Chairmen and Members of the Managing Committee of WUAs, DCs and PCs of WRCP command area.

- Continue and complete verification of the documents for forming WUAs in areas other than WRCP command and area in Trichy Region, prepared by WRO officials and arrange to pass them on to the District Collectors concerned for verification, finalization of the list of voters and issue of necessary notifications.

- Arrange to complete all the preparatory works for the conduct of elections for the command area other than that covered by WRCP and Trichy Region and complete the elections as per TNFMIS Act.

- Commence the preparation of documents for the WUAs to cover all the systems in Trichy Region.

- Arrange for the design, procurement and installation of flow measuring devices in the distribution systems handed over to the farmers organization (WUAs, DCs and PCs) in Chennai, Madurai and Pollachi Regions. Commence training of farmers in flow measurements and documentation, and for effective functioning of the associations.

- Prepare a proposal and get it approved for re-organizing the present PIM unit in Chief Engineer (O&M and ISW) office for effectively monitoring the implementation of PIM in Tamil Nadu and ensuring the sustainability of the farmers organization(WUAs, DCs and PCs) activities, in the state. This needs the deployment of a separate Chief Engineer (PIM) with adequate technical and support staff both at head quarters office as well as in all the regional FOT cells proposed now in all the four WRO Regions and IMTI.

- Develop upgraded infrastructural facilities to support the PIM units at head quarters, WRO Regions and IMTI. There is also a need to create a separate data base to cover all the activities related to all the PIM units established in the state.

- Send proposals for building offices to WUAs, DCs and PCs established in the state and develop suitable terms and conditions for extending the required assistance to the associations.

- Arrange for the conduct of "Study Tour" for the benefit of Government officials and farmers.

Project Year - 2 (2007-2008)

- Complete scrutiny of the documents related to WUAs prepared by WRO officials of Trichy Region, by the officials of the FOT cell at Chennai and arrange to send them the District Collectors concerned for follow up action.
- Arrange for the completion of verification of the documents related to Trichy Region command by the District Collector concerned, finalization of the list of voters, publication of the documents with issue of necessary notifications.
- Complete all the preparatory works for the conduct of elections to WUAs for the systems in Trichy Region and conduct the elections to cover the entire area.
- Train the elected President/Chairman and members of the Managing Committee of WUAs, DCs and PCs established in Trichy Region.
- Finalise the DC and PC proposals in respect of WUAs formed in Trichy Region and obtain the approval of the Government. Arrange for the conduct of the elections.
- Provide training to all the elected President/Chairman and members of the Managing Committee of the DCs and PCs.
- Arrange for the Study Tours to cover the Government officials and farmers.
- Provide training on flow measurements and documentation to WRO officials and farmers and in other areas to ensure effective functioning of the associations.

- Complete re-organising of the PIM unit and installation of supporting infrastructural facilities.
- Continue with the construction of office buildings for the WUAs, DCs and PCs.
- Seek approval for the amendments to TNFMIS Act, Rules and Election Rules.

Project Year - 3 (2008 - 2009)

- Arrange for the completion of second election to the WUAs formed in the year 2004, after the expiry of the 5 year Term.
- Conduct study Tours to the Government officials and farmers.
- Develop case studies on "Success and failures" of the functioning of WUAs, DCs and PCs in all the four regions where implementation of PIM has been completed.
- Continue Training of Government officials and farmers on effective functioning of the WUAs, DCs and PCs.
- Organise evaluation of the performance of the farmers associations functioning in different regions and arrange for sustaining the achievements.
- Organise, regional level and state level Seminars to share the experiences of WRO officials, and farmers of the associations and improve upon their functional effectiveness.
- Design a Monitoring and Evaluation system to monitor the out comes of:
    - performance of the WUAs, DCs and PCs.
    - increase in water use efficiency in the distribution systems handed over to the farmers.
    - increase in agricultural productivity and farm income.
- Introduce new water management practices and other water saving decides.
- Intensify the spread of the knowledge of the new agricultural practices through agricultural extension and training.

Project Years - 4&5 (2009 - 2011)

- Organise a Mid-Term review of all the aspects related to implementation of PIM in Tamil Nadu and document the findings.
- Intensity the extension activities to the members of the farmers association, continue close monitoring of the outcomes and initiate suitable remedial measures, wherever necessary.
- Initiate necessary follow up actions based on the outcome of Mid-Term review.

2 POLICY AND INSTITUTIONAL FRAMEWORK

2.1 Introduction

Appropriate policies and formation of institutional arrangements must necessarily address the whole range of rules and regulations, customs and practices, ideas and information and interest of the community group network. These simple but important aspects would together provide the need-based and location-specific institutional framework or the context within which water management actors and other decision-makers operate. The institutional aspects broadly cover the formation of policy directions, mechanisms for effective water distribution and management systems and effective cost-recovery methods. The Government often plays these roles, and there is a need to involve stakeholders in the governance and management of water resources at all levels. There is a need to reform the existing institutions and establish new linkages.

2.2 Water Resources Organization (WRO)

The Water Resources Organization (WRO) under the Chairmanship of Engineer-in-Chief is assigned with the task of implementation of Model Rehabilitation and Modernization of Hanumanadhi sub basin in co-ordination with other departments and monitoring and evaluation of project achievements. Various works are taken up for 12 anicuts,14 main channels and 50 tanks in the sub basin and the operational efficiency of the system is expected to improve after completion of all the works. They are as follows:

- Protective works in the river bed
- Strengthening of anicuts
- Construction of head sluices at open take off channels
- Lining of canals
- Bund Protection
- Providing shutters to sluices
- Channel bank formation with roads
- Providing ground water recharge ponds
- Improving surplus arrangements to tanks
- Cross drainage works

The rehabilitation works such as desilting of tanks, lining of canals, construction of retaining walls, strengthening of bunds, repairing of sluices, gates and weirs are being undertaken by the WRO. As per the proposal and concept, the head reach water shall go to tail end and there should be a minimum guarantee for equal distribution of water upto the tail end. The rehabilitation works can help them to fulfill the aim and objectives.

2.3 Dam Safety Directorate

The Dam Safety Directorate was established in the year 1991 in Tamil Nadu with the object of giving assurance to safety of large dams in Tamil Nadu vide G.O. Ms No: 725 dated 18-04-91. At present there are 75 nos of PWD dams, (including 7 nos of small dams and 5 nos of drinking water supply reservoirs) and 38 nos of Tamil Nadu Electricity Board large dams. The Dam Safety Directorate is headed by a Director in the rank of Superintending

Engineer and at present assisted by an Assistant Executive Engineer with supporting ministerial staff. The important works carried out by the Dam Safety Directorate are as follows:

- Preparation of Health status of Dams
- Technical investigation of large dams by Multi Disciplinary Committee
- Detailed technical investigation of dams by National level experts
- Geological mapping of dams
- History of dams
- State Dam Safety Committee
- Dam safety Project I
- Dam safety Project II

2.4 Water Resources - Institutions

Water is a dynamic element and requires dynamic management. Institutional arrangements are critical to develop and implement water management policies and plans. They drive the implementation of the Strategic Frameworks developed for the management of water resources. Tamil Nadu is laying more emphasis for efficient water management and initiated number of policy, institutional and legal framework to ensure additional productivity with the available water resources. As part of this, the following state level organizations have been created to ensure judicious exploitation of water resources.

2.4.1 Water Resources Control and Review Council (WRCRC)

The Government of Tamil Nadu has formed the Water Resources Control and Review Council to take steps to formulate water management strategies and implementation of the Water Policy vide G.O. Ms. 1404 PW (XI) Dept dt. 30.09.03 and in Govt. letter No. 31877/PW (R1) D/95-6 dt. 11.12.95.

The composition of WRCRC and functions are as follows:

(1) Chief Minister - Chairperson
(2) Minister for public works - Vice-Chairman
(3) Minister for Local Administration - Vice-Chairman
(4) Minister for Agriculture - Vice-Chairman

The other Members are

(5) Chief Secretary to Government
(6) Secretary to Government, Public Works Department
(7) Secretary to Government, Finance Department
(8) Secretary to Government, Agriculture Department
(9) Secretary to Government, Municipal Administration & Water Supply Department
(10) Secretary to Government, Environment and Forest Department
(11) Secretary to Government, Rural Development Department
(12) Secretary to Government, Revenue Department

(13) Secretary to Government, Animal Husbandry & Fisheries Department
(14) Secretary to Government, Industries Department
(15) Secretary to Government, Planning & Development Department
(16) Secretary to Government, Law Department
(17) Commissioner of Land Administration
(18) Member Secretary, Tamil Nadu State Planning Commission
(19) Chairman, Tamil Nadu Pollution Control Board
(20) Chairman, Tamil Nadu Electricity Board
(21) Chairman & Managing Director, Chennai Metropolitan Water Supply & Sewage Board
(22) Managing Director, Tamil Nadu Water Supply & Drainage Board
(23) Engineer-in-Chief, Water Resources Organization
(24) Chief Engineer, Design Research & Construction Support, Water Resources Organization
(25) Chief Engineer, State Ground & Surface Water Resources Data Center, Water Resources Organization
(26) Chief Engineer, Plan Formulation, Water Resources Organization
(27) Chief Engineer, (O & M), Water Resources Organization
(28) Director, Irrigation Management & Training Institute
(29) Director of Agriculture
(30) Vice-Chancellor, Anna University
(31) Director of Industries & Commerce
(32) Vice-Chancellor, Tamil Nadu Agricultural University
(33) Chief Engineer, Agricultural Engineering
(34) Director of Water Technology Center, Tamil Nadu Agricultural University
(35) Director of Public Health and Preventive Medicine
(36) Two representatives from the Water Users' Community in the private sector, who have demonstrated knowledge and interest in water use and development to be appointed by the Government and whose terms of office shall be defined in the order of appointment
(37) Director, Institute for Water Studies - Member Secretary

The Council shall meet once in three months and such other times, as may be necessary to carry out its functions and activities. The other powers, functions and terms of references of the above council shall be as laid down in the G.O. read above. Statutory status to the above council, if needed, shall be accorded later.

Power and Functions of the Water Resources Control and Review Council (WRCRC)

With the high percentage of the State's surface water resources already utilized, the scope for construction of new surface water storage reservoirs is limited. Therefore, more efficient water management is the most promising source for additional productivity in Tamil Nadu. The opportunities for conservation and reuse, in irrigation, industrial use and

municipal water supply system have also to be explored. The proposed Council (WRCRC) shall set out policies in this regard.

The Water Resources Control and Review Council shall establish allocation priority norms for water use for different sectors with provision for drinking water, being given the highest priority.

No scheme proposed for exploitation of water shall be excluded from the purview of the Council.

The Council will take necessary steps to formulate the water management policy to be followed by the State. After the policy is prepared and accepted, after wide circulation, the Council will implement it, in an effective manner. Monitoring the implementation of the Policy will be the primary function of the Council.

While taking a look at the various schemes proposed by the user departments, the Council will get the technical input for these schemes from the various members of the Council. The Water Resources Control and Review Council will also examine the impact of extraction, utilization and conservation of water of the other users.

The Council shall also

(i) Formulate water policies for the State and basin water development, control and management

(ii) Establish principles, standards and procedures for allocation of water under licenses, preparation of comprehensive regional or river basin plans and for formulation and evaluation of water policy and related land resources projects using technical, economic, social, legal and environmental criteria

(iii) Serve as an advisory and co-coordinating body for the State in water and related matters

(iv) Review and approve State and river basin master plans; prioritisation of different sectional water needs

(v) Review and approve macro planning, distribution management of water resources taking into account the water needs of different sectors (agriculture, industrial, drinking, social, etc.). Small schemes need not be referred to the Council (WRCRC). For e.g., drinking water supply schemes less than say 10 Million liters need not be referred to the Council.

(vi) Review and approve for publication, on annual assessment of the adequacy of supplies of water necessary to meet the present and their projected State and basin water requirements

(vii) Issue orders as may be necessary to carry out its functions.

Water Resources Projects/Programmes by the Government

Water Resources and related projects and programmes of the Government shall be submitted by the proposing agency/agencies to the WRCRC, which may, before taking action, if necessary, refer the matter to the Institute for Water Studies for comments, in accordance with the principles and guidelines laid down. No programme, plan, project or water works explicitly or implicitly included within the powers and functions of the WRCRC will be eligible for public funding and budgetary allocation without the recommendation of WRCRC.

The conflicts/problems arising during normal administration/ maintenance of irrigation systems shall not be referred to WRCRC and they may be resolved under rules and guidelines, procedures governing the systems existing at present.

On going Central and State schemes like Command Area Development (On Farm Development and Rotational Water Supply), Micro Irrigation Schemes, and Watershed Development Programmes under River Valley Project shall be excluded from the purview of WRCRC.

Any agreement among Government agencies involving the use of water for domestic and municipal water supply, irrigation, hydro power production, industrial or other commercial uses, watershed, coastal areas and environmental protection measures shall, in all cases, be subject to review and approval by WRCRC. In the review of such agreements, the WRCRC may consult the parties, other Government agencies concerned and the Institute. The WRCRC could evolve its own procedures to ensure proper functioning in the achievement of its objectives.

Resolution of Conflict Arising from Projects

Conflicts arising from project and agreements would be resolved by the WRCRC by public hearing or by any other method suitable and practicable.

Meeting of the WRCRC

The WRCRC, shall meet once in three months and such other times as may be necessary to carry out its functions and activities, At all meetings, decisions shall be made by a vote of the (simple) majority of those attending.

The WRCRC shall function for two years and thereafter, a review of the functioning of the Council shall be made and, if need be, appropriate statutory status could be accorded later.

The Government has also instituted the following sectoral sub-committees to support the functions of WRCRC as per the suggestions of the World Bank.

(i) Irrigation and Agriculture

(ii) Urban and Rural Domestic and Live-stock Water Supply and Sanitation

(iii) Power and Industrial

(iv) Ground Water Regulation

(v) Environment

The Government after consideration constituted the technical working group committees as presented in the following tables

Table 2.1 Technical working group committees of WRCRC

S.No	Name of the Sector	Members	Designation
1	Irrigation and Agriculture	Engineer-in-Chief, Water Resources Organization, Public Works Department	Chairman
		Director, Center for Water Resources, Anna University	Member
		Director, Agriculture Department	Member
		Chief Engineer, Agriculture Engineering Department	Member
		Chief Engineer, (Plan Formulation) WRO, Public Works Department	Member
		Chief Engineer (State Ground and Surface Water Resources Data Center) Water Resources Organization, PWD	Member
		Officer in charge of Central Ground Water Board at Chennai	Member
		Chief Engineer & Director, Institute for Water Studies	Member Secretary
		Commissioner of Fisheries	Member
2.	Urban and Rural Domestic and Livestock water supply and Sanitation	Engineer-In-Chief, Water Resources Organization, Public Works Department	Chairman
		Engineering Director, Tamil Nadu Water Supply and Drainage Board	Member
		Engineering Director, Chennai Metropolitan Water Supply & Sewerage Board	Member
		Director, Animal Husbandry	Member
		Director, Centre for Environmental Studies, Anna University	Member
		Director, King Institute, Guindy	Member
		Director, Public Health & Preventive Medicine or his nominee	Member
		Chief Engineer (State Ground and Surface Water Resources Data Center	Member

		Chief Engineer & Director, Institute for Water Studies (IWS)	Member-Secretary
3	Power and Industry	Engineer-In-Chief, Water Resources Organization, Public Works Department	Chairman
		Chief Engineer, Tamil Nadu Electricity Board	Member
		Director, Industries and Commerce	Member
		Chief Engineer, Planning Tamil Nadu Water Supply & Drainage Board	Member
		Chief Environmental Engineer, Tamil Nadu Pollution Control Board	Member
		Chief Engineer (Plan Formulation) WRO, Public Works Department	Member
		Managing Director, SIPCOT	Member
		Managing Director, Tamil Nadu Industrial Corporation	Member
		Chief Engineer & Director, IWS	Member-Secretary
4.	Groundwater Regulation	Chief Engineer (State Ground and Surface Water Resources Data Center) Water Resources Organization	Chairman
		Engineer-In-Chief, Water Resources Organization	Member
		Chief Engineer, Agricultural Engineering Department	Member
		Chief Engineer, Planning, Tamil Nadu Water Supply & Drainage Board	Member
		Chief Engineer (Plan Formulation) WRO, Public Works Department	Member
		Officer in charge of Central Ground Water Board at Chennai	Member
		Engineering Director, Chennai Metropolitan Water Supply and Sewage Board	Member
		Chief Engineer and Director, Institute for Water Studies	Member-Secretary

Table 2.2 Technical working group committees of Environmental Sector

S.No	Name of the Sector	Members	Designation
1.	Environment	The Secretary to Government, Public Works Department, Chennai-9	Chairman
		The Secretary to Government, Environment and Forest, Chennai-9	Member
		Engineer-In-Chief, WRO	Member
		Chief Engineer, Plan Formulation	Member
		Chief Engineer (State Ground and Surface Water Resources Data Centre) WRO	Member
		The Chairman, Tamil Nadu Pollution Control Board	Member
		Director of Agriculture	Member
		The Principal Chief Conservator of Forests	Member
		Director of Public Health and Preventive Medicine	Member
		Director, Center for Water Resources, Anna University	Member
		Director, Center for Environmental Studies, Anna University	Member
		Chief Engineer & Director, WRO, Institute for Water Studies	Member-Secretary

2.4.2 State Ground and Surface Water Resources Data Centre (SG & SWRDC)

The Groundwater Directorate was upgraded as one of the wings of PWD (Groundwater) in 1972 and subsequently it was renamed as State Ground and Surface Water Resources Data Centre (SG &SWRDC) in 1995.

The objectives of SG&SWRDC are as follows:

- Continuous monitoring of monthly hydrological, hydro meteorological, water level parameters and water quality for ground and surface water
- Consultancy services to Public, Government Departments and Private sector undertakings
- Storage of Data and dissemination

The SG & SWRDC of WRO monitor both Surface and Ground water quality and the ground water fluctuations continuously on a monthly basis. The quality of ground water is monitored twice in a year immediately before and after the monsoon period. The Surface water quality is also monitored under the Hydrology Project. Whenever there is flow in the river, the samples are taken and analyzed for various parameters. The water quality data are stored after validation. The ground water potential is assessed and reported in bulletins district wise. The data are also being supplied to other departments, universities etc., by collecting the rates stipulated by the government.

The organization is headed by the Chief Engineer with core staff in the areas of Geophysics, Hydrology, Draughting, Engineering and Drawings. The center has an excellent state of the art laboratory, GIS Centre. The total sanctioned staff strength is 1,646 and out of this about 340 posts are vacant.

2.4.3. Institute of Water Studies (IWS)

The Government of Tamil Nadu in G.O. Ms. No.457 PWD dated 8.4.1974 established the Institute for Water Studies (IWS) in the year 1974 in order to plan, assess and manage the water resources of Tamil Nadu in a scientific manner. A Director in the rank of Chief Engineer, PWD, heads this Institute and under him a team of Engineers, Hydrogeologists, Geochemists, Geophysicists, Environmental Engineers, Photogeologists and Remote Sensing Scientists and an Agro Economists are working. The total sanctioned strength is 93 and out of this 76 are in place now. The IWS and its existing environmental divisions are working in consonance with its original objectives.

The Objectives of IWS are as follows

- Development of a set of broad principles for planning and management of water resources
- Assistance in the formulation of water management policies
- Fostering or undertaking research related to planning and policy making in those areas where the needed work is not already being done and coordinating the efforts that is already underway
- Development of training programmes, particularly in connection with water planning and policy making
- Provision of advice to Government on specific policy matters referred to it, such as the development of principles for water allocation on the merits and costs of water diversion schemes and water usage schemes

Technical Secretariat

This Secretariat is a multi disciplinary unit functioning as an advisory body between the Government of Tamil Nadu and the Palar & Tambaraparani basin stations within the IWS.

2.4.4 Tamil Nadu Pollution Control Board (TNPCB)

Tamil Nadu Pollution Control Board (TNPCB), established in 1982, functions with Head Office at Chennai, headed by Chairperson, one Joint Chief Environmental Engineers office headed by Joint Chief Environmental Engineer, nineteen District Offices headed by District Environmental Engineers and five District Offices headed by Assistant Environmental Engineers. The Board has established three Advanced Environmental Laboratories, ten District Environmental Laboratories and one Mobile Environmental Laboratories to assist in the Analytical and Scientific side.

TNPCB is implementing the Pollution Control Legislations and Rules and Notifications framed therein. In discharging the duties entrusted to it, the Board investigates, collects and disseminates data relating to water, air and land pollution, lays down standards for sewage/trade effluent and emissions.

2.4.5. Department of Environment (DoE)

The Department of Environment was created in G.O.Ms.No.335, Environment and Forests Department dated 13.10.95 as the Nodal Department for dealing with Environmental Management of the State. The Department is entrusted with the implementation of major projects like pollution abatement in the river Cauvery, Vaigai and Tamiraparani; Pollution abatement in Chennai City waterways; National Lake Conservation Programme and all aspects of Environment other than those dealt with by Tamil Nadu Pollution Control Board.

Objectives of Department

- Implementation of National River Conservation Plan, for the abatement of pollution in River Cauvery, Vaigai and Tamiraparani and Chennai city waterways
- Implementation of National Lake Conservation Programme for the abatement of pollution in the selected lakes
- To carry out various environmental awareness programmes through National Green Corps and Eco-Clubs
- To enforce the provisions of the Coastal Regulation Zone Notification
- To provide web-based information through Environmental Information System (ENVIS) on the Status of Environment Tamil Nadu, the Biodiversity profile and the status of river cleaning activities in the state.
- To deal with all aspects of environment other than those dealt with by Tamil Nadu Pollution Control Board from time to time.

2.5 Water Resources – Policies and Acts

2.5.1 Constitutional Provisions

The Constitution of India in its Article 48 provides for the protection and preservation of the environment and states that "the state shall endeavor to protect and improve the environment and to safeguard the forests and wild life of the country".

Further the Article 5l-A(g) on fundamental Duties emphasizes that, "It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wild life and to have compassion for living creatures".

These two provisions of the constitution are the guiding principles for various environmental legislations in the country and safeguarding environment.

2.5.2 Water Acts

Water (Prevention and Control of Pollution) Act, 1974

Water Act is the first environmental regulation that brought in the state and central pollution control boards to control / regulate environmental pollution in India. Amended twice in 1978 and 88, the Act vests regulatory authority on the State Pollution Control Boards and empowers them to establish and enforce effluent standards for industries and local authorities discharging effluents.

- Vests the regulatory authority on the State Pollution Control Boards and empowers them to enforce to effluent discharge standards to prevent water pollution (both for industries and local authorities)

- Section 24 of the act prohibits the use of stream or well or on land disposal for of polluting substances violating the disposal standards laid down by the board

- Section 25 of the act requires an application to be made to the state board to establish any treatment and disposal system that is likely to discharge sewage or trade effluent in to a stream or well or sewer on land

- Sections 41 and 44 provides for penalties for not complying the various provisions or directives of the board

- Section 48 deals with the offences committed by Government Departments

- Section 55 asserts that all local authorities shall render help and assistance and furnish information to the board as it may require for discharge of its functions, and shall make available to the board for inspection and examination such records, maps, plans and other documents as may be necessary

The act empowers the board to levy and collect cess on water consumed by the industry or local authority and to utilize and augment resources for the Pollution Control Boards. In line with this provision, The Water (Prevention & Control of Pollution) Rules, 1975 were formulated. This act will be of significant importance for the water supply and sanitation projects, as the project activities if not planned carefully are expected attract various section of the act. In the present case the increase in. supply water quantity due to continuous water supply will require the declaration from the respective local body for payment of additional water cess to the TNPCB.

Water (Prevention and Control of pollution) Act of 1974 (Central Act 6 of 1974) as Amended in 1988

This Act provides for the prevention and control of water pollution and restoration of water quality to desirable levels. States may establish Boards for Prevention and Control of Water Pollution. Boards have the necessary powers and functions to address water pollution

and abatement issues and problems and the technical and administrative staff to carry out their decisions.

Water (Prevention and Control of pollution) Cess Act No. 36 of 1977

This Act is a companion Legislation to the 1974 Act. It provides for the levying and collecting of fees from local authorities and industries based on water delivered or consumed.

2.5.3 National Water Policy

The National Water Policy lays down general guidelines in preparing basin-wise master plan, priorities for water use, inter-basin transfer, etc. The National water policy enunciated by the GOI in 1987 has recognized that water is prime natural resource, a basic human need and a precious national asset. It has recommended that resource planning in the case of water have to be done for a hydrological unit such as a drainage basin as a whole, or for a sub-basin. It has further emphasized that special multi-disciplinary units should be set-up in each State to prepare comprehensive plans taking into account the needs of not only irrigation, but also the various other water uses so that the available water can be put to optimum use. The National Water Policy has recommended to establish a standardized National information system with a network of data banks and data bases, integrating and strengthening the existing Central and State level agencies, and improving the quality of data and the processing capabilities for better planning.

National Water Policy- 2002

The National water policy was revised by Ministry of Water Resources, GOI in April 2002. The Policy recommends for water resources planning where water resources development and management will have to be planned for a hydrological unit such as drainage basin as a whole or for a sub basin, multisectorally taking into account surface and ground water for sustainable use incorporating quantity and quality aspects as well as environmental considerations.

The Policy recommends to establish river basin organizations for planned development of a river basin/sub basin and special multi disciplinary units for preparing comprehensive plans taking into account not only the needs of irrigation but also harmonizing various other water users. The Policy has prioritized water allocation in the order as follows:

- Drinking water
- Irrigation
- Hydropower
- Ecology
- Agro and non agricultural industries
- Navigation and other uses

The Policy addresses a participatory approach to Water Resources Management where all the stakeholders, Water Users' associations and local bodies should particularly be involved in the operation, maintenance and management of water infrastructures/ facilities at appropriate levels.

2.5.4 Tamil Nadu Water Policy

Based on the concept of the National Water Policy of Government of India, the Government of Tamil Nadu has also formulated a water policy called 'Tamil Nadu Water Policy '. Tamil Nadu is the pioneer in the establishment of river basin organizations suggested in National Water Policy 2002.

The institute for Water Studies drafted the above policy and submitted to Government in January 1994. It has been approved by the Government of Tamil Nadu and published in G.O. Ms. No. 716 PW (WR) Dept dt. 13.07.94. The Institute for Water Studies function as the implementing agency of the policy. The ultimate goal of the State's Water Policy is to develop a 'State Water Plan', which will be the blue print for all water resources development and use in the State.

Within the framework provided by the National Water Policy, the broad objectives of the Tamil Nadu Water Policy are:

1. Establish a Management Information System (MIS) for water resources
2. Ensure preservation and stabilization of existing water resources
3. Plan for augmentation of utilizable water resources
4. Promote research and training facilities for water resources management
5. Establish allocation priorities for water use by different Sectors with provision of drinking water being of highest priority
6. Maximize multi purpose benefit from surface and groundwater, land and other resources
7. Provide adequate water for domestic users
8. Maximize hydro power generation within the constraints imposed by other water users
9. Provide adequate water for industry

2.5.5 The Tamil Nadu Groundwater (Development and Management) Act, 2003

This Act extends to the whole of the state of Tamil Nadu except the areas to which the Chennai Metropolitan Area Groundwater (Regulation) Act, 1987 extends. It shall come into force on such date as the Government may, by notification, appoint and different dates may be appointed for different areas and for the different provisions of this Act. A specific authority called as Tamil Nadu Groundwater Authority will implement the Act. The constitution of this authority is under consideration in the Government of Tamil Nadu.

2.5.6. Regulations and Procedures

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 officers to operate and maintain reservoirs and distribution systems.

Compendium of Rules and Regulations, Part II Rules for Flood Regulation (1984)

The reservoir levels, at which certain release rules are to be implemented, are prescribed. It provides the lists of the officials to be notified under prescribed conditions. It outlines steps to be taken in disastrous situations like cyclones and floods.

Inland Waterways Authority of India Act No. 82 of 1985

This Act calls for the creation of the Inland waterways Authority of India to develop, maintain and regulate inland waters for shipping, navigation and other related matters, such as removal of obstructions, control discharge of materials and for conservation measures to protect the water ways.

Inter-State Water Disputes Act No. 33 of 1956, as Amended

This Act Provides for the adjudication of disputes relating to inter State Rivers and River Valleys by a Water Disputes Tribunal constituted by the Central Government upon receipt of a request for such action from a State that feels an Inter-State river dispute has or is likely to arise with a neighboring State. Before establishing the adhoc Tribunal, the Central Government must be of the opinion that the dispute cannot be resolved by negotiation. The decision of the Tribunal shall be considered final and binding upon the parties.

Chennai Metropolitan Water Supply and Sewerage Act, Tamil Nadu Act, No. 28 of 1978, as Modified up to 31 August 1981.

As per this Act, the Board has power over construction, drilling and altering of wells, ponds, tanks, and cisterns providing drinking water and the power to regulate, control and charge for existing or future use of groundwater for all purposes except irrigation, in the Chennai Metropolitan Area

Tamil Nadu Water Supply and Drainage Board Act No.4 of 1971 as Amended

The Act creates a special board to address drinking water supply and drainage issues and problems in Tamil Nadu. The board is a corporate body consisting of appointed members of the public and officials from certain State agencies. Board is charged with developing and executing schemes for providing drinking water supplies and drainage facilities.

Chennai Metropolitan Area Groundwater (Regulation) Act No. 27 of 1987

This act authorizes the Chennai Metropolitan Water supply and Sewerage Board to prohibit drilling new wells in the designated area unless the user first obtains a permit from the Board and to prepare a register of all existing wells. As per this act, pre-existing users, except agricultural users, must apply for a license within 15 days of date of Act. All new users must obtain a license from the Board. This Act directs the Government to issue instructions to the Board on the implementation of an artificial recharge scheme; This Act grants the Board power to adopt regulations to prevent seawater intrusion.

Tamil Nadu Water (Prevention and Control of Pollution) Rules, 1983, No. SRO A-236 (a)/83 Gazette No. 348.dated September 30, 1983, Part III - Section I(a)

It provides for organization and functioning of the Pollution Control Board. It prescribes functions of State Water Laboratory.

The Tamil Nadu Pollution Control Board (TNPCB) enforces the enactment on Environment and Pollution Control on Water, Air, and Environment Protection. As per G.O. Ms. No. 213 (ECI) Department dated 30.3.89 Environment and Forests, no new industry is to be cited within one km from water sources. Annexure I to these G.O gives the list of industries for which total ban has been imposed for location of the industries from the embankment of the water sources mentioned in Annexure II. The TNPCB will examine the case and obtain the approval of Government for setting up highly polluting industries from water sources, other than mentioned in Annexure II. The TNPCB has prescribed the effluent standards in BP Ms. 30 TNSCP dated 21.02.84. The Government reconsidered the regulation of this G.O. regarding locating new industries with reference to Water Sources has been modified from one km. to 5 km. Government Order Ms. No. 127 Environment and Forests dated 8.5.98 states that no new industries (Red category type) will be sited within 5 km. radius from Water Sources.

The existing policy aspects both at national and state level have sufficiently empowered to execute water resource development projects and also to address the issues relating to environmental management for sustainable use of water and water development in the State.

2.5.7 River Basin Management and Development Board

The River Basin Management and Development Board was constituted vide G.O. Ms. No.31, Public Works (W2) Department, dated 12.01.2001 to manage the water based activities of Palar and Tambraparani basins initially. The Honorable Minister for Water Resources is the Chairman with the members from all the Water User Departments in the Government, MLAs representing the constituencies in the river basin, Panchayat Union Chairman, Municipal Chairman, Panchayat Presidents of the concerned districts, Presidents of WUAs, concerned district Collectors, representatives of the concerned departments, representatives of Industries, representatives of NGOs and the officials from WRO. The Chief Engineer, WRO is the member secretary

River Boards Act No. 49 of 1956 as Modified

This Act declares that Central Government may exercise control over the regulation and development of inter-State Rivers and river valleys to an extent necessary to protect the public interest. The Central Government can establish a River Board to advise as to development and regulation, co-ordination of activities, allocation of costs and progress of development

2.6 National Environment Policy

The current National policies for environmental management are found in the National Forest Policy, 1988, the National Conservation Strategy and Policy Statement on Environment and Development, 1992, Policy Statement on Abatement of Pollution, 1992 and the National Water Policy, 2002. They have contributed to environmental management substantially. Salient Features of the National Environment Policy, 2004 are set out below:

- **Conservation of Critical Environmental Resources**: To protect and conserve critical ecological systems and resources, and invaluable natural and man-made heritage which are essential for life-support, livelihoods, economic growth, and a broad conception of human well-being.

- **Intra-generational Equity: Livelihood Security for the Poor**: To ensure equitable access to environmental resources and quality for all sections of society, and in particular, to ensure that poor communities, which are most dependent on environmental resources for their livelihoods, are assured secure access to these resources.

- **Inter-generational Equity**: To ensure judicious use of environmental resources to meet the needs and aspirations of present and future generations.

- **Integration of Environmental Concerns in Economic and Social Development**: To integrate environmental concerns into policies, plans, programmes, and projects for economic and social development.

- **Efficiency in Environmental Resource Use**: To ensure efficient use of environmental resources in the sense of reduction in their use per unit of economic output to minimize adverse environmental impacts.

- **Environmental Governance**: To apply the principles of good governance (transparency, rationality, accountability, reduction in time and costs, and participation) to the management and regulation of use of environmental resources.

Enhancement of Resource for Environmental Conservation: To ensure higher flows comprising finance, technology, management skills, traditional knowledge, and social capital, for environmental conservation through mutually beneficial multi-stakeholder partnerships between local communities, public agencies, and investors.

2.7 Air (Prevention and Control of Pollution) Act, 1981

Similar to Water Act, the Air Act vests the regulatory authority on the State Pollution Control Boards and empowers them to enforce to air quality standards to prevent air pollution in the country. Section 21 of the act requires an application to be made to the state board to establish or operate any industrial operation. This act however, is not of major significance for the water and sanitation projects as no air polluting activities are anticipated.

2.8 The Environment (Protection) Act, 1986

The Environment (Protection) Act, popularly known as EP Act, is an umbrella legislation that supplements the existing environmental regulations. Empowered by EP Act, the Ministry of Environment & Forests (MoEF), Government of India has issued notifications regulating siting of industry and operations, procuring clearance for establishing industries and development projects with appropriate EIA studies, coastal zone regulations and other aspects of environment.

- Empowers the Government of India (section 6) to make rules to regulate environmental pollution by stipulating standards and maximum allowable limits to prevent air, water, noise, soil and other aspects of environmental pollution

- Prohibits carrying out any operations that emits pollutants in excess of standards (section 7)

- Regulates handling of hazardous substances and identifies the persons responsible for discharges and pollution prevention (section 9)

- Section 17 deals with the offences committed by Government Departments

- Formulated Environmental (Protection) Rules, 1986, Hazardous Wastes (Management and Handling) Rules, 1989 and Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 in accordance with the sections 6, 8 and 25 of EP Act.

While the water supply and sewerage projects are not notified as the projects requiring ministry's clearance in the EIA notification issued in 1994, investment / development projects costing above Rs.500 million however require ministry's clearance. However since the present project investment is spread over three cities it will not attract this clause.

2.9 The Indian Forest Act, 1927

Section **5** states that after declaring the particular land as reserved forest, no fresh clearings for any purpose shall be made except in accordance with such rules made by **State Government.**

Section 26 states the acts prohibited in such forest in addition to the section 5.

Sections 30, 32 furnish power to the State government to regulate certain acts (clearing for cultivation, or building or any other purpose of any land etc, in such forests) specified in the section, in protected forests.

Section 35 furnishes power to state government to prohibit certain acts (clearing of vegetation etc) in lands not being the property of government.

2.9.1 Forest (Conservation) Act, 1980(as Amended In 1988)

As per Section 26 of Indian Forest Act, 1927 number of activities are prohibited in forest areas and demands prior approval of the Central government to use forest land for non-forest purposes.

The Forest (Conservation) Act, 1980 prohibits large-scale diversion of forestland for non-forest use. As amended in 1988, no State Government or any authority shall make such diversions except with the prior approval of the Central Government.

2.9.2. The Forest (Conservation) Act, 1980

Section 2 of the Act restricts the state government on the de-reservation of forests or use of forestland for non-forest purposes.

2.9.3. The Forest (Conservation) Rules, 1981

Rule 4 states the procedure to make proposal by state government seeking prior approval to de-reserve the forest for non-forest purposes (section 2 of Forest Act, 1980), provided that all proposals involving clearing of naturally grown trees in forest land or portion or thereof for the purpose of using it for afforestation shall be sent in the form of working plan / management plan.

The provisions of this attracted in water supply and sanitation projects, when structures, transmission lines and other components are passing through forest areas. As presented in section 5.3.2, the proposed replacement of a part of the leaking rising main between Kundargi and Tumarguddi in Belgaum is aligned along the existing road abutting the reserved forests near Dasanhatti and Tumarguddi. Since the portion of the rising main to be replaced is not yet finalized the requirement of clearance from the forest department will be required only if the finalized portion falls within the designated forest area.

2.9.4. Wildlife Protection Act, 1972

This act promulgated to provide for the protection of wild animals birds and plants and for matters connected therewith. The provisions under this act are as below.

- Section 9 of the Act mentions that no person shall hunt any wild animal specified in Schedule I

- The act prohibits picking, uprooting, damaging, destroying, acquiring any specified plant from any forestland

- It bans the use of injurious substances, chemicals, explosives that may cause injury or endanger any wildlife in a sanctuary

- No alteration of the boundaries of a National Park shall be made except on a resolution passed by the Legislature of State and

- Destruction or damaging of any wildlife property in national Park is prohibited

2.10 Manufacture, Storage and Import of Hazardous Chemical Rules, 1989

These rules aim at providing control for the generation, storage and Import of hazardous chemicals. According to these rules, the user of hazardous chemicals has to perform the following and dispose the hazardous waste as mentioned in the rules

- Identify the potential hazards of the chemicals and to take adequate steps for the prevention and control of such hazards
- Develop or provide information about the chemical in the form of safety data sheet and
- Label the specified information on container of hazardous chemical and

Chlorine used for disinfection of water is categorized as hazardous chemical as according these rules and usage of these chemicals above 10 tons per year attracts the provisions of these rules. At the rate of around I mg/I, the usage of chlorine for the existing supply levels will be more than 10 tons in all the three cities. Hence provisions under this rule will be applicable for all the project local bodies.

2.11 Notification on Coastal Regulation Zone, 1991

All coastal stretches of seas, bays, estuaries, creeks, rivers and backwaters which are influenced by tidal action up to 500 mts from the High Tide Line and the land between the Low Tide Line and the High Tide Line are declared as the area within Coastal Regulation Zone (CRZ). However, the distance from the HTL to which proposed regulations will apply in the case of rivers, creeks and backwaters may be modified on a case to case basis for reasons to be recorded while preparing Coastal Zone Management Plans by the competent authority. However, in this latter case, the distance from the HTL will not be less than 100 meters or width of the creek, river or back water, which ever is less.

These rules classify CRZ into three distinct zones of CRZ 1, 11 and III. While no development activities are permitted in CRZ I, specific activities that will not interfere with the coastal eco-system are allowed in CRZ 11 and 111. Water supply and sanitation projects, especially those in coastal areas or those projects, which are developed in CRZ areas, will attract the provisions of these rules. Since the present project activities do not fall near coastal areas the applicability of the CRZ does not arise.

2.12 Irrigated Agriculture- Institutions

The key focus areas for IAMWARM are on irrigated agriculture modernization and on integrated water resources management to improve the productivity of water.The proposed project development objective is to improve and sustain irrigation service delivery and productivity of irrigated agriculture with effective integrated water resources management in a river basin/sub-basin framework in Tamil Nadu.

Institutional Modernization for Irrigated Agriculture (targeted modernization and improved asset inventory and management plans (for instance, dams, tanks, irrigation infrastructure, agricultural, horticultural, fisheries data) technical and managerial upgrading of irrigation development and service delivery institutions, modernization of manuals/procedures, computerization, LAN and WAN, knowledge management software, information management and sharing, public interaction, closer integration of WRO/PWD and Agriculture, Horticulture, Agricultural Engineering, Livestock/Fisheries Departments. Sustainable Agriculture modernization (cropping systems diversification and management to improve water conservation and farmer returns, integrated pest and nutrient management, public private Partnerships for extension, post-processing, certification, marketing)

2.12.1 Multi Disciplinary Project Unit (MDPU)

Multi Disciplinary Project Preparation Panel (MDPPP) was constituted for evolving environmental action plan in Hanumanadhi Sub-basin drawing the professionals from all the line departments. The MDPPP has prepared an integrated micro level action plan for Hanumanadhi Sub-basin and implemented under WRCP Phase I. Since the IAMWARM project is a successor to WRCP Phase I, the MDPPP was converted as Multi Disciplinary Project Unit (MDPU) to review, monitor and implement the activities of various line departments under IAMWARM project.

The prime objective of this multi-disciplinary approach is to increase the productivity of water on a joint sector model and the farmers shall have to share part of the project investment cost.

The activities of the line departments under IAMWARM project are as follows:

Table 2.3 Activities of the Line Departments

Department	Responsibilities
WRO of PWD	Rehabilitation and Modernisation
Agricultural Engineering Department	Training and skill development to members of WUAs on high tech micro irrigation system
Tamil Nadu Agricultural University	Adaptive Research Trails
Agricultural Department	Procurement and supply of improved seed varieties, organic manure, introduction of System Rice Intensification (SRI) techniques
Agricultural Marketing	Transportation of agricultural products, information on latest market trends, cold storage, providing farm roads
Horticultural Department	Introduction of high yielding variety horticultural crops, application of organic manure, tissue culture for banana
Fisheries Department	Aquaculture in farm ponds, village ooranies and tanks, to provide additional income to the farmers
Forest Department	Raising "Social Forestry" on tank bunds, field boundaries, construction of check dams and growing vegetation in the catchment area
Social Welfare Department	Training on community organization, social welfare, education of the farming community

2.12.2 WRO- Environmental Cell Division

The activities of the Environmental Cell Division under WRO/PWD are as follows:

- Environmental base line data collection of the respective river basins.
- Documentation of environmental and social issues and monitoring the work.
- Water & Soil quality monitoring before restoration of water bodies and after restoration of water bodies.
- Conducting field oriented demonstration projects related to environmental issues.
- Creating environmental and social awareness among the stakeholders of the basin.

2.12.3 Agricultural Engineering Department

Agricultural Engineering Department proposes to disseminate the upgraded agricultural engineering technology information, high tech micro irrigation systems like drip, sprinkler and tower irrigation systems to all the water users in the basin. The main aim of the Agricultural Engineering Department works are as follows:

- To improve the productivity of water per unit per land.
- To improve the livelihood of farming and labour community
- To create an infrastructure base for water conservation techniques.
- To train the engineers and farmers on effective water management towards sustainable development
- The Agricultural Engineering Department has already carried out the following components for achieving the above said goals.

2.12.4 Department of Agriculture

The aim of the Agriculture Department is to improve the agricultural productivity through modernization of irrigation system, upgraded water management and farmers participation. The following components are being taken as action plan by Agriculture Department

- Paddy SRI (System of Rice Intensification) demonstration
- Improve the existing coconut garden
- Organic farming- green manure seed distribution
- Distribution of hand operated sprayers
- Technology demonstration
- Coconut coir compost demonstration
- Vermicompost demonstration
- Conducting seminars to create awareness by means of publicity

2.12.5 Tamil Nadu Agricultural University (TNAU)

The main objectives of TNAU are to increase water productivity in agriculture and horticulture crops of the project. To achieve the above goal, TNAU has taken six Adaptive Research Trials (ART) under 14 anicuts.

The principles in the ARTs are increasing the productivity of the crop through introduction of high yielding varieties

The activities being carried out by TNAU are as below

- System of Rice Intensification (SRI)
- High density banana with fertigations
- Drip irrigation in coconut, sugarcane
- Micro sprinkler to groundnut, cotton, vegetables and pulses

2.12.6 Horticulture Department

The Horticulture Department has taken very few assignments

- Tissue culture in banana growing
- Hybrid/ high yielding vegetables

2.12.7 Fisheries Department

The main objective of the Fisheries Department is to increase fish production and uplift the socio economic condition of the fishermen by implementing various welfare programmes such as

- Increase fish production by scientific fish culture in tanks
- Demonstration of fresh water prawn culture and fish culture in farm ponds
- Installation of cages for rearing of fish lings

2.12.8 Agriculture marketing and agri business

The main aim is to facilitate easy marketing facilities to the farmers. This department is undertaking the following activities.

- Installation of solar dryer for chillies drying.
- Construction of grading center for cleaning and value addition
- Supply of mini vans and vegetables crates
- Conducting farmers training

2.12.9 Forest department

The Forest Department proposed to raise babul/ karuvel plantations on tank beds in plain catchment area. They have submitted an action plan indicating details on catchment management works in sensitive areas of the river basins, forest produce, water conservation, environmental and social benefits.

2.12.10 Social welfare and development of Women Department

The aim of this department is to impart training for WUA's/ women farmers for which the following activities are being carried out under MDPPP

- Group formation
- Capacity building training
- SHG Members Training
- Animator & Representative Training
- EDP Training

  a. Skill Training

  b. Skill Up gradation Training

c. Vocational Training

2.13 Participatory Irrigation Management

The Government of Tamil Nadu have accepted the concept of Participatory Irrigation Management (PIM) and encourages the farmers participation in the operation and maintenance of the irrigation water distribution systems in all the irrigation systems maintained by the Government in the State. Under WRCP, the PIM programme has so far been implemented to cover an area of about 6.0 lakh hectares; out of about 21 lakh hectares spread over 20 out of 30 districts in the State.

2.13.1 Water User Associations (WUAs)

Totally 1965 Farmers Councils (WUAs) were formed and registered, as detailed below:

Table 2.4 Farmers Councils

1	1997 – 2002 (irrigation systems)	1272 Nos.
2	2001 – 2002 (irrigation tanks)	620 Nos.
3	2003 – 2004 Under Scheme completion	73 Nos.
	Total	**1965 Nos.**

2.13.2 The Tamil Nadu Farmers' Management of Irrigation Systems Act 2000

This Act received the assent of the President on the 25th February'2001 and is published as Act No. 7 of 2001. It provides for Farmers' participation in the Management of Irrigation Systems and for matters connected therewith or incidental thereto. The main objective of this Act is 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, by involving the farmers and inculcating a sense of ownership of the irrigation system in them in accordance with the water budget and the operational plan. It also facilitates scientific and systematic development and maintenance of irrigation infrastructure through farmer organizations. The farmer organizations have been involved fully in the management and maintenance of the irrigation system for effective and reliable supply and distribution of water.

The Act is having Seven chapters dealing with the matters relating to farmers' organization, functions of farmer' organization, funds of farmers organization, offences and penalties, settlement of disputes and miscellaneous matters.

2.14 Irrigation Acts

2.14.1 Bhavani Reservoir Irrigation Cess Act No. 16 of 1933 as Amended

It covers allocation of water from the Bhavani Reservoir through the issuance of permits to registered landowners, designating the land, time of use, type of crops that may be grown, and distribution channel serving the land. It provides for the levy of water-cess (at maximum rates specified for type of crop) on permitted lands.

2.14.2 Tamil Nadu Irrigation Cess Act No.7 of 1865, as Modified unto 31 October 1980

This is the fundamental water-cess or fee act for irrigation water use. It provides the policy basis for imposing a water charge. It establishes a policy of recovering a rate of return from beneficiaries of government funded irrigation projects.

2.14.3 Tamil Nadu Irrigation, Levy of Betterment Contribution Act No.7 of 1955, as Modified up to 31 October 1980.

It provides for betterment assessments be made against the land which is significantly' benefited by the completion of certain improvement works.

2.14.4 Tamil Nadu Irrigation Tanks (Improvement) Act No. 19 of 1949, as Modified up to 30 April 1949.

Under this Act, the Government has the authority to improve efficiency and capacity of government owned or operated tanks, regardless of location. The owners of land are subject to pay all or a portion of the costs of improvements.

2.14.5 Tamil Nadu Irrigation (Voluntary Cess) Act No. 13 of 1942, as modified up to 30 November 1980

This Act pertains to a special levy against lands for maintenance of certain irrigation and drainage works constructed or maintained by the Government.

2.14.6 Tamil Nadu Irrigation Works (construction of Field Bothies) Act No. 25 of 1959, as Amended

The District Collector is authorized to require landowners to construct or improve field channels or ditches. This Act prohibits anyone from obstructing or interfering with the flow of water in a field.

2.14.7 Tamil Nadu Irrigation Works (Repairs, Improvement and Construction) Act No. 18 of 1943, as Modified up to 30 November, 1980

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. This Act provides for recovery of costs and fees.

2.14.8 Mettur Canal Irrigation Cess Act No. 17 of 1953

This act provides specific legislation for levying of water charges on certain lands irrigated under the Mettur Canal.

2.14.9 Tamil Nadu Rivers Conservancy Act No.6 of 1884 as Amended in 1969

As per this Act the State government can declare a river or parts thereof, to be subject to conservation measures in designated areas.

2.14.10 Tamil Nadu Canals and Public Ferries Act No.2 of 1890

This Act extends the Bhavani Reservoir Irrigation Cess Act of 1933 to additional lands in Coimbatore and Salem districts.

2.15 Aquaculture Acts

2.15.1 Tamil Nadu Aquaculture (Regulation) Act. No 6 of 1996

It deals with aquaculture - culturing of shrimp, prawns, fish or any other aquatic life - in saline water, in saline soil but does not include fresh water aquaculture in coastal stretches of land, estuaries, creeks, rivers, and backwaters. The District Committee comprising District Collector as the Chairman, Chief Executive Officer of Brackish Water Fish Farmers Development Agency as the Member Secretary, Joint Director of Agriculture, Executive Engineer, PWD (Irrigation), Executive Engineer, PWD, (Ground Water), District Forest Officer, District Environmental Engineer of TNPCB, Regional Deputy Director of Town and Country Planning as members, shall examine applications, make enquiries in all aspects and forward the same to Director of Fisheries for granting license.

2.15.2 Nilgiris Game and Fish Preservation Act No.2 of 1879

It provides protection and prohibits selling of wildlife and fish from the Nilgiris District.

2.16 Tamil Nadu Agricultural Produce Marketing (Regulation) Act 1987

It deals to amend and consolidate the law relating to, and to make better provisions for, the regulation of buying and selling of agricultural produce and the establishment and proper administration of markets for agricultural produce in the State of Tamil Nadu.

It is expedient to provide for the better regulation of buying and selling of agricultural produce and the establishment on proper administration of markets for agricultural produce in the State of Tamil Nadu.

2.17 Panchayat & Land Acts

2.17.1 Tamil Nadu Panchayat Act No. 35 of 1958, as Amended

This Act prescribes purpose and manner of organizing village and town Panchayat. It authorizes Panchayat to construct and repair various small water related structures. This Act allows the Government to transfer to Panchayats the duty of protecting and maintaining any irrigation works or regulates distribution of water.

2.17.2 Tamil Nadu Land Improvement Schemes Act No. 31 of 1959, as Amended

The purpose 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 (including groundwater), prevention and mitigation of soil erosion, protection of land against damage from floods or drought, protection of Reservoirs from sedimentation and reclamation of waste lands. It provides for establishment of Boards at three levels, viz., State, District and River valley catchment area for carrying out the Act. This Act could be considered as a key law for improving water resources development, utilization, management, and conservation in Tamil Nadu.

2.18 Implications of various Acts on IAMWARM Project

Whenever a new project is conceived such as the IAMWARM, there is often the apprehension that there might be some implications by way of impacting on the existing organizations, institutional frameworks, policies and programmes. By its very nature agriculture modernization and water resource management are highly evolving subjects and there is constant transformation in the practices pursued by different line departments. For instance, there are a host of organizations such as

- WRO, PWD
- Agriculture Engineering Department
- Tamil Nadu Agricultural University
- Agriculture department
- Agriculture marketing
- Horticulture department
- Fisheries department
- Forest department
- Social welfare department

Naturally the functioning of the above departments would have an impact on agriculture modernization and water resource management because of the policy formulations evolved over a period of time. However, what is important to note is to determine the diverse aspects of the policy outcomes of the above departments and make them to function in consonance with the IAMWARM project. This obviously would mean that the IAMWARM project need not necessarily be pursued in isolation. There is a need to bring in some kind of congruence between the IAMWARM project and the existing line departments to achieve demonstrable results in some specific areas such as

- Desiltation of tanks
- Catchment degradation
- Cold storage facilities
- Marketing accessibility and information technology
- Sewage treatment plants
- Water weeds and juliflora
- Migration
- Social and environmental problems

3 REVIEW OF PAST EXPERIENCES

The Tamil Nadu Water Resources Consolidation Project (TNWRCP) was planned for a holistic development with an integrated vision for water sector development and management and user participation in planning and management to achieve a demand driven process. The strategy emphasizes on environmentally and socially sustainable basin approach for water resources planning and management, including conjunctive use of water. Agricultural intensification and diversification to be supported under this proposed intervention would contribute to creation of both on farm & off farm employment and create enabling environment for private sector participation. The project contributed to the poverty reduction and sustainable growth. The TNWRCP project is implemented in all the basins. The Project is a multi hierarchical programme, which addressed the existing deficiencies through a mix of institutional reforms and rehabilitation of physical assets.

The ESA study has been carried out to provide input into the TNWRCP in accordance with the World Bank operational guidelines. The primary objective of the ESA study is to identify the key environmental and social issues related to the project. A wide range of data has been collected pertaining to physical, environmental and social aspects. The study has been carried out in seventeen river basins and environmental and social attributes has presented in the GIS platform in respect of Palar, Vaippar and Kothaiar. A detailed study is carried out on the Model Rehabilitation project being implemented in the Hanuman Nadi sub basin of Thamiraparani river basin on MDPU structure. The activities of various departments involved in this model project and the methodology adopted have been evaluated. Suggestions are made for each department's activities and for the over all structure of the MDPPP for incorporation while replicating the same to other basins.

3.1 Tamil Nadu Water Resource Consolidation Project (TNWRCP)

Tamil Nadu Water Resource Consolidation Project (Phase I) was taken up in 1995 with the financial assistance of World Bank at an estimated cost of Rs.11433 million and the project was completed on 30.9.2004.

3.1.1 Core objectives

- To introduce Water Resource Planning by river basins across all users of water
- To improve agricultural productivity through modernisation and completion of irrigation system, upgraded water management and farmers participation
- To assure sustainability of water infrastructure and the environment and
- To improve Institutional and Technical Capacity for managing the State Water Resources

A macro level planning has been completed for 16 basins out of 17 basins in the State leaving the Cauvery river basins due to water dispute on sharing of water. The Water Resources Management Project was also piloted in the Hanumanadhi sub basin of Tambraparani

3.1.2 Lessons learnt from WRCP

The lessons learnt from the TNWRCP Project area as follows:

- The Farmers' Management of Irrigation Systems Act 2000 (FIMS Act) is a much better basis for irrigation management than the Societies Act on which the SAR was based

- A separate component for Land Acquisition and Economic Rehabilitation, with a separate LAER Cell, works well for acquiring land but there are still limitations in the ability to economically rehabilitate project affected persons

- An extended and detailed policy preparation provided a sound basis for successful project implementation.

- The economic impact of an irrigation project will be improved by the inclusion of an agricultural component with strong agricultural support services at the outset. Investment in agricultural services should be flexible enough with government extension services and tied to marketing networks.

- More efficient procurement organization and procedures might avoid some delays in project implementation. A frequent training procedure during implementation is necessary, given the turnover of middle-level staff, to avoid delays in procurement aspects.

- Covenants such as that to reduce subsidies to TNEB, which have little direct relevance to project activities and are difficult to enforce, should not be imposed since dealing with these takes considerable time and effort of both the Bank and Borrower with negligible returns.

- Involving intended beneficiaries in planning, implementation and monitoring improved transparency, instills a sense of ownership and can reduce conflicts.

- NGOs played a useful role in training farmers and WUAs but NGOs without adequate experience in this works should only be employed in conjunction with other experienced organizations capable of training the inexperienced.

- Recognizing the role of WUAs as change agents, the involvement of women farmers and NGOs can create a multiplier effect. Convergence of various development schemes operating in WUAs should be routed through them to have additive effects.

- In the case of financial management it is better to contract reputed firms instead of local small firms for software development and for quality based selection (QBS).

- Twinning consultancies is a good idea but the terms of reference for such consultancies must be drafted with greater attention to details and the implementing agency should be supported derive maximum benefit from such arrangements.

- Focus on policy issues, institutional restructuring, cost recovery aspects should be consistent throughout the project implementation period.

The key goals of IAMWARM project would naturally have a bearing on the outcome and the lessons learned from WRCP. In other words, it would be feasible and practical to juxtapose the lessons learned from WRCP along side the key goals of IAMWARM project so that continuity is lent to the subject. What is important is to evolve the goals of IAMWARM project not loosing site of the outcomes of WRCP.

3.2 Participatory Irrigation Management (PIM)

The Government of Tamil Nadu had launched the scheme of Water Resources Consolidation Project (WRCP) in 1995, with the financing of the project by the World Bank. One of the four prime objectives of WRCP is "to improve the agricultural productivity through modernisation and completion of irrigation systems, upgraded water management and farmers participation". This objective was mostly achieved through System Improvement and Farmers Turnover (SIFT) programme, which constituted a major and most important component of Water Resources Consolidation Project implemented during the period from 1995 to 2004

The Government of Tamil Nadu have accepted the concept of Participatory Irrigation Management (PIM) and encourages the farmers participation in the operation and maintenance of the irrigation water distribution systems in all the irrigation systems maintained by the Government in the State. Under WRCP, the PIM programme has so far been implemented to cover an area of about 6.0 lakh hectares; out of about 21 lakh hectares spread over 20 out of 30 districts in the State.

3.2.1 Experiences of PIM

After the "Institutional Reforms" carried out under WRCP with the technical guidance and advice from the World Bank, the Public Works Department had been reconstituted into four Regions Viz., Chennai, Trichy, Madurai and Pollachi covering four groups of river basins existing in the State. The department has also been renamed as "Water Resources Organisation (WRO) of P.W.D." Each Regional Office is headed by a Chief Engineer of WRO and functions as the Basin Manager for the group of river basins delineated as regional operational area and brought under his control: WRCP was implemented in all the Regions except Trichy, which covers the Cauvery Basin. Water Resources Organisation (WRO) thus had been made responsible for involving farmers in the operation and maintenance decisions, turning over of Operation and Maintenance responsibilities of distribution systems to the farmers and other related activities.

As a first step in the implementation of PIM under WRCP, the Centre for Water Resources of Anna University was involved and the methodology and approaches in implementing the programme of farmers involvement worked out. NGOs were also involved in mobilizing the farmers in the command area of WRCP and assist the field level officers of the WRO in forming the Farmers' Councils (equivalent to Water Users Associations - WUAs)

and registered under Tamil Nadu Societies Registration Act of 1975 since there was no specific Act on PIM in the State at that point of time.

3.2.2 Water User Associations (WUAs)

Totally 1965 Farmers Councils (WUAs) were formed and registered, as detailed below:

Table 3.1 Farmers Councils (WUAs)

1	1997 – 2002 (irrigation systems)	1272 Nos.
2	2001 – 2002 (irrigation tanks)	620 Nos.
3	2003 – 2004 Under Scheme completion	73 Nos.
	Total	1965 Nos.

Experiences in Formation of WUAs

In the initial stages, farmers were not cooperating with the WRO officials in organizing the village level meetings and they did not readily accept the new concept of PIM. Only a few farmers used to attend the meeting. The reasons for poor response was examined in detail and the ways and means to enhance the level of participation of farmers were discussed and analyzed taking into account the experiences of other States in this regard. 152 Assistant / Junior Engineers of O&M units of WRO were identified and appointed as FOT Team Leaders with necessary field supporting staff besides the deployment of 17 groups of NGOs.

With the constitution of FOT Teams and with the involvement of NGOs, there were marked improvements in the attendance in the meetings in villages. Since enhancing the level of participation involves bringing in attitudinal changes among the farmers, it was realized that this job could effectively be done by NGOs in association with WRO field officials. With the deployment of NGOs, with Teams of Institutional Development Specialists (17 Nos.) and Social Organizers (281 Nos.), the much- needed social input was provided to both the WRO field officials and farmers. By building up necessary rapport with the farmers, NGOs were able to convince the farmers about the new concept of PIM programme after organizing a number of meetings in the villages. Necessary training was provided to the NGOs and their group (before deploying them to visit the villages), on how to promote PIM activities, since such type of activities were new to them. They took long time to absorb the message and transmit to the farmers to complete their assigned jobs.

A Senior Advisor with necessary field experiences in the implementation of irrigation projects and with adequate management experiences was engaged during 1998 to fine-tune the process of implementation of PIM programme and to continuously encourage on the farmer's participation. His services are continuously being utilized.

With the combined and united efforts of both the FOT Team Leaders and NGOs, village level meetings with the farmers were organised creating necessary awareness about the need and advantages of their participation in the irrigation management activities. More enthusiasm and acceptance were observed among the farmers' group as well as the WRO officials.

The office bearers of the Farmers Councils (FCs) were also provided with basic training by the Irrigation Management Training Institute (IMTI), which had been identified as the Nodal Agency for the design and organizing of training programmes under WRCP.

With the completion of system improvement works mostly covering the rehabilitation and modernisation of the main canal systems of the irrigation systems proposed under IWRCP, attempts were made by the WRO officials in negotiating with the Farmers Councils (WUAs) for commencing the "Joint Management and Turnover Process" as contemplated under WRCP, to join together and make all decisions related to system operation and maintenance aspects. The members of the Farmer Councils were provided with an opportunity to get the benefit of "hands on experience" in the process of operation and maintenance of the systems atleast for one irrigation season. During November 2000, a Project Level meeting was organized at Pollachi covering the Parambikulam Aliyar Project (PAP) command, in which the Hon'ble Minister for Public Works and other political dignitaries participated, besides a very large gathering of farmers. Field observations and enquiries undertaken in some of the irrigation systems like Parambikulam Aliyar Project and Sathanur Project, indicated, the level of enthusiasm exhibited by the farmers (water users) in their participation in the process of decision making for system operation and maintenance.

During the joint management process related to irrigation water distribution, it was brought to the notice of WRO officials by the members of FCs (WUAs) that even though improvement to the main systems were carried out under WRCP, the rehabilitation works of the distributaries and minors comprising of the distribution system were left out for most of the systems, considerably affecting the delivery of assured water supply to the tail ends. A suggestion was made to examine the need for carrying out the Minimum required rehabilitation works in the distribution systems to be turned over, so that these systems will be fit enough for such turn over. Environmental training may be given to WUA's by EC Divisions, where the WUA is taking much behind Co-ordination with NGO.

3.2.3 Success stories after implementation of PIM

- It has provided a very good opportunity for regular contact between the farmers and the WRO officials and there is a good rapport developed. The farmers are generally ready to clean the supply channel and field channel systems of the tanks, where there is a possibility that the tanks may get some water. The distribution system under Major, Medium and Minor Irrigation systems are being maintained by WUAs concerned.

- The office bearers of some WUAs, walked through the command areas under the area of operation of WUAs, and carried out the desilting of the field channels& uprooted the 'Neyveli Kattamani (Weed)' in the water spread areas before the onset of the monsoon, by utilizing the additional maintenance grant apportioned to them together with their contribution collected as a membership fee.

- Dependence on the Government for everything is slowly getting reduced (Water distribution being done by the WUAs under WUA areas).

- When the department carries out the operations, the schedules are strictly followed. But in the operations done by the WUAs, there developed flexibility & adjustments among the farmers according to their need, resulting into mutual co- operation. (Resolution passed and implemented by the Udumalai Kalvai Kudimangalam Village,

is a representative sample, which states, "During the recent first and second zone irrigation in PAP, instead of 15 days continuous supply of water for irrigation, the system of 5 days supply of water in 3 shifts was resorted to, resulting into supply of water up to tail end, to the entire satisfaction of farmers. As the system is overwhelming among the farmers of this WUA, this General Body insists on, that the system of 5 days supply of water in 3 shifts shall be implemented during all the irrigation seasons".)

- Since a Managing Committee take the responsibility of solving the problems, then and there, the function of water regulation and distribution is going on smoothly.
- Water pilferage by the farmers is considerably reduced, since the management of water is regulated by the WUAs also (the jurisdiction of a WRO section, may be up to 30Kms stretch, where 8 or more WUAs are functioning, the responsibility of watching and controlling the pilferages are now shared by the office bearers of WUAs also.)
- It has provided an opportunity for some inter-transmission of water between the WUAs, to meet out the timely needs of water, developing a give and take policy.
- Number of police cases is under decline, since the differences in opinion among the farmers are solved then and there by the WUAs.
- Quality and standard of maintenance works carried out by the direct supervision of WUAs are coming up to the expected standards.
- Few of the court cases, which were long pending have been solved or withdrawn due to the strong and concrete efforts of the WUAs.
- It has provided an opportunity to the farmers, who have lost their belief in solving their grievances, to come forward and make them solved by the WUAs. Mainly the WUAs have become a forum for expressing the views of every water user, which would enable the Department to provide the required service to the farmers in the matters of irrigation management, which would ultimately result into increased agricultural productivity.
- Unity and co-operation developed among the farmers.
- Certain conflicts arise among them are settled down by themselves.
- When there is a failure of monsoon and scarcity of water, the mind set of farmers has been changed in such a way that the farmers themselves have come forward to distribute the available water equitably.
- The farmers in the head sluice reach are willing-fully ready to allow the tail end farmers to use their lands for cultivation, in case of no assured supply of water to the tail ends.
- The farmers extend their support to the WRO/Revenue Officials, in the eviction of encroachments in some catchment areas and canal systems.
- The farmers who are accustomed to the practice of irrigation by transacting oral instructions are now functioning by passing resolutions after meetings & discussions.

- Registers are maintained by them.
- The four sub committees as contemplated in the Act are formed and functioning in some areas.
- The disparity among the farmers based on the land holdings, resulting into first priority to the maximum landholder and least supply to the minimum land holders/tail-enders are being now eliminated.
- Farmers are participating in the water regulation operations, and the water for irrigation is being utilized economically.
- It has become useful to increase the awareness, participation and commitment of people and to protect and enhance their well-being. It is useful to follow a participatory, transparent and objective approach.
- Grievances of the farmers are solved at a single point in the field itself.
- The habit of encroachments in the commands by the farmers is slowly diminishing, since the responsibility of safeguarding the irrigation systems has been realized by them, as the sense of ownership of the irrigation system has been inculcated in them, after the implementation of PIM.
- Damages to the Public properties, by them either intentionally or unintentionally for their self-benefits have been reduced.
- There are more chances now, for getting the development of ayacut increased, due to the feasibility of ensuring sustainable & equitable supply of water up to the tail end.

3.3 LAER (Land Acquisition and Economic Rehabilitation) Cell

A separate component for Land Acquisition and Economic Rehabilitation, with a separate LAER Cell, works well for acquiring land but there are still limitations in the ability to economically rehabilitate project-affected persons

This cell was created as per the suggestions made by the World Bank to expedite the land acquisition and implement the rehabilitation plans for the projects under WRCP. This cell is functioning under the supervision of Secretary to Government, PWD in the Secretariat. The cell has expedited the land acquisition plans and fast compensation settlements have taken place for the projects under WRCP. Hence, the same plans and procedures for land acquisition and settlement of compensation to the project affected people may be extended to all the projects under WRO. The cell is engaged in taking care of redressing grievances and mitigating negative social impacts of the people caused due to the construction of canals, reservoirs and dams, it is suggested that the Government of Tamil Nadu may consider to continue the cell as a permanent establishment.

3.4 Environmental Cell Division (EC Division)

There are three environmental cell divisions under WRO, PWD. The EC divisions are headed by an Executive Engineer at the regional level. The EE will report to Superintending Engineer at Chennai. The Chief Engineer (PF) will head the three environmental cell divisions.

3.4.1 Activities of Environmental Cell Divisions

- Environmental base line data collection of the respective river basins.
- Documentation of environmental and social issues and monitoring the work.
- Water & Soil quality monitoring before restoration of water bodies and after restoration of water bodies.
- Conducting field oriented demonstration projects related to environmental issues.
- Creating environmental and social awareness among the stakeholders of the basin.

3.5 Pilot Project in Hanumanadhi Sub-Basin – Review

Multi Disciplinary Project Unit (MDPU) was constituted to implement the WRCP under WRO, PWD. Since, IAMWARM project is a successor to WRCP which is also be implemented under MDPU adopting integrated approach with the participation of the line departments and the stakeholders using water from the basin. The prime objective of this multi-disciplinary approach is to increase the productivity of water on a joint sector model and the farmers shall have to share part of the project investment cost. A pilot model rehabilitation project was implemented in the "Hanumanadhi Sub-Basin of Thamiraparani river basin" under the supervision of MDPU. The strategy focuses on convergence of the following Agencies/Departments.

1. Water Resources Organization, PWD
2. Agricultural Engineering Department
3. Agriculture Department
4. Forest Department
5. Fisheries Department
6. Social welfare Department
7. Horticulture Department
8. Agriculture marketing and Agri Business Department
9. Tamil Nadu Agricultural University

3.5.1 Options

- To go for rainwater harvesting
- Introduce high tech farming with post harvest techniques
- Ensure protection of farm produce till it reaches the consumers
- Consumption of Water for Agriculture which is 80% to be reduced by adopting conveyance efficient techniques like Micro irrigation, pressure irrigation and flow irrigation using pipes

- Increase the storage condition of aquifer by providing farm ponds and rejuvenation of wells etc
- Adopting cropping practices and tilling practices to reduce water consumption and increasing the yield per hectare by using less water

3.5.2 Water Resources Organization (WRO)

The Water Resources Organization (WRO) under the Chairmanship of Engineer-in-Chief is assigned with the task of implementation of Model Rehabilitation and Modernization of Hanumanadhi sub basin in co-ordination with other departments and monitoring and evaluation of project achievements. Various works are taken up for 12 anicuts, 14 main channels and 50 tanks in the sub basin and the operational efficiency of the system is expected to improve after completion of all the works. They are

- Protective works in the river bed
- Strengthening of anicuts
- Construction of head sluices at open take off channels
- Lining of canals
- Bund Protection
- Providing shutters to sluices
- Channel bank formation with roads
- Providing ground water recharge ponds
- Improving surplus arrangements to tanks
- Cross drainage works

The rehabilitation works such as desilting of tanks, lining of canals, construction of retaining walls, strengthening of bunds, repairing of sluices, gates and weirs are being undertaken by the WRO. As per the proposal and concept, the head reach water shall go to tail end and there should be a minimum guarantee for equal distribution of water upto the tail end. The rehabilitation works can help them to fulfill the aim and objectives.

Observations

Some people are objecting the lining of canals. Farmers expressed that a portion of the bed surface of the canal should not be lined to allow seepage of water which recharges the ground water.

Seasonal conditions may be kept in view while undertaking the canal lining to ensure uninterrupted supply of water to the villages around the canal

Proportioning of water should be done to ensure the proper supply of water to the tanks situated in the lower reaches of the basin.

3.5.3 Agricultural Engineering Department

Agricultural Engineering Department proposes to disseminate the upgraded agricultural engineering technology information, high tech micro irrigation systems like drip,

sprinkler and tower irrigation systems to all the water users in the basin. The main aim of the Agricultural Engineering Department works are

- To improve the productivity of water per unit per land.
- To improve the livelihood of farming and labour community
- To create an infrastructure base for water conservation techniques.
- To train the engineers and farmers on effective water management towards sustainable development
- The Agricultural Engineering Department has already carried out the following components for achieving the above said goals.

Observations

The overall issues and requirement of mitigation measures in the basin are not covered. Importance is given in the mechanization of agriculture activities by providing drip sprinklers, seed harvesting machines etc. Contour bunding, vegetative barriers to arrest soil erosion are also essential in watershed development activities.

3.5.4 Agriculture Department

The aim of the Agriculture Department is to improve the agricultural productivity through modernization of irrigation system, upgraded water management and farmers participation. The following components are being taken as action plan by Agriculture Department

- Paddy SRI (System of Rice Intensification) demonstration
- Improve the existing coconut garden
- Organic farming- green manure seed distribution
- Distribution of hand operated sprayers
- Technology demonstration
- Coconut coir compost demonstration
- Vermicompost demonstration
- Conducting seminars to create awareness by means of publicity

Observations

The Agricultural Department has taken many activities as said above. But there is not a clear correlation among the different components. According to a survey conducted in Pudukottai and Pollachi, farmers completely shifted from the inorganic cultivation practices to organic cultivation practices. They explained that total shifting is also possible and the yield is also good. While promoting organic farming mulching techniques, soil improvement, macro and micro nutrients, crop pattern, method of filling, control of insects by bio fertilizers and yield improvement plays important role. They shall have the detailed plan towards the policy change such as from inorganic farming concepts to organic farming techniques.

The farmers' participation or willingness, while in change of cultivation practices are to be addressed.

3.5.5 Tamil Nadu Agricultural University (TNAU)

The main objectives of TNAU is to increase water productivity in agriculture and horticulture crops of the project. To achieve the above goal, TNAU has taken six Adaptive Research Trials (ART) under 14 anicuts.

The principles in the ARTs are increasing the productivity of the crop through introduction of high yielding varieties

The activities being carried out by TNAU are as below

- System of Rice Intensification (SRI)
- High density banana with fertigations
- Drip irrigation in coconut, sugarcane
- Micro sprinkler to groundnut, cotton, vegetables and pulses

Observations

The activities aim to reduce the input cost and to maximize the profits, while doing ART (Adoptive Research Trial). But after completing the demonstration project, the farmer should come forward to adopt the technology. From the activities it was observed that, the input in land will be increased due to mechanization. In many places, the drip irrigation reduced the yield of coconut. Drip irrigation combined with inorganic pesticides will increase the salt concentration which leads to soil degradation. Based on the views of the farmers, drip irrigation combined with bio fertilizers may produce better results.

3.5.6 Horticulture Department

The Horticulture Department has taken very few assignments

- Tissue culture in banana growing
- Hybrid/ high yielding vegetables

Observations

The intervention by horticulture department is comparatively very less. Horticulture crops play big role in building farmers economy. The waste lands can also be used for horticulture crops with less water and organic farming concepts. Hence they can do still better approach for all kinds of crops.

3.5.7 Fisheries Department

The main objective of the Fisheries Department is to increase fish production and uplift the socio economic condition of the fishermen by implementing various welfare programmes such as

- Increase fish production by scientific fish culture in tanks
- Demonstration of fresh water prawn culture and fish culture in farm ponds
- Installation of cages for rearing of fish lings

Observations

The scientific approach put forth by the Fisheries Department is appreciable in all aspects. The only one precaution shall be taken in fish culture is farm ponds. Still the farmers using extensive fertilizers and pesticides. The excessive fertilizers and traces are – through run off to farm ponds. Hence the water quality shall be checked often in the farm ponds. Bioaccumulation of fertilizers through fishes will affect the human being.

3.5.8 Agriculture marketing and agri business

The main aim is to facilitate easy marketing facilities to the farmers. This department is undertaking the following activities.

- Installation of solar dryer for chillies drying.
- Construction of grading center for cleaning and value addition
- Supply of mini vans and vegetables crates
- Conducting farmers training

Observations

The overall needs of the farmers for the marketing of their produce are not properly visualized. The basin wise concept was not taken into account, while preparation of their action plan for the basin and only the target-oriented works have been taken up. There are number of opportunities available for establishing marketing linkages to the farmers produce. A few areas are mentioned below for better understanding.

1. Establishment of decentralized cold storage may be thought of for the benefit of farmers using the solar energy.
2. Organic farming which is an emerging area may be promoted and capacity among the farmers built for obtaining certification and capitalization of available opportunities
3. Setting up of organic vegetable shops may be encouraged and special prices may be fixed to encourage the farmers to opt for organic farming.
4. Promote value addition to the agricultural produce by establishing micro enterprises with appropriate marketing linkages.
5. Capacity building may be planned to the farmers and self help groups in improving the quality in value addition products, packaging, branding etc to enter into the urban markets.

3.5.9 Forest department

The Forest Department proposed to raise babul/ karuvel plantations on tank beds in plain catchment area. They have submitted an action plan indicating details on social forestry, forest produce, water conservation, environmental and social benefits.

Observations

The hilly catchment area has degraded due to man made activities. But the Department proposed only one activity under MDPPP. Regenerating degraded catchment by undertaking by software and hardware approach is not covered. Since Hanumanadhi sub-basin is a model basin for water resources development activities, catchment plays an important role in arresting soil erosion, stopping deforestation and regenerating the degraded forest area, these activities shall also be considered as a basin wise approach.

The Forest Department should also concentrate on overall issues in catchment area and the remedial measures such as gully plugging, contour bunding, construction of check dams, vegetative barriers, tree plantations etc in the hilly areas to arrest the soil erosion and maintain the eco systems.

3.5.10 Social welfare and development of women Department

The aim of this department is to impart training for WUA's/ women farmers for which the following activities are being carried out under MDPPP

- Group formation
- Capacity building training
- SHG Members Training
- Animator & Representative Training
- EDP Training
  a. Skill Training
  b. Skill Up gradation Training
  c. Vocational Training

Observations

1. The Overall issues and the requirement of the basin are not visualized.
2. The Department would have been identified the potential areas for training which are having potential for employment.
3. An integrated enterprise development approach may be promoted for the women who have undergone EDP training.(Promotion of micro enterprises)
4. Setting up of women haats may be thought off with backward and forward linkages for promotion of marketing the products produced by the women directly to the consumers.

After review of the existing reports and had discussions with the senior officers of PWD, the following lessons are drawn from the implementation of pilot project on Haunmanadhi.

3.5.11 Lessons learnt

- The pilot project launched at Hanumanadhi Basin is first of its kind in Asia integrating the activities of various line departments and has some results to show
- The change in cropping pattern, modernized agriculture techniques has led to increase in the yield
- Training given to farmers on latest irrigation techniques for high yielding variety of rice and other crops has changed socio economic profile of the farmers
- In places like Pudukottai and Pollachi the farmers have completely shifted to organic cultivation and achieved better yield. This is the out come of the farmers getting exposure to organic farming techniques. This is an area for possible replication in other basins.
- There are visible signs of empowerment among the farmers in the judicious use of water
- The project has fallen short of its goals essentially because of inadequate rainfall over the last four years resulting in poor renewal of tanks
- The project has not achieved results commensurate with the investments made due to project planning at short notice.
- Most of the stakeholders are not clear about the objectives and activities of the project
- Though a beginning was made to integrate all the line departments activities, the project could not achieve the full success due to gaps in coordination among the line departments officials.

3.6 Tamilnadu Women in Agriculture (TANWA) funded by DANIDA

Women, in small and marginal farm families carry very heavy load of work both in the farm and house as compared to men. In India 78% of women are engaged in agriculture, compared to 63% of men. Their contribution to agriculture is immense but they have very little control over resources. Their participation in decision making process is also less. In this context TANWA project is designed to reorient and involve to them in agriculture. TANWA Project funded by the Danish International Development Assistance (DANIDA), in two phases starting from 1986. TANWA aims at increasing agricultural productivity and improving food security among small and marginal women farmers. The project is ended in 2002.

3.6.1 Objectives

- Improving the productivity and quality of life of all family members through securing full utilization of women's potential in agricultural production on small and marginal holdings
- Transfer knowledge and skills from trained women farmers to fellow farmers
- Improve access to existing agricultural extension services to women farmers
- Increase women farmers' ability to use existing services
- Increase the number of women agriculture officers in the Department of Agriculture
- To strengthen farm women's position in society
- To guide farm women to adopt relevant new technology and give them the appropriate skills through practical training

3.6.2 Strategy

Technology is transferred to small and marginal women farmers through village based training, farm women conferences and follows up support at village level.

Women agricultural officers have been recruited to train farm women. The five day training course covers a maximum of 10-12 skills related to crop production, animal husbandry, agricultural techniques, agro forestry, bio fertilizers, sericulture, pisciculture, apiculture etc

3.6.3 Lessons learnt

- 215 women agricultural officers have been positioned for the first time with TANWA's initiatives
- 60,000 women farmers have now been familiarized with more than 200 technologies and in turn they have shared these technologies with nearly 400,000 women
- TANWA's farm women groups have gradually evolved and felt the need for joint action and networking
- Agricultural productivity in these women's farms have increased from 14% to as high as 80%

After review of the above scheme, it is proposed to establish and strengthen the women haats in the project for provide direct marketing facilities to the women group products.

3.6.4 Objectives of the Haat

- The women Haat to be on lines of trade fair to bring together buyers and sellers of various regions
- To help bring in the technology improvement in various product ranges
- Conducting of thematic Haats like food processing to reach out producer women to specialized market segments for support for a range of product
- To hold workshops with specialist in the various fields from the various parts of the Country as well as manufacturers who will be able to negotiate and discuss with women's groups, manufacturing various products for a tie up

- To create brand awareness and impart brand management techniques
- Improving and introducing new economical packing techniques
- Helping in evolving market accessible pricing strategies
- Financial and marketing linkages

Benefits of Haat

Table 3.2 Benefits of Haat

Market Needs	Haat offers
Exclusivity	Competitive advantage; uniqueness by way of its distinctive features and the cost and value benefits that it would offer the quality, variety and ambience of the service provided
Value (price/benefits)	Insignificant fee charged compared to host of benefits provided (storage, trolleys, conference rooms, R&D etc)
Comfort	Information center, online booking and information of calendar of events, "an umbrella service"
Performance	Experience of the corporation in strategy formulation and implementation
Networking	Existing network with the organized and un-organized women groups and institutions will allow immediate access to market the concept
Risk Reduction Strategy	Build reputation, nurture contacts, compete vigorously on basis of expertise and successful experience

3.7 Pudhu Vazhvu

Tamil Nadu has proposed to implement "Pudhu Vazhvu" project with World Bank's assistance. The project was approved by the World Bank in May 2005.

"Pudhu Vazhvu" meaning 'New Life' is to create opportunities and build social capital in poor communities and to involve the communities themselves in designing and implementing the changes that will affect their daily life. It is envisaged that the project will cover around 3,50,000 target families in 2300 Gram Panchayats comprising 12185 habitations in 70 backward blocks spread over 15 districts.

3.7.1 Objectives

The specific objectives are to improve the livelihoods and empower the target rural poor (particularly women and other disadvantaged groups) through

- Developing and strengthening pro-poor local institutions/groups (including village Panchayats)
- Building skills and capabilities of the poor and
- Financing productive demand-driven subproject investments.

3.7.2 Expected Outcomes

- 20% increase in incremental income against base year for 50% of the target households by end of project
- 70% target households should have increased their income
- At least 70% of all identified vulnerable population e.g disabled and tribals are organized into SHGs and have accessed special assistance funds
- At least 70% of SHGs/EAGs of the poor have accessed funds through linkage with banks and other financial institutions.

In view of the above-mentioned ongoing developmental projects, the activities under this project facilitate integration of some of the ongoing development programmes in the State for the benefit of the stakeholders. The project will provide synergies and strengthen the development process of the State.

3.8 Social Welfare Schemes and Programmes

The government schemes and programmes that are being implemented are as follows:

3.8.1 Schemes

- Member Of Legislative Assembly Constituency Development Scheme (MLACDS)
- Namadhu Gramam
- Rural Housing Scheme
- Sampoorna Grameen Rozgar Yojana (SGRY)
- Swarnajayanthi Gram Swarozgar Yojana (SGSY)
- Pradhan Mantri Gramodaya Yojana (PMGY)
- Rashtriya Sam Vikas Yojana (RSVY)
- Pradhan Mantri Gram Sadak Yojana (PMGSY)

- Provision Of Urban Amenities In Rural Areas (PURA)

Member of Legislative Assembly Constituency Development Scheme (MLACDS)

MLACDS, a fully State Government funded scheme has the main objective of taking up works to bridge the infrastructural gaps in the Assembly Constituencies. Allocation per constituency was Rs.82.00 lakhs. The MLAs are recommended to prioritise the works for Drinking Water Supply works (Rs.15.00 lakh), Namadhu Grammam Scheme (Rs.15.00 lakh), Hostels for BC/MBC (Rs.5.00 lakh), laying of cement roads including Village Panchayat roads and street lights (Rs.15.00 lakhs). For the remaining Rs.32.00 lakhs MLAs have the liberation to propose other works in accordance with guidelines. During 2004-05, a sum of Rs.192. 70 crores was released and 9983 works were taken up.

Namadhu Gramam

The scheme implemented since August 2004 has the objective of achieving cent per cent enrolment of children in schools, reducing infant mortality, eliminating female infanticide, poverty reduction and achieving village sanitation through people's participation. To encourage greater people's participation, Village Panchayats are given incentives for an amount of Rs.55 crores based on their performance. Thus, the scheme Namadhu Gramam involves motivated voluntary action for sustainable and holistic rural development.

Highlights of Namadhu Gramam Thittam

The major objective of the Namadhu Gramam Thittam is to ensure all round development of our villages across Tamil Nadu. These bold initiatives will be implemented with an outlay of Rs.200 crores. An initial provision of Rs.52.21 crores has been made in the Budget Estimates for this purpose. NABARD also will support the funding of this programme.

Namadhu Gramam enables the principles of democratic decentralization and participatory approach to foster comprehensive development of every village in Tamil Nadu. Under this programme, the Gram Sabha will meet to draw up an action plan to ensure specific improvements in areas such as drinking water, sanitation, drainage, health, women empowerment, nutrition, cleanliness and hygiene, elementary education, environmental improvement, management of water resources, village roads and streetlights. The Gram Sabha will be assisted by officials from every Department to render all necessary assistance. Specific monitorable indicators will be spelt out to enable the Gram Sabha to monitor the performance of its action plan. This includes attention to dropout rates in local schools, village cleanliness and general health and hygiene. The purpose of this programme is to enable the Gram Sabha to focus on issues, which confer real benefits on the people and improve their quality of life and the living environment.

Rural Housing Scheme

The State Government formulated a new credit linked participatory programme for upgrading kutcha houses in rural areas. The scheme has the components of

- Beneficiary contribution (Rs.5001-)
- Government subsidy (Rs.25001-) and

- Loan component to be availed (Rs.70001-). The programme is being implemented through women SHGs. During 2004-05, a sum of Rs.5.00 crores has been released for upgrading 20.000 kutcha houses.

Sampoorna Grameen Rozgar Yojana (SGRY)s

The SGRY was launched in 2001 with the aim of providing wage employment in rural areas and thereby food security and improve nutritional levels by merging the Employment Assurance Scheme (EAS) and Jawahar Gram Samridhi Yojana (JGSY). The labourers engaged in works taken up under this programme receive rice as part of wages at the rate of 5 kgs. per man day. The Centre and State Government share cash component in the ratio of 75:25. During 2003-04, a total of 158996 works which includes 10630 Village Panchayat Tanks, 6651 thrashing floors, 6809 buildings for SHGs and 321 mat huts were taken up under this programme. Over 1,34,842 works including 12204 compost yards, 9177 village tanks, 188 multi purpose centers for fishermen, 733 mini godowns, 3180 Noon Meal Centre Buildings, 1254 Buildings for Self Help Groups and 246 drinking water ooranies were taken up during the year 2004-05.

Swarnajayanthi Gram Swarozgar Yojana (SGSY)

SGSY, launched in 1999, is a holistic programme of self-employment by organising the rural poor into Self Help Groups of 10-20 members through a mix of bank credit and Government subsidy. It brought all the earlier poverty alleviation programmes like IRDP, TRYSEM, DWCRA, SITRA, GKY and MWS under one umbrella. It is a credit-cum-subsidy programme.

During 2003-04, to provide marketing support for SHGs products, the Government launched the rural bazaar website and a State Level Federation i.e. District Supply and Marketing Societies (DSMS) in all the districts. Besides this, information kiosks i.e. RASI Centre (Rural Access to Services through Internet) was extended to all the districts. Tamil Nadu ranks second next only to Andhra Pradesh in terms of number of credit linked SHGs. As on 31st March 2005, a total of 185921 SHGs were functioning in the State with a membership of 30 lakh women.

Pradhan Mantri Gramodaya Yojana (PMGY) (Rural Shelter Component)

PMRY launched in 200-01 give financial assistance for selected basic services such as primary health, primary education, rural shelter, rural drinking water, nutrition and rural electrification. In 2003-04, 5803 new houses were taken up for a total outlay of Rs.1877.76 lakhs. In 2004-05, 5478 houses were completed with an allocation of Rs.18. 78 crores.

The total outlay on the above rural poverty alleviation schemes stood at Rs.88717.36 lakhs in 2003-04 and Rs.55330.00 lakhs in 2004-05. The Government of India's contribution towards the programmes constituted 43 per cent and 57.0 per cent in 2003-04 and 2004-05 respectively. Of the total expenditure of Rs.55330.00 lakhs in 2004-05, SGRY bagged a major share i.e. 56.00 per cent. Table below highlights the expenditure incurred on these poverty alleviation programmes.

Rashtriya Sam Vikas Yojana (RSVY)

A new initiative, viz. the Backward Districts Initiative under the Rashtriya Sam Vikas Yojana (RSVY) (Development and Reform Facility) has been launched by Government of India with the main objective of putting in place programmes and policies with the joint efforts of the Centre and the States which would remove barriers to growth, accelerate the development process and improve the quality of life of the people. The scheme aims at focused development programmes for backward areas which would help reduce imbalances and speed up development. This component would cover 100 districts in the country. The identification of backward districts within a State has been made on the basis of an index of backwardness comprising three parameters with equal weights to each: (i) value of output per agricultural worker, (ii) agriculture wage rate and (iii) percentage of SC/ST population of the districts.. The number of districts per State has been worked out on the basis of incidence of poverty. In addition, thirty two districts which are affected by Left Wing Extremism would also be covered. Fifty Backward Districts and 16 districts affected by Left Wing Extremism in the country were to be covered in the Annual Plan 2003-04.

The main objectives of the scheme are to address the problems of low agricultural productivity, unemployment and to fill critical gaps in physical and social infrastructure. The District Administration / Panchayat Raj Institutions accordingly would be required to prepare a Three Year Master Plan with nested Annual Action Plans. The Plan is to be based on a SWOT (Strengths, Weaknesses, Opportunities and Threats) Analysis, review of ongoing schemes and identification of a few lead bottlenecks in development. The additionality is to be used to meet local needs through schemes in this lead sectors which would make a dent on the poverty of the district in a time bound manner.

Thus, the prime objective is to address the problems of pockets of high poverty, low growth, low agricultural productivity, unemployment and poor governance by putting in place programmes and policies which would remove barriers to growth and accelerate the development process.

An amount of Rs.45 crores would be provided for each of the districts covered over a period of three years at the rate of Rs.15 crores per year for implementation of various developmental programmes such as drought proofing (soil conservation, afforestation, social forestry, wasteland development and minor irrigation); agriculture, horticulture, etc; infrastructure (road and power); social sector (health and education) and livelihood support (income generating activities such as hand looms, information technology, agricultural processing, etc). Under the scheme 15 per cent *of* the funds would be earmarked for maintenance of assets in health, education and veterinary sectors. The main focus and strategy of the scheme will be on infrastructure development and income generation for under-privileged. The NGOs and Self Help Groups will also be involved at every stage including plan formulation, implementation and monitoring. The districts from Tamil Nadu which have been identified for coverage under the Backward Districts initiative of RSVY are Tiruvannamalai, Dindigul, Cuddalore, Nagapattinam and Sivagangai. For the year W03-04, Tiruvannamalai district was approved for coverage and out of the allocation ofRs.1500 lakhs to Tiruvannamalai district, watershed development works in 14 micro watersheds in 8 blocks, afforestation of degraded forests in 30 villages, improvement of 71.20 kms. of roads, expansion of Horticulture, floriculture and Medicinal plants in 200 ha. mass education of 1500 Health Volunteers, establishment of 18 information centers one in each block, modernization of handloom sector by training of 400 weavers on korvai attachment, provision of computer for modern design, effluent treatment plant, repairs to 31 Health Sub-Centres and 37 school buildings, infrastructural facilities to PHCs were provided.

Pradhan Mantri Gram Sadak Yojana (PMGSY)

The PMGSY programme was launched in December 2000 with the objective of providing connectivity by way of all weather roads to the unconnected habitations in the rural areas. It aims to cover all habitations, with a population of 1000 persons and above in three years (2000-2003) and with a population of 500 to 999 by the end of the X plan i.e. 2007. It is a centrally sponsored scheme. The PMGSY covers only the rural roads i.e. Other District Roads and Village Roads. During the year 2003-04, 498 road works to a length of 1113.92 kms. at an estimated cost of Rs.26478 lakhs have been taken up. In 04-05 implementations of works costing Rs.11791 lakhs was taken up.

Provision of Urban Amenities in Rural Areas (PURA)

PURA which was christened on August 15, 2003 aims at self-sustaining development of the country. It also seeks to reduce congestion in urban areas and bridge the rural-urban divide.

The PURA model consist of 4 connectivities - physical, electronic, knowledge and economic - to enhance the prosperity of cluster of villages. Under physical connectivity, a group of 15-25 villages would be linked to one another by road and also a ring road accessible to each village. Besides roads, transport facilities and electricity have also been included. Electronic or digital connectivity means linking villages with modern telecommunication and information technology services, knowledge connectivity means establishing (in every 5-7 kms. of the ring road) a school, a higher education centre and a hospital and economic connectivity aims to establish good marketing facilities within this group of villages so that all the commodities and services of daily use can be produced and sold in these markets.

Government of India has envisaged development of over 4000 rural clusters located in backward regions. A sum of Rs.300 lakhs for each cluster has been provided and thus Rs. I 2000 crores would be spent on the development of 4000 PURAs. In Tamil Nadu, out of 30 districts, 23 towns, with clusters / villages have been identified in 22 districts by Ministry of Rural Development. Government of India for implementing the PURA projects.

3.8.2 Programmes

- Empowerment and Poverty Reduction
- Self Sufficiency
- Village Infrastructure Development Programme
- Integrated Rural Housing Programme
- Member of Parliament Local Area Development Programme (MPLAD)
- Total Sanitation Campaign
- Central Rural sanitation Programme
- National Project in Bio Gas Development
- Drought Prone Area Development Programme (DPAP)
- Integrated Wasteland Development Programme (IWDP)
- Community Welfare Development Programme

Empowerment and Poverty Reduction Programme

This new programme implemented in 2004-05 would provide shelter, nutrition and health securities and welfare measures to 25 poorest of poor households in each village panchayat for which guidelines have been issued. A sum of Rs.5.00 crores has been released to the districts during 2004-05 for implementing the programme.

Self Sufficiency Scheme

This innovative participatory programme is implemented with demand driven approach. The objective of the scheme is to revive the concept of community participation in planning, execution and maintenance of community assets. Under this scheme, the public should contribute a minimum of 25 per cent of the total cost in the form of cash/kind or labour. The Government supplements the community efforts by providing 75 per cent of the project cost with technical support. By this way of participatory method, the scheme maximizes the utility value of the funds allocated by the Government. During 2004-05, Rs.40.00 crores was allotted and 2176 works were taken up.

Village Infrastructure Development Programme

Improvement of Village Standees was taken up with the assistance of NABARD for providing facilities such as construction of stalls, street lights, drinking water, toilets, approach roads, drainages etc. During 2004-05, 33 shandies at a cost of Rs.244.04 lakhs were provided with infrastructural facilities, such as construction of stalls, street lights, drinking water, toilets, approach roads, drainages, etc. with the assistance of NABARD

Centrally Sponsored Schemes

A slew of Centrally Sponsored Schemes are in operation in Tamil Nadu to address livelihood concerns and infrastructural requirements.

Integrated Rural Housing Programme

The Indira Awaas Yojana, a sub-scheme of JRY, operationalised from 1999-2000 with a view to help the rural people belonging to SC/STs, freed bonded labourers, non-SC/STs, ex-service men and disabled persons to construct dwelling units and upgradation of existing unserviceable kutcha houses. The total allocation under this scheme was Rs.154.25 crores in 2004-05.

The upper permissible limit of construction assistance per new unit was fixed as Rs.25000 in plain areas and Rs.27500 in hill/difficult .areas. The funds under lAY are shared between Centre and States in the ratio of 75:25. During 2003-04, 36426 new houses were constructed with the State and Central Government's allotment of Rs.6240.15 lakhs and Rs.5606.80 lakhs respectively. During 2004-05, 37676 new houses were constructed under the scheme.

Upgradation of Unserviceable Kutcha houses into Pucca houses

This is a sub- component of lAY. Government of India has revised the construction assistance for Upgradation for Rs.I0,000 to Rs.12,500. During 2003-04, 18689 kutcha houses were upgraded with State and Central Government's allotment of Rs.467.23 lakhs and Rs.1401.69 lakhs respectively. In 2004-05, 19265 kutcha houses had converted into pucca houses.

Table 3.3 Poverty Alleviation Programmes

Name of the Scheme	Expenditure Incurred					
	Govt. of India		State Government		Total	
	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05
SGRY	25201.50	20538.1	8400.50	6846.026	33602.53	30960.67
Rural Housing – IAY	7008.49	9026.48	6707.30	6398.355	13715.79	15424.84
Innovative Scheme for Rural House and Habitat Development	65.84	Scheme Discontinued	-	Scheme Discontinued	65.84	-
Pradhan Mantri Gramodaya Yojana (Housing)	1877.76	1877.76	-	-	1877.76	1877.76
Swarna Jayanthi Gram Swarozgar Yojana Scheme	4398.68	-	1463.23	-	5852.91	7066.734
Total					**88717.36**	**55330.00**

(Rs. in Lakhs)

Source: Department of Rural Development

Member of Parliament Local Area Development Programme (MPLAD)

The Member of Parliament Local Area Development Programme was introduced in 1993 to undertake developmental works of capital nature in the respective constituencies of the members of Parliament. In Tamil Nadu, there are 39 Lok Sabha MPs and 18 Rajya Sabha M Ps. Therefore the Government is entitled to receive annually Rs.114 crores from GOI under the scheme. The works undertaken under this scheme includes construction of school buildings, village roads 1 approach roads, irrigation channels, bus shelters, desilting of village ponds, etc. During 2004-05, a sum of Rs.102.00 crores was released by Government of India and 4135 works were taken up.

Total Sanitation Campaign

For improving sanitary condition in rural areas 'total sanitation campagn' projectwas implemented in the project districts. The cost of the project is shared between the Centre and State Governments and beneficiaries. So far this project is implemented in 29 districts with a total cost of Rs.327.32 crores.

Central Rural sanitation Programme

This programme was restructured and introduced as total sanitation campaign in March 2002. It is a community-led and people centre programme. It emphasises on information, education and communication (IEC), Human Resource Development (HRD) and Capacity Development activities. The objectives of the programme are to bring about an improvement in the general quality of life and accelerate sanitation coverage in the rural areas, generate awareness creation and health education to cover schools in rural areas with sanitation facilities and promote sanitary habits among students, encourage cost effective and appropriate technologies in sanitation and to reduce the incidence of water and sanitation diseases. During 2003-04. 440227 individual household latrines. 156 sanitary complex for women, 5965 school toilets, 5276 anganwadi toilets and 77 Rural Sanitary Mark and Production Centres (RSM/PCs) were constructed. A sum of Rs.1781 lakhs has been proposed in the budget estimate 2004-05 for this programme.

National Project in Bio Gas Development

This programme aims at promoting eco-friendly non-conventional energy source with multiple benefits. To prevent deforestation, production of enriched manure and to improve sanitation and hygiene by linking sanitary toilets with bio gas plants are the objectives of this programme. This is fully centrally sponsored programme with a subsidy component of Rs.2100/- for general category, Rs.2880/- for SC/STs and small farmers and Rs.3500 for hilly areas.

3.9 Area Development

In view of the fixed supply of area available for crop cultivation, agricultural growth depends critically 011 the increase in productivity, cropping intensity and crop diversification. In the above backdrop, rising population and dwindling net area cultivated have severely limited the potential for extensive and intensive cultivation. With a view to augmenting the availability of land resources ripe for development, the Department of Rural Development. Government of India has been formulating a host of area development programmes such as Drought Prone Area Programme (DPAP), Integrated Wasteland Development Programme (IWDP) etc. Ultimately, the goal is to make the arid and semi arid lands arable. The fecundity of the soil will improve thanks to the execution of these schemes. Two area development schemes are implementing by the Department of Rural Development in the State.

3.10 Drought Prone Area Development Programme (DPAP)

DPAP, which is implemented by adopting a holistic approach, is in operation since 1972- 73 covering 80 blocks in 17 districts. The major objectives of this scheme are optimum utilization of natural resources like land, water, etc., mitigation of adverse effects of droughts and prevention of ecological degradation. Apart from this, creation of gainful employment is fundamental to the philosophy of this programme. From 1995-96 onwards Watershed approach is being adopted in the implementation process and the participation of the local population is vital. Each watershed covers an extent of about 500 ha.

Cost of' developing a watershed is fixed at Rs.6000/- per ha. with effect from 1.4.2000. The span of the implementation period is spread over 5 years. About 297 watershed projects were completed in 1995-2000 involving an expenditure of Rs.5920.25 lakhs.

Government of India and Tamil Nadu share the expenditure on a 50:50 basis. Total area treated worked out to 1.49 lakh hectare during 2003-04, the Central assistance received was Rs.2428 lakhs and the State share Rs.88 lakhs. The State share outlay under "Assistance to DRDA under DPAP" will be Rs.700 lakhs during 2004-05. This programme is being implemented through DRDA at the district level and by the Agriculture Department at the State level.

3.11 Integrated Wasteland Development Programme (IWDP)

The IWDP is being implemented since 1993-94 in non-DPAP blocks. This project aims at developing non-forest wasteland adopting watershed approach. The unit cost was set at Rs.6000/- per ha. with effect from 1.4.2000. It is a project funded through 100 per cent grant by Government of India. Expenditure of the scheme is shared between Government of India and State Government on a 11:1 basis.

So far Government of India sanctioned 41 projects for implementation between 1993-94 and 2003-04. II districts had been prioritized for developing wasteland at a cost of Rs.3300 lakhs covering an area of 55053 ha. during the period from 2003-04 to 2007-08. Districts selected are Coimbatore, Dharmapuri, Dindigu.J, Kancheepufam, Madurai (west), Ramanathapuram, Salem, Tiruvallur, Thiruvannamalai and Villupuram (west). Following the 73rd Constitutional Amendment, the Village Panchayat is being given more responsibility in implementing the IWDP. With effect from 2003-04 'Hariyali' guidelines are being followed for taking up new area development activities under DPAP and IWDP. The salient features of 'Hariyali' guidelines are that funds are being routed through the Presidents of Grama Panchayats, who are directly responsible for the implementation of the programme.

3.12 Provision of Infrastructural Facilities in Tribal Blocks

3.12.1 The objectives

- To assist the ST families to cross the poverty line with special emphasis on improving
- Agriculture, irrigation and education in tribal areas and

- To provide basic infrastructure facilities for better living conditions. An amount of Rs.51.23 lakhs has been provided under budget estimate for 2004-05

3.13 Community Welfare Development Programme

3.13.1 Clean Village Campaign

The clean village campaign programme encompasses all activities for environmental sanitation and protection such as management of solid and liquid waste including human and animal excreta, effective implementation of ban on plastics including collection and disposal of plastics, water conservation and rain water harvesting, conversion of bio-degradable waste into vermicompost through community participation. The major objectives of this campaign are:

- To raise awareness of the community and the adverse consequences of current open defecation practices;

- To recognize the needs of different categories of people and promote sanitation needs of specific groups like children, women and adolescents, aged people, disabled etc.
- To promote environmental sanitation in all institutions like anganwadies; schools, health centres, public places etc.
- To develop and promote technology options for different geographic locations and conditions of water availability, depth of water table etc.
- To promote the hygienic behaviour through change in knowledge, attitude practices and skills for improving environmental sanitations;
- To empower the community and local governments in planning, implementation and strengthening their managerial capacity and responsibility on all aspects of environmental sanitation
- To enable networking, coordination and better convergence of various agencies and groups working in the sector with a view to optimizing efficiency of implementation and ensuring sustainability of systems.

A State Level Rural Sanitation Society has been formed to coordinate and direct the Clean Village Campaign programme and it will be linked with UNICEF sanitation programme. A sum of Rs.75 lakhs is provided for this purpose in the Budget Estimate, 2004-05.

3.13. 2 Frame-work of Panchayat Raj Institutions (PRIs)

For effective implementation of all the welfare programmes of the Government, decentralized planning is essential. Decentralized planning and grass root participation pivot on the strength and dynamism of the PRIs. With a view to provide constitutional status to local self 8Overnment to impart certainty, continuity and strength, for devolution of powers to local bodies and for allotment of adequate resources were taken into account while the 73rd and 74th amendments to the constitution of India were carried out in 1992.

In Tamil Nadu, there are 12618 village panchayats functioning of which 60 per cent have a population size of 1000-2000. About 20 per cent of the village panchayats have 2000-5000 population.

A total number of 385 panchayat unions in the State are distributed in 29 districts. Villupuram district has the (22) largest number of panchayat unions and Nilgiris has the lowest (4) number of panchayat unions.

Table 3.4 No. of Panchayats as on 2003-04 by Population

Sl.No	Population	No. of Village Panchayats	% share to total
1.	Upto 500		
2.	500-1000	1317	10.4
3.	1000-2000	7628	60.5
4.	2000-5000	2473	19.6
5.	5000-10000	1113	8.8
6.	10000 above	87	0.7
	Total	**12618**	**100.0**

Source: Directorate of Rural Development

Training programmes have been proposed to the Chairpersons of the rural local bodies, covering areas like local administration, financial management, accounting procedures, constitutional provisions, Government Acts, rules, etc. to shoulder the administrative responsibilities of the bodies. These training programmes will be organised in a phased manner through SIRD and RETCs. An amount of Rs.65. 73 lakhs including Central share of Rs.15. 73 lakhs have been provided during 2004-05.

3.13.3 Finances of the Village Panchayats

Following the enactment of Tamil Nadu Panchayat Act 1994, two State Finance Commissions were constituted. These two Commissions had assessed the development that had so far occurred at the village level, identified gaps in developmental needs and recommended devolution of funds to the PRI to fill the gap between the total requirements and actual availability of funds. The Third State Finance Commission to study the financial position of the rural and urban PRIs as of 31.3.2005 in harmony with Article 243 of the Constitution and Section 198(I) of Tamil Nadu Panchayats Act 1994 has been formed.

The Terms and Reference of the 3rd State Finance Commission cover the entire gamut of issues ranging from collection of user charges for services rendered to governing principles in the distribution of finances between the State Government and PRIs. It will focus on the enhancement of efficiency in the functioning of the PRI and demarcation of functions of the State Government and that of the local body at the existing levels of delegation of administrative power: dimension of the debt-servicing burden of the local bodies etc.

Pool 'A' and Pool 'B' are two categories to which the State Finance Commission grant has been devolved. Pool 'A' category includes surcharge on stamp duty, local cess and local cess discharge, seignior age fees on minor minerals and 90 per cent of entertainment tax based on place of origin. Pool 'B' category forms all State 1axes except entertainment tax. Under Pool 'B', 8 percent of total tax available excluding entertainment tax is divisible as grant to Local Bodies (87%) and reserve, equalization and incentive fund (13%). Rural and Urban Local Bodies share the grant on 58:42 rates. Similarly reserve, equalization and incentive fund is also shared on the same ratio. Funds set up part for rural Local Bodies is shared on the ratio of 47:45:8 between Village Panchayats, Panchayat Unions and District Panchayats respectively.

Further more, the Eleventh Finance Commission Grant has also been devolved to rural panchayats to meet the cost of maintaining civic services including primary education, primary health care, safe and potable drinking water, street lighting, sanitation including drainage and scavenging facilities etc.

The quantum of resources accruable to Village Panchayats under Pool' A' category is influenced by interplay of factors such as location of Panchayats abutting urban centres, hub of services activities, robust performance of agriculture and small scale industry. Government establishments drive and initiative of the Panchayat Presidents in collection of property tax, water charges, voluntarily forthcoming of the villagers to timely pay their1axes and user charges etc.

Under pool-A total revenue stood at Rs.146.61 crores against Rs.223.49 crores in 2002-03. Surcharge on stamp duty is the single largest category under Pool-A contributing to 74 per cent of the aggregate resources in 2003-04.

Table 3.5 Distribution of Panchayat Unions & Village Panchayats by District 2004-05

Sl.No.	Name of the District	No. of Panchayat Unions	No. of Village Panchayats
1	2	3	4
1	Kancheepuram	13	648
2	Tiruvallur	14	539
3	Vellore	20	753
4	Tiruvannamalai	18	860
5	Cuddalore	13	681
6	Villupuram	22	1104
7	Dharmapuri	8	251
8	Krishnagiri	10	337
9	Salem	20	385
10	Namakkal	15	331
11	Erode	20	343
12	Coimbatore	19	389
13	The Nilgiris	4	35
14	Thanjavur	14	589
15	Nagapattinam	11	434
16	Tiruvarur	10	430
17	Tiruchirapalli	14	408
18	Karur	8	158
19	Perambalur	10	322
20	Pudukkottai	13	498
21	Madurai	13	431
22	Theni	8	130
23	Dindigul	14	306
24	Ramanathapuram	11	429
25	Sivagangai	12	445
26	Virudhunagar	11	450
27	Tirunelveli	19	425
28	Tuticorin	12	408

29	Kanniyakumari	9	99
	Total	**385**	**12618**

Source: Directorate of Rural development

3.14 Rural Poverty Profile

Poverty reduction has been a major goal of development policy. Thanks to implementation of wage and self-employment poverty alleviation programmes, the ratio of poverty has been on the wane over time. The proportion of people below the poverty line in rural Tamil Nadu, which was at 57.43 in 1973-74 declined 32.48 in 1993-94 and further to 20.55 in 1999-2000. The corresponding tall noticed in urban areas was from 49.40 to 39.77 per cent and 22.11 per cent respectively.

Table 3.6 Trends in Incidence of Poverty in Tamil Nadu

(In percentage)

Year	**Rural**	**Urban**	**Combined**
1973-74	57.43	49.40	54.94
1977-78	57.68	48.69	54.79
1983	53.99	46.96	51.66
1987-88	45.80	38.64	43.39
1993-94	32.48	39.77	35.03
1999-2000	20.55	22.11	21.12

Source: Union Planning Commission

For the purpose of providing assistance under the poverty alleviation programmes, the Ministry of Rural Development has been periodically conducting survey/Census at the beginning of each Five Year Plan. However, there were discrepancies between survey results and the State estimates of poverty. Therefore to rectify this lacuna, multiple criteria using qualitative parameters like household occupation, housing condition, number of earners, asset condition had been taken to calculate the poverty line.

In terms of Government of India guidelines, the State Government conducted the BPL Census 2002 as per the recommendations of the Report of the Expert Group on Identification of Households Below Poverty Line. A normative approach for identification of the rural poor was adopted by introducing a "score-based, ranking" based on relative deprivations revealed by certain socio-economic indicators in contrast to the 'income' and 'expenditure' approach adopted in the BPL Census, 1992 & 1997 respectively. The Methodology takes into account 13 scorable socio-economic parameters including operational holding of land, housing, clothing, food, security, sanitation, ownership of consumer durables, literacy, labour force, means of livelihood, status of children, type of indebtedness, migration and the nature of assistance preferred. The Survey was conducted using a Questionnaire Form having Basic Information about the individual household in Part A and Identification and sub-categorization of the household in the Part B Section.

The profile of household gives the basic information about educational status, average monthly income of the household, type of operational holding of land, availability of land for house construction and access to drinking water supply. Besides these the social status of the

family is identified and probed whether the family is a beneficiary of any of the Government Welfare Schemes, The questionnaire further helps to collect information on the pallicipation of family members in SHG activity and the family was listed under BPL category during the last survey. The Part II of the questionnaire identifies sub-categorization of poor using thirteen scorable socio-economic parameters given in Part II - Statistical Tables of this document. Each of the indicators have "0" marks to "4" marks, Thus for the 13 parameters, the total marks will vary from 0-52 marks. From the above Score Based Ranking, the households have been classified into "Poor" and "non-poor".

Given the methodological problems and other operational constraints the Government has crafted an ambitious project viz., Tamil Nadu Empowerment and Poverty Reduction Project (TNEPRP) with the objective of effecting a significant reduction in the level of poverty, empowering the vulnerable section of the society and improving livelihood security. It intends to supplement the on-going intervention in poverty alleviation and also build upon the success and develop new strategies. A beginning has been made with the implementation of Puduvazhvu Thittam targeting 25 most poor (ultra poor) families in each village panchayats of Tamil Nadu.

The challenges involved in Rural Development are being resolutely tackled by a combination of good governance, aimed at effective implementation of programmes by ensuring synergy through convergence approach, people's participation and above all endeavoring to make rural development all inclusive.

Table 3.7 Performance of Important Schemes during 2003-04

Sl. No	Name of the Scheme 2003-04	Objective s of the Scheme	Employment Generated	Achievement	
				Physical	Financial
(1)	(2)	(3)	(4)	(5)	(6)
I. Rural Shelter Scheme:					
1.	Indira Awaas Yojana (IAY) (New Houses)	To Provide free houses to the houseless families below poverty line in rural areas.		37488	100.42
2.	Upgradation of Unserviceable Kutcha Houses	Upgradation of Kutcha houses of families living below poverty line		19581	19.40
3.	Innovative Scheme for Rural housing and Habitat Development	To popularise low cost technology and usage of locally available materials in construction of buildings in rural areas		3 projects	65.84
4.	Pradhan Mantri Gramodaya Yojana (Rural	To provide shelter, primary education, primary health, nutrition, water and electrification in rural areas		6477	19.52

	Shelter)				
II	Pradhan Mantri Gram Sadak Yojana (PMGSY)	To give connectivity with all weather roads to all unconnected rural habitations with population above 500 by 2007		50.76 kms.	43.370
III	Swarnajayanthi Gram Swarozgar Yojana (SGSY)	To provide sustainable income to the rural poor who are below poverty line by organizing them into SHGs. Training them for vocation and providing them credit linkage with financial institutions		37607 SHG formed 60048 women. 1259 physically handicapped 23574 SC and 1858 ST benefited	
IV	Sampoorna Grameen Rozgar Yojana (SGRY) Stream I	The primary objective of the scheme is to provide additional wage employment in rural areas and thereby provide food security and improve nutritional needs	265.194 lakh mandays	105128	171.07
(1)	(2)	(3)	(4)	(5)	(6)
	Sampoorna Grameen Rozgar Yojana (SGRY) Stream II	The primary objective of the scheme is to provide additional wage employment in rural areas and thereby provide food security and improve nutritional needs	246.877 lakh mandays	48718	164.95
V	Member of Parliament Local Area Development Programme (MPLAD)	To take up developmental works identified by the concerned MP		5602	115.45
VI	Restructured Central Rural Sanitation Programme (RCRSP)	The programme envisages a demand driven approach with greater public participation and more emphasis give for IEC activities to create awareness among the rural masses		451701	43.58
VII	National Programme of Improved chulas	To present deforestation of minor forest product for fuel to climate hazards to improve health and		15000 chulas	0.150

		hygiene of women to reduce drudgery in collection of fuel materials and in cooking			
VIII	National Programme of Biogas	To promote eco-friendly Non-conventional Energy Source with multi benefits like prevention of deforestation production of enriched manure and to improve sanitation hygiene		2000 biogas plants	0.620

Note: i. Criteria adopted for selection is a need based and priority wise
ii. In respect of SGSY it is open to all (preference to RPL) that are willing to do manual work in minimum wages

3.15 HYDROLOGY PROJECT - I

The World Bank have come forward to assist five Government of India agencies viz CGWB, IMD, CWC, NIH and CWPRS, and nine states viz., Gujarat, Maharashtra, Karnataka, Kerala, Tamilnadu, Andhra pradesh, Orissa, Madhyapradesh and Chattisgarh in the formation & execution of Hydrology Project-I.

This project is intended to assist the Government of India agencies and the participating states setting up of a reliable and well designed network for collection, transmission, processing, storage and dissemination of data covering Surface water and Ground water both in terms of quantity & quality.

- Agreement was signed between the World Bank and the Government of Tamil Nadu on 22.9.1995
- Project has become operative from 21.12.95 for a period of 8 years i.e., up to 31.12.2003

3.15.1 Integrated Data Center For Surface Water And Ground Water - Activities:

The project can be broadly classified into two components viz., Surface water component and Groundwater component.

(i) Surface Water Components

- Collection of flow data from Gauging Stations in various river courses.
- Collection of storage data from major tanks by installing Automatic Water level Recorders.
- Monitoring of return / regenerated flows in select command areas and measurement of flow into sea.

- Surface water sampling locations have been designed for all river basins in Tamil Nadu and samples are being collected once in a month during flow period to assess the surface water quality.
- Collection of Hydro meteorological data from rain gauge stations, full climatic stations and automatic weather stations.
- Collection of data on reservoir sedimentation and water quality data by establishing level - I water quality laboratories and silt laboratories.
- Improvement of infrastructure facilities - Office buildings, Site stores & Quarters etc.,
- Creation of database in the dedicated hydrological surface data processing software Viz., HYMOS.
- Exchange of information within the State and Central Organization through the State Data Storage Centre.
- The data are collected and primary validated in the sub-divisional data processing centre and are secondary validated in the divisional data processing centre before sending to state data processing centre.
- Inter agency validation of data are done with India Meteorological Department and Central Water Commission.

(ii) Ground Water Components

- Collection of water level data from the existing 1746 observation wells.
- Construction of 690 piezometers in the hard rock areas and 162 piezometers in the sedimentary formations and collection of water levels from digital water level recorders installed under HP.
- Validation of water level data in three stages:
  i. Primary Validation at Divisional Data Processing Centre.
  ii. Secondary validation at Regional (Circle) Data Processing Centre.
  iii. Integrated Hydrological validation at State Data Processing Centre.

- Creation of District wise database in Groundwater Data Entry Software (GWDES) at SDPC.
- Upgradation of four water quality laboratories with new building and sophisticated equipments to analyze more pollution parameters.
- Exchange of information within the State and Central Organization through the State Data Storage Centre.

(iii) Water Quality

- **About 3400 ground water samples are being collected from shallow observation wells and bore wells. Surface water samples in all the 17 river basins are also monitored in 71 locations. The samples are tested for the suitability of domestic, agriculture and industrial purposes.**
- **To carry out the above study four laboratories are functioning at Chennai, Trichy, Madurai and Pollachi. All the above Laboratories are recognized under EPA (1986) by the Central Pollution Control Board (CPCB) Delhi.**
- **The laboratories are having the facilities to analyze General Parameters, Pollution Parameters in addition to the Bacteria analysis**

- **The Chennai Laboratory is having the facility to analyze pesticide and toxic metals. The presence of toxic metals and pesticides in Ground and surface water are also being studied by this Wing.**
- **Ground Water quality data are also available from 1972 onwards.**
- **For general public and other Departments water samples are analysed at prescribed rates.**

(iv) Data Storage Centre

- Stores and administers the storage of all field and processed hydrological data collected in the State.
- Makes the data available to authorized Hydrological data users.
- Maintains HIS-catalogue of all data stored in its own database and those stored in the data bases of other States and of the Central Agencies.

(v) Creation of GIS Data sets under Hydrology Project - I.

Spatial database is organized with 15' by 15' geographic area, corresponding to Survey of India toposheet of scale 1:50,000. These digital data sets are of high quality following the Quality Checking / Quality Assurance test strategies proposed by the World Bank.

The following themes are generated digitally on 1:50,000 scale toposheet wise pertaining to Tamil Nadu.

1. Land use/cover
2. Soil
3. Geology & Structure
4. Geomorphology
5. Administrative boundary upto block
6. Hydrologic boundary upto water shed
7. Settlement upto village
8. Drainage
9. Transport network
10. Elevation Contours and spot heights.

Tamil Nadu State is covered in 228 toposheets. All the GIS data sets will be available for various spatial analysis and queries that are related to Hydrology and water resources planning.

4 BASELINE ENVIRONMENTAL AND SOCIAL INFORMATION

Tamil Nadu, the Southern State of the Indian peninsula is spread over 1,30,058 km^2 and lies between 08° 05" N and13° 35" N and 76° 15" E and 80° 20" E. It is surrounded by the States of Andhra Pradesh in the north, Kerala in the west, Karnataka on the Northwest, Indian Ocean on the south and the Bay of Bengal on the east. The Eastern and Western ghats of India meet in Tamil Nadu and run along its eastern and western borders. The famous hill stations of Tamil Nadu like Udhagamandalam, Kodaikanal, Kothagiri and Yercaud are situated in this region.

4.1 Demography

The growth in human population over the years has had both the positive and negative impact on overall quality of environment. As the demand for energy has increased the potential for electrical energy production has also been tapped to a great extent. Apart from that we have also realized the importance of non-conventional energy sources to minimize the pressure on the conventional energy sources. Growth in population has led to the enhanced growth in tourism. It is now considered to be one of the fastest growing industries in TamilNadu. The ever-increasing population migration leads to the problem of urbanization and human settlement. Urbanization is an inevitable challenge, which has to be faced and handled properly in the right perspective. The sanitation facilities, hygiene, sewerage, water supply and above all, proliferation of slums are the important concerns.

As per 2001 census, the population of Tamil Nadu is 62405679 and the sex ratio is 987. The sex ratio of children in Tamilnadu is 942. The density of population is 480 persons/sq.km. The percentage of scheduled castes in the state is 19 and that of scheduled tribes is 1.04.The percentage of literacy is 73.45 in TamilNadu. The total birth rate per 1000 is 18.3 and death rate is 7.6

District wise population details are given in annexure. The details of population in rural and urban areas of TamilNadu are given in the table below:

Table 4.1 Total Population of Tamil Nadu

	Total Population	Male Population	Female Population	Sex Ratio	Area	Density
Total	62405679	31400909	31004770	987	130058.00	479.83
Rural	34921681	17531494	17390187	992	117532.75	297.12
Urban	27483998	13869415	13614583	982	12525.25	2194.29

Table 4.2 Total Child Population of Tamil Nadu

	Total Children (Age 0-6)	Male Children (Age 0-6)	Female Children (Age 0-6)	Child Sex Ratio (Age 0-6)	Area	Density
Total	7235160	3725616	3509544	942	130058.00	479.83
Rural	4232644	2189995	2042649	933	117532.75	297.12
Urban	3002516	1535621	1466895	955	12525.25	2194.29

Table 4.3 Total SC Population of Tamil Nadu

	Total Scheduled Castes	Male Scheduled Castes	Female Scheduled Castes	Sex Ratio SC	Area	Density
Total	11857504	5932925	5924579	999	130058.00	479.83
Rural	8308890	4159182	4149708	998	117532.75	297.12
Urban	3548614	1773743	1774871	1001	12525.25	2194.29

Table 4.4 Total ST Population of Tamil Nadu

	Total Scheduled Tribes	Female Scheduled Tribes	Male Scheduled Tribes	Sex Ratio ST	Area	Density
Total	651321	322404	328917	980	130058.00	479.83
Rural	551143	272397	278746	977	117532.75	297.12
Urban	100178	50007	50171	997	12525.25	2194.29

Table 4.5 Literacy rate in Tamil Nadu

	Total Literates	Male Literates	Female Literates	Literacy Rate	Area	Density
Total	40524545	22809662	17714883	73.45	130058.00	479.83
Rural	20319498	11835689	8483809	66.21	117532.75	297.12
Urban	20205047	10973973	9231074	82.53	12525.25	2194.29

Source:2001 Census of Tamil Nadu

4.1.1 Working population

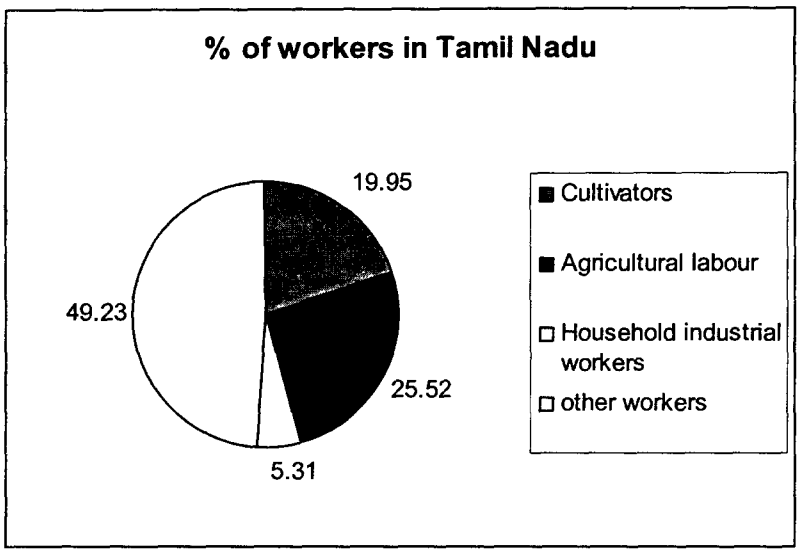
The working population of Tamil Nadu, 24.2 million in 1991, had increased to 27.8 million in 2001. However, statistics reveal that the proportion of workers to the total population had actually declined during the 40-year period of 1961-2001 from 45.7 per cent to 44.8 per cent, though there was an upward trend between 1981 and 2001, from 41.7 per cent to 44.8 per cent. What is disturbing is that the number of marginal workers increased from 1.4 million in 1991 to 4.1 million in 2001. This implies that the increase in the worker participation rate (WPR) was the result of an increasing number of marginal workers rather than main workers. The higher rate of worker participation in the rural areas, as compared to the urban areas, has been a disquieting trend, though the urban WPR accelerated at a faster rate when compared to the rural WPR during the period 1981-2001. A positive feature was that female WPRs, in both rural and urban areas, increased at a faster rate than male WPRs with the result that total female workers increased from 31.4 per cent in 1981 to 34.7 per cent in 1991.

A salient point in the development of Tamil Nadu is that child labour has shown declining trends as the State's efforts in various social sector programmes have borne fruit.

Programmes such as mid day meals, incentives for school enrolment, free school uniforms, free bus passes, girl child development schemes and marriage assistance have made it possible for children to avoid entering the labour market. An accelerated growth rate of per capita income has enabled some households to withdraw the younger age group earners from working.

The total work participation rate in the State is 44.67. 19% are main cultivators, 25% are agricultural labour, 5% are in household industries while 49% are other workers. Fig 4.1 gives the percentage of workers in Tamil Nadu.

Fig 4.1 Percentage of workers in TamilNadu



Source:2001 Census of Tamil Nadu

4.2 Tamil Nadu Human Development Report

The Tamil Nadu Human Development Report is important as it provides insights into the process of development in a State characterised by heavy industrialisation, urbanisation, better growth rates and poverty levels which are below the national average. It not only identifies problem areas, it also assesses the successes of Tamil Nadu, especially in the areas of women's empowerment and social development. Based on a candid appreciation of the ground reality, the document highlights the future thrust areas for the government and civil society in the State. While this Report examines the HDI in Tamil Nadu, it goes beyond the HDI in order to investigate the overall human development situation in the State. The Report recognises that the HDI too is "limiting" in the sense that other dimensions of human development, such as shelter, social security and decision-making etc. that are also important for increasing overall well being, are not necessarily captured by the HDI. This Report not only serves as a summary of the human development scenario in Tamil Nadu, but also seeks explanations as to why the State has fared well in certain areas but not in others. Factors contributing to human development are disaggregated and analysed at the district level with a view to understanding the regional disparities and the reasons behind them. The Report also highlights the policy interventions that are required to correct such imbalances. There is no doubt that in the years to come, the Tamil Nadu HDR will become an important tool in planning for growth, social justice and equity in the State.

4.2.1 Status of Human Development in Tamil Nadu

Tamil Nadu's HDI (2001) was 0.657 as compared to 0.571 for India. It is also well placed in the South Asian context and fares better than some of the neighboring countries of India. According to the Planning Commission, Tamil Nadu ranks third among the 15 major States of India, though on few specific indicators it lags behind some States. Within Tamil Nadu there are gaps and variations in the inter-district HDI, but its level of achievement suggests that high standards of literacy and health can be reached despite low per capita income. Even so, improvement of income levels would ensure improved literacy and health status.

Table 4.6: District-wise HDI and GDI values, 2001

District	HDI value	GDI value
Chennai	0.757	0.766
Kancheepuram	0.712	0.710
Thiruvallur	0.654	0.651
Cuddalore	0.644	0.643
Villupuram	0.587	0.582
Vellore	0.658	0.655
Tiruvannamalia	0.612	0.608
Salem	0.626	0.625
Namakkal	0.636	0.631
Dharmapuri	0.584	0.582
Erode	0.658	0.656
Coimbatore	0.699	0.697
Nilgiris	0.685	0.686
Tiruchirapalli	0.671	0.671
Karur	0.647	0.641
Perambalur	0.596	0.592
Thanjavur	0.630	0.629

GDI is important for comparing the stages of gender development and to assess the extent of gender equality. In this area, Tamil Nadu's achievement is better than the attainment of the country as a whole, while within the State there is a symbiotic correlation between human development and gender development indices. This reinforces the view that human development is not an end in itself; rather it is necessary to create an overall improvement in the condition of the people.

4.3 Climate

The maximum and minimum temperatures in the plains is 42.8^0 C and 12.0^0 C respectively and that of the hill stations is 33.5^0 C and 4.6^0 C respectively. The average annual rainfall in the State is 961.8 mm.

The state benefits from northeast monsoon rains (October–December), unlike other parts of India, where southwest monsoons (June–September) bring more rain. In Tamilnadu, 85% of the total area benefits from the northeast monsoon; only 15% benefits from the southwest monsoon.

4.4 Water resources

Water is the most important resource for the livelihood of the human beings. Tamil Nadu is water deficient state despite receiving approximately 950 mm of rainfall per year. Tamil Nadu has number of seasonal rivers. The surface water resources are almost fully harnessed by impounding the available water in 61 major reservoirs and also in 39,202 big and small tanks. As per the estimates, 60% of the ground water resources have also been utilized. So the management of available water resources on a sustainable basis becomes quite imperative.

There are 17 river basin groups in Tamil Nadu, a majority of which are water stressed. There are 61 major reservoirs, about 40,000 tanks and about 3.0 million wells that heavily utilize the available surface water (17.5 BCM). Agriculture is the single largest consumer of water in the state, using 75% of the states water. Irrigation through a combination of canals, wells and tanks increases the reliability and availability of water for farming and is essential for cultivating crops in much of the state. About 30% of the net irrigated area is watered by canals, 21% by tanks and 49% is fed by wells. The remaining area is irrigated by other sources such as streams and springs. Rainfed agriculture employing about 25% of farmers accounts for 46% of the net sown area of 5.5 million hectares. The per capita availability of water resources in Tamil Nadu is 900 cubic meters a year as against 2200 cubic meters for all India.

4.5 Forest Cover

In Tamil Nadu 17.5% of the area.is covered under forest out of which a sizeable area is under degraded condition.Tamil Nadu is extremely rich in biodiversity but adequate attention has not been paid in the past to assess it effectively; as a result many species have become endangered.

Tamil Nadu is rich in flora and fauna and some of its major wildlife sanctuaries like Mudumalai, Anaimalai(Indira Gandhi W.S), Madras Crocodile Bank trust, Guindy national park, etc, are situated in the hills of the Western ghats providing home to elephants, tigers, bisons and a variety of monkeys and deers. There are more than 3000 plant species found in Tamil Nadu, out of which a majority are found in the mixed deciduous forests of this region

4.6 Wetlands

In Tamilnadu, we have utilized more than 90% of the available surface water and more than 60% of the available ground water. Since Independence, many dams have been

constructed to utilize the surface water and further development is almost nil. The recent studies indicate that irrigation through tanks is decreasing and irrigation through wells increasing. Drinking water source for most of the cities in Tamilnadu is from rivers, lakes and tanks. In olden days, the local people maintained these water bodies, which has diminished over the past few decades resulting in their dismal conditions. Presently people have started looking to the government for assistance. The wetland details are given in the following table:

Table 4.7 Wetlands of Tamil Nadu

Total number of water bodies	39,202
Panchayat Union tanks	20,413
Public Works Department tanks	8,903
Ex-Zamin tanks	9,886
Length of rivers and canals	7,420 kms
Area of reservoirs	52,000 ha
Area of tanks and ponds	6,92,000 ha.
Area comprising brackish water (5,600 places)	400 ha.
Area under mangroves	21 sq. km.

4.7 Agriculture

43% of Tamil Nadu's geographical area is under agriculture with a per capita figure of 0.0982 ha.of agricultural land. While agriculture and allied sectors account for nearly 62% of the total employment of the state, their contribution to economy is only 22%. In order to increase the productivity we have relied too much on improved crop varieties, fertilizers and pesticides. The residues of these have affected soil structure and polluted the water through leaching. India is the leader in fruit production in the world. The horticulture and plantation crops occupy a total of 7,53,985 ha. of area. However, there is need to improve the productivity of these crops on sustainable basis without affecting the overall land and water environment

The principal food and non-food crops such as paddy, millets, pulses and oilseeds, cotton and sugarcane are being cultivated in the State. Paddy, a staple food crop, is grown extensively in the rice bowl districts viz. Thanjavur, Thiruvarur and Nagapattinam. Agriculture which suffered extensively during 2001 – 02, 2002 – 03, 2003 – 04 due to severe drought, experienced an appreciable revival fortunes during 2004 – 05. There was improvement in the area, production and productivity of various crops during 2004 – 05. The area production and yield rate of principal crops are given in the table below:

Table 4.8 Area Production and Yield Rate of Principal Crops

Crops	Area (Lakh ha)			Production (Lakh tones)			Yield Rate(Kgs./ba.)		
	2002-03	2003-04	2004-05 (FFE)	2002-03	2003-04	2004-05 (FFE)	2002-03	2003-04	2004-05 (FFE)
Paddy	15.17	13.97	19.09	35.77	32.23	53.02	2359	2308	2777
Millets	7.12	9.03	9.70	6.83	8.88	11.35	958	983	1170
Pulses	5.63	5.37	5.76	2.00	2.01	2.29	356	375	397
Food Grains	27.92	28.37	34.55	44.60	43.12	66.66	1598	1520	1929
Oil Seeds	5.92	6.95	8.22	7.60	9.64	13.20	1284	1387	1606
Cotton	0.76	0.98	1.43	0.84	1.23	2.18	188	213	259
Sugarcanes	2.61	1.92	2.32	24.17	17.66	23.40	9244	9192	10086

Source: Directorate of Economics and Statistics, Chennai-6

Anticipating a favorable situation, the target proposed for 2005-06 is given in the table below:

Table 4.9 Proposed productions for 2005-06

Sl. No.	Crops	Area (L.Ha.)	Production (L.MT)
1	Rice	20.00	78.00
2	Millets	11.00	15.51
3	Pulses	8.00	3.76
	Total Food-grains	39.00	97.27
4	Cotton (L.bales)	2.50	5.85
5	Sugarcane (Gur)	3.00	36.40
6	Oilseeds	10.50	18.59

The agricultural performance of the state is given in the Table below. (Kg per ha.)

Table 4.10 Agricultural performance of Tamil Nadu

Crop	Average Yield		Highest yield in India	Tamil Nadu's place
	India	Tamil Nadu		

Rice	1804	3350	3510 (Punjab)	Second
Jowar (Cholam)	769	962	962 (Tamil Nadu)	First
Bajra (Cumbu)	610	1348	1348 (Tamil Nadu)	First
Redgram	616	710	1301 (Bihar)	Fourth
Total Food-grains	1562	2238	3830 (Punjab)	Fourth
Total Oilseeds	710	1611	1611 (Tamil Nadu)	First
Groundnut	733	1784	1784 (Tamil Nadu)	First
Cotton	193	305	410 (Punjab)	Third
Sugarcane	64562	106778	106778 (Tamil Nadu)	First
Source: Agricultural Statistics at a glance 2004 - Agrl. Statistics Division - GOI				

4.7.1 Agriculture as major employment provider

Agriculture continues to be the main stay for rural workers. Despite an absolute reduction in farm employment over the years, there is increase in the share of both male and female employment in agriculture crop production during the post-reform period compared to the pre-reform period in Tamil Nadu. While share of male employment in field crop production activities rose to 91 per cent from 88 per cent that of rural women employment in the same activity rose to 85.4 per cent from 83 per cent. In terms of employment absorption livestock activity followed with a share of 8.7 per cent for women employment. At the all India level there was relative stability during both periods. The share obtaining for crop production activity was 84 per cent and livestock II per cent in respect of female employment.

It is evident that there is excessive dependence of rural workers on field crop production sector. The employment in field crop production in Tamil Nadu accounted for as high as 89.84 per cent and 89.52 per cent at All India. Although the excessive dependence on field crop production sector continued till the end of the nineties considerable restructuring of agriculture employment overtook in a number of States induced partly by shifts in domestic demand and partly by the opportunities thrown upon by the open economic regime

The growth of employment in agriculture oscillated over from being positive in 1983-94 to negative during 1993-00 in Tamil Nadu. The growth rates of employment (crop sector) in respect of field crop production for two sub-periods: 1983/1993-94 and 1993-94/1999-2000 was from 0.57 per cent to (-) 1.30 per cent in Tamil Nadu. Employment growth in non-crop segments (plantations, livestock and fishing) has shown fluctuation. The rate of growth of employment of rural workers in the plantation sub-sector witnessed a decline from 5.68 per cent in 1983-94 to (-) 1.02 per cent during 1993-00 in Tamil Nadu.

The labour-absorptive capacity of agriculture as a whole is under stress due to declining land man ratio, increasing marginalization of holdings, labour-saving cropping pattern of adjustments, increasing mechanization of field crop operations, increasing treat to domestic agriculture through open door trade policy etc. need to be reiterated In particular. The employment in the non-farm sectors in majority of the States has witnessed varying degree of improvements in transport, storage – communications, construction and manufacturing (agro-based). However, the pace of rural non-farm employment expansion has failed to compensate the sluggish labour absorptive capacity of agriculture. Thus, the all-round setback in the non-farm sector is a matter of worry as it provides a major share of employment in rural economy. All accelerated pace of agricultural growth is the surest way of augmenting the pace of agricultural employment expansion.

The strategies of the Government to achieve the goal in Agricultural sector are as follows:

- Adoption of alternative cropping strategies derived for agro-climatic zone based cropping pattern evolved by TNAU to raise remunerative crops and to ensure maximum utilization of available land and water aiming to increase cropping intensity

- As a part of Alternative Cropping Strategy, cultivation of Jatropha, Sugar beet and Sweet sorghum are aiming at, as announced by the Hon'ble Chief Minister on Contract farming basis through approved Industrial entrepreneurs for the production of Ethanol and Bio diesel. These crops are highly remunerative and can be grown in moderately fertile lands with comparatively less water
- Taking up cultivation in vast tract of waste lands through Massive Comprehensive Waste Land Development programme as announced by the Hon'ble Chief Minister
- Much emphasis on dry land development integrating Watershed Development and Waste land Development programme
- Adoption of dry land development technologies and crop production technologies for dry land crops to step up the productivity
- Identification and promotion of relevant technologies to bridge the gap between the potential yield and actual yield of major crops
- Speedy transfer of technologies to the farming community through ICT (Information and Communication Technology)
- Conduct of Seminars, Workshops and Intensive Pre-season campaigns involving line Departments to enthuse and assist farmers to harvest good crops and to get good profit
- Efforts to provide technologies and advice on Agriculture, Horticulture soil and moisture conservation, Animal Husbandry etc., under one roof
- Introduction of Contract farming system for Maize, Oilseeds, Pulses and Cotton in potential districts with assured buy back arrangements at pre-announced price or prevailing market price if it is high. The main objective of the programme is to ensure expansion of area under these crops and to motive farmers especially SF / MF farmers to get assured remunerative price for the produce

- Ensure availability of quality seeds on enhanced SRR through Public Private Partnership
- Massive adoption of integrated nutrient management and integrated pest management technology with emphasis on eco friendly Agriculture Development
- Much focus on restoration of soil through organic farming approach and to promote vermicomposting, compost making through plueorotus, green manuring etc
- Efforts to provide site specific macro and micro nutrient recommendations on the basis of soil test village wise fertility Index
- Promotion of micro irrigation to maximize water use efficiency
- Empowerment of women by revitalizing TANWA groups.

4.7.2 Agricultural Marketing in Tamil Nadu

Empowerment of farmers through what is called disintermediation in other words, eliminating the middlemen, common agents in marketing agricultural produce is essential. Because of revolution in Information and Communication Technology, E-commerce has been gaining momentum. Agricultural marketing is the process of encompassing all the steps involved from the producer to consumer including pre-and-post harvest processes such as assembling, grading, storage, transportation and distribution. Promotion of standardization and grading of agriculture products is the main function under institutionalized agricultural marketing. An effective quality control mechanism is imperative for improving the marketability of products.

Demand influences the prices of agricultural produce to a great extent rather than supply conditions since market period is very short. As a result, farmers become more vulnerable to price fluctuations. Therefore, farmers need easy access to well-built market network on a regular basis to secure better price for their produce.

In order to market agricultural produce, the Market Committee Act 1959 was amended as the Tamil Nadu Agricultural Marketing (Regulation) Act 1987. It was brought into force from 1.2.1991. At present there are 20 Market Committees with 273 Regulated Markets and 15 sub-markets covering the entire State except Chennai and Nilgiris districts. The strategy is to enable the farmers to realize a remunerative price for the produce on one hand and on the other to enable the consumer to buy agricultural produce at reasonable prices. To promote agricultural exports from Tamil Nadu three Agri-Export Zone (AEZ) one for cut flower at Hosur, Dharmapuri district, second for flowers at Doty, Nilgiris district and third for mango in Theni and 5 other districts has been established at a total cost of Rs.65.34 crores. It is also proposed to establish a AEZ exclusively for cashew at Cuddalore district through private sector participation at a project cost of Rs.10.36 crores.

Under this marketing network, forty important agricultural commodities are brought under the fold of the Marketing Cooperatives to sell the commodities through 273 regulated markets. 96 commercial grading centres, 11 kapas grading centres, one tobacco – grading centre. Total value of agricultural produce sold by agricultural marketing cooperatives during 2004-05 was at Rs.307.26 crores which is moderately lesser than in 2003-04. Sugarcane

Table4.11 Value of Agricultural Produce Sold by Marketing Cooperatives

(Rs. In crores)

Sl. No.	Crop	2001-02	2002-03	2003-04	2004-05
1	Foodgrains	24.75	40.44	38.73	35.08
2	Cotton	116.71	92.51	90.43	94.59
3	Chillies	1.53	1.56	2.81	2.81
4	Coffee	-	-	-	-
5	Sugarcane gur	150.78	138.34	92.72	79.74
6	Species/spices	0.37	1.93	0.11	*
7	Oilseeds	24.62	15.11	16.09	13.06
8	Others	112.35	120.17	100.10	81.08
	Total	431.11	410.06	340.87	307.26

Source: The Registrar of Cooperatives, Chennai - 10

gur and cotton are the major commodities traded through the regulated markets.

4.8 Irrigation

Tamil Nadu with a geographical area of 130 lakh hectares is ranked eleventh in size among the Indian States. The net area sown in Tamil Nadu is about 60 lakh hectares of which about 30 lakh hectares or 50% get irrigation facilities from sources as given below: -

Canals	9.50 lakh hectares
Tanks	9.00 lakh hectares
Wells & tube wells	11.50 lakh hectares

4.8.1 Development of Irrigation in Tamil Nadu

The National Commission on Agriculture in 1976 assessed the ultimate irrigation potential of Tamil Nadu through Major and Medium Irrigation sources as 15.00 lakh hectares. At the commencement of the First Five Year Plan, (1951-1956) there were 23 Major and Medium Irrigation Projects benefiting 11.00 lakh hectares. In the IX plan period upto 2001-2002, the area under irrigation has risen to 29.72 lakh hectares.

During the 10^{th} Five Year Plan (2002-2007) upto 2003-2004, an additional irrigation potential of 2323 hectares has been created. During 2004-2005, additional irrigation potential of 7573 hectares is expected to be created and in the year 2005-06 an irrigation potential of 5143 hectares is proposed to be created.

4.9 Tank systems

Tank systems re an integral part of Irrigated Agriculture system. The importance of controlled water supply is indispensable for the sustainability in low land paddy production, which varies enormously from region to region and country to country. What essential is the degree of importance given to the three elements of water management namely resource management within the watershed, conveyance to the crop fields and management within farm ? KVBfields. While water losses in the paddy fields are to be discouraged, they need not necessarily amount to the losses to the watershed as a whole, if they are converted into groundwater and pumped back to the surface. In India, the second largest rice producing country of the world, 80% of water is used for irrigation..

There are around 40,000 irrigation tanks in Tamilnadu, India, irrigating about 0.63 million ha of paddy fields. Whatever, the shortcoming at their creation, existing irrigation tanks remain as an asset to the sustainability of paddy agriculture in Tamilnadu, provided their live storage is not reduced and the related irrigation facilities are not deteriorated to serve the purpose. Past experiences show that availability of surface water resources are not always reliable, which has turned the paddy farmer's attention to the exploitation of ground water on a very much larger but manageablescale. The tables below describes the categorization of tanks, area irrigated by tanks in TamilNadu and the constraints in tank irrigation development.

Table 4.12 Categorization of Tanks in Tamil Nadu

Type	Command area	No. of tanks
1. In charge of Local Government		
a) rainfed small size	< 20 ha	16,477
b) rainfed medium size	20-40 ha	3,936
2. In charge of State Government		
a) rainfed tanks	> 40 ha	5,276
b) system Tanks	varying	3,627
3. Old Private Tanks	varying	9,886
Total		39,202

(Source: PWD)

Table 4.13 Area irrigated by different sizes of Tank in Tamil Nadu

a) < 200 ha	39,102	838,000
b) 200 – 280 ha	40	11,000
c) 280 – 400 ha	30	11,000
d) > 400 ha	30	40,000
Total	39,202	900,000

(Source: AED)

Table 4.14 Constraints in tank irrigation development and required modernization measures

Component		Category	Constraints	Modernization measures
Tank System Facilities	Tank	Catchment Treatment	• Soil erosion induced reduction in tank storage and tendency for silting up at intake points	• Desilting of storage area and at intake points • Conservation of catchment through soil erosion control measures such as afforestation and terracing
		Tank Bund	• Insufficient top width and freeboard due to soil erosion of top level. • leakage	• Restoration of top width and free board. • Reinforcement of bund top and slopes with lining.
	Intake and outlet Structures	Intake works	• Water leakage due to damaged shutters • Broken water control facilities such as Plugs and Barrels • Broken and damaged front and rear inlets and outlets	• Provision of new slide gates and shutters • Provision of new plugs, plug rods and barrels • Reconstruction of inlets and outlets.
		Surplus Weir	• Insufficient length • Damaged leaky body wall and eroded rear protective works	• Increase of length and modifications of crest shape to increase discharges. • Reconstruction and reinforcement of damaged works.
	Supply Works	Supply Channel	• Reduction of design discharge as a result of silting of channel • Deterioration of stone masonry channel • Insufficient flow velocity due to weed growth • Leakage	• Periodical desilting of supply channel. • Reconstruction of damaged portion and strengthening at vulnerable sites. • Cleaning of vegetation in the channel.
Irrigation System	Distribution Network		• Slow movement due to obstruction by vegetation growth • Heavy seepage loss • Salt injury in inundated command areas due to channel leakage	• Periodical repair of channel by Water Users Association. • Lining of main distribution channel • Proper maintenance of drainage channel
	Operation and Management		• Occurrence of non irrigated area due to insufficient water control structures	• Lined channel with proper regulating and diversion structures at off-take points.
	Irrigation management		• Continuous over drawl without relevance to actual need, unofficial restoring subordinating equity to vested interests, small size plot-to-plot irrigation	• Irrigation scheduling based on crop water requirements, cropping pattern and effective rainfall etc., land consolidation.

Tank irrigation is a profitable technology in economic, environment and social terms but under present conditions of management it is deteriorating rapidly. Extent as well as reliability of this technology is decreasing. Because of potentials for additional rice cultivation for about 16 million ha under tank irrigation, it is important to select holistic improvement strategies that fully exploit the potentials of tank irrigation. In general, sustainable crop production requires better performance of these small-scale irrigation structures tanks, which needs modernization of physical structures, efficient distribution of water to and in farm fields as well as among the farmers and proper maintenance of tank system after the modernization through farmers participation.

4.10 Dam Safety

The Dam Safety Directorate was established in the year 1991 in Tamil Nadu with the object of giving assurance to safety of large dams in Tamil Nadu vide G.O. Ms No: 725 dated 18-04-91. At present there are 75 nos of PWD dams, (including 7 nos of small dams and 5 nos of drinking water supply reservoirs) and 38 nos of Tamil Nadu Electricity Board large dams.

4.10.1 Dam safety project. I

The Dam safety Assurance and Rehabilitation Project in Tamilnadu was carried out from 1991-1998 with World Bank funds. Totally, an amount of Rs.22.82 crores had been spent under the following components:

1. Institutional strengthening	Rs. 3.43 crores
2. Basic facilities	Rs. 5.41 crores
3. Remedial works for dams	Rs. 13.98 crores

Basic facilities like access roads, back up powers, communication network, weather station etc. were provided for dams. Remedial works to the dams such as providing upstream face treatment to minimize seepage, providing additional surplus arrangements to discharge excess floodwater, strengthening of masonry and earthen dams etc. were carried out in 9 dams based on the recommendation given by the Dam Safety Review Panel.

4.10.2 Dam Safety Project. II

Now, another proposals for rehabilitation and improvement works to 22 public works Department dams and for institutional strengthening for a value of Rs.709 millions has been sent to the Central Water Commission, in November, 2005 by the Government. Of Tamilnadu for posing under the Dam Safety Project –II which named as "Dam Rehabilitation and Improvement Project (DRIP) for getting assistance of the World Bank.

In additional to the above, the World Bank has conducted workshops on DRIP and creation of new funding pattern, which is named as DRIF by World Bank with the public, private partnership and World Bank and other commercial and National banks and state Government. Contribution like RIDF is operated by NABARD.

4.10.3 PWD Dams

The list of PWD dams are given below:

Table 4.15 PWD dams

S.No	River Basin	Name of the Dam
1	Palar Basin	Rajathope Kanar
		Mordhana
2	Varahanadhi Basin	Vidur
3	Pennaiaru Basin	Krishnagiri
		Sathanur
		Thumbalahalli
		Pambar
		Vaniar
4	Vellar Basin	Willingdon
		Manimukthanadhi
		Gomukhi
		Kariakoil
		Anaimaduvu
5	Vaigai Basin	Vaigai
		Manjalar
		Marudhanadhi
		Sothuparal
6	Vaippar Basin	Pilavakkal (Periyar)
		Pilavakkal (Kovilar)
		Vembakottal
		Kullursandhal
		Anaikuttam
		Golwarpatti
7	Tambaraparani Basin	Gundar
		Manimuthar
		Gatana
		Ramanadhi
		Karuppanadhi
		Adavinainar Koil
		Vadakku Pachaiyar
8	Kodayar Basin	Pechiparal
		Perunchani
		Chittar Dam – I
		Chittar Dam – II
		Poigaiyar
9	Nambiyar Basin	Kodumudiyar
		Nambiar
10	Ponniar	Kelavarapalli
		Sulagiri Chinnar
11	Drinking Water Supply Reservoirs	Poondi Reservoir
		Chembarambakkam
		Redhills
		Cholavaram
		Veeranam

The detailed Dam safety plan, procedures and formats are detailed in Annexure

4.11 Sand mining

Sand mining in the riverbed is a lucrative job. This process is going on for years together. Government has approved certain sand queries from where sand is to be removed subject to certain rules and regulations. The entire sand in the river bed has been removed and the rocky bed is exposed in many places. A list of quarries maintained by the PWD Department is given in the table

Table 4.16 Approved Sand quarries

S.No	Region	Total No. of Quarries Approved	Functioning
1	Chennai Region	124	35
2	Trichy Region	54	17
3	Pollachi Region	19	1
4	Madurai Region	42	11
	Total	**239**	**64**

Region wise authorized sand mining spots in Tamil Nadu are given in the following tables

Table 4.17 Authorized Sand quarries in Madurai Region

S.No	Name of the Quarry	District	River
1	Kamutdhi	Ramanathapuram	Gundar
2	Rajapati	Thoothukudi	Vaipar
3	Siragikottai	Ramanathapuram	Vaigai
4	Katchathanallur	Sivagangai	Saruganiyar
5	Virusampatti	Thoothukudi	Vaipar
6	Sirugudi	Sivagangai	Saruganiyar
7	Vasudevanallur	Thirunelveli	Vaipar
8	Eluvankottai	Sivagangai	Manimuthar
9	Sankaranatham	Virudhnagar	Vaipar
10	Athankarai	Virudhnagar	Vaipar
11	Mukkani	Thirunelveli	Tambaraparani

Table 4.18 Authorized Sand quarries in Chennai Region

S.No	Name of the Quarry	River
1	Panapakkam	Araniyar
2	Manpakkam	Araniyar
3	Veppedu	Palar
4	Pinayur	Palar
5	Ozhukuvakkam	Palar

6	Punjai arasanthangal	Palar
7	Sembedu	Kosasthaliyar
8	Vrinchipuram	Palar
9	Vadakarai	Palar
10	Poongodu	Palar
11	Tirumalaicheri	Palar
12	Thirupaachanoor	Malattar
13	Karadipakkam	ThenPennaiyar
14	Emapar	Pennaiyar
15	Melsevur	VarahNadhi
16	Thiruvakkarai	VarahNadhi
17	Kizhaku madurthur	ManimukthaNadhi
18	Kelapattu	ManimukthaNadhi
19	Karuvepalankurichi	Vellar
20	Alagianatham	Pennaiyar
21	Kanchankollai	Pennaiyar
22	Viramudaiynnatham	Vellar
23	Elanthapattu	Pennaiyar
24	Ippikonpalli/konjoji kothur	Pennaiyar
25	Theertham/nerlagiri	Markandeynadhi
26	Pathimaduvu/palanapalli	Markandeynadhi
27	Kolathi	Pennaiyar
28	Thatchur	Cheyyar
29	Eyyakulathoor	Cheyyar
30	Kilathur	Cheyyar
31	Pavakkal	Pambar
32	Kuppanatham	Cheyyar
33	Samanur	Chinnar
34	Murugampatti/karuveppampatti) (N o.1)	Pennaiyar
35	Kelavalli/kengarapatti/echampadi(No.2)	Pennaiyar

Table 4.19 Authorized Sand quarries in Pollachi Region

S.No	**Name of the Quarry**	**River**
1	Anaipalayam	Amaravathy

Table 4.20 Authorized Sand quarries in Trichy Region

S.No	Name of the Quarry	River
1	Murungapettai (Muthurasanallur)	Cauvery
2	Nochiyam	Cauvery
3	Thiruengoimalai	Cauvery
4	Chinthavadi	Cauvery
5	Thimmachipuravathiyamm	Cauvery
6	Vathiyam	Cauvery
7	Nanjai pugalur	Cauvery
8	Achampuram	Cauvery
9	Ogalur	Marudaiyaru
10	Thalavai north	Marudaiyaru
11	Kothamangalam-II	Marudaiyaru
12	Southpalamanneri (Thirukkattupalli)	Cauvery
13	Puthur	Cauvery
14	Siddhamalli	Cauvery
15	Vinnamangalam)	Cauvery
16	Sendakkottai (Muthalseri)	Nasuviniyar
17	Neyvellivadapathy	Agniyar

4.12 Fisheries

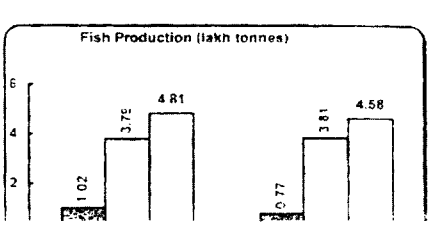
Tamil Nadu has a long and glorious tradition of maritime activities. The tropical climate is conducive for the breeding varieties of fishes throughout the year. The total fish production in the inland fishing was 1.01 lakh tonnes during 1996-97. However the marine fish products were in the order of 3.56 lakh tonnes

Tamil Nadu is one of the prominent maritime States with rich potential in fisheries. The State has a coastal line of 1076 km. sharing 13.4 percent at Natioanl level and a continental shelf of about 41412 sq.kms. The State possesses 0.19 million sq.km of Exclusive Economic Zone (EEZ) accounting for 9.7% of All-India EEZ. An extenet of 56000 ha. Of brackish water area available for aquaculture production of which 4455 ha. (8.0%) are under aquaculture in the State. Besides this, the fisheries sector provides employment opportunities to the coastal people and earns export earnings.

Apart from marine fishing, the State is also endowed with inland fishing potential to the tune of about 3.7 lakh ha. Of water spread area comprising reservoirs, major irrigation and long seasonal tanks, short seasonal and ponds, estuaries and backwaters.

4.12.1 Fish Production

Due to urbanisation and increasing population, there is an increasing demand for



sea food. The State has introduced Fisheries Development Mission at Ramanthapuram district as a 15-point Programme during 2002 – 03. It mainly focuses on the production of both marine and inland fish through innovative and scientific methods in reservoirs, tanks and ponds.

The overall fish production in the State has come down by 4.8% from 4.81 lakh tonnes in 2002 – 03 to 4.58 lakh tonnes in 2003 – 04. The share of marine and inland fish catch put together accounted for 8.0& of total National production in 2002 – 03.

4.12.2 Marine Fish Production

The marine fish production through mechanised and non-mechanised boats had improved marginally by 0.5 per cent from 3.79 lakh tonnes in 2002-03 to 3.81 lakh tonnes in 2003-04. The total number of boats engaged in fishing operation decreased from 68036 in 2002-03 to 66684 in 2003-04. In marine fisheries, problems of over fishing, issues like crossing of international boundaries etc. are being addressed.

Table 4.21 Marine Fish Catches by Boats

Year	Boats in operation (number)			Fish catches through (tonees)		
	Mechanised	Non-Mechanised	Total	Mechanised	Non-Mechanised	Total
2001-02	11444	53844	65288	187142	186719	373861
2002-03	11889	56147	68036	200468	178746	379214
2003-04	11969	54715	66684	204432	176716	381148

Source: Commissioner of Fisheries, Chennai –6

Tsunami of 26th December 2004, visually crippled the economy of coastal districts: impact being severe in the districts of Nagapattinam, Cuddalore, Kanniyakumari, Kancheepuram, Villupuram and Chennai. Thousands of boats, catamarams and fishing nets were destroyed (26112 wodden catamaram, 3402 RRP catamaram, 4170 Vallams, 2391 mechanised boats and 38177 fishing nets). There was extensive damaged to fishing harbours, fish landing centres and trading centres. Almost all the aquaculture farms were destroyed. Due to the damages cause to other infrastructure, Fishing and related activities came to a stand still for almost three months after tsunami. Even though restoration activities had been swiftly undertaken, tsunami had impacted the coastal economy considerably. Loss of marine fish production due to tsunami during 2004-05 is provisionally estimated at not less than 25 per cent of the normal production.

4.12.3 Inland Fish Production

In order to step up inland fish production Fish Farmers Development Agency has been in operation in the State since 1976. There were 12 Fish Farmers Development Agencies in 2003-04. They develop scientific cultural practices in inland water fisheries. The quantum of inland fish production is a function of number of fish ponds/tanks and availability of water and size of investment. There are 1061 major reservoirs, 34734 major irrigation

tanks, 39283 seasonal tanks etc. Total catch by the source reveals that seasonal, tanks and major irrigation tanks alone accounted for 83 per cent of total inland fish production of 77307 tonnes in 2003-04. Inland fish production in the recent past had witnessed a declining trend. It declined from 102217 tonne in 2002-03 to 77304 tonnes in 2003-04. The fall in production is due to failure of monsoon and drying up of irrigation sources in three consecutive years.

The Inland Fishery focuses on augmenting the fish production by utilizing the available inland water resources such as reservoirs, major and minor irrigation tanks, village ponds and tanks etc. The reservoir fisheries management is being undertaken in 44 reservoirs in the State by the Department and in eight reservoirs by the Tamil Nadu Fisheries Development Corporation. The Department has also taken over 32.000 ha. of major and minor irrigation tanks for stocking carp seeds and exploiting with the help of local fishermen.

Table 4.22 Inland Fish Production: By Source

S.No	Sources	2001-02	2002-03	2003-04
1.	Major Reservoirs	973	1095	879
2.	Major Irrigation Tanks (both perennial and long seasonal)	36182	34734	195
3.	Seasonal Tanks	42688	39283	64822
4.	Estuaries and back waters	8591	7500	2800
5.	Fish Farmers Development Agencies	3814	1686	2213
6.	Rivers, Streams, Canals and other Water Sources	11812	8500	-
7.	Miscellaneous (Rice fields, Swamps etc.,)	9631	9419	6404
	Total	**113691**	**102217**	**77304**

Source: Commissioner of Fisheries, Chennai –6

4.12.4 Export of Fish

Tamil Nadu is one of the major fish exporting States in India. The fish products are mostly exported through Chennai and Thoothukudi ports in the State. Marine fish export fetches good export earnings to the State. The total quantity of fish and fish products exported had come down by 2.4 per cent from 70147 tonnes in 2002-03 to 68462 tonnes in 2003-04. The State's share in fish export stood at 17 per cent at the national level (412017 tonnes). The value of total quantity exported worked out to 33.99 per cent of the all India export value.

Table 4.23 Export of Fish and Fish Products

Year	Tamil Nadu		All-India	
	Quantity (Tonnes)	Value (Rs. In Lakhs)	Quantity (Tonnes)	Value (Rs. In Lakhs)
2001-02	58482	201640	424470	595705
2002-03	70147	250787	467297	688131
2003-04	68462	207116	412017	609195

Source: Commissioner of Fisheries, Chennai -6

4.12.5 Other Development Initiatives

Apart from the above activities, the State is implementing certain schemes for the health and wealth of fishery sector such as Fishermen Sea Safety Scheme, Fishermen Free

Housing Scheme, National Fishermen Savings-cum-Relief Scheme, Group Accident Insurance Scheme for Fishermen and the Project like Integrated Marine Fisheries Development Project Phase I and II etc. The Phase II of Integrated Marine Fisheries Development Project was kick-started in 1.4.1998 in 13 coastal districts in Tamil Nadu and planned to distribute 3565 fishing inputs to 100 villages to a tune of Rs.4506 lakhs in the State. The Tamil Nadu State Apex Fisheries Co-operative Federation Limited (T AFCOFED) started functioning from 6.11.1991 in Chennai as a Headquarters. At present, 580 Primary Fishermen Co-operative Societies and nine District Fishermen Co-operative Federation had become members in Tamil Nadu State Apex Fisheries Co-operative Federation Limited (TAFCOFED) and paid a share capital of Rs.89.09 lakhs.

4.12.6 Sustainable Fish Development

In order to facilitate sustainability, the Government of India has imposed a 45-days ban on fish catching during summer season in notified areas in the sea with a view to arresting over-exploitation of fish. This policy contributes towards improved breeding of fish and ensuring sustainable development of fish population. The Supreme Court of India mandated that all the aqua farmers in the coastal areas should obtain approval from Aqua cultural Authorities of India. Aqua-farming is to be carried out beyond 500 metres from the high tide of the sea. This move is to regulate pisiculture in the Coastal Regulation Zone. The potential shrimp farming area consists of 56000 ha. in the State. As on March 2005, 2086 shrimp farms are functioning in 12 coastal districts (except Chennai) of the State. Of these, 883 shrimp farms had got approval from the Aquaculture Authority. The coastal aquaculture had become a thrust area under Fisheries Development Mission in the State. It is proposed to develop 1000 ha. of coastal saline land every year under aquaculture utilising low intensive traditional and improved traditional shrimp farming practices by utilising the support of other' agencies like Marine Product Export Development Agency (MPEDA) in the State. During the past three years (i.e. from 2002) aquaculture fuming has been under taken over an area of about 3100 ha. in the State with the approval of Aquaculture Authority.

4.13 Fertilizer Consumption

The consumption of total fertilizer nutrients recorded a spectacular increase of 42.3% during 2004-05, after experiencing decelaration in growth in the preceding 4 years. Total nutrient consumption increased from 0.713 M t during 2003-04 to 1.015 M t during 2004-05. All the three nutrients registered positive growth. The consumption of N, P_2O_5 and K_2O at 0.479, 0.206 and 0.330 M t, registered sharp increase of 26.6%, 29.8% and 87.3%, respectively, during 2004-05 over 2003-04. The fertiliser consumption recorded positive growth during both Kharif and Rabi seasons. Kharif:Rabi share in total fertilizer consumption changed marginally from 35.65 during 2003-04 to 36:64 during 2004-05. NPK use ratio changed from 2.2:0.9:1 during 2003-04 to 1.5:0.6:1 during 2004-05. The per hectare consumption of total nutrients increased from 114.5 kg during 2003-04 to 163 kg during 2004-05.

4.14 Pesticide Consumption

Pesticides demands have been influenced by more awareness of the farmers for better crop yield. Pesticide usage for the cultivation of food crops among the different states of India showed a mixed pattern. Tamil Nadu consumes 1.2 to 2 kg/ha of pesticide which is followed by Andhra Pradesh and Punjab where 0.8 to 1.2 kg/ha is the rate of consumption.

The environmental load of pesticides in India in term of kg/sq.km. land area presents an interesting picture. Maximum pesticide load is found in the environment of Punjab, Haryana, Delhi and Tamil Nadu. The pollution load in these areas ranges from 70-100 kg/sq.km. land area.

4.14.1 Common Pests

The list of common pests infected and the crops are given in the following table:

Table 4.24 List of Common Pests

S.No	Name of the Pest	Name of the Crop
1	Stem Borer	Paddy
2	Green leaf Hopper	Paddy
3	Leaf Folder	Paddy
4	Leaf Spot	Paddy
5	Powdery Mildew	Groundnut
6	Wilt	Sugarcane
7	Fruit Rot and Sigatoka Leaf Spot	Banana
8	Tikka Disease	Groundnut
9	Wilt of Paddy	Paddy
10	Leaf Spot	Groundnut
11	Red Rot	Sugarcane
12	Powdery Mildew	Grapes
13	Scab	Apple
14	Powdery Mildew	Peas, Pulses
15	Aphid white fly	Cotton
16	Boll Worm – Stem and fruit borer	Brinjal
17	Thrips and Mites	Chillies
18	Bud and Army Worms	Tobacco
19	Boll worm	Maize, Potato and Onion
20	Echinocloa	Grasses
21	Fusarium Leaf Spot	Paddy
22	Powdery Mildew	Soya bean, Tea
23	Cercospora Rust	Citrus and Vegetables
24	Broad Leaved Weeds	Cereals, Nuts and Maize
25	Powdery Mildew	Mango, Pulses
26	Kernel Burnt	Wheat
27	Blister Blight	Tea
28	Pearl Millet and Downy Mildew	Wheat
29	Leaf Blight	Potato
30	Pod Borer	Pulses

4.14.2 Integrated pest management

Integrated Pest Management (IPM) is being adopted in the State for effective and eco-friendly pest and disease management under plant protection. The fanners were given training regarding the identification of predators and stamp out them. This has made the farmers

aware of the need to adopt the IPM technology to minimize the pesticides consumption and thereby save about 20 per cent of the crop loss due to pest and disease.

During 2003-04, plant protection measures such as pest and disease management were carried out in the State. The pest management was carried out to the extent of 32.78 lakh ha. pest treatment under food crops and 17.7 lakh ha. under non-food crops. The area covered under disease treatment was of the order of 16.9 lakh ha. (food crops) and 9.2 lakh ha. (non-food crops) in 2003-04. Under Integrated Pest Management, the IP on demonstration has been carried out through Centrally Sponsored Schemes, Cotton Mini. Mission. II, Accelerated Maize Development Programme, Oilseeds Production Programme and National Pulses Development Project. It was of the order of 1500 nos., 70 nos., 30 nos., 1669 nos. and 536 nos. during 2003-04. During this period, the pest control measures such as seed treatment (26.4 lakh ha.) rat control (0.2 lakh ha.), weed control (0.2 lakh ha.) had been covered. The plant protection with regard to pest control is expected to improve by treating 12.4 lakh ha. for food crops and 8.0 lakh ha. for non-food crops during 2004-05 (upto October 2004). Disease control measures for food crops stood at 6.7 lakh ha. and non-food crops to 4.8 lakh ha. (upto October 2004) in 2004-05

4.15 Crop Diversification

Given the constraint in terms of availability of irrigation for crops, traditional hydrophilic crops (like paddy, banana, and sugarcane) are increasingly subject to moisture stress. Hence, a crop diversification strategy that aims at a shift to crops requiring lesser moisture is increasingly becoming imperative. Crop diversification by a critically re-designed alternative cropping pattern based on agro climate zone may be demonstrated in the farmer's holdings to effectively utilise the natural resources. This could stabilize production and productivity in the State. If focused on switching from low value to high value crops; single crop to multiple/mixed crop; crop alone to crop with crop-livestock – fish apiculture and agriculture production to production with processing and value addition. This would bring high value and labour intensive crops and it could provide adequate income and employment opportunities to farming community in the State. Thus, there arose a need for raising "more crops per drop" with focus on drought resistant and less water consuming crops.

Factors such as declining supply of cultivable land, growing population, rising urbanization, changing tastes and life styles have necessitated crop diversification. Monoculture leads to impoverishment of soil and low productivity. Hence farmers have to be advised to switch over the alternative crops which have assured market and consume less water. Cultivation of less water-intensive crops like sweet sorghum, sugar beat and Jatropha have the potential to intensify the crop diversification process and drive agricultural growth.

4.15.1 Jatropha

In the context of steep increase in the prices of imported oil, attention is being focused on the feasibility of bio-fuel to meet the energy requirements of the economy. Cultivation of Jatropha is being encouraged substantially both by the State Government and the Centre.

Jatropha cultivation is to be taken on one lakh acres under contract farming. The plant has the potential of providing employment to farmers and processors besides contributing to greening. It would contribute to the growth of rural industries for prolluction

of crude oil and refined oil. The cost of cultivation would be Rs.10760 under dry land condition and Rs.19560 under irrigated conditions. Economics of this crop are very encouraging. It is a diesel substitute. Lack of subsidy schemes and the need for higher investment are impeding the cultivation of Jatropha in the State. It is further reported that non-availability of quality seed material is also an inhibiting factor.

4.15.2 Horticulture

Demand for the horticultural crops such as fruits and vegetables are income-elastic. The consumption pattern over a period of time titled towards horticulture products with steady increase in the per capita income. In the wake of growing population and swelling urbanization a favorable shift in consumption in favour of horticultural crops need more coverage of area. These value addition crops provide raw-materials to agro-based industries besides providing employment opportunities to rural masses. The crop diversification technique has been advanced to boost production and productivity of horticultural crops. The horticulture crops contain remarkable potential for export earnings in the State. The share of the State is 5.7 per cent in terms of area under horticultural crops and 7.7 per cent in terms of production at the national level.

India's share in world production of coconut is the number one, vegetables second, natural rubber fourth, coffee sixth, fruits tenth and tea 29th. The horticultural sector consists of a wide range of crops such as fruits, vegetables, spices, plantation crops, floriculture, medicine and aromatic plants, cashew etc. Mango, banana, citrus, apple, guava, papaya and grapes share the bulk of fruit production. Horticulture is a potential source of diversification in agriculture.

The shelf life of food grains is over three years or even more against fruits whose self life ranges between one week and 3 months. In view of this, strategies involve a separate road map for value addition in fruits and vegetables, adequate infrastructure such as cold storage, refrigerated transportation, rapid transit grading, processing, packaging and quality control.

The State has a vast potential for successful cultivation of crops like mango, banana. Cashew, tapioca, medicinal plants and flowers which are being exploited intensive under the Horticulture Mission. The State has set up a Mission for Hollicultural Development aiming to achieve 8 per cent annual growth during X Five Year Plan in this sector. This gives impetus to production, processing for value addition and marketing of horticultural crops such as vegetables, fruits, flowers and medicinal plants. Tamil Nadu is the first State in India to set up a separate Mission for the development of horticulture. It also aims to double the horticulture production by 2011-12 in the State.)

Objectives of Horticulture Mission

- Improving production through balanced nutrition management
- Evolving suitable mechanism for regulating the production of quality planting materials and giving impetus to research;
- Creating & adequate infrastructure for post harvest management especially, preservation and marketing

- Encouraging active involvement of farmers Association in the adoption of modern technologies.

Beyond the Mission's thrust on the production of horticulture crops, it advocated crop development strategies such as adoption of IPM and INM techniques, training of farmers in latest technology, laying of demonstration plots, efficient irrigation management through installation of micro irrigation systems such as Drip Irrigation and Sprinkler Irrigation techniques.

The State signed a Memorandum of Understanding with the Agriculture and Processed Food Products Export Development Authority for setting up an Export Promotion Zone for cashew at Rs.l0.36 crore. The zone will enhance export to Rs.100 crores in three years and provide employment to 20000 persons.

Despite the failure of the monsoon in the last three years, the area under horticulture increased from 7.77 lakh ha. in 2002-03 to 8.25 lakh ha. (15.1 %) in 2003-04 and this area has been projected to 8.91 lakh ha. in 2004-05. The fruits, vegetables and plantation crops shared more than 75 percent of the area coverage under horticultural crops in 2002-03 and 80 per cent in 2003-04 and projected to 78 per cent in 2004-05.

The overall production of horticultural crops had improved from 91.70 lakh tonnes in 2002-03 to 99.46 lakh tonnes in 2003-04 the growth being 8.5 per cent. The projected production stood at 107.45 lakh tonnes during 2004-05 showing a better prospect. The production of fruits and vegetables alone accounted for about 83 per cent in total production in 2002-03 and 85 per cent in 2003-04. The productivity of horticultural crops had experienced a dip of 14.2 per cent in 2002-03. However, it had regained its level by 2.2 per cent in 2003-04. Tangible improvement is anticipated in 2004-05.

4.15.3 Medicinal Plants

With the growing importance of ayurvedic and siddha medicines, the importance of raising medicinal plants is Central to the State's health policy. Area and production of medicinal plants which are confined to Western Ghat districts and also in the districts of Thoothukudi, Dharmapuri Thiruchirapalli. Pudukkottai, Perambalur, Karur and the Nilgiris remained statistic during 2004-05. While, the extent of area covered by medicinal plants was around 4000 ha. total production was estimated at about 8000 tonnes giving an yield per hectare of two tonnes. Area and production are almost in constant proportion.

The State implements State and Centrally-sponsored Schemes viz.. Integrated Horticulture Developmell t scheme (IHDS). Integrated Tribal Development Programme (ITDP). Western Ghats Development Programme (WGDP) and Hill Area Development Programme (HADP) during 2003-04 and also continued in 2004-05. Implementation of these schemes has impacted on area, production and yield.

Table 4.25 Area, Production and Yield rate of Horticulture Crops

Crop	Area (lakh hectares)			Production (lakh tones)			Yield (tones / ha.)		
	2002-03	2003-04	2004-05	2002-03	2003-04	2004-05	2002-03	2003-04	2004-05
Fruits	2.23	2.21	2.39	40.14	36.09	39.08	17.96	16.33	16.37
Vegetables	1.62	1.91	2.06	35.99	46.73	50.59	22.25	24.47	24.53
Spices & condiments	1.46	1.54	1.67	6.25	6.93	7.50	4.27	4.49	4.50
Plantation crops	2.28	2.34	2.53	7.95	8.02	8.68	3.49	3.43	3.44
Flowers	0.18	0.20	0.22	1.35	1.62	1.75	7.65	7.97	7.99
Medicinal plants	>100	0.04	0.04	0.02	0.08	0.08	- -	1.90	1.90
Total	**7.77**	**8.25**	**8.91**	**91.70**	**99.46**	**107.68**	**11.80**	**12.06**	**12.09**

Source: Directorate of Horticulture and Plantation Crops, Chennai –6

The State has an estimated 130 million hectares of coastal land. Of which 33 million hectares are available for reclamation. This programme aims at transforming the rural economy by providing employment opportunities to agricultural labour and the rural poor. The crops like Sweet Sorghum and Jatropha other tremendous opportunities to farmers and improve their income and standard of life. The Sweet Sorghum crops needs 40 per cent of normal water-consuming crops and provides an average yield of 30 tonnes per acre and realizes Rs.10000/- per acre as net income within four months. Similarly, Jatropha, a hard shrub, gives attractive yield for 30 years and thereby could fetch more than Rs.12000 per acre from the third year of cultivation.

4.15.4 Sericulture

Sericulture has potential for employment and income generation. The productivity of silk production depends mainly on the quality of silk worms. The cocoon and raw silk production has been carried out in 26 districts in the State. The improved bivoltine races are being introduced in the State to improve yield rate and fetch higher income to the farmers. In terms of the cocoon and raw-silk production, five districts, namely, Dharmapuri (50.3%), Vellore (12.7%), Erode (10.6%), Coimbatore (6.7%) and Namakkal (3.7%) constitute a high share (85%) out of the total area coverage of 13486 ha. in Tamilnadu.

The average yield of cocoons per 100 laying which prevailed at the end of IX Five Year Plan (2001-02) increased to 58.4 kgs. in 2004-05 (upto February 05) during the X Five Year Plan period. Tamil Nadu is also a major silk consuming State and the estimated requirement of silk would be 1500 metric Tonnes per year. The silk industry in the State is also in the process of adjusting itself to the changing requirements in post WTO. Marketing and branding initiatives like the Silk Mark also help in developing the market for silk products.

4.16 Water Weeds

Water weeds like Eichornia, Ipomoea, Salvinia, Pistia, Trapa, Typha and Prosopis cineraria were found commonly in the water bodies. The aquatic weeds cause enormous damages to the water bodies leading to large-scale water depletion and reduces the water holding capacity of the water body. It also increases the rate of evaporation. The weeds

block the irrigation channels and does not allow the un-wanted matters to enter outside. The quality of water becomes altered so that it as a shelter of many disease causing vectors. It also affects fishing grounds and even block navigation. The entire biotic communities which depend upon these water bodies will be affected.

4.16.1 Remedial measures

- The weeds such as Eichornia, Salvinia, Ipomoea and Pistia can be collected and used as manure
- They can be used for the preparation of vermicompost
- Some of the weeds can be used for the preparation of biogas
- Weeds can also be used as medicine, fodder and food
- Some weeds scavenge the in-organic and organic compounds from water so they can be used as a water purifier
- Some weeds can be grown as ornamental. Usually the dominant weed Eichornia is grown in mud pots by the villagers. They have been called as the water orchids.
- Tubers of Lotus and seeds of Trapa are the good source of food
- Typha can be mainly used for basket making
- Awareness programmes should be organised regarding conversion of water weeds into manure and production of biogas

4.17 Prosopis juliflora

The plant is a perennial deciduous thorny shrub or small tree, to 12 m tall; trunk to 1.2 m in diameter, bark thick, brown or blackish, shallowly fissured; leaves compound, commonly many more than 9 pairs, the leaflets mostly 5-10 mm long, linear-oblong, glabrous, often hairy, commonly rounded at the apex; stipular spines, if any, yellowish, often stout; flowers perfect, greenish-yellow, sweet-scented, spikelike; corolla deeply lobate. Pods several- seeded, strongly compressed when young, thick at maturity, more or less constricted between the seeds, 10-25 cm long, brown or yellowish, 10-30-seeded. Seed compressed and oval or elliptic, 2.5-7 mm long and brown.

Bearing fruits in 3 to 4 years, the trees are usually harvested by hand, often after the fruits have fallen.

Fast-growing, drought resistant, and with remarkable coppicing power, Prosopis is a natural fuelwood candidate. With specific gravity 0.70 or higher, the wood has been termed "wooden anthracite", because of its high heat content, burning slowly and evenly and holding heat well. This species provides >90% of the fuelwood in some Indian villages (Sharma, 1981). Although no direct data on N-fixation of Prosopis are available, Felker and Bandurski (1979) suggest that tree legumes (exclusive of Caesalpiniaceae) fix between 155 and 580 kg/ha/yr. Soils under the crowns of legumes in the desert usually have 10 times more N (0.3%) than those under non nitrogen fixers (0-03%).

4.17.1 Economic applications

In places where juliflora is available, the rural people are directly depending on this for their livelihoods by selling the wood/converting as charcoal in the nearby towns. This needs to be up-scaled in the project for using this with a higher value added projects – Biomass based generation and biomass gasifiers.

4.17.2 Biomass based generation

State Government has initiated efforts to encourage new power generation projects using wood and other agro residues and waste. District level and Taluk level studies were carried out and the information regarding the availability and potential in selected places in the State are available. The entrepreneurs who wants to promote biomass power plants may be encouraged under this project to come forward for setting up of power plants in the places where juliflora is abundantly available so that the farmers can get better remunerative price for this wood. This will enhance the income levels of the farmers.

4.17.3 Biomass gasifiers

To meet the thermal and electrical energy requirements of industries and other organizations a new scheme of installing gasifiers is being promoted by MNES. The village Panchayat under this project may be encouraged to install gasifiers for water pumping.

4.18 Livestock

A perusal of total livestock population in Tamil Nadu since 1982 exhibits that there are variation across the Quinquennial Censuses particularly with reference to the population of cattle, sheep and goats. With respect to buffaloes, a steady decline has been noticed since 1982. As per the latest Quinquennial Livestock Census 2004, total livestock population stood at 249.41 lakhs – cattle at 91.41 lakhs, buffaloes 16.58 lakhs, sheep 55.93 lakhs, goats 81.77 lakhs and others 3.72 lakhs. In the case of poultry population, it increased by leaps and bounds – 182.84 lakhs in 1982. 359.41 lakhs in 2001 and 865.9 lakhs in 2004. Acceleration in the poultry is mainly due to heavy demand. Fodder problems is the main cause for decrease in cattle and buffaloes population. Government endeavours to upgrade the indigenous cattle and buffaloes to high quality animals.

Table 4.26 Trends in Livestock Population (lakhs) – Tamil Nadu

Year	Cattle	Buffaloe	Sheep	Goats	Others	Total	Poultry
1982	103.66	32.12	55.37	52.46	18.26	261.87	182.84
	(-4.03)	(4.35)	(4.69)	(24.85)	(135.31)	(8.45)	(27.44)
1989	93.53	31.28	58.81	59.20	20.85	263.66	215.70
	(-9.77)	(-2.62)	(6.21)	(12.85)	(14.18)	(0.68)	(17.97)
1994	90.96	29.31	56.12	58.65	21.75	256.79	238.54
	(-2.75)	(-6.30)	(-4.57)	(-0.93)	(4.32)	(-2.61)	(10.59)
1997	90.47	27.41	52.59	64.16	24.76	259.39	365.11
	(0.54)	(-6.48)	(-6.29)	(9.39)	(13.84)	(1.01)	(53.06)
2001	91.82	27.08	53.47	68.08	4.78	245.22	359.41
	(1.49)	(-1.20)	(1.67)	(6.11)	--	(-5.46)	(-1.56)
2004	91.41	16.58	55.93	81.77	3.72	249.41	865.9
	(1.03)	(-39.51)	(6.35)	(27.45)	- -	(-3.85)	(97.62)

Source: Directorate of Animal Husbandry and Veterinary Services, Chennai -6

The cattle population is concentrated in the districts of Villupuram, Thiruvannamalai, Vellore, Dharmapuri, Thanjavur, Pudukottai, Coimbatore, Cuddalore, Dindigal and Kancheepuram whereas the buffaloes are preponderance in the districts of Namakkal, Villupuram, Kancheepuram, Erode, Salem and Thiruvallur. These districts are called milk belts of the State.

Productivity of cattle and buffaloes in Tamil Nadu is relatively low, going by the internatior standards. This is due to the predominance indigenous and native stock of animals. To impro the cattle stock, the Tamil 'Nadu Livesto Development Agency has brought all breedi activities under a single umbrella and an artifici insemination programme is being carried out. decline in breedable female population is noticed 200`4 Quinqunnial Livestock Census – from 47. lakhs in 2001 to 41.17 lakhs in 2004 in respect cattle and from 15.15 lakhs to 9.01 lakhs in respe of buffaloes.

Breedable Female Population

Lakhs

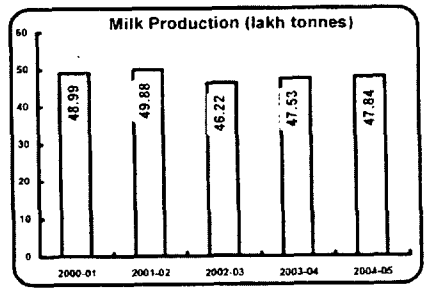
Category		1997	2001	2004
Cattle				
	o Exotic and Crossbred	12.61	18.78	25.89
	o Indigenous and Native pure	32.02	28.34	15.28
	Total	**44.63**	**47.12**	**41.17**
Buffaloes				
	o Murrah & Graded	3.74	4.97	2.90
	o Indigenous	13.64	10.18	6.11
	Total	**17.38**	**15.15**	**9.01**

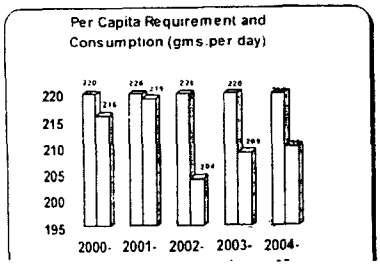
The share of breedable female exotic and crossbred cattle accounted for 28.32% (25.89 lakhs) and indigenous and native pure works out to 16.72% (15.28 lakhs) of the total cattle population of 91.41 lakhs during 2004. Among breedable female buffaloes population the share of murrah graded was 17.49% (2.90 lakhs) and indigenous 36.85% (6.11 lakhs) out of the total buffalo's population of 16.58 lakhs during 2004.

4.18.1 Milk production

After agriculture, dairy is the largest employer in the State particularly among the women. The milk production and availability are as follows:

In conformity with the growin population, rising urbanisation and changi consumption pattern and increasing per capi income, milk production has grown to meet t current as well as the future demands. The mi production doubled in 1980's, whereas the pa of growth in milk production somewhat slow down in 1990s.





Milk production rose from 46.22 lakh tonnes in 2002-03 to 47.53 lakh tonnes in 2003-04 and further improved to 47.84 lakh tonnes in 2004-05.

Despite increase in milk production, State's share during 2003-04 at All India level hovered around 5.9 per cent in 2001-02 and 5.4 per cent in 2003-04. The per capita availability of milk per day was 204

gms. in 2002-03, 209 gms. in 2003-04 and 210 gms in 2004-05, the increase being 2.9 per cent.

Tamil Nadu Cooperative Milk Producer's Federation procured milk through 7117 and 7493 Primary Cooperative Societies in the State during 2003 – 04 & 2004 – 05. The total milk production by societies had improved by 17.6 per cent from 18.88 LLPD in 2002-03 to 22.21 LLPD in 2003-04 and further improved by 7.0 to 23.76 LLPD in 2004 - 05.

These societies procured more than 17 per cent of the State total milk production of 47.53 lakh tonnes in 2003-04. The quantity of milk sold had also gone up from 6.53 LLPD in 2002-03 to 6.91 LLPD in 2003-04 and improved to 8.09 LLPD(17.1%) in 2004-05. The value was to the tune of 85.71 lakh per day and 90.70 lakh per day respectively. The value of the milk products had plummeted in the case of the products such as butter, ghee tetra pack SM I Ltr. tetra pack - SM 200 ml. cheese, mysorepak, butter milk and flavoured milk during 2003-04 compared to the preceding year 2002-03. The value of milk products sold for the quantity of SMP (12064.5MTs), Butter(1631.9 MTs) and Ghee (7949.1 MTs) to the tune of Rs.9244.46 lakhs, 802.62 lakhs and 8860.09 lakhs respectively. However, the quantity and sale of milk, milk powder (4437.6 mt.), Tetra pack - TM 1 Ltr. (75058 litre), ice creams (133841 litre), Gulabjamun (1525 kgs.), khova (289452 kgs.), curd (517900 nos.) and Maavin (77026 nos.) had witnessed an increasing trend from Rs.2300.04 lakhs in 2002-03 to Rs.4328.27 lakhs in 2003-04 in the State.

Table 4.27 Milk Products and Value

Year	Tamil Nadu	All India	% Share of Tamil Nadu	Percapita availability (gms. per day)	
	(Lakh tonees)			Tamil Nadu	All India
2001-02	49.88 (1.9)	844 (4.3)	5.9	219 (1.4)	225 (2.3)
2002-03	46.22 (-7.3)	862 (2.1)	5.3	204 (-6.8)	230 (2.2)
2003-04	47.53 (2.8)	881 (2.2)	5.4	209 (2.5)	231 (0.4)
2004-05	47.84 (0.65)	-	-	210 (0.48)	

Source: Directorate of Animal Husbandry and Veterinary Services, Chennai –6

4.18.2 Milk yield

The average yield rate of milk from exotic and crossbred animals improved from 6.150 kgs. in 2002 – 03 to 6.177 kgs. in 2003 – 04 and further to 6.244 kgs. in 2004 – 05. The yield rate of indigenous cows rose from 2.554 kgs. in 2002 – 03 to 2.663 kgs. in 2003 – 04 and further to 2.680 kgs in 2004 – 05. The milk yield of buffaloes increased to 4.20 kgs. in 2004 – 05 from 4.125 kgs in 2003 – 04 and 4.112 kgs. in 2002 – 03.

Table 4.28 Average Yield Rate of Milk (Kgs., / Animal / day)

	Category	2001-02	2002-03	2003-04	2004-05
I.	Cows				
a.	Exotic and Crossbred	6.320 (4.0)	6.150 (-2.69)	6.177 (0.44)	6.244 (1.08)
b.	Indigenous	2.760 (-0.1)	2.554 (-7.46)	2.663 (4.28)	2.680 (0.64)
II.	Buffaloes	4.200 (0.1)	4.112 (-2.09)	4.125 (0.32)	4.200 (1.82)

Source: Directorate of Animal Husbandry and Veterinary Services, Chennai -6

4.19 Poultry

India is the fourth largest producer of eggs in the world and the eighth largest producer of broilers. The industry turnover is estimated at Rest 10,000 crores per annum. An annual output of 30,000 million eggs and 1000 million broilers yielding five lakh tones of poultry meat. The poultry sector provides employment to 100 million people and accounts for about 2 % of the total GDP of India. Bird performance is comparable to the best in developed countries.

Currently 4 states Andhra Pradesh, Maharashtra, Punjab and Tamil Nadu account for more than 50 percent of the total output of eggs and broilers in the country. The domestic market for eggs and poultry meat is large and growing due to changes in the life styles higher awareness of health consciousness of the urban populations.

Several breakthroughs in poultry science and technology have led to development of genetically superior birds capable of high production. Manufacturing of high tech poultry equipment for producing feed, pharmaceuticals and health care products including vaccines are factors contributing to the higher productivity. Corporate houses promoting fresh chilled or frozen chicken sales at superior ,clean, hygienic outlets has also added to the promotion of poultry products. In the coming future, India will see witness the new different ways the poultry products are sold. Live chicken sales will continue-to be sold along with the entry of big corporate players giving the sector a big boost, in the form of branding of eggs and chicken and its value added products, helping better promotion of the industry as such.

However domestic poultry industry is plagued with high costs of feed, high taxes and inefficient supply chain. Several measures are necessary to improve the status of the poultry industry. Unorganized slaughter processes need to be replaced by designated slaughtering areas with investments in rendering plants. Infrastructure in for transportation and cold chain has to be created to improve supply chain efficiency. Consumer awareness has to be improved as regards hygienic techniques of slaughtering. Poultry is a sector very appropriate for government - private sector joint man-ship

4.20 Water Borne Diseases

Water-borne diseases are any illness caused by drinking water contaminated by human or animal faeces, which contain pathogenic microorganisms. The full picture of water-associated diseases is complex for a number of reasons. Over the past decades, the picture of water-related human health issues has become increasingly comprehensive, with the emergence of new water-related infection diseases and the re-emergence of ones already known. Data are available for some water-, sanitation- and hygiene-related diseases (which include salmonellosis, cholera, shigellosis), but for others such malaria, schistosomiasis or the most modern infections such legionellosis or SARS CoV the analyses remain to be done. The burden of several disease groups can only partly be attributed to water determinants. Even where water plays an essential role in the ecology of diseases, it may be hard to pinpoint the relative importance of aquatic components of the local ecosystems.

4.20.1 Malaria

Malaria still continues to be one of the major Public health problems in certain pockets of TamilNadu. The following factors contribute for the persistence of malaria.

1. Migration of population for various reasons.
2. Rapid urbanization.
3. Tremendous developmental activities especially construction of buildings, over bridges etc.

4.20.2 Malaria situation in Tamilnadu:

- In Tamil Nadu State during 90's a total of 1,20,029 cases were recorded out of which 59.6 % were recorded from the urban areas and 40.4% in rural.
- The coastal villages of Ramanathapuram, Paramakudi and Nagapattinam and riverine villages of Dharmapuri,Krishnagiri and Tiruvannamalai were endemic for malaria.
- Due to the intensive control measures like active and passive surveillance, vector control measures etc. taken up by the PH dept the malaria case incidence has been drastically brought down to 43053 in 2000.
- At present the coastal villages of Nagapattinam which were once endemic are almost free from malaria.
- The incidence of malaria in Ramanathapuram and Tiruvannmalai show a decreasing trend. However, Malaria is emerging as a problem in Nagerkoil.

The following table shows the incidence of malaria in rural and urban areas of Tamilnadu.

Table 4.29 Malaria incidence in rural and urban Areas of Tamil Nadu

Year	State Cases	Rural Cases	Chennai Cases	Chennai %
1990	120029	48478	51272	42.7
1991	144762	57403	67013	46.3
1992	151633	52298	72314	47.7
1993	148057	42908	76749	51.8
1994	104964	39736	48352	46.1
1995	92375	40739	41822	45.3
1996	80586	27249	45930	57.0
1997	72426	23429	41735	57.6
1998	63915	16023	40475	63.3
1999	56366	12141	38165	67.7
2000	43053	7574	31861	74.0
2001	31551	5121	23652	75.0
2002	34523	5490	27205	78.8
2003	43396	12233	29058	67.0
2004	41640	10841	28229	67.8
2005	40594	13560	25153	62.0
2006(May) Provisional	9778	2512	6656	68.0

The following are the details of cases and deaths due to the ADD/Cholera in Tamil Nadu.

Table 4.30 Details of ADD/Cholera in Tamil Nadu

Year	Acute Diarrhoeal Diseases			Cholera		
	Cases	Deaths	Fatal rate	Cases	Deaths	Fatal rate
1997	78025	520	0.67	2261	2	0.09
1998	77677	368	0.47	1807	0	0.00
1999	74583	266	0.36	1807	1	0.06
2000	64130	195	0.30	1328	1	0.05
2001	59511	159	0.27	1110	1	0.09
2002	69889	199	0.28	1591	3	0.19
2003	58784	66	0.11	390	1	0.26
2004	77333	119	0.15	1500	2	0.13
2005	70465	65	0.09	777	1	0.13
2006 (Jan to May)	23933	18	0.08	99	1	1.01

4.21 Municipal Solid Waste

The implementation of Municipal Solid Waste (Management & Handling) Rules 2000, has become the mandatory responsibility of the Urban Local bodies. Based on the above Rules, Government of Tamil Nadu have issued instructions to all Urban Local bodies to set up waste processing and disposal facilities. In addition to this, the Hon'ble Supreme Court has directed cities with one million plus population to file an Action Plan for solid waste management and all the cities in Tamil Nadu having million plus population namely, Chennai, Madurai and Coimbatore Corporations have filed their Action Plans before the Hon'ble Court. The Commissionerate of Municipal Administration has taken initiatives in facilitating the preparation of similar Action Plans by all other ULBs in order to comply to the Municipal Solid Waste (Management & Handling) Rules 2000 in a time bound manner.

The main requirement in this regard is the identification of suitable land for locating disposal facilities. About 56 Municipalities and 5 Corporations have adequate land and the Government have so far assisted 19 Municipalities for procurement of land. Action is being taken to complete the process of identifying suitable land in the remaining Urban Local Bodies.

Apart from making available required land for compost yards, it is also proposed to

- improve efficiency in primary collection
- increase the fleet strength for the secondary transportation
- use modern equipments in the disposal / land filling areas.

The present generation of garbage in ULBs ranges between 9000 – 10000 M.T. per day. Collection and segregation of garbage at source is practised in 70 % wards in Municipalities in the State. The goal is to achieve 100 % source segregation, disposal of garbage in a scientific manner and making the streets and roads, garbage free.The privatization of Solid Waste Management has been encouraged in all Municipalities and Corporations. Self Help

Groups are also being involved in Solid Waste Management. In Chennai City, the per capita generation of solid waste per day is 500 gms. The estimated generation of solid waste per day is 3200 MTs of garbage and 500 MTs of debris.

4.22 Disaster Management

Managing unpredictable disasters such as floods and earthquakes had posed severe challenges to Administration (Government). But the occurrence of the devastating tsunami on 26-12-2004 which struck Indian coast causing enormous damages to the life and property in the coastal areas of Tamil Nadu was the most gruesome and daunting. Tsunami affected as many as 13 districts in Tamil Nadu and the scale of destruction was grave in the districts of Nagapattinam, Cuddalore and Kanniyakumari. Besides leaving nearly 8000 people dead, it rendered many thousands homeless and affected the livelihood security of lakhs of persons. It has virtually crippled the economy in the coastal areas due to the destruction of fishing gear (vessels, nets, boats, etc.) and severe damage caused to the infrastructure. The scale of destruction being unprecedented, relief and rehabilitation measures posed real challenges. Government of Tamil Nadu resolutely faced the challenge and a massive relief and rehabilitation programme was launched to tide over the crisis. The Government mobilized government machinery, civil society, NGOs and Corporate sector in Relief and Rehabilitation measures in the affected areas. The response to the challenge has been widely acknowledged.

4.23 Rainwater Harvesting

The State government has initiated rain water harvesting as a multi-pronged strategy under Government's 15-Point Programme to ensure water security to the State's entire population as mandatory. It was emphasized to save every drop of water for safe drinking and other purposes like agriculture, industry, government offices, schools, hospitals, buildings.

Rain water harvesting was recently introduced in the State for direct collection of water. Rainwater could be stored either for direct use or recharged into the ground water acquifer for use. The Rain Water Harvesting method viz., Roof-top Harvesting and Roof-top/Open Space. Harvesting is being adopted in the State. This could augment rainwater into open and bore wells and thereby improve the ground water recharge and meet the demand for water during water crisis. The Metro Water Board and TWAD Board have constituted exclusive RWH Units.

The rainwater harvesting concept has also become mandatory and implemented in the State with the following basic objectives.

- To conserve and augment the storage of ground water by creating awareness among public
- To reduce water table depletion by participating various agencies
- To improve the quality of ground water by imparting training to individuals/organizations/Government Agencies
- To arrest sea water intrusion in coastal areas and offer technical guidance and assistance based on the geological formations
- To avoid flood and water stagnentation in urban areas and to promote RWH both in individual and in public places

- To control formation of cracks on walls and also to assure proper maintenance of the harvesting structures after installation.

The State had created rain water harvesting structures through the departments like Highways, Rural Development, Municipal Administration and Water Supply, Tourism Development Corporation and Hindu Religious and Charitable Endowment, Agriculture and School Education. Under this campaign, a total number of 257.76 lakh water harvesting structures were constructed in the State. Of these structures, structure created by Agricultural Engineering Department was for the purpose of augmenting rain water into wells and farm ponds. The RWH structures for agricultural purpose accounted for 1.41 lakh numbers, out of the total 257.76 lakh numbers.

Since the water resources are scares, the State Government with the help of the Central Government is implementing the programmes viz. comprehensive wasteland development programmes and the National Watershed Development Project for rain fed areas. These programmes will help to enhance the conservation methods and recharging the groundwater levels.

4.24 Comprehensive Wasteland Development Programme

There are two components under this programme – Participatory Watershed Development and Development of Public Wastelands by corporate houses, small companies and federation of women-run SHGs. These two components are being implemented on a micro watershed approach.

4.25 Participatory Watershed Development

Under this programme a subsidy of Rs.8500/- is being provided per hectare. In 2002 – 03 this component was implemented in 10 districts of Tamil Nadu covering a target of 55,000 ha on a pilot basis with a fund of Rs.30 crores. An area of 21,771 ha was tackled and 23.66 lakh seedlings (15.39 lakh agro-forestry and 8.27 horticulture) were planted.

Measures for improving the water conservation can be adopted from the National Watershed Development Project for rain fed areas which is a centrally sponsored scheme. Under this approach village watershed committees have been formed and made mandatory on their part to plan, implement, monitor and maintain the watersheds. The objectives of all the initiatives that are launched are fostering natural resources, stepping, water productivity and protect ecological balance.

4.26 Information Technology in Tamil Nadu

Information Technology is used in various Government Departments of Tamil Nadu.like Revenue, Transportation, Judiciary, Secretariat and also in Universities and colleges.The power of IT has reached the villages indicating an easier and faster communication access for the rural people. Public-private Government Academia jointly promoted the SARI(Sustainable Access in Rural India) rural connectivity pilot project in Melur taluk, Madurai district.

. The State has a long tradition of scientific and technological innovation. The distinct advantages enjoyed by the State are: a large reservoir of highly skilled technical manpower (an annual turnout of 79000 Engineering Graduates and 58500 Diploma holders), investor-friendly policies, sound infrastructure facilities, sustained efforts to attract foreign direct investment and State level IT Task Force to implement the IT policies. Management Information System is increasingly being introduced by the Government in all the State Government Departments.

The State has already formulated a policy on IT. The policy on Information Technology - Enabled Services (ITES) and a comprehensive Hardware Policy are being prepared. With the formulation of the new Hardware policy (under preparation), Tamil Nadu will have comprehensive policy initiatives in all three major areas of IT industry. The Hardware policy will enable the State to emerge as a major destination for investment in hardware manufacture also and will provide a boost to employment opportunities. The phenomenal growth in IT and ITES sectors brightens placement opportunities for the professionals and other graduates in Tamil Nadu.

Tamil Nadu has succeeded in establishing a state of the art IT infrastructure system. Facilities at TIDEL Park have been fully utilized. Because of continuous demand for infrastructure facilities the State has made an effort to establish two more parks viz. one at Siruseri and other in Mahindra City with 1000 acres and 1700 acres respectively.

Apart from Chennai, Coimbatore is emerging as a tier-2 exporter of software and BPO services. During 2003-04, Coimbatore exported software and IT- related services to the value of Rs.100 crores. It is expected to increase to Rs.1000 crores in the next few years. The Government is also proposed to develop Coimbatore and Hosur as hubs for ITES and BPO and companies such as HSBC and WIPRO are showing interest to set up companies in Coimbatore.

The State Government plans to create a Knowledge Industry Townships (KIT) with an aim to set up knowledge-oriented industries and the Information Technology Corridor. The KIT is designed to provide high quality integrated township facilities with civic amenities and facilitate to set up new units.

4.26.1 IT Enabled Services (ITES) Policy 2005

The Government of Tamil Nadu unveiled ITES Policy on 9th September 2005. The basic objectives of the policy are:

- To get the maximum global ITES investments to Tamil Nadu
- To develop Human Resources specific to ITES Sector
- To create world class infrastructure for IT & ITES and an enabling framework or protection of intellectual property and data
- To generate employment and other ITES opportunities in major cities in Tamil Nadu
- To provide a conducive environment for the sector by reducing regulations and increasing Opportunities.

This policy seeks to establish the State as the global ITES capital and consolidate its leadership position by leveraging the inherent strengths of the State. IT Enabled Services are Human Intensive Services that are delivered over telecom networks or the internet with a range of business segments. The business segments include Medical Transcription. Legal Database Processing, Remote Maintenance, Back Office Operations, Data Processing Call Centers, Human Resources Services, Insurance Claim Processing, Business Processing Outsourcing etc.

All administrative, physical and infrastructure incentives offered in IT Policy 2002 shall be applicable to ITES sector also. The highlights of the Policy includes enacting legislation to entire data security, customer privacy and deal with IT related violations in general and encouraging establishment of information Technology Enabled Services (ITES) Parks in tier-2 and tier-3 cities. Strengthening the language capabilities of students will be a key sector the Government will focus on. The Government will encourage universities and institutions in the State to create institutional infrastructure for acquiring foreign language skills. Further the Policy states that taking computer literacy in schools to the next level, the Government will provide language and ITES skills to students. Being aware that the future manpower needed by the ITES sector is still in the schools, imparting of ITES skills at the level of standards 9 to 10 will be taken as a goal from academic year 2005-06 onwards. It is also proposed to celebrate the birth anniversary of the Mathematical Genius Ramanujam (Dec 22) and Information Technology day in Tamil Nadu.

4.26.2 IT Kiosks in Rural India

In rural India, more than half of India's villages lack telephone connectivity, let alone Internet access.

The lack of information and communication infrastructure results in people having to waste time and money chasing information and government officials. Lack of clarity in processes, and corruption and mismanagement in systems and operations, is rampant. The inaccessibility of information affects the rural poor more than other sectors of the community. Similarly, lack of market information (on commodity prices, various input suppliers, etc.) leads to loss of income and exploitation of rural entrepreneurs by middlemen. Such exploitation and losses further marginalize small and marginal farmers and village artisans.

The implications of this scenario on the rural people (with differential impacts on the poor and other vulnerable groups) are three-fold:

- Loss of income
- Loss of time
- Loss of opportunity

In this context, Information and Communication Technologies (ICTs) can play a significant role in making information available at a reasonable cost. ICTs promise to provide innovative solutions to the problems of poverty and inequality by accelerating development and introducing transparency into systems and operations.

The IT Kiosks can also be effectively put to use for disseminating the information on environment and social aspects. This will help in generating awareness among the community at large. The ultimate idea is to get the stakeholders to zealously work for the furtherance of environment and social concerns.

4.26.3 Information from IT Kiosks

- Market information and linkages
- Price of agriculture commodities
- Storage facilitation
- Knowledge and extension facilitation
- Irrigation facilitation
- Harvest and transportation of produce
- Seeds, fertilizers and pesticides
- Farm machinery

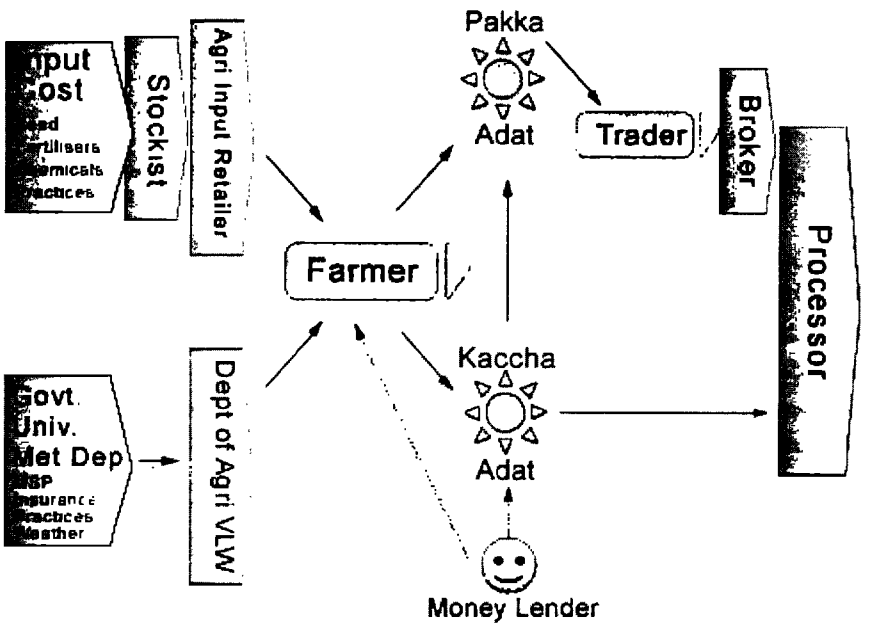
In the present context of IAMWARM project, additional information pertaining to the environmental and social issues in each river basin can also be made available to farmers through these rural kiosks. The issues that can be focused are:

- Soil types and suitable crops
- Crop yield
- Meteorological data
- Population and live stock census
- Encroachments in water bodies
- Government schemes and programmes
- Education and employment

4.26.4 ITC e-Choupal – A Case Study of linking Agriculture and CSR

ITC's International Business Division, one of India's largest exporters of agricultural commodities, has conceived e-Choupal as a more efficient supply chain aimed at delivering value to its customers around the world on a sustainable basis.

The e-Choupal model has been specifically designed to tackle the challenges posed by the unique features of Indian agriculture, characterized by fragmented farms, weak infrastructure and the involvement of numerous intermediaries, among others.



e-Choupal' also unshackles the potential of Indian farmer who has been trapped in a vicious cycle of low risk taking ability > low investment > low productivity > weak market orientation > low value addition > low margin > low risk taking ability. This made him and Indian agribusiness sector globally uncompetitive, despite rich & abundant natural resources.

Such a market-led business model can enhance the competitiveness of Indian agriculture and trigger a virtuous cycle of higher productivity, higher incomes, enlarged capacity for farmer risk management, larger investments and higher quality and productivity.

Further, a growth in rural incomes will also unleash the latent demand for industrial goods so necessary for the continued growth of the Indian economy. This will create another virtuous cycle propelling the economy into a higher growth trajectory.

The Model in Action

Appreciating the imperative of intermediaries in the Indian context, 'e-Choupal' leverages Information Technology to virtually cluster all the value chain participants, delivering the same benefits as vertical integration does in mature agricultural economies like the USA.

'e-Choupal' makes use of the physical transmission capabilities of current intermediaries – aggregation, logistics, counter-party risk and bridge financing – while dis-intermediating them from the chain of information flow and market signals.

With a judicious blend of click & mortar capabilities, village internet kiosks managed by farmers – called sanchalaks – themselves, enable the agricultural community access ready information in their local language on the weather & market prices, disseminate knowledge on scientific farm practices & risk management, facilitate the sale of farm inputs (now with embedded knowledge) and purchase farm produce from the farmers' doorsteps (decision making is now information-based).

Real-time information and customized knowledge provided by 'e-Choupal' enhance the ability of farmers to take decisions and align their farm output with market demand and secure quality & productivity. The aggregation of the demand for farm inputs from individual farmers gives them access to high quality inputs from established and reputed manufacturers at fair prices. As a direct marketing channel, virtually linked to the 'mandi' system for price discovery, 'e-Choupal' eliminates wasteful intermediation and multiple handling. Thereby it significantly reduces transaction costs.

'e-Choupal' ensures world-class quality in delivering all these goods & services through several product / service specific partnerships with the leaders in the respective fields, in addition to ITC's own expertise.

While the farmers benefit through enhanced farm productivity and higher farm gate prices, ITC benefits from the lower net cost of procurement (despite offering better prices to the farmer) having eliminated costs in the supply chain that do not add value

The Status of Execution

Launched in June 2000, 'e-Choupal', has already become the largest initiative among all Internet-based interventions in rural India. 'e-Choupal' services today reach out to more than 3.1 million farmers growing a range of crops - soyabean, coffee, wheat, rice, pulses, shrimp - in over 31,000 villages through 5200 kiosks across six states (Madhya Pradesh, Karnataka, Andhra Pradesh, Uttar Pradesh, Maharashtra and Rajasthan).

The problems encountered while setting up and managing these 'e-Choupals' are primarily of infrastructural inadequacies, including power supply, telecom connectivity and bandwidth, apart from the challenge of imparting skills to the first time internet users in remote and inaccessible areas of rural India

Several alternative and innovative solutions – some of them expensive – are being deployed to overcome these challenges e.g. Power back-up through batteries charged by Solar panels, upgrading BSNL exchanges with RNS kits, installation of VSAT equipment, Mobile Choupals, local caching of static content on website to stream in the dynamic content more efficiently, 24x7 helpdesk etc.

Going forward, the roadmap includes plans to integrate bulk storage, handling & transportation facilities to improve logistics efficiencies.

As India's 'kissan' Company, ITC has taken care to involve farmers in the designing and management of the entire 'e-Choupal' initiative. The active participation of farmers in this rural initiative has created a sense of ownership in the project among the farmers. They see the 'e-Choupal' as the new age cooperative for all practical purposes.

This enthusiastic response from farmers has encouraged ITC to plan for the extension of the 'e-Choupal' initiative to altogether 15 states across India over the next few years. On the anvil are plans to channelise services related to micro-credit, insurance, health and education through the same 'e-Choupal' infrastructure.

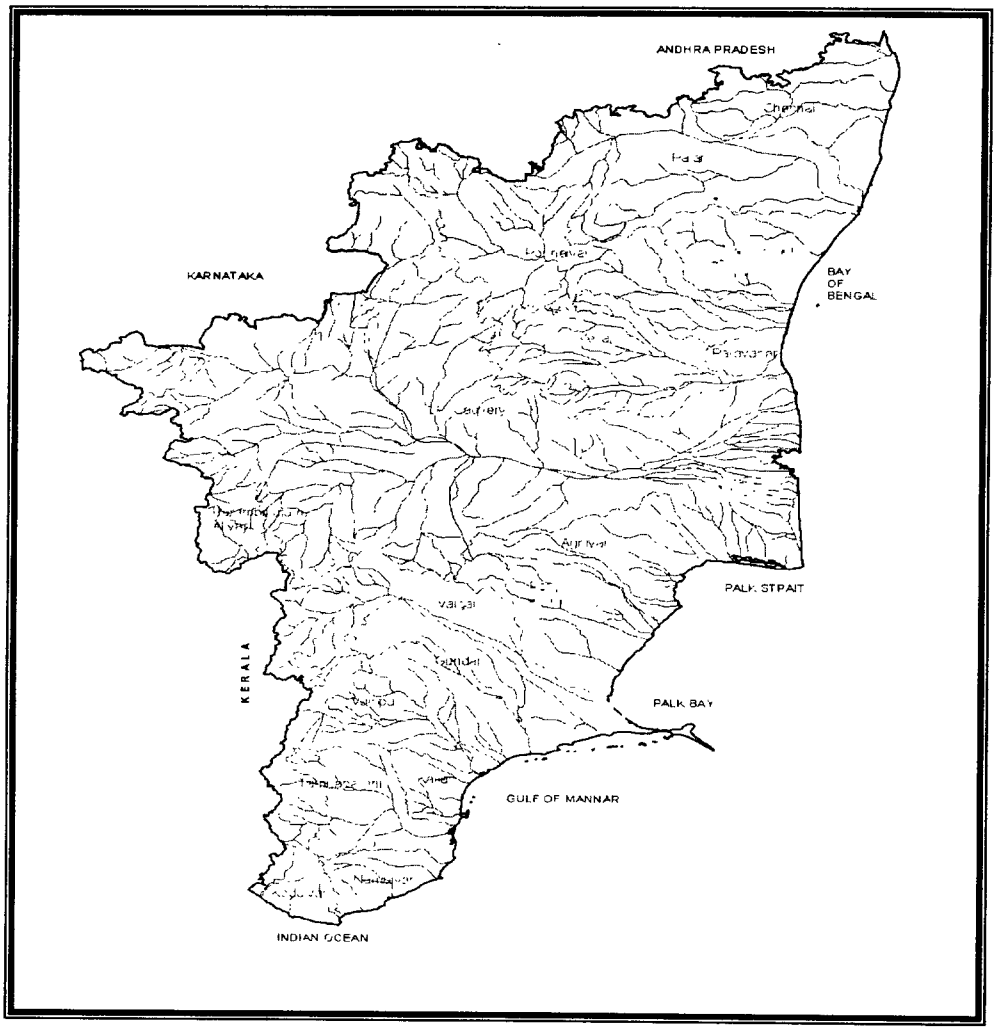
4.27 Study Area

The IAMWARM project is for the entire State of Tamil Nadu covering 117 sub-basins in 17 river basins of Chennai, Palar, Varahanadi, Ponnaiyar, Paravanar, Vellar, Agniyar, Pambar & Kottakaraiyar, Vaigai, Gundar, Vaippar, Kallar, Tamirabarani, Nambiyar, Kothaiar, Parambikulam & Aliyar Project. In the first year 41 sub basins are proposed under this project. The methodology adopted for this study includes stakeholders consultations, field visits, secondary data collection, compilation and interpretation.

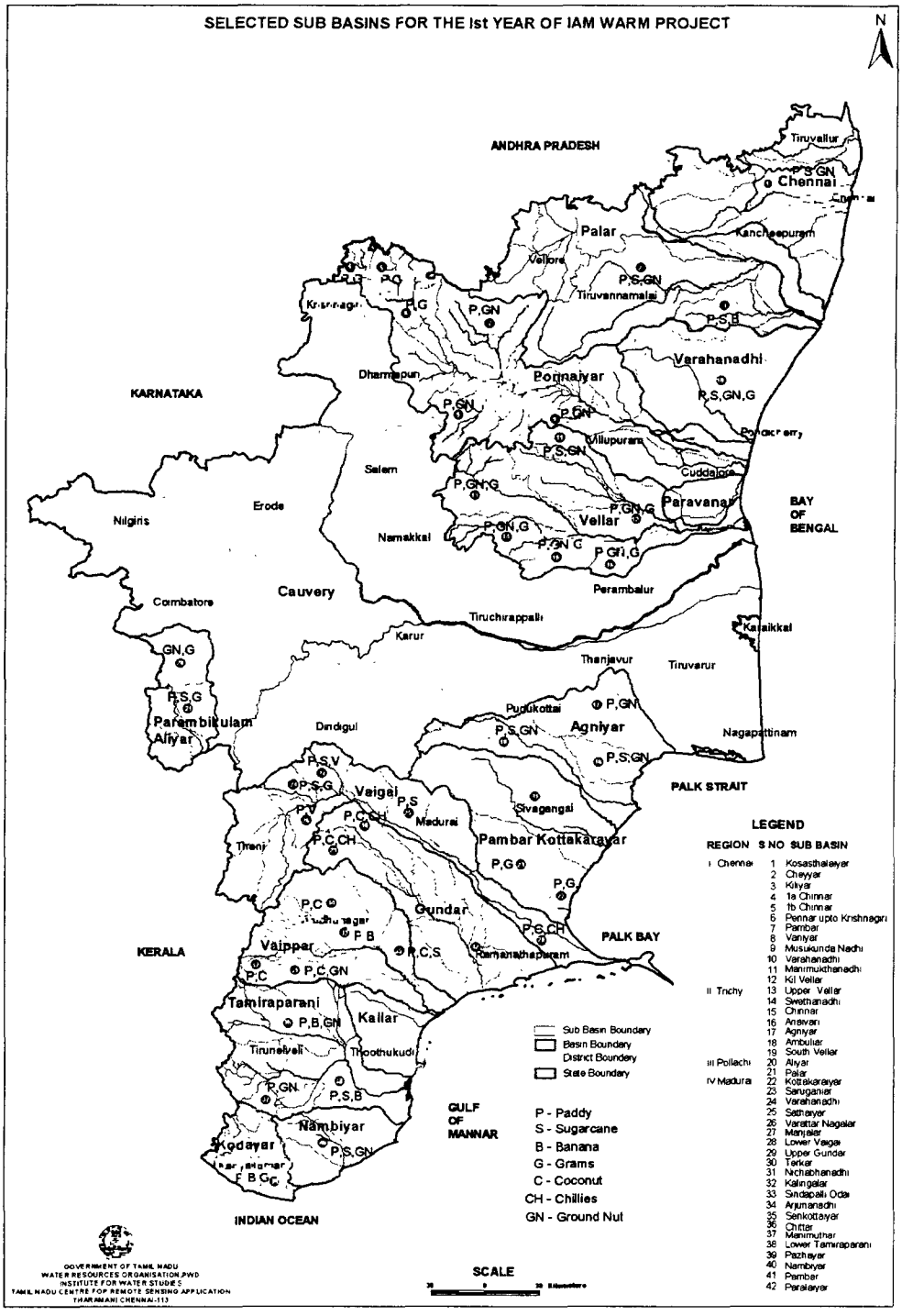
Baseline environmental and social information pertaining to the 17 river basins namely Chennai, Palar, Varahanadi, Ponnaiyar, Paravanar, Vellar, Agniyar, Pambar & Kottakaraiyar, Vaigai, Gundar, Vaippar, Kallar, Tamirabarani, Nambiyar, Kothaiar, Parambikulam & Aliyar Project are discussed in detail in Annexure I.

The maps of the sub basins are also given in Annexure I

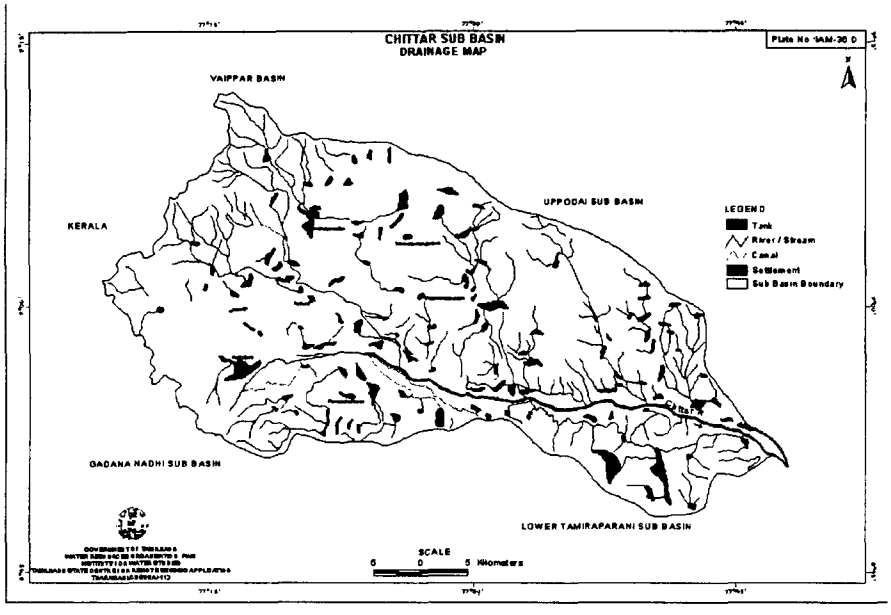
4.27.1 Basin Map



4.27.2 Sub Basin Map



4.27.3 Chittar Sub Basin (Drainage Map)



4.28 Environmental and Social Issues in the Sub Basins

Environmental and social issues pertaining to 16 river basins and 42 sub-basins that are taken under the project for the first year are presented here. The environmental and social issues in the sub basins have been identified through stakeholder consultative workshops in the river basins of Tamilnadu. EPTRI has conducted 17 stakeholder consultation workshops in 16 river basins. The objective of stakeholders consultation is to minimize the negative impacts in the area and make them feel that they are the ultimate beneficiaries of the project in this process the views ascertained from the stakeholders is analyzed and incorporated in the project document. The ESA study initially obtained the opinions of the stakeholders and the same has been analyzed and incorporated at the sub basin level. The meetings are conducted in the following places in 16 river basins.

Table 4.31 Stakeholder consultation workshops in 16 river basins

S.No	Major River Basin	Place of the workshop
1	PAP	Pollachi
2	Pennaiyar	Thiruvannamalai
3	Pennaiyar	Krishnagiri
4	Vellar	Athur
5	Agniar	Pudukkottai
6	Vaigai	Madurai
7	Vaippar	Srivalliputtur
8	Tamirabarani	Thirunelveli
9	Kothaiyar	Nagercoil
10	Nambiyar	Vallioor
11	Palar	Cheyyar sub basin Kancheepuram
12	Varahanadhi	Tindivanam
13	Kottakaraiyar & Pambar	Sivagangai
14	Vaigai	Paramakudi
15	Gundar	Aruppukottai
16	Vellar	Perambalur
17	Chennai	Kosasthalaiyar sub basin Thiruvallur

The key environmental and social issues specific to areas in 42 sub basins are detailed below:

Table 4.32 Major environmental and social issues in the sub basins

S. No	Main River Basin	Sub Basin	Environmental Issues	Social Issues
1	**Chennai**	1. Kosasthalaiyar	• Industrial Pollution • Sea water intrusion reduced the quality of groundwater • Sand Mining is prevalent in the river bed areas • Siltation • Coastal erosion • Weed growth • Industrial effluents released into river • Domestic Sewage released into river • Over exploitation of ground water • Dumping of debris into tanks	• Encroachment in the river and tank beds • Poor sanitary conditions • Skin allergies • Mosquito breeding due to water stagnation and Elephantiasis
2	**Palar**	2. Cheyyar	• Ground water contamination • Dying Effluents In Arni Taluk • Water contamination due to Kattamanku • Sand mining seen in the river bed areas • Domestic Sewage of Arni town and Thiruvathipuram • Water weeds	• Poor literacy levels • Anthrax disease in cattle • Provide good linkage for marketing

		3. Kliyar	• Sand mining seen in the river bed areas • Ground water depletion due to industries • Solid waste problem in Vandavasi Municipality • Sea water intrusion near Vayalur • Sugar mill effluents in Padalam • Water weeds • Lack of sewage treatment plant Vandavasi and Madurantagam Municipalities	• Seasonal migration due to unemployment • Poor marketing facilities and poor value addition • Poor literacy levels leading to migration • Poor sanitary conditions and unhygienic conditions • Diseases surveillance due to mosquitoes and pigs
3	**Pennaiyar**	4. Chinnar 1 a	• Domestic sewage • Poor solid waste management • Drinking water pollution due to drainage water. • Sand mining seen in the river bed areas • Soil erosion seen in the river and tank beds • Water weeds	• Livestock reduction with unidentified diseases • Poor sanitary conditions • Poor literacy levels • Water borne diseases in this river basin
		5. Chinnar 1 b	• Sand mining seen in the river bed areas • Water contamination • Domestic sewage led into rivers • Water weeds • Textile effluents	• Seasonal migration due to poor literacy levels • Livestock reduction with unidentified diseases • Poor sanitary conditions and sanitation programmes are not properly implemented. • Health problems due to mosquitoes and stagnation of water

		6. Pennaiyar to Krishnagiri	• Water pollution due to industries • Mango processing effluents released into tank leading to water contamination and algal blooms • Sand mining is very high in the river bed area • Poor solid waste management • Soil erosion seen in the river and tank beds	• Health problems due to industrial water pollution • Livestock diseases and decrease in the trend of livestock. • Encroachment of river and tank beds
		7. Pambar	• Lack of solid waste disposal method • Sago industrial effluents a major problem • Water weeds	• Seasonal migration due to poor literacy levels • Livestock reduction due to diseases • Poor sanitary conditions leading to diseases • Encroachment of irrigation canals
		8. Vaniyar	• Lack of solid waste disposal method • Sago industrial effluents led into the river • Sand mining is seen in the riverbed areas.	• Seasonal migration due to poor literacy levels • Livestock reduction due to diseases • Poor sanitary conditions in the residential areas
		9. Musukundanadhi	• Municipal sewage letting out into rivers • Sand mining in the river bed areas • Lack of sewage treatment plant	• Seasonal migration due to poor literacy levels • Livestock reduction due to unidentified diseases • Poor sanitary conditions in the residential areas

4	**Varahanadhi**	10. Varahanadhi	• Mining of rocks • Municipal sewage letting out into rivers • Sand mining in the river bed areas • Water weeds	• Seasonal migration due to poor literacy levels • Livestock reduction due to unidentified diseases • Lack of awareness in solid waste minimization and management
5	**Vellar**	11.Manimuthanadhi	• Coconut trees are affected due to water pollution • Sand mining is prevalent in the river beds • Over exploitation of ground water	• Social conflicts in water utilization • Inadequate school teachers leading low literacy levels • Anthrax diseases in cattle
		12. Kil Vellar	• Municipal sewage letting out into rivers • Effluents from sugar industries released into river • Lack of sewage treatment plants	• Seasonal migration due to lack of employment • Livestock reduction due to diseases • Poor drinking water supply and sanitation
		13. Upper Vellar	• Sago industrial effluents released into river • Sand mining leading to depletion in ground water level	• Seasonal migration due to lack of employment • Livestock reduction due to diseases • Poor drinking water supply and sanitation • No marketing facilities
		14. Swethanadhi	• Ground water pollution • Sand mining in the river beds • Air pollution due to cement factory	• Seasonal migration due to lack of employment • Livestock reduction due to diseases in cattle • Poor drinking water supply and sanitation • No marketing facilities • Problem of mosquitoes leading to malaria

		15. Chinnar	• Ground water pollution • Sand mining in the river bed areas	• Seasonal migration due to lack of employment • Livestock reduction due to unidentified diseases. • Poor drinking water supply and sanitation • Females affected by cancer
		16. Anivari	• Ground water pollution • Sand mining prevalent the river beds • No proper solid waste management	• Seasonal migration due to unemployment • Livestock reduction due to lack of vetenary hospitals • Poor drinking water supply and sanitation
6	**Agniar**	17. Agniar	• Excessive nitrate concentration in ground water • Poor solid waste management • Soil erosion seen in river and tank beds • Excessive use of chemical fertilizers polluting the surface a well as ground water.	• Seasonal migration due to poverty • Reduction in grassing land and livestock • Low literacy rate due to poverty • Poor marketing facilities • Poor sanitary conditions leading to several diseases.
		18. Ambuliar	• Juliflora growth is predominant • Sand mining seen in the river beds • Excessive use of chemical fertilizers polluting the ground waters	• Seasonal migration due to unemployment • Women empowerment through SHGs • School drop outs due to lack of teachers • Poor sanitary conditions leading to several diseases.
		19. South Vellar	• Juliflora growth is predominant • Sand mining seen in the river beds • Over exploitation of ground water	• Seasonal migration due to lack of employment • Women empowerment through SHGs • No health care centers

7	**Parambikulam Aliyar Project**	20. Parambikulam Aliyar	• Soil erosion seen in the river and tank beds • Siltation and deforestation • Sand mining leading to depletion of water level. • Pollution due to coir industries • Excess fluoride and nitrate concentration	• Improved livelihood due to coir industries • Decrease in livestock due to diseases • Women empowerment through SHGs • Water borne diseases due to unhygienic conditions
		21. Palar	• Soil infertility due to salinity • Ground water pollution • Catchment area degradation	• Improved livelihood due to coir industries • Decrease in livestock due to unidentified diseases • Women empowerment through SHGs
8	**Kottakaraiyar**	22. Kottakaraiyar	• Juliflora and Ipomea growth • Soil alkalinity and erosion • Sand mining seen in the river beds • Chlorides in ground water • Sewage discharge into water bodies • Solid waste disposal • Water logging in coastal areas • Respiratory disorder in RS Mangalam area	• Seasonal migration due to lack of employment • Skin diseases and health problems due to poor sanitary conditions • Lack of small scale industries in the areas
		23. Saruganiar	• Juliflora and Ipomea growth • Soil alkalinity • Sewage discharge into water bodies • Lack of solid waste disposal method • Respiratory disorder in Vellalore areas	• Migration due to lack of employment • Skin diseases and health problems due to poor sanitary conditions • Lack of teachers in primary schools

9	**Pambar**	24. Pambar	• Juliflora growth • Ground water depletion due to exploitatation • Lack of Sewage & Solid waste disposal method • Water weeds • Water logging in coastal areas • Industrial effluents into water bodies • Siltation in tanks • Dumping granite quarry waste along the road	• Migration due to lack of employment • Livestock reduction due to lack of vetenary hospitals • Encroachment in irrigation canals, river beds
10	**Vaigai**	25. Varaganadhi	• Sand mining in the river beds • Siltation seen in tanks • Reduction in fish population due to sewage	• Out seasonal migration due to lack of employment • Reduction in livestock due to lack of vetenary hospitals • Social conflicts in distribution of water for the tail end farmers • Lack of water storage facilities • No storage facilities for food grains • Prone to drought and floods
		26. Sathaiyar	• Juliflora and Ipomea growth • Sand mining in the river beds • Soil erosion in river and tank beds • Air pollution due to flour mills • Mixing of sewage into tanks	• Out seasonal migration due to lack of employment • Reduction in livestock due to diseases • Social conflicts in distribution of water for the tail end farmers • Encroachments in river beds and tanks • Poor marketing facilities • Health problems due to sewage

		27. Varattar – Nagalar	• Juliflora growth • Soil erosion seen in river and tank beds • Poor solid waste management	• Out seasonal migration due to lack of employment • Reduction in livestock due to unidentified diseases • Social conflicts in water distribution • Health problems due to indiscriminate dumping of solid waste
		28. Manjalar	• Juliflora and Ipomea growth • Sand mining and soil erosion in the river beds • Siltation leading to depletion in water level • Mixing of sewage into tanks	• Out seasonal migration due to lack of employment • Reduction in livestock due to unidentified diseases • Social conflicts in water distribution
		29. Lower Vaigai	• Juliflora growth • Sand mining and soil erosion in the river beds • Salt water intrusion in the surrounding areas thereby making the water unfit for drinking • Ground water salinity	• Out seasonal migration due to lack of employment • Reduction in livestock due to unidentified diseases • Social conflicts in distribution of water • No electricity connections • Problem of pigs and mosquitoes leading to diseases
11	**Gundar**	30. Upper Gundar	• Juliflora growth • Sand mining and soil erosion in the river beds • Lack of water supply in the entire basin • Lack of Sewage disposal and Garbage disposal method	• Encroachment in river beds • Dry land agriculture reduction in livestock • Poor marketing and transportation facilities

		31. Terkkar	• Juliflora growth predominant • Sand mining seen in the river bed • Lack of Sewage & solid waste disposal method	• Encroachment of catchment area • Dry land agriculture • Reduction in livestock due to diseases
		32.Paralaiar	• Juliflora growth • Sand mining seen in the river bed • Water borne diseases due to unhygienic conditions • Sewage & solid waste disposal method • Air pollution due to brick kilns	• Drought prone area • Seasonal Migration due to unemployment • No marketing facility • No organized cattle farm • Reduction in livestock due to diseases
12	**Vaippar**	33. Nichabanadhi	• Soil erosion seen in the river bed • Siltation depleting the water level • Poor solid waste management • Dye industry effluents letting out directly into the river. • Lack of Sewage disposal method	• Dry land agriculture • Reduction in livestock due to diseases • Women empowerment through SHGs • Inadequacy of teachers in schools • Prevalence of child labour due to poverty
		34. Kalingalar	• Sugar industrial effluent letting out directly into the river. • Ground water contamination • Lack of Solid waste disposal method • Untreated sewage let into river	• Dry land agriculture • Reduction in livestock due to diseases • Women empowerment through SHGs

		35. Arjuna Nadhi	• Soil erosion and Sand mining in the river bed • Effluent disposal from match, fireworks, printing & willow industries • High TDS, magnesium, bicarbonates & chlorides • Lack of Solid waste disposal method • Untreated sewage let into water bodies	• Dry land agriculture • Reduction in livestock due to diseases • Women empowerment through SHGs • No cold storage facilities
		36. Sindapalli Odai	• Sedimentation found in tanks • Soil erosion and Sand mining in the river bed • Dumping of solid waste in water bodies • Sewage pollution • Effluent disposal from match, fireworks, printing & willow industries	• Dry land agriculture • Reduction in livestock due to diseases • Women empowerment through SHGs
		37. Senkottaiyar	• Drought prone sub basin • Sewage disposal into water bodies • Lack of Solid waste disposal method	• Dry land agriculture • Reduction in livestock due to diseases • Women empowerment through SHGs

13	**Tamiraparani**	38. Manimuthar	• Sewage pollution • Encroachment of canal • Soil erosion in the river and tank beds	• Seasonal migration due to unemployment • Reduction in livestock due to diseases • Lack of marketing facilities • Encroachment of irrigation canals, tanks • Lack of cooperative milk society
		39. Chittar	• Sewage pollution • Solid waste dumping into water bodies • Sand mining and weed growth. • Siltation leading to decrease in water level • Industrial effluents directly led into river	• Seasonal migration due to unemployment • Poor sanitary and sewage conditions leading several health disorders • Malaria and other diseases due to indiscriminate dumping of solid wastes and mosquitoes
		40 Lower Tamiraparani	• Sewage pollution • Solid waste dumping into water bodies • Sand mining and weed growth • Sea water intrusion into the coastal areas • Industrial effluents directly led into river	• Seasonal migration due to unemployment • Poor drinking water facilities • Health problems due to unhygienic conditions • Lack of veterinary hospital

14	**Kothaiyar**	41. Pazhayar	• Salinity and alkalinity • Soil erosion in the river and tank beds • Poor solid waste management at tourist spots • Water weeds • Entry of untreated effluents into water bodies • Agro industry effluents • Sea water intrusion in coastal areas • Increased use of chemical fertilizers in the fields pollutin ground as well as surface waters • Ground water depletion due to excessive withdrawl by pepsi and coke companies • Fluoride in ground water in Anjugramam, Azhuppapapuram and Kattuvilai	• Migration due to lack of employment • Reduction in livestock due to diseases • Women empowerment through SHGs • Poor sanitation and drinking water facilities, • Encroachment of river banks, tanks etc • Poor marketing facilities • High transportation costs

15	**Nambiyar**	42. Nambiyar	• Sand mining leading to decrease in water level • Dumping of solid and agricultural wastes • Sea water intrusion in coastal areas • Soil erosion in the river and tank beds • River bed degradation and instability of stream course	• Seasonal migration due to lack of employment • Reduction in livestock due to diseases • Women empowerment through SHGs • Poor sanitation and drinking water facilities • Agricultural labour scarcity • Water borne diseases like malaria & diarrhea

4.29 Water Related Environmental Issues in River Basins

The environmental issues in the river basins pertaining to water are detailed below:

Table 4.33 Water related Environmental issues

Environment Problem	Sectors and Activities Contributing to Problem	Effort on Sectors and Other Water Users
Pollution of rivers and other water bodies	• Industry discharge of untreated industrial effluents • Domestic Sector: discharge of raw sewage and inadequate disposal of domestic solid water	• Water supply: contamination of water fir various uses. • Tourism: foreclosure of recreational uses • Religion: inadequacy of water for ceremonial use
Reduced river flow	• Irrigated Agriculture, Industry and Domestic Water Users: excessive withdrawal of river water • Construction of storage structures	• Ecology: change or loss of aquatic ecology; loss of river regenerative capability • Fishery: loss of fish and foreclosure of fishing activities • Tourism: foreclosure of recreational uses • Religion: loss of water for ceremonial use
Nutrients: surface and groundwater contamination and eutrophication of lakes and reservoirs	• Agriculture: surface runoff or leaching of nitrogen, phosphorous applied as fertilizer and animal wastes. • Sanitation: discharge of raw sewage; infiltration from inadequate disposal of domestic solid waste	• Domestic water supply: excess nitrate in drinking water • Energy (hydro-power), irrigation and flood control: impairment of reservoirs due to eutrophication • Fishery: loss of fish • Ecology: disruption of food chain and propagation of unwanted species.
Water logging and soil salinity	Irrigated Agriculture: over-use of water and inadequate drainage	Agriculture: loss of arable land
Waterborne diseases	• Urban and Rural Sanitation: discharge of raw sewage and inadequate disposal of domestic solid waste.	• Domestic water supply: unsafe drinking water • Health: water-related illness

	• Education and Health: inadequate education in hygiene	
Toxic pollution of surface and ground water	• Industry: inadequate disposal of hazardous wastes and discharge of industrial effluents	• Domestic water supply: contamination of drinking water • Ecology: toxic effects on aquatic organisms and changes in aquatic community structure
Ground water depletion and contamination	• Irrigated Agriculture: excessive withdrawal of groundwater • Domestic water supply: excessive withdrawal of ground water	• Domestic water supply: inadequate quantity and quality of drinking-water • Agriculture: inadequate water quantity for irrigation
Loss of wetlands	• Urban growth and industrial development in ecologically sensitive areas • Agriculture expansion • Water-related projects	• Ecology: loss of biodiversity • Fisheries: destruction of coastal areas and loss of mangrove forests for fish breeding.

The anticipated environmental and social impacts due to the activities in the river basins are discussed in detail in the succeeding chapter.

5 ANTICIPATED ENVIRONMENTAL & SOCIAL IMPACTS AND ANALYSIS OF ALTERNATIVES

5.1 Introduction

The analysis of alternatives explores the opportunities that may be capitalized through sensitive inclusion of environmental and social safeguard measures into the project. Analysis of alternatives approaches for identification of sub-projects, prioritization of intervention measures and alternative physical and institutional interventions, which would help in eliminating poverty, and improve the well being of the stakeholder community. The applicability of these alternatives is based on the lessons learnt while implementing the project, such alternative approaches may be further developed and suitable amendments are made in the Social and Environmental Management Framework. The assessment of impacts of each of the proposed project activities would serve as an additional guideline for modifying or strengthening the activity to enhance positive impacts and to minimize negative environmental impacts.

The rehabilitation with community participation is expected to have positive impact on the environment. The rehabilitation result in the augmented supply of irrigation water, better recharge of groundwater, better quality of drinking water, increased productivity, enhanced employment opportunities and better well-being of the stakeholder communities. Moreover, project interventions or activities would help in better management of natural resources and improve the overall environment and local ecology.

5.2 Legal and Administrative Framework

The Government of India, in their Notification issued on 27-01-1994 have made it mandatory to obtain environmental clearance for projects as required under the Environmental Protection Act, 1986. The list of projects requiring environmental clearance from the Central Government includes:

"River Valley projects including hydropower, major Irrigation and their combination including flood control"

The consolidated guidelines for diversion of forestlands for non-forest purposes under the Forest Conservation Act (1980) state

"All proposals for diversion of forest land above 5 ha and up to 20 ha, are to be examined by the Regional Chief Conservator of Forests in consultation with the Advisory Group consisting of representatives of the State Government from the Revenue Department, Forest Department and Planning Department".

Analysis of alternatives defines the issues and a clear basis for choice among the alternatives for the decision-makers. Deterioration began after the decline in the role of community in the management and taking over the responsibility by the State.

The major problems are:

- Siltation results in reduction in the storage capacity,
- Encroachment on natural and other water ways and feeder channels in the catchment area,
- Extension of cultivation and encroachment in the foreshore area, damage to the dam, surplus-weirs, main and field channels.

There are different alternatives to rehabilitate with short-term and long-term perspectives. The analysis of probable impacts of major interventions is presented below.

5.3 Environmental Impacts

Environmental impacts are expected not only on the site of the dam and the reservoir, but also in the watershed. The following locations are taken into account.

- Area that is to be inundated
- Catchment area upstream of the planned dam
- Catchment area downstream of the planned dam
- River upstream of the planned dam
- River downstream of the planned dam
- Reservoir area

5.3.1 Impact on land environment

Due to inundation land will be lost. The loss includes Patta Lands, Poramboke Lands and Forests. The economic loss as a result of the inundation is estimated as Rs 2,83,000 per year. The people who are living and working here must leave the area. They will receive compensation for the loss of the land. About Rs. 6.00 Million has to be paid as compensation.

5.3.2 Impact on flora and fauna

The river upstream is likely to be affected by the dam construction. The present riverbanks will be permanently inundated and effectively lost. The ecosystem will change thoroughly. Habitat of aquatic fauna that lives in flowing water with high oxygen content will disappear. Instead a stagnant water habitat will develop. Fish species and bottom fauna will be replaced by other species. Most probably biodiversity will decrease locally. Water vegetation is likely to develop, especially in the shallow parts of the reservoir. Water birds may also be attracted to the reservoir.

5.3.3 Impact on water environment

The water quality in the reservoir will depend on a number of factors. Since there are no industrial or agricultural activities upstream no nutrients or chemical contaminants are to be expected. If, however, vegetation is not removed prior to inundation, at least in the first year poor water quality due to decomposition of vegetation is expected.

5.3.4 Impact on siltation

The expected siltation rate of the reservoir is difficult to predict. However, since the slopes of the hill adjacent to the reservoir are only sparsely forested and the soil consists mainly of sand and sandy loam, rain may be expected to cause considerable erosion of the slopes near the reservoir. Further upstream the hills are still densely forested and the erosion here will be not severe. It is assumed that the reservoir is replenished 3 times a year, meaning an average retention time of 4 months.

The water that will be released from the reservoir may have decreased sediment concentrations, because the solids would have settled in the reservoir. The sediment sluice will only affect the siltation in a small area near the sluice. The lower sediment load in the downstream river may increase the erosion downstream.

5.3.5 Impact on downstream river

As a result of the presence of the dam the flow pattern in the downstream river stretch will change completely. The flow pattern will no longer depend upon the rainfall but much on the operation of the spillway, which is regulated according to the needs of the downstream water demand. The design discharge through the sluice is 7.63 M^3/s. During the filling of the reservoir the downstream river stretch will be dry due to lack of flow. It is, however not expected that extreme high flows will be attenuated, and therefore the spillway is proposed with a design capacity of 1,850 M^3/s.

After release of water from the reservoir the downstream river stretch will temporarily carry water. After a while, when the water has been let into the irrigation channels, the riverbed will fall dry again, apart from some pools that will hold stagnant water.

Availability of water

The amount of water that will be made available by the dam construction is expected to cover the water demands for agriculture, drinking, livestock and industries in the project area.

Ground water

Infiltration of surface water into the ground will take place in the reservoir, downstream river and the irrigation channels. It is expected that the groundwater level will increase in the project area. As a result of the large amount of surface water the evaporation will also increase.

5.3.6 Impact on human health

The likelihood of water borne diseases greatly depends on the developments in the ecosystem. Shallow parts of the reservoir may provide conditions for aquatic vegetation that host mosquitoes and snails which are vectors of water-borne diseases. Also the shallow, warm water pools that will appear in the downstream river provide possible habitats for mosquitoes.

5.3.7 Indirect environmental impacts

The increased accessibility of the area, made possible by road construction, and the availability of water can cause an increased pressure on the environment. The results may be on-site environmental degradation, decrease in water quality, and increase of sedimentation rate due to clearing forest for agricultural purposes or cutting tree for timber or firewood.

5.4 Social Impacts

Social impacts due to the project interventions are both positive and negative. These may be of long term or short-term impacts which are detailed below.

5.4.1 Positive Impacts

Empowerment of Social Groups

The groups like WUAs, SHGs will be empowered, provided there should be ensured membership for the landless and other deprived sections of the community. It acts as the conflict resolution mechanism and reduces the differences in access to water between the large and small farmers and the head-reach and tail end farmers.

Enhances the Standard of Living

Improved sources of irrigation will result in the increased income and reduces the unfavorable and conditional dependency of the poor on land lards and moneylenders. It arrests the seasonal migration and develops the non-farm activities.

Gender Equity

With the improved access to membership and enhanced income, there is opportunity, especially for the women groups for equity and in turn further improvements.

Prevents Migration

Agricultural and allied activities will be increased, with the improved irrigation facilities, which in turn lead to enhanced livelihoods and prevent out-migration.

5.4.2 Negative Impacts

Impact on quality of Water

Due to accumulation of minerals and water logging, the quality of water gets affected. It leads to water borne diseases and other associated health problems.

Induced impact on Water Quality

Due to the accumulation of minerals water quality will be decreased. Besides this, with the access to improved irrigation sources, formers may go for more number of crops in turn increases the use of pesticides and fertilizers.

Food systems failure

Lapses in coordinating and strategizing the irrigation infrastructure may cause periods of food systems failure. Safeguard measures may be taken up as suggested in the social and environmental management frame work.

Chaos

In the absence of the proper planning for the crop diversification being the major intervention of the project, leads to chaos due to lack of information on crop planning, suitability of crops and availability of water. The formers have to be trained in the areas of suitability of crops according to the agro, climatic and soil conditions.

Impact on Human health

At the reservoir sites there is more possibility for the water-borne diseases. Medical facilities at reservoir sites should be set up keeping in view of the number of accidents Regular visits of doctors to the site from the Primary Health Centers and district hospitals would be necessary. Proper First Aid facilities may be made available at all strategic points of campsite and educate labour for administering first aid in emergencies.

5.5 Environment Management Plan (EMP)

The Environmental Management Plan (EMP) aims to mitigate measures to restore and preserve the eco-system of the possible adverse impacts, if any, due to proposed project The mitigation steps are used to minimize or prevent negative impacts on environment due to proposed development activity. The environment impact, which may occur as a result of construction activity of diversion weir, intake structure, underground desilting tank etc are considered on following lines:

- Eco-system (both aquatic & terrestrial)
- Individual Species
- Geophysical environment of the area
- Human population

The main aim of Environment Management Plan is to ensure that the proposed development in study area, say 10 km radius, maintains its sustainable balance with cautious approach towards utilization of non-renewable resources. Government & non-Government agencies like State Environment Protection and Pollution Control **Board and more importantly the people in the area and non-Government organizations, need to extend their valuable contribution, suggestions and co-operation.**

The main impacts on Environment are likely to occur during construction phase. In the E.M.P., it is proposed to take possible corrective measures to ensure that these effects are kept to bare minimum. The E.M.P., therefore, shall start from planning stage itself and should focus on:

- A summary of biologically rich areas
- Catchment Area Treatment Plan
- Compensatory Aforestation Scheme.
- Landscaping of Colonies, Quarries and other works
- Environment monitoring management during construction and post construction period

5.5.1 Environmental Management - During Execution Stage

Fugitive dust emission and solid waste will be generated during site preparation, construction of labour huts, storage, approach roads etc. In addition there will be some increase in the noise levels around the site. These impacts will be temporary, occurring during cleaning/clearing for site preparation & will be localized. Water spray system will be adopted for suppression of dust, hence reducing the impacts to minimum. Solid waste will be disposed along with the muck in pre-identified and approved dumping sites. As there is little or no habitation near the proposed development activity as such slight rise in noise levels have no effect. Hence no additional measures will be necessary.

5.5.2 Construction

Management of Labour Camps

The strength of about 600 workers in the project area during the construction stage is likely to generate considerable impact on the existing environment of the area. The aim of the EMP is to minimize these stresses to acceptable limits. It will be made mandatory for the contractors to provide desired facilities at labour camps. Some of the conditions of contract shall be

Community Toilets

Properly desired block of community latrines as per strength of labour

Community kitchens

A community kitchen for each labour camp shall be provided. The fuel used in these community kitchens can be LPG or diesel /K. oil. The project authorities will make provision for opening a fuel wood depot as a back up measure

Provision of Water Supply

Water for drinking purposes shall be arranged from near by streams flowing upstream of labour camps and stored in tanks. Necessary filtration and bacteriological treatment, so required, will be provided. It will be ensured that water sources/storage and septic tanks/soak pits are planned far from each other.

Sewerage Treatment

One community toilet can be provided for each 20 labourers. For each 500 person or for 20 toilets, one septic tank would be provided followed by soak pits as per accepted design and portable sewerage treatment plants are to be provided wherever concentration of labour is high.

Solid Waste Management

The solid waste usually generated from labour camps contains, mostly of composotible wastes like vegetable matters and combustible waste like paper, cans, plastic etc. and some non-degradable waste like glass/ glass bottles etc. At peak season 650 persons are likely to be there during construction phase and @ 5 kg/per person per day, total waste requires management will be approximately 0.75 mt per day. One small covered tipper shall be provided for collection & disposal of waste. The composotible waste will be dumped in large pits/ low lying area combustible waste shall be collected and properly burned and non-degradable waste shall be dumped in muck disposal sites.

5.5.3 Health Environment

Unskilled and skilled workers are likely to be deployed during the peak construction stage. It is recommended that one dispensary shall be developed near site at a location, which is easily accessible to all the labour camps.

The dispensary shall be housed in a properly planned building. The proposed health center will have facilities for emergency care of insect bites, diarrhea, fever, minor accidental injuries and under all circumstances immediate medical care shall be provided for workers. A first-aid post with a first aid box with essential medicines, first aid appliances, dressing materials, splints, stretcher and wheel chair shall be places in a specially constructed medical booth/ check post at a site easily approachable from other construction sites. First aid posts shall have facilities such as telephone connection, fire fighting equipments and one vehicle or ambulance for effective functioning.

5.5.4 Air Environment Management

The air pollution shall be from construction of dams, tunnels, surge shaft & powerhouse etc. These activities will generate large quantity of dust during drilling, blasting and hauling operations. Measures will be taken to mitigate the fugitive dust from different operations.

a) Polythene or rexin cover or any suitable sheets of height 7 to 10 m to be erected along the boundary of the site to reduce the dispersion of the dust during site preparation and construction activities.
b) Water sprinklers shall be used regularly during this phase to attenuate dust generation.
c) The workers within the site shall be provided with nose masks and goggles to Minimise dust inhalation

5.5.5 Afforestation

The loss of forest area must be made up by compensatory forest over twice the area of non-forest land. This reforestation must preferably be within short distance of the removed forest and within the same district.

5.5.6 Water Environment

The land use change to water spread and canals would bring in the potential benefits of the ayacut development. The accompanying plantation, along the canal bunds and the foreshore, would be the only measure, which can help rejuvenate lost bio diversity. The fisheries development programme in the reservoir would maintain water quality and encourage bird visits in turn introducing new ecological relationships, which in time would build up biomass for a new land use pattern.

5.5.7 Sedimentation

To prevent formation of sediment deposits at the reservoir entrance a sluice that enables sediment flushing must be constructed

5.5.8 Soil erosion

Engineering measures should be taken for erosion control in agricultural land. The various measures covered in this category are:

- Contour cultivation
- Contour bunding
- Graded bunding
- Vegetated waterways

Erosion control measures for non-agricultural lands

The non-agricultural lands requiring implementation of erosion control measures include herbs & scrubs, and open vegetation. These would require the following control measures:

- Afforestation
- Gully control
- Pasture development

5.5.9 Compensation of loss of agricultural land

The people who will be displaced must be suitably rehabilitated. Financial compensation for the loss of land and housing is not sufficient. They must be provided with new houses and land. Their standard of living must be maintained by ensuring access to resources at least equaling those lost.

5.5.10 Control of land uses in the watershed

To prevent sedimentation of the reservoir and subsequently loss of storage, conversion of forest into agricultural land must be prevented.

5.5.11 Replicate natural flooding regime

To decrease the loss of ecological values of the downstream river and to mitigate the decrease of economic values of the floodplains (agriculture) the regulation of the dam releases may be geared to the natural water and sediment demands.

5.5.12 Mitigate Disruption of Riverine Fish

To maintain the possibility of upstream and downstream migration of fish a minimum flow must be established. Fish ladders or other means of passage must be constructed. Spawning grounds must be protected.

5.6 With and Without Environment Management Plan

This scenario was based upon the assumption that the proposed development would go ahead without any environmental management options being implemented. If the environmental management strategies discussed above is fully implemented, the adverse impact of the project would be reduced, and there will be an overall improvement in physical, chemical, biological and socio-economic environment of the region.

5.7 Analysis of alternatives with and without project

Table 5.1 Analysis of alternatives

Concern	Without Project	With Project
Catchment area	• Depletion of land resources well continue soil erosion, loss of fertile top soil and nutrients • Feeder channels and natural waterways blocked and diverted by encroachers • Unsustainable land use • Fragile and poor lands used for cultivation of crops • Sparse vegetation, scarcity of organic manure • Unsustainable use of chemical	• Treatment of arable and non-arable land will arrest soil erosion and loss of nutrients along with fertile soil • Treatment of natural drainage channels, cleaning of feeder channels • Scientific land use planning • Crops as per the land capability • Tree crops/dry land horticulture • Increased tree cover, higher bio-mass production

	fertilizers, depletion of soil fertility • Degraded pastures and grazing lands • Denudation of forest cover and shortage of fodder and fuel • Siltation of tank bed due to soil erosion in catchment and foreshore areas • Ecological imbalance	• Increased supply of organic manure, better soil health • Rejuvenation of pastures and grazing lands through silvi-pastoral system • Higher production of fuel and fodder, less dependence of forest • Land treatment using eco-engineering techniques arresting soil erosion and reduction in the rate of silt accumulation in the tank bed • Better environment
Tank bed/off-shore area	• Soil erosion due to lack of soil conservation measures and faulty cultivation practices • Lot of encroachment and impediments for free low of rain water into the tank • Most of the tanks have accumulated silt and reduced storage capacity by more than half of the potential storage • Tanks are infested with different kinds of weeds and thorny bushes (Prosopis juliflora, Ipomia camica jacq, Zandu grass, etc.,) • No vegetable barriers/silt traps of filters in foreshore area • The sluice and surplus-weir are under disrepair • At many places tank bunds/dams have developed cracks/stone pitching has given way and are weak and carry an element of security/safety risks	• Application of appropriate soil conservation measures and adoption of suitable cultivation practices • Removal of encroachment and allowing free flow of water with the provision of silt traps, filter points, etc. • Desilting of tanks will augment the storage capacity of tanks • Tanks will be cleaned and made free of weeds during desilting operation • Planting of bamboo and other trees in the foreshore will serve as filters and also be used by the poor as raw material for handcrafts • Sluice, waste-weir and operating system will be repaired • Tank dam/bunds will be strengthened by using excavated silt / other material. Pitching of interior wall with stone will be carried our wherever necessary
Command and adjoining area	• A sizable area under the tank command is left fallow due to shortage of irrigation water from the tank. • Main and field channels are either damaged, encroached or	• Productive lands can be through back under cultivation after the rehabilitation of tanks • Main as well as field channels will be realigned for proper

	disappeared due to lack of interest or non-availability of irrigation water from the tank for a long time • Most of the farmers located at the tail-end of the command do not get enough and timely water supply, suffer losses due to shortage of water during crucial crop growth stage • Only single crop is grown in most of the command areas • Currently, flood system of irrigation is used wherein water from main / sub-channels is released in the field at the higher elevations and is allowed to flow into the lower parts of the command area by gravitation. This leads to wastage of precious water, loss of nutrients and helps the transmission of diseases and pests from one plot to another • Lot of water is lost through seepage from main channels • Depleting groundwater and lowering of water table • Lack of water and vegetation increases the temperature and desiccation effect in the surrounding area. This also results in higher frequency of irrigation	irrigation • Tank users association will be responsible for equitable distribution of water among the command farmers. Decide about the schedule for release of water • There is good possibility of increasing cropping intensity once the accumulated silt is removed from the tanks • The main and branch channels (field channels) will be used to conserve and minimize wastage of irrigation water. • Main channels may be lined wherever possible and necessary to arrest seepage • Improved recharge of groundwater aquifers will arrest lowering of water table level. • Adequate water in the tank and vegetation around keeps the local atmosphere cool and humid, reduced requirement of irrigation
Others	• Shortage of drinking water for animals due to inadequate storage • Drying up of tanks and silt accumulation discourages fishing activity • Non-availability of water forces women to was clothes near the bore well, which supplies drinking water. The washing of clothes near the bore well creates cesspool and	• Rehabilitation will augment storage capacity of the tank structure and provide drinking water to animals • Availability of water in the tank for a fairly long time provides opportunities for fish culture. • Healthy water bodies attract water loving birds and insects. Many of these are predators of crop pests while others like honeybees help pollination.

	breeding place for mosquitoes. • Moreover, seepage of water pollutes the underground aquifers with detergents and other chemicals • Dried tanks in the state of disrepair do not provide any aesthetic value but an ugly picture of sick and dead.	• Availability if water in the tanks for washing clothes and to meet other domestic needs will keep the environment clean and neat. The flora and fauna present in the tank has a great capacity to degrade the hazardous chemicals and thus keep the system healthy. • Tanks with clean water, surrounded by good vegetation, with birds around definitely provide a pleasing lock and have great aesthetic value

5.8 Social and Economic Impact and Alternative Strategies

5.8.1 Positive Impacts

Social, Economic and Environmental Impact	Benefit enhancing or Mitigating Alternative Strategies
• Improved source of irrigation is to result in a decline of an unfavorable dependence of the poor on the rich	• Ensure membership of landless and sharecroppers in the WUA
• Possible increase in income through second crop in the command	• Ensure activities to promote sustainability of tank and reservoir structures
• Minimizing of difference in access to water between the head-reach and tail-end farmers	• Ensure the distribution channels are kept in good repair at the end of each crop. • Keeping space for small water paths to the fields down the command area to be made mandatory. • Practice of flooding the plot of land, allowing water to overflow only after a certain number of days of application of manure to be stopped. • Command area farmers with their own sources of irrigation barred from using field channels for harnessing water.
• Increased employment opportunities for women from the poorer and lower caste households	• Greater involvement of women from all sections decision making process

5.8.2 Negative Impacts

Social, Economic and Environmental Impact	Benefit enhancing or Mitigating Alternative Strategies

• Loss of income due to crop loss affected by water logging in the catchment /tank/ basin	• Under the Integrated Tank Management Plan, plan and erect check dams, bunds and similar other structures.
• Increased dependence on market, under unfavorable terms, especially for credit supported agricultural inputs (fertilizers, pesticides, etc.)	• The WUAs may undertake to supply these inputs to the member farmers to minimize market-determined vulnerability.
• The rich get richer; the bigger landowner gets more benefit of the project implementation.	While keeping the linkage between the extent of land owned and the costs to borne / user tax to be paid, a weightage has to be added to bigger landowners to determine their contributions. For instance: • Calculate the average size of land owned per household in the command. Those owning double this average may be made to pay one unit cost extra; likewise, those owning thrice the average to pay an additional unit cost • Likewise, add an additional cess on those with additional source of irrigation from which the plot (s) in the command area receives supplementary water. The additional cess shall be at a higher rate if the source of water is located in the command area and supplied to fields outside it. • Farmers selling water or sharecropping for water should pay a proportion of their share received to the tank user association, annually or per crop. • Income thus additionally generated should be spent for creating tank-related assets to the tail enders, small and marginal farmers owning land in the command, or for the benefit of the vulnerable groups without lands either in the command or elsewhere. **Examples of such activities**: • Undertake watershed development activities in the dry lands, • Erect cement structures for water flow in the tail ends, • Undertake desilting activities in the distribution channels, • Subsidies agricultural inputs supplied by the WUAs, etc.

6 STAKEHOLDERS' CONSULTATIONS

Stakeholder consultation is an important aspect in this project to obtain the perception and views of the stakeholders on social and environmental concerns pertaining to the local areas. The objective of stakeholders consultation is to minimize the negative impacts in the area and make them feel that they are the ultimate beneficiaries of the project in this process the views ascertained from the stakeholders is analyzed and incorporated in the project document. The ESA study initially obtains the opinions of the stakeholders and the same has been analyzed and incorporated at the sub basin level.

The objective of consultation is to increase multi-stakeholders participation in the project. Women and vulnerable persons and families have to participate more effectively. Consequently, there would be higher participation of farmers, fisherfolks, WUAs, Line department officials, SHGs, women and decreased gender disparity with respect to access. Usage and fulfillment derived from water-increased participation would also help reduce poverty. Participation would generate awareness, enhance knowledge and allow for better income generation practices. Reorganized water sector would directly impact agriculture productivity that can be optimized by participative processes.

Purpose of participation is to increase productivity of water. Water is traditionally considered valuable in most part of India and Tamil Nadu is no exception. However, in reality there is wastage and inappropriate usage regularly. Insufficient availability of water is only a part of the water problem. Water productivity does not stop at storage or conservation of water and extends to its effective utilization. The utilization can be made more efficient by combine efforts of all using or managing water. The conclave is fairly encompassing and includes a number of stakeholders. These stakeholders should be consulted to improve efficiency of usage and productivity.

6.1 Target participants

WRO officials, Line department officials, Farmers, Farmer Associations, Members of Water User's Associations, NGOs, SHGs and Women.

6.2 Consultation workshops

EPTRI has hired the services of GAIA International Organization, Thiruvanmiyur, Chennai for providing local assistance and resource persons to facilitate the consultations in the regional language. EPTRI professionals and the resource persons from the local organization have conducted 17 stakeholder consultation workshops in 16 river basins which are as follows:

Table 6.1 Stakeholder consultation workshops in 16 river basins

S.No	Date of workshop conducted	Major River Basin	Place of the workshop
1	13.2.2006	PAP	Pollachi
2	2.3.2006	Pennaiyar	Thiruvannamalai
3	3.3.2006	Pennaiyar	Krishnagiri
4	4.3.2006	Vellar	Athur
5	6.3.2006	Agniar	Pudukkottai
6	7.3.2006	Vaigai	Madurai
7	8.3.2006	Vaippar	Srivalliputtur
8	9.3.2006	Tamirabarani	Thirunelveli
9	10.3.2006	Kothaiyar	Nagercoil
10	11.3.2006	Nambiyar	Vallioor
11	3.3.2006	Palar	Cheyyar sub basin Kancheepuram
12	4.3.2006	Varahanadhi	Tindivanam
13	6.3.2006	Kottakaraiyar & Pambar	Sivagangai
14	7.3.2006	Vaigai	Paramakudi
15	8.3.2006	Gundar	Aruppukottai
16	10.3.2006	Vellar	Perambalur
17	11.3.2006	Chennai	Kosasthalaiyar sub basin Thiruvallur

6.3 Process of Consultations

The processes of consultations are being kept very simple and largely interactive. The consultations carried out in two-way processes between facilitators and the participants. Consultations are held in a congenial environment at a venue, which is amenable to all the participants. All the consultations are held in the local language and the issues emerged

during the consultations are analyzed and recorded. The photographs of the stakeholder consultative workshops are enclosed at Annexure 2.

The basin wise environmental, social issues and the recommendations emerged during the consultative workshops are furnished as follows:

1. Pollachi (PAP Basin):

The main issues identified in the above workshop are:

- Avenue tree plantations should be encouraged in farmer's wastelands to increase the green cover.
- Coir related value addition industries are to be setup.
- Sprinkler and drip irrigation should be introduced in the entire canal instead of selected area.
- Rural enterprises should be taken up to reduce unemployment and to arrest migration.
- Live stock development should be encouraged.
- Dairy activities should be encouraged.
- Post-harvesting technologies should be promoted with alternative energy.

2. Thiruvannamalai (Pennaiyar Basin):

Environmental Issues:

- Water pollution due the release of sewage water into the river
- Poor solid waste management
- Mixing of drinking water along with drainage water
- Ground water level is decreasing (from 25 feet to 400 -500 feet), ground water quality is declining and also deteriorated.
- Soil erosion seen in the river and tank beds

Social Issues:

- Primary health center is 5 km away from the village and the water borne diseases are prevalent.
- Decline in Livestock.
- Encroachments in the river and tank beds
- Drinking water supply is prone to health diseases
- The village has a primary school and most of them have studied up to 8^{th} -10th class.
- Villagers work in agricultural field, brick industry and rice mill.
- Youngsters are migrating to Kerala and Karnataka due to unemployment

Recommendations:

- Drip irrigation is a viable option for all the crops except paddy.
- Vegetables and fruits can be cultivated through drip irrigation to conserve water.
- Suggested introducing modern agricultural practices for increasing the productivity of the crop.
- Agricultural farmers can take up fish culture in their own land by ponds. Fisheries department will support such projects.
- Alternative cropping can be practiced in the drought prone areas.
- Department of Forest has suggested to plant tree crops in the catchment area of the tanks and riverbeds to prevent encroachment and soil erosion.
- Irrigation facilities like canal, tank and well irrigation should be improved by desilting, and rejuvenating tanks and wells.
- The ipomoea plant should be removed in all the tanks.
- Agricultural marketing should be improved and seed should be supplied through agricultural society and not through private agencies.
- Farmers should have good linkage for marketing their products. As the Price is not uniform within the district, the Government should fix uniform rates.

3. Krishnagiri (Pennaiyar river Basin)

Environmental Issues:

- Effluents released from many industries has affected the river water quality.
- In Mittal village, tank water is used for fish culture. Waste from the mango processing unit is released into the tank leading to water contamination and algal bloom.
- In Arasambatti village, sewage is released directly into the tank leading to health problems/ diseases.
- Untreated industrial effluents and sewage from household are directly released into the river basin with out effluent treatment.
- Sand mining is very high in the riverbed area, leading to decline in ground water table.
- Due to indiscriminate dumping of solid waste in the riverbed and tanks, the surface water is getting polluted. The industrial effluent entering from Bangalore and Hosur are directly released into the river system and has resulted in water pollution.

Social issues:

- 50% of livestocks are infected with unidentified diseases.
- There are plenty of opportunities available in the agriculture sector but agricultural laborers are migrating to Karnataka for higher wages. They are employed in building construction and laying of water and telephone cables.

Recommendations:

- The main supply and branch channels should be cleaned regularly and the tank in the district must also be desilted regularly.
- Recommended to construct check dams after the tanks to store the surplus water.
- Water wastage is a major issue of concern. Moreover the tanks do not have bunds. Recommended constructing bunds along the tanks to save the water.
- Cold storage facilities should be provided for preserving fruits.
- Awareness should be created on vermi-composting and organic farming.
- All the encroachments in PWD tanks should be removed.
- Commodity groups should be formed for selling coconut and other agricultural products.
- Irally Panchayat Union near Kaveripattinam is generating power through solid waste. This project may be implemented in all the panchayats.
- Recommended to provide individual loan to purchase modern agricultural implements.

4. Athur (Vellar River Basin)

Environmental Issues:

- Due to water pollution caused by sago industries, lot of coconut trees are affected and yield is also reduced
- Ground water level is depleting due to sand mining and over exploitation of the ground water.
- Due to indiscriminate dumping of solid waste in the riverbed and tanks, the surface water is getting polluted. The industrial effluents entering from the local factories (Sago industries) are directly let into the river with out any treatment.
- Water Pollution causes snoring in the bullocks

Social Issues:

- Due to water pollution water borne diseases are spreading in this river basin
- Most of the cattle are affected by Anthrax disease; no prevention methods have been identified.
- Public toilet system is currently very unhygienic.
- In the work place the male is getting higher salary than the female.
- Agriculture laborers are not interested to work in agriculture due to low wages. They are migrating to Karnataka for higher wages in different kind of works viz., building construction, laying of water and telephone cables.

Recommendations:

- Information should reach to the tail end farmers in the Ayacut areas.
- The municipality and district administration should take necessary action to provide hygienic drinking water.
- Recommended to plant trees along the tank bunds to check erosion.
- Strict enforcement according to the available base maps should be done to stop encroachment of riverbeds.
- Check dam system should be provided to recharge the ground water.
- Water treatment plants should be set up to treat the sewage water.
- Extension of Modern Agricultural Implements.
- Cold storage facilities should be provided.
- Milk powder factories, Sugarcane factories and modernized sago factories may be opened to increase the employment opportunity.
- De-siltation should also be carried out in the tank areas.
- Proper embryo transplantation techniques are required to get more hybrid livestock.
- Recycling of wastewater to avoid pollution from sago industries.
- Cattle sheds should be provided.
- Marketing access should provide for SHG products.

5. Pudukkottai (Agniar River Basin):

Environmental Issues:

- Monsoon failure and mismanagement of irrigation source resulted in reduction of agricultural employment and in permanent migration to other places.
- Sewage water is released into the tank and ponds in the urban and semi urban areas.
- Most of the solid wastes are dumped in ponds and tanks.
- Excess nitrate concentration occurs in common areas, and a few saline pockets are highly in saline and alkaline.
- Grassing lands are reduced in the recent past.

Social Issues:

- Farmers are not getting reasonable price for their agricultural product like paddy, groundnut and banana.
- Due to poverty, children are working in the hotel.
- Majority of the students are not educated due to poverty.
- Sanitation programmes are not properly implemented; nearly 80% of the toilets are unused due to water scarcity.
- Female students are not continuing their higher studies, since they have to take care of their homes while their parents are moving to other places for work.
- Difference in the wage rate in farm level work. Male wage rate is Rs.100/ per day and female wage rate is Rs. 50/-per day.
- There is a decreasing trend in livestock.

Recommendations:

- To create awareness on cultivation of herbal plantation and Government should provide subsidy.
- Government should intervene and fix the reasonable prices for agricultural products.
- 100% insurance should be given to loss of crops due to natural calamities.
- Model market system should be established for agricultural product to get better price for the commodity.
- Workshop should be organized to educate people about the importance of toilet and hygiene.
- Mobile vetenary van should be provided for medical treatment.
- No user charge should be collected from the public for using the toilet and a provision should be made to provide water facilities to the public toilet.
- Community bore wells should be installed in the dry lands to assure irrigation in these areas. The well should be connected to the drip and sprinkler irrigation system.
- Water User Association should manage both wet and dry land community bore wells.
- All the wastelands should be converted to cultivable lands.
- For the prevention of soil erosion, trees should be planted in the catchments area of the tank.
- Check dam should be constructed every 2km in the river for recharging the ground water
- Water can be saved using drip and sprinkler irrigation to get better yield from the crop.
- Farm development through lining of field channel etc.
- To sustain ground water level, percolation ponds should be constructed in the basin area.
- To establish or lay road in ayacut area of the tank.
- Supply channel of the tank should be cleaned
- Encroachments should be evicted from the catchments and supply channel of the tank area.
- Establish paperboard industry and cashew industry to increase the employment opportunity.

6. Madurai (Vaigai Basin)

Environmental Issues:

- Around 40-50 system tanks are not able to get river water due to sand mining.
- Drought and flood seasons are more intensified in this location
- During flood farmers could not save water due to lack of check dams
- The Nitrate value in most of the wells in this basin is high, this may be due to the application of the nitrate bearing fertilizers and pesticides, high concentration of the Nitrate in the drinking water induce Methamoglobinemia in infants.
- The maximum concentration of the nitrate above 800 mg/l is found in the village Chittarkottai.
- Air pollution due to flour mills located in the town
- Salt water intrusion due to solar salt pans
- Ipomea problem in the tanks
- Inadequate ground water due to excessive sand mining.
- Agricultural laborers are employed for only three months
- Only source of water is surface water
- River level is lower that of the agricultural fields due to sand mining
- Sewage from towns and cities are released into the channels and canals.
- Fish kill due to sewage discharge
- Due to urbanization, solid wastes are dumped in the river, canals and tanks
- Solid waste of Paramakudi, Ramnad is discharged in the river.
- All the towns are along the Vaigai river basin must be provided with sewage treatment plants.
- Poor farmers have been affected without electricity connection in these areas.
- Over extraction of ground water has resulted in depletion of ground water table

Social Issues:

- In agricultural sector, the females are getting lesser wages when compared to males. The male is getting Rs.70/ as wages per day. However, the female is getting only Rs.25/- per day.
- There is decreasing trend in bullock population in this area.
- The village doesn't have common facilities to store food grains.
- Poor sanitary conditions in the residential areas.
- Health problems due to sewage.
- Abandoned pigs in the gutters causes health problems
- Encroachment of irrigation canal prevented the link between Ramnad big tank and small tanks used for drinking.
- Marketing through Self Help Group should be encouraged.
- Need for mobile veterinary hospital in these areas.
- Farmers are migrating for employment, (For every 6 months), Youngsters are also migrating to Tiruppur to work in the textile industries.
- Menace due to abandoned temple cattle's which spoils agriculture.
- Salinization of ground water. The ground water could not be used for drinking or for agricultural purposes.

Recommendations:

- The Government should take necessary steps for equal distribution of water from head to tail Enders in the river basin.
- Farm pond arrangement needed
- Fish culture should be encouraged
- Needs for direct marketing facilities
- Training in cottage industries, livestock rearing, fish culture, vermin-composting
- The Government should enhance the Paddy procurement price and other agricultural products.
- The tank fishing right should be given to the Water Use Association.
- Desilting should be done in the entire tank to maximize the storage level.
- A separate newsletter should be published to disseminate the modern agriculture techniques and share the opportunities for marketing, training, hiring of agricultural implements etc
- Adolescent girls must be trained in alternative employment
- Direct procurement of agricultural products by the Government
- Environmental awareness should be created among the villagers
- Basic facilities like primary health centre, roads, drinking water facilities, veterinary hospital and toilet facilities
- The Alnaga Nallur and Pandiyarajapuarm sugar factories are closed. Government should take necessary steps to reopen the sugar mill.
- Urgent need for sewage treatment Plant and (STP) Solid Waste management facilities.
- Training programme for the farmers on pond fish culture, mud crab and ornamental fishes to increase the employment opportunities.
- PWD department should allow the farmers to desilt the tanks and use the silt for brick making
- Both Panchayath and PWD tanks must be managed by any one of the organization
- Crop cultivation in the renovated areas of Juliflora thorny trees, such renovated areas does not require manure, fertilizers and pesticides
- Well water could be used for alternative crops like fruit trees, coconut etc through drip irrigation to conserve water.
- Check dam should be constructed in the catchment area for reducing soil erosion.
- Rotational water supply and rotational crop cultivation should be encouraged
- 50% subsidy for well irrigation
- Renovation of irrigation facility is required
- Bore wells are to be setup nearer to the check dams/shutters for crop irrigation during water scarcity period
- Sewage fed forage crop cultivation facility should be developed
- Aquatic weed Ipomea clearance is urgently needed
- Training on drip and sprinkler irrigation system for sugarcane, banana and coconut crops for farmers.

7.Srivalliputhur (Vaippar River Basin)

Environmental Issues:

- This Basin has vast area of Vertisols (Black soil) because of this salinity and alkalinity problems are more predominant than acidic problem. This results in low yield in crop production
- The TANCEM Ltd, Alangulam has impaired the air quality upto a distance of 10 km. radius outside the plant in the southwest direction. The natural regulation and irrigated crops were affected severely due to dust deposition.
- Untreated sewage is discharged into the nearby streams for disposed on lands, In Virudhunagar town the untreated sewage is pumped into Kousiganadhi, which is passed around the town.
- Dyeing effluent released into the land in Rajapalayam has polluted the land as well as the irrigation and drinking water sources.
- Solid waste dumped in Rajapalayam has created air and water pollution problems.
- There is no equal distribution of water in the canals.
- All irrigation tanks, canal and channels are affected by encroachment.
- In Vaippar river basin, Vilathikulam and Kovilpatti taluks of VOC district, Sankarankoil taluk of Nellai Kattabommon district and Sathur taluk of Kamarajar district are subjected to frequent droughts.
- Destruction of coral reefs and eco system in coastal areas

Social Issues:

- In the agricultural sector, male is getting Rs 80/day and female is getting Rs. 40/day.
- There is no sufficient teacher in many schools.
- There is no water facility in public toilet in many villages. Water supply should be provided to the public toilet to avoid open toilet.
- Farmers need storage facilities and they need fair price for selling all agricultural commodities.
- Cotton price is not uniform, it always get fluctuation during the harvest time.
- Child labour is prevalent in the matchbox industry.
- People are migrating to other states like Uttar Pradesh and Karnataka for their livelihood.
- Prevalent diseases recorded are diarrhea, cholera, enteric fever and jaundice.
- Decreasing trend in cattle population due to reduced grassland.

Recommendations:

- Cold storage facilities for tomato and other fruit crops should be established.
- Efforts must be taken preserve the existing forest coverage and also take measures for afforestation
- Sustainable drinking water schemes
- Improving the overall irrigation efficiency
- Saving water to the possible extend, to implement RWH
- Development of less water consuming industries in drought prone areas.
- All the municipalities and Panchayats have to organize sewage collection, treatment and disposal system.
- The field channels should be lined to improve the irrigation management.
- Tree plantation should not be done in the irrigation tank areas.

- Desilting should be done in channels, canals and tanks. And also eucalyptus tree should be removed in the Western Ghats to sustain the ground water level.
- Check dam should be constructed in the river to maintain the ground water as well as to protect soil erosion.
- Old pump set motors should be replaced with new motors at a subsidy price to reduce the consumption of electricity.
- Agricultural instruments should be given to the farmers with 50% subsidy.
- To sustain ground water level percolation ponds should be constructed.
- Government should provide agricultural implements with subsidy rate.
- The cement industry may be asked to take all precautions as per the standards for the smoke emitted by the plant.
- The government should appoint teacher to improve the quality of education.
- Programmes like mulberry plantations, transfer of fodder development technology, water storage structures, and fish culture may be promoted.

8. Thirunelveli (Tambraparani basin)

Environmental Issues:

- All municipalities and Town Panchayats are letting sewage water in to the canal without any treatment.
- Out of about 880 tanks in the river basin few tanks have been taken up for modernization, hence possibility of rehabilitating the other in a phased manner has to be explored.
- Water scarcity in North kodaimel canal, due to unequal distribution of water.
- Water scarcity is prevalent in the Tamirabarani river basin due to the installation of the 160 pump sets.
- 4500 acres of agricultural lands were not cultivated due to water scarcity and improper maintenance of the irrigation system.
- There is no equal distribution of the water in this canal.
- In Thoothukudi area, seawater intrusion is prevalent during the summer season due to over pumping of ground water.
- Sand mining is prevalent in the Ramanathi, Patchaiyaru and Tamirabarani. Sand quarry contractors are mining sand beyond the Government's prescribed norms.
- SUN Paper mill is letting out water directly in to the canal without any treatment leads to various skin diseases.
- Soil erosion in the watershed areas and siltation in the reservoirs, tanks and channels.
- Agro-chemicals used in the agriculture get mixed with the surface water and leached into the ground water.
- Ground water quality get degraded due to geological formation in the sub-basin
- Various types of chemicals fertilizers used in the ayacut in Tamirabarani basin as well as pesticides applied on the crops contribute to pollution in the river.
- In Sawyerpuram area, where the ground water extraction is on a large scale, high salinity is noticed in ground water due to seawater intrusion and presence of marine calcareous materials.

- The India cements factory at Thalaiyuthu is creating air pollution in and around Tirunelveli town.
- Bio medical wastes directly dumped into Kannadiyan canal.

Social Issues:

- Only 25% of subsidy is provided to the farmers to purchase the agricultural implements. Very few farmers own the modern agricultural implements.
- There is no proper marketing for agricultural product; middlemen and traders are getting more advantage for all agricultural products.
- Children's are working in hotels as child laborers.
- Children are migrating to Tiruchy, Tirupur and Bombay for their livelihood.
- Male gets 40% higher wage compared to females.
- There is shortage of labour for agricultural works in this area.
- Malaria disease is prevalent due to sewage water disposal
- There is no mobile vetenary hospital

Recommendations:

- A proposal for artificial recharge in sawyerpuram teriland area of Chidambarerer district.
- Farmers need cooperative milk society to get reasonable price for milk.
- Government should build separate pump sets and water tanks for toilets.
- To setup regulated market for agricultural product to get fair price.
- Government should arrange marketing for bio-fuel (jetropa) plant.
- Check dam should be constructed in every 2 kilometer through out the canal for maintaining the ground water level.
- Encroachment should be evicted for maintaining the irrigation system.
- The department should organize training centers to create awareness about modern agricultural implements and usage of those instruments.
- There are nearly 70 tanks in this canal, affected by siltation. Government should de-silt these tanks to provide better irrigation and to maintain the ground water level.
- Agricultural department should provide modern paddy harvester with low rent.
- Government should initiate farm ponds to grow fishes.
- Fisheries department should provide subsidy and training to the farmers to improve the farm fish culture.
- Industrial and municipal waste should be treated and reused.
- Less water consuming industries should be located in place where the availability of water in plenty is in question.
- Action may be taken to take up drainage relief woks to protect the valuable cultivated lands from inundation.
- Action may be taken closely to monitor the ground water quality in these areas and prevent over extraction of ground water to avoid seawater intrusion.
- Conjunctive use of surface and ground water.
- Improving the conveyance efficiency by minimizing seepage losses by lining the system.
- Creating percolation ponds to conserve the soil moisture.

- Providing community wells for irrigation.
- Renovating the old tanks and ponds, desilting of supply channel and construction of water harvesting structures to improve irrigation potential.
- Bringing the dry land under deep-rooted fruit plants and vegetative gardens to improve ecological condition.
- Introduction of drip and sprinkler irrigation for effective water management for effective farms and vegetable garden which will save large quantity of water
- Planting Palmyrah and other perennial trees in the wastelands to prevent soil erosion by wind
- Restoring the ecological balance through resources conservation, afforestation and positive land development

9. Nagerkoil (Kodaiyar basin)

Environmental Issues:

- Illegal sand mining reduces ground water table in this area.
- Catchment degradation and soil erosion is high.
- Acidity problem is more predominant than the saline and alkaline problem. The acidity problem is mainly due to the presence of aluminum, manganese and iron in toxic concentration. Soil acidity inhibits biological nitrogen fixtures.
- Encroachments in the riverbanks affecting the irrigation system and also pollutes the waterways.
- Agro industries are letting out effluent without treatment in to the rivers and canals.
- Accumulation of Solid waste in the tourist spots.
- Sewage water is directly letting in to the canal without any treatment at Sugandirma and Parattai canal.
- Cultivation area has been reduced due to the scarcity of water.
- There were about 40,000 acres of land was under cultivation, under the scheme Petchiparai anicut system. But, now only about 20,000 acres are under cultivation due to scarcity of water.
- Seawater intrusion in Kanniyakumari district lead to the salinisation of ground water.
- Land fertility becomes low due to chemical fertilizer.
- Ground water level is decreasing due to the extraction of water by the multi national companies like Pepsi and Coke companies.

Social Issues:

- Trader's are mining sand and selling it to the Kerala State.
- The prevalent diseases recorded are acute diarrhea, Cholera, Enteric fever, malaria and Jaundice.
- Only 50% of the people are using the toilet facilities.
- Marketing facility is very poor. Middleman is enjoying more profit than farmers.
- Due to high cost of transport, farmers can't take their product to the market.

Recommendations:

- Equitable distribution of irrigation water by better water management

- Improve the performance of the existing irrigation systems by suitable structural measures.
- The modern drip irrigation facilities may be utilized for crops and orchards, which not only increase the irrigation efficiency but also the yield.
- Conjunctive use of surface water.
- Adaptation of better agricultural practices such as crop as crop rotation, raising garden crops and other less water consuming crops.
- Drought control measures such as soil conservation measures, conjunctive use of surface and ground water may be introduced in the dry pocket.
- Recommended to construct percolation ponds for sustaining the soil moisture.
- Nagercoil municipality should construct STP for treating the sewage water before releasing in to the water bodies.
- Government should directly procure paddy from the farmers.
- Transport subsidy should be given to the farmers for transporting agricultural products.
- Awareness should be created on "Eco tourism concepts"
- Eco tourism should be promoted in these areas
- Drip irrigation should be provided to avoid wastage of water from Palayar River.
- Marketing facilities should be arranged to sell the agricultural products.

10. Valliyoor (Nambiyar River Basin)

Environmental Issues:

- Saline, alkaline and acidic soils are occurring in patches, saline and alkaline problem is more predominant in this basin
- High ground water depletion due to sand mining in this basin
- Soil erosion is also high in the catchment area.
- Solid waste is disposed in the Valiyuoor and Sathur river basin.
- Sea water Intrusion is prevalent in the coastal area of this basin
- Sand mining is prevalent in this river basin, affects the ground water level.
- There is 75%upland in this area, if government provides subsidy and training for bio diesel plantations the farmers are willing to do bio diesel plant.

Social Issues:

- There is labor scarcity in agriculture.
- Marketing facilities for organic manure.
- There is 50% wage difference, female is getting only Rs 40/day and male getting Rs.100/day.
- Due to uncertainty of agriculture, people are migrating to Kerala Bombay and Chennai for their livelihood.
- Requested to have veterinary mobile hospital and demand fair price for the milk.

Recommendations:

- Government should allot separate place for selling agricultural products.

- Government should provide 75% subsidy for the construction of toilet in the rural areas, the common toilet system is not functioning properly
- Recommended to divert the excess water from the Tamirabarani river basin to Nambiyar river basin.
- Feasibility of diverting west flowing rivers to Nambiyar, Hanumanadhi and Karumeniar basin may be studied.
- Action plan may be drawn to improve and maintain the wild life and bird sanctuaries in a more scientific way.
- Action plan may be drawn to improve the Eco tourism spots.
- Construction of farm ponds to improve the ground water level with the subsidy from the government.
- To clean up the old well for rainwater harvesting.
- Subsidy to replace the old irrigation pumps and set to avoid consumption of more electricity.
- To construct community bore well for drip irrigation during the water scarcity period with 100% subsidy.
- Agriculture department should provide threshing floor in each village.
- Horticultural crops can be cultivated in the windmill areas.

11. Kancheepuram (Palar River Basin)

Cheyyar Sub basin Environmental Issues:

- Sand mining in Cheyyar river Basin
- Domestic sewage of Arni town and Thiruvathipuram
- Pollution due to dying and silk Industries in Arni block
- Ipomea, Juliflora and Vizhal in 20 taluks of Kovilur block.

Kliyar Sub Basin Environmental Issues

- Entry of domestic sewage with Suganadhi River, Chemavalam and Thiruthan tanks
- No STP in Vandevasi and Madurantagam Municipalities
- Solid waste problem in Vandavasi Municipality
- Sugar mill effluent in Padalam
- Sea water intrusion near Vayalur and aquatic weeds

Social issues:

- Primary health center required adequate facilities
- The agricultural product market prize is fixed by the middle man
- Most of the people studied up to +2, Literacy level is low and Migration is prevalent to Chennai and Kerala for the construction work and rubber industry.
- The agricultural marketing performance is very low
- Hospital facilities should be improved.
- Water transport from other peri-urban areas close to Chennai A good deal of groundwater is pumped from agricultural wells and transported into the city everyday for Kliyar sub basin

- Water, hitherto claimed only by the agricultural sector is used more and more for non-agricultural urban uses – there emerges competing demand for water – water transport from rural to urban areas in Kliyar sub basin
- Similarly water sellers – a few benefit a great deal by selling water to urban use by abandoning their agriculture but this affects groundwater availability in the adjoining wells; depletion of groundwater or fast declining groundwater table would affect the livelihoods of a majority of village population.

Recommendations:

- Rain water collection in ooranies, village tanks for recharging ground water
- Land reclamationSoil and water conservation measures
- Desilting of tank and supply channels
- Flood water management and supply channels
- Irrigation water management through drip and sprinkler irrigation methods

12. Tindivanam (Varahanadhi River Basin):

Environment Issues:

- In the Kazahuveli Swamp there is permanent problem of inundation of seawater and reclaiming waste area of cultivation.
- The Kazahuveli swamp is a large lagoon near the seashore full of water during rainy season, when dry, there is arid waste with salt efflorescence.
- 30-40 percent of the people are migrating to Chennai.
- Sewage water is directly released into the river and tanks.
- Mining of rocks (quarry) pollutes the village tanks.
- Problem of Kattamanaku weed in the tanks.

Social Issues:

- 80% of the farmers are marginal farmers owning less than 1hec and hence agricultural economy is very poor.
- There is increase in agricultural labourers with limited industrial activities and it may affect the overall economic status of laborers depending on agriculture in this basin.
- Increase in agricultural labourers to cities for want of employment during failure of monsoon and off-season.
- Boys are less educated when compared with girls.

Recommendations:

- All rights should be given to the Water User Association such as fish rearing in the tanks, earth work, channel lining and bund construction
- Kazahuveli swamp can be converted into fresh water lake and store water can be pumped to higher elevation to irrigate dry lands.
- The watercourses and drainage courses have to be periodically maintained free from encroachments. So that to discharge the flood waters without causing submersion and consequent breaches in upper reaches.

- Land use regulation to minimize water use during drought for example, changing over from traditional agricultural to pasture or grass land.
- Demand reduction strategies for example, changing crops and cropping practices and domestic water use.
- Drip and sprinkler irrigation may be encouraged.
- To provide improved conveyance efficiency by minimizing on way loses by lining the supply system.
- To mitigate drought, measures like compartmental bunding, application of gypsum as soil conditioner, enriching the soil fertility, summer ploughing to prevent disease carried over through crop residues and soil.
- Adopting integrated pest management and formation of broad beds and deep furrows etc. may be some of the soil conservation measures to mitigate drought.
- Effective utilization of ground water storage reservoirs including recharging.
- Rural labourers of this backward area to be provided with adequate employment opportunities in their locality by establishing more small-scale industries and agro based industries.
- Sustainable drinking water schemes may be implemented.

13. Sivagangai (Kottakaraiyar & Pambar River basin):

Environmental Issues:

- The municipalities and Panchayat unions in this basin are practicing open drainage system and are letting the sewage in the local drains untreated.
- Opening of the hard soils, which are kept fallow for more than a decade with the help of tractor ploughing to retain rainwater to the maximum.
- Compartmental bunding, application of gypsum as soil conditioner, enriching the soil fertility, summer ploughing to prevent diseases carried over through crop residues and soil, adopting integrated pest management and formation of broad beds and deep furrows etc may be some of the soil conservation measures to mitigate droughts.
- As this basin is a "Basin of Tanks", continuous maintenance of tanks is essential
- Scientific conjunctive use of surface and ground water
- Creation of percolation ponds to conserve the soil moisture
- Provide community wells for irrigation
- Renovating of old tanks and ponds, desilting of supply channels and construction of water harvest structures to improve irrigation potential.
- Bringing the dry land under deep-rooted fruit plants and vegetable gardens to improve ecological conditions.
- The overall efficiency of tank irrigation system is very low (it ranges from 30 to 45%)
- Crop diversification and short term crops could be introduced to conserve water
- Soil erosion in the riverbed and consumption of water by the thorny trees exotic tree *Prosopis Juliflora*.
- Increase in Chloride concentration in the groundwater
- Ipomea weed problem
- Water Users Association should be given more rights particularly in cutting unused trees, fishing, earthwork etc.

Social Issues:

- The watershed development should be implemented with short-term plans as a preliminary measure and long term plans as a permanent measure.
- Land use regulation is to be adopted to minimize water use during droughts. The integrated technology for dry land farming should be introduced among the farming communities.
- To provide alternative employment during lean season.
- Migration due to unemployment could be avoided.
- Civil works related to water resources could be entrusted to Water Users Association.
- Appointment of more numbers of teachers to improve the educational status.
- Adolescent girls are going for laborer work in Textile mills at the cost of Rs. 30-40/day.
- Employment through cottage industries should be promoted and alternative employment such as animal husbandry, fish culture should be promoted among and agriculture farmers.
- Training programmes on vermin-compost technology and biogas production.
- Market linkage should be promoted to sell the agricultural products of the farmers.
- Small-scale industries should be promoted.
- Improvement on status of livelihood through to livestock and fish culture.
- Prevalence of rural health problems and health problem due to Ipomea.
- Skin diseases due to poor water quality.

Recommendations:

- A comprehensive watershed development programme which encompasses the total development of a catchment area has to be prepared by looking into soil type, land gradient, rainfall, topography, moisture retention potential of the soil and evapotranspiration condition of the soil, to derive maximum returns per unit of land.
- Fencing of water bodies meant for drinking water.
- Promotion of Self Help Groups (SHG) in cottage industries and marketing.
- Cold storage facilities for fruits and vegetable.
- Training programmes on honeybee cultivation, vermin-culture, seed making technology, tissue culture, fish and mud crab cultivation.
- Facilities should be provided for seed making technology.
- Transportation/collection facilities for small-scale cow milk producers have to be recommended.
- Industrial and municipal wastewater should be treated and reused.
- The concept, namely the value of the produce obtained per unit of water consumed should be introduced.
- Possibility of diverting water from adjacent Vaigai river basin through Periyar Main Canal for irrigation purposes can be considered.
- Action plan may be drawn to improve the agricultural productivity by adopting the suitable crops for these areas under modern technology.

14. Paramakudi (Vaigai Basin)

Environmental Issues:

- Around 40-50 system tanks are not able to get river water due to sand mining which made the river deeper.
- Drought and flood seasons are more intensified in this location.
- Well water could be used for alternative crops like fruit trees and coconut etc through drip irrigation to conserve water.
- Use of farm ponds for fish culture and mud crab culture to increase the job opportunity for the youngsters.
- Farm pond should be promoted and fish culture in farm ponds.
- Rotational crops and promotion of suitable dry land crops.
- Street/abandoned pigs in the gutters leads to health problems.
- Urgent need for sewage treatment and solid waste composting facilities.
- Air pollution due to flower mills.
- Encroachment in the irrigation canal prevented the links between Ramnad big tank and small tanks meant for drinking water purpose for the Ramnad town.
- A common place for organizing farmers meeting/training.
- Insisted direct procurement of products by Government.
- Environmental awareness should be created among villagers.
- Urgent requirement of de-silting of Veeravanur tank
- The catchment area of the water bodies is reduced due to the poor water management.
- Water users association should be provided with tree cutting and fishing rights.
- Needed modernized agricultural practices.
- Salt water intrusion due to solar saltpans.
- Marketing should be promoted through the Self Help Group.
- Alternative employment may be created for the farmers.
- Farm ponds should be promoted.
- Menace due to abandoned temple cattle's, which spoils agriculture.
- Ipomiea problem.
- Ground water is saline and could not be used for drinking/agricultural.
- Surface level variation occurs between river and irrigation tanks due to sand mining.
- Only source of water is surface water
- Crop cultivation in the renovated areas of Juliflora thorny trees doesn't require manure, fertilizers and pesticides.
- Emphasized on crop rotation.
- Producers wanted to fix the price of the agricultural products.
- Training in cottage industries, livestock rearing, fish culture, vermicomposting may be given to the farmers.
- Revenue from sand mining should be distributed equally to concerned Panchayats.
- Fishes were killing due to the release of untreated sewage in to the river and tanks.
- Renovation of irrigation facility is required.
- Bore wells are to be setup nearer to check dams/shutters for crop irrigation during water scarcity period.
- Sewage fed forage crop cultivation facility needed.
- Sewage treatment plants should be setup to avoid pollution

- Fish stocking in irrigation tanks fisheries department
- Fishing rights in the irrigation tanks needed
- Fish seed stocking should be done through Fisheries department
- Health problem due to Ipomiea should be avoided
- Solid waste of Paramakudi, Ramnad must be disposed hygienically

Social Issues:

- Paddy procurement price should be enhanced.
- Health problems due to disposal of sewage.
- Migration of people for employment opportunity (6 months in a Year).
- Only for three months agriculturists are employed.
- Migration due to unemployment.
- Adolescent girls must be trained in value addition of palm products and eco- friendly paper making and marketing.
- Needs direct marketing facilities.
- Price fixation required for agricultural communities e.g. Red Chilies.
- Subsidy arrangement for exchange of old water pump.
- Health problem due to Ipomea.

Recommendations:

- A separate newsletter for the WUA must be arranged to disseminate the modern agriculture techniques and share the opportunities for marketing, training, hiring of agricultural implements etc.
- All the towns along the Vaigai river basin should be provided with sewage treatment plants.
- Rights of utilizing income from the tank should be given to WUA.
- Rotational water supply and 50% subsidy for well irrigation.
- Drought is drier and during floods farmers could not save water due to lack of check dams, more no of check dams should be constructed.
- Panchayath and PWD tanks must be managed by any one of the organizations.

15. Gundar Basin, Aruppukottai:

Environmental Issues:

- The entire basin is deficient in respect of surface water.
- The soil is generally poor in nature and rainfall and irrigation facilities are also deficient.
- Check Dams/Small reservoir facilities must be developed.
- Concrete lining of water supply canal is essential.
- Schemes for groundwater utilization needed.
- Act should be developed for rotational distribution of water.
- A model farm should be developed.
- Identification of cropping pattern is needed.
- Drip and sprinkler irrigation should be popularized and must be compulsorily implemented through governance.

- 37% irrigated agriculture-gives 45% agriculture production.
- 63% rainfed agriculture gives rest of the production.
- Water consumption/acre is more in Tamil Nadu and the crop yield /acre is less.
- Eco-friendly livestock rearing for e.g sheep farming is better than goat rearing.
- Developing the forest cover for eco-stabilization.
- Minimum 33% of forest should be maintained.
- Treatment at catchment area needed for eco restoration in river basin.
- Separate drinking tank for livestock.
- Insurance for livestock is available.
- Fodder supply is arranged in the AH department.
- Forest should be maintained.
- No coup system.
- Goat rearing in stalls.
- Fodder cultivation in waste lands.
- Wasteland could be developed through tree crop e.g. lilly, casuarina, eucalyptus etc.
- Forest extension division promotes forest development.
- Medicinal plants cultivation should be encouraged.
- Alternative employment programme for tribals living in forest is available.
- Water and soil testing lab is available.
- Soil quality management is essential.
- Organic farming increases profit.
- Commercial agriculture should be practiced.
- Bio-control of insects.
- Drip/sprinkler irrigation is to be used to safe guard water sources.
- Only in 1996 Gundar river basin was identified.
- 6000km^2 area covers five districts viz. Virudhunagar, Padukkotai, Madurai, Sivagangai and Ramnad.
- Juliflora is the main problem in irrigation tanks.
- Sewage from Madurai pollutes Gaundar River. A sewage treatment plant should be implemented for treating the sewage.
- Sewage fed fish culture should be encouraged.
- 40% of the land lacks water supply.
- Change in mentality of stakeholders needed.
- Stakeholders should avoid Juliflora plant cultivation.
- Juliflora should be eradicated from the irrigation tanks.
- Juliflora depletes ground water and spoils the well irrigation.
- Juliflora consumes water equal to sugarcane.
- Juliflora consumes 4500 crores worth of water/year. Eradication of Juliflora is highly essential to safeguard the water resources.
- Encroachment in irrigation canals.
- Maintenance of irrigation canal needed.
- Fish culture, livestock rearing training required.
- Land reclamation required for agricultural purposes.
- Modern agricultural facilities should be implemented.
- Air pollution due to brick kiln.
- Needs training in medicinal plants cultivation.

- Sand mining should be avoided.
- Storage facilities for agriculture crops.
- Encroachment in irrigation canal should be removed.
- 50% of people migrated to Madurai city for employment.
- Madurai city sewage farm pollutes the ground water.
- SHG should go for live stock rearing.
- Flower cultivation is the main crop.
- Alagar Firm-pollutes the air up to 5 km radius- it should be rectified.
- Due to drought, fodder depleted, live stock rearing dwindled.
- No facilities for disposal of house hold wastes.
- Drinking water problem is prevalent.
- Menace of Juliflora in the irrigation tanks and all irrigation infrastructures.
- Encroachment of supply canals should be removed.
- Biogas plant can be set up connecting public toilets.
- Regulated market for agriculture products needed.
- Vocational training for adolescent girls needed and Loan facilities should be arranged for farmers.
- Agriculture of this area dwindled.
- Agro industries need to be setup.
- More dams to be constructed e.g. Algar Anai.
- Cold storage facilities for vegetables and fruits.
- Training and funding is required for value added agricultural products.
- Every village must have a tank to hold the rainwaters harvesting.
- Marketing of medicinal plants without mediators.
- Training on value addition of cucumber needed.
- Demonstration farm for Jetropa plants.
- Transportation facilities and road facilities must be created to take care of agriculture products to Madurai market.
- Encroachments in the irrigation infrastructure should be removed.
- Tank should be renovated only by the farmers association.
- Ground water is hard in nature and correct advise of crop cultivation using that water is needed.
- Problem in the paddy procurement by Government.
- Environmental up gradation required.
- De-silting of irrigation tank

Social Issues:

- Increase of malaria is high in Ramanathapuram, Kamarajar and Pasumpon Muthuramalinga, Thevar districts.
- Migration due to unemployed.
- Separate tanks for livestock must be identified.
- Live stock rearing should be promoted.
- Marketing agri-products needed.
- Up gradation of present school status.
- Flower cultivation and tissue culture.
- Toilet facilities needed to maintain sanitation.

- Training needed on alternative crop cultivation.
- No cattle rearing, only goat rearing.
- Self-employment facilities may be arranged.
- Worst sanitation problem in the village.
- Prevalence of disease due to worst sanitation.
- More bore wells needed for drinking water supply.
- Cattle washing in the drinking water well should be prevented.

Recommendations:

- Self Help Group among females should be motivated
- Toilets are required
- Training in Jaggery preparation, Tailoring for adolescent girls is needed.
- Goat rearing along with social forest develop must be implemented Poultry farming should be promoted.
- Milk society should be created.
- Action may be taken to treat the effluent from the industries.
- Action may be taken to treat the domestic sewage from municipalities for developing fodder for cattle instead of leaving them raw in open space and watercourses.
- Action may be taken to bring more area under forest cover.
- Hospital facilities needed

16. Perambalur (Vellar Basin)

Environmental issues:

- Air pollution is above the permissible level in the vicinity of Ariyalur cement factory.
- There are number of sago industries located near Chinna Salem releasing the effluents directly into the river.
- Milk chilling plants near Chinna Salem discharges its effluent with out treatment.
- The Mangroove forest existing in the mouth of Vellar River joining with sea is at present being disturbed by human intervention.
- The air surrounding the sago factories and milk chilling plants near Chinna Salem is having foul smell.
- The major industries pollute the atmosphere is the Naively Lignite, Thermal Power Stations.
- Few pockets, which are facing water shortage even for meeting the domestic needs. They are Chinna Salem and few villages in Kallakurichi block.
- The quality of ground water is saline and the surface water is polluted.
- Sand mining is predominant.
- Plastic waste dumped in to the tank
- Industries in and around Vridhachalam lot of chemical industries, acid-manufacturing units pollutes both surface and ground water.

Social Issues:

- Water borne diseases such as acute diarrhea, cholera, jaundice and water related diseases like malaria are reported in this area.

- There is no laboratory facility in the primary health center
- Inadequate teachers in the schools
- Most of the farmers are marginal and small and they were engaged in quarry works as a coolie for a low wage
- Drinking water should be properly treated.

Recommendations:

- Facilities should be created for the Solid waste management.
- A separate website should be created to know the marker prize and the new technologies available in the field of agriculture, horticulture and agricultural engineering.
- Close patrolling may be needed to prevent this short of human intervention to save the Mangroove forest.
- Action may be taken to treat the effluent on the open grounds and they create water pollution.
- Sewage Treatment Plant should be installed for treating the sewage.
- Production of agro based products like Pickles, medical plant, Banana plats, milk-based product etc should be encouraged.

17. Tiruvallur (Kosasthalaiyar Sub Basin)

Environmental issues:

- In a context of rapid industrial growth and vast urban expansion, cities experience a severe stress due to factors such as scarcity of land for urban use, pollution, lack of adequate drinking water and sanitation.
- Degradation of coastal ecology and seawater intrusion. In most of the situations, with a view to reducing stress, metropolitan cities eat into peri-urban areas. This builds up pressure and often results in conflicting interests in the use of natural resources in peri-urban areas.
- Deforestation, industrialist ion and urbanization have led to ecologically unsustainable practices.
- Over extraction of Ground water Notable well fields in these river basins are Minjur (about 120 agricultural wells have been converted into water selling wells), Thamaraippakkam (over 50 agricultural wells) Panjetty (over 100 agricultural wells), Kanigapper (60 agricultural wells) and Poondi. Kadambathur (80 agricultural wells). However, sustainability of these basins is a big question mark due to round the clock pumping in these areas. It was apparent from our preliminary field visits in these areas that many agricultural wells and many wells, which were supplying water to the Chennai city, have become dry.
- Moreover, due to nearness to the sea, seawater intrusion has already reduced the quality of groundwater in these areas. In several places, farmers and local people are agitated over round the clock pumping of groundwater from agricultural wells to the city needs.
- Forest department is planting Casuarinas and Mangrove in the coastal area of Tiruvallur.
- Emphasized the importance of bio shield during the natural calamity.

- Recent Tsunami has resulted in seawater intrusion in the coastal villages of Tiruvallur.
- Agricultural Department is promoting Bio-diesel plants extensively. Mohan Brewery is the authority agent to receive the bio diesel plant. The initial cost of investment is Rs.6000 and the final product sold in the market for Rs. 25000. The southern railways is using bio-fuel plan for running the train.
- Usage of fertilizer is getting reduced.
- Linkage should be created between the farmer and the agricultural department for a better agricultural practices.
- Sand mining is prevalent.
- Ground water quality has been changed due to water mining and decline the ground water due to sand mining.
- Illegal occupation in the catchment areas.
- Drinking water problem in Thiruvallur, Poondi etc.
- Dying factory located in the R.K.pet, Pallipattu, polluted the waterways.
- Water pollution due to dying factory and other industries.
- Untreated sewage is released in the river

Social Issues:

- Water borne diseases such as acute diarrhea, cholera, jaundice and water related diseases like malaria are reported in this area.
- Separate tanks for livestock must be identified.
- Live stock rearing should be promoted.
- Marketing agri-products needed.
- Needs direct marketing facilities.

Recommendations:

- Fencing of water bodies meant for drinking water.
- Promotion of Self Help Groups (SHG) in cottage industries and marketing.
- Training programmes on honeybee cultivation, vermiculture, seed marketing technology, tissue culture, fish and mud crab cultivation.
- Facilities for seed making technology.
- Transportation/collection facilities for small scale cow milk producers.
- Industrial and municipal waste water should be treated and reused.
- Action plan may be drawn to improve the agricultural productivity by adopting the suitable crops for these areas under modern technology.
- Tank should be renovated, de-silted
- Encroachments in the canal, lakes and in the catchment areas should be removed
- Interlinking catchments to water shed area and it also recharges the groundwater
- Catchment area should be increased by desilting the tank
- Illegal occupation should be removed from the tank, canal.
- Training should provide on crop diversification and use of modern agricultural implements to the farmers.
- Awareness programmes on various issues like vermicomposting, herbal products and drip and sprinkler irrigation systems to the farmers.

- De-siltation of tanks required.
- Channel should be lined.
- Encroachments should be cleared through the revenue department.

Social and Environment Management Framework (SEMF) is prepared based on the environmental and social issues arising out of the stakeholders' consultations and the project interventions and presented in detail in the next chapter.

7 SOCIAL AND ENVIRONMENTAL MANAGEMENT FRAMEWORK

7.1 Introduction

The project will support the efforts of the Tamil Nadu Government to strengthen the water resources management. This project includes broadly- irrigated agriculture modernization and water resources management. In order to deal with the adverse impacts, the preparation of social and environmental framework has been undertaken. This has to be implemented by the Project Implementing Agency (PIA) and their staff and apply to all proposed sub-project activities through all stages of the project cycle for incorporation of environmental and social management measures. Good social and environmental management practice is a well –established element of project preparation and implementation. It is more important in the context of an effective water resources management where additional criteria must be considered such as physical investments, besides capacity building. Development of the SEMF therefore attempts to respond to the needs of the rehabilitation and the opportunities provided by it. It also contains Action Plans for various key issues like Dam Safety, Pest Management, Cultural Property Management, Rehabilitation & Resettlement, Tribal Issues, Gender Issues and Community Sensitization that need to be addressed through the project. The SEMF has to be further modified based on the lessons learnt from the first year projects.

7.2 Overview of TNWRCP and IAMWARM projects

Tamil Nadu has implemented a World Bank financed Water Resources Consolidation Project (WRCP) from 1995-2004. The WRCP project has contributed to improving the environment by developing a State Environmental Planning Framework, by creating an Environmental Cell (EC) in the office of Chief Engineer (Plan Formulation), formation of three WRO EC divisions as focal points for environmental activities in the WRO, creating and strengthening an environmental wing at the Institute of Water Studies (IWS). A special unit in the PWD Secretariat has been created for Land Acquisition and Economic Rehabilitation (LAER). Water Resources Research Fund (WRRF) capitalizing on the success of the WRRF established in the TN WRCP, this investment would expand the activities undertaken using the fund for targeted studies, awareness raising and applied research on key water and irrigated agriculture issues (including related environmental and social development issues) facing the State. Consideration of multi-sectoral aspects of water resources development has been enhanced through the Water Resources Research Fund (WRRF). National and International training was given by the project to improve capability in water planning and management. Agricultural productivity has been improved by rehabilitation and system improvement, organization of farmers and turnover of operation and maintenance (O&M) to water user's association (WUAs) in 16 major and medium irrigation systems, 25 minor schemes and 620 non-system irrigation tanks, covering 638,000 ha. Nine unfinished schemes undertaken by the State have been completed to serve a further 16,000 ha, considerably enhancing agricultural production. The estimated increase in agricultural production due to the project would include 376,900, t/year of paddy and 31,000, t/year of groundnuts.

Tamil Nadu is one of the driest States in India, averaging only 925 mm of rainfall a year. Per capita availability of water resources in Tamil Nadu is only 900 cubic meters a year, compared with 2,200 cubic meters for all of India. The State's dry season lasts five months (January through May) even in good years, and severe droughts occur in 3 of 10 years, severely limiting cultivation of crops between June and September. A recent series of droughts and water shortages has highlighted the importance of good water resources and irrigation management. Tamil Nadu's geographic area can be grouped into 17 river basins, a majority of which is water-stressed. There are 31 major river basins, about 40,000 tanks (traditional water harvesting structures) and about 3 million wells that heavily utilize the available surface and ground water. Irrigation through a combination of canals, wells, and tanks increase the reliability and availability of water for farming and is essential for cultivating crops in much of the state. Rainfed agriculture, employing approximately 25% of farmers, accounts for 46% of the net sown area of 5.5 million hectares. The agriculture sector faces major constraints due to dilapidated irrigation infrastructure coupled with water scarcity (both quality and quantity) due largely to growing demands from industry and domestic users for surface water resources. The rate of extraction of ground water has exceeded recharge rates, resulting in falling water tables. Water quality is also growing concern. Effluents discharged from tanneries and textile industries and heavy use of fertilizers and pesticides have had a major impact on surface water quality, soils and ground water. Long-term growth in agriculture and rural income depends in large part on increasing efficiency of use of water.

In addition, diversification into higher value, less water-intensive products, such as fruits, vegetables, spices and lives stock products, may be one of the most promising sources of agricultural growth. Tamil Nadu's agro-climatic conditions are well suited for diversified agriculture. Rapidly increasing incomes and changing patterns of food demand also provide strong inputs for diversification. The increased agricultural diversification in higher value processing is likely to generate new rural non-farm employment opportunities. Increased availability of water and greater efficiency of water use in the dry season (for example, through the widespread adoption of drip irrigation) could enable cultivation of crops year-round, providing employment in agricultural production and processing, benefiting the rural poor. Improving efficiency of water use and diversification requires improved irrigation service delivery together with better resource management measures.

The IAMWARM project is a successor to the recently completed TN WRCP. The key focus areas of IAMWARM are - irrigated agriculture modernization and water resources management to improve the productivity of water.

IAMWARM Sub-Basin Project Cycle: Environmental and Social Aspects

Table 7.1 IAMWARM Sub-Basin Project Cycle

Stage	Key Activities
Pre-Planning	• Collation of available social and environmental information (incl. on demography, water uses, pollution, resource management, sand mining, etc.) • Preparation of thematic maps on environmental and social issues • Initial consultations with various groups to determine key project stakeholders
Planning	• Consultations on issues and options (ensuring participation of all key stakeholders) • Participatory development (with analytical input) of Sub-basin Development and Management Plans and procurement documents • Facilitation of participatory drafting of MOU
Appraisal	• Gender Issues • Tribal Development • Pest Management • Natural Habitats • Land acquisition/R&R • Participatory Irrigation Management • Construction-related
Implementation	• Community contracting • Community supervision • Monitoring any unforeseen environmental or social impacts
Post-Implementation	• Identify linkages and further work to improve social and environmental sustainability • Reflect environmental and social issues in the Implementation Completion Report for the Sub-basin

7.3 Social and Environmental Management Framework (SEMF) for the IAMWARM Project

The SEMF and its recommendations are not intended to be a separate stand-alone exercise that would risk being "out-of-sight". The SEMF, along with the re commendations of the Pest Management Plan, Resettlement Action Plan, Tribal Development Plan and Gender Action Plan is to be mainstreamed into project activities and treated as an integral part of the IAMWARM planning, implementation and monitoring. The plans presented should help ensure compliance with GOI, GoTN and World Bank policies and procedures on environmental and social safeguards.

Table 7.2 SEMF

Component: A **Irrigated Agricultural Modernization**					
Project Interventions **(1)**	**Environmental**		**Social**		
	Potential Negative Environmental Impacts **(2)**	**Mitigatory Measures** **(3)**	**Potential Negative Social Impacts** **(4)**	**Mitigatory Measures** **(5)**	**Responsible Agency** **(6)**
1. Modernization of Irrigation Infrastructure (System/non-system/ rain fed tanks, distribution system, pump set efficiency)	• Accumulation of debris due to desiltation. • Flooding during periods of heavy rains • Water scarcity during periods of drought. • Induced impact of increased pesticide and fertilizer use	• Spreading the debris and leveling the banks of water bodies. • Inter connectivity of canals, feeder channels, tanks etc in the basin • Monitoring and maintenance of water distribution mechanisms • Promoting organic farming with improved training.	• Decrease in drinking water quality due to accumulation of minerals • Possibility of water borne diseases • Social hierarchy in harnessing water sources causing disturbed social relations. • Lapses in coordinating and strategizing the irrigation infrastructure may cause periods of	• Establishment of Mini water treatment units. • Creating awareness for hygiene and community participation in common property resource management.	• WRO/MDPU • Dam Safety Department etc.

	• Increase in over all use of water resources • Likelihood of breaches to dams and tanks. • Dilapidated dams pose a hazard through breaching and over flows.	• Awareness campaigns in water conservation • Making inventories of geological and physiographical features using GIS. • Dam safety through rehabilitation and maintenance is required. Detailed dam safety plan is at Annexure III. • Proper designing and maintenance of dams and tanks, and quality control.	food systems failure.	• Ensuring equitable distribution of water through WUAs.	
2. Institutional modernization for irrigation agriculture (asset inventory; management plans for dams, tanks and irrigation infrastructure; agricultural, horticultural, livestock and fisheries data; and Modernization of	• Risk of crop failure and low yield of horticultural produce. • Infestation by pests. • Depletion in fish resources.	• Selection of suitable crops for both mono-crop and poly-crop irrigated agriculture and promoting organic Farming. • Effective measures as per the Pest Management Plan, which is annexed at IV.	• Lack of full-fledged data on physiographical, ecological and traditional knowledge systems and lack of sharing and coordination will be an impediment to the effective implementation of the project. • Malnutrition, impact on income and livelihood • Tank System: Tanks have played an important role in the	• As a safe guard alternative sources of livelihood management in non-farm activities like tailoring, leaf plates, candle making, and computers need to be taken care of. • Collection,	• Agriculture University and Agriculture Department • Fisheries Department • Social Welfare Department • Horticulture Department

documentation, computerization, LAN and WAN, Information management and sharing, public interaction, coordination of line departments)		• Treatment of industrial effluents and pollutants to prevent contamination of the water bodies in the drainage system. • Reducing the organic pollution • Using fish waste as chicken feed • Control of water weeds, mosquitoes	culture of a community and several cultural and religious customs and rituals are intertwined with the sacrality of the tank. The project interventions may affect some cultural properties located on or next to the 'tank structure' (e.g. on the tank bund, in the tank bed). However measures taken to improve the tank system will be taken favorably by the village community, if the scarcity of cultural landscapes is not disturbed. Cultural property management is Annexed at V. • Knowledgebase and Analytical improvement.	compilation, upgradation,computerization and sharing of data relating to census of human population and livestock, forests, agriculture, horticulture and fisheries would help in developing right strategies for sustainability of the project. • Access to the fish seeds has to be improved. For the enhancement of livelihood recreational facilities may be improved along with fish seed banks,	

				farm ponds, fisheries in reservoirs cage fishes, ornamental fishes. Market information may be included in the kiosks. • Care should be taken in not disturbing the sacrality and emotional bondage to burial grounds, shrines of folk deities on tank bed, small places of worship on tank embankment, temples close to the waste weir and sacred trees/groves due to project interventions. •Knowledgebase	

				and analytical skills of the line department officials has to be improved in the areas of GIS, Modeling and Irrigation schedule/ Real time forecasting model etc.	
3. Agricultural Diversification Fisheries, Horticulture, Livestock.	• Pesticide & fertilizer use: Although the project will not finance fertilizers and pesticides, induced impacts of increased fertilizer and pesticide use (mainly because of diversification of cropping patterns and increased cropping intensity) will probably take	• It is proposed to strengthen awareness and training activities for integrated pest management on use of organic manure, etc for both the command and catchment farmers. (Pest Management Plan is at Annexure IV)	• Although the proposed project activities may not cause or induce any significant adverse impacts on the public health front, contaminated drinking water source may create health problems.	• The proposed project provides an opportunity to enhance the management of preexisting public health concerns in the basin.	WRO/TNAU Dept. of Fisheries, Agriculture, Horticulture Agricultural Engineering Department

	place in the project area - in both the command and catchment areas due to agricultural extension activities.				
4. Sustainable Agriculture Modernization (cropping systems diversification and management, integrated pest and nutrient management, public private partnerships.	• Risk of crop failure due to non-adoptability of certain crops to different soils and agro-climatic zones.	• Diversification of cropping system needs to be undertaken using the expertise and knowledge of the local farmers and agricultural extension workers. • Nutrient management and pest control using indigenous knowledge base and organic farming combined with modern pest management techniques needs to be adopted.	• Lack of adequate price structure and procurement mechanisms to promote income generation to the farmers leads to exploitation by middlemen and uncertain market conditions.	• Public-private partnerships may be promoted to facilitate storage facilities; direct market linkages (like Rythu Bazars in AP) and access to IT kiosks would help in getting fair price to the farmers.	MDPU/WRO

Component: B **Water Resources Management**					
1. State Level interventions: Effective implementation of the Policies/Acts related to the Resource regulatory mechanisms.	Though the proposed project won't lead to the following issues, State Level Committees must address the issues like • Encroachment of catchments, riverbeds, supply channels, tank beds. A separate strategy for the tribal development has to be adopted as per the Tribal Development Strategy annexed at VII.	• A separate Resettlement Action Plan has to be adopted as per the Resettlement Framework is at Annexure VI.	• Watershed Management • Waste Land Development	• Inter linking of supply channels has to be taken up. Creation of percolation tanks to hold run-off water must be implemented and maintained. • Waste lands in the sub basin should be used for horticulture crops/bio-diesel plants with less water and using organic farming.	MDPU/WRO Dept. of Agriculture/ Animal Husbandry/Forest
2. Basin Level interventions: Execution of the State's Policies.	• Sand mining	Non judicial and excessive sand mining has to be controlled. Mining to be regulated in the riverbed considering the following:			

		• Sand to be mined evenly in the river bed without detrimental to the natural aquifer and the ground water at that location • Flow in the river to down stream should not be affected due to mining. • Quantum of replenishment of sand every year at the location is to be assessed and mining to be planned.	• Women's Issues • Livestock reduction • Lack of market linkages	• Measures have to be taken in accordance with the gender action plan annexed at VIII. • Livestock provision and management • Farmers have to be linked with the IT kiosk for information and backward and far ward linkages has to be established.	
	• Ground water quality	• Dye effluents, sand mining etc has degraded the ground water quality. CETP/STPs have to be established wherever necessary and illegal sand mining has to be controlled.	• Drinking water problem	• Establishment of mini treatment plans to supply safe drinking water.	
	• Sea water intrusion	• This can be achieved by controlling sand mining and minimizing	• Public Health	• Waterborne diseases has to be controlled	

	• Deforestation	the extraction of ground water. • Afforestation of barren & hilly slopes should be carried out. To protect forests the following are to be considered • Active participation of local population through VSSs for regenerating degraded forests. • Implementation of eco development programmes	• Lack of awareness/information • Deforestation of the Mangrove, grass lands and savannah wood lands, the characteristic floristic zones in these river basins, has affected the subsistence and survival strategies of the indigenous people like Irulars, Kanikars, Paliyans, Sholagas and Nari Kuruvas who depend upon these forests for wild plant foods, honey, small game and minor forest produce.	through action plans and awareness campaigns • Farmers have to be enlightened on environmental issues • Regeneration of these forested eco systems would not only benefit the indigenous peoples but also helps bio-diversity conservation. • Developing social forestry to meet the demand for the fuel wood and fodder.	

	• Siltation	Desilting must be done regularly. This silt and sediments cause not only the reduction in the storage capacity of the lake, but also accumulation of the nutrients that promote pollution of lake water and luxurious growth of aquatic weeds, algae and bio-organisms. To avoid this desilting and dredging work has to be given importance			
	• Aquatic weed, viz., Hyacinth, Ipomea and Prosopis	• . The weeds along with channel courses can be removed by mowing using power equipment provided the banks of channels are relatively smooth and not too steep. The mowing operation is usually required at rather frequent intervals to control weed growth. • A heavy chain attached between two tractors can be dragged down the			

		channel for removing the weeds grown in it. The chain tears the rooted weeds from the bottom. • The weeds can be controlled chemically by spraying 2,4-D, glyphosate or paraquat weedicides as post emergence herbicides. However, in the use of above chemicals for the control of these weeds, special care is required as all these chemicals are unsafe to crops grown in the command area and fish life. It is recommended that spraying of 2,4-D can be taken up in the dry season or when there is no water in the channel or during the agricultural off seasons. • In small areas or lightly infested areas, the best way to control all these weeds is by manual weeding.			

	• Solid waste Management	Steps should be taken to control the dumping of coir and domestic wastes in the canals. The principal methods of refuse disposal are: • Dumping • Controlled on sanitary land fill • Incineration • Composting • Manure pits • Burial			
3. Water Resources Research Fund Suggested Studies are • Degradation of catchments area and its impact on the river basin • Sustainable use of Ground Water • Crop Diversification and optimal crop pattern • Status and feasibility of Integrated Pest Management (IPM) and Organic forming • Study of aquatic Eco System • Project impact on socio-economic issues of the Basin • Need assessment Studies.					

7.4 Social and Environmental Management Framework (SEMF) for the IAMWARM Project-Sub-Basin wise.

Table 7.3 SEMF for the IAMWARM project

Sl. No	Main River Basin	Sub Basin	Environmental Issues	Social Issues	Mitigatory Measures	Responsible Agency
1	Chennai	1.Kosasthalaiyar	• Industrial Pollution • Sea water intrusion • Sand Mining • Siltation • Coastal erosion • Weed growth • Industrial effluents • Domestic Sewage • Over exploitation of ground water • Dumping of debris into tanks	• Encroachment • Poor sanitary conditions • Skin allergies • Mosquito breeding due to water stagnation • Elephantiasis	Watershed management, waste land development and awareness campaigns on various aspects for hygiene and community participation may be taken up. Banks of water bodies maybe leveled after spreading the debris and silted material. Desilting must be done regularly and dredging work has to be given importance. Non-judicial and excessive sand mining has to be controlled and regulated. Seawater intrusion can be prevented by controlling sand mining and minimizing the extraction of ground water. The weeds can be removed by using power equipment at frequent intervals. Rehabilitation programme may be taken up for the encroachers.	EC Division, Chennai, MDPU/ Dept of Public Health

2	**Palar**	2. Cheyyar	• Ground water contamination • Dying Effluents In Arni Taluk • Water contamination due to Kattamanku • Sand mining • Domestic Sewage • Water weeds	• Poor literacy • Anthrax in cattle • Farmers opposition to vaccination	CETP may be established. Non-judicial and excessive sand mining has to be controlled and regulated. Steps should be taken to control the dumping of coir and domestic wastes in the canals. The weeds can be removed by using power equipment at frequent intervals. Awareness campaigns on various aspects for hygiene and community participation may be taken up.	• TNPCB /EC Division, Chennai, MDPU

		3. Kliyar	• Sand mining • Domestic sewage • Ground water depletion due to industries • Sea water intrusion • Sugar mill effluents • Water weeds • Lack of sewage treatment plant	• Seasonal migration • Poor marketing facilities • Poor literacy • Poor sanitary conditions • Problems due to mosquitoes and pigs	Non-judicial and excessive sand mining has to be controlled and regulated. Seawater intrusion can be prevented by controlling sand mining and minimizing the extraction of ground water. The weeds along with channel courses can be removed by using power equipment at frequent intervals. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Farmers have to be linked with the IT kiosk for information and backward and far ward linkages Awareness campaigns on various aspects for hygiene and community participation may be taken up.	EC Division, Chennai, MDPU/ Dept. of Agriculture/Dept. of Public Health etc.

3	**Pennaiyar**	4. Chinnar 1 a	• Domestic sewage • Poor solid waste management • Drinking water pollution due to drainage water. • Sand mining • Soil erosion • Water weeds	• Live stock reduction • Poor sanitary conditions • Poor literacy • Water borne diseases	Non-judicial and excessive sand mining has to be controlled and regulated. Mini water treatment plants may be established. Steps should be taken to control the dumping of coir and domestic wastes in the canals. The weeds along with channel courses can be removed by using power equipment at frequent intervals. Livestock provision and management Awareness campaigns on various aspects for hygiene and community participation may be taken up.	EC Division, Chennai, MDPU/ Dept. of Animal Husbandry, / Local Bodies

		5. Chinnar 1 b	• Sand mining • Water contamination • Domestic sewage • Water weeds • Textile effluents	• Seasonal migration • Live stock reduction • Poor sanitary conditions • Health problems	Non-judicial and excessive sand mining has to be controlled and regulated. The weeds along with channel courses can be removed by using power equipment at frequent intervals. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Livestock provision and management Awareness campaigns on various aspects for hygiene and community participation may be taken up.	EC Division, Chennai, MDPU/ Dept. of Agriculture/ Animal husbandry / Public Health

		6. Pennaiyar to Krishnagiri	• Water pollution due to industries • Mango processing effluents • Sand mining • Poor solid waste management	• Health problems • Live stock diseases • Encroachments	Non judicial and excessive sand mining has to be controlled and regulated. Awareness campaigns on various aspects for hygiene and community participation may be taken up. Rehabilitation programme may be taken up for the encroachers	EC Division, Chennai, MDPU/ Dept .of Animal Husbandry / Public Health

		7. Pambar	• Municipal sewage • Sago industrial effluents • Water weeds	• Seasonal migration • Live stock reduction • Poor sanitary conditions • Encroachment	Steps should be taken to control the dumping of coir and domestic wastes in the canals. The weeds along with channel courses can be removed by using power equipment at frequent intervals. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Livestock provision and management Awareness campaigns on various aspects for hygiene and community participation may be taken up	EC Division, Chennai, MDPU/ Dept..of Animal Husbandry / Public Health

		8. Vaniyar	• Municipal sewage • Sago industrial effluents • Sand mining	• Seasonal migration • Live stock reduction • Poor sanitary conditions	Non-judicial and excessive sand mining has to be controlled and regulated. Steps should be taken to control the dumping of coir and domestic wastes in the canals Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Livestock provision and management Awareness campaigns on various aspects for hygiene and community participation may be taken up	EC Division, Chennai, MDPU/ Dept..of Animal Husbandry / Public Health

		9. Musukundanadhi	• Municipal sewage • Sand mining • Lack of sewage treatment plant	• Seasonal migration • Live stock reduction • Poor sanitary conditions	Non judicial and excessive sand mining has to be controlled and regulated. Steps should be taken to control the dumping of coir and domestic wastes in the canals. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Livestock provision and management Awareness campaigns on various aspects for hygiene and community participation may be taken up.	EC Division, Chennai MDPU/ Dept..of Animal Husbandry / Public Health
4	**Varahanadhi**	10. Varahanadhi	• Mining of rocks • Municipal sewage • Sand mining • Water weeds	• Seasonal migration • Live stock reduction • Lack of awareness	Non judicial and excessive sand mining has to be controlled and regulated. Steps should be taken to control the dumping of coir and domestic wastes in the canals.	EC Division, Chennai MDPU/ Dept..of Animal Husbandry

					Weeds can be removed by using power equipment at frequent intervals. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Livestock provision and management Awareness campaigns on various aspects for hygiene and community participation may be taken up	
5	**Vellar**	11.Manimutha nadi	• Coconut trees are affected due to water pollution • Sand mining • Over exploitation of ground water	• Social conflicts • Inadequate school teachers • Anthrax in cattle	Non judicial and excessive sand mining has to be controlled and regulated.	EC Division, Chennai MDPU

		12. Kil Vellar	• Municipal sewage • Effluents from sugar industries • Lack of sewage treatment plants	• Seasonal migration • Live stock reduction • Poor drinking water supply and sanitation	Steps should be taken to control the dumping of coir and domestic wastes in the canals Mini water treatment plants can be established. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Livestock provision and management Awareness campaigns on various aspects for hygiene and community participation may be taken up	EC Division, Chennai MDPU/ Dept..of Animal Husbandry/ Dept.of Public Health

		13. Upper Vellar	• Sago industrial effluents • Sand mining	• Seasonal migration • Live stock reduction • Poor drinking water supply and sanitation • No marketing facilities	Non judicial and excessive sand mining has to be controlled and regulated. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Livestock provision and management Farmers have to be linked with the IT kiosk for information and backward and far ward linkages	EC Division, Chennai MDPU/ Dept..of Animal Husbandry/ Public Health/ Agriculture

		14. Swethanadhi	• Ground water pollution • Sand mining • Air pollution due to cement factory	• Seasonal migration • Live stock reduction • Poor drinking water supply and sanitation • No marketing facilities • Problem of mosquitoes	Non judicial and excessive sand mining has to be controlled and regulated. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Livestock provision and management Farmers have to be linked with the IT kiosk for information and backward and far ward linkages Awareness campaigns on various aspects for hygiene and community participation may be taken up	EC Division, Chennai MDPU/ Dept..of Animal Husbandry/ Dept.of Public Health/ Dept.of Agriculture

		15. Chinnar	• Ground water pollution • Sand mining	• Seasonal migration • Live stock reduction • Poor drinking water supply and sanitation • Females affected by cancer	Non judicial and excessive sand mining has to be controlled and regulated. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Livestock provision and management	EC Division, Chennai MDPU/ Dept..of Animal Husbandry/ Public Health/
		16. Anivari	• Ground water pollution • Sand mining • No proper solid waste management	• Seasonal migration • Live stock reduction • Poor drinking water supply and sanitation	Non judicial and excessive sand mining has to be controlled and regulated. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Livestock provision and management	EC Division, Chennai MDPU/ Dept..of Animal Husbandry/ Dept.of Public Health/

6	**Agniar**	17. Agniar	• Excessive nitrate concentration • Juliflora growth • Poor solid waste management • Soil erosion • Excessive use of chemical fertilizers	• Seasonal migration • Reduction in grassing land and live stock • Low literacy rate, no marketing facilities • Poor sanitary conditions	Steps should be taken to control the dumping of coir and domestic wastes in the canals weeds can be removed by using power equipment at frequent intervals. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Awareness campaigns on various aspects for hygiene and community participation may be taken up	EC Division, Coimbatore MDPU/ Dept..of Animal Husbandry/ Public Health/ Agriculture

		18. Ambuliar	• Juliflora growth • Sand mining • Excessive use of chemical fertilizers	• Seasonal migration • Active SHGs • School drop outs • Poor sanitary conditions	Non judicial and excessive sand mining has to be controlled and regulated. weeds can be removed by using power equipment at frequent intervals. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Special school drive programmes may be takenup. Awareness campaigns on various aspects for hygiene and community participation may be taken up through SHGs.	EC Division, Coimbatore MDPU/ Dept..of Animal Husbandry/ Public Health/ Agriculture

		19. South Vellar	• Juliflora growth • Sand mining • Over exploitation of ground water	• Seasonal migration • Women empowerment-SHGs • No health care centers	Non judicial and excessive sand mining has to be controlled and regulated. weeds can be removed by using power equipment at frequent intervals. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.	EC Division, Coimbatore MDPU/ Dept..of Animal Husbandry/ Dept.of Public Health/
7	**Parambikulam Aliyar Project**	20. Parambikulam Aliyar	• Soil erosion • Siltation and deforestation • Sand mining • Pollution due to coir industries • Excess fluoride and nitrate concentration	• Improved livelihood due to coir industries • Decrease in live stock • SHGs • Water borne diseases	Desilting must be done regularly and dredging work has to be given importance Non-judicial and excessive sand mining has to be controlled and regulated. Livestock provision and management Awareness campaigns on various aspects for hygiene and community participation may be taken up	EC Division, Coimbatore MDPU/ Dept..of Animal Husbandry/ Public Health/

		21. Palar	• Soil infertility • Ground water pollution • Catchment area degradation	• Improved livelihood due to coir industries • Decrease in live stock • SHGs	Livestock provision and management	EC Division, Coimbatore MDPU/ Dept..of Animal Husbandry/ Dept.of Public Health/ Dept.of Agriculture
8	**Kottakaraiyar**	22. Kottakaraiyar	• Juliflora and ipomea growth • Soil alkalinity and erosion • Sand mining • Chlorides in ground water	• Migration and crop rotation • Skin diseases and health problems • Lack of small scale industries	Non judicial and excessive sand mining has to be controlled and regulated. weeds can be removed by using power equipment at frequent intervals. Migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Awareness campaigns on various aspects for hygiene and community participation may be taken up	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry/ Public Health/ Agriculture

		23. Saruganiar	• Juliflora and ipomea growth • Soil alkalinity • Chlorides in ground water	• Migration and crop rotation • Skin diseases and health problems • Lack of teachers	Weeds can be removed by using power equipment at frequent intervals. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Awareness campaigns on various aspects for hygiene and community participation may be taken up	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry/ Public Health/ Agriculture
9	**Pambar**	24. Pambar	• Juliflora growth • Surface water pollution • Ground water depletion	• Migration and crop rotation • Live stock reduction	Weeds can be removed by using power equipment at frequent intervals. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Livestock provision and management	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry/ Agriculture

10	**Vaigai**	25. Varaganadhi	• Juliflora growth • Sand mining • Salt water intrusion due to salt ponds • Siltation • Nitrate concentration in ground water • Reduction in fish population due to sewage	• Out seasonal migration • Reduction in live stock • Social conflicts • Lack of water storage facilities • No storage facilities for food grains • Prone to drought and floods	Non judicial and excessive sand mining has to be controlled and regulated. Weeds can be removed by using power equipment at frequent intervals. Desilting must be done regularly and dredging work has to be given importance Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Common storage facilities may be established. Awareness campaigns on various aspects for hygiene and community participation may be taken up	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry/ Agriculture

		26. Sathaiyar	• Juliflora and ipomea growth • Sand mining • Soil erosion • Air pollution due to flour mills • Mixing of sewage into tanks	• Out seasonal migration • Reduction in live stock • Social conflicts • Encroachments • No marketing facilities • Health problems due to sewage	Non judicial and excessive sand mining has to be controlled and regulated. Weeds can be removed by using power equipment at frequent intervals. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Awareness campaigns on various aspects for hygiene and community participation may be taken up Livestock provision and management	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry/ Public Health/ Agriculture

		27. Varattar – Nagalar	• Juliflora growth • Sand mining and soil erosion • Poor solid waste management	• Out seasonal migration • Reduction in live stock • Social conflicts • Health problems	Non judicial and excessive sand mining has to be controlled and regulated. Weeds can be removed by using power equipment at frequent intervals. Steps should be taken to control the dumping of coir and domestic wastes in the canals Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Livestock provision and management Awareness campaigns on various aspects for hygiene and community participation may be taken up	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry/ Public Health/

		28. Manjalar	• Juliflora and ipomea growth • Sand mining and soil erosion • Siltation • Air pollution due to flour mills • Mixing of sewage into tanks	• Out seasonal migration • Reduction in live stock • Social conflicts	Non judicial and excessive sand mining has to be controlled and regulated. Weeds can be removed by using power equipment at frequent intervals. Desilting must be done regularly and dredging work has to be given importance Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Livestock provision and management	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry/

		29. Lower Vaigai	• Juliflora growth • Sand mining and soil erosion • Salt water intrusion • Ground water salinity	• Out seasonal migration • Reduction in livestock • Social conflicts • No electricity • connections • Problem of pigs	Non judicial and excessive sand mining has to be controlled and regulated. Weeds can be removed by using power equipment at frequent intervals. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Solar lighting system may be established. Awareness campaigns on various aspects for hygiene and community participation may be taken up Livestock provision and management	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry/ Public Health/
11	**Gundar**	30. Upper Gundar	• Juliflora growth • Sand mining • Lack of water supply • Air pollution due to brick kilns	• Encroachment • Dry land agriculture reduction in live stock • Poor marketing and transportation facilities	Non judicial and excessive sand mining has to be controlled and regulated. Weeds can be removed by using power equipment at frequent intervals.	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry/ Agriculture

		31. Terkkar	• Excess fluoride and nitrate in Ground Water • Juliflora growth • Sand mining	• Encroachment of catchment area • Dry land agriculture • Reduction in live stock	Non judicial and excessive sand mining has to be controlled and regulated. Weeds can be removed by using power equipment at frequent intervals. Livestock provision and management	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry/ Agriculture
		32.Paralaiar	• Juliflora growth • Sand mining • Poor solid waste management • Water borne diseases	• Drought prone area • Migration • No marketing facility • No organized cattle farm • Reduction in live stock	Non judicial and excessive sand mining has to be controlled and regulated. Weeds can be removed by using power equipment at frequent intervals. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Livestock provision and management	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry/ Agriculture

12	**Vaippar**	33. Nichabanadhi	• Soil erosion, Siltation • Poor solid waste management • Dye industry effluents	• Dry land agriculture • Reduction in live stock • Women empowerment-SHGs • Inadequacy of teachers • Prevalence of child labour	Desilting must be done regularly and dredging work has to be given importance Steps should be taken to control the dumping of coir and domestic wastes in the canals Livestock provision and management.Teacher-student ratio may be increased along with bridge cources.	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry/ Dept.of Agriculture
		34. Kalingalar	• Sugar industrial effluent	• Dry land agriculture • Reduction in live stock • Women empowerment-SHGs	Common Effluent Treatment Plant (CETP) may be established. Livestock provision and management	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry
		35. Arjuna Nadhi	• Soil erosion • Sand mining	• Dry land agriculture • Reduction in live stock • Women empowerment-SHGs • No storing facilities	Non-judicial and excessive sand mining has to be controlled and regulated. Livestock provision and management Common storage facilities may be established.	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry/ Agriculture

		36. Sindapalli Odai	• Sedimentation • Sand mining • Soil erosion • Dumping of solid waste • Sewage pollution	• Dry land agriculture • Reduction in live stock • Women empowerment-SHGs	Non-judicial and excessive sand mining has to be controlled and regulated. Steps should be taken to control the dumping of coir and domestic wastes in the canals Livestock provision and management	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry
		37. Senkottaiyar	• Drought prone sub basin	• Dry land agriculture • Reduction in live stock • Women empowerment-SHGs	Drought Prone Area Development (DPAP) programmes may be implemented extensively. Livestock provision and management	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry

13	**Tamirapa rani**	38. Manimuthar	• Sewage pollution • Hospital waste dumping • Sand mining and Juliflora growth • Water logging • Encroachment of canal • Soil erosion •	• Migration • Reduction in livestock • Lack of marketing facilities • Encroachment of canal • Lack of cooperative milk society	Steps should be taken to control the dumping of coir and domestic wastes in the canals A separate Resettlement Action Plan has to be adopted for the encroachers. Weeds can be removed by using power equipment at frequent intervals. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Livestock provision and management	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry Agriculture

		39. Chittar	• Sewage pollution • Solid waste dumping • Sand mining and weed growth. • Siltation • Paper mill effluents	• Migration • Poor sanitary conditions • Malaria	Desilting must be done regularly and dredging work has to be given importance. Non-judicial and excessive sand mining has to be controlled and regulated. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Awareness campaigns on various aspects for hygiene and community participation may be taken up	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry/ Dept. of Public Health

		40 Lower Tamiraparani	• Sewage pollution • Solid waste dumping • Sand mining • Juliflora and weed growth • Sea water intrusion	• Migration • Poor drinking water facilities • Health problems • Lack of veterinary hospital	Non-judicial and excessive sand mining has to be controlled and regulated. Seawater intrusion can be prevented by controlling sand mining and minimizing the extraction of ground water. Steps should be taken to control the dumping of coir and domestic wastes in the canals Weeds can be removed by using power equipment at frequent intervals. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Awareness campaigns on various aspects for hygiene and community participation may be taken up	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry/ Dept. of Public Health

14	**Kothaiyar**	41. Pazhayar	• Salinity and alkalinity • Sand mining • Soil erosion • Poor solid waste management at tourist spots • Water weeds • Entry of untreated effluents • Juliflora growth • Agro industry effluents • Sea water intrusion • Increased use of chemical fertilizers • Ground water depletion due to excessive withdrawl by pepsi and coke companies	• Migration • Reduction in live stock • Women empowerment-SHGs • Poor sanitation and drinking water facilities, • Encroachment of river banks, tanks etc • Poor marketing facilities • High transportation costs	Non-judicial and excessive sand mining has to be controlled and regulated. Seawater intrusion can be prevented by controlling sand mining and minimizing the extraction of ground water. Weeds can be removed by using power equipment at frequent intervals. Migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Livestock provision and management	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry/ Public Health
15	**Nambiyar**	42. Nambiyar	• Sand mining • Dumping of solid and agricultural wastes • Sea water intrusion • Soil erosion • River bed degradation and	• Migration • Reduction in live stock • Women empowerment-SHGs • Poor sanitation and drinking water facilities	Non-judicial and excessive sand mining has to be controlled and regulated. Seawater intrusion can be prevented by controlling sand mining and minimizing the extraction of ground water. Seasonal migration can be	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry/ Public Health

			instability of stream course	• Agricultural labour scarcity	avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Awareness campaigns on various aspects for hygiene and community participation may be taken up Livestock provision and management	

Note: The above table is primarily based on the basin micro-level reports and stakeholders consultative meetings. It is suggested to prepare the micro level reports for the sub-basins.

7.5 Irrigation Scheduling Model

Irrigation scheduling is the process used by irrigation system managers to determine the correct frequency and duration of watering. Irrigation-scheduling scheme considers sensitivity of the crop to water stress at different growth stages.

The following factors may be taken into consideration:

1. Precipitation rate of the irrigation equipment
2. Soil infiltration rate.
3. Slope of the land being irrigated
4. Soil available water capacity
5. Current watering requirements of the plant.
6. Amount of time in which water or labor may be available for irrigation.
7. Timing to take advantage of projected rainfall

The goal in irrigation scheduling is to apply enough water to fully wet the plant's root zone while minimizing overwatering and then allow the soil to dry out in between waterings to allow air to enter the soil, but not so much that the plant is stressed beyond what is allowable.

In recent years, more sophisticated irrigation controllers have been developed. The devices that are helpful in irrigation scheduling are rain sensors, which automatically shut off an irrigation system when it rains, and soil moisture sensing devices such as tensiometers and gypsum blocks.

Real-time irrigation scheduling under limited water supply is considered. The goal is to develop an irrigation operation policy which maximizes crop yields and is responsive to current season changes in weather and other variables. As irrigation decisions are sequential and dependent on crop and soil water status, and also crop yields can only be known at the end of the season.

Irrigation scheduling model can increase irrigation efficiency and yield by proper timing and application of irrigation water. This is especially important in the conversion to improved irrigation systems, which have the potential to increase yields and irrigation efficiency, provided the concerned officials has to know how to manage the system through some form of irrigation scheduling.

Irrigation scheduling simulation models to perform the soil water balance using soil, crop and meteorological data and to provide information on the soil moisture status. Irrigators tend not to use climate based irrigation scheduling models, because of a lack of user friendliness of the models, lack of trust in the basic assumptions behind the models, and a lack of economic reward perceived by the irrigators if they were to take the time and effort to learn how to use the models. However, the use of models present serious difficulties for application in real time since they require not only validation but also a support advisory service and training of irrigation extensionists, managers and/or farmers.

7.5.1 Area of Application

- For automating irrigation at small and medium size farms.
- Suitable for drip and sprinkler irrigation.
- Can be used in Green Houses.

7.5.2 Advantages

- Adequate quantity of water and nutrients supply result in high yield.
- Low cost.
- It starts watering just at the right time.
- It stops the watering when field capacity is reached.
- It takes in to account the effective rainfall for scheduling irrigation.
- It saves water and labour cost involved with manual operation.
- No leaching of minerals and nitrogen vital for plants healthy growth.
- Eliminates the long term ill-effects of over irrigation causing development of salinity.
- The circuit can be interfaced to any resistance type soil moisture sensor
- There is option for soil moisture base irrigation scheduling or time based irrigation scheduling.

7.6 Real Time Forecasting Model

Agriculture is heavily weather dependent world over and is more so in tropical monsoon country like India. Further, India is one of the few countries in the world severely affected by cyclonic storms. Farming community needs to be advised in time by producing custom-tailored weather forecasts to initiate suitable measures to increase the production and minimise the losses as well. Agricultural contingency planning in real-time mode needs weather forecasts over agro-climatic zone level beyond the time scale of short-range weather forecasts.

Real time forecasting model is necessary for assured water supply. Forecasting should be done based on the seasons. River basin level forecasting is needed and the basin managers have to advise the farmers on the meteorological conditions prior to growing crops. Farmers will adopt this model if there is assured water supply.

Organizations fully equipped with state-of-the-art supercomputing infrastructure can develop suitable Numerical Weather Prediction (NWP) models to issue medium range weather forecasts, which can inform and guide the farmers in advance to undertake various farming activities based on the expected weather. Organizational set up at the basin level is required for effective monitoring of seasonal conditions and crop planning.

7.7 Application of World Bank Safeguard Policies

Table 7.4 Bank Safeguard Policies

Policy	Applicability	Comments
Environmental Assessment (OP/BP 4.01)	Yes	Significant adverse social or environmental impacts are not expected as all significant physical investments are expected to be in the nature of rehabilitation of existing assets. However, an integrated Environmental and Social Assessment (ESA) with an Environmental and Social Management Plan (ESMP) to both manage risks and maximize environmental and social opportunities will be finalized based on earlier work and experiences of the TN WRCP project and consideration of new activities proposed in the TN IAMWARM project.
Natural Habitats (OP/BP 4.04)	No	No adverse impacts on natural habitats expected, but this issue will be further tracked during the ESA implementation
Forests (OP/BP 4.36)	No	No proposed activities would trigger this policy.
Pest Management (OP 4.09)	Yes	No pesticides and fertilizers are expected to be financed directly by the project; however, there may be induced impacts of increased fertilizer and pesticide use due to improved agricultural intensification and diversification. The project will support scaling-up statewide Integrated Pest Management and Integrated Nutrient Management efforts and support for safer and organic food production and marketing. A pest management plan will be proposed as part of the ESA and ESMP.
Cultural Property (OPN 11.03)	TBD	No significant adverse impacts on cultural property expected, but this issue will be examined during the ESA (particularly in relation to proper management of any religious and other physical cultural property associated with tanks during rehabilitation).
Indigenous Peoples (OD 4.20)	TBD	No adverse impacts on tribals are expected, but the project will examine ways to improve benefits to tribals, women, and other vulnerable groups as part of the ESA.
Involuntary Resettlement (OP/BP 4.12)	Yes	No significant resettlement expected – but these will be examined further as preparation proceeds. The successful arrangements adopted under the previous TN WRCP project will also be adopted as required.
Safety of Dams (OP/BP 4.37)	Yes	The project will support safety of dams associated with the project areas (unless already addressed under other parallel projects). The project will also support safety improvement of tank systems as part of tank rehabilitation.
Projects on International Waterways (OP/BP 7.50)	No	No project activities in international waterways.
Projects in Disputed Areas (OP/BP 7.60)	No	No project activities in disputed areas.

7.8 Guidelines for Screening Social Safeguards

This provides guidelines for addressing potential social impacts in the proposed sub-projects that are eligible for funding under the Project. Typical activities envisaged to be financed are listed below with typical social concerns and opportunities as well as an identification of typical social mitigation measures, which are to be included in the sub-projects. The checklists prepared for each sub-project will enable the preparation of detailed Plans.

Table 7.5 Sub Project Activities and its Impacts

Sector	Sub-Project and type of activities	Potential impacts and social concerns	Typical mitigation measures
Fishing Infrastructure	• Harbour Support activities • Engine repair centers • Fishing Auction Centres • Communication centers • Drain Yards • Approach road	• Positive impacts in increasing fishing infrastructure • Use of public lands • Acquisition of small amount of private lands • Loss of temporary access to lands.	• Consultation and participation during preparation of mitigation plans and identification of infrastructure needs • Compensation for loss of assets at replacement cost.
Agriculture and Animal Husbandry	Reclamation of Sodic lands Shelter Plantations Livestock development	• Positive impacts to enhance • Livelihoods and bring land to cultivable status • Small amount of land requirement for plantations	• Consultation and participation of identification of schemes.

Note: The above list is only illustrative and any additional activities that may be considered will be mitigated in accordance with requirements and needs.

7.9 Checklist for Screening of Land Acquisition and Resettlement Impacts

This Form is to be used by the Safeguard Focal Point (SFP) at the Sector/District level in Screening Subproject Applications in respect of PAPs/land acquisition. This information will be submitted as soon as sub-project is identified. Based on the impacts, the need for preparation of sub-project specific Resettlement Plan will be determined.

(a) Number of Subproject:
(b) Proposing Agency:
(c) Subproject Location (include map/sketch):
(d) Sub-project Objective:
(e) Expected Subproject Activities:
(f) Infrastructure to be constructed:
(g) Infrastructure to be rehabilitated:
(h) Estimated Cost:
(i) Proposed Date of Commencement of Work:
(j) Technical Drawing/Specifications Reviewed (circle answer): Yes __ No __
(k) Major adverse impacts expected and mitigation proposed:
(l) Will the subproject involve land expropriation or demolition of existing structures? Yes/No,

If yes, provide details in Land acquisition **Assessment sheet III (a)**

(m) Current land uses of the above affected lands (use)_____(ha)_____
(n) Will the subproject negatively impact livelihoods Yes/No (If yes, describe impact separately):
(o) Whether any common facilities or others structures affected due to acquisition of above land;
(p) Indicate whether any scheduled caste/tribe population is affected or living in the affected villages. Yes/No (If yes, describe the group)

(q) Type of Plan required: (a) Resettlement Plan..... (b) Abbreviated Plan..... (C) No Plan required.....(d) Whether Tribal Plan is required: Yes/ No

Signed by Sector/District ESMF coordinator: Name: _____
Title: _____
Date: _____

Signed by ESMF Coordinator at PMU
Name:
_____
Title: _____
Date: _____

7.9.1 Land Acquisition Assessment Data Sheet

(To be used to record information in case of requirement of use of land for sub-projects)

1. Likely land requirement for the sub-project (Ha):

(a) Government_____ha (b) Private _____ha (c) Temple Land_____ha

(d) Gram Panchyat_____ha (e) any other----------ha

2. Method of land acquisition (Land Acquisition Act, Private Negotiations or voluntary Donation3):
3. Locations:
4. No of landowners to be affected:
5. No. of structures affected:
6. Current uses of the affected lands:
7. Users:
    a) Number of Customary Claimants:
    b) Number of Squatters:
    c) Number of Encroachers:
    d) Number of Owners:
    e) Number of Tenants:
    f) Others (specify): _____ Number:
    g) Common facilities affected: (Describe)----------

8. Details of standing crops to be affected:
9. Any other properties such as wells or trees, etc. to be affected:
10. In case of voluntary donation, sufficient proof must be obtained ((notarized or witnessed statements. Provisions of the government order in this regard will be made known to the private landowners in case of negotiations.

3 In case of voluntary donation appropriate agreement will be executed between landowner and implementing agency prior to handing over of the land to prevent any further claims.

7.9.2 Guidelines for Preparation of Land Acquisition and Involuntary Resettlement Plans

1.Land acquisition and involuntary resettlement will be kept to a minimum, and will be carried out in accordance with these guidelines. Subproject proposals that would require acquisition of productive lands and demolition of structures will be carefully reviewed to minimize or avoid their impacts through avoidance or minimization process. The principle objectives of resettlement are as follows:

a) Secondary involuntary resettlement will be avoided or minimized by exploring all possible options that have least impacts in terms of secondary land acquisition and resettlement ;
b) In unavoidable circumstances, the affected persons irrespective of their legal status will be assisted in their efforts to improve their livelihoods and standards of living or at least restore them in real terms to the pre-affected levels; and,
c) The compensation and assistance to the project affected people are based on the principle that people shall not suffer net losses as a result of the project.

2.Eligibility for Benefits

Project Affected Persons (PAPs) are defined as persons whose livelihood or shelter is directly affected by the project activities due to acquisition of the land owned or used by them. PAPs deemed eligible for compensation are:
(a) Those who have formal legal rights to land, water resources or structures/buildings, including recognized customary and traditional rights;
(b) those who do not have such formal legal rights but have a claim to usufruct rights rooted in customary law; and
(c) those whose claim to land and water resources or building/structures do not fall within (a) and (b) above, are eligible to resettlement assistance to restore their livelihood.

3.Involuntary Resettlement Support Principles

The project implementation agencies will ensure timely provision of compensation and resettlement assistance to the project affected peoples. The following are the key principles.

a) any resettlement will be carried out as a sustainable development project;
b) replacement land with an equally productive plot, cash or other equivalent productive assets;
c) materials and assistance to fully replace solid structures that will be demolished;
d) Incase of temporary loss of access to lands, compensation in the form of lease rent will be paid;
e) replacement of damaged or lost crops and trees, at replacement cost;
f) Project affected people whose remaining land holding become uneconomical will be offered an option to acquire residual lands and will be provided long term economic rehabilitation assistance.

g) Individuals may elect to voluntarily contribute land or assets provided the persons making such contributions do so willingly and are informed that they have the right to refuse such contributions;
h) in case of physical relocation, alternative provisions for replacement of houses with adequate basic civic amenities at the resettlement sites.

4. Support Principles for Different Types of Impacts

The support principle for broad category of impacts is summarized below.

Table 7.6 Category of Impacts

Type of Impact	Support Principles
Loss of land and immovable assets	• The Government will compensate the lost assets at their replacement cost • The option of voluntary donation is available to the asset owners
Loss of House and Shelter	• Every effort will be made by the Government to ensure that new housing is available before people are required to relocate. • If resettlement sites are developed close to the existing villages the local "host population" will also be consulted about their views and needs, and be given appropriate support to reduce any negative impact caused by an influx of new people.
Loss of Livelihood or Income Opportunities	• Assistance will be given to the affected population to reestablish their livelihood and income, and to compensate for temporary losses.
Group Based Development Opportunities	• Through designs, provision of infrastructure, and other support mechanisms, the project will replace lost assets and minimize any negative impact on groups, particularly groups that are considered vulnerable.
Targeted Support to Vulnerable Groups	• Vulnerable groups will be provided with additional options and support mechanism than those not considered vulnerable.
Unidentified impacts	• Unforeseen impacts will be documented and mitigation measures based on the principle of ESMF will be proposed.

5. Land Acquisition and Payment of Compensation

Land acquisition is likely to take place through combination of several methods. Identification of available vacant government lands will be most preferred method. In addition, the lands belonging to temples trusts, Gram Panchyats, etc. will also be

explored. In some cases the landowners or Gram Panchyats or temples may come forward for voluntary donation of lands. The private land acquisition will be made through private negotiations or using the land acquisition process. Based on the above support principles, the individual entitlements will be proposed and included in the RP.

6. The GoTN has brought out a Government Order (GO.MS. No.75 dated February 10, 2005) for using private negotiations for faster acquisition of private lands. Under this provision, a district level negotiation committee will negotiate the cost land to be acquired with landowners. The district committee is authorized to negotiate up to 200% of either the market value as defined under the land acquisition act or the guideline value fixed by the state government for collection of stamp duty during the registration of sale transitions, which ever is less. Provisions of the government order in this regard will be made known to the private landowners in case of negotiations. If their remaining land holding becomes uneconomical, the land owners will be offered an option to surrender the residual land against the compensation and long term economic rehabilitation measures will be provided to enable them to improve or at least maintain their pre project living standards. In case of private lands used for transits, appropriate lease rent will be paid. In case of any voluntary donation of land appropriate agreement between the land owner and implementing agency will be executed to avoid any climes of compensation at a later stage

7. In case of Pondichery, the relocation site lands will be acquired by using the Land Acquisition Act. Section 4(1) notices have been issued in certain cases. The compensation will be fixed at the higher of either the guideline value or market value. The guideline values are revised on annual basis and the highest transition sale value of similar lands in the preceding one-year before notification is being considered as market value. In addition, 30 % solarium and interest from the section notification will be paid. The lands will be acquired using urgency clause of land acquisition wherever required by paying 80% of initial estimated value and the balance amount will be paid after completion of the process. The process is likely to take about 6 months.

8. In case of losses to structures, the compensation will be determined in accordance with the Public Works Department's current Schedule of Rates for new construction of similar quality without depreciation.

9. Consultation Process

Implementing agencies will ensure that all occupants of land and owners of assets located in a proposed subproject area are consulted. Community meetings will be held in each affected villages to inform the local population of their rights to compensation and options available in accordance with these guidelines.

10. Sub- Project Approval

In the event that a subproject involves land acquisition against compensation or loss of livelihood or shelter, the implementing agency shall:

(a) Not approve the subproject until a satisfactory RP has been prepared and shared with the affected person and the local community; and
(b) Not allow works to start until the compensation and assistance has been made available in accordance with the framework.

11. Preparation of Resettlement Plans (RPs)

Having identified the potential impacts of the relevant sub-projects, the next step is to develop action plans to mitigate the impacts. The RPs provides a link between the impacts identified and proposed mitigation measures to realize the objectives of involuntary resettlement. The RPs will take into account magnitude of impacts and accordingly prepare a resettlement plan that is consistent with this framework for Bank approval before the sub-project is accepted for Bank financing.

(a) Sub-projects that will affect more than 200 people due to land acquisition and/or physical relocation and where a full Resettlement Plan (RP) must be produced. Such plan will be prepared as soon as the sub-project is finalized and cleared prior to approval of the corresponding civil work bid document.

(b) Sub-projects that will affect less than 200 people will require an abbreviated RP;

(c) The above plans will be prepared as soon as subproject is finalized, prior to Bank's approval of corresponding civil works bid document; and,

(d) Projects that are not expected to have any land acquisition or any other significant adverse social impacts; on the contrary, significant positive social impact and improved livelihoods are exempted from such interventions.

The indicative outline of Resettlement Plans is provided in annex IV (a)

Indicative outline of Resettlement Plans

The scope and level of detail of the resettlement plan vary with the magnitude of land acquisition and complexity of resettlement. The plan is based on up-to-date and reliable information about (a) the proposed compensation payment and resettlement of adversely affected groups, and (b) the legal issues involved in resettlement. The resettlement plan covers the elements below, as relevant. When any element is not relevant to project circumstances, it should be noted in the resettlement plan.

(i) **Description of the sub- project**: General description of the project and identification of the project area.

(ii) **Potential impacts**: Identification of: (a) the project component or activities that give rise to land acquisition and resettlement (b) the alternatives considered avoiding or minimizing land acquisition and resettlement; and (c) the mechanisms established to minimize resettlement, to the extent possible, during project implementation.

(iii) **Objectives:** The main objectives of the resettlement program.

(iv) **Results of census socioeconomic surveys:** The findings of surveys to be conducted in the early stages of project preparation and with the involvement of potentially affected people, including:(a) the results of a census survey covering; (b)current occupants of the affected area to establish a basis for the design of the compensation payment and resettlement program and to exclude subsequent inflows of people from eligibility for compensation and resettlement assistance;(c)standard demographic and socio-economic characteristics of affected households,(d) the magnitude of the expected loss—total or partial—of assets, and the extent of impacts, physical or economic;(e) public infrastructure and social services that will be affected; and(f)social and cultural characteristics of affected communities, including a description of formal and informal institutions (e.g., community organizations, ritual groups, nongovernmental organizations (NGOs) that may be relevant to the consultation strategy and to designing and implementing the resettlement activities.

(v) **Eligibility:** Definition of affected persons and criteria for determining their eligibility for compensation and other resettlement assistance, including relevant cut-off dates.

(vi) **Valuation of and compensation for losses:** The methodology to be used in valuing losses to determine their replacement cost; and a description of the proposed types and levels of compensation under local law and such supplementary measures as are necessary to achieve replacement cost for lost assets

(vii) **Resettlement measures:** A description of the packages of compensation and other resettlement measures that will assist each category of eligible affected persons to achieve the objectives of the policy. In addition to being technically and economically feasible, the resettlement packages should be compatible with the cultural preferences of the displaced persons, and prepared in consultation with them. Any measures necessary to prevent land speculation or influx of ineligible persons at the selected sites. The provisions of housing, infrastructure (e.g., water supply, feeder roads), and social services (e.g., schools, health services); plans to ensure comparable services to host populations. Additional measures to ensure that such vulnerable groups as indigenous people, ethnic minorities, the landless, and women are adequately represented.

(viii) **Income Restoration Measures:** Wherever the livelihoods are affected, appropriate measure for improvement or restoring of livelihoods including assistance during the transition period will be proposed which should be compatible with the cultural preference and skill of the affected people.

(ix) **Community participation**: Involvement of affected people for consultation with and participation of in the preparation and implementation;(b) a summary of the views expressed and how these views were taken into account in preparing the resettlement plan;(c) a review of the alternatives presented and the choices made by affected persons wherever options available to them, including choices related to forms of compensation and resettlement assistance. And

(x) **Integration with host populations:** Measures to mitigate the impact of resettlement on any host communities, including: (a) consultations with host communities and local governments;(b) arrangements for prompt tendering of any payment due the hosts for land or other assets provided to resettlers;(c) arrangements for addressing any conflict that may arise between resettlers and host communities; and (d) any measures necessary to augment services (e.g., education, water, health, and production services) in host communities to make them at least comparable to services available to resettlers.

(xi). **Implementation Arrangements:** The description of agencies responsible for implementation of compensation payment and resettlement activities should be outlined and an assessment of the institutional capacity of such agencies and NGOs; and any steps that are proposed to enhance the institutional capacity of agencies and NGOs responsible for resettlement implementation.

(xii). **Grievance procedures:** Affordable and accessible procedures for readdress of disputes arising from resettlement; such grievance mechanisms should take into account the availability of judicial recourse.

(xiii) **Implementation schedule:** An implementation schedule covering all payments of compensation and other applicable resettlement activities from preparation through implementation, including target dates for the achievement of expected benefits to resettlers and hosts and terminating the various forms of assistance. The schedule should indicate how the resettlement activities are linked to the implementation of the overall project.

(xiv) **Costs and budget:** Tables showing itemized cost estimates for all compensation payments and associated resettlement activities other contingencies; timetables for expenditures; sources of funds; and arrangements for timely flow of funds, and funding for land acquisition and resettlement should be described.

(xv). **Monitoring and evaluation:** Arrangements for monitoring of compensation payments and resettlement activities by the implementing agency, supplemented by independent monitors as considered appropriate by the Bank, to ensure complete and objective information; performance monitoring indicators to measure inputs, outputs, and outcomes for resettlement activities; evaluation of the impact of resettlement for a reasonable period after all resettlement and related development activities have been completed; using the results of resettlement monitoring to guide subsequent implementation.

(xvi). **Abbreviated Resettlement Plan:** An abbreviated plan covers the following minimum elements

(a) a census survey of displaced persons and valuation of assets;
(b) description of compensation and other resettlement assistance to be provided;
(c) consultations with displaced people about acceptable alternatives;
(d) institutional responsibility for implementation and procedures for grievance redress;
(e) arrangements for monitoring and implementation; and
(f) a timetable and budget.

7.10 List of Ineligible Activities

Subprojects with any of the attributes listed below will be ineligible for support under the proposed project.

Attributes of Ineligible Subprojects

- Any project activity with the potential for significant conversion or degradation of critical natural habitats. Including, but not limited to, any activity within:
    - Declared Forest Reserves
    - Wildlife Reserves;
    - National Parks and Sanctuaries;
    - CRZ I or any CRZ zone where activities are not allowable in accordance with the CRZ Notification.
- Any project that is not consistent with applicable laws and regulations.
- Any project with the potential for significant damages to cultural property.
- Any project that is not consistent with the project description at time of project negotiations, unless subsequently agreed to with the Bank along with the appropriate level of environmental and social management.
- Amy project or activity involving the procurement of pesticides not allowable under Bank guidelines

7.11 Indicative Outline Terms of Reference for Social Assessment (Working Draft) 4

Social assessment is the instrument used by the government to analyze social issues and solicit stakeholder views for the design of sub-projects. This draft ToR provides an outline of generic terms of reference for each District, covering the sub-

projects of relevance. The government will adapt this general framework based on the local context and the needs of specific District.

Introduction

The purpose of the social assessment is to ensure transparency and accountability in the delivery of Project reconstruction benefits or programs and to recommend appropriate measures to manage significant social risks. The feasibility and acceptability of the new relocation sites, the efficiency and equity of implementation mechanism, maintaining good relation with host population at new relocation sites and special needs of the vulnerable groups (women, widows, children, lower castes, physically challenged people, etc.) are some the important issues that will be examined during the social assessment process. The subprojects to be assessed in the Sector/ District should be briefly identified in this introduction and a brief explanation given on implementing arrangements for the social assessment

Background information

Include a brief statement of the rationale for the sub-projects to be included, their intended objectives, a description of their major components, implementing agency(ies), current status and timetable, and describe any associated existing programs or schemes.

Objectives

The social assessment's objective is to increase the likelihood of achieving sub-project's intended social outcomes, insuring their efficiency and equity. To achieve this objective, the consultant will assess the likely positive and negative social impacts, particularly on vulnerable groups, of the reconstruction activities planned and assess the level of awareness, concerns and attitudes of people towards these planned activities. The social assessment will be guided by the principles for reconstruction and resettlement of Project affected communities attached to this TOR. The Social Assessment will cover both categories of people affected Project and project activities. Summarize the scope of the social assessment and discuss its timing in relation to the sub-project preparation, design and implementation. Describe in the final ToR the specific tasks expected from the agency conducting the assessment, for example:

Task 1: Description of the proposed sub-projects and their intended social outcomes
Task 2: Brief description of the socio-cultural, institutional, historical and political context
Task 3: Assess legislative and regulatory considerations and role of local government
Task 4: Analysis of key social issues –for example, diversity and gender issues, institutional arrangements, information flows and rules for effective decision-making, participation of Stakeholders and potential social risks including, but not limited to, the feasibility and Acceptability of the sub-project outcomes, efficiency and equity of implementation arrangements, relations between beneficiaries and non-beneficiaries, efficacy of site selection, conflict

management or grievance-redress processes, and the maintenance of public assets created.

Task 5: Assess land tenure issues such as loss of ownership documents, physical boundaries of properties affected during Project and related issues with a view to propose suitable measures to restore the property documents and update the land records.

Task 6: Assess whether any impacts to known tribal groups in the affected villages and accordingly prepare the Tribal Development Plans in accordance with the World Bank's Operational Directives 4.20 Indigenous Peoples. These plans should be appropriate to the cultural preferences and the need of tribal groups.

Task 7: Data collection and research methods –consultation approaches required to ensure participation of both categories of affected people (Project and Project), for example focus group discussions, key informant interviews and triangulation of data collection; as well as quantitative surveys needed and statistical techniques to be employed

Task 8: Recommended strategy to achieve social development outcomes

Task 9: Implications for analysis of alternatives, management and implementation arrangements

Task 10: Developing a plan and indicators for sub-project participatory monitoring

Expected outputs, schedule and reporting relationships

Within 2 weeks the consultant will prepare an inception report including their work plan and methodology with a detailed schedule of the social assessment tasks to be completed, as described in the terms of reference. Within 2 months they will provide a draft social assessment report which will identify stakeholders and their expectations, interests or concerns, assess the social risks of the sub-projects (both the risk of the sub-project's impacts on the vulnerable, as well as other social risks to the sub-project's feasibility or success), and recommend design changes or mitigation measures or action best able to manage those risks during implementation. Note to whom the team will give preliminary and final drafts of each output. The final report will be completed by month 4, and will include relevant charts and graphs, statistical and qualitative analysis and, in some cases, raw data obtained during the social assessment. In addition to the outputs of the social assessment, include a note on the social assessment process itself, stating any difficulties likely to be faced by the team in conducting the social assessment, and the most appropriate dissemination strategy for its findings. The report and accompanying materials will be provided in English and Tamil and posted in District Administration offices.

Consultant team

Social assessment requires a multidisciplinary team to meet the different demands of the assignment. Key positions and skills should correspond to the sub-projects to be assessed. The terms of reference should specify key positions on the team. Individual time requirements should be specified for each assignment. One team member will be appointed team leader, and be responsible for the entire team's performance.

7.12 Land Acquisition and Monitoring Sheet

1. Name of the sub-project:
2. Village/Town:
3. Name of the Land Owner:
4. Area of land acquisition (Ha):
5. Type of Land: (a) Irrigated……. (b) Non-irrigated: …..(c) homestead…… (d) Barren……(e) other (specify)…..
6. (a) Market value (in Rs/Ha): …… (b) Guideline Value..(in Rs/Ha)……
   (c) Date of latest revision of guideline value:…….
   (d) Negotiated Price (in Rs/Ha)…… (e) Total compensation Paid… (….% of guideline value)
7. Date of Negotiations:
8. Date of registration of sale deed:
9. Payment Details : (Cheque No, etc.),
10. Details of standing crops affected and compensation payment details
11. Details of any other properties affected such as wells or trees, structures affected and compensation payment details ……..
12. Area of left over land holding……
13. Option for surrendering left over land if it is residual[5]
14. Long term rehabilitation measures (if required)……..
15. Remarks……..

Signature of District/Sector SEMF Co-coordinator

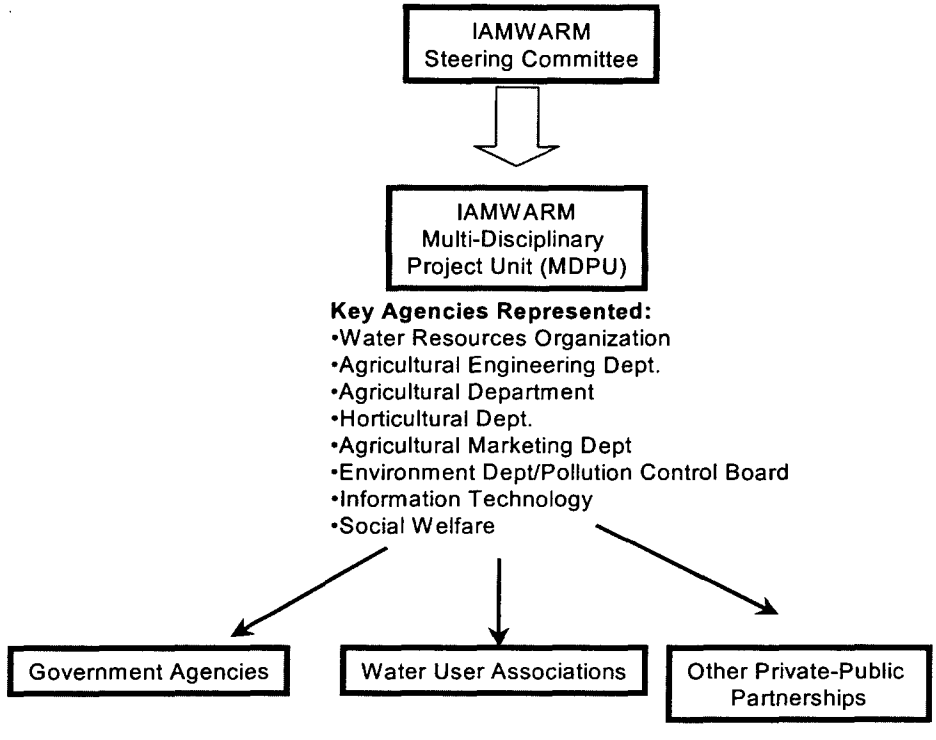
[5] The thresholds for residual lands will be decided based on the local norms.

7.13 Overall Suggestions

7.13.1 Institutional Strengthening

Institutional strengthening and reform is a continuous process and will be continued. Special efforts are made to bring about the changes among the departments who are involved in the project for proper infrastructure development, strengthening, reorganization, training and orientation of human resources. The key entity in the institutional framework is to set up a management cell in the WRO and to expand environmental and social development cells.

- Orientation and motivation towards participatory approach in development and management.
- Induce professionalism and accountability.
- Develop work norms and culture.
- Develop a system for addressing public grievances effectively and timely.
- Ensuring quality assurance and safety structures.



T

he above institutional arrangements for implementation of different components would be made such that participation of different stakeholders particularly primary stakeholders and women are ensured. The components will also address sustainability arrangements during the project period. The focus will be laid on encouraging and supporting farmers

to adopt the propagated technology and practices, strengthening of marketing and other linkages. However, technological backstopping and evaluation activities will continue. In this section, a brief description of proposed training and capacity building initiatives, institutional arrangements and a SWOT analysis thereof are presented.

Table 7.7 SWOT Analysis of Institutional Strengthening under IAMWARM Project

Sl. No	Institution	Strength	Weakness	Opportunity	Threat
1.	MDPU	• Possess Technical and Professional staff • Apex Coordinating unit • Regular review of the interventions • Responsibility of the agencies Would be fixed • Decentralized process formulation • Need based implementation as desired • Facilitation of technical intervention • Support in Development of project action plan • Coordination with line departments for effective implementation • Regular monitoring and coordination • Regular training to field staff • Timely Flow of	• Lack of coordination among the depts. • Weak project level structural linkages • Lack of technical persons • Lack of support for process monitoring • Lack of manpower • Improper Coordination may slow down the progress	• Strong monitoring and feedback support • Data analysis and interpretation • Dovetailing of programmes at project level • Sustenance of institutions may be ensured • Provide technical trainings • Ensure sustenance of institutions • Facilitate the process for action plan development • Streamline project management	• Discontinuation of Technical staff • Transfer of Project Coordinator • Funds needs to be properly and timely processed • Institutions developed must have a proper take over mechanism • Development of timely MIS • Lack of coordination with field staff • Lack of coordination with implementing agencies may affect the objectives

		data and information • Strengthening of institutions through networking			
2.	Project Implementation Unit	• Availability of technical man power • Monitoring of project activities	• Priority to focus upon their own departmental activity • Administrative control rests with department head	• Proper coordination would bring high result • Sustenance of project implementation on effort may be ensured	• Lack of continuous monitoring at the field level • Irregular maintenance of MIS may effect the project progress
3.	Farmers, Live stock farmers, Fisher folk, WUAs, Women, NGOs, SHGs	• Coordination at the project level for planning, implementation and monitoring of the activities. • Collective decision making • Involvement in planning, implementation and monitoring	• Lack of farmers involvement may affect technology transfer • Difference among farmers may affect project implementation • Formation of unwilling group may discontinue the efforts • Lack of transparency may affect implementation process	• May be developed as center for technology transfer and collective marketing • Involvement of farmers beyond Panchayat • Involvement of farmers may be promoted • System may be developed as a unit for collective marketing	• May create dependency on the project • Groups may discontinue due to lack of facilitation • Group formed due to self-interest may create problem
4.	Partner NGOs	• Facilitation of effective community mobilization process • Promotion of farmers organization • Create an	• Lack of skill staff may affect the pace of the project • Communication gap at field level may affect technology adoption and	• An opportunity to maximize people's participation • NGOs may develop their own field for sustainability	• Lack of trained staff would minimize project output • Discontinue o staff may break the dissemination process

		enabling environment for community participation	transfer • Lack of coordination with departments may lead to poor recognition of the project	of the groups • Regular visit by field staff would develop effective monitoring system	• Internal Irregularities by any NGO may damage project recognition • Lack of coordination would definitely affect the project management system
5.	External M&E Agency	• A source for unbiased reports • Continuous Process of concurrent monitoring • Facilitate corrective measures • Highlight the issues to the concerned	• Lack of trained staff toward project may affect the cause • Lack of understanding with stakeholders may create differences • Communication gap may affect corrective measures	• Development of good project management system • Gaps may be timely identified at the field level • Overall monitoring of project activities may be strengthened	• Lack of coordination may create problem • Issues highlighted may not be timely addressed
6.	Banks	• Bank linkages processes may be strengthened • Coordination with departments would promote agri-business	• Lack of support staff at banks may dilute bank linkage efforts • Priority not to groups may slow down credit flow	• Banks may adopt the groups for agri business promotion • Capacitate the resources of groups • Develop a strong credit support	• Priority if not given may dilute bank linkage process • Regular change of staff may create gaps • Irregular facilitation by field staff may create communication gap
7.	Training Institutions	• Regular capacity of the stakeholders may be	• Lack of coordination may crate duplicity	• Need based training requirement may be	• Wrong identification of institution may minimize

		upgraded • Inputs to farmers may be given timely as per the need • Network with such institutions could develop effective master trainers	• Trainings may be ineffective due to poor training module • Lack of orientation toward project may mis match training content	developed • Regular monitoring and feedback may be ensured	training process • Lack of coordination may affect training arrangement • Lack of monitoring may not reflect impact of trainings • Involvement of not good resource persons may lead to unsatisfactory

The expectations of the direct beneficiaries extended beyond the project, into, empowerment - Social and economic. Realization and sustenance of the benefits depend largely on the project's efforts towards enabling the beneficiary households to absorb and sustain technical, institutional and management practices that the project activities sought to instill. Participation needs to be designed as decentralized governance framework. The challenge, thus, is to widen and deepen community participation by strengthening, the process - Beneficiary selection, Participatory planning, Social intermediation, Gender initiatives etc.

7.13.2 Training and Capacity Building

The need for training and capacity building of all stakeholders is imperative towards ensuring adequate appreciation and addressing environmental and social issues associated with the project. Training programmes for farmer's is suitably designed to update them to use the modern agricultural implements for obtaining higher yield and quality product. Training modules are designed for the line department representatives for better coordination and timely implementation of the projects designed. Training locations and the language selection for training should be customized to suit the convenience of the trainees. Where the turnouts of villagers is low, decentralized training locations close to the villages of the trainees, with the involvement of NGOs (if required) shall help achieve the desired results.

Table 7.8 Principal aspects of training required for various stakeholders

S.No	Levels	Trainees	Principal aspects to be covered
1	State Level	MDPU, Officials involved in IAMWARM,	GIS based environmental & social planning Analysis of monitoring & stakeholder feedback
2	Basin Level	Line Departments, Bureaucracy and Politicians	Sensitization about of environmental & social issues
3 a	Project Level	Project Officials, Govt. Officials of Tamil Nadu	Sensitization about importance of environmental & social issues Methods to record impact monitoring & project evaluation indicators
3 b	Project Level	NGOs WUA, Farmers, Livestock farmers, Fisherfolk, Women, Self Help Groups	Sensitization about importance environmental & social issues Ways to address such issues in the project
4	Village Level	Rural youth, Landless labourers, Shopkeepers/Vendors/Traders, General Public	Sensitization about environmental & social issues Mitigation & monitoring measures to address environmental & social issues

Course outline for MDPU, Officials involved in IAMWARM

- Environment and social impact assessment, case studies
- Environmental issues in irrigation systems
- Environment management in irrigation systems
- MoEF guidelines and notifications
- Environmental policy and regulations
- Carrying capacity based developmental planning
- Use of GIS in irrigation systems – case studies
- Conservation of water resources, pollution prevention, waste water treatment – case studies
- Conjunctive use of surface and ground water
- R & R plan
- Environment and Social planning
- Irrigation and public health issues
- Environment surveillance and monitoring and
- Field visit

Course outline for Line Departments, Bureaucracy and Politicians

- Components of environment
- Environmental policy and legislation
- Database management and decision support system
- Carrying capacity based developmental planning
- Environmental management tools
- Environmental surveillance and monitoring
- Watershed management
- Wasteland development
- Pest management & organic farming
- Crop diversification
- R & R plan
- Application of GIS in irrigation systems
- Field visit

Course outline for Project Officials, Govt. Officials of Tamil Nadu

- Environment protection: Water, air, land and socioeconomic
- Environment laws
- Environment impact assessment
- Watershed management
- Modern agriculture management techniques
- Crop diversification
- Wasteland development
- Promotion of low cost state of art alternative energy technologies
- SWOT analysis in irrigation systems
- Information management system
- Water conservation, available technologies in waste water treatment
- Soil conservation
- Lab sessions

Course outline for NGOs WUA, Farmers, Livestock farmers, Fisherfolk, Women, Self Help Groups

- **Water**
  - Water supply system at village level
  - Available water resources
  - Drinking water
  - Over exploitation of groundwater
- **Agriculture**
  - Cropping pattern
  - Use of pesticide and insecticide
  - Effect of pesticide on soil
  - Environment friendly pest control
  - Fodder for cattle

  - Availability of water for agriculture
  - Water logging and salinity
  - Organic farming
  - Agriculture marketing

- **Environment**
  - Water and waste water management
  - Sanitation and health
  - Water tank management
  - Vermicomposting
  - Alternative energy sources

- **Income generation**
  - Biogas from live stock
  - Bio-manure from farm waste
  - Organic farming
  - Composting
  - Bio-pesticide preparation from neem
  - Seed storage
  - Cooperative financing facilities
  - Water harvesting structures – in situ conservation measures
  - Field visit

Course out line for Rural youth, Landless labourers, Shopkeepers/Vendors/Traders, General Public

- Environment and eco-system management
- Rural environmental issues
- Indoor air pollution
- Water conservation
- Watershed management
- Crop diversification
- Agriculture marketing
- IT Kiosks

Income generation

- Biogas from live stock
- Bio-manure from farm waste
- Organic farming
- Composting
- Bio-pesticide preparation from neem
- Seed storage
- Cooperative financing facilities
- Water harvesting structures – in situ conservation measures
- Field visit

7.14 Training due to Mechanization

There is the aspect of some redundancy in the labour force as a consequence of mechanization in agriculture. Redundant labour force is merely idle manpower. This idle manpower either in the rural or in the urban context is reckoned with a huge social problem as such we cannot allow mechanization creating a social problem. The social problem can be adequately addressed by consciously evolving re-skilling programmes for the benefit of the labour force so that they have suitable redeployment avenues.

Training should be given to the line department officials on

- Water, soil quality analysis / and Sampling Techniques. .
- Environment , Ecology and development
- Resources conservation concept in Irrigation systems.
- Refuse, Reduce, Reuse, Recycle Concepts for sustainable agriculture practices.
- Traditional farming systems and modern farming system an over view.
- Restoration of water bodies using bio control systems.
- Need of Green projects or green construction, Green Consumerism and Green production in River Basins.
- Experiences of PIM in various states.
- Bio dynamic Farming towards sustainable Agriculture practice.
- Organic Farming and water conservations.

7.15 Institutional Framework

Institutional arrangement for the implementation of different components would be made such that participation of different stakeholder's particularly primary stakeholders, PRIs and women would be ensured. The design would also address the sustainability arrangements during the project period. Project will remain present in each basin. The focus will be laid on encouraging and supporting farmers to adopt the propagated technology and practices, strengthening of marketing and other linkages. However, technological backstopping and evaluation activities will continue. In this section, a brief description of the proposed institutional arrangements and a SWOT analysis thereof are presented.

7.16 Institutional Framework - State Level

MDPU would coordinate the project activities, which is being implemented by the line departments. Technical and professional staff located at MDPU provides technical and administrative support to the implementing agencies. The MDPU would be the apex coordination unit to monitor the activities of the project. Time to time guidelines and circulars as required would be sent by MDPU to all implementing agencies.

7.17 Project Implementation Agencies

Within each of the line departments Nodal Officer would be designated for effective implementation of the project activities. The Nodal Officer would coordinate with MDPU to implement their activities and he would be responsible to carry out the project activities as per the action plan and would also ensure timely submission of Monthly Progress Reports (MPRs) and other documents as per the need.

7.17.1 Basin level

All the line departments would implement the project activities through their line departments where a nodal officer would be appointed to coordinate the activities with MDPU.

7.17.2 Project level

WRO official will coordinate all the activities to be carried out under the project. He will be the key person.

7.17.3 Beneficiary organizations

NGOs, WUAs, Farmers, Livestock farmers, Fisherfolk, Women, SHGs etc.

7.17.4 SHGs/Stakeholders

These will be the basic for project implementation activities. The line departments at the project level in consultation with these organizations would decide planning, implementation and monitoring of the activities. Farmers, SHGs would also take up saving and credit activities and would also have bank linkages for cultivation, income generation and off farm activities.

7.17.5 Partner NGOs

All the activities with regard to community mobilization, gender initiative, credit and other interventions at the group level and community level would be facilitated by the NGOs who will be coordinating with respective departments and their performance would be assessed as per the indicators developed in the project appraisal document. As per the TOR, the services will be delivered by the concerned NGOs and their presentation of work would be evaluated by MDPU. The NGO functionaries will be trained on different subjects as per the training need and other institutions as per the arrangements under the training plan.

7.17.6 Commercial Banks

Banks as an institution plays an important role in organising and sanction of loans, especially regional rural banks play an effective role in lending process to the Farmers, SHGs. Farmers/SHG have their own bank account in the nearest bank, the bank officials also monitor their activities. Time to time Farmers/SHG members participate in joint workshop and training programme as organized by NABARD, Commercial banks etc.

7.18 Training Institutions

The training institutions identified under the project would develop the capacity of the farmers during the project period and as experienced under the pilot project implemented in Hanuman Nadhi, it will be further focused to design management / marketing training, specialized technical training and other technical training for all the stakeholders at different institutions. Services of district level and state level institutions would be taken periodically and specialized trainings would be outsourced to specific identified institutions all over the country.

7.19 External Monitoring & Evaluation Agency

To monitor the project activities and outcome, an external agency would be hired; the agency would periodically coordinate with departments and other stakeholders to assess their performance and provide appropriate inputs to improvise upon the concerned issues. The external monitoring agency would facilitate the project staff to adopt timely corrective measures at different levels to reduce the gaps.

7.20 Constitution of an Apex Body at State Level

The IAMWARM project aims at the overall development of the State by exploiting the full potential in the major growth sectors of agriculture and water resource management. The activities under this project aim at the holistic approach of all the line departments who are committed for overall development of the State. In this context, there is a need to look at the under employment and the contribution of growth rate of the major sectors like agriculture, animal husbandry and fisheries so as to identify the institutional gaps and to strengthen the same in the project for achieving the said goal.

7.20.1 Agriculture Technology Mission

From the foregoing, it is evident that there is stagnation in agriculture output and decline in growth of animal husbandry and fisheries thus resulting in under-employment. To address this issue as also the need for modernisation of techniques in the farm sector as well as other related sectors such as dairy, animal husbandry and fisheries, it is suggested that an Agricultural Technology Mission may be constituted at the State level to create and revive public institutions in the rural areas and implement policies which will immediately reduce agrarian distress, and over time provide protection to farmers, encourage the most productive and sustainable forms of land and water use, provide stable livelihood and employment to the rural population and improve the incomes of the rural population over time. The goal of this Mission is to

- The ATM must act as the umbrella organisation for the planning, direction and implementation of all of the policies relevant to agriculture and allied sectors and the welfare of farmers and farm workers. It should be a permanent body coordinating the activities of various departments.

- The focus should be on empowering the farming community, with the active involvement of locally elected bodies such as Panchayats and participatory institutions such as gram sabhas.

- The ATM must have a holistic approach to the problems of agriculture in the state, addressing the particular problems in each area within a broader context and in such a manner as to encourage co-operation and synergy between the activities of various state/central government departments/agencies and local level institutions.

- It should formulate policies and take action on meeting the challenges of the WTO regime, organising policy research on critical issues in agriculture and recommending policies to meet the changing needs in this sector and suggesting the measures required for educating the farmers through farmers' organisations.

The neighboring state of Andhra Pradesh has constituted similar Mission headed by the Hon'ble Chief Minister.

7.21 Suggestions for the Farmers for the sustainability of WUA's

- Due share in water cess, fishing rights, usufructs, tree rights, auctioning of lotus flowers, lotus leaves and utilization of poramboke lands within the WUA area for growing vegetation to raise revenue to the WUAs for active implementation of PIM.

- More participation of farmers is required, for which the Government have to arrange for more awareness campaigns through mass media also.

- Forming the other tiers of farmers organisation viz. DCs & PCs as early as possible.

- The existing encroachments should be evicted from the tank systems. Another one time grant as a financial support is necessary from Government to carry out the O & M functions of the system. All emergency repairs and special repairs works should be done by the WUAs from the funds granted by the Government. Specific orders to take legal action against the offenders may be issued by the Government for not handing over the assets to the WUAs by the defunct farmers councils.

- Sufficient percentage of amount has to be sanctioned exclusively for the irrigation system maintenance works from the MP / MLA's Constituency Development Funds, for which specific orders of the Government is required.

- Office buildings for each WUA is essentially required in order to have a common place to discuss and solve the disputes among the members of WUA and to keep the records and other materials under safe custody.

- Telephone facilities to be provided to the WUAs to have the effective communication between members and office bearers of WUAs.
- The duties and responsibilities vested with the office bearers as per the Act, shall be made known to the Police department, Revenue department, Bank etc., in order to enhance the effective functioning of the WUA.

7.22 Suggestions for speedy implementation of PIM

- PIM is to be implemented in part of the entire command area of a State, in order to gain experience and overcome the bottlenecks that may arise. Not only that, the success of PIM will attract the farmers in the remaining command areas resulting into 100% participation and gain momentum for the process.
- Formation of WUAs may be initiated as a first task and then the rehabilitation works could be done involving the WUAs also or vise versa, is considered the best way, rather than carrying out both the tasks simultaneously since the field officials as well as farmers may find it very difficult.
- Changing the mind set of the irrigation department officials as well as the farmers is very essential in the matters of turning over of O&M responsibilities, involving sociological aspects.
- Awareness creation and adequate training before and after implementation of PIM are the prime areas where no compromise shall be given.
- The success of PIM is directly proportional to assured supply of water up to tail ends and financial sustainability to the WUAs, which shall be ensured.
- Formation of PIM cell comprising of like minded members with involvement in this aspect will strengthen the belief of the farmers in the matters of best support in respect of PIM.

7.23 Suggestions for disaster management and institutional strengthening

- Development of state and district management plans
- Development of disaster risk management and response plans at village/ward, Gram Panchayat, Block/Urban Local body levels

- Constitutions of Disaster Management Teams and Committees at all levels with adequate representation of women in all committees and team.

- Capacity building of Disaster Management Teams at all levels. Special training for women in first aid, shelter management, water and sanitation, rescue and evacuation etc

- Capacity building in cyclones and earthquake resistant features for houses in disaster prone districts, training in retrofitting and construction of technology demonstration units.

- Integration of disaster management plans with development plans of local self governments

- Development of national/state database on vulnerability, disaster risk management and sustainable recovery

- Strengthening National and State Governments through support for hardware and software for disaster risk management and capacity building of institutions

- Awareness campaigns on disaster management in school curriculum and schedule to drills in disaster prevention and response for schools

- Development of training manuals in Disaster Management for District, Block, Gram Panchayat, Villages/ wards for each State in vernacular languages

- Strengthening disaster management information centers in programme states and districts for accurate dissemination of early warning and flow of information for preparedness and quick recovery operations.

7.24 Water Conservation Measures & Institutional Strengthening

The State government has initiated measures for water conservation through water shed development programme with the assistance of Govt.of India. The objective of watershed programmes is to adopt a holistic approach for development of society involving the local people as partners. The Panchayats have the overall powers and implement the watershed programmes involving village committees, NGOs etc.

The conservation measures adopted in this programme are construction of check dams, contours and injection bores. The water conservation measures are also implementing in the State under the food for work programme which is also sponsored by the Govt.of India. Every farmer, farmers' cooperatives, Panchayats and district Administration in water scarce areas has to

- Take up conservation measures like construction of bunds, check dams, contours, injection bores, desilting of ponds and wells and repairs of canals

opt drip, sprinkler and other water saving irrigation techniques
- Avail benefits of Union & State Government schemes

7.25 Suggested Institutional Arrangements

The existing policy, institutional and legal framework has been reviewed keeping in view with the proposed activities of the IAMWARM project and suggested the following institutional arrangements for effective implementation of the project which would include:

1. State-level (converting the WRCRC to a State Water Council, amalgamating the associated sub-committees and upgrading the Institute of Water Studies (IWS) and the Surface and Groundwater Data Center (SGDC) to a State Water Resources Agency, establishment of a Water Regulator, development of appropriate policy and institutional arrangements, instruments, and information tools to promote flexible water resources management)

2.The existing environmental cells under IWS and CE (Plan Formulation) need to be strengthened by adding the following specialists

- Environmental scientist
- Environmental engineer
- Environmental economist
- Statistician
- Agriculture Scientist
- Sociologist
- IT Specialist

3. Creation of two additional environmental cells by converting the two existing planning and design cells. All the five environmental cells can be under the control of a Superintending Engineer at Chennai. The following is the reporting system after converting the two existing planning and design cells into environmental cells.

4. After strengthening the existing Environmental cells under IWS & CE Plan Formulation of WRO with additional subject specialists as suggested and creation of two additional environmental cells, the following documents may be prepared in consultation with the Department of Environment, Government of Tamil Nadu.

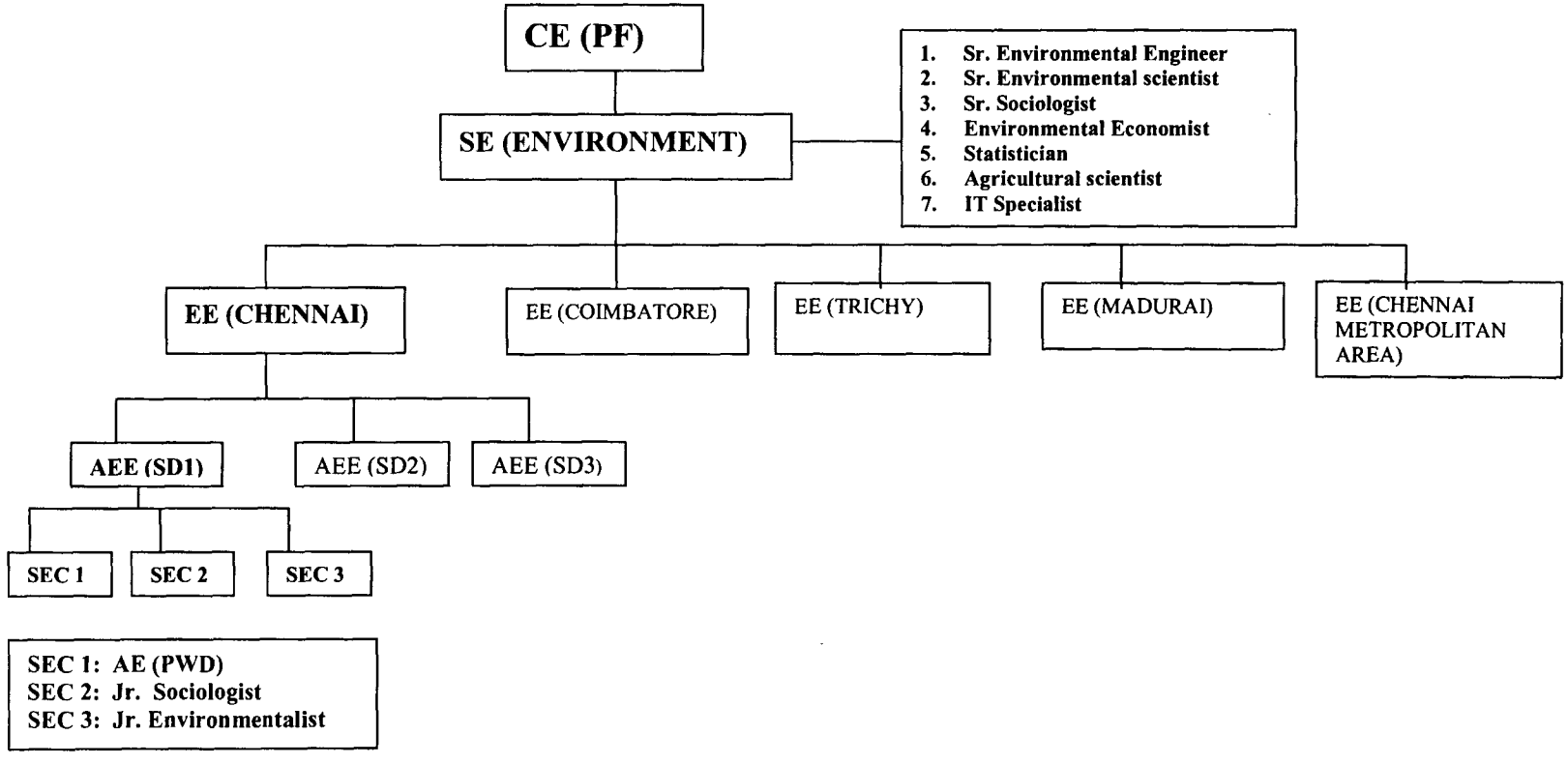
- Environmental Action Plan for River basins
- Master plans for specific works: e.g. artificial recharge or for coastal region
- Environmental Impact Assessment for proposed projects
- Database on environment-friendly technologies and practices
- Methods of conserving water resources in irrigation, industrial use and municipal water supply system
- Methods of recycling and reuse of water

- Performance of Sewage and Effluent Treatment Methods
- Clean technologies, methods of waste minimization and resource recovery techniques
- Clean practices for agriculture
- Inventory of waste items and pollutants
- Rapid appraisals of certain aspects for planning and evaluation
- Mid-term and long-term assessment of schemes and programmes
- Domestic and sanitary habits of local people that cause significant water pollution
- Propagate environment-friendly technologies and practices
- Facilitate public participation by awareness promotion, training and technical advice
- Conduct dialogue to make agencies and individuals responsible

The Environmental Cell Divisions may be given more research and development works to solve the issues. Continuous research and development is necessary to simplify and to identify the suitable technology for which all EC Divisions may be considered as in WRCP. The environmental cells will also show special attention for public participation in the following tasks

- Participatory management including maintenance of physical structures
- Water conservation and recycling
- Problems and damages caused to livestock
- Encroachment prevention and eviction
- Desilting and silt disposal
- Watershed development and artificial recharge
- Waste minimization
- Identification of sources of waste generation
- Monitoring of pollution
- Take up public complaints of water pollution and co-ordinate with TNPCB

7.26 SUGGESTED ORGANIZATIONAL STRUCTURE FOR ENVIRONMENTAL AND SOCIAL DEVELOPMENT CELL



NOTE: 1. The structure suggested for AEE (SD1) is applicable for AEE (SD2) & AEE (SD3)
2. The structure suggested for EE (Chennai) region is applicable to the remaining 4 regions also.

8 MONITORING FRAMEWORK

8.1 Need for Monitoring & Evaluation

The monitoring and evaluation process is one of the most important tool for project management. The monitoring and evaluation process includes Internal and External Monitoring. Internal Monitoring which will be conducted at regular intervals and primarily reports on the progress of work and the process related indicators. Some impacts would also be included as identified in the project design stage. The external monitoring and evaluation, that will once be undertaken when the project is halfway through its time schedule and next at the end of the project (mid term and end term evaluation respectively). The external monitoring also focus on the impacts of the project as well the process adopted in the design, implementation and post implementation.

Adoptive major decisions should be taken to monitor the environmental and social indicators. The principal aspects for which the IAMWARM should have a sound monitoring and evaluation framework are as follows:

1. Evaluation of how successful the has been implementing its plans and how the results achieved contribute to the achievement of plan goals and

2. Monitoring the condition of Environmental and social parameters during implementation and post implementation period.

The monitoring and evaluation indicators can be broadly categorized into three parts:

- **Input /process indicators:** To monitor the progress of various activities proposed in the plan.

- **Out put indicators:** To monitor whether the inputs have resulted in outputs as desired.

- **Impact indicators:** To monitor the long-term impacts of the project, this establishes whether the goals of the project have been fulfilled.

Table 8.1 Use of Various Indicators

	Pre-planning stage	Planning stage	Implementation stage	Post implementation stage
Process indicators	☐	☐	☐	☐
Output indicators		☐	☐	☐
Impact indicators		☐	☐	☐

8.2 Monitoring and Evaluation for IAMWARM

Monitoring and evaluation process embedded in the information management system shall evaluate the physical and financial progress along with the target values in a time frame i.e monthly, quarterly, half-yearly and annually. This will also evaluate the effectiveness of the project in terms of achieving the benchmark values set forth for each indicator for social and environmental mitigation /enhancement measures.

For physical interventions and related expenditure the out put qualities can be directly measured and cumulative values can be compared with the target values at any time frame. For the social and environmental mitigation /enhancement measures the effectiveness of the project implementation can be compared with the pre project base line values (bench marks) of the indirect indicators for each output and out come and the target values in a time frame.

The project authorities after completion of each stage can evaluate the project performance and may suggest any modification/ correction in the project processes to meet the goal of the project .the following sections explain the importance of management information system (MIS) and how the M & E process shall be undertaken through the MIS.

8.2.1 Monitoring Mechanism

Monitoring and Evaluation Indicators to be developed to ensure implementation of environmental and social safeguard elements that have been built into all stages of the project like screening and selection, planning for interventions, detailed design, implementation, operation and maintenance and periodic performance evaluation by

- Water User Associations (WUAs),
- Project Authority at Sub Project Level,
- Basin Board /CE.

At each stage indicators have been framed for Inputs / Process, Outputs and Outcomes / Impacts. The Benchmarks and Indicators combine both quantitative and qualitative types of data. The implementing agencies, client groups as well as independent third parties shall record the indicators. A consultative framework is proposed to record relevant issues from the

village level institutions and villagers. Lessons learnt from monitoring and stakeholders feedback shall be used to make possible adjustments in the project design and implementation to better address the safeguard measures. The GIS database shall be upgraded as an integral part of Management Information System through regular data updation, data analysis and information dissemination to all stakeholders.

8.2.2 Monitoring Mechanism - Benefits

- Strengthening of Dams and Canals
- Equanimity and surety of Water distribution
- Acceleration of production and productivity in agricultural area
- Acceleration and development of production and productivity in agricultural area
- Management of village tanks and
- Participation and strengthening of water user agencies

8.3 Key Monitoring Indicators

The key monitoring indicators for projects are sub projects for the pre planning shall be

Table 8.2 Key Monitoring Indicators for Projects and Sub Projects

Process indicators (Monitoring agency)	Out put indicators (Monitoring agency)
Number of reconnaissance visits (EE, REGION WISE)) Number of consultations/ sensitization meetings (EE, REGION WISE)) Photographs/recordings and signed minutes at consultations (EE, REGION WISE))	Salient features and spatial location of problems on sketches/ topo sheets & sub project maps (EE, REGION WISE)) Listing of key non spatial issues (EE, REGION WISE)) List of stake holders and level of stake (EE, REGION WISE)) List of agreed intervention measures for each sub project (EE, REGION WISE)) List of required action plans or EIA requirement (EE, REGION WISE))

The above can be achieved by structuring and evolving an appropriate MIS. The MIS can cover all the important variables/bench marks that the IAMWARM project seeks to achieve. The MIS will help in the effective implementation of the project while identifying the bottlenecks, if any.

Monitoring indictors for Planning, Designing, Implementation and Post Implementation shall be:

Table 8.3 Monitoring Indictors for Planning, Designing, Implementation and Post Implementation

S.No	Environmental and social parameters	Benchmark indicators (before implementations)	Outcome indicators (during implementations)	Impact indicators (post implementation)	Monitoring Agency
1	Soil Erosion/Gully Formation	Area of waste lands		Area of waste lands	AED, WRO
2	Soil quality	Organic matter content/ nutrient content pesticide residue		Organic matter content/ nutrient content pesticide residue	Agriculture University and Agriculture Department
3	Soil moisture	Moisture content		Moisture content	AEE (Sub Div), WUA
4	Siltation	Silt load in catchment runoff water	Silt load in catchment runoff reservoir water	Silt load in catchment runoff water	WRO
5	Surface water quantity	Hydrologic parameters/irrigation system efficiency		Hydrologic parameters/irrigation system efficiency	State Ground and Surface Water Resources Data Center
6	Surface water quality	Salinity, nutrient content, pesticide residue presence of industrial effluents, pathogens	Pathogens in labour camp runoff	Salinity, nutrient content, pesticide residue presence of industrial effluents, pathogens	WRO
7	Ground water quantity	Depth to ground water		Depth to ground water	State Ground and Surface Water Resources Data Center

8	Ground water quality	Salinity, nutrient content, pesticide residue presence of industrial effluents, pathogens		Salinity, nutrient content, pesticide residue presence of industrial effluents, pathogens	State Ground and Surface Water Resources Data Center
9	Water logging	Area under water logging	Temporary water logging	Area under water logging	Agriculture Department
10	Seepage/leakage	Measure of leakage water		Measure of leakage water	WRO
11	Air pollution		Air pollution levels		TNPCB
12	Noise pollution		Noise levels		TNPCB
13	Deforestation	Forest cover area /density	Pressure on local fuel resources	Forest cover area /density	Forest Department
14	Weed growth	Quantity of weeds per unit area of reservoir bed		Quantity of weeds per unit area of reservoir bed	WRO
15	Wild life	Habitat area /habits of concerned wild life	Disturbance to wild life	Habitat area / habits of concerned wild life	Forest Department
16	Aquatic life	Health of aquatic creatures	Pressure on aquatic resources	Health of aquatic creatures	Fisheries Department
17	Biodiversity	Number of local flora and fauna species	Impact on flora and fauna species at risk from external agencies	Number of local flora and fauna species	Forest Department
18	Solid waste		Quantity and nature of solid waste		Local Urban Bodies
19	Fertilizer use	Average Fertilizer usage by type per filed unit area		Average Fertilizer usage by type per filed unit area	Agriculture Department
20	Pesticide use	Average pesticide usage by type per filed unit area		Average pesticide usage by type per filed unit area	Agriculture Department

21	Displacement	Number of people to be displaced	Number of people to be displaced	Number of people to be displaced	Social Welfare Department
22	Lively hood	Number of people lost lively hood	Number of people lost lively hood	Number of people lost lively hood	Social Welfare Department
23	Common property recourses	Number of people losing access	Number of people lost access	Number of people lost access	Revenue Department
24	Schedule cast/tribe	Number of project affected persons	Number of project affected persons	Number of project affected persons	Social Welfare Department
25	Work load on women	Distribution of women's nature of work in 24 hours	Distribution of women's nature of work in 24 hours	Distribution of women's nature of work in 24 hours	Social Welfare Department
26	Child labour	Distribution of child nature of work in 24 hours	Distribution of child nature of work in 24 hours	Distribution of child nature of work in 24 hours	Social Welfare Department
27	Conflict	Number of conflicts and issues	Number of conflicts and issues	Number of conflicts and issues	Revenue Department
28	Public health	Incidence and nature of work related diseases	Incidence and nature of work related diseases	Incidence and nature of work related diseases	Department of Public Health
29	Cultural properties	Spatial extent of impacts	Conditions of structure and its surroundings enhancement proposed	Conditions of structure and its surroundings	Archeology Department
30	Aesthetic/cultural /religious values	Number and nature of values at risk	Number and nature of values infringed	Number and nature of values infringed	HR & CE

8.4 Monitoring and Evaluation Indicators

Monitoring and Evaluation Indicators have been developed to ensure implementation of environmental and social elements that have been built into all the stages of the project namely:

- Area (ha), production (tons) and value (Rs) of higher-value crops
- Productivity of water (Rs/m3)
- Livestock (% stall fed)
- Fisheries (water spread area in ha by type, production in tons/yr, value in Rs/yr)
- Adoption of improved technologies (e.g. drip/sprinkler area, etc.)
- Reliability of irrigation
- IT adoption (WRO and MDPU MIS, # of e-kiosks, cell services, web portal use, etc.)
- GIS/Remote sensing/Management Information system should be made use
- PIM (No. of WUAs, # of meetings held, attendance at meetings, O&M money collected by WUAs, # disputes settled by WUAs)
- Income to farmers (survey on Rs/household/yr from farm and non-farm activities – baseline, mid-term and end of project) and migration EE (Region wise) erns
- Process (Sub-basin development and management plans prepared, appraised, Implementation Completion Reports completed, Social and Environment Management Frameworks applied, IRR)
- Marketing (Marketing sites/access, modernization of existing centers, new centers, arrivals, post-processing equipment and centers, Public-Private Partnerships, etc.)
- Training (# of people trained in state, national and inter-national – line agency and WUAs, farmers, etc.)
- Institutional linkages

BASELINE ENVIRONMENTAL AND SOCIAL INFORMATION OF RIVER BASINS

CHENNAI BASIN

Demography

Chennai river basin consists of 11 taluks spread out in Tiruvellore, Vellore (part) and Kanchepuram(part) districts. There are 19 blocks covering the river basin within this, nearly 312 villages and 52 towns. According to 2001 population, the population concentration in villages is works out to be 6,62,320 and in urban areas (Chennai City, Municipalities and Townpanchayats) and total population located within 5 Km areas urban area 62,36,061, which shows high population concentration in Chennai river basin.

Location

The Chennai basin is situated between latitudes 12° 40'N and longitudes 79°10'E and 80°25'E at the north east corner of Tamil Nadu. The basin area is 7,282 km^2, out of which 5,542 km^2 lie in Tamil Nadu limits and the remaining area lies in Andhra Pradesh limits. The present extent of Chennai city is 172sq km and the area covered by the Chennai Metropolitan area is 1167 sq kms. The length of the Chennai River basin is estimated to be about 329 Km, which passes through Tiruvallur, Kanchepuram(part) and Vellore (part)

Hydrology

Chennai River Basin consists of 4 important rivers i.e. Araniyar, Kosathalaiyar, Coum and Adayar and each has its own sub basin to drain the surface runoff.

Hydrogeology

The yield in the borehole in crystalline rock formation varies from 90 to 4541pm. In the Gondwana formations the yield of the well varies from 45 to 180 lpm. The yield in the tertiary formation varies from 68 to 90 lpm. The yield in quaternary formations varies from 158 lpm to 14900 lpm.

Ground water potential

The depth to ground water level in the different sub basins are in the range of 2 to 12m. Over the years, progressive lowering in the ground water level is observed in the lower reaches of the entire sub basin. The levels of groundwater in different sub basins are ranges from 2 to 12m. The total ground water potential of the basin is 1120 Mcum

Stage of Ground Water Exploitation

The level of water exploitation in the basin area over a period of time has been

increased from 4 (dark areas) and 8 (> 100%) areas between 1997 and 2003. This has further defined into Critical and Semi critical zones, which indicate an alarming rate of 8 blocks.

Surface Water Potential

According to runoff coefficient of 0.15 adopted for plains for south-west and north east monsoon and based on the total surface water potential for 75% probably, the total Chennai basin has annual surface water potential of 784 MCM.

Surface water potential during South west monsoon	248.0 MCM
Surface water potential during North east Monsoon	422.0 MCM

Surface Water Quality

Based on the sample collected from BOD, heavy metals content, coliform content in the water collected from the Cooum, Adyar, and Buckingham canal are much in excess of permissible limits for domestic use. Pollution of surface water in Chennai City is very high due to addition of industrial and municipal waste.

Ground Water Quality

The general fall of groundwater level in Chennai basin group was observed to be 1m and 2m for 10 years and 20- years respectively. It is observed that the Chennai basin group is predominantly sodium chloride type. The ground water available in Chennai basin group is free from iron and fluoride. The nitrate content is seen in groundwater in the areas near Arakkonam.

Overall pH, Chloride, EC and TDS level exceeds in Cooum river and similarly, Kosathalaiyar water quality exceeds the limit in selected areas i.e. urban areas in North Chennai indicate the water quality level having high value of EC.

Industries

In Kosathalaiyar sub basin,out of the 96 industries ,nearly 50% of the industries are consuming less than 10 KLD of water for the industrial production. Some of the major chemical industries situated in Eranavur, Manali, Kosapur of Puzhal Block are utilizing 1000 KLD to 18000 KLD. Nearly 50% of industries are having trade effluent and 38 industries are having arrangement for treating the effluent and using it within their premises for various uses. Severe problem relating to air and water exit in North Chennai area i.e. Manali, Ennore areas. Tannery industry located in Chrompet area create pollution problem leading to contamination of groundwater in Pallavaram and Chrompet.

Sewerage System

Chennai city's sewerage system is serving for more than 41 lakhs population consists of a network of gravity sewers, force mains and pumping stations serving different parts of the city. Due to raw sewage inflow into the waterways level of B.O.D is

very high in all river area within the city.

Solid waste

In general, MSW is a continuous problem for all over India and TN is no exeption. The mix of sewage water into the system, spoils the environment at the tail end of the Cooum and Adayar rivers.

Forest

The total area of forests located in the basin is 29,855 ha, which forms 5.1% of the total area. Flora and fauna details Guindy National Park, Arignar Anna Zoological Park and Pulicat lake Bird Sanctuary are some of the major spots in the basin.

Agriculture

The major crop is paddy as it occupies 69.3% of the gross cropped area. In the basin 3,66,858 tones of paddy, 5109 tones of oil seeds, 8206 tones of millets, 541 tones of pulses and 7,70,849 tones o-f sugarcane are produced on an average per annum.

Water weeds

It is observed from the field offices in Chennai Basin area that the aquatic weeds growth, ipomoea, locally known as Kadal Palai is found to be in almost 80% of the tanks. According to the officials the plant growth varies between 40% and 80% in various tanks. In general weeds growth restricts the water storage and loss in capacity of the tanks. There are nearly 47 tanks have been identified affected by the above weeds

Sedimentation

Siltation studies done in Kaveripakkkam tank show that average annual silt load is 0.0519 MCM/year and average annual silting rate is 0.0003228 MCM/Sq.Km. The studies done in Konasamudram tank show that annual rate of silting is 0.013 MCM.

Sand mining

Excess quarrying of sand from Cooum river near A.N.Kuppam anicut has resulted in washing away of anicut portion. The causeway near Tiruvallore Railway station across Cooum, the Karanodai Bridge across Kosathalaiyar in Chennai – Calcutta highway and the Tamaraipakkam anicut were affected due to excess sand quarrying.

Sea water intrusion

Seawater intrusion has started in many places, resulting in soil loosing their fertility and found uneconomical for cropping. Seawater instruction is noticed around Minjur belt, north of chennai and about 10000 ha. in Gummidipoondi, Sholavaram, and Ponneri blocks are affected.

Encroachments

River basin is being encroached for various kinds of activities;which includes urban activities, farming activities and industrial activities. Out of 1591 tanks in the basin, majority of the tanks are affected by encroachments near Arani, Periyapalayam, Pooneri and this may create the chances of occurrence of flood during monsoon period by arresting the free flow of water in the river

Fisheries

There are 58 Marine fishing villages are located in Thiruvallur district with a population of 55,000. The fisherman community use mechanised boats for their fishing activities and there are roughly 800 mechanised boats and 2500 Kattumarams are being used. Two fishing farms located in this region one at Pulicat and another at Chetpet using fresh water with a total production of 15,948 tonnes in the basin. Inland fishing is dominant in Kancheepuram district as there are 64 fisherman villages with a population of fisherman 45,000 identified in the district as per 2002 figures. The total production of fishing in Pulicat lake is 928 kg/ha. The Inland Fish production in Kanchepuram is 8221 Tonnes in 2002-01.

Adayar Estuary and Creek

Chennai is one of the few cities having an estuarine ecosystem. The Adayar creek is of a tidal type and a part of the natural estuarine ecosystem located right in the heart of the city. The Adayar river, of which the creek is a part, is highly polluted. But at the estuary there is still vegetation and nesting of migratory birds.

The ecological functions of a creek can be summarised as follows:

a)Acts as a natural flood control system
b)Prevents storm damage by retaining storm water.
c)Maintains water balance in the region.
d)Is a nutrient-rich spawning ground for aquatic life.
e)Provides visual contrast and diversity to the landscape.
f)Cleans polluted water and prevents eutrophication.
g)Supports biodiversity.

Diseases

Acute Diarrhea is a major disease prevailing in the basin, however there are no deaths reported under this disease. In addition Dysentery and Jaundice is prevalent in the basin (majority of the areas lies in Tiruvallur district) and few deaths reported due to Dysentery and Jaundice. This is due to contamination of sewage water and lack of knowledge with the people to boil and drink the water for safety reasons.

Sub Basins under IAMWARM for the 1st year

Araniyar, Kusathalaiyar, Coum and Adyar River are the four important rivers in this basin, each having its own sub basin to drain the surface runoff.

Kosathalaiyar sub basin

The Kusathalaiyar River originates from the surplus waters of Kaveripakkam tank, which is one of the irrigation tanks supplied by Palar Anicut. Kesawaram anicut has been constructed across the Kusathalaiyar with a regulator to supply water to Coum River. Nagari and Nandhi rivers are the tributaries of Kusathalaiyar just above Poondi reservoir. Chennai basin contains of 4-sub basin, Sathayamoorthy sagar, popularly known, as Poondi reservoir is the only reservoir constructed across Kusathalaiyar. Red Hills, Cholavaram and Chembarabakkam are the other reservoirs in this basin.

System deficiencies

1. Overall efficiency of tank irrigation system is 30-40%*
2. There is 15-20% reduction in tank storage capacity due to siltation
3. Poor water scheduling
4. Inadequate supplies produce water stress condition and yield is reduced.
5. Water losses due to unlined canals

Proposed actions

1. Conjuctive use of surface and ground water
2. Renovating old tanks, desilting of ponds and supply channels and water harvesting
3. Crop rotation
4. Selective lining to canals where seepage loss is appreciable

PALAR RIVER BASIN

Demography

Palar river basin consists of 20 taluks spread out in Vellore, Kanchepuram and Tiruvanamalai districts. There are 45 blocks covering the river basin within these nearly 507 villages and 46 towns According to 2001 population, the population concentration in villages is works out to be 10,87,765 and in urban areas (Municipalities and Townpanchayats) is 15,12,565 and total population located within 5 Km areas is 25,00,3334, which shows quantum of population concentration near to palar river basin.

Location

The Palar river basin lies between 12^0 14' N and $13^0$37 N latitudes and $77^0$48'40" E and 80^0 14'40" E longitudes. The total area of the basin is 18,300 km^2 of which 10,910 km^2 is present in Tamil Nadu. The basin area is spread in the districts namely, Vellore, Tiruvannamalai and Kancheepuram covering 4,710 km^2, 4,013 km^2 and 2,187 km^2, respectively. The Palar river basin is bounded on its Northern side by the Swarnamughi river basin of Andhra Pradesh and the Chennai basin on the Northeastern side.

Hydrology

Palar River originates in Nandhi Durg, Kolar district in eastern part of Karnataka State at an elevation of 800m above MSL, which passes through the hilly terrain of south western part of Andhra Pradesh and enter into Tamilnadu on the west of Vaniyambadi town and flows through Vellore, Thiruvannamalai and Kancheepuram Districts and finally enter into Bay of Bengal near Sadarangapattinam The total length of the river is estimated to be about 350 Km.The important tributaries are Poiney, KavundinyanagaNadhi, Malattar, Cheyyar, Agaram, Kiliyar and Vegavathi

Geology

Palar river basin consists of hard crystalline rock masses of Archaean age in most of the basin area and sedimentary rocks of Gondwana, tertiary and quaternary age on the eastern part of the basin.

Hydrogeology

The hydrogeology of the Palar river basin is such that 87 % of the area under the basin is hard crystalline rock while the remaining 13 % is sedimentary. The general depth of the bedrock varies from 10 m to 60 m where crystalline formations are found. Ground water is found to occur in semi confined / confined or water table conditions.

Surface Water Potential

Palar river basin receives an average annual rainfall of 1039 mm. The Palar River Basin having an annual potential of 1758 MCM and average annual flow into the sea works out to be 12.5 TMC.

Ground Water Potential

The ground water potential of the basin is 2610.32 MCM.

Surface Water Quality

Analysis of water samples shows that during the flow pH, Electrical Conductivity, Total Hardness, Chloride and Coliform values are within the limits. Dissolved Oxygen falls below 5 mg/lit at places such as Koudanaya river, Nandhiyalam village, Rajakal head sluice, Mettur village and at stretches between Wallajabad to Asur due to mixing of Tannery effluent with water. This affects the aquaculture in the area. The river water is contaminated with domestic sewage. It is also found that Total Dissolved Solids is beyond the tolerable limit in tannery-polluted areas. Chloride is above the acceptable limit but below permissible limit. Total hardness fluctuates above and below tolerable limits and Biological Oxygen Demand is found to be very high in some head works.

Ground Water Quality

The ground water in Upper Palar basin is highly unsafe for domestic and irrigation purposes owing to the high chloride values which exceed the permissible limits. In Kamandala Naganadhi, Upper Cheyyar and Lower Cheyyar zone the salinity and chloride values are within the acceptable limits. In the Lower Palar zone comprising Wallajabad, Kanchepuram and Mamandur ground water contains high salinity and chloride caused by industrial and tannery effluents. Moderate salinity is observed in Kilsathamangalam, Nallulumalai, West Salai, Vendur and Thirukallukundram.

Industrial effluents have polluted ground water in Pernambut, Ambur, Thuthipattu and Vaniyambadi. The chloride concentration is of the order of 1000 mg / l against the standard of 250 mg / l. In certain packets at Pernambut, Ambur and Vaniyambadi irrigation water has high sodium concentration and is grouped under high saline and sodium water.

Industries

There are 120 large and medium scale industries and 11,000 small-scale industries are functioning in the basin area. This includes manufacturing of Textile, Wood, paper products rubber plastics, chemical, leather etc. There are sizable numbers of large scale industries are engaged in Leather, Automobiles, and Chemical products in this region. Vaniyambadi, Ambur, Arcot, Ranipet, Kanchepuram, Chengelput and Cheyyar. There are nearly 473 Tanneries are located in Vellore and Vaniyambadi region.

Sewage and Solid waste

There are number of towns that are located all along the river course i.e. Vaniyambadi, Ambur, Pallikonda, Vellore, Ranipet, Arcot, Gudiyattam, Peranambattu, Arani, Tiruvettipuram, Chengam, Kanchepuram, Ayyampettai, Walajabad, Chengalpattu etc. discharging heavy amount of untreated sewage water without any treatment into the river course and nearby water source. Dumping of solid waste along the river margins and tanks, which block the natural, recharge capacity of the water source.

Water weeds

Out of 661 tanks in the Palar Basin areas, it is identified that nearly 200 tanks in the basin having weed growth for 80%.

Agriculture

Rice, Cholam, Cumbu, Ragi, Sugarcane, Pulses, Groundnut, Banana and Coconut, are cultivated extensively in Vellore district, while Cotton is cultivated in a few places. The total land used for cultivation of these crops is 2,76,062 ha. Rice, Ragi, Sugarcane, Pulses, Groundnut and Coconut are the major crops cultivated in Kanchepuram district. Land used for cultivation here is 2,324 ha which is comparatively lower than that used in Vellore District. The major crop in this river basin is paddy.

Seismic Zones

The basin area is falls under the Zone II of seismic zones classification. The basic seismic coefficient for Palar basin is 0.02 and the importance factor for all types of dams is 3. The design of dams and water retaining structures are based on IS: 1893 – 1984.

Forest

Forest Department records show a total extent of 1,92,461 ha under forests in the Vellore district. Among this area 89 % is Reserve forest, 2.6 % is Reserve Land and 8.4 % under unclassified forests. The total forest area in Tiruvannamalai district is 42,630.41ha. Kancheepuram district has a reserves forest area of 230.19 km^2 while the reserved lands and unclassified forestlands are 5.61 km^2 and 2.31 km^2 respectively.

Sea Water Intrusion

Seawater intrusion is not predominant in the coastal area except some pockets near Kalpakkam, where the large-scale water extraction and sand mining activity trigger the factor of seawater intrusion especially in Vayallur areas in Thirukazukundrm block.

Sedimentation

Average annual rate of silting in the Uthiramerur tank, Maduranthakam tank, Dusi - Mamandur tank and Kalavai tank were 0.45 %, 0.051 %, 0.593 % and 2.37 % respectively. A loss of 37.63% and 16.24 % capacity were observed in the Maduranthakam tank and Uthiramerur tank in 1985 and 1987

Encroachments

Out of 661 tanks in Palar river basin, majority of the tanks are affected by encroachments. Damal tank is encroached by 25%. Dumping of Solid Waste is also one among the reasons for encroachment. Vegavathi river area near Ayyampettai encroached by 50%. River margins near Vellore, Ayyampettai, Wajajabad, Ambur, Vaniyambadi, Arni, Vandavasi and several other places are affected by encroachments.

Fisheries

Inland and marine fishing are practiced in this basin. Brackish water fish farm at Vaninchavadi produce about 1 tonne /annum. Fishing in Kalavai Tank situated in Vellore district with fish production about 9000 tonnes. The marine fish production is estimated at 700 tonnes/annum.

Diseases

Acute Diarrrhoea Disese (ADD) is prevalent in all districts. Gastroenteritis is the most prevalent disease in Vellore and Thiruvanamalai districts. Malarial fever is also a common disease and Iodine Deficiency is a common problem in Vellore and Vaniyambadi region.

Sub basins under IAMWARM for the 1st year

Cheyyar Sub Basin

Cheyyar sub basin originates from Javadhi hills and flow through Thiruvannamalai and Kanchipuram districts and confluence with Palar near Thirumukkodal village in Walajabad. The maximum area is in Thiruvannamalai distict.The total area of the sub basin is 4311.88 sq.km. Cheyyar sub basin has 8 taluks i.e. Chengam, Thiruvannamalai, Aarcot, Cheyar, Polur, Uthiramerur, Vandavsi and Arni. There are 6 tributaries to the Cheyyar river and it has 2 reservoirs and 8 major anicuts. Paddy is the major crop in the sub basin.

System deficiencies

1. Overall efficiency of tank irrigation system is 30-40%
2. There is 15-20% reduction in tank storage capacity due to siltation
3. Poor water scheduling
4. Inadequate supplies produce water stress condition and yield is reduced.
5. Water losses due to unlined canals

Proposed actions

1. Conjuctive use of surface and ground water
2. Renovating old tanks, desilting of ponds and supply channels and water harvesting
3. Crop rotation
4. Selective lining to canals where seepage loss is appreciable

Kliyar Sub Basin

Kliyar sub basin has four taluks i.e. Wandiwash, Uthirumerur, Maduranthakam and Cheyyar. Wandiwash taluk consists Uthiramerur and Pernamallur blocks. Uthirumerur taluk consists of two blocks i.e. Kalasappakkam and Chetput. Maduranthakam taluk consists of Maudranthakam block and Cheyyar taluk consists of three blocks i.e. Lathur, Cheyyar and Anakkavur.

System deficiencies

1. Overall efficiency of tank irrigation system is 30-40%
2. There is 15-20% reduction in tank storage capacity due to siltation
3. Poor water scheduling
4. Inadequate supplies produce water stress condition and yield is reduced.
5. Water losses due to unlined canals

Proposed actions

1. Conjuctive use of surface and ground water
2. Renovating old tanks, desilting of ponds and supply channels and water harvesting
3. Crop rotation
4. Selective lining to canals where seepage loss is appreciable
5. Use of drip and sprinkler irrigation.

PENNAIYAR RIVER BASIN

Demography

The population, density of the basin is 4334 persons per sq.km. The literacy rate is 62.3% for male and 49.2% for female. The birth and death rates are 17.23 and 5.94 per thousand as per 2001 statistics. The distribution of population between urban and rural is 15% and 85% respectively. Agriculture is the main occupation of rural population. The farmers mostly depend on tank irrigation and well irrigation besides areas under projects like, Krishnagiri Reservoir, Sathanur Reservoir etc. Most of them are marginal and small farmers and there is inequality in the distribution of lands. This aspect has seriously eroded the economic viability of farm, leading to reduced efficiency, productivity and profit margin.

Location

Pennaiyar River originates on the south-eastern slopes of Chennakesava Hills, northwest of Nandidurg in Karnataka State at an altitude of 1000 m above M.S.L. After flowing through Karnataka, the river enters Tamilnadu near Begalur village of Hosur Taluk. Pennaiyar river basin is bounded by Cauvery basin at its West, Vellar basin at South and Palar & Varahanadhi river basins at its North. The geographical co-ordinates of this basin are Latitude 11°45'00" North to 13°14'00" North and Longitude 77°45'00" East to 79°45'00 East. The total area of the basin in Tamilnadu State is 11,257 Sq.Kms.

Hydrology

The Pennaiyar river is having 10 tributaries, namely, a. Chinnar-I, b. Chinnar-II, c. Markandanadhi, d. Pullampattinadhi, e. Pambar, f. Vaniar, g. Kallar, h. Pambanar, i. Musukundanadhi and j. Thurinjalar. There are 7 major Anicuts namely Nedungal Anicut, Kumarapatti Anicut, Ichembadi Anicut, Sathanur pick up Anicut, Tirukkoilur Anicut, Ellis Choultry Anicut and Somavur Anicut, 152 Minor Anicuts and about 22 open offtake channels. Total ayacut of the basin is 90806 Ha.

Geology

The geology of the area include metamorphic complex meta sediments and younger intrusives of Archaean formations on the central and western portion and the overlying sedimentaries of upper Cretaceous, tertiary and quaternary formations of the eastern part. The Archaean formations include granite gneiss, charnockite, hybrid gneiss and mixed gneiss, magmatites, denites, pyroximites etc. of Dharwar group and Dolerite. Pegmatite, granites synites, carbonatites of younger intrusives.

Hydrogeology

Pennaiyar river basin is underlain by crystalline formations on the western part of the basin and by sedimentary formations in the eastern coastal part of the basin. The thickness of the weathered zone varies from 5 to 60 m bgl. The yield of the boreholes range from 27 lpm to 205 lpm. In hard rock area yield varies from 60 to 180 lpm and transmissivity vary

from 0.45 m^2/day to 338.4 m^2/day. In sedimentary formations, the yield of the borewells ranges from 61 lpm to 1273 lpm and transmissivity ranges from 17.5 m^2/day to 1133 m^2/day.

Ground Water Potential

The zone of water level fluctuation varies from 3.90 m to 10.78 m in hard rock areas and from 2.15 m to 7.10 m in alluvium areas. The water level elevation above MSL varies from 80.0 m to 40.0m in hard rock areas and from 40.0m to 0m in sedimentary formations of the basin. The hydraulic gradient of ground water in the basin is 3.15 m/km in hard rock areas and from 0.93 m/km in sedimentary areas.The Total Ground water potential in Pennaiyar basin is 1560 MCM. There are about 172 observation wells in this basin.

Ground Water Exploitation

This river basin is converted into 51 blocks. Out of 51 blocks, 32 blocks are over exploited, 2 blocks are critical 13 blocks are semi critical and 4 blocks are safe.

Surface Water Potential

The annual surface water potentialin the 4 zones based on 75% dependable rainfall is 1282 MCM.

Surface Water Quality

The quality of water in kelavarapally dam is polluted drastically due to the effluent and sewage let into the Pennaiyar River on the upstream side of kelavarapally reservoir. The surface water quality of krishnagiri reservoir shows that the water is alkaline in nature and the DO was present at near saturation levels; the nitrate concentration varied from 0.1-0.4 mg/l, while phosphate varied from 0.1-1.0 mg/l.

Ground Water Quality

In the basin, the chloride values do not exceed the limit. Total hardness above 180 mg/l exists in nearly 90% of ground water basin, which restricts the use of water for industries. Ground water in Melumalai, Mettupatti, Periyadobhai, Hanumanthapuram, Chinnamuthur, Bargur, Agaram, Kunnathur, Anandur, K. Vetripatti, Harur, Pappireddi areas are found to contain fluoride above the permissible limit of 1.5 mg/l. Ground water quality impairment has occurred on account of excessive salinity and fluoride in about 20% of the hard area of the basin. In the sedimentary area of the basin, the ground water is suitable for human consumption and irrigation use.

Industries

In the Ponnaiyar river basin there are about 7146 numbers of small-scale industries and medium industries. The small scale industries include food, beverage, tobacco, cotton, textile, paper, leather, chemical, metal and machinery products and the large and medium industries belongs to the categories like, fertilizer, paper, sugar, automobiles, textiles and machinery products

Forest

The catchment area of Pennaiyar basin is having reserve forests to an extent of 97.25 Sq.Km. the reserve forest area covers 3 major reserve forests mainly Sanamavu Reserve Forest, Kamasandra Reserve Forest and Maharaja Kadai Reserve Forests. The types of forests found in the catchment are tropical dry mixed deciduous forests, Secondary dry deciduous forests and dry deciduous scrub forest. There are also plantations like Eucaluyptus, Bamboo, Tamarind and Cashew in some parts of the catchment

Deforestation

The reserved forest area in the catchment area falling in Hosur, Krishnagiri, Uthanagarai and Dharmapuri taluks are in a highly degraded condition. While the forest area in Harur taluk, especially Chettari hills are fairly dense. The areas in Tirupattur taluk are fairly open due to heavy influences, especially goats. The forest in Chengam and Thiruvannamalai taluks are open due to excessive goat rearing and illicit felling of trees.

Agriculture

In this basin major crop is paddy. Oil seed crops like groundnut, millets like cholam, campu, varagu, ragi, pulse crops like blackgram, greengram, sugarcane and banana are also cultivated in this area. The extent of crop area irrigated is 62227 Ha and the extent of Non-system crop area is 412106 Ha.

Seismic Zones

The basin area is falling under the Zone II. The basic seismic coefficient for Pennaiyar is taken as 0.02 and the value of importance factor of all types of dams is considered as 3. And being designed based on the specifications specified in IS 1893 – 1984.

Sedimentation

The loss in storege capacity of Krishnagiri Reservoir in 26 years is 30.81% and the rate of silting is 1.19. Classification of reservoir curves indicated the Krishnagiri reservoir to be flood-plain-foot-hill type

Soil Erosion

Severe zones of erosion are seen in the Veppanapally water shed, the middle and lower part of Markhandanadhi water shed, the lower part of Nachikuppam water shed and the lower Pennaiyar water shed.

Solid Waste

Dharmapuri, Thiruvannamalai, Villupuram, Cuddalore and Vridachalam municipalities are having compost yards. Other municipalities and town panchayat are not having disposal facilities. There is absolutely no solid waste collection and disposable mechanism at village level in river basin area.

Salinity

The Electrical Conductivity values in the hard rock area varied from 350 to 6400 micro siemens per centimeter. It has been observed that 19% of the wells exceeds the recommended limit of 1500 mg/l, which approximately corresponds to the Electrical conductivity value of 2250 microsiemens per cm. Saline pockets in hard rock area fall around Krishnagiri, near Thirupattur- around Papparapatti, Thoranapatti, Andiappanur and Alangayam and near Dharmapuri.

Sea Water Intrusion

Sea water - fresh water interface is observed only shallow-phreatic aquifer located along the coastal width 1.5 - 4.0 km. Potable aquifer zone dispositioned in the range between 40 mts and 200 mts at Cuddalore O.T., General Hospital, Villipalayam, Kudikady and Periyapattu

Diseases

The observed general trend is that the number of cases of water borne diseases reported is larger during post monsoon period. Acute Diarrohea diseases (ADD) is the major disease reported in the basin

Sub basins under IAMWARM for the 1st year

Chinnar 1a sub basin

Chinnar 1-a sub basin originates from Hosur taluk and it is having an area of 144.52 sq.km. This has been identified as a deficit sub basin at the rate of 0.25%. The registered ayacut of this sub basin is 461.87 Ha.

System deficiencies

1. Unassured supply of water and prolongued drought
2. Low crop yields
3. Over exploitation of ground water
4. Non adopting modern irrigation and agriculture practices
5. No organized coordination among the farmer communities

Proposed actions

1. Strengthening of existing tank bunds and repairs to head sluice and surplus weir
2. Providing hitech micro irrigation facilities
3. Encouraging horticulture crops like fruits, vegetables, spices and medicinal plants
4. Training to farmers and water user association members

Chinnar 1b sub basin

Chinnar 1-b sub basin originates from Hosur taluk and it is having an area of 280.65 sq.km. This has been identified as a surplus sub basin. The registered ayacut of this sub basin is 749.47 Ha.

System deficiencies

1. Unassured supply of water and prolongued drought
2. Low crop yields
3. Over exploitation of ground water
4. Non adopting modern irrigation and agriculture practices
5. No organized coordination among the farmer communities

Proposed actions

1. Strengthening of existing tank bunds and repairs to head sluice and surplus weir
2. Providing hitech micro irrigation facilities
3. Encouraging horticulture crops like fruits, vegetables, spices and medicinal plants
4. Training to farmers and water user association members

Vaniar sub basin

Vaniar is one of the tributaries of Pennaiyar River. It originates from the shaveroys hill ranges at an altitude of 1420 m above MSL and enters into the plains above 5km in Mullikadu in Papireddipatti taluk of Dharmapuri district. The total length of the river is 55 kms and the catchment area is 1100 sq.km. There are 2 reservoirs, 42 anicuts and 8 tanks in the sub basin. The total ayacut is 8003.16 Ha.

System deficiencies

1. Damaged anicuts
2. Canal silting and encroachments
3. Over exploitation of ground water
4. Non adopting modern irrigation and agriculture practices
5. No organized coordination among the farmer communities

Proposed actions

1. Provision of sand vent with shutter arrangements and construction of head sluices
2. Strengthening of existing tank bunds and repairs to head sluices,anicuts and surplus weir
3. Canal lining and eviction of encroachments
4. Providing hitech micro irrigation facilities
5. Rehabilitation of Vaniar dam infrastructures
6. Training to farmers and water user association members

Muskundhanadhi sub basin

Muskundhanadhi sub basin originates from Kalrayan hills and extends through eastern part of sankarapuram and Rizivandhayam area. The total area of the sub basin is 175.59 sq.km. It is having 11 anicuts and 22 tanks. The average annual of the sub basin is 950 mm. it is proposed to construct a reservoir in the upper reaches of the river. The registered ayacut of the sub basin is 1185.71 Ha.

Proposed actions

1. Desilting of tanks
2. Strengthening of existing tank bunds and repairs to head sluices,anicuts and surplus weir
3. Canal lining
4. Alternate cropping
5. Introduction of micro irrigation facilities

Pennaiyar upto Krishnagiri dam sub basin

The sub basin originates from Hosur taluk and has an area of 680.59 sq.km. this is a deficit sub basin at the rate of 0.39%. The registered ayacut of the sub basin is 5250.39 Ha.

System deficiencies

1. Unassured supply of water and prolongued drought
2. Low crop yields
3. Over exploitation of ground water
4. Non adopting modern irrigation and agriculture practices
5. No organized coordination among the farmer communities

Proposed actions

1. Strengthening of existing tank bunds and repairs to head sluice and surplus weir
2. Providing hitech micro irrigation facilities
3. Encouraging horticulture crops like fruits, vegetables, spices and medicinal plants
4. Training to farmers and water user association members

VARAHANADHI RIVER BASIN

Location

Varahanadhi basin is situated between Latitude 11° 55' North and 12° 30' North and Longitude 79° 05' East 80° 05' East. The total basin area is 4357 Sq. km of which 4214 sq. km lies in Tamil Nadu and 143 sq. km. lies in Pondichery State. The districts covered by the basin are Kancheepuram, Thiruvannamalai and Villupuram Districts.This basin is bounded by Palar basin on the North, Ponnaiyar basin on the West and South and Bay of Bengal on the East.

Hydrology

The Varahanadhi River originates in between the borders of Kilpenathur taluk of Thiruvanamalai District and western borders of Gingee Taluk in Villupuram District. The total length of the river estimated to be 78.50 Km with a total catchment area of 1936.75 Sq.Km. Varahanadhi River basin consists of two sub basins namely Varahanadhi and Ongur, the smaller sub basin called Nallavur or Kondamur located between Varahanadhi and Ongur sub basins, Other tributaries of this basin include Annamanagalam, Nariyar, Tondiar, Pambaiyar, Pambai channel and Chengai odai.

Geology

The terrain of Varahanadhi River Basin consists of different type of rocks, which is dominated by Crystalline by 87%, and sedimentary rock by 13 % and alluvial found along the coastal areas. The Varahanadhi basin completely drains in Villupuram district and geological formation identified underlain by crystalline metamorphic complex in the western parts of district and sedimentary tract in eastern side.

Hydrogeology

The hydrogeology of this basin is such that 87 % of the area under the basin is hard crystalline rock while the remaining 13 % is sedimentary. The general depth of the bedrock varies from 10 m to 60 m where crystalline formations are found.

Surface Water Potential:

The river basin has the water potential of 416 MCM based on 75% dependability of rainfall.

Ground Water Potential

The utilizable ground water recharge, draft and balance potential of Varahanadhi basin has been estimated, which shows the overall ground water recharge potential of 1482 MCM. Therefore, the total potential for this basin is estimated to be 1898 MCM.

Ground Water Exploitation

Varahanadhi river basin has been exploited fully by excess of water withdrawal, which makes the entire classification under over exploited category. According to 2003 data from the ground water department reveal that 7 blocks are identified with over exploitation ground water resources.

Surface Water quality

Varahanadhi is a non-perennial river and flow is possible only during the rainy days i.e. north east monsoon period and since last two years there is no water is identified in the river basin area.

Ground Water Quality

The ground water quality in different villages in the block of Villupuram, Tiruvannamalai and Kancheepuram (Varahanadhi River basin area only) indicate presence of EC value of 3640 microsiemen/cm in Omandur in Tindivanam Block of Villupuram District and 3140 in Orathur in Villupuram Block in Villupuram District . Similarly in Chitamur Block, the presence of EC value of 4890 microsiemen/cm indicates the quality is unfit for any safe use.

Industries

There are about 30 large and medium scale industries and more than 2,600 small scale industries are functioning in this basin area. These industries mainly engaged in manufacturing of Oil, Sugar, machinery, Textile, chemical, leather, food, beverage, plastic paper, fertilizer, cement products etc. There are sizable numbers of large industries engaged in food, tobacco, textiles, automobiles, Chemical products in the region.

Agriculture

Dominant irrigated cropping is paddy as it occupies 52.7% of the gross irrigated area. The other important irrigated crops in this basin cultivated in rotation with paddy are groundnut, sugarcane, millets like, cholam, cumbu and ragi, pulses, cotton etc. Under unirrigated cropping it is groundnut based. The organic farming in river basin support for growing of fruit and vegetable crops including flowers. There is high potential exist for organic farming in this are, which need proper attention for maintaining long term organic farming activities in the basin area .

Forest

Forest areas in this district contribute about 7.77% of the total area, which spread in the basin area bordering Salem, Dharmapuri and Tiruvanamalai Districts with divisions of Reserve Foret, interface forest and social forest. Teakwood, rosewood and Sandal wood trees are found to be grown in the hills.

Sand mining

The sand mining is a major problem in this basin, which poses major treat to riverbed of Varahanadhi. However the Water Resources Organisation having approved 5 places of sand quarry in this basin

Water Logging

In the urban areas of Gingee, Villupuram etc. are having the problem of water logging in selected pockets due to lack of drainage and storm water provisions.

Water Weeds

This basin is affected by the waterweeds in general. Out of 1421 tanks, nearly 100 tanks have been identified with 100% weeds growth spread out in the entire basin. Remaining tanks have 10% to 25% with aquatic weeds such as Cyprus rotundas, (korai, Velikattan.

Seismic Zones

The basin area is falling under the Zone II. The basic seismic coefficient for Varahanadhi is taken as 0.02 and the value of importance factor of all types of dams is considered as 3. And being designed based on the specifications specified in IS 1893 – 1984.

Diseases

The observed general trend is that the number of cases of water borne diseases reported is larger during post monsoon period. Acute Diarrohea diseases (ADD) is the major disease reported in the basin

Varahanadhi sub basin

System deficiencies

1. Overall efficiency of tank irrigation system is 30-40%
2. There is 15-20% reduction in tank storage capacity due to siltation
3. Poor water scheduling

4. Inadequate supplies produce water stress condition and yield is reduced.
5. Water losses due to unlined canals

Proposed actions

1. Conjuctive use of surface and ground water
2. Renovating old tanks, desilting of ponds and supply channels and water harvesting
3. Crop rotation
4. Selective lining to canals where seepage loss is appreciable
5. Use of drip and sprinkler irrigation.

VELLAR RIVER BASIN

Demography

Vellar river covers fully Athur taluk of Salem District, Thittagudi and Kallakurichi taluks of Villupuram District. It covers partly Harur taluk of Dharmapuri District, Salem taluk of Salem District, Rasipuram taluk of Namakkal District, Ariyalur & Perambalur taluks of Perambalur District, Udayarpalayam, Thuraiyur Taluks of Trichy District, Kattumannar Koil, Chidambaram & Vridachalam Taluks of Cuddalore District.

Location

The Vellar river basin is located in the Northern part of Tamilnadu state, between latitude 11° 13' North and 12° 00' North and longitude 78° 13' East and 79° 47' East. The total area of the Vellar river basin is 7659 Sq. Km. A portion of Dharmapuri, Salem, Trichy, Villupuram and Cuddalore districts are covered in Vellar river basin. This basin lies in between Ponnaiyar basin in the north and Cauvery basin in the south.

Hydrology

The river Vellar is having 6 tributaries. They are (i) Anaimaduvu, (ii) Swethanadhi, (iii) Kallar, (iv) Chinnar, (v) Manimukthanadhi, (vi) Gomukhi. A portion of Dharmapuri, Salem, Perambalur, Trichy, Villupuram and Cuddalore districts are covered in Vellar river basin. The Vellar basin is a medium river basin in Tamilnadu. The river Vellar originates at Chitteri hills in Salem District, flows entirely within Tamilnadu and falls into Bay of Bengal at Portonovo.

Geology

Both Archaen and sedimentary formations occupy this basin. Archaen group of rocks occurs on the western part of the basin (82% of-basin area) and sedimentary formations of cretaceous, tertiary and quaternary systems on the eastern part.

Hydrogeology

The depth to water level of aquifer varies from 2m to 15m in hard rock area and lowest water level is 9.00m in alluvium. The zone of water level fluctuation varies from 2.20m to 13.39m in hard rock areas and varies from 2.83m to 16.40m in sedimentary areas. The hydraulic gradient of ground water in this basin is 2.75m/km in hard rock areas and 0.65m/km in sedimentary areas. The average hydraulic gradient of Vellar river basin is 1.70m/km.

Stage of Ground Water Exploitation

Out of 39 blocks, the State Ground Water Department has identified 7 blocks as safe (< 70%), 11 blocks as semi critical (70% to 90%), 1 block as critical (90% to 100%)

and 20 blocks as Over –exploited (> 100%).

Water potential

The annual total water resource potential of this basin is 2409 MCM. This basin also receives surplus water of 78 MCM from Veeranam tank of adjoining cauvery basin at Sethiathope anicut. Thus the total water potential of this basin is 2415 MCM.

Surface Water Quality

It is found that during flow pH, EC, Total Hardness, Chloride, Coliform values are within the limits. But in Koudinyar river, Palar in Nandhiyalam village and Palar river in Rajakal head sluice near perumbakkam on Kanchepuram to Arcot route, Palar in Mettur village enroute from Walajabad to Asur the Dissolved Oxygen falls below the limit of 5mg/lit, which is due to Tannery effluent mixing with water this effects the aquaculture in the area. Total dissolved solids are very high beyond the tolerable limit. Chloride is above the acceptable limit but below permissible limit, Total hardness fluctuates above and below tolerable limits and Biological oxygen demand found to be very high in some head works.

Ground Water Quality

In Mangalur, Thiyagadurgan, Viragathur, Kalathur, Edaicheruvai, Miralur, Keerapalayam, Karikai Athur and Peddanaickanpalayam areas, the quality of ground water is salined and unsafe for human consumption. The Chloride values are also high in these areas. The nitrate values are also found to exceed the permissible limits indicating the nitrate risk. The chemical composition data for few bore wells in Portonovo, Sethiathope and Purudakurayapettai locations indicate that they are of good quality. Overall ground water quality assessment indicate that about 80% of the ground waters are good to moderate in quality and may be used for human consumption and utilization purposes.

Industries

There are 9229 industries located in basin area. The water pollution due to industrial activities is minimum except ground water pollution in Pennadam area in Perambular district and discharge of Neyveli mining waters into Wallaja tank

Sewage and Solid Waste

There is no Sewage treatment plant either for municipalities or Town Panchayats. They are letting untreated/ primary treated sewage either on land or into water bodies. There are very few villages in Vellar basin is having community toilets.

Except Vridhachalam municipality, no composting yard for solid waste management is available in Vellar River Basin. There is absolutely no solid waste collection and disposable mechanism at village level in river basin area.

Forest

Thick dense forest occurs in the chitteri and Kalrayan hills. Medium dense forest occurs in the Kolli, Pachamalai, Chitteri and Kalrayan hills. Low dense forest and shrub forests are well developed in the slopes and foot of hills. Isolated pockets of reserve forest occur in the basin. Total forest area of the basin is about 27 %

Seismic Zones

The basin area is falling under the Zone II. The basic seismic coefficient for Vellar is taken as 0.02 and the value of importance factor of all types of dams is considered as 3. And being designed based on the specifications specified in IS 1893 – 1984.

Agriculture

The major crop of this basin is paddy. Oil seeds crop like gingelly, groundnut, coconut, sunflower and castor, millets, pulses and sugarcane are grown in this area

Sedimentation

Though there are 5 reservoirs in this basin. In Wellington Reservoir, the loss in capacity over 61 years is 22.58% and % capacity loss per year is 0.36%. Some of the watercourses of the system run near the river Vellar and occurrence of the heavy rains due to the effect of cyclone results in floods in Vellar causing breaches and damages to the banks and structures in the irrigation system.

Water logging

Water logging seems to be a serious problem at least in one of the six tank ayacuts studied (Ambapuram, Kummadimoolai, Nathamedu, Chokkankollai, Kothavacheri and Sathappadi tanks). The farmers reported that about 25% of the total cropped area under Ambapuram tank are affected by water logging.

Water weeds

Kothavacheri, Nathamedu, Kummididmoolai, Sathappadi and Chokkankollai tanks are infested with weeds such as Water hyacinth and Ipomoea SP.

Sea Water Intrusion

In the coastal area, i.e in Cuddalore district the analysis of water samples from bore wells and open dug wells were done. Open dug wells in the coastal villages Thopuiruppu, C-Muttlur, Kallai and Portnovo shows poor quality ground water. Deep bore wells drilled at Periyakomatti, Thatchakadu, Chidambaram IB, Pinnathur and Pichavaram shows very poor quality of water (EC- 12800 micromhos, TDS-7682 mg/l).

Sub basins under IAMWARM for the 1st year

Manimuktha nandhi sub basin

The basin originates in Kalryan hills with drainage Area of 749.54 Km having I two drainages namely Mani river and Muktha river originating in the Northern par of the eastern slope of the Kalrayn Hills in Sankarapuram Taluk at an altitude of about 40 km and the Muktha River flows for 32 km. Manimuktha Nadhi sub basin having 18 Anicuts , 49 PWD tanks, and one Manimuktha Nadhi reservoir having the total Ayacut of 5027 Hectares. Average rainfall is 950mm in this sub basin.

Upper Vellar sub basin

It originates at an altitude of 1266m. At its starting pointing, it is known as Anaimaduvu River is called Anaimaduvu reservoir. Upper Vellar sub basin is having sixty-five Anicuts and thirty-three PWD tanks.

Lower vellar basin

The lower velar river starts from Tholudur Anicut and finally falls into portnova in Bay of Bengal. The basin is situated between latitude 11° 13' N-12° 00'N and Longitude 78° 13' E-79° 47'E. The total area of this basin is 1753 Sq.Km. the total length of lower Velar River is 128 kms. The total register Ayacut of the sub basin is 44,166 hectares. The annual rainfall of the sub basin is 1165 mm

System deficiencies

1. Submersion of standing crops during heavy flood times.
2. Silting of channels and breaches of bunds in tanks and of channels.
3. Lack of adequate control of regulating structures like anicut etc.,
4. Deteriorated canal with low efficiency and their inspection roads.
5. Full growth of Neyveli Kattamanakku, and other scrup jungles obstructs the free flow and ayacuts at the tail end area suffering for inadequate supply.

Proposed actions

1. Lining of channels.
2. Rehabilitate the Irrigation Structures such as anicuts, regulators, head sluices inlets, bed dam and tank sluices weirs etc.,
3. Desilting channel.
4. Formation of fore shore bund in tanks.
5. Flow measurements structures etc.,
6. On farm Development works to Anicuts and Tanks etc.,
7. Construction of community wells etc.,

Anivari odai sub basin

Anivariodai originates in Perambalur taluk joins the vellar on its right flank at about 10 km below the confluence point of Chinnar. The total irrigated area is 1140 hectares and 59 tanks. The total population is 0.126 million.

System deficiencies

1. Old irrigation network
2. Low Water use efficiencies
3. Inadequate transportation , storage and marketing facilities

Proposed actions

1. Lining of channels.
2. Rehabilitate the Irrigation Structures such as anicuts, regulators, head sluices inlets, bed dam and tank sluices weirs etc.,
3. Desilting channel.
4. Formation of fore shore bund in tanks.
5. Flow measurements structures etc.,
6. On farm Development works to Anicuts and Tanks etc.,
7. Construction of community wells etc.,

VAIGAI RIVER BASIN

Demography

In the Vaigai basin there has been a progressive increase in population in the last three decades. The projected figure for the year 2015 AD is about 46 million. Increase in population in the areas of catchment is also responsible for degradation and environmental impact. The catchment area hitherto untouched started getting exploited for daily domestic needs of the local inhabitants who have started concentrating in the area.

Location

Vaigai basin is one of the major seventeen river basins in Tamilnadu. It lies between the geographic co-ordinates N latitude 9° 15' and 10° 20' and E longitude 77° 10' - 79° 05'. Vaigai river basin covers an area of about 7031 sq. km. and lies in the Madurai, Theni, Dindigul, Sivagangai and Ramnad Districts of Tamilnadu.

Hydrology

The hydrology of the vaigai basin has been worked out sub basin wise. The vaigai river basin has been divided into ten sub – basins from the origin to the sea. The total sub basin area is 7031.46 Sq.km against the basin area of 7039 Sq. km.

The major tributaries namely Suriliar, Theniar, Varatar, Nagalar, Varahanadhi, Manjalar, Marudhandhi, Sirumalayar, Sathiar, Uppar etc. constitute the sub basins of vaigai basin. Vaigai basin consists of ten minor basins of Suruliar, Upper Vaigai, Theniyar, Nagalar, Varahanathi, Manjalar, Sirumalaiyar, Sathaiyar, Uppar and Lower vaigai. The major reservoirs in this basin are Periyar, Vaigai, Sothuparai, Manjalar and Marudhanadhi reservoirs.

Geology

This area consists of Archaean formations like granite, charnockites, granite gneiss, and quartzite and Quaternary formations like alluvial sediments upper gondwana, tertiary sand stone. Hard rock occupies 74% sedimentary 26% of total area.

Hydrogeology

The borehole lithological and aquifer parameter studies have revealed the existence of weathered granular aquifer, phreatic to semi confined aquifer in the alluvium and valleyfills in the crystalline rock formation and confined to semi confined aquifer conditions in the sedimentary formations. The depth of bedrock thickness in the crystalline formations varies from 9 to 60m below ground level in the fracture zones. Valley fill thickness is varying from 10 to 25m below the ground level including the fracture zones. Alluvial thickness and the extent is phreatic and confined to the river.

The thickness is varying from .10 to 25m and the lateral extent is 6 to 12 km beyond Madurai.

Ground Water Potential

Water levels are being observed in number of shallow observation wells and borewells in the entire vaigai basin. Water levels are observed every month during the first week. Hydrographs for all the wells are being maintained. As per the estimate, the net recharge of the Vaigai Basin is about 993.07 MCM. The net extraction is around 540.37 MCM and balance potential available is 452.70 MCM

Surface Water Potential

The surface water potential of the basin is 2025.92 Mcum based on 50% dependability and 1571.01 Mcum based on 75% dependability

Surface Water Quality

As per the samples taken from Peranai regulator indicates that water is clear and contains lesser amount of chemical constitutions such as TDS, PO_4, NO_2. Most of the physico – chemical parameters are within the permissible limits. This can be attributed to lesser human activities and provision of effluent treatment plants provided by the industries discharging their effluent into the river.

Ground Water Quality

The wells located at Ramanathapuram, Valantharavai, Idayanvalasai and Periyapattinam with the EC values ranging from 1125 to 2590. In other places like Mandapam, Devipattinam, Chithayankottai, Sembadayarkulam, the quality of water is poor with EC values ranging from 3125 to 6240. The poor quality is due to marine sedimentation in this area.

Sand Mining

Indiscriminate and illegal sand mining was going on at an alarming rate throughout Vaigai riverbed. Sand was mined to a depth of more than 3 mts and even more in some places. As a result in a major portion of the river the entire sand in the riverbed has been removed and the rocky bed is exposed in many places like Mannadimangalam, Thenur and Thiruvedagam villages.

Sedimentation

The studies revealed that the capacity of the reservoir as on 1976 is 178.191 Mcum as against the original capacity of 194.785 Mcum. The rate of silting was observed to be 0.473% per year and the average rate of sedimentation per sq. km. of catchment area was 0.0004 Mcum. It was also observed that the useful life of the vaigai reservoir was estimated to be 155 years. So, the catchment area should be stablised by suitably addressing the causes of soil erosion.

Encroachment

On both sides of the Vaigai people encroached and constructed houses. Apart from the banks the riverbed is also encroached. Vaigai River from the headreach to the tail end, this menace of encroachment is there everywhere. Especially in the reaches where small villages and towns are located close to the main river and the irrigation channels taking off from Vaigai River and its tributaries the encroachment problem is predominant. The Raja Boobala Samudhram tank in Budipuram of Theni district is one of the classic example of encroachment.

Solid Waste

Vaigai River is no exception. Solid waste dumping is a problem for all the river basins. The tributaries of Vaigai like Theniyar, Varahanadhi etc. get the same treatment. Solid waste is dumped into the irrigation channels also in the Cumbum valley area. In the head reach in Varusanadu village solid waste is dumped in the river course. In Chinnamanur the solid waste is collected by vehicles and dumped in the compost yard. But the people living near by the river and the channel put their household solid waste in the channels nearby. In Periyakulam municipality the solid waste is dumped in the existing compost yard. In Madurai city the position is alarming. Even though large quantity of solid waste is collected and dumped in the compost yard people living on both banks of river dump the solid waste into the river. Similarly lower down reaches in Tiruppuvanam and Paramakudi the solid waste are put into the river and the irrigation channels. In Paramakudi the solid waste is dumped in the compost yard situated in Urapuli village near Paramakudi.

Water Logging

A large area lies downstream of Sakkarakottai Kanmai near the villages Therkutharavai, Vallimadavalasai, Viranvalasai, Kannanendal and Pallamorkulam. Another stretch of land lies near the villages Naganada chaultry, Madattur, Pannakarai and Nattakulam. Another area lies near the villages Vannankundu, Badratharavai, Regunathapuram, Karantharavaikudi. In addition to this water logged area is available near Rettaiurani, Tamaraikulam, Vellariodai and Manangudi.

Salinity

In vaigai basin the coastal areas such as Sivagangai and Ramanathapuram districts have been affected with soil salinity. The other districts such as Theni, Dindigul and Madurai are not affected with salinity. The coastal saline soils such as in

Ramanathapuram and Sivagangai districts have saline ground water table at shallow depth. Both the ground water and the soils are rich in chlorides and sulphates of sodium, magnesium and calcium. The soil salinity and depth to ground water table vary with the season. Soil salinities are maximum in dry seasons and minimum in monsoon months.

Industries

The industries in the vaigai basin are categorised as Rubber, Textiles, Spinning, Sugar, Distillery, Food Beverages, Dyeing, Pulp and Paper, Electro Platting chemicals, Dairy and Miscellaneous. These industries have been further classified as Red, Orange and Green categories depending upon the pollution level of the effluent.

Agriculture

In this basin there are well knitted irrigation systems from where water is supplied for irrigation from major reservoirs, anicuts, channels etc in addition to the tank systems. The dominant crops cultivated in the Vaigai basin are paddy, cholam, cumbu, ragi, green gram, black gram, chillies, groundnut, gingelly, cotton, sugarcane, vegetables and banana.

Seismic Zones

The basin area is falls under the Zone II of seismic zones classification. The basic seismic coefficient for Vaigai Basin is 0.02 and the importance factor for all types of dams is 3. The design of dams and water retaining structures are based on IS: 1893 – 1984.

Water Weeds

The two common weeds responsible are *"**Eichhornia crassipes**"* and *"**Ipomea carnea**"*. In Vaigai River, *Ipomea carnea* is the major bank and shore weed. Severe blockage of water by *Ipomea carnea* has led to the formation of mini silt islands (Isles) in the rivers, which now grow several weedy bushes and cause floods. Water hyacinth also dissiminates in larger places and causes severe disturbance in Vaigai River. Besides these two notorious waterweeds, the other waterweeds such as Pistia, Nelumbo, Nymph, Hydrilla, Vallisneria etc., causes some problems in Vaigai River.

Diseases

The important water borne diseases in the basin are caused acute diarrhoeal diseases, reproductive tract infection, Amoebiasis, Worm infestation, typhoid fever, Viral fevers Jaundice and Malaria

Sub basins included in IAMWARM for the 1st year

1. Swedhanadhi sub basin

Swedhanadhi originates from kolli hills in Rasipuram taluk of Salem district at an altitude of 1417 m above MSL. The sub basin is having 33 anicuts and 18 tanks.

System deficiencies

1. Silting of supply channels
2. Anicuts are in dilapidated condition
3. Erosion of side banks

Proposed actions

1. Strengthening of head works and repairing the anicuts
2. Lining of supply channels and reconstruction of sluices
3. Construction of field channels upto 10 Ha
4. Desilting of sathaiyar dam and tanks

2. Varaganadhi sub basin

Varaganadhi originates from western ghats and joins vaigai near Gullapuram. It has 11 anicuts and 31 tanks. The total area of the sub basin is 390.The total annual rainfall in the sub basin is 851 mm. The total ayacut is 3041.18 Ha.

System deficiencies

1. Silting of supply channels
2. Anicuts are in dilapidated condition
3. Erosion of side banks
4. Water use efficiencies are minimum
5. Inadequate facilities of transportation and marketing

Proposed actions

1. Strengthening of head works and repairing the anicuts
2. Lining of supply channels and reconstruction of sluices
3. Construction of field channels upto 10 Ha
4. Desilting of sathaiyar dam and tanks

3. Sathaiyar sub basin

Sathaiyar originates from sirumalai hills and flows southward and empties into Vaigai River. The basin covers an area of 819 sq.km. The total ayacut of the sub basin is 4279.89 Ha.

System deficiencies

1. Silting of supply channels
2. Anicuts are in dilapidated condition
3. Erosion of side banks
4. Water use efficiencies are minimum
5. Inadequate facilities of transportation and marketing

Proposed actions

1. Strengthening of head works and repairing the anicuts
2. Lining of supply channels and reconstruction of sluices
3. Construction of field channels upto 10 Ha
4. Desilting of sathaiyar dam and tanks

4. Manjalar sub basin

Manjalar originates from Palani hills and runs towards east and joins Vaigai River near Koottathu. There are 9 anicuta and 9 tanks in this sub basin. It receives an annual rainfall of 775 mm. The total sub basin area is 470 sq.km. The total ayacut of the sub basin is 2155.53 Ha.

System deficiencies

1. Silting of supply channels
2. Anicuts are in dilapidated condition
3. Erosion of side banks

Proposed actions

1. Strengthening of head works and repairing the anicuts
2. Lining of supply channels and reconstruction of sluices
3. Construction of thrashing floor at every village

AGNIYAR RIVER BASIN

Demography

The total population of the basin based on 2001 census is 1021222. In this basin male population (505487) constitutes 49.50 % of the total population. The total female population (515735) of 2001 has an edge over male population constituting 50.5% over the total population of the basin for 2001. The total population density of the basin (Based on 2001 census) is 302.63 / Sqkm

Location

Agniyar River Basin is located in between latitudes 90° 55' N to 100° 48' N and Longitudes 78° 14' E to 70° 30' E. The total area of Agniyar basin is 4,566 km^2 and lies entirely within Tamil Nadu. It has three minor river basin namely Agniyar, Ambuliyar and Southvellar. The western portion is 200m above sea level and tapers towards the east and reaches sea level. Tank irrigation plays an important role and there are about 40,00 irrigation tanks irrigating about 76,350 ha.

Hydrogeology

The bore wells drilled in the crystalline area are shallow ranging in depth between 30 and 60 m and the bore wells drilled in the sedimentary formation are medium to deep ranging from 150 to 350 m depth. The yield of the wells in the Archaean formation varies from 5 to 50 lpm, where as in the sedimentary formation yield of the wells various between 25 to 500 Ipm. In the cretaceous formations, the yield varies between 5 lpm to 60 Ipm. In the alluvium formation, the yield of the well varies between 100 to 1000 Ipm.Artesian conditions were encountered in Manalmelkudi and in Kattumavadi Villages. The maximum yield of well is found in Kuppaikudi and in Orathanadu area.

Ground Water Availability

The total ground water potential in this basin is 920 MCM

Surface Water Potential

This is a small river basin comparatively with lesser drainage area. The 75 % annual weighted rainfall of this basin is 652.93 mm the annual surface water potentials are assessed for 75 % dependable rainfall for Agniyar River Basin is 585 MCM. The total surface water potential is about 697.54 million cum. A further quantity of 499.81 million cum of water is receiving from Grand anaicut canal summing the total surface water potential of the basin to 1197.34 million cum.

Ground water potential

The average annual ground water potential is 984.89 Million cum.

Surface Water quality

The maximum value of salt concentration of 8,448 ppm is recorded at Sathankulam and Aranikulam tanks. The minimum value of 3,200 ppm is recorded at Keemakanmoi, Periyakulam Eri, Kothamangalam and Periyakulam.

Ground Water quality

The ground water quality study of Agniyar basin reveals that the water quality is found to vary from good to moderate in most parts of the basin. Electrical Conductivity (EC) in this basin is varying between 0.9 mhos/cm to 1.34 mhos/cm. Sodium Absorption Ration (SAR) ranges between 1.4 and 36.6. In places like Avudayarkoil Aranthangi and Annavasal etc of this basin SAR is found to be higher than that of the permissible value of 1.4. Hence in those places water is not suitable for irrigation. The geo-chemical type of this basin is sodium chloride. Generally a moderate ground water quality prevails in many parts of the basin.

Agriculture

The cropping pattern is slowly changing into other pattern depending upon the availability of water source. Rice is the major crop in Agniyar basin. Other important crops are Groundnut, Cotton, Pulses, Millets, Gingelly, Chillies and Sugarcane. Rice is grown in three seasons, namely Kuruvai, Samba and Thaladi. The major crop is Groundnut, which occupies 68.49 % of gross rain fed crops. Other important dry land crops like Millets and Cotton are raised in rotations with Groundnut.

Forest

The forest coverage in this basin is very low, about 5 % of the basin area.

Sand mining

Sand mining is a very common phenomenon in rural area and is being transported through bullock carts, mini tractors and lorries

Aquatic environment

There are about 30 fishing villages with a population of 0.18 Million. Inland fishing through tanks and ponds is 4,500 tones per annum. A few aquaculture industrial units are located in the coastal areas of this basin in Anadaikadu, Rajamadam, and Eripurakkai of Pattukottai Taluk of Thanjavur District and around Kattumavadi of Avudaiyarkoil Taluk in Pudukkottai District.

Solid waste

Solid waste management is one of the important factors to be taken care in respect of environment. Among the municipalities, pudukkottai is doing extensive solid waste management programmes and on the other hand in pattukottai it is being paid less importance than in pudukottai. A quantity of about 25 to 30 MT is generated per day and composted an aerobically.

Diseases

The types of diseases prevailing in the basin are Fever, Typhoid fever, Tuberculosis, Leprosy, Twakrogam, Verinam, Hypertensive diseases, Isehemic diseases, Sivogam, Nasrogam and others.

Water weeds

All ponds situated nearer to the habitations are the sources and the existence of waterweeds. The tanks affected by waterweeds are water hyacinth, salvania, water penywort, spirulina, giant brown kelp and red seaweed.

Sub Basins Ubder IAMWARM 1st year

Agniyar Sub Basin

The Agniyar river otherwise Known as "Agnanavimochana" originates from the surplus of Kulathur tank in Kulathur Village, Kulathur taluk of Pudukottai District at latitude of 10° 35 N and longitude of 78° 46 E and at a distance of 36km from Trichy along Trichy-Pudukkotai road. The river runs for a distance of about 80 km from its origin and joins the Bay of Bengal at about 5 km South of Rajamadam Village of Pattukkottai Taluk. Agniyar has three tributaries namely Nariar I, Nariar II, and Maharaja Samudram.

Ambuliyar Sub Basin

River Ambuliyar has its origin in the catchment area of Manjamviduthi tank of Alangudi Taluk, Pudukottai District. The River after traversing a total distance of 48 km empties into Bay of Bengal in Ammanichatram Village of Pattukottai Taluk in Thanjavur District. The total sub basin area of Ambuliyar is 759.70 km^2. In the Upper Ambuliyar basin there are no tributaries, but two tributaries join in the lower Ambuliyar Basin.

South Vellar Sub Basin

The South Vellar River originates as a stream in Kumarikatti reserve forest area near Manjinampatti Village, 20 km Northwest of Thuvarankurichi in Manapparai Taluk of Tiruchi District. The total length of South Vellar River from its origin to its confluence with sea is about 137 km. The total basin area of Vellar River is 1931.51 km^2. The main tributaries of South Vellar River are Nerunjiludiar and Gundar.

System deficiencies

1. Most of the anicuts, sluices and weirs are in damaged condition
2. Water use efficiencies are minimum due to old irrigation practices
3. Inadequate facilities of marketing, storing and transportation

Proposed actions

1. Providing equitable distribution of irrigated water by better water management
2. Rehabilitation of anicuts, tanks and lining of supply channels, desilting of tanks.
3. Alternate crop pattern
4. Adopting sprinkler and drip irrigation
5. Creating awareness among farmers, public and local bodies.

PAMBAR RIVER BASIN

Demography

The total population of the basin based on 2001 census is 1021222. In this basin male population (505487) constitutes 49.50 % of the total population. The total female population (515735) of 2001 has an edge over male population constituting 50.5% over the total population of the basin for 2001. The total population density of the basin (Based on 2001 census) is 302.63 / Sqkm.

Location

The Pambar basin is bounded by the longitudes $78^0$7'20" E to $79^0$7'9" E and latitudes $9^0$44'19"N to $10^0$25'32"N. It is spread over the districts of Pudukkottai, Sivagangai, Trichy, Dindigul, Madurai and Ramnad.

Hydrology

The main river Pambar (one of the minor rivers in Tamil Nadu) originates in left side Callingullah of Thamaraikanmoi which is the tail end tank of Thamaraikanmoi group, in Thirumayam village and taluk in Pudukkottai district and traverse through Pudukkottai district & Ramanathapuram district and gets divided into three courses and finally falls into the Bay of Bengal .The rivers Kottakariyar, Thenar and Virusuliar alias Manimuthar are the three tributaries joining the main river Pambar.

Geology

The area is comprised of Archaean complex on the northwest and overlain by upper Gondwana, Tertiary and recent to sub recent formations on the east. Cretaceous formations occur in the sub surface.

Hydrogeology

The thickness of weathered zone varies from 20-40m BGL. In Crystalline formations the depth of bore wells range from 14-82m BGL. The Yield of the bore wells range from 50 lpm to 200 lpm. In the sedimentary formations, the thickness of sandstone varies from 70-100m BGL. The depth of the bore well ranges from 27m to 429m BGL. The yield of the bore wells ranges from 50-500 lpm.

Surface water potential

Rainfall is the only source that contributes to this potential. Isohyetal method was used to arrive at the average rainfall using Isohyets for all the 3 different seasons. The surface water potential of the basin is 508.8 Mcum

Ground water potential

The ground water potential of the basin is 1085.14 Mcum.

Surface Water Quality

The quality of surface water at Pambar basin is found to be contaminated but the contamination level has to be considered low which is good both for human consumption and irrigation use.

Ground Water Quality

Areas of Pudukottai and Ranmad Districts the TDS in water exceeds 2000 ppm which limits its use for internal consumption

In Pambar basin the following areas are having high nitrate content namely Keelasevalpatti, Kattukudipatti, Kottaiyur & Sambanur.The EC in the lower reaches are found to vary much from the permissible limits. Pulipatti and Kottampatti of Melur taluk are the areas posing potential danger of fluoride.

Agriculture

Of the total cultivable area of 112510 ha, 75293 ha of area is covered under wet agriculture and the remaining 37217 ha under dry crops. There are only a few wells in the command area and in dry crop area for supplementation. Mostly rainfed dry crops are raised in the dry lands and only in areas where well irrigation facility is available, irrigated dry crops are raised, Some farmers, raise irrigated dry crops even in the absence of wells in their lands, by purchasing water from adjacent wells.

Sand mining

At present sand mining is not being done any where in the basin area due to non-availability of sand.

Water weeds

Of the waterweeds generally found in waterway, Ipomoea and water hyacinth are the two plants that are common. While Ipomoea is commonly found in many tanks in the basin, water hyacinth grows prolifically in Ooranies.

Seismic zones

The basin area is falling under the Zone II. The basic seismic coefficient for Pambar is taken as 0.02 and the value of importance factor of all types of dams is considered as 3. And being designed based on the specifications specified in IS 1893 – 1984.

Solid waste

Water bodies of the nearby areas are invariably used for disposal. Six such cases

have been noticed in Pambar basin, which are Tiruppathur where All the solid waste produced by the town population is disposed off in the foreshore of Panikkanendal tank, Singanpunari is yet another town that deposits its solid waste of 5 tonnes, in the Palar river which flows very near to the town, Thirumayam and Ponnamaravathi the waste is dumped in dumped at foreshore of Vengai kanmoi and Thirumukkani tank.

Diseases

Acute diarrhoeal disease, cholera, Typhoid, Jaundice, Malaria, Measles and chicken pox are the diseases common in all areas of the basin.

Salinity

The taluks affected by salinity in this basin are Devakkotai, Thirupattur and Thiruvadanai. The range of percentage of area affected in the basin is 30-100%

Literacy

The literates of the basin are 620820, which constitute 60.79% of the total population. The no. of male literates is 367341 constituting 59.17 % and the female literates (253479) constitute 40.83 %.

System deficiencies

1. Low level of tank bunds and deep bed sluices reduce the storage capacity of the tank
2. Dilapidated conditions of sluices and weirs resulting in uncontrolled water delivery
3. Lack of adequate control of regulating structures like anicuts

Proposed actions

1. Improving the overall irrigation efficiencies by rehabilitation of conveyance and storage system
2. Conjunctive use of surface and ground water by giving awareness to farmers
3. Lining of field channels to the required extent
4. Rehabilitation of system and non system tanks and anicuts

GUNDAR BASIN

Demography

Gundar Basin is having a total population of 2,289,876 of which 1,149,875 is male population and 1,140,001 is female population. Within the basin Madurai South Taluk area is having highest population 944,663 of which male 478,419 and female 466,244.

Location

Gundar river basin is one of the major river basins of Tamil Nadu with a drainage area of 5912 Sq. km. It is located between the geographic co-ordinates Latitude 9^0 05'N– 10^0 03'N and Longitude 77^0 35' E – 78^0 35' E. It is situated in between Vaigai basin in the North and Vaippar basin in the south. The basin covers part of Madurai, Sivagangai, Virudhunagar, Ramanathapuram and Thuthukudi Districts

Hydrology

The Gundar River takes its rise from the Eastern slope of Varusanadu hills at an altitude of 500 m and about 60 km westward of Madurai city. Gundar basin includes Vembar, Palar and Kottakudiar (Uthirakosamangaiar) sub basins. Vembar sub basin is located in the southern side of Gundar Basin. Palar and Kottakudiar (Uthirakosamangaiar) sub basins are located on the northern side of Gundar Basin

Geology

Gundar river basin comprises crystalline rocks of Achaean age on the Northwest and sedimentary rocks of tertiary and quaternary age on the southeastern coastal area. Archaean and sedimentary formations are more or less equally distributed in this area.

Hydrogeology

The thickness of withered zone in crystalline areas is from 15 to 40 m and highly sheared and jointed zone is from 10 to 60m below ground level. Depth to bedrock varies from 10 to 60m in the crystalline formation and is in the increasing trend in the coastal sedimentary. The depth of the boreholes drilled in the crystalline formations ranges from 24 to 50m in general. The reported yield of bore wells in the crystalline formations range from 18 to 836 liters per minute (lpm). The specific capacity values varying from 0.001 to 0.09 m^3/min/m indicate that the hard rock in the basin is generally poor aquifers. Transmissivity varies from 16 to 168 m^2 / day. About 40 % of the basin area is occupied by sedimentary formation. Specific capacity of bore wells in the sedimentary formations range from 0.00018 m^3/min/m to 0.226 m^3/min/m.

Surface water quality

There is no surface flow in the basin due to failure of monsoon, hence surface water quality as on date could not be assessed and reported. However the past experience shows that the surface water in the basin is generally good and fit for irrigation and other purposes.

Ground Water quality

Ground water quality is generally good in small patches within the basin in Thirumanglam, Vilathikulam, Thiruchuli, Madurai and Ramanathapuram taluks with total dissolved solids ranging between 31 - 499 mg/l. Except a few patches in major portion of Ramanathapuram, Kadaladi, Mudukulathur, Kamudi and Paramakudi Taluks the quality of groundwater is poor with total dissolved solids above 2000 mg/l. Almost 75% of the basin area the quality is moderate with TDS ranges between 501 to 1999 mg/l. Fluoride concentration in drinking warer is high in Narikudi,T. Meenakshipuram,P.Pudupatti, Ramanujapuram villages of Madurai district.The nitrate concentarion is also high in Utthappanaickanur, Chinnakattlai and Elaiarpathi villages.

Industries

In this basin there are 1293 small, medium and large-scale industries with various kinds of activities. Most of the industries are small and medium scale industries and there is only a few large scale industries. Out of 1293 industries 1037 are located in Madurai South and Thirumangalam Taluk and 256 are in rural area. Concentration of industries is high only in urban areas – Madurai and Thirumangalam Taluk. In rural areas the numbers of industries are thin.

Waterweeds

There is lush growth of Juliflora on the Kattanur tank bund of Virudhunagar district. In Girudhumal river within Madurai city limit in the stretches wherever sewage water from the adjoining habitats let into the river there is abundant growth of water Hyacinth. Near Ellies Nagar growth of water Hyacinth choked the Girudhumal River. Valaiveesi Teppakulam near Ellis Nagar and Virahanur Tank are fully infested with water Hyacinth.Ipomoea is present in majority of tanks in Gundar basin.

Encroachments

The Gudumal River has been encroached and the solid wastes and Garbage collected from the houses situated in the vicinity are being dumped in Girudamal. The encroachments in other channels, which are flowing across Madurai city, cause much damage to the life and property of people during floods.

Solid Waste

The Major Source Of Solid Wastes Dumped in water bodies is the Madurai city lying in the South of river Vaigai. Various locations of water bodies namely Gridhumal River, supply channels passing through Madurai city and tanks.

Agriculture

The main occupation of people living in Gundar Basin is only agriculture and Cattle rearing. 80 % of the population is having their livelihood by means of these two sectors only. Most of the lands are rain fed used for cultivation of dry crops like Ground nut, Millets, Cotton and Pulses. The area under tanks is cultivated with crops like Paddy, Cotton, Millets and Pulses according to the availability of water in the tanks. Perennial crops like Sugarcane, Banana and Flowers are cultivated in the tank fed areas supplemented by wells.

Literacy

Total literate population in the basin is 1,611,937 of which male literate 907,124 and female literate 704,813. In the basin 70.39% people are literate. Within the basin Madurai south taluk having highest population is also having highest male literates 498,495 and female literates 423,250.

Sub basins under IAMWARM for the 1st year

Therkkar sub basin

Therkkar River originates from the northern end of Doddappanaicken hill ranges near Usilampatti in Madurai District. There are 271 tanks situated within the Therkkar minor basin chatchment area. The total ayacut under these tanks is 9736.09 ha.

Paralaiyar sub basin

The river Paralaiyar is a tributary of Gundar River. It starts about 11 Kms west of Manamadurai that is from the surplus of Keelapasalai Tank and is fed by surplus of many Vaigai fed tanks in Manamadurai taluk of Sivagangai District. The river runs into two arms up to Mosukudi where it joins together and runs through Manamadurai, Pramakudi, Kamuthi, and Mudukulathur Taluks. The total area of sub basin is about 670 sq.km.The total No of tanks benefited under this basin is 41. The total ayacut under this basin is about 1586.00 Hec.

The cropping pattern of this system

1st crop is paddy and the 2nd crops are chilly, groundnut, pulses, vegetables and cotton.

System deficiencies

1. The system is one of the old system existing for more than hundred years, as such requires rehabilitation.
2. Heavy accumulation of silt due to hilly region and contour nature of canal system.
3. No scheme works were done during the passt years. Results non-effective irrigation.
4. Lack of adequate control of regulating structures like anicut etc.,
5. This sub basins totally consistes of Non system tanks. Hence this non-system tank requires rehabilitation.

Proposed actions

1. Improving the supply channels to improve and assure the irrigation efficiency of the conveyance system by rehabilitation of the supply channels in the way of desilting and lining the supply channel.
2. Rehabilitation of non-system tanks and its components like sluices, weirs etc.,
3. Rehabilitate the Anicut by Repairs and Reconstruction of Anicuts.
4. Improve the River system and channel by River Training works.
5. To improve the facilities by agriculture by providing Thrashing floor,
6. Construction of open wells, etc.,
7. To improve the Basic Activities of the WUA by constructing Buildings for water users Associations.

KALLAR RIVER BASIN

Demography

The river basin covers three taluks i.e, Kovilpatti, Ottapidaram and a small part of Vilathikulam. Under Kovilpatti it comes around 23 panchayats, under Ottapidaram it comes around 24 panchayats and under Vilathikulam taluk 9 panchayats. Thus there are 56 panchayats with a population of 52517 in Kovilpatt. 71158 in Ottapidaram 29795 in Vilathikulam.

Location

The river basin Kallar including Korampallamaru is situated entirely in Tuticorin district between the latitudes 8 ° 45' N and 9 ° 09' N and longitudes 77 ° 45' E and 78 ° 13' E. 40.66% of the total area of Tuticorin district (4621 km^2), which accounts to about 1878.80 km^2 is covered by the Kallar river basin area. There are two rivers in this river basin. They are the Kallar River in the northern side and Korampallam River in southern side. This basin is surrounded by Vaippar basin in the north, Tambiraparani basin in west and south and the Gulf of Mannar in the east.

Hydrology

The Malattar is the main tributary of river Kallar. The catchment area of the basin is 465.7358 sq. km. There are eight anicuts in the Kallar river basin.

Geology

The basin is covered by geological formation of Archaean, tertiary and recent to sub-recent periods. The Archaean sets up of rocks are identified at Ottapidaram and Vilathikulam taluks which are found to have crystalline metamorphic complex exposed in many areas. Tertiary rock sandstones are recorded in the coastal village of Pattinamarudur.

Hydrogeology

The quaternary sediments occurring in this basin are represented by laterites, older alluvium, recent alluvium and teri sands. In this alluvial formation, the depth of the bore wells drilled varies from 18m to 302.4m BGL.

Seismicity

The north east part of Tamil Nadu including Chennai is included in zone III according to the revised seismic zoning map. The remaining areas come under the zone II. Kallar river basin including Korampallamaru is included in zone II where the seismic activities are comparatively less.

Surface water potential

Total surface water potential of this basin is 203 MCM, which is roughly 0.8% of the available surface water potential of the state.

Ground water potential

The ground water details for the Kallar river basin are observed from seven stations, namely Eppodumvendran, Idaiseval, Keelakarai, Kadumbur, Kulathur, Pasuvandanai and T.Duraiyoor. The ground water levels in all the seven stations were declining gradually in the past few years

Surface Water Quality

High TDS is observed in wells near the coastal tracks. High nitrate concentration is noticed in Vilatikulam, Kovilpatti, Kayathar, Pasuran thanai, Puthiamputur and Eppodum ventran. Domestic sewages of wayside villages are directly discharged into the river. The industrial effluents allowed into the river cause water pollution in several areas. Major industries located in Thoothukudi in Kallar basin spoil marine eco system. Sterilite industry also located in this basin is causing water pollution.

Ground Water Quality

Kallar basin is not having enough water resources and the rural population depends on ground water for drinking purposes. For fresh water the EC ranges from 10 to 1000 micromhos/cm. In kallar basin area the EC ranges from 600 to 9000 micromhos/cm which is an indication of water pollution.pH is also high on the alkaline side, ranging from 7.10 to 9.0. The total hardness and total dissolved solids are also high in all the places. The average concentration of sulphates and chlorides are very high. Nitrate exceeds the drinking limit of 45 ppm. Ground water of kallar basin is generally hard to very hard in nature, with high sulphates, bicarbonates and high concentration of nitrates. The ground water quality is poor in most of the area of Kallar basin.

Forest

The forest cover area that is found around the river basin is 2341.01 hectares. The forest area cover under the RF (reserve forest area) was noticed only at two places in kallar river basin. 1. Kurumalai - 1258.24 hectares - this comes under the Kovilpatty taluk and 2. Salikulam - 1082.77 hectares - present in the Ottapidaram taluk. There are 5 Reserve Forests in the basin.

Agriculture

In the Kovilpatti taluk, which comes under the Kallar basin area, constitutes of 73.57% of dry lands and 26.43% of wetlands. The Ottapidaram taluk area, which comes under the Kallar basin area, consists of 82.05% of dry lands and 17.95% of wetlands. As

in the case of Vilathikulam taluk under the basin area the dry land percentage was as high as 96.11% while the wetland percentage was a low 3.89%. In average, the kallar basin area consists of 83.91% of dry land and 16.09% of wetlands. Among cereals, paddy, cumbu and cholam occupy greater proportion of the area. Green gram and black gram are the major pulses cultivated. Among spices, coriander and chillies accounts for greater proportion of the area. In the non-food category cotton occupies the major area.

Sand mining

Among the villages covered the river basin, illegal sand mining is carried out in Mullur. Water flows through the Kallar and Korampallam only during the rainy seasons. Due to the sand mining the free flow of water is interrupted and much water doesn't reach the end region of the river.

Industries

A total of 57 match industries and the waste are dumped in a pit and finally burnt. The effluents are discharged in to the open drains. So far, there has been no pollution problem in the activity of these small-scale industries. Calcium factories/ bone mill at Chozhapuram village sends out foul smell in the area. There are 12 salt pans and 6 match factories.

Solid waste

Ottapidaram block has this consistent problem where the solid wastes are dumped into water bodies.

Soil Erosion

Erosion is witnessed near Tharuvaikulam and Vellapatti in a slow and steady pace. The Pattinamarudur coast has remains of rocks on the shore that clearly portrays the action on waves on the rocks leaving behind ruptured marks. In the river basin the dry lands occupy the major share compared to wetlands

Waterweeds

Eppodhumvendran tank has sometimes the infestation of Eichornia sp., Lemna major and L. minor. Other than that there is no major water infestation for this basin area.

Water logging and salinity

Water logging is a phenomenon when the soil is clay in nature. These types of lands avoid the percolation of water and water is easily retained. As for salinity this occurs in almost all the coastal villages of Ottapidaram and Vilathikulam taluks. The villages that face salinity problem in the coastal area include Veppalodai, Vadakkukalmedu, Therkukalmedu, Tharuvaikulam, Pattinamarudur and Sakkammalpuram. The salinity problem occurs throughout the year.

Sea Water Intrusion

The seawater intrusion is found to be a major problem in some of the villages in both Kallar and Korampallam river basins. Irrational exploitation of the groundwater by digging bore wells has paved way for the intrusion of the seawater into the ground water table. The effect of seawater is felt up to a distance of 9 Km towards the villages in Ottapidaram and Vilathikulam taluks.

Diseases

Most of the villages in both the river basins were devoid of any proper drainage system or sanitation system. The water borne diseases in both the basin areas are found to be caused by bacteria and viruses. The major bacterial diseases are Cholera, Typhoid, Paratyphoid, Dysentery, Diarrhea, Leptospirosis and Tuberculosis.

System deficiencies

1) This system is a good old system existing for more than thousand years, as such requires rehabilitation.
2) Heavy accumulation of silt due to hilly region and contour nature of canal system.
3) The deteriorated condition of the conveyor system resulting in heavy seepage, leakage, especially in the left out portions of WRCP Phase I.
4) Lack of adequate control of regulating structures like anicut etc.,
5) Deteriorated canal with low efficiency and their inspection roads.
6) Rehabilitation of system and non system tanks.
7) Lack of awareness among the farmers for effective utilization of water.
8) Lack of modern communication system for effective water regulation

Proposed actions

1. Improving the overall efficiency of the conveyor systems.
2. Rehabilitation of system and non system tanks.
3. Conjunctive use of surface and ground water in all sources by giving awareness among farmers.
4. Providing micro irrigation wherever possible in consultation with line departments.
5. Introducing horticultural crops requiring less water consumption.
6. Introducing modern techniques in crop cultivation like SRI, Vermi compost, coir pith etc., by giving awareness among farmers using demo plots.
7. Providing check dams, gully plugging etc., so as to increase the ground water recharge and reduction in soil erosion.
8. Providing adoptive research trials and publicity, seminar etc, among the farmers of the sub basin with the help of TNAU.
9. Providing modern communication system for effective water regulation.

KODAIYAR RIVER BASIN

Demography

Kothaiyar basin has an area of 1523 Km^2 and it covers almost the entire Kanyakumari District. There are four Municipalities, five urban town Panchayats, sixty-one rural town Panchayats and one Panchayat Township. The population density of this basin is 994 people per Km^2 as against state population density of 428 people per Km^2

Location

Kodaiyar river basin is located between latitude 08°05 N and 08°35 N and longitude 77°05 E and 77°35 E. This basin lies at the southern most tip of Indian Peninsular. This is a small basin having an area of 1533 Sq.Km and hilly area of 607 Sq. Km, which is more than $1/3^{rd}$ of basin area. The entire basin in the north and Nambiyar basin in the east and Neyyar basin of Kerala state in the west. Out of four taulk of Kanniyakumari districts it covers the full extent of Villavancode, Kalkulam and Agastheeswaram taulk and most of Thovalai taulk.

Hydrology

The river Kodaiyar originates in the western slope of Western Ghats and falls into Arabian Sea near Thengapattinam in the name of Tambaraparani. The river has got two main tributaries – Kodaiyar and Paralayar.The river Kodaiyar is the major tributary of river Kuzhithuraiar and it originates on the western slopes of Agasthia hills at an altitude of 1500m M.S.L. and has many tributaries of which Chittar I and Chittar II are major ones.

Geology

The geological formations met within the Kothaiyar river basin belong to the Archaean, Tertiary and Quarternary ages. The Archaean formations include garnetiferous sillimanite gneiss, garnetiferous biotite gneiss, felspathic gneiss and charnockite. The tertiary formations include thin bands of shell limestone, sandstone and variegated clay, which are overlain by recent to sub recent kankar, laterite, terisands coastal alluvium and soils.

Hydrogeology

Groundwater in this basin occurs under water table conditions in the weathered zones of gneiss and charnockites. The depth of well extends upto 40m below ground level (bgl). The water level varies from 19 to 25m in summer and in winter it reaches to ground level to 3m below ground level. Weathered and partially weathered zone underlying the topsoil varies from 8m to 65m bgl.

Water Potential

The surface and groundwater potential of Kodayar basin is 925 MCM, 342.1 MCM and Pazhayar Sub Basin is 95.5 MCM, 117.09 MCM respectively.

Surface Water Quality

The entire sewage coming from the Municipal limits of Nagercoil is let into Pazhayar River and its branch Parakkaikal. This poses considerable pollution. Surface water quality is affected due to coir retting along the coast of Kanyakumari district.

Ground Water Quality

The chloride contents in the well near Mylady exceeds the permissible limit of 1000 mg/lit, the content being 1175 and 1283 mg/lit for pre and post-monsoon period respectively. However in well Aralvoimozhi increased sulphate content is noted over certain periods. In Mylaudy and Aralvoimozhi nitrate content is found to be high. In general water quality is found to be good in most areas.

Agriculture

Kothaiyar basin has a total cultivated area of 106559 ha. The net area sown on an average is 80944 ha and area sown more than once is about 19816 ha. The major crop is paddy. The oil seeds crop like gingelly, groundnut, castor, millets like cholam, cumbu, ragi, pulse crops like green gram, red gram, balck gram, and sugar cane occupies the remaining area.

Forest

The Forests in Kanyakumari District are verdant and virgin and are said to be 75 million years old. Of the total district area of 167130 ha. Government Forests occupy an area of 50486 ha which comes to about 30.2 % of the total District geographic area. The forest area is 30.2 % of total district geographical area, which is next to Nilgiris district with 59 % and Dharmapuri District with 38 % in the State. The District is having 52% of its forests as dense forests coming only second to Dharmapuri District with 58 %.

Sand mining

Sand mining is severe in the places of Chitharai, Mancaud, Themanoor and Kuzhithurai of the basin area.

Soil Erosion

There is the specific catchment degradation problem in the watershed of this basin. The areas severely affected by this basin are Kanyakumari and Thengaipattinam.

Encroachment

The river basin is degraded and damaged due to different types of encroachments. The waterspread area of most of the ponds reduced and increased siltation. The encroachment of the channels and their banks reduced or totally obstructed the flow of

water.

Weeds

Waterweeds are a major problem in most of the ponds in Kanyakumari district. The blocks affected by waterweeds are Rajakkamangalam, Agasthesswaram, Kallakulam and Vilavancode. The dominant weeds are Eichhornia, Ottelia, Lotus, Lilly, Ipomoea, Salvinia, Pistia, Trapa, Typha and Neptunia.

Sea Water Intrusion

Kanniyakumari Districts covers a long coastline running for about 65km. Length. Cystaline rocks comprising granite occupy most of the 6 miles area from sea cost and gneiss acts as a barrier to seawater intrusion. The coastal area of the basin is affected by this saline water intrusion. Sea Water intrusion is recorded in many coastal villages, particularly in Anjugramam, Manakudy, Puthalam, Pallam, Eathamozhy, Rajakkamangalam, Kadiyapattinam, Colachel, Midalam, Enayam, and in many others particularly during summer.

Diseases

The common water borne diseases prevalent in the basin are malaria, diarrhea, Jaundice, Japanese encephalitis and cholera.

Solid waste

Some of the ponds in Municipal; and Town Panchayat areas were filled up with solid wastes and now converted into play grounds, stadiums; and for construction of buildings.

Seismic Zones

The basin area is falling under the Zone II. The basic seismic coefficient for Kodaiyar is taken as 0.02 and the value of importance factor of all types of dams is considered as 3. And being designed based on the specifications specified in IS 1893 – 1984.

Literacy

The literacy rate is 85.7% for males and 78.39% for females as against the state literacy rate of 74.83% for males and 52.29% for females.

Pazhayar sub basin

Pazhayar is one of the sub basins of Kodayar basin considered for treatment under IAMWARM Project. The river Pazhayar actually originates in the Northern slope of

Western ghats from Kurathimalai at an altitude of 550m above M.S.L. Thadavaiyar, Ulakkaruviar, Koya Odai, Alanthuraiyar and Poigaiyar are the tributaries of Pazhayar.The river Pazhayar, a medium size river originating near Surulacode, drains the Pazhayar basin and finally enters the Arabian Sea near Manakudy after traveling a distance of 35km. The Pazhayar sub basin area is 476 sq.km.

System deficiencies

1. This system is a good old system existing for more than thousand years, as such requires rehabilitation.
2. Heavy accumulation of silt due to hilly region and contour nature of canal system.
3. The deteriorated condition of the conveyor system resulting in heavy seepage, leakage, especially in the left out portions of WRCP Phase I.
4. Lack of adequate control of regulating structures like anicut etc.,
5. Deteriorated canal with low efficiency and their inspection roads.
6. Rehabilitation of system and non-system tanks.
7. Lack of awareness among the farmers for effective utilization of water.
8. Lack of modern communication system for effective water regulation

Proposed actions

1. Improving the overall efficiency of the conveyor systems.
2. Rehabilitation of system and non-system tanks.
3. Conjunctive use of surface and ground water in all sources by giving awareness among farmers.
4. Providing micro irrigation wherever possible in consultation with line departments.
5. Introducing horticultural crops requiring less water consumption.
6. Introducing modern techniques in crop cultivation like SRI, Vermi compost, coir pith etc., by giving awareness among farmers using demo plots.
7. Providing check dams, gully plugging etc., so as to increase the ground water recharge and reduction in soil erosion.
8. Providing adoptive research trials and publicity, seminar etc, among the farmers of the sub basin with the help of TNAU.
9. Providing modern communication system for effective water regulation.

KOTTAKARIYAR RIVER BASIN

Demography

The basin has a total population of 5,12,046. Out of this male population is 250061 accounts for 48.84% and the female population is 261985 accounts for 51.16%. The average population density of the basin is 229.41 persons/sq.km. The percentage of male literacy of the total male population is 73.78% where as the percentage of female literacy is 55.34.

Location

The Kottakaraiyar basin lies in between $78^0$23'42" E to $79^0$1'12. 5" E longitude and $9^0$29'20" N to $10^0$2'56" N latitudes. The basin extends over a total area of 2232.06 Km^2 in the districts of Madurai, Sivagangai and Ramnad.

Hydrology

Kottakaraiyar River is a jungle stream formed by the surplus of many tanks in Sivaganga and Thiruvadanai taluks. The river originates from Kottakaraiyar anicut constructed just below the link channel in Suryankottai River.

Geology

The area is comprised of Archaean Complex on the north west and overlain by Upper Gondwana, Tertiary and recent to sub recent formations on the east. Creataceous formations occur in the Sub-surface. Overlying the Archaeans, upper gondwana formations, known as Sivaganga beds of upper Jurassic age crop out over cretaceous formations of lower cretaceous formations consist of top forming marker limestone bed and the bottom forming the clay sandstone with shale formations.

Hydrogeology

The basin is built up of Archean rocks comprising of Gneisses and Charnockites on Western part and sedimentary rocks comprising of Tertiary sandstone and laterite in the Eastern portion. The thickness of weathered zone varies from 20-40m BGL. In Crystalline formations the depth of bore wells range from 14-82m BGL. The Yield of the bore wells range from 50 lpm to 200 lpm. In the sedimentary formations, the thickness of sandstone varies from 70-100m BGL. The depth of the bore well ranges from 27m to 429m BGL. The yield of the bore wells ranges from 50-500 lpm.

Surface Water Potential

The total surface water potential of the basin is 310.92 Mcum.15% of rainfall recorded is available in the form of surface flow in any season.

Ground Water Potential

The total ground water potential of the basin is 304.69 Mcum

Surface Water Quality

Sewage disposal is a daily phenomenon, the sewage ponds up in low pockets and gets diluted only when the tank receives water. This amounts to large-scale contamination and affects soil crop and, ground water, as also the health of humans and cattle and aquatic life.

Ground Water Quality

In Kalaiyarkovil, Thondi, Thiruvadani, Devakottai, Sivangangai areas, the ground water quality is found to be saline and unsafe for human consumption and the chloride values exceed the permissible limits. In Ilayangudy, Sivagangai and Semburam of Karaikudy taluk the ground water wells are found to have excessive nitrates causing nitrate contamination. In some areas of Manamadurai, and Paramakudy taluks, fluoride in ground water is below the lower tolerable limit of 0.4-ppm .In Thondi of Tiruvadanai Taluk and in RS Mangalam the TDS exceeds 5000 ppm. Potable water is available in areas near the coast only at very shallow depth of 6m.

Industries

Except for a few textile industries, there are no major industries in this basin. Small-scale industries are needed to be established in order to generate employment in the villages.

Agriculture

Agriculture is the main occupation of the basin population besides Cattle and sheep-goat keeping and poultry. Of the total cultivable area of 82038 ha, 57715 ha of area is covered under wet agriculture and the remaining 24323 ha under dry crops. Mostly rainfed dry crops are raised in the dry lands and only in areas where well irrigation facility is available, irrigated dry crops are raised. Some farmers, raise irrigated dry crops even in the absence of wells in their lands, by purchasing water from adjacent wells.

Seismic Zones

The basin area is falling under the Zone II. The basic seismic coefficient for Kottakariyar is taken as 0.02 and the value of importance factor of all types of dams is considered as 3. And being designed based on the specifications specified in IS 1893 – 1984.

Water weeds

The weed growth is the major issue of concern in this basin. Most of the water-spread area is covered with ipomea, water hyacinth. Ipomoea is commonly found in many tanks in the basin. Water hyacinth grows prolifically in Ooranies. An average of about 15% of the basin area is estimated to have been covered by these pest plants. The problems encountered in the basin due to the prolific growth of these plants are

Water logging

In low-lying areas near the coast water logging conditions prevail. Theseeas are located between Tondi and Devipattinam. The average width of the area affected is about 1.2 km.

Sea Water Intrusion

Seawater intrusion is a problem near coastal areas. In R.S.Mangalam, and other coastal areas, potable water is available only in depths up to 6m. In R.S.Mangalam, the TDS exceeds 7000mg/litre.

Diseases

Acute diarrheal disease (A.D.D), cholera, Typhoid, Jaundice and Malaria are the diseases that affect the basin population generally. Respiratory disorders and TB are common in Vellalore and areas where stone quarrying is doneLeprosy is prevalent in all areas although the prevalence rate is small.

Sub basins under IAMWARM for 1st year

Kottakariyar sub basin

Kottakariyar sub basin originated from RS Mangalam tank and confluences at Palk Strait near Puthukadu. Nattarkal and Nattar are the tributaries of the basin. The total area of the sub basin is 1427.20 sq.km.

Saruguniar sub basin

Saruganiar river is the first river of the basin originating from Alavaikottai tank of Sivagangai Taluk and confluences at R.S. Mangalam big tank and a part of this falls in Kottakariyar.The Surplus of this tank empties into the Palk Strait near Puthukadu. The total area of the sub basin is 557.56 sq.km

System deficiencies

1. Low level of tank bunds and deep bed sluices reduce the storage capacity of the tank
2. Dilapidated conditions of sluices and weirs resulting in uncontrolled water delivery
3. Lack of adequate control of regulating structures like anicuts

Proposed actions

1. Improving the overall irrigation efficiencies by rehabilitation of conveyance and storage system
2. Conjunctive use of surface and ground water by giving awareness to farmers
3. Lining of field channels to the required extent
4. Rehabilitation of system and non system tanks and anicuts

NAMBIYAR RIVER BASIN

Demography

The total population of Nambiyar basin as per 2001 census is 155926 and the male population is 74491 and that of females is 81435.

Location

Nambiyar River Basin is located in the Southern most part of South India and situated between 8 °33' N and 8° 33' N altitude and the longitude 77° 28 E and 78° 6 E. The total area of the basin is 2084 Sq.Km. This basin is bounded by Tambaraparani basin in the North, Pazhayar and Valliyoor basin on the West, Bay of Bengal on the East and Indian Ocean on the South.

Hydrogeology

Water level in winter reaches ground level and in summer it lowers down to 10m. Draw down in the ayacut is 2m and recuperation requires 15 hrs. Nearly 2736 wells are located and each well irrigates an area of 1.7 hectares. The non-ayacut area of the sub-basin is 67930.3 hectares. The weathered thickness in the non-ayacut extends up to 17m. Average depth of the well is 11m. Water level in summer lowers down to 9m and reach 4m in winter. Draw down in the non-ayacut is 1.5m and the recuperation requires 15hrs.

Seismicity

In the seismic Zoning Map of India published by Bureau of Indian Standards, the basin lie in Z one II, which corresponds to seismic intensity VI on M.M. scale. However, the western part of the basin is close to zone III that corresponds to seismic intensity VII.

Surface water potential

The annual surface water potential for 75% dependability is 203.87MCM

Ground water potential

The ground water potential of the Nambiyar basin can be taken as 274.74 MCM/year

Industries

Palmyra industry is in many places. The cottage industries include be-keeping, artificial flowers making, cane furniture, wood turning industry, tailoring etc. Safety matches are done in many places. Handloom weaving, beedi rolling and net weaving are predominant in some places. Cotton and yarn and textile are the main items produced by the large-scale industries.

Agriculture

Wet crops like paddy, banana, fruits and vegetables, groundnut pulses, millets, cotton are grown and irrigated dry crops like groundnut, pulses, and millets are grown in the basin

Forest

The forest area is only 12.7%, which is very much low compared to national standards, dense forest occurs only in the high altitude ranges of Mahindragiri and surrounding areas. In the plains medium and low dense forest and scrub forest developed.

Water Weeds

Most of the Basin area is covered with waterweeds like Eichornia crassipes, (Mart.) Solms. Lamb, Ipomea carnea Jacq, Prosopis cineraria (L.) Druce. Due to the encroachment of these weeds the flow of water and ground water potential are severely affected. Besides these weeds there are other minor weeds are also seen in the basin.

Diseases

The incidence of water borne diseases is high. Malaria is in high order in Tirunelveli district.

System Deficiencies

1. As the irrigation network is age old, the existing conveyance distribution systems are functioning with moderate / less efficiencies.
2. Due bto outdated old traditional method of irrigation practices, the water use effieciencies are also minimum.
3. The income of the farmers are mainly from agricultural outputs and thereby the living standards of the farmers and their dependant are not enriched.
4. Due to inadequate facilities of transporting, storing and marketing, the full bebefit of the hard works are not rewarded. This in turn reflects in the growth of the Nation.

Proposed actions

1. Improving the over all irrigation efficiency of the existing irrigation system.
2. Saving surface water to possible extent and planning for rain water harvesting.
3. Rehabilitation and modernization of the irrigation structures.
4. Improving the overall conveyance efficiency and in also providing equitable distribution of irrigation water.
5. Improve the system tanks and Non system tanks.
6. Adopting Sprinkler and drip irrigation.

7. Conjunctive use of surface and Ground water in all sectors.
8. Awareness and participation of women in WUA.

PARAMBIKULAM ALIYAR RIVER BASIN

Demography

The total basin population is 14, 61,744.There is a significant growth rate in this basin. Valparai taluk is less thickly populated and there has been a reduction in its growth rate by 4%. The literacy percentage is 65.44 in the basin.

Location

Parambikulam Aliyar Project (PAP) basin is one of the inter-state project of Kerala and Tamil Nadu lies between latitude $10^0$10'N and 10^0 30'N and Longitude between 76^0 and $77^0$13E. The total catchment area of PAP is 841 km^2. The PAP command area is located in parts of Pollachi, Udumalpet, Palladam and Triuppur taluks in Coimbatore district. A little part of the areas extends into Kangeyam and Dharapuram taluks of Erode district.

Hydrology

Parambikulam River has its origin in Ramakrishna hills and confluence with Challakudi River, the catchment of this dam lies in both Tamilnadu and Kerala state areas, which is dense forest. The total catchment area of PAP is 841 sq.km. The PAP successfully accomplished the diversion of integration of 8 west flowing rivers of which 6 in the Annamalai hills and 2 in the plains for the benefit of drought prone areas of Coimbatore and Erode districts of TamilNadu and stabilizing the existing irrigation system in Chittorpuzha of Kerala.The important tributaries of PAP river basin are Upper Nirar, Thunakadavu, Sholayar and Thirumoorthy.

Geology

The basin area of PAP consists of metamorphic igneous rocks.

Hydrogeology

The potential hard rock aquifers are found in Coimbatore district. The existences of deeply weathered and fractured zones are noticed along certain lineaments, which are capable of yielding potential supplies.

Surface Water Quality

In Thunakadavu dam, the TDS concentration is high. The impounded surface water from Upper Aliar is also very soft with low mineral matter content but however shows somewhat higher figures compare to other dam sources. Surface water is getting contaminated due to coconut fibre soaking. The units of textile industry are contributing most of the contamination and pollution.

Ground Water Quality

The ground water quality is generally alkaline with pH values ranging from 7.2 to 9. The quality of water in the major part of the area is moderate. Ground water of moderate salinity (less than 200 micromhos/cm) occurs in areas adjoining the various 2000 micromhos/cm has been observed in areas around Palladam and Udumalpet. The poor quality of water is noted in Unjavelampatti, Chinnapoolanginar, Dhali, Udumalpet and Poosaripatti villages. The highest value of EC of >8000 microsiemens/cm is observed in Chinnapoolanginar.

Nitrate concentration is reaching as high as 1200 mg/l. Excessive concentration of nitrate in ground water is found in udumalpet pollachi, negamam, annamalai and kottur. In Anamalai, there is a large fluctuation in the nitrate concentration in ground water over a period of time. Some of the areas with excess fluoride in groundwater are Eachanari, Vadachiittoor, Sangampalayam, Vedasandur, Unjavelampatti, Kolarppatti, Devanurpudur, Erisanampatti, and Karamadaiyur. The occurrence of fluoride is attributed to appetite rich granties gnesis.

Agriculture

The total cropped area is about 190907 Ha which is about 39% of the total basin area. Main crops are cereals, pulses, oil seeds and fibre .Tea plantations are conspicuous in hilly reasons. Paddy is cultivated in the some low-lying pockets. Coconut farmers are suffering for need of water in Pollachi, Udumalai and Palladam areas.

Forest

Indira Gandhi wild life sanctuary is one of the important catchment area of the PAP. There are about 320 bird species in the sanctuary. Anamalai wild life sanctuary is the largest sanctuary in Tamil Nadu with a wide variety of flora and fauna including many endemics.

Catchment degradation

There is excessive deforestation in Western Ghats. Cattle growing are polluting the river system. Due to cattle washing in the water bodies, there is a spread of leptospirosis disease in vk pudur, anaimalai, kothur and samathur.

Seismic Zones

The basin area is falling under the Zone II. The basic seismic coefficient for PAP is taken as 0.02 and the value of importance factor of all types of dams is considered as 3. And being designed based on the specifications specified in IS 1893 – 1984.

Salinity

Ground water of moderate salinity (less than 200 micromhos/cm) occurs in areas adjoining the various 2000 micromhos/cm has been observed in areas around Palladam

and Udumalpet. Such poor quality, areas are generally covered by black cotton soil with poor drainage. The urban areas of Palladam, Udumalpet and Tiruppur have contributed to higer salinities due to human activities and also due to textile industry to some extent.

Sand mining

Sand mining is done in water-spread areas of Aliyar and Thirumurty dam. This has lead to ground water depletion in the riverbed.

Water logging

Water logging is found in certain places like Poosaripatti and Anamalai in Pollachi taluk, Ammapatti in Gudimangalam block, Kongalnagar, salayur and C.P.Kinar in Udumalpet block.

Water Weeds

Waterweeds are a major problem in the PAP basin. The waterweeds like Pistia and Eichornia cover larger area of water body in Anamalai, Kottur and Samathur.

Diseases

Water borne bacteria are responsible for causing cholera, dysentery and gastro enteritis. Diseases like Malaria, Yellow fever, filariasis are distinctly seen in Anamalai, Kottur, Somanur, Dhali of the basin.

Tribals

A total of 4600 tribals with 6 major tribal communities in 35 settlements in PAP basin. Tribals play a criucal role in preserving forest and wild animals and primitive agricultural practices. Natural organic farming and bio control of pests are practiced.

Palar sub basin

Palar is one of the sub basins of PAP basin. The average rainfall in this sub basin is 90 cm.

System deficiencies

1. 40% of the conveyance system has been rehabilitated under wrcp phase 1
2. Conveyance efficiency gets reduced to greater extent
3. Tail end areas are not getting equitable supply of water

Proposed actions

1. Increasing application efficiency from 65 -85%
2. Rain water harvesting
3. Replacement of inefficient agricultural pumpsets
4. Construction of godowns, drying yards and supply of tarpaulins
5. Reduce the conveyance and distribution losses and improve it to 70-80% by field channel lining

TAMBRAPARANI RIVER BASIN

Demography

This is the largest basin, 212 revenue villages are included in this area. It starts with Tirunelveli taluk and ends with Tiruchendur taluk of Tuticorin district. The total area of this river basin is 1,57,090.7 hectare. Total population of this area is 4,83,632. The total female population (2,49,938) is larger than the male population (2,33,694). The overall literacy rate of Tamiraparani river basin is 57%. In this area 66% of the male population and 53% of the female population are literates

Location

The River Tamiraparani is located in the world map, between 08° 8' and 09° 23' N latitude and 77° 09' and 77° 54' E longitude. The total area of the district is 6,823 sq. km. The river basin of the district includes Shenkottai, Tenkasi, Sankarankovil (Part) Veerakeralampudur, Ambasamudram, Nanguneri (Part), Tirunelveli and Palayamkottai taluks. In the Thoothukudi district Srivaikuntam and Tiruchendur Taluks (Part), are in the river basin. The total area of the basin constitutes 5942 sq km the whole basin lies fully in the boundaries of Tamilnadu.

Hydrology

The river Tambraparani originates at Agastya-Malai (Pothigai Hills) on the Eastern slopes of Western Ghats at an altitude of 200 OM and it confluences with the bay of Bengal at Gulf of Mannar. The total length of river is 120 K.M. (80 K.M. in Tirunelveli District and 40 K.M. inThoothukudi District approximately. Kariyar, Servalar, Pambar, Manimuthar, JambuNathi, Ramanathi, GadanaNathi, Patchaiyar, Chittar are the tributaries of Tambraparani. The river drains with its tributaries an area of about 4500 sq. km.

Hydrogeology

The aquifer thickness in the sedimentary area ranges between 5.0 to 40.0 m underlain by clay, Sand stone, shale or weathered rock, water table in aquifer varies from 10m to 18.0m bgl.

Surface water and ground water potential

The annual water potential of the state including surface and ground water is assessed as 46,540 Mm^3 (1643 TMC) where as the estimated demand is 54,395 Mm^3 (1921 TMC) as of now and is likely to shoot up to 57,725 Mm^3 (2038 TMC) by the year 2050.

Surface Water Quality

The Calcium Carbonated hardness varies from 20 – 125 mg/l. Though the hardness of water in Tambraparani basins was not very high, even that the level was

found to be ecologically effective. The amount of Chloride ion was ranges from 7 – 28 mg/l, this moderate level of Chlorides cause sufficient water pollution. The values of TDS ranges from 20 – 201 mg/l. BOD ranges between 1.0 – 5.0 mg/l. and COD ranges between 8.0 – 200 mg/l.

Ground water quality

The ground water is fit for domestic and industrial purpose in inland area while in coastal areas, there is Saline water intrusion results in high concentration of TDS and minerals like chlorides and renders the ground water unsuitable for the purpose for which they were serving.

Industries

The industries located within 5 km from the banks of Tamiraparani River are Tamil Nadu State Transport Corporation Workshop, Papanasam, Coats Vyolla Limited, Vickramasingapuram, Sun Paper Mills, Cheranmadevi and TamilNadu State Corporation Workshop Tirunelveli. In addition to that many small-scale industries are also located along the banks of the river. There are 26 industries in the basin area.

Agriculture

Paddy, Banana, Sugarcane, Groundnut, Chillies, cotton, Sorghum, Cumbu, Ragi, Vegetables and Pulses are the various crops raised in Tamiraparani basin area. In dry regions, diversified cropping patterns exist and no single crop claims a large share of the gross cropped area. Millets are cultivated in dry lands as rainfed crops. The dominant crops cultivated in the Tamiraparani are paddy, banana, groundnut, chillies, cholam, cumbu, ragi and maize. In this basin, the major crop is paddy as it occupies 60.7% of the gross cropped area.

Forest

The reserve forest is comprised of two adjacent wildlife sanctuaries viz. Kalakkad wild life sanctuaries and Mundanthurai Wild life Sanctuaries. Both in Tirunelveli district and also part of Veerapuli and Kilamalai reserve forest in Kanyakumari district. The total area of the reserve is 895 sq. km The total catchments area of this basin is 4500 sq. km. of which hilly catchments area (western ghats) is 688 sq. km. The papanasam reserve forest, part of kalakad- Mundanthurai tiger reserve is included in this catchment.

Catchment Degradation

The total catchment area of this basin is 4500 km^2 of which hilly catchment area is 688 km^2. The Papanasam reserve forest and a part of Kalakad - Mundanthurai tiger reserve constitute the catchment area. In the Upstream areas of Thamiraparani River, removal of vegetation, erosion of bank materials, absence of canopy cover are the common features.

Soil Degradation

Tamiraparani river basin with tropical climate typically faces the problem of soil degradation to a higher degree during summer, as vegetation dries up and the ground is loosend, topsoil-developing cracks. Subsequently heavy rains carry huge quantum of silt in to the river.

Waterlogging

Water logging is found in the taluks of Palyamkottai, Ambasamudram, Tirunelveli and Srivaikuntham of Tirunelveli District in Tambraparani Basin Water logging in Tirunelveli district is not permanent in nature.

Salinity

In the areas like Punnakayal and Athur in Thoothukudi district, the backwater flows in to Tambraparani River. Due to this the ground water in the adjoining places has been contaminated. In sawyerpuram area, where the ground water extraction is little bit larger scale, high salinity is noticed in ground water due to presence of calcareous materials

Encroachment

Encroachment is intensive in plains of the river, channel and ponds. Encroachments occur in Chittar Water Basin in 27 villages, in Gundar 2, in Hanumannadhi 14, in Karuppanadhi 5, in Tambraparani 49 and in Manimuttar 1village.

Water Weeds

The invasion of waterweeds is more pronounced in this basin. Eichhornia and Ipomoea are the most dominant weeds in this basin. The infestation ranges from 10 to 100% in the tanks in this area. In Melathiruvenkatanathapuram tank Nymphaea Stellata (Lily), Melumbium Speciosum (Lotus) are seen. Pistia is seen in tanks in Muneerpallam, Kilanatham, vagaikulam, Udaiarkulam, etc. The infestation of waterweeds is estimated to be 3200 ha in this sub-basin

Solid Waste

Out of the 21 local bodies, which are letting untreated raw sewage in to the river, only the Tirunelveli municipality is provided with a sewerage scheme for part of the town. This scheme covers the main town and palaya pettai area. The total length of the sewers is about 40km. Pumping station is located to the east of Nainarkulam.

Diseases

When the water is released from the Papanasam reservoir, bad odur is felt.

Impounded water in the reservoir contains ova of mosquitoes and other virus germs causing malaria, Typhoid, Cholera etc.

Seismic Zones

The basin area is falling under the Zone II. The basic seismic coefficient for Tambraparani is taken as 0.02 and the value of importance factor of all types of dams is considered as 3. And being designed based on the specifications specified in IS 1893 – 1984

Sub basins under IAMWARM for the 1st year

Manimuthar sub basin

The river Manimuthar is a major tributary of the Tamiraparani. It arises from the dense forest atop Senkutheri in Ambasamudram taluk at the height of about 1300 m. above MSL. The tributaries of the Manimuthar are the Keezha Manimuthar (lower or eastern Manimuthar) and the Varattar. The river runs from its source for a distance of 9 km. and confluences with the Tamiraparani near Kallidaikurichi. The catchment area of the river is 100.55 km^2. The total area of the Manimuthar sub basin is 199.5 sq km. The total area of this sub basin is 4,204.47 hectare and total population is 20,459. Among this female population is 10,304 and male population is 10,155. In manimuthar sub – basin 72% male population is literate and 54% of female population is literate. Though the female population is higher than the male population the literacy rate of female population is low.

System Deficiencies

1. Heavy silt accumulation due to hilly region
2. Deteriorated condition of conveyor system resulting in heavy seepage, leakage especially in the left out portions of WRCP phase-1
3. Lack of adequate control of regulating structures like anicuts, sluices

Proposed actions

Improving the overall irrigation efficiency of conveyor system by rehabilitation of channels, tanks and anicuts

1. Conjunctive use of surface and ground water
2. Adoption of latest technology in agriculture

Chittar sub basin

Chittar sub – basin is the second largest area in the Tamiraparani river sub – basin. 127 revenue villages are come under Chittar sub – basin. The total area of this sub – basin is 1,51,547.8 hectare. Total population of this area is 4,68,577. Male population is 2,31,790 and female population is 2,36,787. In chittar sub – basin the total literacy rate is 47%. The male literacy rate is 58% and female literacy rate is 35%.

There are 17 anaicuts in Chittar irrigation system. Total ayacut is 9646 ha. Of this 2074 ha is irrigated directly and 7,570 ha is irrigated indirectly. Total number of villages benefited is 120 and there are 4,294 wells in this area. Tank irrigation is the major source in this sub basin.

System Deficiencies

1. Heavy silt accumulation due to hilly region
2. Crop failure
3. Traditional methods of irrigation practices
4. Difficulty in transportation
5. Damages due to wild animals

Proposed actions

Improving the overall irrigation efficiency of conveyor system by rehabilitation of channels, tanks and anicuts.

1. Providing drip and sprinkler irrigation systems to conserve ground water
2. Constriction of rain water harvesting structures such as farm ponds
3. Adoption of latest technology in agriculture
4. Construction of Gabion structures across the waterways to arrest siltation in the downstream tanks

Lower Tamiraparani sub basin

System Deficiencies

1. Heavy silt accumulation due to hilly region
2. Deteriorated condition of conveyor system resulting in heavy seepage, leakage especially in the left out portions of WRCP phase-1
3. Lack of adequate control of regulating structures like anicuts, sluices

Proposed actions

1. Conjunctive use of surface and ground water
2. Adoption of latest technology in agriculture
3. Providing thrashing floors, farm roads for easy conveyance and to get quality farm products
4. Training the farmers in hitech irrigation systems
5. Improving the overall irrigation efficiency of conveyor system by rehabilitation of channels, tanks and anicuts

VAIPPAR BASIN

Demography

Vaippar basin area further covers 14 taluks and 17 panchayat unions. The taluks covering fully within the basin are Srivilliputhur, Rajapalayam, Sattur, Virudhunagar, Sivakasi and Sivagiri while covering part of taluks of Peraiyur, Thirumangalam, Aruppukottai, Kariapatti, Kovilpatti, Ettayapuram and Vilathikulam and Sankaran kovil.

Location

Vaippar river basin is located in the southern most part of South India and situated between latitude 8° 59'N to 9° 49'N and longitude 77° 15 E to 78° 23' E. This basin is bounded by Vaigai basin and Western Ghats on the western side, Tambaraparani and Kallar river basin on the southern side and Gundar river basin on the northern side and the Gulf of Mannar on the east. The basin area of 5423sq.km covers the administrative districts of Virudhunagar (68%) Madurai (7%) Tirunelveli (5%) and Thoothukudi (20%). There are 9 municipalities, 6 town panchayats and 13 rural town panchayats.

Hydrology

The river Vaippar is known as Nichabandhi in the upper reaches. Only after the confluence of Deviar with Nichabandhi the river is called as Vaippar.The River originates at an altitude of 1,651 m above MSL in the Vasudevanallur reserve forests on the Eastern slopes of the Western Ghats at Neduntheri Mottai in Sivagiri Taluk of Tirunelveli district.

Hydrogeology

The occurrence and movement of groundwater in the hard rocks are controlled by the secondary porosity developed in them. Since the greater part of Virudhunagar District is underlain by crystalline metamorphic rocks of Archaean age, weaker zones like joints, fractures and fault zones and the pore spaces in the weathered zone play a dominant role in determining the water bearing and yield characteristics of these rocks. The weathered thickness in this formation varies from 4-30 mt and depth to basement varies from 10-63 mt. The maximum and minimum water levels are observed as 1 mt and 25 mt below ground level.

Ground Water Potential

The ground water potential is 1167 MCM, which is roughly 4.9% of the available total ground water potential of the state. There are at about 148 observation wells in the basin covering an area of 18.3 sqkm.

Surface water potential

The total storage capacity of this basin as created now is 638.86 mcm (104.46mcm + 559.40 mcm).

Surface Water Quality

The surface water quality is generally good in all sub basins, low in TDS (<0.5 gms/cm), chloride medium to hard (temporary) alkaline in nature. All streams and tanks complied with drinking and irrigation quality standards. The surface water is low in T.D.S. and Chlorides, medium to hard (temporary), alkaline in nature and complies with drinking and irrigation water quality standards. The E.C. value varies from 0.13 ms/cm to 1.46 ms/cm. Nitrogen concentrations are less than 5 ppm.

Ground Water Quality

Water samples show that certain parts in Virudhunagar and Sivakasi are having less fluoride content (<0.4 mg/l) while in Aruppukottai, Kariapatti, Sathur and Rajapalayam area, the content is above 1.5 mg/l. In Vaippar basin, Srivilliputhur, Alangulam, Sathur, Naduvakurichi and Vellankulam are areas of high concentration of nitrate. The industrial effluents discharged by the textile and dying units contaminate the ground water.

Industries

In the Vaippar basin about 76 major and medium industries and 9000 minor industries are located mostly concentrated in Sivakasi, Srivilliputhur, Sattur, Rajapalayam and Virudhunagar taluks of Virudhunagar district, Kovilpatti in Thoothukudi district and Vasudevanallur in Tirunelveli district. Textile, cement, chemical industries, match and fireworks industries are prominent in the area. Sattur, Sivakasi and Rajapalayam are the leading industrial towns in this basin.

Agriculture

In Vaippar basin, major area is under black soils viz., Vertisols and less area red soils and other types of soils. Paddy, sugarcane, cotton, Chillies, Vegetables, Pulses, Millet, Groundnut and Sunflower are the crops raised in Vaippar basin area. Paddy is the principal crop extensively cultivated in the state. Paddy is grown in all the districts in the state. It accounted for 32.8% of the total cropped area in the state during 2000-01.

Seismic Zones

The basin area is falling under the Zone II. The basic seismic coefficient for Vaippar is taken as 0.02 and the value of importance factor of all types of dams is considered as 3. And being designed based on the specifications specified in IS 1893 – 1984.

Forest

The total area of this basin is 5423 km^2 of which plain area is 4841 km^2 and hilly area is 582 km^2. The Vasudevanallur reserve forest, Rajapalayam reserve forest and Srivilliputtur reserve forest of Western Ghats are included in the hilly catchment area.

Water Logging

Water logging temporarily occurs during rainy season in Virudhunagar and Thoothukudi Districts. It is understood that we can expect a possible drainage problem if the E.C value of the soil exceeds due to the salinity of soil.

Water Weeds

The common waterweeds present in the river basin are water hyacinth, Ipomea, Nymphaea Typha and water lettuce. Water hyacinth and Ipomea Carnia are common everywhere. These are present in Vilathikulam, Rajapalayam and Sivagiri taluks.

Sand mining

Sand has been removed to a depth of about 1.80 m in the Nagariyar River near Kallanai anicut in Seithur village, Rajapalayam taluk. As a result, there is no flow of water on the left side of the river through Kallanai anicut to the lower down tanks. Sand mining is noticed on the upstream side of the Rajapalayam – Kalingapatti Road bridge near Vadakarai Village in the Sevalperiar river to a depth of about 1.20 m. Sand mining was found to be severe on the down stream side of the road bridge leading to Shenbagathoppu, in the head reach of Anathalaiyar river which joins Kayalkudiyar river near the origin. Sand mining is alarming on the upstream and down stream of the check dam as well as in the vicinity of the infiltration well for a depth of about 1.20m and 2.50m respectively.

Solid waste

In Vaippar basin there are 9 Municipalities, 6 urban town Panchayats and 13 rural town Panchayats.

Rural town Panchayats	**Solid waste generated/day**
(1) T.Kallupatti	2.4 MT
(2) Pudur	2.2 MT
(3) Sethur	5.5 MT
(4) S .Kodkulam	3.5 MT
(5) Kariapatti	3.8 MT
(6) W.Pudupatti	2.4 MT
(7) Sundarapandian	2.5 MT
(8) Mamsapuram	5.5 MT
(9) Rayagiri	3.1 MT
(10) S.Pudur	3.6 MT
(11) Thiruvengadam	1.9 MT
(12) Sivagiri	6.4 MT
(13) Vasudevanallur	6.4 MT

Seawater intrusion

Seawater intrusion is experienced in Vilathikulam taluk of Vaippar basin. The river Uppodai is an estuarine complex area having the influence of the tidal seawater that can be felt to a distance of 5-6 km. inland. At Keelzhavaippar village, where the Vaippar river joins the sea, sea water intrudes upto Vaippar bridge and extends upto Subramanyapuram making ground water and drinking water saline.

Diseases

Acute Diahhoreal disease, Respiratory tract infection, whooping cough, Arthritis and Viral fevers are more prevalent than other diseases in Virudunagar district while Malarial cases numbering about 194 were reported in Kil Vaippar, Vaippar and Vembar villages in Thoothukudi district. Respiratory tract infection, Anaemia, Typhoid and Viral fevers are common in Sankarankovil taluk of Tirunelveli district. In Kovilpatti area, gastro-enteritis, dysentery, cholera, jaundice and meningitis are reported. Sandaiyur hamlet in T.kallupatti block, Madurai District has old leprosy cases and in M.Puliampatti few people are affected by hydrosol and filaria. Goiter is found in T.Kunnathur while corneal ulcer (eye problem) in Peraiyur block.

Sub basins under IAMWARM for the 1st year

Nichabanadhi Sub basin

Vaippar is called as Nichabanadhi in the head reach. It originates in Vasudevanallur reserve forest on the eastern slopes of Western Ghats in Sivagiri Taluk of Tirunelveli District. Ullatrumottai and Pudumalai Kavu are the other two hills on the other side of Kerala State. This sub basin area is 565 sq.km out of which the hilly area is 62 sq.km. There are 18 anicuts, 15 system tanks, and 151 non-system tanks in this sub basin. The command area is 5683.71 ha.

Kalingalar sub basin

The river Kalingalar, a tributary of Nichabanadhi, originates in the Vasudevanallur reserve forest area, just north of the origin of Nichabanadhi at an altitude of about 1325 m. The total drainage area of this sub basin is 111 sq.km. There are five anicuts across Kalingalar. There are 31 tanks under this sub basin. The total registered ayacut including system and non-system ayacut is 2451.22 ha.

Sinkottaiyar sub basin

Sinkottaiyar originates near Aruppukottai area at about 100 m above MSL. Sinkottaiar starts in the plains with a catchment area of 487 sq.km. Aruppukottai and Nagalapuram towns lie in this sub basin. The command area under this sub basin comes under non-system ayacut. 37 tanks feed an extent of 2105.82 ha.

Sindapalli uppodai sub basin

Sindapalli Uppodai is a tributary to Arjunanadhi and it is a small sub basin. It

originates at an altitude of about 120m above MSL near Duraisamypuram village of Sivakasi taluk. Sindapalli uppodai has a plain catchment area of 177 sq.km. There is no anicut across Uppodai. There are 25 non-system tanks in this sub basin and the total registered ayacut is 842.60 ha.

Arjuna nadhi sub basin

Arjunanadhi is a major tributary to Vaippar River Periyar reservoir was constructed in the year 1976 across the river Periyar with a capacity of 5.452 mcm to benefit 388.5 ha.

System deficiencies

1. The system is a good old system existing for more than hundred years, as such requires rehabilitation.
2. Heavy accumulation of silt due to hilly region and contour nature of canal system.
3. Lack of adequate control of regulating structures like anicut etc.,
4. Deteriorated canal with low efficiency and their inspection roads.
5. The system and Non-system tanks are to be rabilitated.

Proposed actions

1. Rehabilitation of system and non-system tanks, Anicuts.
2. Introducing hitech irrigation methods including drip and sprinkler irrigation.
3. Laying of pipelines for water conveyance.
4. Water harvesting structures for ground water recharge.
5. Sinking of new bore wells and electrification.
6. Thrashing floors and farm road in necessary places.
7. Providing modern agriculture machineries.
8. Providing retaining structures where erosion is high.
9. Conjunctive use of surface and ground water in all sources by giving awareness among farmers.
10. On farm development works.
11. Replacement of old pumps sets.
12. Desiliting of existing inflow / outflow and drainage channels.
13. Farm pond
14. Community Wells.
15. WUA Buildings.
16. Training and exposure visits for farmers and project staff.

CHENNAI BASIN

1. Districts and Coverage of area

S.No	District	Districts area in Sq.Km.	District areas falling in the basin (Sq.Km)	% of area in the basin
1	Chennai	174	174	100
2	Tiruvallur	7857	4275	54.4
3	Vellore	6077	1093	17.98

Source: IWS, Tharamani

2. Details of Sub basin area

S.No.	Name of the Basin	Area of the Basin (Sq.Km)
1	Araniyar	763
2	Kusaithaliyar	3240
3	Cooum	682
4	Adayar	857
	Total	5542

Source: IWS, Tharamani

3. Geographical Spread– Taluk and Blocks

S.No	Name of River Basin	District	Taluk	Block
1	Chennai	Chennai		
2		Thiruvallur	Gummidipoondi	
				Gummidipoondi
			Ponneri	Sholavaram
				Minjur
			Uttukottai	Ellapuram
			Tiruttani	Tiruttani
				Thiruvelankadu
			Pallipattu	Pallipattu
				RKPet
			Thiruvallur	Poondi
				Kadambattur
				Tiruvallur
			Poonamalle	Poonamele
3		Kanchepuram	Sriperumbudur	Kunnathur

4		Vellore		
			Arakkonam	Kaveripakkam
				Nemili
				Arakkonam
				Sholigar
			Walajapet	Walajapet

4. Details of Major Reservoirs

S No	Name of the Dam/Reservoir	Capacity (MCM)		Command Area (ha)
		Before Raising FRL	After Raising FRL	
1	Poondi	77.96	97.98	NIL
2	Red Hills	80.71	93.46	NIL
3	Cholavaram	25.63	25.30	NIL
4	Chembarabakkam	88.36	103.23	5, 452

5. Water Potential of Sub-basins

S.No	Name of Sub-basin	Utilisable ground water recharge in MCM	Net ground water in MCM	Balance potential in MCM	Percentage of development
1	Araniyar	140.49	69.10	71.39	49.18
2	Kuasithalaiyar	549.99	448.66	101.33	81.57
3	Coum	206.70	148.28	58.42	71.34
4	Adayar	222.21	102.82	119.39	46.27
	Total	1119.39	768.86	350.53	68.69

6. Water exploitation areas

Basin	Overexploited > 100 % Exploited	Critical 90- 100 % Exploited	Semi-Critical 70%- 90%	Safe < 70%
Tiruvallur	Ellapuram Minjur Pallipattu RKPet Thiruttani Tiruvelankadu	Kadambatthur Poonamalle	Gummidipoondi Madhavaram Pooneri Sholavaram Thiruvallur	Villivakkam
Vellore	Sholingur	Nemili	Arakkonam	
			Walaja	
			Kaveripakkam	
Kanchepuram	Kunnathur			

7. Water Demand and Water Balance

S No	Purpose	1999	2004	2019	2044
1	Domestic uses	230.88	253.32	320.62	432.79
2	Agriculture	3655.57	3655.57	3033.69	2619.11
3	Industries	129.35	172.46	301.81	517.38
4	Livestock	38	38	38	38
5	Power	22.4	23	25	30
6	Environment	28	28	28	28
7	**Total**	**4104.2**	**4170.35**	**3747.12**	**3665.28**
8	**Water Balance (MCM)**	**-2078.2**	**-1739.35**	**-1316.12**	**-1234.28**

(Source: State framework resources Plan of Tamil Nadu)

8. Land use / Land cover

S. No	Description	Area (ha)
1	Geographical area	5,54,200
2	Forest	28,264
3	Barren and uncultivable waste	17,734
4	Land under non - agricultural use	1,45,755
5	Cultivable waste	12,192
6	Permanent pastures and other crazing land	12,192
7	Current fallows	74,817
8	Other fallows	52,649
9	Land under Misc. use	15,518
10	Net area sown	1,95,078

(Source: State Framework resources plan PWD/WRO)

9. Crops and extent of cultivation

S No	Crop	Season	Area (ha)	Gross Irrigated Area (%)
1	Paddy	Samba	79,390	60.3
		Navarai	29,205	22.2
		Soranavari	23,070	17.5
	Sub Total		1,31,665	100

2	Ground Nut	Dec-April	37,622	19.8
3	Sugar cane	Jan-Nov	8,546	4.5
4 5 6	Cholam Cumbu Ragi	Mar-Jun	5,395	2.8
7	Vegetables	Feb-July	3,545	1.9
8	Pulses Black gram Green gram	Feb-April	3,545	0.7
9	Gingelly	Jan-May	1,039	0.5
10	Chillies	Feb-July	1,019	0.5

(Source: Environmental Status report of Chennai Basin, 2001)

10. List of tanks with weeds

S.No	Location	Name of Tank	Type of Weed
1	Kakkalur	Kakkalur Tank	Ipomea
2	Kadambattur	Kadambattur	Prosopis
3	Pandur	Pandur	Prosopis
4	Panambakkam	Panambakkam Big and Small Tank	Ipomea
5	Senji	Senji Big tank	Ipomea
6	Valliyur	Valliyur tank	Ipomea
7	Pattaraiperumpudur	Pattaraiperumpudur Manjakuppam	Prosopis
8	Misrakandapuram	Misrakandapuram	Prosopis
9	Mylerwada	Mylerwada	Prosopis
10	Athimanjari	Athimanjari	Ipomea
11	Janakarajakuppam	Janakarajakuppam Padmapuram	Prosopis
12	Peddanaganpudi	Peddanaganpudi	Prosopis
13	Silambu	Silambu tank	Ipomea
14	Vediyankadu	Vediyankadu	Prosopis
15	Veeramangalam	Veeramangalam	Ipomea
16	Medur	Medur Large	Prosopis
17	Guduvanjeri	Guduvanjeri Tank	Prosopis
18	Andavoyal	Andavoyal	Ipomea
19	Aladu	Aladu ex zamin tank	Prosopis
20	Vembedu	Vembedu ex zamin tank	Ipomea
21	Tatamanji	Tatamanji system tank	Prosopis
22	Kattur	Kattur system tank	Prosopis
23	Pralayambakkam	Pralayambakkam	Ipomea

		PWD tank	
24	Nallur	Nallur Tank	Prosopis
25	Gnayar	Gnayar tank	Ipomea
26	Perungavoor	Perungavoor tank	Prosopis
27	Amoor	Amoor tank	Prosopis
28	Nerkundrum	Nerkundrum tank	Ipomea
29	Athipattu	Athipattu Thangal PWD tank	Prosopis
30	Arani	Arani PWD Tank	Ipomea
31	Puduvoyal	Puduvoyal ex zamin tank	Ipomea

11. List of Red Category industries in Kosasthalaiyar Basin

S.No.	Name of Industry	Total no in the basin	No.of Industries		Disposal of Effluent	
			Generating Trade effluent	Using with in their premises	Using with in their premises	Letting out in open ditches/storm water drains
1	Chemical	40	21	15	15	6
2	Rubber	2	2	1	1	1
3	Steel plant	4	1		1	
4	Elector Planting	1	1		1	
5	Oil&Refinery	3	3	2		3
6	Paper&pulp	1	1	1	1	
7	Engineering	8	2	1	1	1
8	Foundry	6	2	2	2	
9	Cement	1	1	1		1
10	Tannery	4	3	3	1	2
11	Fertilizer	4	3	3	1	2
12	Thermal Plant	3				
13	Pesticide	1				
14	Petrochemical	2	2	2	1	1
15	Non-ferrous	1				
16	Miscellaneous	15	8	7	8	
	Total	**96**	**50**	**38**	**33**	**17**

12. Prevalent Diseases

Year	Reported Cases				
	Acute Diarrhea	Dysentery	Cholera	Jaundice	Malaria
2002	7098	2678	435	324	45
2003	7247	2455	345	267	43

13. Population details

Districts	Region	Population		
		Persons	Male	Female
Vellore	Total	30,26,432	15,29,944	14,96,488
	Rural	20,66,718	10,48,055	10,18,663
	Urban	9,59,714	4,81,889	4,77,825
Kanchipuram	Total	24,42,179	12,44,756	11,97,423
	Rural	14,29,610	7,24,502	7,05,108
	Urban	10,12,572	5,20,257	4,92,315
Tiruvallur	Total	27,38,866	13,90,292	13,48,574
	Rural	12,46,832	6,25,817	6,21,015
	Urban	14,92,034	7,64,475	7,27,559
Chennai	Total	42,16,268	21,61,605	20,54,663
	Rural	0	0	0
	Urban	42,16,268	21,61,605	20,54,663

14. Literacy level

Districts	Literate		
	Persons	Male	Female
Vellore	1572292	950943	621349
Kanchipuram	1980898	1096992	883906
Tiruvallur	1857231	1041183	816048
Chennai	3079004	1670094	1408910

(Source: Statistical handbook of Tamil Nadu, 2002)

15. Tourist attractions

S No	District	Tourist Place/Pilgrim center
1	Chennai	Fort St. George, Santhome, AnnaSquare, Deer Park, Snake Park, Marina, Kapileswar Temple, Besant nagar temple
2	Vellore	Vellore Fort, Elagiri,Rathinagiri and Sholingur
3	Kancheepuram	Anna zoological park, Mammallapuram,VGP golden beach, MGM, Kishkintha and Kancheepuram temple
4	Tiruvallur	Poondi reservoir, Sriperumbudur, Thiruverukadu and Thiruttani

(Source: Statistical Handbook of Tamil Nadu, 2002)

16. Sewage generation

	Population 2001	Estimated Sewage Generation (MLD)	Existence of Sewerage Under Ground (C/P)	Open (C/P)	Upto Primary	Upto Secondary	Upto Teritiary	No Treatment	Nature of disposal and quantity		
									Water Body		
									River	Reservoir	Land
A) Corporation											
Chennai	4,216,268	112	yes				yes	No	112		
B) Municipalities											
Thiruvallur	45,517	12.60	-	P	-	-	-	Yes	3.50	-	9.10
Avadi	230,913	55.00	-	P	-	-	-	Yes	-	-	55.00
Ambathur	302,492	54.00	-	P	-	-	-	Yes	-	2.00	52.00
Kathivakkam	32,556	14.70	-	P	-	-	-	Yes	-	-	14.70
Madhavaram	76,793	16.50	-	P	-	-	-	Yes	-	-	16.50
Thiruvottiyur	211,768	49.62	7.6 Km.(p)	P	-	-	-	Yes	40.00	-	9.62
Alandur	146,154	43.50	-	P	-	-	-	Yes	-	-	43.50
Thambaram		27.30	-	P	-	-	-	Yes	-	-	27.30

	137,609										
Pallavaram	143,984	28.65	-	P	-	-	-	Yes	-	-	28.65
C Town Panchayats (Urban)											
Thruverkadu	30,734	9.00	P	P	-	-	-	Yes	7.00	-	2.00
Thiruthani	38,502	12.00	-	C	-	-	-	Yes	-	-	12.00
Poonamallee	42,522	8.50	-	C	-	-	-	Yes	-	-	8.50
Manali	28,174	-	-	P	-	-	-	Yes	-	-	-
Porur	28,782	2.80	-	P	-	-	-	Yes	2.80	-	-
Towns	Population 2001	Estimated Sewage Generation (MLD)	Existence of Sewerage Under Ground (C/P)	Open (C/P)	Upto Primary	Upto Secondary	Upto Teritiary	No Treatment	Nature of disposal and quantity		
									Water Body		
									River	Reservoir	Land
Ponneri	24,205	5.40	-	P	-	-	-	Yes	-	-	5.40
Naravarikuppam	18,327	-	-	P	-	-	-	Yes	-	-	-
Minjur	18,327	2.50	-	P	-	-	-	Yes	-	-	2.50

Puzhal	20,297	1.00	-	P	-	-	-	Yes	-	1.00	-
Chinnasekkadu	9,744	-	-	P	-	-	-	Yes	-	-	-
Thirunindravur	29,395	-	-	P	-	-	-	Yes	-	-	-
Uthukottai	10,639	-	-	P	-	-	-	Yes	-	-	-
Maduravayal	44,127	7.00	P	P	-	-	-	Yes	7.00	-	-
Thirumazhisai	15,271	4.80	-	P	-	-	-	Yes	-	-	4.80
Gumudipoondi	16,116	3.30	-	P	-	-	-	Yes	-	-	3.30
Pallipat	8,904	-	-	P	-	-	-	Yes	-	-	-
Pammal	49,744	10.75	-	C	-	-	-	Yes	-	-	10.75
Anakaputhur	31,733	5.20	-	P	-	-	-	Yes	-	-	5.20
Chitlapakkam	25,292	4.75	-	P	-	-	-	Yes	-	-	4.75
Kundrathur	25,028	9.85	-	P	-	-	-	Yes	-	-	9.85
Nandhampakkam	9,093	6.55	-	P	-	-	-	Yes	-	-	6.55
N.Guduvancherry	27,386	6.43	-	P	-	-	-	Yes	-	-	6.43
Perungalathur	27,386	5.30	-	P	-	-	-	Yes	-	-	5.30

	Population 2001	Estimated Sewage Generation (MLD)	Existence of Sewerage Under Ground (C/P)	Open (C/P)	Upto Primary	Upto Secondary	Upto Teritiary	No Treatment	Nature of disposal and quantity		
									Water Body		
									River	Reservoir	Land
Puzhudivakkam	29,086	6.90	-	P	-	-	-	Yes	-	-	6.90
Sriperumpudur	16,085	4.75	-	P	-	-	-	Yes	-	-	4.75
Sholinganallur	15,519	3.85	-	P	-	-	-	Yes	-	-	3.85
Pallikaranai	22,503	3.80	-	P	-	-	-	Yes	-	-	3.80
Thiruneermalai	29,086	6.85	-	P	-	-	-	Yes	-	-	6.85
Total	6,236,061	545.15									369.85

17. Status of solid waste management

	Population 2001	Solid Waste Management (Tonnes)	Workers for solid waste anagement	waste management			
			Total No.	No./1000 Population	Availability Of Compost Yard	Recycling as Manure Yes/No	If yes annual Production

Minjur	18,327	4.5	4	90	15				
Puzhal	20,297	2.85							
Chinnasekkadu	9,744	NA							
Thirunindravur	29,395	3.5	3	98	18				
Uthukottai	10,639	NA							
Maduravayal	44,127	2.5	0.5	20	10				
Thirumazhisai	15,271	NA							
Gumudipoondi	16,116	NA							
Pallipat	8,904	5.50	5.00	90.91	28	0.70	Nil	No	-
Pammal	49,744	5.50	4.50	81.82	6	0.31	Nil	No	-
Anakaputhur	31,733	3.80	3.50	92.11	10	0.58	Nil	No	-
Chitlapakkam	25,292	4.20	4.00	95.24	14	0.56	Nil	No	-
Kundrathur	25,028	2.50	2.25	90.00	8	0.72	Nil	No	-
Nandhampakkam	9,093	-	-	-	-	-	Nil	No	-
N.Guduvancherry	27,386	-	-	-	-	-	Nil	No	-
Perungalathur	27,386	3.50	3.25	92.86	13	0.68	Nil	No	-
Puzhudivakkam	29,086	-					Nil	No	-
Sriperumpudur	16,085	1.76	1.50	85.23	21	2.33	Nil	No	-
Sholinganallur	15,519	1.25	1.00	80.00	3	0.13	Nil	No	-
Pallikaranai	22,503	2.50	2.00	80.00	6	0.60	Nil	No	-
Thiruneermalai	29,086	1.25	1.00	80.00	3	0.13	Nil	No	-
Total	6,236,061								

PALAR BASIN

1. Geographical Area and Coverage

S.No.	Districts	Area (sq.km.)
1	Vellore	4710.58
2	Kanchepuram	2187.90
3	Thiruvanamalai	4012.19
	Total	10,910.67

Source: IWS Report, Tharamani

2. Geographical Spread– Taluks and Blocks

S.No	District	Taluk	Block
1	Vellore	Walajapet	Sholinghur(part)
			Walajapet (part)
		Arcot	Arcot
			Timiri
		Gudiyatham	Gudiyatham
			Pernampet
		Katpadi	KVKuppam
			Katpadi
		Tirupattur	Tirupattur (part)
			Natrampalli (part)
		Vaniyambadi	Madhanur
			Jolarpett(part)
			Alangayam (part)
		Vellore	Anicut
			Vellore
			Kaniyambadi
		Arakkonam	Kaveripakkam (part)
			Nemili (part)
	Kanchepuram	Kanchepuram	Kanchepuram (part)
			Walajabad (part)
		Chengalpattu	Kattankaolathur (part)
			Thiruporur (part)
		Thirukazhukun drum	
			Thirukazhukundrum
		Sriperumbudur	Sriperumbudur (part)

		Uthiramerur	Uthiramerur
		Maduranthagam	Achrapakkam(part)
			Madhurantagam(part)
		Cheyyar	Lathur (part)
			Chittamur(part)
	Thiruvanamalai	Cheyyar	Vembakkam
			Cheyyar
			Annakavur
		Vandavasi	Pernamallur (part)
			Thellar (part)
			Vandavasi(part)
		Polur	Polur
			Kalasapakkam
			Chetput
		Thiruvanamalai	Thurijinapuram(part)
		Chengam	Jawadhi Hills
			Pudupalayam
			Chengam(part)
			Thandrampet(part)
		Arni	Arani
			West Arani

3. Zone wise surface water potential

S.No.	**Name of zone**	**75% Dependable Surface Water Resource in MCM**		
		South West	North East	Annual
1.	Upper Palar	147.46	162.44	409.52
2.	Lower Palar	81.25	117.46	245.57
3.	Kavundanilya Naganadhi	45.94	50.57	137.55
4.	Upper Cheyyar	113.53	135.99	315.09
5.	Lower Cheyyar	90.22	112.54	261.52
6.	Kiliyar Palar	121.54	207.48	388.75
Total for Palar River Basin		599.94	786.48	1758.0

Source: State Frame Work Report, IWS, Tharamani

4. Ground Water exploitation areas - 2003

District	Over exploited- Greater than 100%	Critical- 90% to 100%	Semi Critical- 70% to 90%	Safe – less than 70%*
Kanchepuram	Tiruporur	Thirukalikundrum	Chittamoor	Acharapakkam
	Kattankalathur		Uthiramerur	
	Walajabad			
	Kanchepuram			
	Madurantagam			
	Lathur			
	Sriperumpudur			
Vellore	Kaniyambadi	Nemili	Walaja	
	Anaicut		Kaveripakkam	
	Madanur			
	Peranampet			
	Gudiyatham			
	KVKuppam			
	Katpadi			
	Thirupattur			
	Alangayam			
	Nattrampalli			
	Jolarpet			
	Arcot			
	Timiri			
	Vellore			
Thiruvanamalaiai	Chengam	Javadhi Hills	Annakavoor	Tellar
	Thurinjipuram	Arni west	Arni east	Peranamallur
	Vandavasi		Chetpet	
	Kalasapakkam		Cheyyar	
	Polur		Vembakkam	
	Pudupalayam			
	Thandarampet			

5. Total Water Requirement (in MCM)

S. No	Purpose	1999	2004	2019	2044
1.	Agriculture	3655.57	3655.57	3655.57	3655.57
2.	Domestic	116.88	127.82	160.64	215.33
3.	Industrial	64.65	86.20	150.85	258.60
4.	Live Stocks	60.09	60.09	60.09	60.09
5.	Power	10.00	10.00	10.00	10.00
	TOTAL	**3907.19**	**3939.68**	**4037.15**	**4199.59**

6. Land use pattern

S.No	Land Use Type	Area (hectares)
1	Forest area	2,18,620
2	Barren and Uncultivated (Including wasteland)	42,412
3	Non agricultural	1,72,042
4	Cultivated wasteland	18,804
5	Permanent pastures and grazing land	15,219
6	Current Fallows	93,128
7	Other Fallows	46,244
8	Miscellaneous Use	10,762
9	Net area sown	4,76,836

(Source: Status report of the Palar basin, 2003)

7. Population

Districts	Region	Population	Male	Female
Vellore	Total	34,82,970	17,43,871	17,39,099
	Rural	21,64,654	10,85,192	10,79,462
	Urban	13,18,316	6,58,679	6,59,637
Kanchipuram	Total	28,69,920	14,55,302	14,14,618
	Rural	13,35,189	6,73,387	6,61,802
	Urban	15,34,731	7,81,915	7,52,816

Tirvanamalai	Total	21,81,853	10,93,191	10,88,662
	Rural	17,81,304	8,93,132	8,88,172
	Urban	4,00,549	2,00,059	2,00,490

(Source: Statistical handbook of Tamil Nadu, 2002)

8. District wise literacy level

Districts	Literates	Male	Female
Vellore	22,46,052	12,66,981	9,79,071
Kanchipuram	19,80,898	10,96,992	8,83,906
Tiruvannamalai	13,17,651	7,73,367	5,44,284

(Source: Statistical handbook of Tamil Nadu, 2002)

9. District wise Tourist attractions

S.no	District	Tourist Place/Pilgrim center
1	Vellore	Vellore Fort, Elagiri,Rathinagiri and Sholingur
2	Kancheepuram	Anna zoological park, Mammallapuram,VGP golden beach, MGM, Kishkintha and Kancheepuram temple
3	Tirvannamalai	Sattanur, Javvadu Hills and Tiruvanmalai temple

10. Environmental Status of Domestic sector – Sewerage Condition-Towns in Palar River Basin

Name of the town	Population 2001	Estimated Sewage Generation (Lakh Lit)	Existence of Sewerage		Upto Primary	Upto Secondary	Upto Teritiary	No Treatment	Nature of disposal and quantity		
			Under Ground (C/P)	Open (C/P)					Water Body		
									River	Reservoir	Land
Dharapadavedu (TP)	30070	12.00						Yes			1
Kalinjur (TP)	16853	7.20						Yes			7.20
Kangeyanallur (CT)	12669	6.00						Yes			6.00
Gandhinagar (Katpadi Extn) (TP)	9487	4.00						Yes			4.00
Pallikonda (TP)	20771	10.40						Yes			10.40
Shenbakkam (TP)	13390	7.20						Yes			7.20
Sathuvachari (TP)	44942	20.00						Yes			20.00
Konavattam (CT)	9359	4.00						Yes			4.00
Allapuram (TP)	26948	12.00						Yes			12.00
Thorapadi (TP)	13924	6.40						Yes			6.40
Palavansathu (CT)	16962	8.00						Yes			8.00
Odugathur (TP)	8148	4.00						Yes			4.00
Virupakshipuram (CT)	12885	5.60						Yes			5.60
Thuthipattu (CT)	6984	2.40						Yes			2.40
Uthayendram (TP)	11567	5.60						Yes			5.60
Jaffrabad (CT)	6631	2.40									2.40
Tiruvanamalai											
Polur (TP)	25505	11.20	No	Yes	-	-	-	Yes	-	-	11.20

Arani (M)	60815	21.00	No	Yes	-	-	-	Yes	-	-	21.00
Kannamangalam (TP)	7316	2.10	No	Yes	-	-	-	Yes	-	-	2.10
Peranamallur (TP)	5557	1.75	No	Yes	-	-	-	Yes	-	-	1.75
Tiruvethipuram (M)	35201	14.14	No	Yes	-	-	-	Yes	-	-	14.14
Pudupalayam (TP)	10005	7.00	No	Yes	-	-	-	Yes	-	-	7.00
Kalambur (TP)	13291	4.20	No	Yes	-	-	-	Yes	-	-	4.20
	1512565	529.708									497.548

12. Water Quality Analysis – Palar River (Selected Locations, Wells and Parameters)

District	Block	Village	Well No	Date of collection	EC_GEN	pH_GEN	Ca	SO4
Palar River								
Kancheepuram	Thirukazhukkuntram	Vayalur	U23091	1/24/03	860	8.2		
Kancheepuram	Thirukazhukkuntram	Vayalur	U23091	4/24/03	920	7.8		
Kancheepuram	Thirukazhukkuntram	Vayalur	U23091	7/27/03	790	7.5	48	5
Kancheepuram	Thirukazhukkuntram	Sadras	U23089	7/21/03	1060	8.4	54	77
Kancheepuram	Thirukazhukkuntram	P. V. Kalathur	02001	7/21/03	670	8	44	29
Kancheepuram	Kattankolathur	Patravakkam	02026	7/30/03	810	8.4	40	65
Kancheepuram	Kattankolathur	Karunilam	02012	7/21/03	1380	8.1	86	86
Kancheepuram	Kancheepuram	Orikkai Water Works	2403	7/31/03	370	8.5	24	19
Kancheepuram	Kancheepuram	Kailasanatharkoil	U23005	7/31/03	1520	8.1	36	44
Kancheepuram	Walajabad	Walajabad	02037	7/31/03	1620	8.3	52	144
Vellore	Kaveripakkam	Karivedu	U23029	7/17/03	1420	8	40	81
Vellore	Kaveripakkam	Karivedu	U23029	1/9/03	1600	8.6		
Vellore	Arcot	Pudupadi	21527	7/18/03	6300	7.5	20	350
Vellore	KV Kuppam	Latteri	21541	7/24/03	1430	8.1	68	115

Vellore	Gudiyatham	Gundalapalli	21547	7/24/03	2560	7.7	40	226
Vellore	Gudiyatham	Arumbaruthi	21511	7/25/03	2640	8.2	72	211
Vellore	Natrampalli	Kothur	21542	7/29/03	1410	8.4	22	72
Vellore	Vaniyambadi	Vaniyambadi	23023	1/6/03	3550	8.3		
Vellore	Vaniyambadi	Vaniyambadi	23023	4/11/03	3680	8.2		
Vellore	Vaniyambadi	Vaniyambadi	23023	7/28/03	3800	8.5	48	211
Vellore	Vaniyambadi	Natrampalli	21543	7/29/03	1270	8.3	24	91
Vellore	Vaniyambadi	Vengili	21512	7/28/03	1430	8.2	58	106
Vellore	Vaniyambadi	Thekkupattu	21544	7/28/03	1260	8.2	16	71
Vellore	Madhanur	Kommeswaram	21550	7/28/03	3430	8	120	274
Vellore	Anaicut	Perumugai	23071	7/25/03	950	8.2	20	62
Vellore	Vellore	Poigai sathyamangalam	23078	1/10/03	1740	8		
Vellore	Vellore	Poigai sathyamangalam	23078	4/8/03	2450	7.9		
Vellore	Walajahpet	Sengalnatham	21556	7/19/03	6600	7.6	40	523
Vellore	Walaja	Sathambakkam	U23042	7/19/03	760	7.7	30	35
Vellore	Walajahpet	Gudimallur	21529	7/19/03	900	8.4	34	45
Tiruvannamalai	Cheyyar	Natteri	21578	8/12/03	2970	7.5	168	149
Tiruvannamalai	Cheyyar	Dusi	21577	8/19/03	1410	7.8	36	61
Kancheepuram	Thirukazhukkuntram	Vayalur	U23091	1/24/03	78	4		
Kancheepuram	Thirukazhukkuntram	Vayalur	U23091	4/24/03	113	4		
Kancheepuram	Thirukazhukkuntram	Vayalur	U23091	7/27/03	106	5	463	200
Kancheepuram	Thirukazhukkuntram	Sadras	U23089	7/21/03	138	3	646	265
Kancheepuram	Thirukazhukkuntram	P. V. Kalathur	02001	7/21/03	74	3	404	170
Kancheepuram	Kattankolathur	Patravakkam	02026	7/30/03	149	4	461	295

Kancheepuram	Kattankolathur	Karunilam	02012	7/21/03	213	11	824	380
Kancheepuram	Kancheepuram	Orikkai Water Works	2403	7/31/03	50	2	236	125
Kancheepuram	Kancheepuram	Kailasanatharkoil	U23005	7/31/03	277	8	993	120
Kancheepuram	Walajabad	Walajabad	02037	7/31/03	213	5	1005	190
Vellore	Kaveripakkam	Karivedu	U23029	7/17/03	269	3	781	300
Vellore	Kaveripakkam	Karivedu	U23029	1/9/03	383	2		
Vellore	Arcot	Pudupadi	21527	7/18/03	1914	5	3571	1800
Vellore	KV Kuppam	Latteri	21541	7/24/03	149	19	917	325
Vellore	Gudiyatham	Gundalapalli	21547	7/24/03	468	41	1634	410
Vellore	Gudiyatham	Arumbaruthi	21511	7/25/03	447	23	1591	300
Vellore	Natrampalli	Kothur	21542	7/29/03	163	17	859	305
Vellore	Vaniyambadi	Vaniyambadi	23023	1/6/03	865	22		
Vellore	Vaniyambadi	Vaniyambadi	23023	4/11/03	822	21		
Vellore	Vaniyambadi	Vaniyambadi	23023	7/28/03	978	17	2342	900
Vellore	Vaniyambadi	Natrampalli	21543	7/29/03	199	7	680	355
Vellore	Vaniyambadi	Vengili	21512	7/28/03	213	13	848	500
Vellore	Vaniyambadi	Thekkupattu	21544	7/28/03	128	8	755	265

PENNAIYAR BASIN

1. Basin Area District Wise

S. No.	Name of the District	Total Area of the District	Area of the basin falling in the District	% Area of the District falling in the basic	% Area of basin falling in the District
1.	Dharmapuri	9622	6744.03	70	59.91
2.	Vellore	6077	460.35	7.57	4.09
3.	Thiruvannamalai	6312	1761.00	13.54	7.59
4.	Villupuram	7222	2195.22	30.4	19.5
5.	Cuddalore	3678	1002.44	27.25	8.91
			11257.00		100.00

2. List of Blocks

S.No.	Block Name	Taluk Name	District Name
1.	Papireddipettai	Harur	Dharmapuri
2.	Harur	Harur	Dharmapuri
3.	Morapur	Harur	Dharmapuri
4.	Uttangarai	Uttangarai	Dharmapuri
5.	Dharmapuri	Dharmapuri	Dharmapuri
6.	Nallamapalli	Dharmapuri	Dharmapuri
7.	Palacode	Palacode	Dharmapuri
8.	Kaveripattanam	Pochampalli	Dharmapuri
9.	Bargur	Krishnagiri	Dharmapuri
10.	Krishnagiri	Krishnagiri	Dharmapuri
11.	Kelamangalam	Dhenkanikottai	Dharmapuri
12.	Veppanapalli	Krishnagiri	Dharmapuri
13.	Sholagiri	Hosur	Dharmapuri
14.	Hosur	Hosur	Dharmapuri
15.	Karimangalam	Palacode	Dharmapuri
16.	Mathur	Uttangarai	Dharmapuri
17.	Pennagaram	Pennagaram	Dharmapuri
18.	Thally	Dhenkanikottai	Dharmapuri
19.	Alangayam	Vaniyambadi	Vellore
20.	Thirupattur	Thirupattur	Vellore
21.	Kandili	Thirupattur	Vellore
22.	Nattarampalli	Thirupattur	Vellore
23.	Jolarpet	Thirupattur	Vellore

S.No.	Block Name	Taluk Name	District Name
24.	Yercaud	Yercaud	Salem
25.	Ayodhyapattinam	Valapadi	Salem
26.	Peddanayakkampalayam	Attur	Salem
27.	Thiruvannamalai	Thiruvannamalai	Thiruvannamalai
28.	Thandrampattu	Chengam	Thiruvannamalai
29.	Chengam	Chengam	Thiruvannamalai
30.	Pudupalayam	Chengam	Thiruvannamalai
31.	Thurinjapuram	Thiruvannamalai	Thiruvannamalai
32.	Kilpennatur	Thiruvannamalai	Thiruvannamalai
33.	Kandamangalam	Villupuram	Villupuram
34.	Kolianur	Villupuram	Villupuram
35.	Kanai	Villupuram	Villupuram
36.	Thiruvennainallur	Ulundurpettai	Villupuram
37.	Thirukovillur	Thirukovillur	Villupuram
38.	Mugaiyur	Thirukovillur	Villupuram
39.	Rishivandiyam	Kallakurichi	Villupuram
40.	Sankarapuram	Kallakurichi	Villupuram
41.	Kalarayan Hills	Kallakurichi	Villupuram
42.	Ulundurpet	Ulundurpet	Villupuram
43.	Tiyagaidurgam	Kallakurichi	Villupuram
44.	Gingee	Chenji	Villupuram
45.	Thirunavalur	Ulundurpettai	Villupuram
46.	Annagraman	Panruti	Cuddalore
47.	Panruti	Panruti	Cuddalore
48.	Cuddalore	Cuddalore	Cuddalore
49.	Vridachalam	Vridachalam	Cuddalore
50.	Kurinchipadi	Cuddalore	Cuddalore
51.	Kammapuram	Vridachalam	Cuddalore

3. Storage Capacity and Command Area of Reservoirs

S.No.	Name of the Reservoir	Capacity in MCM	Ayacut in Ha.
1.	Krishnagiri	66.10	3642
2.	Sathanur	229.00	18222
3.	Pambar	7.00	1620
4.	Shoolagiri Chinnar	2.30	352
5.	Vaniar	11.80	4212
6.	Thumbalahalli	3.70	884
7.	Kelavarapalli	13.10	3240
	Total	**333.00**	**32172**

4. Ground Water Availability Zone Wise

S.no	Zone	Recharge area Km^2	Recharge MCM/Yr	Extraction MCM/Yr	Balance MCM/Yr
1.	Zone 1 (basin area from Karnataka territory to Krishnagiri reservoir)	1005	102	88	14
2.	Zone 2 (from Krishnagiri to Sathanur Dam)	3876	550	497	53
3.	Zone 3 (from Sathanur to Thirukovilur anicut)	1533	222	198	24
4.	Zone 4 (Thirukovilur anicut to sea)	2075	625	560	65
	Total	**8489**	**1499**	**1343**	**156**

Source: IWS Report, PWD, WRO.

5. Projected water demand and water balance for various uses in Mcm.

S.no	Purpose	1999	2004	2019	2044
1	Domestic uses	74.69	80.56	96.43	122.88
2	Agriculture	2668.8	2668.8	2321.4	2089.78
3	Industries	104.39	139.18	243.57	417.54
4	Livestock	53.84	53.84	53.84	53.84
7	**Total**	**2901.72**	**2942.38**	**2715.24**	**2684.04**
8	**Water Balance**	**-31.72**	**-72.38**	**154.76**	**185.96**

Source: State framework resources Plan of Tamilnadu

6. Water Requirement for Irrigation Purpose

Crop	Area in Ha.	Net Crop Water Requirement Mm^3
SYSTEM AREA		
Paddy	23973 6020	206.80 51.93
Groundnut	13981	63.45
Ragi	12433	50.45
Sugarcane	5820	75.66
Total	62227	448.29

NON-SYSTEM AREA		
Paddy (tanks)	28579	246.54
Paddy (Others)	41166	355.12
Sugarcane	26436	343.68
Total	412106	945.34

Source: IWS Report, PWD, WRO

7. Classification of Ground Water Exploitation

S.no	Block Name	Classification as on January 2003
1.	Papireddipatti	Over Exploited
2.	Harur	Over Exploited
3.	Morapur	Over Exploited
4.	Uthangarai	Over Exploited
5.	Dharmapuri	Over Exploited
6.	Nallamapalli	Over Exploited
7.	Palacode	Over Exploited
8.	Kaveripattanam	Semi Critical
9.	Bargur	Over Exploited
10.	Krishnagiri	Semi Critical
11.	Kelamangalam	Safe
12.	Veppanapalli	Over Exploited
13.	Sholagiri	Semi Critical
14.	Hosur	Semi Critical
15.	Karimangalam	Over Exploited
16.	Mathur	Over Exploited
17.	Pennagaram	Critical
18.	Thally	Safe
19.	Alangayam	Over Exploited
20.	Thirupattur	Over Exploited
21.	Kandili	Over Exploited
22.	Nattarampalli	Over Exploited
23.	Jolarpet	Over Exploited
24.	Yercaud	Safe
25.	Ayodhyapattinam	Over Exploited
26.	Peddanayakkampalayam	Over Exploited
27.	Thiruvannamalai	Over Exploited
28.	Thandrampatty	Over Exploited
29.	Chengam	Over Exploited
30.	Pudupalayam	Over Exploited
31.	Thurinjiapuram	Over Exploited

S.no	Block Name	Classification as on January 2003
32.	Kilpennatur	Over Exploited
33.	Kandamangalam	Over Exploited
34.	Kolianur	Over Exploited
35.	Kanai	Semi Critical
36.	Thiruvennainallur	Over Exploited
37.	Thirukovillur	Semi Critical
38.	Mugaiyur	Over Exploited
39.	Rishivandiyam	Over Exploited
40.	Sankarapuram	Over Exploited
41.	Kalarayan Hills	Safe
42.	Ulundurpet	Over Exploited
43.	Thilyagaidurgam	Semi Critical
44.	Gingee	Over Exploited
45.	Thirunavalur	Critical
46.	Annagranam	Semi Critical
47.	Panruti	Semi Critical
48.	Cuddalore	Semi Critical
49.	Vridachalam	Semi Critical
50.	Kurinchipadi	Semi Critical
51.	Kammapuram	Semi Critical

Source: GW, PWD, WRO, Taramani.

8. Land use/ Land cover

S.no	Description	Area (ha)
1	Geographical area	125700
2	Forest	8500
3	Barren and uncultivable waste	---
4	Land under non - agricultural use	3700
5	Cultivable waste	---
6	Permanent pastures and other crazing land	---
7	Current fallows	29750
8	Other fallows	722300
9	Land under Misc. use	28700
10	Net area sown	65000

Source: State Framework resources plan PWD/WRO

9. Cropping Pattern and Crop Calendar

Ist Crop	IInd Crop	IIIrd Crop
Paddy (Aug.-Jan.)		Ragi, Millet, Bajra & Pulses (Jan to April)
Paddy (Oct.-Feb.)		
Paddy (Feb.-Jun.)	Groundnut (Nov.-Feb.)	
Paddy (Dec.-Apr.)	Groundnut (Jul.-Oct.)	
Banana (Jan.-Dec.)		
Sugarcane (Jan.-Dec.)		
Sorghum (Jan.-Apr)		

10. Disease Prevalence

A. Diarrhoea

(In Nos.)

S.no	District	Year									
		1999		2000		2001		2002		2003	
		Cs	Ds	Cs	Ds	Cs	Ds	Cs	Ds	Cs	Ds
1.	Dharmapuri	2258	24	1386	10	1876	31	1433	17	1797	7
2.	T.V.Malai	8891	15	5733	3	7441	2	8909	7	8167	1
3.	Vellore	9675	20	7706	26	6014	23	5781	20	5884	16
4.	Villupuram	3940	33	2498	8	1601	8	2620	7	2121	0
5.	Cuddalore	4733	4	5359	17	3724	12	3862	11	3176	5

B. Cholera

(In Nos.)

S.no	District	Year									
		1999		2000		2001		2002		2003	
		Cs	Ds	Cs	Ds	Cs	Ds	Cs	Ds	Cs	Ds
1.	Dharmapuri	14	0	4	0	12	0	18	2	30	1
2.	T.V.Malai	8	0	11	0	6	0	11	0	3	0
3.	Vellore	37	0	33	0	20	0	13	0	8	0
4.	Villupuram	20	0	8	0	15	0	10	0	5	0
5.	Cuddalore	6	0	6	0	7	0	4	0	1	0

C. Dysentery (In Nos.)

S.no	District	Year									
		1999		2000		2001		2002		2003	
		Cs	Ds	Cs	Ds	Cs	Ds	Cs	Ds	Cs	Ds
1.	Dharmapuri	5457	0	3869	0	4016	0	4016	0	4691	0
2.	T.V.Malai	3888	0	1678	0	1200	0	1636	0	2024	0
3.	Vellore	4293	0	4723	0	6202	0	3598	0	3476	0
4.	Villupuram	4439	1	1742	0	0	0	0	0	0	0
5.	Cuddalore	3343	0	310	0	1790	0	834	0	314	0

D. Typhoid (In Nos.)

S.no	District	Year									
		1999		2000		2001		2002		2003	
		Cs	Ds	Cs	Ds	Cs	Ds	Cs	Ds	Cs	Ds
1.	Dharmapuri	126	0	46	0	83	0	349	0	201	0
2.	T.V.Malai	149	0	82	0	272	0	229	0	169	0
3.	Vellore	66	0	143	0	279	0	305	0	122	0
4.	Villupuram	1	0	0	0	0	0	0	0	0	0
5.	Cuddalore	23	0	0	0	0	0	0	0	0	0

E. Jaundice (In Nos.)

S.no	District	Year									
		1999		2000		2001		2002		2003	
		Cs	Ds	Cs	Ds	Cs	Ds	Cs	Ds	Cs	Ds
1.	Dharmapuri	14	0	36	0	0	0	11	0	10	0
2.	T.V.Malai	55	0	10	0	17	0	65	0	13	0
3.	Vellore	16	0	2	0	85	0	25	0	104	0
4.	Villupuram	11	0	2	0	0	0	0	0	0	0
5.	Cuddalore	56	0	0	0	0	0	0	0	0	0

Source: DMS, Chennai.

11. Population Details

Districts	Region	Population		
		Persons	Male	Female
Vellore	Total	3026432	1529944	1496488
	Rural	2066718	1048055	1018663
	Urban	959714	481889	477825
Dharmapuri	Total	2442179	1244756	1197423
	Rural	1429610	724502	705108
	Urban	1012572	520257	492315
Tirvanamalai	Total	2042979	1030052	1012927
	Rural	1800051	907424	892627
	Urban	242928	122628	120300
Cuddalore	Total	2280530	1148729	1131801
	Rural	1527936	770160	757776
	Urban	752594	378569	374025
Villupuram	Total	2943917	1484573	1459344
	Rural	2517447	1269889	1247558
	Urban	426470	214684	211786

Source: Statistical handbook of Tamilnadu 2002

12. Literacy level

Districts	Literate		
	Persons	Male	Female
Vellore	1572292	950943	621349
Dharmapuri	1376328	-	-
Tirvanamalai	917548	580423	337125
Cuddalore	1443851	834940	608911
Villupuram	1675027	991886	683141

Source: Statistical handbook of Tamilnadu 2002, DES of TamilNadu

13 Tourist attractions

S.no	District	Tourist Place/Pilgrim center
1	Vellore	Vellore fort, Elagiri, Rathinagiri and Sholingur
2	Dharmapuri	Hogenakal, Krishnagiri dam, Vanniyar dam and Teerthamalai
3	Tiruvanamalai	Sattanur, Javvadu Hills and Tiruvanmalai temple
4	Cuddalore	Pitchavaram, Chidambaram and Vadalur
5	Villupuram	Tiruvakkarai, Kalrayan Hills, Mylam Temple and Tirukoilur Temple

Source: Statistical handbook of Tamilnadu – 2002

14. Industries

S. No.	Name & Location of Industry	Raw materials used	Production capacity	Water consumption m^3/day	Quantity of effluent m^3/day	ETP/STP details	Solid waste details
1.	Premier Mills Ltd. Lathur Village Hosur Taluk Dharmapuri Dist.	Cotton - 190 T/m Polyster fibre - 25 T/m Textile dyes - 5 T/m Acetic acid - 3.7 T/m Common salt - 18 T/m etc.	Yarn : 200 T/m Cotton, Synthetic and polyster Fabric : 25 lakhs mts/m	Domestic : 400 Process : 950 Cooling & Boiler Blow down : 250	Sewage : 300 KLD Effluent: 950 KLD	ETP constructed as per TNPCB norms	ETP sludge: 927 T/year
2.	Lakshmi Ring Travellers Ltd. Peramdepalli Village Hosur Taluk Dharmapuri Dist.	Ammonia gas- 36 m^3/day Nitrogen- 12 m^3/day Methanol - 30 Lts/day LPG - 24 m^3/day	Ring travellers	Domestic : Not available Process : 28	Sewage : Not available Effluent : Not available	ETP constructed as per TNPCB norms.	Nil
3.	Kallakurichi Cooperative Sugar Mills Ltd. Moongithuraipattu Kallakurichi Taluk Villupuram Dist.	Sugar cane - 7.5 lakh T/month Lime - 150 T/m Sulphur - 30 T/m	Sugar - 7500 T/m Molasses - 2700 T/m Bagasee - 22500 T/m	Process : 650 Domestic : 100	Effluent : 650 Sewage : 50	ETP constructed as per TNPCB norms.	Ash - 12 T/day dumped in low lying areas.
4.	Chemplast Sanmar Ltd. Marigampalli Village, Krishnagiri Taluk, Dharmapuri	Not available	Not available	Not available	Not available	ETP installed as per TNPCB	i) Yeast - 1.6 T/day used as manure ii) ETP sludge 87/ day disposed as

S. No.	Name & Location of Industry	Raw materials used	Production capacity	Water consumption m^3/day	Quantity of effluent m^3/day	ETP/STP details	Solid waste details
	Dist.					norms	land fill iii) Fly ash - IT/day disposed as land fill
5.	Mira Textiles & Industries (India) Ltd. (Paper Division) Vadakkunemili Village, Thirukoilur Taluk Villupuram Dist.	Waste kraft - boxes & cuttings - 28 T/day Alum - 0.85 T/day Rosin - 0.08 T/day Starch powder - 0.1 T/day	Kraft paper - 750 T/m	Domestic : Not available Process : 200	Sewage : Not available Effluent : 200	ETP installed as per TNPCB norms.	Not available
6.	Arunachala Milk Product Nallavanpalayam Thiruvannamalai	Cow milk - 30000 lts/day	Processed milk - 25000 lts/day	Domestic : 1.5 Process : 50	Sewage : 1.2 Effluent : 50	ETP installed as per TNPCB norms	Not available
7.	K.C.V. Milk Firm Pudukoilur Village Chengam Taluk T.V.Malai Dist.	Milk - 5000 lts/day	Processed milk - 4000 lts/day	Domestic : 2.0 Process : 15	Sewage : 1.5 Effluent : 15	ETP installed as per TNPCB norms	Not available
8.	Arunal Milk Products Thiruvadal Street	Milk - 12000 lts/day	Processed milk - 10000 lts/day	Domestic : 2.0 Process : 25	Sewage : 1.5 Effluent : 25	ETP installed as per	Not available

S. No.	Name & Location of Industry	Raw materials used	Production capacity	Water consumption m^3/day	Quantity of effluent m^3/day	ETP/STP details	Solid waste details
	Thiruvannamalai					TNPCB norms	
9.	Heritage Foods India Ltd., Thirunamanallur Thiruvannmalai Dist.	Milk - 5000 lts/day	Processed milk - 400 lts/day	Domestic : 2.5 Process : 30	Sewage : 2.0 Effluent : 30	ETP installed as per TNPCB norms	Not available
10.	Arunachalam Sugars Ltd. Malapambadi Village T.V.Malai Taluk	Not available	Not available	Domestic : 10 Process : 610	Sewage : 9 Effluent : 610	ETP installed as per TNPCB norms	Not available

15. Solid Waste Details

A. Dharmapuri District

S. No.	Name of urban local body	Popula-tion	Solids waste T/day		Collection efficiency	Workers for solid waste management		Availability of compost yard Yes/No	Recycling as manure Yes/No	If yes, quantity of annual production in T
			Genera-tion	Collect-ion		Total No.	No/1000 population			
a.	**Municipalities**									

1.	Dharmapuri	64696	45	38	84%	90	1.39	Yes	Yes	48
2.	Krishnagiri	64587	30	25	83%	68	1.03	No	No	-
3.	Hosur	84394	12	9.5	79%	35	0.78	No	No	-
	Total	**213677**	**87**	**72.5**	**82%**	**193**	**1.04**			
b.	**Town Panchayats**									
1.	Harur	21523	3.5	3.4	100%	35	1.59	Yes	Yes	4.5
2.	Palacode	18667	4.5	4.5	100%	20	1.1	No	No	-
3.	Karimangalam	12035	0.8	0.8	100%	25	1.35	Yes	Yes	0.8
4.	Pennagaram	15306	3	3	100%	20	1.18	No	No	-
5.	Kaveripattanam	14378	4	4	100%	25	1.51	No	No	-
6.	Kelamangalam	11052	3	3	100%	9	0.9	No	No	-
7.	Uthangarai	15443	2.5	2.5	100%	19	1.31	No	No	-
8.	Papireddipatti	8583	0.25	0.25	100%	6	0.7	No	No	-
9.	Bargur	12582	1.8	1.8	100%	12	1.0	No	No	-
10.	Mathur	15257	3	3	100%	7	0.69	No	No	-
	Total	**165437**	**30.35**	**30.35**	**100%**	**196**	**1.11**			**5.3**

Source: District Environmental Profile, Dharmapuri District.

B. Thiruvannamalai District

S. No.	**Name of urban local body**	**Popula-tion**	**Solids waste T/day**		**Collection efficiency %**	**Workers for solid waste management**		**Availability of compost yard Yes/No**	**Recycling as manure Yes/No**	**If yes, quantity of annual production in T**
			Genera-tion	**Collect-ion**		**Total No.**	**No/1000 population**			
a.	**Municipality**									
1.	Thiruvannamalai	130567	18.0	15.0	83.3	4	0.03	Yes	No	-

	Total	130567	18.0	15.0	83.3	4	0.03	Yes	No	-
b.	**Town Panchayats**									
1.	illpennathur	12468	1.0	1.0	100	7	0.56	Yes	No	-
2.	Chengam	23223	5.0	5.0	100	25	1.29	Yes	No	-
3.	Pudupalayam	10005	1.0	1.0	100	11	1.67	Yes	No	-
	Total	**45696**	**7.0**	**7.0**	**100%**	**43**	**1.17**	**-**	**-**	**-**

Source: District Environmental Profile, Thiruvannamalai District.

C. Villupuram

S. No.	**Name of urban local body**	**Popula-tion**	**Solids waste T/day**		**Collection efficiency %**	**Workers for solid waste management**		**Availability of compost yard Yes/No**	**Recycling as manure Yes/No**	**If yes, quantity of annual production in T**
			Genera-tion	**Collect-ion**		**Total No.**	**No/1000 population**			
a.	**Municipalities**									
1.	Villupuram	95455	7.2	6.0	90	66	1.2	Yes	No	Nil
	Total	95455	7.2	6.0	90	66	1.2	Yes	No	Nil
b.	**Town Panchayats**									
1.	Kallakurichi	36793	4.8	4.0	83.3	34	1.11	No	No	Nil
2.	Thiyagadurgam	13633	2.4	2.0	83.3	18	1.26	No	No	Nil

3.	Sangarapuram	12263	1.2	1.0	83.3	8	0.72	No	No	Nil
4.	Thirukoilur	27197	3.6	3.0	83.3	36	1.26	No	No	Nil
5.	Thiruvennainallur	8582	1.2	1.0	83.3	9	1.02	No	No	Nil
6.	Ulundurpet	19258	3.6	3.0	83.3	15	0.8	Yes	No	Nil
	Total	**117726**	**16.8**	**14**	**83.3**	**120**	**1.03**	-	-	-

16. Raw Water Quality Data of Kelavarapalli Dam for the year 2003 - 2004

S. No.	Parameter	April 2003	May 2003	June 2003	July 2003	Aug. 2003	Sep. 2003	Oct. 2003	Nov. 2003	Dec. 2003	Jan. 2004	Feb. 2004
1.	Turbidity	27	31	27	22	21	16	20	21	21	19	25
2.	Electric Conductivity	1026	1047	1041	993	916	824	843	872	995	1013	1044
3.	Total Dissolved Solids (mg/l)	718	733	729	965	641	612	590	610	697	709	731
4.	pH	7.7	7.9	7.9	7.9	7.6	7.8	7.8	7.5	7.8	7.6	7.7
5.	Total Hardness (mg/l)	242	248	254	244	242	216	211	225	245	254	259
6.	Iron (mg/l)	0.34	0.32	0.32	0.34	0.32	0.18	0.34	0.2	0.3	0.3	0.4
7.	Nitrates (mg/l)	2	2	7	7	12	9	7	8	7	7	4
8.	Chlorides (mg/l)	134	149	152	145	130	124	120	120	126	128	144
9.	Fluorides (mg/l)	0.45	0.45	0.45	0.5	0.45	0.45	0.45	0.4	0.35	0.4	0.5
10.	Sulphates (mg/l)	7	6	9	33	15	12	8	8	10	10	12
11.	Phosphates (mg/l)	6.2	7.9	5.0	5.9	8.7	10.6	7.8	6.3	7.6	9.6	8.5

12.	COD (mg/l)	83	76	-	81	50	-	-	41	-	50	-
13.	Total coliform	9000	900	-	16000	1600	-	-	1600	-	3000	-
14.	Fec. Coliform	220	10	-	240	23			130	-	120	

Source: TWAD Board, Krishnagiri

17. Treated Water Quality Data of Kelavarapalli Dam for the year 2003 - 2004

S. No.	Parameter	April 2003	May 2003	June 2003	July 2003	Aug. 2003	Sep. 2003	Oct. 2003	Nov. 2003	Dec. 2003	Jan. 2004	Feb. 2004
1.	Turbidity	4	4	4	4	5	5	4	4	4	4	5
2.	Electric Conductivity	1067	1093	1084	1037	970	916	874	904	1031	1044	1074
3.	Total Dissolved Solids (mg/l)	747	766	759	726	679	641	612	633	722	731	755
4.	pH	7.7	7.7	7.7	7.7	7.6	7.7	7.7	7.6	7.7	7.7	7.7
5.	Total Hardness (mg/l)	258	255	274	254	240	227	216	234	256	260	267
6.	Iron (mg/l)	0.07	0.1	0.1	0.07	0.13	0.08	0.06	0.06	0.1	0.1	0.1
7.	Nitrates (mg/l)	2	3	6	8	12	12	6	7	7	6	4
8.	Chlorides (mg/l)	159	162	171	157	150	138	130	132	140	143	146
9.	Fluorides (mg/l)	0.4	0.4	0.45	0.45	0.4	0.4	0.4	0.35	0.35	0.4	0.45
10.	Sulphates (mg/l)	159	67	70	65	59	39	36	38	40	44	52
11.	Phosphates (mg/l)	1.7	0.7	0.7	0.6	1.5	2.0	2.4	2.1	2.1	2.1	2.5
12.	COD (mg/l)	50	55	-	-	25	-	-	25	-	30	-
13.	Total coliform	4	0	-	-	0	-	-	0	-	0	-
14.	Fec. Coliform	2	0	-	-	0	-	-	0	-	0	-

VARAHANADHI BASIN

1. Geographical Area and Coverage

S.No.	Villupuram	Thiruvanamalai	Kanchepuram
Total area of the districts (Sq.Km.)	7217	6191	4433
Basin area in the districts (Sq.Km.)	3138	306	770
Percentage areas of the districts	43.48	4.94	17.37
Percentage of areas of basin in each district	74.47	7.28	18.27

2. Geographical Spread– Taluks and Blocks

Name of River Basin	Area (Sq.Km.)	District	Taluk	Block
Varahanadhi	4214	Villupuram		
			Melmalayanaur	Melmalayanur
				Vallam
				Gingee
			Tindivanam	Mailam
				Marakkanam
			Vanur	Vanur
			Villupuram	Vikkravandi
				Villpuram
				Kandamangalam
		Thiruvanamalai	Thiruvanamalai	Kilpenathaur
		Kanchepuram	Cheyyar	Chittamur
			Maduranthagam	Achrapakkam

3. Projected water demand and water balance for various uses in Mcm.

S.No.	Purpose	1999	2004	2019	2044
1	Domestic uses	43.1	47.13	59.22	79.38
2	Agriculture	1604	1604	1364	1204
3	Industries	30.15	40.2	70.35	120.6
4	Livestock	28.68	28.68	28.68	28.68
7	Total	1705.93	1720.01	1522.25	1432.66
8	Water Balance	192.07	177.99	375.75	465.34

Source: State framework resources Plan

4. Total Water Demand

S.No.	Purpose	Total Water Demand			
		2004	2019	2044	2050
1	Agriculture	1604.00	1604.00	1604.00	1604.00
2	Domestic	127.82	160.64	215.33	228.37
3	Industrial	40.2	70.35	120.6	132.7
4	Livestocks	28.68	28.68	28.68	28.68
	Total	1720.01	1762.25	1832.66	1849.59
	Balance (potential is 1898)	177.99	135.75	65.34	48.41

5. Ground water exploitation in 2003

Over-Exploited (> 100 %)	Critical (90 and 100 %)	Semi Critical (70 and 90%)
Gingee Kandamangalam Villupuram Mailam Marakanam Melmalaiyanur Vallam	Vanur Vikravandi	None

6. Drought Prone Areas

S.No	District	Block	Name of Habitation affected
1	Villpuram	Melmalaiyanur	1. Pinnalur 2. Porkunam
		Vallam	1.Sengamedu 2. Melkalavai
		Vikravandi	Sivaperumalpalayam
		Vannur	Elayandipattu Kadagampattu & Mettu Street

7. Waste Lands

District	Block	Waste Land	% to total Land
Villupuram	Melmalaiyanur	3084.33	8.97
	Gingee	526	1.42
	Vallam	1991.9	7.10
	Mailam	1038.27	3.64
	Marakkanam	2790.25	6.57
	Vannur	5322.18	11.83
	Vikravandi	1787.67	7.48
	Villupuram	504.06	2.55
	Kandamangalam	364.04	1.81
	Kilpenathaur	2501.59	9.22
	Chitamur	5552.02	16.79
	Achrapakkam	3663.61	10.69
		3084.33	8.97

8. Catchments areas

S.No.	Catchment Area	District	Taluk	Block
1.	Varahanadhi	Villupuram	Gingee Tindivanam Vanur Villupuram	Melmalayanur Gingee Vallam Mailam Marakkanam Vanur Vikkravandi Kandamangalam Villupuram

9. Forest Coverage – Catchment Area

Classification	Extent in Ha.	Percentage to total Forest Area
Geographical area	4,21,700	
Forests	32,757	7.70
Current fallow area	48,327	77.24
Other fallow area	15,168	15.06
Total		100.00

10. Major soil types

District	Taluk	Red soil	Sandy Loam	Clayey Loam	Brown clayey
Villupuram.	Villupuram	15	40	45	-
	Vanur	30	40	3	
	Gingee	60	40	-	-
.	Tindivanam	40	40	20	-
Tiruvanamalai	Tiruvanamalai	55	42	3	-
Kancheepuram	Cheyyur	10	-	-	90
	Madurantagam	10	-	25	65

11. Land use classification

S. No	Description	Area (ha)
1	Geographical area	421400
2	Forest	32757
3	Barren and uncultivable waste	29805
4	Land under non - agricultural use	66910
5	Cultivable waste	11200
6	Permanent pastures and other crazing land	4342
7	Current fallows	48327
8	Other fallows	15168
9	Land under Misc. use	13482
10	Net area sown	194409

12. Seasons of Cropping

S. N	Ist Crop	Season	II nd Crop	Season
I. Irrigated Crop				
1.	Paddy-Samba	Aug/Sep to Dec/Jan	Paddy-Navarai	Jan/Feb to Mar/Apr
2.	Paddy-Samba	Sep/Oct to Jan/Feb	Paddy-Somavari	Mar/Apr to Jun/Jul
3.	Paddy-Samba	Jul/Aug to Nov/Dec	Groundnut/Millet/Pulses/Gingelly	Dec/Jan to Mar/ Apr
4.	Paddy-Samba	Aug/Sep To Dec/Jan	Chillies/Cotton/Vegetables/Onion	Feb/Mar to Jul/Aug
5.	Sugarcane planted	Jan to Nov	Sugarcane planted	Nov to Oct
II. Un Irrigated Crop				
6.	Groundnut/Pulses	Jun/Jul to Sep/Oct	Pulses/Gingelly/Ragi	Oct/Nov to Dec/Jan
7.	Millet/ Pulses	Jun/July to Sep/Oct	Pulses/Gingelly	Oct/Nov to Dec/Jan

13. Area under Crop Cultivation

District	Blocks	Cropping pattern	Area (hect.)
Villupuram.	Melmalayanur	Paddy, Groundnut, Cumbu or ragi, sugarcane, Gingely, Cotton, Pulses	8.97
	Gingee		1.42
	Vallam		7.10
.	Mailam	Paddy, Groundnut, Cumbu or ragi, sugarcane, Gingely	3.64
	Marakkanam		6.57

	Vannur	Paddy, Groundnut, Cumbu or ragi, sugarcane, Gingely	11.83
	Vikkravandi	Paddy, Groundnut, Cumbu or ragi, sugarcane, Gingely	7.48
	Kandamanag lam		2.55
	Villupuram		1.81

14. Population details

Districts	Region	Population		
		Persons	Male	Female
Tirvanamalai	Total	2042979	1030052	1012927
	Rural	1800051	907424	892627
	Urban	242928	122628	120300
Villupuram	Total	2943917	1484573	1459344
	Rural	2517447	1269889	1247558
	Urban	426470	214684	211786
Kanchipuram	Total	2442179	1244756	1197423
	Rural	1429610	724502	705108

15. Literacy level

Districts	Literate		
	Persons	Male	Female
Tirvanamalai	917548	580423	337125
Villupuram	1675027	991886	683141
Kanchipuram	1980898	1096992	883906

16. Tourist attractions

S. No	District	Tourist Place/Pilgrim center
1	Dharmapuri	Hogenakal, Krishnagiri dam, Vanniyar dam and Teerthamalai
2	Cuddalore	Pitchavaram, Chidambaram and Vadalur
3	Villupuram	Tiruvakkarai, Kalrayan Hills, Mylam Temple and Tirukoilur Temple
4	Trichy	Mukkombu Anicut, Puliyoncholai, Rock fort Temple and Sri Rangam
5	Salem	Yercaud, Sangagiri, Kolli Hills, Tiruchengodu and Taramangalam

Source: Statistical handbook of Tamilnadu – 2002

17.Water Quality Analysis -2003

District	Tahsil / Taluk	Village	Well No	Date of collection	EC_GEN	PH_GEN	Ca	Mg	Na	K	HCO3
Villupuram	Chenji	Chinnanolambai	33002	1/6/03	1140	8.2					
Villupuram	Chenji	Alampundi	33017	1/6/03	820	8.5					
Villupuram	Chenji	Melmalayanur	33005	1/8/03	1410	8.4					
Villupuram	Chenji	Melmalayanur	33005	7/7/03	2040	8	104	83	191	13	543
Villupuram	Chenji	Kilmampattu	31518	7/15/03	2300	8.1	48	83	258	28	470
Villupuram	Chenji	Alampoondi	31520	7/15/03	800	8.5	20	50	74	5	243
Villupuram	Chenji	Sathampadi	31526	7/15/03	2660	8.4	28	126	368	15	311
Villupuram	Tindivanam	Salai	33014	1/6/03	710	8.3					
Villupuram	Tindivanam	Vadasiruvalur	33008	1/8/03	2230	8.3					
Villupuram	Tindivanam	Kilsevur	33012	1/8/03	1300	8.3					
Villupuram	Tindivanam	Omandur	31523	7/14/03	3640	7.9	164	173	322	8	177
Villupuram	Tindivanam	Vadasiruvalur	33008	7/14/03	2440	8.2	24	92	285	98	397
Villupuram	Tindivanam	Kilsevur	33012	7/14/03	1040	8.5	20	36	124	38	220
Villupuram	Tindivanam	Salai	33014	7/15/03	750	8.5	14	43	97	5	243
Villupuram	Tindivanam	Avanipur	31528	7/16/03	970	8.4	30	36	127	8	183
Villupuram	Tindivanam	Saram	31529	7/16/03	730	8.7	30	39	55	32	162
Villupuram	Vanur	Perumpakkam	33030	1/6/03	890	8.4					
Villupuram	Vanur	Bommayapalayam	33045A	1/11/03	890	8.4					
Villupuram	Vanur	Bommayapalayam	31555	7/14/03	220	8.2	20	21	5	5	64
Villupuram	Vanur	Kiliyanur	31530	7/16/03	860	8.3	22	60	87	5	294

Villupuram	Vanur	Perumpakkam	33030	7/16/03	1030	8.6	14	43	131	98	275
Villupuram	Vanur	Bommayapalayam	33045A	7/16/03	990	7.7	32	21	104	149	189
Villupuram	Villupuram	Orathur	33042	1/8/03	1250	8.2					
Villupuram	Villupuram	Kilperumpakkam	31532	7/7/03	1430	8.1	50	61	159	5	311
Villupuram	Villupuram	Orathur	33042	7/7/03	3190	8.1	312	83	225	196	482
Villupuram	Villupuram	Esalam	31531	7/10/03	2430	7.8	40	95	414	5	537
Villupuram	Villupuram	Athanurvinayagapuram	31533	7/10/03	1000	7.8	76	51	92	3	403
Tiruvannamalai	Tiruvannamalai	Thatchampattu	23038	1/4/03	1210	7					
Tiruvannamalai	Tiruvannamalai	Kilpennathur	21515	1/7/03	1860	8					
Tiruvannamalai	Tiruvannamalai	Polagunam	23112	1/7/03	1180	8.2					
Tiruvannamalai	Tiruvannamalai	Kilpennathur	21515	4/21/03	1850	8					
Tiruvannamalai	Tiruvannamalai	Thandarai	21516	7/10/03	590	8.5	32	16	69	6	116
Tiruvannamalai	Tiruvannamalai	Nachanendal	21559	7/10/03	450	8.4	20	22	53	4	122
Tiruvannamalai	Tiruvannamalai	Palayanur	21560	7/10/03	800	8.7	16	43	87	6	165
Tiruvannamalai	Tiruvannamalai	Thatchampattu	23038	7/10/03	2000	7.9	76	83	219	9	311

Tiruvannamalai	Tiruvannamalai	Thiruvannamalai	23005	7/11/03	1210	8.2	48	54	120	6	305
Tiruvannamalai	Tiruvannamalai	Kunnamurinji	21513	7/12/03	1040	8.1	10	26	189	9	433
Tiruvannamalai	Tiruvannamalai	Kolakkaravadi	21514	7/12/03	1650	8.6	40	22	288	22	214
Tiruvannamalai	Tiruvannamalai	Kilpennathur	21515	7/14/03	1780	8.4	20	75	235	9	195
Tiruvannamalai	Tiruvannamalai	Mangalam	21565	7/14/03	1030	7.8	50	39	101	10	268
Tiruvannamalai	Tiruvannamalai	Poyyanandal	21566	7/14/03	740	8.3	48	34	51	5	116
Tiruvannamalai	Tiruvannamalai	Keekalur	21568	7/14/03	1300	8.3	38	55	147	7	238
Tiruvannamalai	Tiruvannamalai	Keekkalur	23111	7/14/03	1340	8.3	20	69	143	7	195
Kancheepuram	Madurantagam	Acharapakkam	13244	1/23/03	1000	8.3					
Kancheepuram	Madurantagam	Mugaiyur	13251	1/23/03	1050	8.3					
Kancheepuram	Madurantagam	Puthirankottai	13002	1/24/03	370	8.8					
Kancheepuram	Madurantagam	Sitravadi	13005	1/24/03	900	8.3					
Kancheepuram	Madurantagam	Sitravadi	13005	4/25/03	570	8.2					

Kancheepuram	Madurantagam	Acharapakkam	13244	4/25/03	860	7.6					
Kancheepuram	Madurantagam	Mugaiyur	13251	4/25/03	900	7.4					
Kancheepuram	Madurantagam	Orathy	02036	7/21/03	580	8.4	58	13	48	9	98
Kancheepuram	Madurantagam	Salaiyur	02014	7/27/03	2920	7.4	240	66	334	3	336
Kancheepuram	Madurantagam	Chithamur	02015	7/27/03	4890	7.8	272	185	460	59	281
Kancheepuram	Madurantagam	Thennampattu	02035	7/27/03	1150	8.8	28	22	202	7	415
Kancheepuram	Madurantagam	Kadugupattu	13004	7/27/03	330	7.8	30	5	39	2	183
Kancheepuram	Madurantagam	Malaivaiyavur	13009	7/27/03	700	8.6	36	21	71	41	268
Kancheepuram	Madurantagam	Vinayaganallur	13240	7/27/03	1500	7.2	124	29	150	23	342
Kancheepuram	Madurantagam	Ammanur	13242	7/27/03	380	7.6	32	13	37	3	171
Kancheepuram	Madurantagam	Acharapakkam	13244	7/27/03	800	7.4	62	29	74	3	183
Kancheepuram	Madurantagam	L.Endathur	13246	7/27/03	680	7.8	64	28	39	6	238

VELLAR BASIN

1. District Wise River Basin Details

S.no.	District	Area of the District in Km^2	Area covered by Vellar Basin Km^2	%age area of the district covered in the basin	%age area of the basin covered by the district
a.	Dharmapuri	9622	69	0.72	0.90
b.	Salem	5205	2439	46.85	31.84
c.	Perambalur	3691	1545	41.85	20.17
d.	Trichy	4404	113	2.56	1.48
e.	Villupuram	7222	1855	25.68	24.22
f.	Cuddalore	3678	1638	44.53	21.39
	Total		7659		100%

2. Revenue divisions and taluks of the basin

Name of the district	Name of the revenue division	Name of the taluks
Dharmapuri	Dharmapuri	Harur
	Krishnagiri	Hosur
	Hosur	Palacode
		Pennagaram
		Dharmapuri
		Krishnagiri
		Denkanikottai
		Uthangarai
Villupuram	Kallakurichi	Villupuram
	Thirukoilur	Thirukoilur
	Tindivanam	Ulundurpet
	Villupuram	Vanur
Cuddalore	Chidambaram	Cuddalore
	Cuddalore	Panruti
	Virudhachalam	Vridhachalam
Salem	Salem	Yercaud

	Attur	Salem
	Mettur	Attur
	Sankari	Gangavalli
		Omalur
		Edapadi
Trichy	Trichy	Trichy
	Lalgudi	Sri Rangam
	Musiri	Manaparrai
		Musiri
		Thottiyam
		Manachennalur

3. Land use/ Land cover

S. No	Description	Extent in sq. km.
1	Total Geographical Area	7659.00
2	Forest	369.86
3	Barren and Uncultivable waste	1914.86
4	Land put to non-agricultural use	
5	Cultivable waste	
6	Pastures & Other Grazing lands	617.22
7	Land under tree and groves	28.29
8	Current fallow	
9	Other fallow	638.29
10	Net area sown	4090.66
	Total (2 to 10)	**7659.00**
11	Area sown more than once	1433.42
12	Gross area sown	5524.08
13	Irrigated area	1427.64

4. Ground Water Assessment

S.no.	Zone	Recharge MCM	Discharge MCM	Balance MCM
1.	Zone 1 (Swedanadhi, Kallar river subbasins upto Tholudur regulator)	308	274	34
2.	Zone 2 (Manimuktha, Gomukhi subbasins upto Vridachalam)	435	370	65
3.	Zone 3 (From Tholudur to Sethiathope anicut)	232	213	19
4.	Zone 4 (below Sethiathope anicut to sea)	47	42	5
	Total	1022	899	123

5. Population

(In Millions)

Area	2004	2009	2014	2029	2054
Urban	1.123	1.325	1.563	2.411	3.259
Rural	3.519	3.828	4.164	5.517	6.87
Total	4.642	5.153	5.727	7.928	10.129

6. Crop Water Demand

S.no	Crop	Duration	NIR in mm	Area cultivated in ha @ 40%	Area cultivated in ha @ 75%	Total area in ha	Water Demand MCM
1.	Paddy	Aug-Jan & Oct-Feb	790	81637.25	3483.75	85121	1559.02
2.	Cholam	Feb-May	408		2602	2602	14.15
3.	Cumbu	Feb-May	408		6474	6474	35.22
4.	Ragi	Feb-May	458		2257	2257	13.78
5.	Greengram	Feb-May	300		113	113	0.45
6.	Blackgram	Feb-May	300		147	147	0.59

7.	Sugarcane	Jan-Dec	1800		14471	14471	347.30
8.	Cotton	-	650		1136	1136	9.85
9.	Groundnut	Sep-Feb	500		17010	17010	113.40
10.	Gingelley	Sep-Feb	400		2142	2142	11.42
11.	Sunflower	Jan-May	500		2	2	0.01
12.	Chillies	Sep-Feb	850		6063	6063	68.71
13.	Onion	Sep-Feb	400		2977	2977	15.88
14.	Turmeric	Sep-Dec	850		1145	1145	12.98
15.	Banana	Jan-Dec	1800		1104	1104	26.50
	Total			81637.5	71309	142764	2229.26

7. **Present and Future Water Demand** (In MCM)

S.no.	Sector	2004	2009	2014	2029	2054
1.	Domestic					
a.	Urban	36.89	43.52	51.34	79.2	107.05
b.	Rural	51.37	55.89	60.79	80.54	100.3
	Sub Total	88.26	99.41	112.13	159.74	207.35
2.	Agriculture	2229.26	2229.26	2229.26	1938.87	1745.36
3.	Livestock	51.17	51.17	51.17	51.17	51.17
4.	Power generation	0.5	0.5	0.5	1.0	1.0
5.	Industries					
a.	Small Scale	15.16	19.34	24.67	51.28	173.65
b.	Large Scale	40.55	51.74	66.02	137.23	464.7
	Sub Total	55.71	71.58	90.69	188.51	638.35
	Total	**2424.9**	**2451.92**	**2483.75**	**2339.29**	**2643.23**

8. Ground Water Exploitation

S.No.	Block Name	Classification as on January 2003
1.	Papireddipatti	Over Exploited
2.	Thalaivasal	Over Exploited
3.	Gangavalli	Over Exploited
4.	Attur	Over Exploited
5.	Pethanayakampalayam	Over Exploited
6.	Ayothipattinam	Safe
7.	Valapadi	Over Exploited
8.	Pammarathupatti	Over Exploited
9.	Namagiripettai	Over Exploited
10.	Kollimalai	Safe
11.	Vennandurai	Over Exploited
12.	Sendamangalam	Over Exploited
13.	Sendurai	Safe
14.	Veppur	Over Exploited
15.	Veppanthatti	Over Exploited
16.	Perambalur	Over Exploited
17.	Alathur	Over Exploited
18.	Ariyalur	Semicritical
19.	Thirumanur	Safe
20.	Andimadam	Safe
21.	Thuraiyur	Over Exploited
22.	Uppliyapuram	Over Exploited
23.	Thiyagadurgam	Semi Critical
24.	Sankarapuram	Over Exploited
25.	Rischivandhiyam	Over Exploited
26.	Kallakurichi	Critical
27.	Chinnasalem	Semi Critical
28.	Kalrayanmalai	Safe
29.	Ulundurpet	Over Exploited
30.	Parangipettai	Semi Critical
31.	Bhuvanagiri	Semi Critical

S.No.	Block Name	Classification as on January 2003
32.	Keerapalayam	Safe
33.	Kammapuram	Semi Critical
34.	Vridachalam	Semi Critical
35.	Kurinjipadi	Semi Critical
36.	Nallur	Semi Critical
37.	Kattumannar Koil	Semi Critical
38.	Mangalur	Semi Critical
39.	Portonovo	Safe

Source : GW, PWD, WRO, Taramani

9. Fisheries

S. No.	District	Total Coastal line in Kms	Total Inland Fresh Water Spread Area in Ha	Estuaries and Brackish Water Area in Ha	Inland Quantity in Ton/ Annum	Marine Quantity in Ton/ Annum
a.	Dharmapuri	Nil	1628	Nil	160	Nil
b.	Salem	Nil	15346	Nil	213	Nil
c.	Perambalur	Nil	10400	Nil	4637	Nil
d.	Trichy	Nil	10634	Nil	225T	Nil
e.	Villupuram	41	1881	Nil	68	1.1
f.	Cuddalore	57.5	18866	9100	5240	28345

10. Land Use Classification

S.No.	Classification	Area
1.	Aquaculture	1.56
2.	Barren Rocky / Stony waste	124.74
3.	Coastal wet lands	0.33
4.	Deciduous	375.16
5.	Dry Crop	979.05
6.	Ever Green / Semi Ever Green	129.78
7.	Fallow	219.51

8.	Forest - Blanks	18.36
9.	Forest - Plantations	265.6
10.	Gullied / Ravenous land	38.96
11.	Industrial area	0.39
12.	Land with scrub	207.9
13.	Land without scrub	114.32
14.	Marshy/Swampy land	2.13
15.	Other Forest land	109.65
16.	Plantation	1043.86
17.	Reservoirs/Lakes/Tanks	253.82
18.	River/Stream	100.64
19.	Rural Settlements villages	223.92
20.	Salt affected lands	57.39
21.	Salt pans	0.18
22.	Sandy area	5.52
23.	Scrub forest	363.38
24.	Town and cities	26.1
25.	Unnotified forest area	299.12
26.	Water logged	0.68
27.	Wet crop	2418.26

11. Live Stock Population

S.no.	Block	Plough Animals	Buffaloes	Cows	Goat	Sheep	Pig	Poultry
A.	**Salem District**							
1.	Attur	-	3742	14456	23653	6546	6914	48200
2.	Ayodyapatinam	-	1474	1552	569	925	2754	1139
3.	Gangavalli	-	7330	3669	37763	4709	4132	16065
4.	Panamarathupatti	5901	-	5256	15438	4399	2476	89190
5.	P.N.Palayam	-	14795	23703	32149	8634	6798	133486
6.	Talaivasal	-	9860	18043	36072	10996	6734	234725
7.	Valapadi	-	7720	18852	21814	8597	4690	45714
B.	**Villupuram District**							

S.no.	Block	Plough Animals	Buffaloes	Cows	Goat	Sheep	Pig	Poultry
1.	Chinnasalem	21298	17752	40313	22300	-	13315	36320
2.	Kallakurichi	29089	9668	28384	32100	-	20398	35914
3.	Kalavayan Hills	10683	2884	15102	6300	-	4143	88233
4.	Rishivandiyam	4130	1086	7318	7200	-	1740	53430
5.	Sankarapuram	30250	6342	18565	10500	-	1835	80300
6.	Thigadurgam	18878	11332	22439	36000	-	5230	45340
7.	Ulundurpet	28114	2937	35430	25300	-	10130	-
C.	**Cuddalore District**							
1.	Bhuvanagiri	9650	4520	9725	6136	-	2100	23330
2.	Kammapuram	14760	6468	32689	7340	-	4300	13713
3.	K.M.Koil	63848	45060	40464	52000	-	15212	61926
4.	Keerapalayam	7226	12343	12622	8302	-	3200	22661
5.	Kumaratchi	6642	6807	7329	4401	-	2100	26600
6.	Mangalur	18630	7979	34984	12336	-	4500	8073
7.	Nallur	16234	11822	40482	23229	-	5600	38388
8.	Portonova	5732	2863	4397	2067	-	1200	28424
9.	Vridachalam	14105	10893	42365	18124	-	8300	38636

Source : District Statistical Hand Book

12. Industries

S. No.	Name & Address of Industry	Category	STP/ETP Status	APC Measures Status	Distance from Water Source	Mode of Disposal
1.	India Cement Ltd. Alathiyur Senthurai Taluk Perambalur Dist. **(Cement)**	Red - Large	STP Installed	Installed	Within 1 km from Annaivari Odai	Treated effluent on their own land
2.	Madras Cement Ltd Alathiyur Senthurai Taluk	Red - Large	STP installed	Installed	Within 1 km from Annaivari Odai	Treated effluent on their own land

S. No.	Name & Address of Industry	Category	STP/ETP Status	APC Measures Status	Distance from Water Source	Mode of Disposal
	Perambalur Dist. **(Cement)**					
3.	Ambica Sugars Ltd. Perambalur Dist. **(Sugar)**	Red - Large	ETP Provided	Installed	On the banks of Vellar river	On land adjacent to river
4.	Supreme Renewal Energy Ltd. Perambalur Dist.	Red - Large	ETP Installed	Installed	On the banks of Vellar river	On land adjacent to river

Source: TNPCB, Trichy.

13. Population details

Districts	Region	Population		
		Persons	Male	Female
Dharmapuri	Total	2442179	1244756	1197423
	Rural	1429610	724502	705108
	Urban	1012572	520257	492315
Cuddalore	Total	2280530	1148729	1131801
	Rural	1527936	770160	757776
	Urban	752594	378569	374025
Villupuram	Total	2943917	1484573	1459344
	Rural	2517447	1269889	1247558
	Urban	426470	214684	211786
Salem	Total	2992754	1551357	1441397
	Rural	1605726	841200	764526
	Urban	1387028	710157	676871
Trichy	Total	2388831	1194133	1194698
	Rural	1274516	636558	637958
	Urban	1114315	557575	556740

Source: Statistical handbook of Tamilnadu 2002

14. Literacy level

Districts	Literate		
	Persons	**Male**	**Female**
Dharmapuri	1461245	872014	589231
Cuddalore	1443851	834940	608911
Villupuram	1675027	991886	683141
Salem	1752966	1033301	719665
Trichy	1689780	927388	762392

Source: Statistical handbook of Tamilnadu 2002

VAIGAI BASIN

1. The distribution of the basin area in different districts

S.no	Name of the district.	Area of the district in Sq. km.	Area covered by the basin in sq. km.
1.	Madurai	6565	3913
2.	Dindigul	6058	1587
3.	Ramanathapuram	4232	770
4.	Sivagangai	4086	761
	Total		**7031**

2.List of blocks and taluks

Blocks	Taluks	Districts
Cumbum Uthamapalayam Chinnamanur Bodinayakanur Theni Periyakulam Andipatty Mayiladumparai	Uthamapalayam Bodinayakanur Theni Periyakulam Andipatty	Theni
Dindigul Athoor Battalagundu Nilakottai Natham Kodaikkanal	Dindigul Nilakottai Natham Kodaikkanal	Dindigul
Vadipatti Alanganallur Madurai East Madurai West Thirupparankundram Melur Kottampatti	Vadipatti Madurai North Madurai South Melur	Madurai
Sivagangai Thiruppuvanam Manamadurai Ilaiyangudi	Sivagangai Manamadurai Ilaiyangudi	Sivagangai
Paramakudi Nayinarkovil	Paramakudi	Ramanathapuram

Bogalur Ramanathapuram Thiruppullani Mandapam	Ramanathapuram Rameswaram	

3.List of sub basins and their areas

S.No	Name of Sub-basin	Area (Sq. Km.)		Total area (Sq. Km.)
		Plains	Hills	
1	Upper Vaigai	244.02	532.75	776.77
2	Suriliar	564.92	151.54	716.46
3	Theniar	386.96	237.74	624.70
4	Varattar – Nagalar	512.78	122.92	635.70
5	Varahanathi	234.91	155.38	390.29
6	Manjalar	241.76	228.24	470.99
7	Sirumaliar	474.20	51.04	525.24
8	Sathiyar	667.27	151.73	819.00
9	Uppar	847.36	5.34	852.70
10	Lower Vaigai	1212.74	7.86	122.60
TOTAL		**5386.92**	**1644.54**	**7031.46**

3. Land Use / Land Cover

S.no	Category	Area Extent in sq. km.
1.	Sparsely irrigated Crop land	1037
2.	Dry crop land	1086
3.	Intensively irrigated Crop land	2192
4.	Semi Deciduous Forest	662
5.	Dry Deciduous Forest	481
6.	Scrub Forest	855
7.	Low Evergreen Forest	49
8.	Urban built up land	27
9.	Water spread area of Vaigai dam	26
10.	Plantations	150
11.	Coconut groves	61
12.	Coastal plantations	39
13.	Swamps	45
14.	Barren rocky outcrop	107
15.	Uncultivable waste	225

	TOTAL	7042

4. Surface water potential

zone	Dependability		
	50%	**75%**	**90%**
Zone 1	993.75	814.89	729.41
Zone 2	266.37	192.30	170.50
Zone 3	279.86	224.22	184.24
Zone 4	112.34	86.56	79.38
Zone 5	373.50	261.04	209.19

5. Projected water demand for various uses in Mcm.

S. No.	Purpose	1999	2004	2019	2044
1	Domestic uses	142.09	151.99	181.61	231.03
2	Agriculture	3840	3840	3966	3966
3	Industries	46.82	62.42	109.24	187.26
4	Livestock	28.08	28.08	28.08	28.08
5	Environment	12	12	12	12
6	**Total**	**4068.99**	**4094.49**	**4296.93**	**4424.37**
7	**Water Balance**	**-1496.99**	**-1522.49**	**-1724.93**	**-1852.37**

6. Classification of forest area

S.No	Category	Area Extent Sq. Km.	Area %
1	Semi deciduous forest	662.36	9.42
2	Dry deciduous forest	480.94	6.84
3	Scrub forest	854.96	12.16
4	Low Evergreen forest	49.31	0.70
5	Plantations	149.88	2.13

7. Solid Waste Collection In Major Towns

S.no	Name of the Local Body	Civic Status	Population	Daily Generated garbage (M.T)
1	2	3	4	5
1	Cumbum	M	58713	23.400
2	Pudupatty	T.P	9977	0.170
3	Kamayagoundanpatty	T.P	12165	0.225
4	Highwavys	T.P	7028	-
5	Gudalur	T.P	35442	0.500
6	Hanumanthanpatty	T.P	9436	0.045
7	Uthamapalayam	T.P	22871	0.125
8	Kombai	T.P	12820	0.400
9	Pannaipuram	T.P	8924	0.110
10	Thevaram	T.P	14501	0.665
11	Markayankottai	T.P	5829	0.805
12	Kutchanur	T.P	6118	0.088
13	Odaipatti	T.P	13116	0.062
14	Chinnamanur	M	38327	4.500
15	Bodinayakkanur	M	73430	7.300
16	Melachokkanathapuram	T.P	11661	0.110
17	B. Meenachipuram	T.P	7207	0.076
18	Boothipuram	T.P	9623	0.110
19	Theni	M	85424	20.000
20	Palanichettipatti	T.P	11750	0.551
21	Veerapandi	T.P	14248	0.350
22	Periyakulam	M	42039	7.300
23	Vadugapatti	T.P	12353	0.455
24	Thamaraikulam	T.P	10264	0.986
25	Thenkarai	T.P	11616	1.085
26	Devathanapatti	T.P	13772	0.135
27	Genguvarpatti	T.P	10569	0.115
28	Andipatti	T.P	22992	1.254
29	Vathalakundu	T.P	20032	NA
30	Pattyveeranpatty	T.P	7744	NA

31	Pannaikadu	T.P	9396	NA
32	Ayyampalayam	T.P	21221	NA
33	Nilakottai	T.P	19630	NA
34	Sevugampatty	T.P	9521	NA
35	Vadipatty	T.P	21750	0.480
36	Sholavandan	T.P	21661	0.350
37	Alanganallur	T.P	11064	0.445
38	Palamedu	T.P	8187	1.180
39	Paravai	T.P	16346	0.115
40	Vilangudi	T.P	21073	0.790
41	Anaiyur	T.P	38302	1.160
42	Madurai	C	922913	350.000
43	Thirupparankundram	T.P	39009	1.982
44	Melur	M	33743	6.160
45	A. Vellalapatty	T.P	7068	0.410
46	Thiruppuvanam	T.P	21435	0.825
47	Manamadurai	T.P	26284	0.950
48	Ilayankudi	T.P	19100	0.850
49	Paramakudi	M	84299	14.100
50	Ramanathapuram	M	61974	11.800
51	Mandapam	T.P	15779	1.000
52	Rameswaram	T.P	7560	4.870

* NA – Not Availed M – Municipality TP – Town Panchayat C - Corporation

8. Industries

Industries - year 2005				**Water requirement – mcm**		
S. No	**Sub basin**	**Large**	**Small**	**Large**	**Small**	**Total**
Growth rate/ per capita in cum		0.08	0.08	2500	2.50	
1	Upper Vaigai	9	1264	8054	1.15	9.69
2	Suriliar	0	872	0.00	0.80	0.80
3	Theniyar	3	702	2.85	0.64	3.49
4	Varatar and Nagalar	14	1053	12.81	0.96	13.77
5	Varahanadhi	6	1064	5.69	0.97	6.66
6	Manjalar	12	1437	11.39	1.31	12.70
7	Sirumalaiar	20	3256	18.51	2.97	21.48
8	Vaigai –Sathiar	37	7568	34.16	6.91	41.07

9	Vaigai – Uppar	33	7190	29.89	6.56	36.45
10	Lower Vaigai	5	2047	4.27	1.87	6.14
	Total	**140**	**26451**	**128.12**	**24.14**	**152.24**

Industries - year 2020				**Water requirement – mcm**		
S. No	**Sub basin**	**Large**	**Small**	**Large**	**Small**	**Total**
Growth rate/ per capita in cum		0.08	0.08	2500	2.50	
1	Upper Vaigai	17	2236	15.11	2.04	17.15
2	Suriliar	0	1543	0.00	1.41	1.41
3	Theniyar	6	1242	5.04	1.13	6.17
4	Varatar and Nagalar	25	1863	22.67	1.70	24.37
5	Varahanadhi	11	1882	10.07	1.72	11.79
6	Manjalar	22	2542	20.15	2.32	22.47
7	Sirumalaiar	36	5760	32.74	5.26	38.00
8	Vaigai –Sathiar	66	13389	60.44	12.22	72.66
9	Vaigai – Uppar	58	12721	52.89	11.61	64.50
10	Lower Vaigai	8	3621	7.56	3.30	10.86
	Total	**248**	**46799**	**226.64**	**42.70**	**269.37**

9. Land use pattern

S.no	**Category**	**Area Extent Km^2**	**Area %**
1	Sparsely irrigated Crop land	1037	15
2	Dry crop land	1086	14
3	Semi Deciduous forest	662	9
4	Dry Deciduous forest	481	7
5	Scrub forest	855	12
6	Low evergreen forest	49	1
7	Intensively irrigated crop land	2192	31
8	Plantations	150	2
9	Water spread area of Vaigai dam	26	1
10	Coconut groves	61	1

11	Barren/ rocky out crop	107	1
12	Urban built up land	27	1
13	Coastal plantations	39	1
14	Swamps	45	1
15	Uncultivable waste	225	3

10. Population Details

Districts	Region	Population		
		Persons	Male	Female
Theni	Total	1094724	553118	5411606
	Rural	502509	255241	247268
	Urban	592215	297877	294338
Madurai	Total	2562279	1295124	1267155
	Rural	1129028	569988	559040
	Urban	592215	297877	294338
Dindigul	Total	1918960	966201	952759
	Rural	1246956	627672	619284
	Urban	672004	338529	333475
Ramnad	Total	1183321	582068	601253
	Rural	883508	433090	450418
	Urban	299813	148978	150835
Sivagangai	Total	1150753	565594	585159
	Rural	826427	404561	421866
	Urban	324326	161033	163293

Source: Statistical handbook of Tamilnadu 2002

11. Literate Statement

Name of the District	Name of the Block	Total Population	Literate	Agricul-turist	Agricultural Labourers	No. of households
1	2	3	4	5	6	7
Theni	Cumbum	101211	51573	3866	23209	16367
	Uthamapalayam	111453	60784	5994	29834	20976
	Chinnamanur	72660	34781	6144	29922	17120
	Bodinayakkanur	167751	106392	7282	43809	NA
	Theni	173985	121300	6405	28897	18125
	Periyakulam	188318	120609	7496	43988	32453
	Andipatty	103703	43110	12876	29393	20970
	K.Myladumparai	69278	24310	9082	23231	16404
Dindigul	Batlagundu	96346	4816	9462	21098	21860
	Kodaikanal	98598	53006	5020	9932	23415
	Athur	136099	72001	10174	34004	32813
	Dindigul	302507	198007	10668	24029	65954
	Nilakotai	196833	34705	16790	29568	26497
	Natham	119222	48396	1441	2565	25488
Madurai	Vadipatty	96807	56182	6069	31832	25300
	Alanganallur	95934	36576	8493	30163	21593
	Madurai west	127108	76484	6201	20353	27940
	Madurai east	122235	65130	8280	27552	45104
	Thirupparankundram	213399	124262	8769	21798	26852
	Melur	115006	56712	21413	27121	26830
	Kottampatti	98944	42324	19972	22630	22802
Sivagangai	Thiruppuvanam	102005	52022	15178	15485	22279
	Sivagangai	124879	62977	19496	11856	27620
	Manamadurai	106866	34084	17368	13819	21018
	Ilayankudi	NA	NA	NA	NA	NA
Ramanathapuram	Paramakudi	137700	103528	16139	7097	15348
	Nainar kovil	49349	21602	19334	9805	9060
	Bogalur	39107	18098	9597	4220	8791
	Ramanathapuram	109609	62989	94430	5379	12722
	Thiruppullani	102448	43418	12830	6415	21364
	Mandapam	156267	89976	6452	4437	21440

12. Tourist Attractions

S.no	Place	Toruist / Pilgrim Centre, Festival
1	Suruli falls	Tourist spot
2	Veerapandi Gowmariamman kovil	Pilgrim centre
3	Kuchanur Saneeswaran kovil	Pilgrim centre
4	Vaigai Dam	Tourist spot
5	Sothuparai Dam	Tourist spot
6	Kumbakarai falls	Tourist spot
7	Devathanapatti – Moogilanai Kamatchiamman kovil	Pilgrim centre
8	Kodaikanal	Tourist spot
9	Kutladampatti falls	Tourist spot
10	Madurai	Tourist spot / Chittirai Festival
	a) Meenakshiamman kovil	Pilgrim centre
	b) Koodal Alagar kovil	Pilgrim centre
	c) Vandiyur Mariamman kovil	Pilgrim centre
	d) Alagar kovil	Pilgrim centre
	e) Thirupparankundram – Murugan kovil	Pilgrim centre
	f) Gandhi Muesium	Tourist spot
	g) Thirumalai Naicker Mahal	Tourist spot
11	Megamalai (Chinna suruli falls)	Tourist spot
12	Paramakudi	Chittirai Festival
13	Rameswaram	Tourist spot
14	Devipattinam	Tourist spot
15	Thiruppullani	Pilgrim centre
16	Thiru Uthirakosamangai	Pilgrim centre

13. Details of Sewage Disposal In Major Towns

Sno	Name of the Local Body	Civic Status	Population	Daily water supply (lakhs/ltr/day)	Daily generated sewage (lakhs/ltr/day)
1	Cumbum	M	58713	39.00	31.20
2	Pudupatty	T.P	9977	4.09	3.27
3	Kamayagoundanpatty	T.P	12165	5.47	4.38

4	Highways	T.P	7028	4.29	3.43
5	Gudalur	T.P	35442	16.30	13.04
6	Hanumanthanpatty	T.P	9436	3.30	2.64
7	Uthamapalayam	T.P	22871	9.38	7.50
8	Kombai	T.P	12820	5.13	4.10
9	Pannaipuram	T.P	8924	4.19	3.35
10	Thevaram	T.P	14501	6.24	5.00
11	Markayankottai	T.P	5829	2.45	1.96
12	Kutchanur	T.P	6118	3.01	2.41
13	Odaipatti	T.P	13116	5.25	4.20
14	Chinnamanur	M	38327	36.52	29.22
15	Bodinayakkanur	M	73430	55.69	44.55
16	Melachokkanathapurm	T.P	11661	4.66	3.73
17	B. Meenachipuram	T.P	7207	3.60	2.88
18	Boothipuram	T.P	9623	5.77	4.62
19	Theni	M	85424	93.00	74.40
20	Palanichettipatti	T.P	11750	4.23	3.38
21	Veerapandi	T.P	14248	6.41	5.13
22	Periyakulam	M	42039	38.00	30.40
23	Vadugapatti	T.P	12353	3.71	2.97
24	Thamaraikulam	T.P	10264	2.98	2.38
25	Thenkarai	T.P	11616	3.95	3.16
26	Devathanapatti	T.P	13772	6.20	4.96
27	Genguvarpatti	T.P	10569	5.18	4.14
28	Andipatti	T.P	22992	8.74	6.99
29	Vathalakundu	T.P	20032	NA	NA
30	Pattyveeranpatty	T.P	7744	NA	NA
31	Pannaikadu	T.P	9396	NA	NA
32	Ayyampalayam	T.P	21221	NA	NA
33	Nilakottai	T.P	19630	NA	NA
34	Sevugampatty	T.P	9521	NA	NA
35	Vadipatty	T.P	21750	10.66	8.53
36	Sholavandan	T.P	21661	14.06	11.25
37	Alanganallur	T.P	11064	6.74	5.39
38	Palamedu	T.P	8187	5.28	4.22

39	Paravai	T.P	16346	10.88	8.70
40	Vilangudi	T.P	21073	9.27	7.42
41	Anaiyur	T.P	38302	13.45	10.76
42	Thirupparankundram	T.P	39009	15.60	12.48
43	Melur	M	33743	10.43	8.34
44	A. Vellalapatty	T.P	7068	4.73	3.78
45	Thiruppuvanam	T.P	21435	13.00	10.40
46	Manamadurai	T.P	26284	14.82	11.86
47	Ilayankudi	T.P	19100	5.74	4.59
48	Paramakudi	M	84299	16.71	13.37
49	Ramanathapuram	M	61974	11.45	9.16
50	Mandapam	T.P	15779	4.60	3.68
51	Rameswaram	T.P		14.00	11.20

M – Municipality TP – Town Panchayat NA – Not Availed

14. List of Observation Wells

S.No	Well No	Location	Co-ordinates			District	Depth in Meter (BGL)	Water Level in Meter (July 99) (BGL)
			Latitude	Longitude	Toposheet No			
1	83046	Kullappagoundanpatti	09 39 44	77 16 35	58 G / 06	Theni	12.30	07.50
2	83045B	Cumbum	09 44 07	77 17 52	58 G / 06	Theni	18.20	15.40
3	83053A	Erasakkanaickanur	09 47 31	77 23 55	58 G / 05	Theni	32.00	27.75
4	83054	Uthamapalayam	09 48 15	77 19 44	58 G / 05	Theni	12.00	09.90
5	83069A	Sangarapuram	09 54 34	77 20 05	58 G / 05	Theni	25.05	19.10
6	830554A	Kombai	09 50 21	77 17 49	58 G / 05	Theni	23.10	17.45
7	83070	T.Meenakshipuram	09 53 00	77 16 54	58 G / 05	Theni	23.10	16.20
8	83068A	Seelayampatti	09 52 17	77 23 36	58 G / 05	Theni	14.50	05.10
9	83085	Kodangipatti	09 59 33	77 26 31	58 G / 05	Theni	08.70	02.10
10	83010A	Bodinaickanur	10 00 14	77 21 26	58 F / 08	Theni	10.85	06.30
11	83011A	Theni	10 01 58	77 29 23	58 F / 08	Theni	20.40	07.20
12	83009	Venkatachalapuram	09 55 00	77 28 29	58 G / 05	Theni	28.40	07.80
13	83553	Kadamalaikundu	09 48 44	77 30 29	58 G / 09	Theni	11.45	07.60
14	83067	Kandamanur	09 55 21	77 31 29	58 G / 09	Theni	19.90	05.20
15	83084	Arappadithevanpatti	10 00 27	77 32 06	58 F / 12	Theni	17.24	06.80
16	83086A	Lakshimipuram	10 04 56	77 31 25	58 F / 12	Theni	21.55	06.05
17	83087	Vaigaiputhur	10 03 31	77 35 26	58 F / 12	Theni	09.35	06.40
18	83501	Gandhipuram	10 07 40	77 33 17	58 F / 12	Theni	09.64	04.28
19	83500	Kottarapatti	10 08 17	77 42 04	58 F / 12	Theni	08.81	06.30
20	83088	Gullapuram	10 03 52	77 38 36	58 F / 12	Theni	09.55	04.52
21	83023	Devathanapatti	10 08 34	77 38 50	58 F / 12	Theni	11.01	02.62
22	83100	Vengadasastrikottai	10 09 13	77 47 23	58 F / 06	Dindigul	11.10	05.50
23	83021A	Pallapatti	10 08 25	77 54 40	58 F / 16	Dindigul	15.43	04.82

24	83092A	Neerathan	10 03 09	77 58 35	58 F / 16	Madurai	10.65	03.38
25	83014	Solavanthan	10 01 14	77 57 46	58 F / 16	Madurai	07.10	03.90
26	83080	Nagari	10 01 04	78 02 04	58 J / 04	Madurai	06.50	02.85
27	83094B	Thavacheri	10 04 23	78 06 56	58 J / 04	Madurai	08.63	Dry
28	83020A	Valayapatti	10 08 54	78 07 10	58 J / 04	Madurai	06.00	04.20
29	83079	Koolapandi	10 00 37	78 09 00	58 J / 04	Madurai	04.60	05.28
30	83027	Puliankulam	09 52 59	78 11 02	58 K / 04	Madurai	06.10	05.15
31	83076	Varichur	09 54 30	78 15 30	58 K / 05	Madurai	07.60	04.75
32	83075	Karuppayiurani	09 56 00	78 11 30	58 K / 01	Madurai	08.35	05.15
33	83019	Parali	10 08 54	78 11 05	58 J / 04	Didigul	06.80	04.72
34	83095	Pulipatti	10 05 04	78 17 20	58 J / 08	Madurai	07.00	05.30
35	83017	T.Palaiyur	09 57 08	78 18 32	58 K / 05	Madurai	09.65	06.85
36	83078	Melapathinettankudi	09 59 45	78 19 52	58 K / 05	Madurai	08.40	04.96
37	83077A	Urankanpatti	09 59 50	78 25 44	58 K / 05	Madurai	09.65	05.45
38	83096	Thumbaipatti	10 05 06	78 21 34	58 J / 08	Madurai	05.34	01.70
39	83233	Thirumansolai	09 51 09	78 19 50	58 K / 05	Sivagangai	08.64	05.21
40	83236	Nallakulam	09 51 35	78 23 20	58 K / 05	Sivagangai	08.64	02.91
41	83124B	Rajakambeeram	09 43 05	78 25 10	58 K / 06	Sivagangai	09.80	07.85
42	83123B	Manamadurai	09 42 00	78 27 00	58 K / 06	Sivagangai	08.60	05.50
43	83129B	Ilaiyankudi	09 37 35	78 37 35	58 K / 10	Sivagangai	11.00	08.00
44	83128B	Paramakudi	09 32 40	78 35 40	58 K / 10	Ramnad	05.70	02.47
45	83275	Bogalur	09 24 25	78 42 50	58 K / 11	Ramnad	11.66	05.63
46	83277	Vairavanendal	09 24 35	78 46 05	58 K / 15	Ramnad	03.50	02.06
47	83136A	Devipattinam	09 28 00	78 54 00	58 K / 15	Ramnad	05.45	02.20
48	83279A	Sathrakudi	09 25 40	78 54 00	58 K / 15	Ramnad	04.17	02.78
49	83134A	Ramanathapuram	09 22 15	78 49 50	58 K / 15	Ramnad	09.35	06.70
50	83280	Valantharuvai	09 20 10	78 54 50	58 K / 15	Ramnad	08.64	05.73
51	83281	Chembadaiyarkulam	09 20 00	78 58 00	58 K / 15	Ramnad	04.98	03.34
52	83282	Uchipuli	09 18 20	79 01 10	58 O / 03	Ramnad	02.98	01.75
53	83132A	Thiruppulani	09 17 00	78 49 50	58 K / 15	Ramnad	06.60	04.24

AGNIYAR BASIN

1. Details of Taluks in the Basin

S.No	District	Taluks
1	Pudukkottai	Alangudi
2		Arathangi
3		Avudayarkoil
4		Gandarvakkottai
5		Kulathur
6		Pudukkottai
7		Thirumayam
8	Thanjavur	Pattukottai
9		Peravurani
10	Tiruchirapalli	Viralimalai

2. Anicuts present in the Sub Basins of Agniyar

Agniyar Sub Basin	Ambuliyar Sub Basin	South Vellar Sub Basin
Sinayakkudi	Pallathividuthy	Kilikudi
Andakulam	Kothamangalam	Pinnakudi
Agniyar (or) Pulavankadu	Senthangudi	Visalue
Maniyavayal	Chithathikkadu	Keemanakanmoi
Madathukkadu	Nelhadikkadu	Sundarapatti
Poovanam	Adaikkathevan	Senthamangalam
Kollukkadu Pumping scheme		Holdsworth
		Sethukanmoi
		Kothamangalam
		Narpavalakudi
		Veeramangalam
		Avudayarkoil
		Karunkadu
		Manalur
		Keeranur
		Manamelkudi

3. Land use / Land cover

Description	Area (ha)
Geographical area	4,56,600
Forest	2,3743
Barren and uncultivable waste	9,132
Land under non - agricultural use	1,09,584
Cultivable waste	14,155
Permanent pastures and other crazing land	4,109
Current fallows	64,381
Other fallows	27,853
Land under Misc. use	8,218
Net area sown	1,95,425

(Source: Environmental Status report of the Agniyar River Basin)

4. Projected water demand and water balance for various uses

S No	Purpose	1999	2004	2019	2044
1	Domestic uses	29.55	31.48	37.29	46.98
2	Agriculture	2344	2344	1916.86	1631.81
3	Industries	25.64	34.18	59.82	102.54
4	Livestock	14.8	14.8	14.8	14.8
6	Total	2413.99	2424.46	2028.77	1796.13
7	**Water Balance**	**-409.99**	**-420.46**	**-24.77**	**207.87**

5. Crop Productivity

S.No	Description of crop	Area (in hectares)	Productivity in Kg/hec
1	Paddy	83500	3158
2	Cholam	326	1306
3	Cambu	30	2796
4	Ragi	278	2316
5	Maize	180	2068
6	Varagu	209	918
7	Green gram	37	543
8	Black gram	2140	518
9	Red gram	1390	505
10	Horse gram	210	0
11	Ground nut	27549	1448
12	Gingelly	1481	453
13	Chillies	181	569

6. Diseases prevailing in the basin

S.No	Name of the disease	No. of patient treated
1	Fever	2458
2	Typhoid fever	410
3	Tuberculosis	1691
4	Leprosy	480
5	Twakrogam	0
6	Verinam	95
7	Vatham	15957
8	Hypertensive disease	414
9	Iṣehemic heart disease	857
10	Sivorogam	0
11	Nasrogam	234
12	Others	43744

7. District wise area and population details

Districts	Region	Population		
		Persons	Male	Female
Trichy	Total	23,88,831	11,94,133	11,94,698
	Rural	12,74,516	6,36,558	6,37,958
	Urban	11,14,315	5,57,575	5,56,740
Thanjavur	Total	22,05,375	10,91,557	11,13,818

8. District wise literacy level

Districts	Literate		
	Persons	Male	Female
Trichy	16,89,780	9,27,388	7,62,392
Thanjavur	14,90,568	8,25,006	6,65,562
Pudukottai	9,19,086	5,25,743	3,93,343

9. Tourist attractions

District	Tourist Place / Pilgrim center
Trichy	Mukkombu Anicut, Puliyoncholai, Rock fort Temple and Sri Rangam
Thanjavur	Darasuram, Grand Anicut, Thanjavur Temple, Thiruvaiyaru, Thirukandiyur and Kumbakonam
Pudukottai	Viralimalai, Avudayiarkoil, Kudumiammalai, Pudukottai, Sittanna vassal, Narthamalai

PAMBAR BASIN

1. Taluk wise Basin Area

Name of District	Name of Taluk of the Basin	Area Sq.Kms
Pudukottai	Tirumayam	385.39
	Aranthangi	19.27
	Avadayarkoil	83.50
Trichy	Manapparai	54.60
Sivagangai	Tiruppathur	789.13
	Devakottai	346.85
	Karaikudi	452.83
	Sivagangai	35.33
Madurai	Melur	356.49
Ramnad	Tiruvadanai	353.28
Dindigul	Natham	475.32
	Dindigul	22.48
Total		3374.47

2. Land use

S.No	Description	Area in ha	Area as a % of Total Area of the basin
1	Total area of basin	337447	100
2	Forest	31864	9.44
3	Barren and Uncultivable land	10650	3.16
4	Land put to non-agriculutural use	53164	15.75
5	Cultivatable waste	14577	4.32
6	Permanent pasture and grazing land	1547	0.46
7	Land under miscellaneous trees groves not included in net sown area	6759	2.00
8	Current fallows	48688	14.43
9	Other fallow lands	57688	17.09
10	Net Area sown	112510	33.35

3. Surface water potential

Season	Calculation	Yield Mcum
SW Monsoon	0.15x3374.47x100x152.74/1000	152.74
NE Monsoon	0.15x3374.47x100x206.65/1000	206.65
Summer	0.15x3374.47x100x149.414/1000	149.414
	Total	508.8

4. Ground water Potential

Name of Taluk	Name of Block	Ground Water Potential for the whole Block ha-m			GW potential of the Basin portion of the block ha-m		
		Total	Available for Irrigation	Basin area in the block ha	GW Available for irrigation	GW Available for industry	GW Total potential available ha-m
1) Sivagangai Dt.							
Devakottai	Devakottai	4562	4481	34685	5043	83	5126
	Kannanur	3888	3833				
Karaikudy	Sakkottai	4818	4706	45283	5972	157	6129
	Kallal	6358	6185				
Tiruppathur	Tiruppathur	5501	5345	78913	11695	350	12045
	Singampunari	4180	4083				
	S.Pudur	2364	2267				
Sivagangai	Sivagangai	9563	9364	3533	689	13	702
	Kalayar koil	12298	12090				
2)Ramnad Dt.,							
Tiruvadanai	Tiruvadani	5874	5673	35328	2611	173	2784
	RS Mangalam	1000	775				
3)Pudukottai Dt.,							
Tirumayam	Tirumayam	6221	6069	38539	6635	196	6831
	Arimalam	5251	5098				
	Ponnamaravathi	5478	5296				
Aranthangi	Aranthangi	9745	9463	1927	456	13	469
Avadayarkoil	Avadayarkoil	10462	10302	8350	2169	34	2203
4)Trichy Dt.							
Manapssparai	Marungapuri	9054	8825	5460	1059	27	1086
5)Madurai Dt.							
Melur	Melur	12902	12609	35649	9682	148	9830
	Kottampatti	6607	6589				
6)Dindigul Dt.							
Natham	Natham	5936	5716	47532	4606	177	4783
Dindigul	Sannarpatti	5193	4981	2248	285	12	297
				337447	50902	1383	52285

(1 ha-m = 0.01Mcum) or 509.02 13.83 522.85Mcum

5. Projected water demand and water balance for various uses in MCM

S No.	Purpose	1999	2004	2019	2044
1	Domestic uses	35.21	37.31	43.6	54.07
2	Agriculture	1960.73	1960.73	1815.28	1637.52
3	Industries	51.89	69.18	121.07	207.54
4	Livestock	24.98	24.98	24.98	24.98
6	Total	2072.81	2092.2	2004.93	1924.11
7	Water Balance	-443.81	-463.2	-375.93	-295.11

Source: State framework resources Plan of Tamilnadu

6. Places of Fluoride contamination.

S.No	Name of Taluk	Name of Village	Fluoride content in ppm
1	Melur	Pulipatti	2.0
		Kottampatti	2.5

7. Places of Nitrate contamination.

S.No	Name of Taluk	Name of Village	Nitrate content in ppm
1	Melur	Pulipatti	66
2	Tiruvadanai	Tondi	1302
3	Karaikudy	Karaikudy	128
4		Vetriyur	177

8. Cropping Pattern

Sl. No	Name of Crop	Name of District				
		Pudukottai	Dindigal	Sivagangai	Ramnad	Madurai
1	Rice	Sep-January	Aug-Dec June-Oct	Aug-Nov to Jan-March	Nov-March	June-Oct Aug-Dec
2	Groundnut (oil Seeds)	July-Sep	Jan-May	Throughout the year		
	Rice	Oct-January				
	Cumbu or Ragi	Feb-May		Jan-July to Aug-Sep		Mar-June June-Sep

3	Groundnut	July-October				June-Oct July-Nov
	Chilles	Oct-Feb				
	Maize	March-June	Jan-May	Aug-Sep	Feb-June Aug-Jan	
4	Ragi	July-Oct				June-Oct
	Rice `	Oct-Feb				
	Cotton	Feb-June	Aug-Sep to Jan-Feb	Feb-March to Sep-Oct	Feb-Aug	Feb-Aug June-Dec
5	Groundnut	June-Oct				Dec-April
	Black gram	Nov-Feb		June-Aug	Mar-May	
	Horse gram,Ragi	Aug-Nov				
	Gingelly	Dec-March				
6	Sugarcane		Throughout the year			Jan-Dec

9. Crop Yield

S.No	Name of Crop	Yield in Kg/ha				
		Pudukotttai	**Sivagangai**	**Dindigul**	**Ramnad**	**Madurai**
1	Rice	2825	2680	3200	2552	3932samba 6100kuruvai
2	Millets	1201	1680	1000	1103	1039
3	Pulses	587	570	620	491	416
4	Groundnut	724	690	950	885	1505
5	Gingelly	370	610	-	404	-
6	Cotton	358	2720	2200	2.4 bales	848
7	Sugarcane	9700	-	-	12400	8900
8	Chillies	-	-	-	808	-
9	Sunflower	-	-	-	351	-

10. Water Demand for agriculture

Sl.no	Name of crop	Area under tank irrigation	Area under well irrigation	Net CWR cm	NIR Mcum	Field efficiency	GIR Mcum
1	Rice (1)	67764		86.05	583.11	0.44	1325.25
2	Rice (2)		7529	86.05	64.79	0.75	86.38
3	Irrigated dry		5582	31.85	17.78	0.75	23.70
						Total	1435.33

CWR – Crop Water Requirement, NIR – Net Irrigation Requirement
GIR – Gross Irrigation Requirement.

11. Diseases in Sivagangai District during January-March 2004

S. No	Name of block	ADD	Malaria	Chickenpox	Measles	TB	Leprosy
1	Thirupathur	5	-	-	-	-	1
2	Sakkottai	1	-	4	-	15	13
3	Devakottai	7	-	-	2	7	1
4	Kannankudi	1	-	-	-	1	-
5	Kalayarkovil	6	1	1	-	4	2
6	Kallal	5	-	-	-	21	2
	Total	25	1	7	-	48	19

12. Abstract of district wise population

Sl.No	Name of Districts	Name of Taluk	No of Villages situated in the basin	Area of the basin Sq.km	Population (2001 Census)		
					Male	Female	Total
1	Dindigul	Dindigul	4	22.48	6074	6042	12116
		Natham	43	475.32	74258	72486	146744
		Total	47	497.80	80332	78528	158860
2	Madurai	Melur	38	356.49	64878	65615	130493
3	Sivagangai	Tiruppathur	96	789.13	118753	125942	244695
		Sivagangai	5	35.33	2697	3241	5938
		Karaikudy	70	452.83	67969	70094	138063
		Devakottai	55	346.85	31523	29107	60630
		Total	216	1624.14	220942	228384	449326

4	Trichy	Manapparai	8	54.60	8677	8724	17401
5	Ramnad	Tiruvadanai	43	353.28	41133	43094	84227
6	Pudukottai	Tirumayam	73	385.39	74426	77719	152145
		Aranthangi	8	19.27	5800	4252	10052
		Avudayarkoil	22	83.50	9299	9419	18718
		Total	104	488.16	89525	91390	180915
GRAND TOTAL			**465**	**3374.47**	**505487**	**515735**	**1021222**

13. Literacy Population

S.No	Name of Districts	Name of Taluk	Literacy (2001 Census)		
			Male	Female	Total
1	Dindigal	Dindigal	4207	3033	7240
		Natham	49792	32447	82239
2	Madurai	Melur	45596	31758	77354
3	Sivagangai	Tiruppathur	84088	35305	119393
		Sivagangai	1989	1770	3759
		Karaikudy	55313	49418	104731
		Devakottai	25589	20011	45600
4	Trichy	Manapparai	5907	3885	9792
5	Ramnad	Tiruvadanai	29472	28696	58168
6	Pudukottai	Tirumayam	53874	39621	93495
		Aranthangi	4340	2338	6678
		Avudayarkoil	7174	5197	12371
Total			367341	253479	620820

14. Category of Tourist spots

S. No.	Name of the Place	Category	Location
1	Pillayr patti Temple	Pilgrimage Centre	Pillayar Patti village
2	Thirukoshttiur Temple	Pilgrimage Centre	Thirukoshttiur village in Thiruppathur taluk.
3	Kundrakudi Temple	Pilgrimage Centre	Kundrakudi

			(v) near Karaikudi
4	Oriyur church	Pilgrimage Centre	Oriyur in Thiruvaadani taluk.
5	Vettangudi Bird Sanctuary	Bird Sanctuary (Tourist spot)	In between Thiruppathur and S .S. Kottai
6	Thirumayam Fort	Tourist Spot	Thirumayam

GUNDAR BASIN

1. Sub basin area

S.No.	Sub Basins	Area Sq.km
1	Terkkar	894
2	Goundanadhi	714
3	Upper Gundar	867
4	Lower Gundar	1638
5	Palar	312
6	Kottakkudiar	770
7	Vembar	717
	Total Area	**5912**

2. Surface Water Potential

S.No	Sub Basins	Surface Water Potential in Mm^3		
		S.W. Monsoon	N.E. Monsoon	Annual
1	Terkkar	33.93	53.80	87.73
2	Goundanadhi	25.98	44.47	70.45
3	Upper Gunder	28.00	49.55	77.55
4	Lower Gunder	52.70	97.59	150.29
5	Palar	6.00	21.38	27.38
6	Kottakkudiar	15.38	51.08	66.46
7	Vembar	14.13	41.59	55.72
	Total	**176.12**	**359.46**	**535.58**

3. List of villages having fluoride value > 1.50 mg/l

S.no	Taluks	Village	Fluoride mg/l
MADURAI DISTRICT			
1	Madurai south	Avaniyapuram Chinnakattalai	1.70 1.80
2	Thirumangalam	Kollarampatti	1.60
3	Usilampatti	Veppanental Uthappanaickanur T.Meenakshipuram	1.90 1.90 2.80
4	Thiruchuli	Narikudi	3.70
5	Aruppukkottai	P. Pudupatti	3.60

		Ramanujapuram Kovilankulam	2.50 2.40

4. Industries

Taluk	Type				Total
	G	O	R	DO	
VIRUDHUNAGAR DIST					
Aruppukottai	0	15	8	0	23
Kariyapatti	0	2	2	0	4
Thiruchuli	0	1	1	0	2
	0	18	11	0	29
MADURAI DIST					
Madurai South	36	447	223	0	706
Usilampatti	0	41	1	0	42
Peraiyur	0	1	2	0	3
Thirumangalam	13	212	106	0	331
	49	701	332	0	1082
SIVAGANGAI DIST					
Manamadurai	1	86	11	4	102
	1	86	11	4	102
RAMANAD DIST					
Paramakudi	0	24	0	0	24
Mudukulathur	0	3	0	0	3
Kadaladi	0	6	1	0	7
Kamudhi	0	15	1	0	16
Ramnad	4	17	0	0	21
	4	65	2	0	71
THOOTHUKUDI DIST					
Vilathikulam	0	3	6	0	9
	0	3	6	0	9
Total	54	873	362	4	1293

5. Pilgrimage Centers, Tourist Spots And Sanctuaries

Location	Pilgrimage Centers/Tourist spots / Sanctuaries	Festivals	Period
Pilgrimage centers & Temples			
Madurai	SriMeenakshi Sundareswarar Temple	Chithirai festival Festival of cradle Navaratri festival	April April September
Madurai	Koodal Azhargar temple	Masi Magam Float Festival	February/March
Thirupparakundram	Lord Subbramaiya Temple	Panguni Uthiram	March – April
Madurai	Mariamman teppakulam Mariamman Temple	Adi krithigai Float faestival	July – August January– February
Thiruchuli	Thirumeninathan swami Temple Birth place of Sri Ramana Maharishi	Bhramotchavam festival	April – May
Uthirakosamangai	Natarajar Temple	Arudhra festival	December
Thiruppullani	Adi Jegannatahaperumal Temple		
Erwadi	Ibrahim syed Aulia Dargha	Annual festival	
Tourist spots			
Madurai	Mannar Thirumalai Naikar Mahal	-	Through out the year

KALLAR BASIN

1. Taluk wise area

S.No	Taluk	Area covered by basin (Hectares)	% of area of the basin covered by the Taluk
1.	Kovilpatti	32227.375	40.77
2.	Ottapidaram	36195.36	45.79
3.	Vilathikulam	10619.265	13.44

2. Details of Anicuts

S.No	Name of the Anicut	Length of channel (m)	Channel fed tanks	Ayacut (acres)
Kallar river basin				
1.	Ketchilapuram	780	Kilavipatti	112.02
2.	Sivanthipatti	2750	Erachi	45.45
3.	Thuraiyoor	2500	Semmaputhur	154.25
4.	Athikinar	1900	Athikinar	318.00
5.	Kattaboman (Left)	1000	Kalmedu (Therku and Vadaku)	443.80
6.	Kattaboman (Right)	300	Pattinamaruthur, Tharuvaikulam (new)	700.22
7.	Pattinamaruthur	4000	Pattinamaruthur	299.80
8.	Melaarasaradi	1000	Tharuvaikulam (old)	388.00

3. Surface water potential of Kallar basin including Korampallamaru

Period	Surface water potential
Southwest monsoon	12.96 MCM
Northeast monsoon	66.79 MCM
Annual	124.56 MCM
Diversion from Tambiraparani basin for irrigation	6.59 MCM

4. Dominant crops

S. No	Taluk	Irrigation	Predominant crops
1.	Vilathikulam	Irrigated	Paddy, Cumbu, Coconut, cotton, Vegetables, chilli and Onion
		Unirrigated	Cholam, Cumbu, Valli, Black gram, Green gram, Maize, Gingily, Sunflower, Caster, Cotton, Tamarind, Chenna, Coriander, Fodder cholam and Drychilli
2.	Ottapidaram	Irrigated	Paddy, Cumbu, Coconut, Vegetables, Chilli (Dry), Onion, Gerry leaves and Flowers
		Unirrigated	Cholam, Cumbu, Black gram, Maize, Green gram, Gingily, Sunflower, Cotton, Chenna, Coriander, Fodder Cholam, Chilli (Dry) and Onion
3.	Kovilpatty	Irrigated	Paddy, Maize, Coconut, Cotton, Vegetables, Dry chilli, Onion and Flowers
		Unirrigated	Cholam, Cumbu, Maize, Valli, Black gram, Green gram, Sunflower, Cotton, Coriander, Fodder cholam And Tamarind

6. Crop yields

S.No	Crops	Average yield (kg/ ha)
I.	Food grains	
	Cereals and Millets	
	1. Paddy	3990
	2. Cholam	889
	3. Cumbu	1434
	4. Ragi	1930
	5. Pulses	
	6. Black gram	288
	7. Green gram	440
II	Oil seeds	
	8. Cotton (in terms of lint)	131
	9. Ground nut	1650
	10. Gingily	182
	11. Sunflower	434
III	Other crops	
	12. Chillies	434

7. List of Industrial units, their Category, Type and Size

Sl. No	Name of the Industrial unit	Category	Type and Size
1.	Sahaya matha salt refinery, Kallurani	Salt	O/L
2.	Kavin chemicals, Subramaniapuram	Chemicals	R/S
3.	Sujana power limited (Gangai kondon), Keelarasadi	Power plant	R/L
4.	Arasan syntax limited, Ottapidaram	Spinning	O/L
5.	South India Bromine & chemical (P) limited, Veppalodai	Chemical	R/S
6.	VPS Spinner, Eppodumvendran	Spinning	O/M
7.	Krithiga spinning mill, Eppodumvendran	Spinning	O/M
8.	Kalpage chemicals, Melarasadi	Chemical	R/S
9.	Sona Chemicals, Nagampatti	Chemical	R/S
10.	Sree Venkateswara carbides, Pasuvanthanai	Chemical	R/S
11.	Alex match works, Ottapidaram	Match	R/S
12.	Sri Palani andavar match works, Ottapidaram	Match	R/S
13.	Pearl city spinning mills, Melarasadi	Spinning	O/S
14.	Sri Murugan spinning, Eppodumvendran	Spinning	O/S
15.	Sujana power limited (Thoothukudi), Keelarasadi	Power plant	R/L
16.	Loyal textiles mills limited, Koilpatti	Spinning	O/L
17.	Lakshmi Mills Limited, Koilpatti	Spinning	O/L
18.	Arasan Fertilizer's (P) Limited, Kadambur	Fertilizer	R/M
19.	K.R. Exports (P) Ltd., Nalattinpudur	Spinning	O/M
20.	Arasan Phosphates (P) Ltd., Kadambur	Chemical	R/S
21.	Madurai Agro – Chemical And Fertilizers, Koilpatti	Pesticide	R/S
22.	Thangam Match Works, Keelaeral	Match	R/S
23.	Appolo Match Company, Koilpatti	Match	R/S
24.	Perfect Match Company, Koppampatty	Match	R/S
25.	Liberty Match Co. (P) Ltd., Kadambur	Match	R/S
26.	Golden Chemical, Koilpatti	Chemicals	R/S
27.	East India Match Factory, Kovilpatti	Match	R/S
28.	Jayam Match Works, Kovilpatti	Match	R/S
29.	Vennus Match Factory, Kovilpatti	Match	R/S
30.	Maheswari Match Factory, Kovilpatti	Match	R/S
31.	Victory Match Factory, Kovilpatti	Match	R/S
32.	Antony Match Factory, Kovilpatti	Match	R/S
33.	Meenatchi Match Factory, Kovilpatti	Match	R/S
34.	The Hindu Match Factory, Kovilpatti	Match	R/S
35.	Annamalai Match Factory, Kovilpatti	Match	R/S

36.	Victory Steel Rolling Mill, Kovilpatti	Steel rolling	R/S
37.	Kirasan Fire Works, Kovilpatti	Match	R/S
38.	Ananth Match Industries, Kovilpatti	Match	R/S
39.	Aruna Match Industries, Kovilpatti	Match	R/S
40.	Alaguram Match Industries, Kovilpatti	Match	R/S
41.	Baskaran Match Industries, Kovilpatti	Match	R/S
42.	Country Match Industries, Kovilpatti	Match	R/S
43.	Eswari Match Industries, Kovilpatti	Match	R/S
44.	Jagath Match Industries, Kovilpatti	Match	R/S
45.	Jaya Match Industries, Kovilpatti	Match	R/S
46.	Kadalai Match Industries, Kovilpatti	Match	R/S
47.	Kamatchi Match Industries, Kovilpatti	Match	R/S
48.	Lakshmi Match Industries, Kovilpatti	Match	R/S
49.	Yesesde Match Industries, Kovilpatti	Match	R/S
50.	Mahalakshmi Match Industries, Kovilpatti	Match	R/S
51.	Liberty Match Industries, Kovilpatti	Match	R/S
52.	Mahanath Match Industries, Kovilpatti	Match	R/S
53.	Pope teaking Match Industries, Kovilpatti	Match	R/S
54.	Prabhath (Ettayapuram) Match, Kovilpatti	Match	R/S
55.	Liberty Match Co. Pvt. Ltd, Pandavarmangalam, Kovilpatti	Match	R/S
56.	Ranganathan Match Works, Kovilpatti	Match	R/S
57.	Srilakshmi Match Industries, Kovilpatti	Match	R/S
58.	Sri Palaniandavar Match Works, Kadambur	Match	R/S
59.	Sundaravel Match Industries Kovilpatti	Match	R/S
60.	The Comerin Match Works, Kovilpatti	Match	R/S
61.	The Kisan Match Works, Kovilpatti	Match	R/S
62.	The Original Wax Industries, Kovilpatti	Match	R/S
63.	Vishwanathan Match Industries, Kovilpatti	Match	R/S
64.	TNSTC, Kovilpatti	Engineering	O/S
65.	Ponnay Cotton Willow Industries, Kovilpatti	Ginning	O/S
66.	K. Velayutham Chetty Farm, Kovilpatti	Oil mill	O/S
67.	Industrial Chemicals, Kurukkuchalai	Lime	O/S
68.	Vishala Knit - Wear (P) Limited, Kovilpatti	Garments	G/S
69.	Valli Garments (P) Limited, Kovilpatti	Garments	G/S
70.	TVT And Sons, Keelaeral	Ginning	G/S

8. Taluk wise population details

S.no	Taluk	Population
1.	Kovilpatti	54475
2.	Ottapidaram	58732
3.	Vilathikulam	12749

9. Literacy details

S. No	Village	Literacy rate %	Male %	Female %
	Kovilpatty			
1.	Achankulam	90	70	30
2.	Edaiseval	90	70	30
3.	Kannakattai	25	50	50
4.	Koppampatti	40	50	50
5.	Manthitoppu	50	70	30
6.	Nalatinpudur	60	50	50
7.	Pungavarnatham	25	50	50
8.	Thottampatti	80	60	40
9.	Kadumbur	10	50	50
10.	Keelairal	55	75	25
11.	Kurumalai	70	30	70
12.	Mudukalankulam	15	70	30
13.	Cholapuram	75	70	30
14.	Uthupatti	15	70	30
15.	Semmapudur	55	75	25
16.	Vadakuvandanam	25	50	50
17.	Therkuvandanam	40	30	70
	Ottapidaram			
18.	Adanur	50	70	30
19.	Eppothumvendran	50	80	20
20.	Dalavaipuram	50	40	60
21.	Kuttanayakanpatti	90	70	30
22.	Kollanparambu	90	50	50
23.	Meenachipuram	15	50	50
24.	Mullur	55	70	30
25.	Ottapidaram	50	70	30
26.	Pasuvanthanai	50	70	30
27.	Tharuvaikulam	20	50	50
28.	Vedanatham	60	60	40
29.	Chandragiri	25	60	40
30.	Jegaveerapandiyapuram	80	50	50
31.	Shanmugapuram	99	50	50
32.	Keelamangalam	60	50	50

10. Chemical Analysis of Water Samples (Ground Water)

KALLAR RIVER BASIN **TALUK: KOVILPATTI** **VILLAGE:KADAMBUR**

S. No	Date	E.C	pH	Ca	Mg	Na	K	HCO_3	CO_3	SO_4	Cl	NO_3	TDS	TH	RSC	SAR	SSL	GCT
1.	1/91	6700	8.4	488	353	460	49	67	18	1512	1400	137	4451	2670	-	3.9	High	CaCl
2.	7/91	No sample																
3.	1/92	6400	8.3	464	335	437	47	61	18	1440	1333	180	4235	2535	-	3.8	High	CaCl
4.	7/92	6600	8.2	380	389	368	39	110	0	1075	1453	161	3920	2550	-	3.2	High	CaCl
5.	1/93	7000	7.9	480	450	575	39	67	0	1728	1595	291	5192	3050	-	4.5	High	CaCl
6.	7/93	8900	9.2	620	353	828	55	146	0	1872	1843	242	5886	3000	-	6.6	High	CaCl
7.	1/94	1400	8.8	60	69	69	117	244	24	86	216	124	987	435	-	1.4	C3S1	CaCl
8.	7/94	500	8.5	30	28	23	26	79	24	6	89	32	298	190	-	0.7	C2S1	CaCl
9.	1/95	6600	8.1	464	399	529	47	177	0	1574	1446	236	4748	2800	-	4.3	High	CaCl
10.	7/95	8000	7.9	220	693	437	59	92	0	1392	1879	298	5024	3400	-	3.3	High	CaCl
11.	1/96	9000	8.4	440	369	920	90	122	30	1872	1773	254	5829	2700	-	7.7	High	CaCl
12.	7/96	1000	8.0	40	51	78	47	214	0	149	145	2	619	310	-	1.9	C3S1	CaCl
13.	1/97	670	8.1	28	58	12	1	171	0	24	121	0	330	310	-	0.3	C2S1	CaCl
14.	7/97	3190	7.9	144	182	202	8	98	0	178	766	248	1777	1110	-	2.6	C4S1	CaCl
15.	1/98	7100	8.4	176	516	69	39	73	18	374	1432	112	2773	2560	-	0.6	High	CaCl
16.	7/98	No sample																

KODAIYAR BASIN

1. Reservoirs

S No	Name of Dam / Reservoir	Capacity (MCM)	Annual Storage (MCM)	Normal Opening of Reservoir	Ayacut area in (ha)
1	Pechiparai Dam	152.36	152.36	1st June	Combined Ayacut of Kodaiyar system is 36836 Ha
2	Perunchani Dam	81.84	81.84	1st June	
3	Chittar Dam – I	17.28	17.28	1st June	
4	Chittar Dam –II	28.55	28.55	1st June	
5	Kodaiyar (Upper Dam) I	118.50	118.50	-	
6	Kodaiyar (Lower Dam) II	0.883	0.883	-	-
7	Kuttiyar Dam	0.227	0.227	-	-
8	Chinna Kuttiyan Dam	2.776	2.776	-	-
9	Poigaiyar Reservoir	2.700	2.700	-	250
	Total	405.116			37086

2. Land use / Land cover

S. No	Description	Area (ha)
1	Geographical area	153300
2	Forest	45543
3	Barren and uncultivable waste	2980
4	Land under non - agricultural use	22801
5	Cultivable waste	128
6	Permanent pastures and other crazing land	63
7	Current fallows	762
8	Other fallows	1066
9	Net area sown	79699

3. Total Demand of Kodayar Basin & Pazhayar Sub Basin

Sector	Kodaiyar Basin	Pazhayar Sub Basin
Domestic	31.33 MCM	18.22 MCM
Irrigation	728.33 MCM	297.97 MCM
Live stock	3.40 MCM	1.56 MCM
Industries	2.31 MCM	10.58 MCM
TOTAL	**765.37 MCM**	**328.33 MCM**
OR	**765 MCM**	**328 MCM**
Water Budget	1267-765 = **502 MCM**	Net deficit 328-213= **115MCM**

4. Surface water quality- February 2004

	1	Station Code	KOD 1	KOD 2	KOD 3	KOD 4	KOD 5	KOD 6	KOD 7	KOD8	KOD 9	KOD 10
	2	Station Code No	170101	170102	170103	170104	170105	170106	170107	170108	170109	170110
	3	Date of Collection	27.02.04	27.02.04	27.02.04	27.02.04	27.02.04	27.02.04	27.02.04		27.02.04	27.02.04
Field Determinants	4	P^H	-	-	-	-	-	-	-		-	-
	5	EC µmho/cm	-	-	-	-	-	-	-		-	-
	6	Do mg/t	4.41	5.98	4.88	3.70	3.78	4.13	2.88		2.31	4.41
	7	Temp. °C	27	27	28	28	27	29	28		29	28
	8	Colour Code	7	7	7	7	7	7	7		7	7
	9	Odour Code	1	1	1	1	1	1	1		1	1
General	10	P^H	9.9	9.5	9.4	9.0	9.1	9.3	9.5		9.9	9.6
	11	EC µmho/cm	5.77	8.34	16.37	5.45	23.75	4.49	14.44		7.38	10.91

	12	TDS mg/l	0.036	0.052	0.102	0.034	0.148	0.028	0.090		0.048	0.068
	13	TSS mg/l	1.0	1.2	1.0	0.4	0.6	0.4	0.6		0.2	0.8
Org.msyyrt utrients	14	NH_3 mgN/l	-	-	-	-	-	-	-		-	-
	15	$NO_3^=$ mgN/l	0.46	0.52	0.69	0.92	0.52	1.33	0.99		0.57	0.55
	16	Total P mg/l	-	-	-	-	-	-	-		-	-
	17	BOD mg/l	0.85	0.56	1.13	2.86	1.86	1.96	2.31	No Flow	1.96	0.86
	18	COD mg/l	6	6	12	18	20	20	24		18	14
Alkalinity	19	Phen. Mg $caco_3$/l	0	0	0	0	0	0	0		0	0
	20	Total mg $caco_3$/l	6	3	10	18	8	35	40		37	10
Hardness	21	Total mg $caco_3$/l	22	22	34	60	28	120	114		114	38
	22	Ca ++ mg $caco_r$/l	-	-	-	-	-	-	-		-	-
Major Ions	23	Ca ++ mg/l	5.61	3.21	10.42	10.42	11.22	24.05	28.06		21.64	5.61
	24	Mg ++mg/l	5.27	9.23	5.27	22.42	12.36	39.56	29.01		39.56	15.82
	25	Na + mg/l	-	-	-	-	-	-	-		-	-
	26	K + mg/l	-	-	-	-	-	-	-		-	-
	27	Cl mg/l	15.82	8.52	9.94	12.78	14.21	44.02	35.50		45.44	18.46
	28	So_4^- mg/l	0.37	0.16	0.27	0.17	0.04	0.25	0.04		0.05	0.01
	29	Co_3^- mg/l	-	-	-	-	-	-	-		-	-
	30	Hco_3^- mg/l	6	3	10	18	8	35	40		37	10
Other	31	Sl mg/l	-	-	-	-	-	-	-		-	-

	32	F mg/l	-	-	-	-	-	-	-		-	-
	33	B mg/l	-	-	-	-	-	-	-		-	-
Coli forms	34	Total MPN/ 100ml	7	2	4	4	8	6	2		9	4
	35	Faccal MPN/ 100ml	2	<2	<2	2	4	2	2		6	2
E.Coli	36	Chloro phyll – A mg/l	-	-	-	-	-	-	-		-	-
Iron	37	Fe – mg/l	-	-	-	-	-	-	-		-	-

5. Industrial effluent contributors in Kanniyakumari District

S.no	Name of Industry	Nature	Sewage (KLD)	Trade effluent (KLD)	Solid Waste (KLD)
1	Arasu Rubber Corporation, Mylar	Rubber	1.50	100	15
2	Indian Rare Earth Ltd, Manavalakurichi	Rare Earth	230	1170	5
3	Arasu Rubber Industries, Manalodai	Rubber	250.00	2400	15
4	Arasu Rubber Corporation, Keeriparai.	Rubber	5.00	70	50
5	Anusm Rubber Industries, Vellamadam	Rubber	0.75	100	Nil
6	Coromandal Proclorite Ltd. Kariakonam	Rubber	1.60	20	Nil
7	Cormarin Latex Products, Nagercoil.	Rubber	0.40	0.20	Nil
8	Kurian Abraham Ltd. Thucklay.	Rubber	0.10	5.00	Nil

6. Crops grown

SNo	Soil Series	Crops Grown	
		Rainfed	Irrigated
1	Thalakudi	Pulses	Banana
2.	Kanyakumari, Thengaipattinam	Coconut	Coconut
3.	Kumarakovil, Muzhucode	Tapioca	Banana
4.	Kalkulam, Aramboly, thengampudur, Suchindram, Kottaram, Therur, Dharmapuram	Pulses	Paddy, Banana
5.	Thiruvattar, Navalkadu, Thuckalay	Pulses	Paddy, Banana, Coconut
6.	Marthandam	Spices	Paddy, Coconut Rubber, Spices
7.	Thovalai, Colachal	Cashew	Orchard crops, Coconut

7. Normal area and productivity of major crops

S.No.	Crop	Area in hectare	Normal yield in Kg/Ha.
1.	Paddy	31000 (Both Crops)	6900 kgs. of paddy
2.	Tapioca	9000	15000 kgs
3.	Coconut	22586	10000 Nuts
4.	Banana	5100	25000kgs
5.	Pulses	3500	250kgs
6.	Rubber	18327	1200kgs
7.	Cashew	1800	2000kgs
8.	Mango	1750	20000kgs.
9.	Arecanut	750	500000 Nuts
10.	Pepper	113	1500 kgs/ha
11.	Glove	518	1250-2500 kgs /ha
12.	Pine apple	81	50 M.T. ha
13.	Jack	754	30.40 M.T. /ha
14.	Tamarind	1731	5.6 M.T. / ha

8. Main forest types

Main Types	Extent (ha.)
Tropical Wet evergreen	–
Tropical Semi evergreen	35600
Tropical Moist evergreen	5233
Littoral & Swamp	215
Tropical dry deciduous	6385
Tropical dry thorn	548
Tropical dry evergreen	450
Sub-tropical broad leaved	–
Montane Wet Temperate	–
Others	805
Total	49236

9. Location and area affected by soil erosion

Level of Erosion	Slight Erosion (e1)	Moderate Erosion (e2)	Severe Erosion (e3)
Areas affected by erosion	Kalkulam, Aramboly, Thengampudur, Suchindram, Kottaram, Therur, Navalkadu, Thuckalay, Dharmapuram	Thalakudi, Kumarakovil, Marthandam, Thiruvattar, Thovalai, Colachal Mullucode	Kanniyakumari, Thengaipattinam.
Total Area affected by Erosion	Area (ha) 37,400	49,791	3,830

10. Water logging

S No	Taluk	Village	Extent (ha)
1	Agastheeswaram	1. Chettikulam 2. Melakulam	2.73 2.00
			4.73
2	Vilavancode	1. Pandiapuram 2. Melanadarkulam 3. Kelenadarkulam 4. Tamaraikuklam	2.54 3.58 3.45 5.47
			15.04

3	Thovalai	1. Aralvaimozhi 2. Kavalkinaru 3. Vadakankulam	2.33 3.71 4.09
			10.13
4	Kalkulam	1. Thiruvettor 2. Vinadu 3. Pandiapuram 4. Alagiamandapam 5. Megamandapam	2.17 1.09 4.40 3.96 4.01
			15.63

11. Solid Waste Management in Municipalities

S.No	Category	Municipality			
		Nagercoil	**Colachel**	**Padmanabhapuram**	**Kuzhithurai**
	Population	208751	23535	20051	20326
	No. of wards	51	24	21	21
	Quantity of Municipal Solid Waste generated per day	62.5 M.T.	5.25 M.T.	4 M.T.	5.13 M.T.
	Percentage of collection of Municipal Solid Waste	59.3	90%	100%	77% by Municipal 33% collected by market lease and others
	Mode of disposal (whether disposed on land or roadside or water bodies etc)	At Compost Yard	Disposed on land	Disposed at Municipal Compost Yard	On land in compost yard
	Whether Source	Yes 51 Wards	Yes. 24 Wards	Yes 21 Wards	Yes 21 Wards

	segregation started and if so in how many wards				
	How the source segregated waste is being disposed at present?	Aerobic Heap method	Stored in bags	By making compost at compost yard	The segregated Waste are being disposed by heaping method
	Whether door to door collection has been started, if so in how may wards	Yes 51 wards	Yes. 24 Wards	Yes 21 wards	Yes 21 wards
	Whether site has been identified for compost yard. If so whether NOC has been obtained from TNPCB	The Site has been identified for compost yard and also visited by A.E.E.T.N.P.C. Board, Nagercoil. NOC will be obtained.	Site has been identified and NOC yet to be obtained	Present compost yard is being maintained for the last 50 years	No. Suitable promboke site in and around 5 KM radius of the Municipal limit
	Whether site for secure landfill has been identified? If so, whether NOC has been obtained from TNPCB	Site to be ascertained	No	Proposed to one portion of existing compost yard may be convert as landfill site.	-do-
	IF NOC	NOC will	No. The Joint	Compost making is	Action is

	has been obtained for compost yeard/secure landfill, what is the status of site? Whether any activity for composting is carried out? Or whether any dumping of waste is carried out in the new site	be obtained. Site for land fill to be ascertained At present dumping of waste is carried out in the existing compost yard.	Inspection of RDO, AEE of Pollution Control Board and Municipal Commissioner is in progress. The date to be fixed by RDO after the inspection of site. NOC proposals to be sent	done as aerobic method.	being taken to purchase new compost yard.
	Any remediation activity has been started for the old landfill site. If so furnish the details	There is no existing land fill site	No. Landfill site available for this Municipality	Proposed to improve the compost and with road, light water supply fence and watchman shed.	Nil

12. Population– 2001

Level	Name	TRU	Total Popln	Total Male	Total Female	Total SC Popln.	SC Male	SC Female	Total ST Popln.	ST Male	ST Female
District	Kanniyamumari	Total	1676034	832269	843765	67712	33365	34347	5443	2678	2765
District	Kanniyamumari	Rural	582107	289516	292591	26848	13210	13638	3561	1773	1788
District	Kanniyamumari	Urban	1093927	542753	551174	40864	20155	20709	1882	905	977
Taluk	Vilavancode	Total	533650	266432	267218	11992	5822	6170	812	394	418
Talu	Vilavancod	Rur	23400	1168	1171	471	226	2454	331	165	166

k	e	al	8	90	18	5	1				
Taluk	Vilavancode	Urban	299642	149542	150100	7277	3561	3716	481	229	252
Village	Kilamalai R.F.	Rural	291	137	154	0	0	0	147	71	76
Village	Mancode	Rural	10457	5046	5411	254	121	133	43	20	23
Village	Arumanai	Rural	7820	3761	4059	265	135	130	0	0	0
Village	Vellomcode	Rural	17252	8538	8714	194	97	97	14	9	5
Village	Edaicode	Rural	7248	3560	3688	199	85	114	5	3	2
Village	Palugal	Rural	6917	3392	3525	105	52	53	0	0	0
Village	Vilavancode	Rural	10432	5234	5198	168	82	86	0	0	0
Village	Pacode	Rural	7633	3755	3878	604	271	333	0	0	0
Village	Nattalam	Rural	11037	5559	5478	183	94	89	4	2	2
Village	Kannathoor	Rural	13121	6574	657\47	204	103	101	0	0	0
Village	Kulappuram	Rural	20767	10393	10374	339	158	181	0	0	0
Village	Methukummal	Rural	20101	10103	9998	583	289	294	87	42	45
Village	Kollencode	Rural	6158	3064	3094	255	118	137	31	18	13
Village	Ezhudesam	Rural	18776	9522	9254	1	0	1	0	0	0
Village	Arudesam	Rural	14762	7354	7408	269	127	142	0	0	0
Village	Painkulam	Rural	21337	10702	10635	394	192	202	0	0	0
Village	Keezhkulam	Rural	12403	6429	5974	0	0	0	0	0	0
Village	Killiyoor	Rural	4019	2009	2010	81	36	45	0	0	0
Village	Paloor	Rural	9243	4684	4559	0	0	0	0	0	0
Village	Midalam	Rural	14234	7074	7160	617	301	316	0	0	0
Town	Kadayal (TP)	Urban	19183	9376	9807	616	288	328	258	127	131
Tow	Arumanai	Urb	15071	7461	7610	500	226	274	18	5	13

n	(TP)	an									
Town	Edaikodu (TP)	Urban	23453	11551	11902	620	286	334	9	4	5
Town	Pazhugal (TP)	Urban	17686	8662	9024	634	332	302	29	16	13
Town	Kaliyakkavilai (TP)	Urban	13311	6577	6734	287	149	138	0	0	0
Town	Pacode (TP)	Urban	22781	11528	11253	37	23	14	0	0	0
Town	Kuzhithurai (M)	Urban	20503	10069	10434	341	161	180	27	13	14
Town	Unnamalaikadai (TP)	Urban	20666	10488	10178	129	63	66	9	5	4
Town	Nallur (TP)	Urban	15563	7850	7713	158	79	79	6	2	4
Town	Pudukadai (TP)	Urban	9037	4598	4439	163	85	78	0	0	0
Town	Kollankodu (TP)	Urban	34425	17393	17032	811	384	427	85	38	47
Town	Ezhudesam (TP)	Urban	18741	9419	9322	1737	850	887	2	0	2
Town	Kilkulam (TP)	Urban	17345	8789	8556	22	11	11	0	0	0
Town	Killiyur (TP)	Urban	19273	9856	9417	395	212	183	0	0	0
Town	Karungal (TP)	Urban	15952	7820	8132	356	174	182	38	19	19
Town	Balapallam (TP)	Urban	16652	8105	8547	471	238	233	0	0	0
Talu k	Kalkulam	Total	537813	266494	271319	17179	8543	8636	3032	1490	1542
Talu k	Kalkulam	Rural	162714	80828	81886	5319	2680	2639	2482	1219	1263
Talu k	Kalkulam	Urban	375099	185666	189433	11860	5863	5997	550	271	279
Village	Veerapuli R.F.	Rural	1708	845	863	66	38	28	1513	747	766
Village	Veerapuli Extn. (Old Kulasekarapuram)	Rural	630	308	322	0	0	0	587	287	300
Village	Thirpparappu	Rural	4281	2140	2141	156	79	77	33	16	17
Village	Aruvikkarai	Rural	11377	5551	5826	155	86	69	11	4	7
Villa	Surulacode	Rur	5452	2839	2613	120	610	598	242	121	121

ge		al				8					
Village	Velimalai Forest	Rural	822	416	406	261	129	132	0	0	0
Village	Mecode	Rural	5009	2474	2535	32	16	16	0	0	0
Village	Attoor	Rural	12261	6119	6142	124	64	60	4	1	3
Village	Veeyanoor	Rural	21315	10572	10743	148	68	80	3	1	2
Village	Valvachagostam	Rural	5117	2518	2599	50	25	25	21	11	10
Village	Thiruvitham-code	Rural	11175	5592	5583	549	263	286	0	0	0
Village	Thackalai	Rural	7073	3562	3511	366	184	182	0	0	0
Village	Kalkulam	Rural	6509	3121	3388	411	207	204	0	0	0
Village	Eraniel	Rural	21433	10491	10942	766	386	380	44	19	25
Village	Colachel	Rural	10176	5282	4894	13	7	6	0	0	0
Village	Thalakkulam	Rural	6466	3060	3406	313	158	155	0	0	0
Village	Kurunthencode	Rural	15482	7730	7752	530	280	250	7	4	3
Village	Kadiapattinam	Rural	16428	8208	8220	171	80	91	17	8	9
Town	Thiruparappu (TP)	Urban	21736	10709	11027	212	100	112	80	41	39
Town	Thiruvattaru (TP)	Urban	18272	8989	9283	158	77	81	18	8	10
Town	Kulasekara-puram (TP)	Urban	16351	8241	8110	341	166	175	62	31	31
Town	Ponmani (TP)	Utban	13480	6727	6753	630	325	305	36	15	21
Town	Kumarapuram (TP)	Urban	13938	6931	7007	92	46	46	5	2	3
Town	Kothinallur (TP)	Urban	15880	7761	8119	160	77	83	0	0	0
Town	Verkilambi (TP)	Urban	18003	8784	9219	135	69	66	0	0	0
Town	Athur (IP)	Urban	11744	5922	5822	84	38	46	8	3	5
Town	Valvaithan-koshtam (TP)	Urban	16686	8282	8404	150	76	74	2	0	2

Town	Mulagumudu (TP)	Urban	18057	8746	9311	272	135	137	0	0	0
Town	Kappiyarai (TP)	Urban	13368	6675	6693	222	108	114	0	0	0
Town	Thiruvithankodu (TP)	Urban	16397	8074	8323	9423	471	471	9	4	5
Town	Vilavur (TP)	Urban	13672	6719	6953	369	193	176	0	0	0
Town	Padmanabha-puram (M)	Urban	20075	9967	10108	2112	1050	1062	7	1	6
Town	Villukuri (TP)	Urban	13696	6773	6923	716	337	379	0	0	0
Town	Alur (TP)	Urban	12379	6126	6253	796	390	406	8	4	4
Town	Eraniel (TP)	Urban	9305	4640	4665	511	254	257	0	0	0
Town	Kallukuttam (TP)	Urban	16989	8487	8502	369	169	200	0	0	0
Town	Neiyyur (TP)	Urban	12288	6037	6251	426	214	2\12	0	0	0
Town	Reethapuram (TP)	Urban	11887	5716	6171	844	419	425	11	5	6
Town	Kolachal (M)	Urban	23787	11996	11791	602	293	309	0	0	0
Town	Manavala-kurichi (TP)	Urban	10412	5190	52222	364	190	174	2	0	2
Town	Mandaikadu (TP)	Urban	12375	6188	6187	142	70	72	0	0	0
Town	Thingalnagar (TP)	Urban	12562	6127	6435	501	255	246	9	2	7
Town	Vellimalai (TP)	Urban	11760	5859	5901	710	341	369	293	155	138
Talu k	Thovala	Total	110719	55057	55662	12381	6188	6193	690	360	330
Talu k	Thovala	Rural	56014	27813	28201	6831	3370	3461	589	310	279
Talu k	Thovala	Urban	54705	27244	27461	5550	2818	2732	101	50	51
Village	Veerapuli R.F.	Rural	240	121	119	0	0	0	223	113	110
Village	Ananthapuram	Rural	4635	2349	2286	380	193	187	0	0	0
Village	Azhagiapandi-puram	Rural	2807	1407	1400	273	136	137	0	0	0
Villa	Derisanamc	Rur	5349	2639	2710	804	376	428	0	0	0

ge	ope	al									
Village	Arumanallo or	Rural	9200	4522	4678	395	191	204	251	129	122
Village	Chiramadam	Rural	1302	671	631	1	1	0	0	0	0
Village	Esanthi-mangalam	Rural	2112	1023	1089	255	127	128	0	0	0
Village	Erachakulam	Rural	5489	2689	2800	1178	594	584	0	0	0
Village	Thirupathisaram	Rural	4881	2372	2509	900	441	459	31	18	13
Village	Chenbagaramanputhur	Rural	11820	5959	5861	1945	964	981	11	6	5
Village	Thovala	Rural	7446	3694	3752	700	347	353	73	44	29
Village	Thekkumalai West	Rural	733	367	366	0	0	0	0	0	0
Town	Azhagiapandia-puram (TP)	Urban	12183	6029	6154	640	320	320	3	1	2
Town	Boothapandi (TP)	Urban	14743	7308	7435	1092	537	555	2	1	1
Town	Thalakudi (TP)	Urban	8568	4285	4283	911	470	441	0	0	0
Town	Aralvaimozhi (TP)	Urban	19211	9622	9589	2907	1491	1416	96	48	48
Taluk	Agastheeswaram	Total	493852	244286	249566	26160	12812	13348	909	434	475
Taluk	Agastheeswaram	Rural	129371	63985	65386	9983	4899	5084	159	79	80
Taluk	Agastheeswaram	Urban	364481	180301	184180	16177	7913	8264	750	355	395
Village	Vadasery	Rural	9660	4799	4861	1629	824	805	4	3	1
Village	Nagercoil	Rural	1486	758	728	469	232	237	0	0	0
Village	Theroor	Rural	4326	2150	2176	745	374	371	33	18	15
Village	Marangoor	Rural	1969	996	973	504	294	255	11	4	7
Village	Kulasekara-puram	Rural	2499	1234	1265	253	133	120	15	8	7
Village	Eraviputhoor	Rural	2715	1363	1352	523	260	263	15	6	9
Village	Suchindrum	Rural	851	429	422	573	292	281	42	19	23

Village	Vadiveeswaram	Rural	5254	2577	2677	1390	675	715	22	12	10
Village	Neendakara-A	Rural	6792	3393	3399	236	118	118	0	0	0
Village	Vempanoor	Rural	10994	5396	5598	236	112	124	0	0	0
Village	Neendakara-B	Rural	18443	9352	9291	1138	536	602	0	0	0
Village	Dharmapuram	Rural	19684	9692	9992	689	324	365	0	0	0
Village	Madhusoodha-napuram	Rural	14842	7355	7487	389	186	203	0	0	0
Village	Thengam-puthoor	Rural	3733	1832	1901	0	0	0	0	0	0
Village	Parakkai	Rural	2130	1076	1054	248	117	131	0	0	0
Village	Thamaraikulam	Rural	10749	5269	5480	479	236	243	9	4	5
Village	Agasteeswaram	Rural	4632	2185	2447	70	31	39	0	0	0
Village	Azhagappa-puram	Rural	384	180	204	120	53	67	0	0	0
Village	Kanyakumari	Rural	8228	4149	4079	292	147	145	8	5	3
Village	Thesur (TP)	Urban	6937	3459	3478	2067	1019	1048	71	30	41
Town	Marungur (TP)	Urban	10103	4971	5132	487	216	271	0	0	0
Town	Nagercoil (M)	Urban	208179	102907	105272	7084	3504	3580	370	177	193
Town	Acharipallam (TP)	Urban	12755	6384	6371	249	140	109	1	1	0
Town	Ganapathipuram (TP)	Urban	13711	6789	6922	472	223	249	0	0	0
Town	Suchindram (TP)	Urban	12052	5921	6131	1088	511	577	94	50	44
Town	Myladi (TP)	Urban	9001	4545	4456	288	133	155	29	11	18
Town	Alagappapuram (TP)	Urban	8121	3769	4352	593	274	319	0	0	0
Town	Puthalam (TP)	Urban	11835	5921	5914	382	174	208	0	0	0
Town	Thengam-puthdur (TP)	Urban	12675	6330	6345	611	308	303	13	6	7

Town	Thenthamarai-kulam (TP)	Urban	11106	5433	5673	106	54	52	1	1	0
Town	Kottaram (TP)	Urban	9919	4939	4980	946	477	469	0	0	0
Town	Anjugramam (TP)	Urban	9353	4633	4720	1235	604	631	0	0	0
Town	Agasteeswaram (TP)	Urban	8995	4416	4579	300	151	149	2	1	1
Town	Kanyakumari (TP)	Urban	19739	9884	9855	269	125	144	169	78	91

13. Population growth during the last century

Year	Growth and Variation		
	Total population	Increase in numbers	Increase in %
1901	359248	-	-
1911	422260	63102	17.56
1921	494125	71865	17.02
1931	581851	87726	17.75
1941	676975	95124	16.35
1951	826380	149405	22.07
1961	996915	170535	20.64
1971	1222549	225634	22.63
1981	1423399	200850	16.43
1991	1600349	176950	12.43
2001	1669763	69414	4.34

14.Area, Population, Literates:2001-2002

Sl. No	Name of the Blocks/ Municipalities	Area (km^2)	Population			Literate		
			Persons	Male	Female	Persons	Male	Female
1.	Agastheswaram	143.35	115188	56778	58410	85970	44282	41688
2	Rajakkamangalam	135.49	127325	63980	63345	92573	48516	44057
3.	Thovalai	360.91	97802	49117	48685	71075	37722	33353
4.	Kurunthancode	109.54	168810	85460	83350	119818	63016	56802
5	Thuckalay	127.41	162019	81739	80280	117437	61607	55830
6	Thiruvattar	88.37	159182	80261	78921	109262	57402	51860

7	Killiyoor	138.86	151034	76515	74519	105231	55695	49536
8.	Munchiri	71.45	175454	88584	86870	116522	61656	54877
9	Melpuram	27.57	173426	86422	87004	120296	63380	56916
10.	Nagercoil Municipality	19.37	190084	94834	95250	152274	78393	73881
11	Padmanabapuram	6.47	19269	9680	9589	14961	7875	7086
12	Colachel	5.18	24305	12320	11985	16822	8731	8091
13	Kuzhithurai	5.15	19226	9467	9759	14740	7513	7227

15. Tourist attractions

S.No	District	Tourist Place/Pilgrim center
1	Kanniyakumari	Circular fort Vattakottai, Padmanabhapuram, Thiruparappu, Udayagiri, Muttam, Kanniyakumari, Suchindram

16. Disease Prevalance

S.No	Name of Taluk	Name of Disease	No. of persons affected in last 10 year
1	Agasthesewaram	1. Malaria	927
		2. Diarrthoea	154
		3. Jaundice	433
		4.Japanese encephalitis	31
		5. Chloera	374
			1919
2	Kalkulam	1. Malaria	464
		2. Diarrthoea	37
		3. Jaundice	573
		4.Japanese encephalitis	12
		5. Chloera	241
			1327

3	Thovalai	1. Malaria 2. Diarrthoea 3. Jaundice 4.Japanese encephalitis 5. Chloera	379 43 141 201 248
			1012
4	Vilvancode	1. Malaria 2. Diarrthoea 3. Jaundice 4.Japanese encephalitis 5. Chloera	272 93 343 12 241

17. Soil erosion

S No	Taluk	Villages prone to Soil Erosion	Quantum of Soil Eroded (ha)
1	Agastheeswaram	1. Rajakkamangalam 2. Suchindrum 3. Theroor 4. Dharapuram	4.33 2.96 4.42 3.01
			15.72
2	Kalkulam	1. Thuckalay 2. Thiruvattar 3. Padmanabapuram 4. Korthankode	4.56 3.88 5.55 4.94
			18.93
3	Thovalai	1. Pothapandy 2. Manavalakurichi 3. Vattakottai	5.45 2.65 3.10
			11.20
4	Vilvancode	1. Kuzhithurai 2. Killiyoor 3. Melpuram 4. Munchirai	2.96 5.01 5.66 11.33

18. Quality of ground water (Selected wells from the Kodaiyar river basin during Jan-Feb-2004)

S. No.	Name of the Site	pH	EC	CO_3	HCO_3	CL	SO_4	Total	Ca	Mg	Na	K	Total	RSC	SAR	Classi-fication
1.	Nagercoil (047)	7.96	0.8	0.4	0.8	8.0	-	9.2	1.0	2.0	5.4	0.02	8.42	-	6.27	C_1S_1
2.	Pothayari	8.09	0.32	0.4 1.2	0.2	1.5	-	2.1	1.6	.2	0.96	0.012	2.772	-	1.01	C_1S_1
3.	Therekal-puthoor	8.66	2.62	2.8	4.0	21.0	-	26.2	0.8	.4	27.8	0.012	29.012	0.4	36.1	$C_3S_3R_1$
4.	Athithapuram	8.62	2.57	1.6	3.2	20.0	-	26.0	0.8	.2	25.2	0.07	26.27	5.0	35.6	$C_3S_3R_3$
5.	Kristhu Nagar	8.12	0.61	1.6	2.6	3.0	-	7.2	1.2	2.2	4.9	0.057	8.357	0.8	3.76	$C_1S_1R_1$
6.	Thovalai	8.27	2.02	0.8	1.2	18.0	-	20.8	1.8	7.8	13.9	0.95	24.45	-	8.96	C_2S_1
7.	Thevasakayam	8.29	1.22	0.8	0.4	10.5	-	11.7	2.8	2.8	5.0	0.012	10.612	-	2.99	C_2S_1
8.	Aralvaimozhi	8.39	1.18	0.8	1	10.5	-	12.3	3	2.8	5.08	0.0	11.88	-	2.98	C_2S_1
9.	Mupanthal	8.09	0.76	1.2	0.8	6.5	-	8.1	3	2.0	2.52	0.58	8.1	-	1.59	C_1S_1
10.	Aralvaimozhi	8.12	1.58	0.4	1.2	14.5	-	16.9	3.4	7.2	4.94	0.012	15.552	-	2.14	C_2S_1
11.	Kavalkinaru	8.45	0.79	-	1.6	4.5	-	6.5	2	1.0	4.42	0.06	7.48	-	3.62	C_1S_1
12.	Anjugramam	7.82	14.5	1.2	0.8	161	-	161.8	3.8	79.2	85.2	3.53	171.73	-	13.22	C_5S_3
13.	Levanjipuram	8.05	1.1	1.2	2	10.5	-	13.7	2.2	4.8	4.59	0.08	11.67	-	2.45	C_2S_1
14.	Azhahappapuram	8.48	0.66	0.8	1.2	4	-	6.4	1.8	2.2	4.13	0.04	8.17	-	2.92	C_1S_1
15.	Myladi	8.26	1.82	1.2	1.0	16.0	-	17.8	4	3.0	14.9	0.05	21.95	-	7.96	C_2S_1
16.	Suchindram	8.52	1.1	0.8	0.2	9.5	-	10.9	2.4	4.4	5.0	0.44	12.24	-	2.71	C_1S_1
17.	Nesamony Nagar	8.66	0.45	0.8	0.2	3.5	-	4.5	1.6	1.2	1.59	0.26	4.65	-	1.34	C_1S_1
18.	Asaripallam	8.47	0.35	1.6	0.2	2.5	-	3.5	0.4	0.8	2.48	-	3.68	-	3.22	C_2S_1
19.	Santhapuram	8.47	1.08	0.8	0.4	9	-	11.0	4.0	2.4	5.28	0.73	12.41	-	2.96	C_1S_1
20.	Friday Market	8.51	0.8	0.4	0.2	7.5	-	8.5	3.0	1.2	4.64	0.33	9.17	-	3.22	C_1S_1
21.	Mootharuni	8.44	0.22	0.8	0.2	2.0	-	2.6	0.8	0.8	1.0	0.03	2.603	-	1.12	C_1S_1
22.	Monday Market	8.09	1.03	0.4	0.4	9.0	-	10.2	3	1.4	5.11	0.48	10.59	-	3.23	C_2S_1
23.	Thickanamcode	8.04	0.28	0.2	0.2	2.5	-	3.1	1.0	0.8	1.65	0.05	3.5	-	1.75	C_1S_1
24.	Karungal	8.3	1.12	0.6	1.6	10.0	-	11.8	5	1.4	4.69	0.19	11.28	-	2.62	C_2S_1
25.	Paloor Kulakari	8.45	0.28	0.6	0.4	2	-	3.0	0.6	1.4	1.04	0.05	3.09	-	1.04	C_1S_1

26.	Killiyoor	8.32	0.25	0.8	0.2	2	-	2.6	0.4	1.0	0.59	0.07	2.06	-	0.70	C_1S_1
27.	Kaichoondi	7.95	1.73	0.8	0.8	18.0	-	19.6	3.6	1.4	13.9	0.14	19.04	-	8.79	C_2S_1
28.	Nambali	7.76	0.53	-	0.6	5.0	-	5.6	1.6	1.2	2.52	0.14	5.46	-	2.14	C_1S_1
29.	Venkanchi	7.88	0.38	-	0.4	3.5	-	3.9	1.2	.6	2.5	0.12	4.42	-	2.63	C_1S_1
30.	Choozhal	7.92	0.11	-	0.4	1.0	-	1.4	0.4	.4	0.73	0.05	1.58	-	1.15	C_1S_1
31.	Chengavilai	8.52	0.66	0.6	0.4	6.0	-	7.0	1.4	2.4	3.78	0.35	7.93	-	2.82	$C_1S_1R_1$
32.	AVM Canal East	8.03	26.5	0.4	1.0	329.5	6.0	336.9	16.6	65.0	240.43	8.15	330.18	51.59	-	$C_5S_3R_1$
33.	Colachel	8.40	1.94	1.6	1.0	15.5	-	18.1	2.6	3.4	16.30	0.25	22.5	9.42	-	$C_2S_1R_1$
34.	Kurumpanai	8.49	0.84	0.8	0.5	7.5	-	8.8	1.8	2.2	4.47	0.06	8.53	3.16	-	$C_1S_1R_1$
35.	Inigo Nagar	8.40	0.68	0.8	0.4	6.0	-	7.2	1.2	0.8	4.62	0.05	6.67	4.62	-	$C_1S_1R_1$
36.	Mel Midalam	8.34	0.51	0.4	0.6	4.5	-	5.5	0.6	0.6	4.17	0.14	5.37	6.97	-	$C_1S_1R_1$
37.		8.02	1.15	0.8	0.4	10.0	-	11.2	3.4	1.8	5.17	0.14	10.51	3.2	-	$C_2S_1R_1$
38.	Keezhkulam	8.16	0.68	0.4	0.2	6.5	-	7.1	1.6	0.6	4.22	0.16	6.58	4.02	-	$C_1S_1R_1$
39.	Thengapattanam	8.20	1.17	-	1.4	12.5	-	13.9	2.6	2.0	9.30	0.14	14.09	6.11	-	$C_2S_1R_1$
40.	Virivilai	8.09	1.34	0.8	0.4	13.0	-	14.2	2.4	2.4	11.3	0.49	16.59	7.29	-	$C_2S_2R_1$
41.	Thoothoor	8.16	0.48	0.8	0.2	4.0	-	5.0	1.8	1.4	1.96	0.35	5.51	1.55	-	$C_1S_1R_1$
42.	Kirathoor	7.95	1.31	0.8	0.4	15.0	-	16.2	2.8	0.4	13.04	0.54	16.78	10.35	-	$C_2S_2R_1$
43.	Kannanagam	7.00	0.50	-	0.6	5.5	-	6.1	0.6	1.4	3.0	0.05	5.05	3.0	-	$C_1S_1R_1$
44.	Kozhivilai	7.50	0.88	-	1.0	9.0	-	10.0	2.2	0.2	4.76	0.85	8.01	3.37	-	$C_1S_1R_1$
45.	Kuzhithurai	7.58	0.57	-	0.8	5.5	-	6.3	2.4	0.4	3.48	0.19	6.47	2.95	-	$C_1S_1R_1$
46.	Marthandam	7.63	0.43	-	0.4	4.0	-	4.4	0.2	1.6	2.61	0.107	4.51	2.75	-	$C_1S_1R_1$
47.	Eraviputhoor Kadai	7.60	0.83	-	0.4	9.0	-	9.4	5.2	0.6	4.60	0.468	10.668	2.75	-	$C_1S_1R_1$
48.	Mulagumoodu	7.80	0.42	-	0.8	3.5	-	4.3	0.6	1.6	1.96	0.12	4.28	1.88	-	$C_1S_1R_1$
49.	Manali	7.95	0.32	-	0.2	3.0	-	3.2	1.4	0.2	1.96	0.16	3.72	2.20	-	$C_1S_1R_1$
50.	Muttichanparai	7.89	0.14	-	0.6	2.0	-	2.6	0.5	1.5	0.59	0.05	2.65	0.59	-	$C_1S_1R_1$
51.	Villukuri	6.30	0.69	-	0.8	7.0	-	7.8	1.2	1.2	4.61	0.58	7.57	4.23	-	$C_1S_1R_1$
52.	Parvathipuram	8.84	1.65	9.6	1.6	8.5	1.6	21.3	12.0	2.0	19.56	0.012	23.572	19.56	8.5	$C_2S_2R_2$
53.	Chunkankadai	8.34	1.28	2.4	2.6	10.0	-	12.5	5.0	0.2	5.05	1.067	11.317	7.14	-	$C_2S_1R_1$
54.	Thottiyode	8.36	1.02	1.2	2.0	8.0	-	11.2	3.6	2.8	5.21	0.04	11.65	2.92	-	$C_2S_1R_1$

55.	Azhakiamandapam	8.22	0.67	1.2	0.6	6.0	-	7.8	3.0	2.2	2.91	0.176	8.286	1.82	-	$C_2S_1R_1$
56.	Verkilambi	8.30	0.40	1.2	0.4	4.0	-	5.6	2.8	0.6	2.47	0.149	6.019	1.90	-	$C_2S_1R_1$
57.	Thiruvattar	7.96	1.18	0.8	4.0	8.5	-	13.3	4.6	0.2	4.59	3.51	12.90	2.96	-	$C_1S_1R_1$
58.	Cherupaloor	7.84	0.94	-	1.6	8.0	1.5	11.1	2.0	4.8	4.61	0.346	11.756	2.505	-	$C_1S_1R_1$
59.	Kulasekaram	6.75	0.60	-	0.8	5.5	-	6.3	2.2	0.6	3.29	0.203	6.293	2.79	-	$C_1S_1R_1$
60.	Thirparappu	6.18	1.28	-	0.8	11.5	-	12.3	3.4	0.2	8.08	0.67	12.35	6.03	-	$C_2S_1R_1$
61.	Kalial	6.49	0.22	-	1.6	2.0	-	3.6	2.0	0.4	0.93	0.26	3.39	0.85	-	$C_1S_1R_1$
62.	Melpuram	6.38	1.15	-	1.2	11.0	-	12.2	4.8	1.4	5.08	0.302	11.582	2.88	-	$C_2S_1R_1$

KOTTAKARIYAR BASIN

1. Taluks in the basin

S.No	Name of District	Names of Taluks lying in the Basin
1	Madurai	Melur Total for the District
2	Sivagangai	Sivagangai, Devakottai, Karaikudy, Ilayangudy, Manamadurai, Total for the district
3	Ramnad	Thiruvadanai Paramakudi Ramnad Total for the district Grand Total for the basin

2. Ground Water Potential

Name of Taluk	Basin area	Total Potential available for the taluk		GW Potential of the basin taluk ha.m		
	Area ha	Total ha m	For irrigation ha m	Total Qty	Irrigation Requirement	Industrial Requirement
Sivagangai	73867	21861	21454	14682	14409	273
Devakottai	8671	8450	8314	1281	1261	20
Manamadurai	12204	6158	5542	1145	1030	115
Karaikudy	11883	11176	10891	1608	1567	41
Ilayangudy	Full			6157	5985	172
Melur	4175	19509	19216	1151	1134	17
Tiruvadanai	56203			4090	3837	253
Paramagudy	16700	1158	1042	264	237	27
Ramnad	1606	1472	1325	91	82	9

	Total	3046929542	927	
(or)	**304.89**	**295.42**	**9.27 Mcum**	

3. Depth to water level below ground level in observation wells

S.No	Well No.	Name of Station	1975	1980	1985	1990	1995	2000	1976	1981	1986	1991	1996	2001
		Sivaganaga iDt												
1	8316 3	Sembanur	7.62	4.75	6.07	8.2	6.95	6.2	4.81	6.2	6.55	6.1	6.55	3.22
2	8312 2	Sivaganai	9.61	1.6	6.65	9.6	9.65	10.2	2.73	1.77	4.8	8.2	8	10.2
3	8323 7	Tamarakki	7.71	4.9	5.19	6.3	5.85	7.9	3.1	3.4	2.27	5.52	5.3	2.55
4	8324 3	Naattrasan kottai	7.87	5.4	7.08	8.75	9.9	7.8	7.3	5.9	6.75	5.4	7.9	4
5	8324 2	Satharasan kottai	9	4.05	5.65	6.65	4.65	5.8	4.42	1.75	5.65	4.32	4.5	3.55
		Madurai Dt												
6	8307 7	Uranganpat ti	6.09	4.1	4.75	5.5	8.12	-	1.4	1.25	1.7	2.8	3.4	
		Ramnad Dt												
7	8314 0C	Tondi	5.3	-	-	4.55	4.8	2.6	3.65	-	-	3.6	4.4	2.1
8	8314 1A	RS Mangalam	4.2	3	3.29	3.86	3.9	3.3	3.9	3.3	3.36	2.42	3.2	3.6

4. Category of industries in the basin

S.No	Category of the Industry	Total No of Industries
1	Stone crusher	1
2	Rice, Oil, Flour Mill	2
3	Weaving and textile Industries	9
4	Auto work shop	2
5	Agro Industries	1
6	Plastic industry	1
7	Brick Kilns	9
8	Auto spares Industry	1

9	Wood industry	1
10	Food and allied food products	2
11	Chemical industry	1
12	Others	5
	Total	35

5. Details of Percolation Ponds Constructed

S.No	Name of Taluk	Name of Reserve Forest	No Of Percolation Ponds
1	Sivagangai	Kollangudi (N)	1
		Allur	1
2	Karaikudi	Panagudi	1
		Keelapoongudi	1
		Ilandaikulam	1

6. Cropping Pattern

S No	Name of Crop	Name of District				
		Pudukottai	Dindigal	Sivagangai	Ramnad	Madurai
1	Rice	Sep-January	Aug-Dec June-Oct	Aug-Nov to Jan-March	Nov-March	June-Oct Aug-Dec
2	Groundnut (oil Seeds)	July-Sep	Jan-May	Throughout the year		
	Rice	Oct-January				
	Cumbu or Ragi	Feb-May		Jan-July to Aug-Sep		Mar-June June-Sep
3	Groundnut	July-October				June-Oct July-Nov
	Chilles	Oct-Feb				
	Maize	March-June	Jan-May	Aug-Sep	Feb-June Aug-Jan	
4	Ragi	July-Oct				June-Oct
	Rice `	Oct-Feb				
	Cotton	Feb-June	Aug-Sep to Jan-Feb	Feb-March to Sep-Oct	Feb-Aug	Feb-Aug June-Dec
5	Groundnut	June-Oct				Dec-April
	Black gram	Nov-Feb		June-Aug	Mar-May	
	Horse gram,Ragi	Aug-Nov				
	Gingelly	Dec-March				

6	Sugarcane		Throughout the year			Jan-Dec

7. Average Yield of the Crops

S. No.	Crop	Normal area Ha	Average Production M.T.	Average Productivity KG / Ha
1.	Paddy	1,30,373	242101	1857
2.	Cholam	2,118	1851	874
3.	Cumbu	807	976	1210
4.	Ragi	1,351	1140	844
5.	Total Millets	4,893	4883	998
6.	Minor millets	617	316	512
7.	Pulses	3,623	1909	527
8.	Cotton	2867 Bales	7282 Bales	2.54 Bales
9.	Groundnut	6,039	5423	898
10.	Sunflower	168	101	601
11.	Gingeily	1,540	653	424
12.	Chillies	16,163	15306	947

8. Population Details

S.No	Name of Districts	Name of Taluk	No of Villages situated in the basin	Area of the basin Km^2	Population (2001 Census)		
					Male	Female	Total
1	Madurai	Melur	4	41.75	12349	12463	24812
2	Sivagangai	Sivagangai	96	738.67	77219	81708	158927
		Manamadurai	13	122.04	7867	8085	15952
		Karaikudy	12	18.83	8671	9178	17849
		Devakkottai	34	86.71	18865	19847	38712
		Ilayankudy	52	378.97	47656	51457	99113
		Total	207	1445.22	160278	170275	330553
3	Ramnad	Paramakudy	27	167.00	20033	21438	41471
		Thiruvadanai	59	562.03	54951	55415	110366
		Ramnad	6	16.06	2450	2394	4844
		Total	92	745.09	77434	79247	156681

Grand Total	303	2232.06	250061	261985	512046

9. Disease prevalence- January to March 2004

S.no	Name of Block	Add	Mal-aria	Chicken -pox	Measles	TB	Leprosy
1	Manamadurai	8	2	27	1	3	2
2	Ilayangudy	32	5	-	-	-	2
3	Kallal	5	-	-	-	21	2
4	Devakottai	7	-	-	-	-	3
5	Sivagangai	49	1	-	4	2	4
6	Kalayarkovil	6	1	1	-	4	2
	Total	137	9	28	5	30	15

10. District wise literacy level

Districts	Literate		
	Persons	Male	Female
Madurai	1795751	1003506	792245
Ramnad	760819	422992	337827
Sivagangai	745735	419480	325895

11. District wise Tourist attractions

1	Tuticorin	Kattabomman Memorial Fort,Jain cave Temple, Thiruchendur temple
2	Tirunelveli	Mundanthurai, Papanasam, Courtallam, Manimuthar, Uvari ,Kalakadu, Ancient Shiva Temple an Vaishnava Temple Sculptures

NAMBIYAR BASIN

1. Area of the sub basins

S.No.	Name of Sub –Basin	Area in Sq. Km		Total
		Plain	**Hill**	
1.	Hanumanadhi	316.61	61.39	378
2.	Nambiyar	959.21	86.79	1046
3.	Karumeniar	660.00	Nil	660
	Total	**1935.82**	**148.18**	

2. Hydrology of the river

Basin	Origin	Length Km	Tributaries	Reservoirs
Hanumanathi	Marathan Odai	43.5	Kallandi Odai Sooravali Odai Kuthirapanchan Odai	Nil
Nambiyar	Thirukarankudi	48.0	Thamaraiyar Parattaiyar	2
Karumaniyar	Manimutharu Channel	46.5	Nil	

3. Block wise Ground water Potential (in MCM)

S.No	Name of Blocks	Ground water Recharge	Utilizable Ground water Recharge	Net Ground water Recharge	Balance ground water draft	Wells feasible for devolvement
01	Nanguneri	88.02	74.82	18.29	56.33	3062

02	Radhapuram	43.81	37.24	27.26	9.98	541
03	Valliyur	64.09	54.47	27.61	26.86	1455
04	Kalakkadu	5.74	38.88	20.90	17.98	974
05	Sathankulam	41.65	34.56	24.45	18.91	523
06	Tiruchendur	43.23	32.43	22.76	16.67	521

4. Water Quality : - Radhapuram

Name of the village	Electrical Conductivity	pH	Calcium	Magnesium	Sodium + Pottasium	Bicarbonate		Sulphate	Chlorine	Nitrate	Total Soilids
						Hco_3	Co_3				
Kavalkinaru	2000	8.3	20	6.3	327	140	36	125	447	81	1169
Radha puram	2350	8.4	48	44	404	92	18	106	496	298	1160

Valliyur

Name of the Village	Electrical Conductivity	pH	Calcium	Magnesium	Sodium + Pottasium	Bicarbonate		Sulphate	Chlorine	Nitrate	Total Soilids
						Hco_3	Co_3				
Nallur	690	8.1	18	33	85	214	0	24	110	7	384
Panagudi	4700	8.3	232	156	473	31	12	240	1007	589	2725
Valliyoor	5900	8.0	384	141	619	61	0	269	1319	806	3569

S No	Location	Ec	NO_3	Fe	F
1	Valasaikinaru	1300	15.0	0.32	0.3
2	karungadal	950	15.0	0.48	0.1
3	Alakinaru	1060	11.0	0.16	0.2
4	Mudalur	2050	4.0	0.16	0.1
5	Periatalai	660	2.0	0.16	-
6	Tiruchendur	4050	3.0	0.16	0.8
7	Kayamozhi	330	4.0	0.16	0.2
8	Udankudi	1920	5.0	0.32	0.6

PARAMBIKULAM ALIYAR PROJECT BASIN (PAP)

1. Number of blocks and taluks

S.No	Taluk	Block	No. of villages
1	Pollachi	Anamalai Pollachi(n) Pollachi(s) kinathukadavu	19 48 29 35
2	Udumalpet	Gudimangalam Madathukulam Udumalpet	24 18 51
3	Valparai	Valparai	71
4	Palladam	Palladam Sulthanpet Sulur Pongalur	21 21
5	Tiruppur	Tiruppur	
6	Dharapuram	Mulanur Dharapuram Kundadam	21 28 22
7	Kangeyam	Kangeyam Vellakovil	20 16

2. Land use classification

Description	Area (ha)
Geographical area	346200
Forest	77894
Barren and uncultivable waste	4609
Land under non – agricultural use	36478
Cultivable waste	937
Permanent pastures and other crazing land	755
Current fallows	59292
Other fallows	7333
Land under Misc. use	1623
Net area sown	157279

3. Salient Features of the dams

Name of Dam	River	Catchment (miles^2)	Yield in TMC	Height of Dam from foundation(ft)	Active storage depth (ft)	Capacity in Tmct	Cost (Rs Lakhs)
Upper Nirar	Nirar	29	9.0	90	--	0.039	178
Lower Nirar	Nirar	39	2.5	165	45	0.274	547
Sholayar	Nirar	47	2.5(TN)	345	160	5.392	1125
Parambikulam	Thunakadavu	88.2	14.0	240	72	17.820	405.4
Thunakadavu	Thunakadavu	16.7	--	85	22	0.557	60
Peruvaripallam	Peruvaripallam	6.10	--	111	--	0.20	34.3
Aliyar	Aliyar	76	9(upto Manakadavu)	145	120	3.864	294.9
Thirumoorthy	Palar	31	1	122	60	1.935	237.80

4. Details of Canals and Ayacuts

S.No	Name of Canal	Length in km	Ayacut in Acres
1	Pollachi Canal	48	23488
2	Vettaikaranpudur Canal	17.2	11181
3	Aliyar Feeder Canal	13.15	4665
4	Udumalpet Canal	30.50	58292
5	Sethumadai Canal	8.20	5044
6	High Level Canal	2.00	2477
7	Old Aliyar Ayacut	5 Anicuts	6400
8	Parambikulam Main Canal	125.4	316383
9	Dhalai Channel	River and Tank	2800
10	Indirect ayacut in three tanks	Tanks	93.4
			431664
	Sub-Basin wise Ayacut		
1	Aliyar dam old and new ayacut	--	51588
2	Thirumoorthy dam Old and new ayacut	--	380106

			4.32 Lakhs Acres

5. Projected water demand and water balance for various uses in Mcm.

Sl. No.	Purpose	1999	2004	2019	2044
1	Domestic uses	44.6	47.89	57.74	74.16
2	Agriculture	1558	1558	1558	1558
3	Industries	33.21	44.28	77.49	132.84
4	Livestock	11.81	11.81	11.81	11.81
6	**Total**	**1647.62**	**1661.98**	**1705.04**	**1776.81**
7	**Water Balance**	**-480.62**	**-494.98**	**-538.04**	**-609.81**

6. Physico Chemical Characteristics

S.No	Characteristics	Kadamparai dam surface water	Upper Aliar dam surface water	Nirar dam surface water	Sholayar dam surface water
1	Electrical conductivity Reciprocal meg ohms per Cm 3@ 20°C	20-40	60-85	16-55	25-55
2	Total Solid @ 105°C mg/l	20-27	39-68	14-50	20-54
3	Total Hardness as $CaCo_3$ mg/l	9-20	23-44	5-22	10-24
4	Total Alkalinity as $CaCo_3$ mg/l	9-13	18-24	7-26	8-22
5	PH	7.2-7.8	6.8-7.8	6.2-8.6	6.4-8.5
6	Nitrate Nitrogen as N mg/l	0-0.3	0.2-1.0	0-0.3	0-1.0
7	Chloride as Cl mgl	3-5	4-8	2-10	4-8
8	Iron as Fe mg/l	0.05-0.30	0.15-0.70	0.05-0.35	0.05-1.40

7. District wise area and population details

Districts	Region	Population		
		Persons	Male	Female
Coimbatore	Total	4224107	2156280	2067827
	Rural	1435036	727610	707426
	Urban	2789071	1428670	1360401
Erode	Total	2574067	1306039	1268028
	Rural	1384746	704855	679891
	Urban	1189321	601184	588137

8. District wise literacy level

Districts	Literate		
	Persons	Male	Female
Coimbatore	2916996	1621164	1295832
Erode	1532258	894339	637919

9. Heritage Resources

1	Coimbatore	Coimbatore, Sengupatti, Bhavani sagar dam, Thirumoorthy hills, Perur and Maruthamalai
2	Erode	Bhavani, Kasturibagram, Kodumudi and Bannari

TAMBRAPARANI BASIN

1. The distribution of the basin area in different districts

S.No.	Districts	Area of the District (Sq. Km)	Area covered by the Basin (Sq. Km)
1.	Tirunelveli	6780	5317
2.	Thoothukudi	4649	625

2. Water balance statement

S. No.	Purpose	1999	2004	2019	2044
1	Domestic uses	48.72	51.44	59.63	73.25
2	Agriculture	2645	2645	2645	2645
3	Industries	34.86	46.48	81.34	139.44
4	Livestock	21.32	21.32	21.32	21.32
6	**Total**	**2749.9**	**2764.24**	**2807.29**	**2879.01**
7	**Water Balance**	**-680.9**	**-695.24**	**-738.29**	**-810.01**

3. Cropping Pattern

Crop Kar	II Crops Pishanam	Advance Kar	Annual Crop	Single Crop	Crop Kar
Paddy (Jun-Sep)	Paddy (Oct-Feb)	Paddy (Apr-July)	Banana Sugarcane	Paddy (Oct-Feb) Sugarcane (Annual) Banana (Annual)	Sorghum Cumbu Ragi Maize Millets Groundnut Thinai Samai Varagu Etc.

4. Crop Rotation (Taluk wise)

	Taluk	Wet Land	Garden	Dry Land
1.	Tirunelveli	Paddy-Paddy-Pulses-Gingelly	Paddy-Pulses	Pulses
		Paddy-Pulses	Paddy-Pulse	Pulses
		Paddy-Cotton	Paddy-Cotton	Gingelly
		Paddy-Sholam	Paddy-Sholam	Cholam
		Paddy-Groundnut	Banana	Avuri
		Banana	Paddy-Vegetables	
		Sugarcane	Paddy-Groundnut	
2.	Palayamkottai	Paddy-Paddy-Pulses-Gingelly	Paddy-Pulses	
		Paddy-Pulses	Paddy-Cotton	Pulses
		Paddy-Sholam	Paddy-Sholam	Gingelly
		Paddy-Groundnut	Banana	Cholam
		Banana	Paddy-Vegetables	Avuri
		Sugarcane	Paddy-Groundnut	
3.	Alangulam	Paddy-Paddy-Pules	Paddy-Pulses	Pulses
		Paddy-Pulses	Paddy-Cotton	Groundnut
		Paddy-Cotton	Paddy-Chilly	Gingelly
		Paddy-Chilly	Paddy-Groundnut	
		Paddy-Vegetables	Paddy-Vegetables	
		Banana	Banana	
4.	Ambasamudram	Paddy-Paddy-Pulses	Paddy-Pulses	Pulses
		Paddy-Pulses	Paddy-Cotton	Gingelly
		Banana	Paddy-Chilly	Cholam
		Sugarcane	Banana	
			Vegetables	
5.	Tenkasi	Paddy-Paddy-Pulses	Paddy-Groundnut	Cholam-Pulses-

				Gingelly
		Paddy-Paddy-Gingelly	Paddy	Cholam-Pulses
		Paddy-Pulses-Banana	Paddy-Cotton/ Chilly	Groundnut-Pulses
		Paddy-Chilly-Cotton		
		Banana		
		Sugarcane		
6.	Shenkottai	Paddy-Paddy-Pulses/Gingelly	Paddy-Pulses/Gingelly	Cholam-Pulses
		Paddy-Pulses	Paddy-Cotton/Chilly	Cholam
		Paddy-Chilly/Cotton	Groundnut-Paddy	Pulses
		Sugarcane	Banana	
		Paddy-Vegetables	Sugarcane	
7.	Sankarankoil	Cotton-Paddy	Pules-Paddy	Pulses
		Chilly-Paddy	Cotton-Paddy	Cotton
		Vegetables-Paddy	Gingelly	Cholam
		Sugarcane	Sugarcane	Gingelly
		Banana	Banana	Sunflower
			Sunflower	

5. List of Industries in Chittar sub basin

S.No	Name of the Industry	Location	Category
1	Oil mills	Alankulam	Green
2	Modern Rice mills	Alankulam	Orange
3	Fibre industry	Pattakurichi	OR
4	Modern rice mill	Tiruchitrambalam	Orange
5	Vaigai Agro products	Poolankulam	Green
6	Yogambigai Chemicals	Andipatti	SR
7	Thatha soap company	Andipatti	Green
8	Saw mill	Pettanadarpatti I	Orange

9	Stone Crusher	Pettanadarpatti I	OR
10	Stone Crusher	Thippanampatti	OT
11	15 Nos. of Modern rice mill	Keelapavoor	Orange
12	Chunnambu powder Industry	Keelapavoor	SR
13	Pot making Industry	Keelapavoor	Green

6. List of industries in Tambraparani river basin

S.No	Name of the industry	Location	Category
1	Chamber Brick making Industry - 5 Nos.	Thirukkolure	Orange
2	Attai Industry	Angamangalam	Green
3	Ricemill	Angamangalam	Orange
4	Brick Maal	Alikkudi	Orange
5	Brick Maal-6l	Kilpidagai Varadarajapuram	Orange
6	Spinning Mill	Parpankulam	Orange
7	Krishna chemicals	Nochikulam	SR
8	Bell Pins	Sivanadiyarkulam	OR
9	Paper (Attai) Company	Mela Tiruvengadanadapuram	Green
10	Polytheen Preparing company	Munnerpallam	SR
11	Soap making industry	Munnerpallam	Green
12	Chunnambu making industry	Munnerpallam	SR
13	Kathiravan chemicals	Munnerpallam	SR
14	Steel plate company	Munnerpallam	SR
15	New Indian Hume Pipe	Ponnakudi	SR
16	Lazza Ice Cream company	Ponnakudi	OT
17	Stone Crusher company	Ponnakudi	OR
18	Chemical cleaning powder	Ponnakudi	SR
19	Brick works	Vilagam	Green
20	Brunda Cotton mill	Mannar kovil	Orange
21	Bigayan Industries-Chunnambu powder	Mannar kovil	SR
22	Ragavendra spinning mill	Sutthamalli	Orange
23	Kompu mill	Kodaganallur	Orange
24	Nellai Concrete construction	Alangarapperi	Orange

	Ltd.		
25	Chunnampu powder industry	Madavakurichi	SR
26	Attai mill	Kondanagaram	SR

7. Cottage Industries

S. No	Item of Manufacture	Total
1	Appalam	158
2	Bee Keeping	7
3	Confectionery	11
4	Artificial flowers	6
5	Aloe Fibre extraction Palm yarn and	10
6	Coconut fibre	64
7	Laundry	45
8	Leather goods making	63
9	Ornamental and jewellary	6
10	Ornamental leather crafts	197
11	Weaving cotton wool textiles	329
12	Tailoring	11
13	Cane furniture	11
14	Agar bathis making	269
15	Korai mats, dates baskets, hand bags,	276
16	window screens	10
17	Palmyra leaf-fancy utility articles	89
18	Palmyra rafters, stoma, furniture cots, etc.	57
19	Wood Turning Industry, other wood works	69
20	Winding of silk, thread, cotton thread and	45
21	artificial yarn	52
22	Coconut leaf	34
23	Beads	19
24	Plastic wire knitting to furniture	147
25	Pickles and mixture making	131
26	Puffed Rice	65
27	Basket (Eathel-Kambu)	129
28	Brass, Copper Vessels	23
29	Country Bricks	19
30	Pottary	6
31	Blacksmithy	1
32	Wet Grain Pounding	12
33	Photo framing	24
	Silk cotton pillow and mattress	
	Homemade snacks	

	Total	**2395**

8. Water Logging

S. No.	Name of the Village	Location	Period - Seasonal / throughout the Year
1.	Melapattam	South of the Essakkiyamman koil / Kalvettankuli	All through the year
2.	Parpankulam	Kalvettankuli-2	All through the year
3.	Krishnapuram	West of the village (kalvettankuli)	All through the year
4.	Paraikulam	Near Paraikulam & South of Uthamapandiyakulam	All through the year
5.	Brammadesam	Near main road (Upto 15-20m)	Rainy Seasons only
6.	Athalanallur	Survey No. 94	Return flow water
7.	Kabaliparan	Near Urvalnthankulam	Rainy Seasons only
8.	Pappakudi	Nanthan thattai	Throughout the year, Return flow water.
9.	Menaparanallur		Return flow water, 15-20 m
10.	Suthamalli	Near Veterinary Hospital	Rainy Seasons only
		Near Palvoor bus stand	Rainy Seasons only
		Pattankallur	Rainy Seasons only
11.	Mangalakurichi		During rainy seasons
12.	Karunkulam	Way to Karunkulam, west side water weeds are in the area.	During rainy seasons

9. Diseases

Authoor kasba	Polia, Uterus Tumor		
Avanpperi	Fever		Seasonal
Chettiyapatth	Jaundice,Dysentry	Waterborn	Seasonal

u		e	
Kachinavilai	Cholera,Jaundice, dysentery	Waterborn e	
Khansahipura m	Typhoid fever		Seasonal
Kilpattam	Typhoid, fever		Seasonal
Kilanattham	Fever		Seasonal
Kodarankula m	Diarrhoea	Waterborn e	Seasonal
Krishnapuram	Elephanttiasis, Thyroid Deficiency & fever		
Laksmipuram	Jaundice,Dysentry,	Waterborn e	Seasonal
Manapadaivee du	Fever		Seasonal
Marudur	Disease due to Climate only		
Melapattam	Fever		Seasonal
Melaputhaeri	Fever		Seasonal
MelaTiruveng adanadapuram	Cholara,Jaundice,		Seasonal
Mookuperi	Typhoid,Jaundice, Cholera	Waterborn e	
Mutur	Typhoid fever		Seasonal
Nalumavadi	Cholera,Jaundice, dysentery	Waterborn e	
Nangaimozhi	Jaundice,Dysentry	Waterborn e	
Nochikulam	Chicken-Pox, Typhoid, Jaundice, fever	Water Born	Seasonal
Palyamchettiku lam	Fever		Seasonal

10. Population details

Districts	**Region**	**Population**		
		Persons	**Male**	**Female**
Tirunelveli	Total	2801194	1372082	1429112
	Rural	1499062	729830	769232
	Urban	1302132	642252	659880
Thoothukudi	Total	1565743	764087	801656

	Rural	903811	437599	466212
	Urban	661932	326488	335444

Source: statistical handbook of Tamilnadu 2002

11. Literacy level

Districts	**Literate**		
	Persons	**Male**	**Female**
Tirunelveli	1917238	1041964	875274
Tuticorin	1140959	598669	542290

Source: statistical handbook of Tamilnadu 2002

12. Tourist attractions

1	Tuticorin	Kattabomman Memorial Fort,Jain cave Temple, Thiruchendur temple
2	Tirunelveli	Mundanthurai, Papanasam, Courtallam, Manimuthar, Uvari ,Kalakadu, Ancient Shiva Temple an Vaishnava Temple Sculptures

13. Water Quality

Sl. No	Quality/Paramater	Mukkudal	Keelaseval	Ramanadhi-Pottalpudur	Gadanadhi-Dam site	Gopalasamudram	Vellankuli	Cheranmadevi	Gopalasamudram river	Aladiyur	Mukkudal I	Mukkudal II	SR No.227/2004 ???
1	pH	6.8	6.7	6.7	7	6.6	6.5	7.7	7.9	7.9	7.7	8	7.8
2	Ec	0.13	0.15	0.74	0.07	0.13	0.09	0.15	0.13	0.1	0.32	1.46	1.45
3	Carbonate (dsm-1)	0	0	0	0	0	0	0	0	0	8.6	1	0
4	Bicarbonate (m eg/lit)	0.8	1	5	0.2	0.8	0.4	1	0.8	0.6	2.2	8.6	5.8
5	Chloride (m eg/lit)	0.5	0.5	2	0.5	0.5	0.5	0.5	0.5	0.5	1	3	6.5
6	Sulphate (m eg/lit)	0	0	0.4	0	0	0	0	0	0	0	2	2.2
7	Calcium (m eg/lit)	1	1.2	1.8	0.6	1	0.6	1	0.6	0.8	1.8	4	2.8
8	Magnecium (m eg/lit)	0	0	4	0	0	0	0.2	0.4	0	0.6	1	6.8
9	Sodium (m eg/lit)	0.3043	0.3478	1.652	0.1739	0.2391	0.2173	0.3043	0.3043	0.1956	0.8695	9.345	3.978
10	Pottasium (m eg/lit)	0.0128	0.0256	0.0256	0.0128	0.0128	0.0128	0.0128	0.0128	0.0128	0.0256	0.2051	0.9743
11	Sodium Absorption Ratio	0.3043	0.449	0.97	0.3174	0.2391	0.3967	0.3928	3043	0.3092	0.7937	5.91	1.815

	(m eg/lit)												
12	Residual Sodium carbonate (m eg/lit)	0	0	0	0	0	0	0	0	0	0	0	0
13	Classification	C1S1R1	C1S1R1	C1S1R1	C1S1R1	C1S1R1	C1S1R1	C1S1R1	C1S1R1	C1S1R1	C1S1R1	C2S1R1	C2S1R1
14	Major salt	Calcium bicarbonate	Calcium bicarbonate	Magnesium bicarbonate	Calcium chloride	Calcium bicarbonate	Calcium chloride	Calcium bicarbonate	Calcium bicarbonate	Calcium bicarbonate	Calcium bicarbonate	Sodium bicarbonate	Magnesium chloride

14. DATA RECORD OF SURFACE WATER SAMPLES COLLECTED FROM TRIBUTARIES OF TAMIRAPARANI RIVER FOR THE MONTH OF FEBRUARY 2004

E.C.Sub division III
Tirunelveli

PWD

Station Code	Station Code No.	Date of Collection	Field Determinations						General				Nutrients			Org. matter		Alkalinity		Hardness		Major ions									Other In	
			pH	EC mho/cm	Do mg/cm	Temp 0c	Colour Code	Odour code	PH	Ec mho/cm	TDS mg/l	TSS mg/l	NH3 mg/l	NO3+ mgN/l	Total p mg/l	BOD mg/l	COD mg/l	Phen Mg Caco3m/l	Total mg Caco3/l	Total mg Caco3/l	Ca++ mg/Caco3/l	Ca++ mg/l	Mg++mg/l	Na+mg/l	K+ mg/l	Cl mg/l	So4- mg/l	Co3- mg/l	Hco3- mg/l	Sl mg/l	F mg/l
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
S1	150201	12/02	NIL	NIL	8.77	26	7	1	8	1.6	0.1	0.6	NIL	1	NIL	0.28	6	0	310	274	NIL	51	96	NIL	NIL	71	0	NIL	64	NIL	NI
S2	150202	12/02	NIL	NIL	4.71	26	7	1	8.2	0.5	0	0.4	NIL	1	NIL	0.56	10	0	315	26	NIL	57	78	NIL	NIL	67	0	NIL	65	NIL	NI
S3	150301	12/02	NIL	NIL	4.13	26	7	1	7.5	20	0.1	0.4	NIL	0	NIL	0.56	6	0	40	30	NIL	4	13	NIL	NIL	13	0	NIL	7	NIL	NI
S4	150302	12/02	NIL	NIL	4.13	28	7	1	7.9	14	0.1	0.8	NIL	1	NIL	0.56	6	0	410	24	NIL	4	14	NIL	NIL	87	0	NIL	60	NIL	NI
S5	150401	12/02	NIL	NIL	4.41	26	7	1	7.3	2.6	0.2	1.6	NIL	0	NIL	0.56	6	0	58	32	NIL	8	12	NIL	NIL	13	0	NIL	9	NIL	NI
S6	150401	12/02	NIL	NIL	..... No Flow																										
S7	150501	12/02	NIL	NIL	46.9	27	7	1	6.4	8	0.1	0.8	NIL	1	NIL	0	2	0	60	32	NIL	8	10	NIL	NIL	17	0	NIL	6	NIL	NI
S8	150502	12/02	NIL	NIL	..... No Flow																										

	Location	Distance in km from origin	Identification
1	Agastiar falls	12	Bathing Ghat

2	Vikkiramasingapuram	14.9	Madura Coats - above effluent mixing point. 100 m U/S of road bridge from main road to Madura Coats
3	Vikkiramasingapuram	15	D/S of Road bridge - do -
4	Kannadian Anicut	19	Crossing river D/S of Manimuthat Confluence
5	Ambasamudram	21	D/S of Road bridge between Ambasamudram and Kallidaikurichi
6	Ambasamudram	30	D/S of Gadana River Confluence.
7	Ariyanayakipuram Anicut	35	D/S of Mukkudal
8	Cheranmadevi	39	Side of Sun Paper Mill
9	Cheranmadevi	39.2	D/S of Road bridge Crossing the river - 200 m below Sun Paper mill
10	Tharuvai	52	Below Confluence point of Pachaiyar River
11	Kurukkuthurai (Tirunelveli Town)	57	Near Murugan temple
12	Tirunelveli	59	U/S of Road Bridge opposite of Collectorate
13	Vellakovil (Palyamkottai)	61	D/S of Cremination Shed.
14	Pottal	64	Near Drinking water Tapping point
15	Manappadaiveedu	67	U/S of Drinking water Tapping point
16	Sivalapperi	71	D/S of Road Bridge & Drinking water Tapping point
17	Marudur Anicut	77	Near Kaliavoor
18	Karungulam	88	Near Drinking water Tapping point
19	Srivaikuntam Anicut	96	Near Srivaikuntam
20	Eral	110	Cause way Crossing - D/S
21	Attur	115	D/S of Highway bridge Crossing Drinking Water Tappint Point

15. Water requirement for different uses

S.No	Uses	Water Requirement (Quantity KI^3)			
		1997-98	2010	2025	2050
(a) Surface Water					
1	Irrigation	318	339	366	463
2	2. Domestic	17	24	36	65
3	3. Industries	21	26	47	57
4	4. Power	7	15	26	56
5	5. Inland Navigation		7	10	15
6	Environment		5	100	
7	Evaporation losses	36	42	50	76
	Total	**399**	**458**	**635**	**732**
(b) Ground Water					
1	Irrigation	206	218	245	344
2	Domestic and Municipal	13	19	26	46
3	Industries	9	11	20	24
4	Power	2	4	7	14
	Total	**230**	**252**	**298**	**428**
	Grand Total(a+b)	**629**	**710**	**933**	**1160**

16. Surface water and ground water potential

S No	Description	2001 (TMC)	2010 (TMC)	2025 (TMC)	2050 (TMC)	% of the total in 2050
1	Domestic	2222	2438	2791	3460	6.00
2	Irrigation	49978	49978	49978	49978	86.58
3	Industries	1555	1633	1757	1985	3.44
4	Power	118	138	162	180	0.31
5	Live Stock	519	519	519	519	0.90
6	Aquaculture	2	2	2	2	-
7	Recreation	1	1	1	1	-
8	Navigation	-	-	-	-	-
9	Minimum Flows	-	-	800	1600	2.77
10	**Total**	**54,395**	**54,709**	**56,725**	**57,725**	**100.00**

17. List of reserve forests in the Tamirabarani

S.No	Name of the Dist	Name of the Taluk	Name of the District	Area in ha (as per register of RF)
1	Tirunelveli	Tirunelveli	**TIRUNELVELI RANGE:**	
			Thalaiyuthu R.F	585.11
			Gangaikondan R.F	441.16
		Palayamkottai	1. Sivalapperi R.F	87.87
			2. Melapattam R.F	404.86
			3. Muthur R.F	343.37
2	Thoothukudi		1.Kuthiraimozhi R.F	5152.31
		Tiruchendur		
			1. Vallanad R.F	2054.85
		Srivaikuntam	2. Kaliyavoor R.F	68.45
3.	Tirunelveli		**SHENKOTTAI RANGE:**	
		Shenkottai	1. Puliyarai R.F	4106.94
			2. Vellakal Teri R.F	346.84
			3. Vadakarai Kilpidagai 3 (b)	176.26
			4. Vadakarai Kilpidagai North	28.74
			5. Vadagarai Kilpidagai	235.87
			6. Achampudur Grazing BlockI	58.38
			7. " Block II	88.89
			8. Ayikudi Grazing Block	92.34
			Kadayanallur Upper Slopes portion	580.37
			COURTALLAM RANGE:	2974.43
			1. Courtallam Upper slopes	687.96
			2. Extension No.I & Lower slopes	93.87 58.20
			3. Extension No.II & Lower slopes	65.61 29.48
			4. Extension No.III & Lower slopes	12.76
			5. Vasudeva Estate	10.78
			6. Panchanthangi Estate	74.26
			7. Old Sy.No.1357 of Ilangi	2.52
			8. Addition to CTM, RF , T. Parvatham Estate	1459.54 562.46
			9. Hope Estate	474.34
			10. Extn. IV to CTm RF	66.03
			11. Kadayanallur Upper slopes	0.36

			12. Chinnakadu R.F	13.41
			13. Kadayanallur Upper 3 Cz	1480.03
			Slopes	788.83
			14. Alkondal Nethiyuthu,	5.03
			Shermadevi	357.70
			15. Addition to Chinnakadu	7.80
			16. Kadayanallur addition 9 bits	55.73
			17. Krishnapuram Upper slopes	150.34
			18. Krishnapuram Upper slopes	227.60
			Extn.	891.21
			19. " Addition	1598.21
			20. Kottamalai reserve	1284.94
			21. "" addition	48.00
			22. " Extension	
			23. Kavalkattu parambu	
			24. Mayamankurichi	6495.55
		SankaranKovil	25. Chokkampatti	4250.88
			26. Vairavankulam	130.19
			27. Uthumalai	158.08
			28. Vellakal Parambu	7.41
				0.90
			SANKARAN KOVIL	3.58
			RANGE:	2.42
			1. Vasuduvanallur Upper	2.86
			slopes	21.28
			2. " Lower slopes	1157.35
		Tenkasi	3. Chinthamani block A+B	6964.18
			4. Narayanapuram	
			5. Addition to Vasudevanallur	
			6. Addition to Thirumalapuram	59115.00
		Ambasamudram	7. Addition to Mealpulaiangudi	
			8. „ Melachinthimani	
			9. „ Narayanapuram	**106643.72**
			10. Konamparambu	
			11. TN. Pudukudy	
			12. Sivagiri	
			R.F. wise details available with W.W Mudanthurai Sanctuary	
			TOTAL	

18. Land use

S No	Taluk	Forest (ha)	Barren un-cultivable land (ha)	Land but non - agriculture (ha)	Cultivable waste (ha)	Grazing Land (ha)	Land under mis-cellaneous trees (ha)	Current fallows (ha)	Other fallows (ha)	Net area sown (ha)	Total area (ha)
1	Tirunelveli	1026	1337	12989	11490	3094	591	2189	13439	9924	56079
2	Palayamkottai	836	2193	7762	2861	388	593	806	9931	5056	30426
3	Nanguneri (Part)	22359	6873	14114	19892	2094	666	4588	11723	12044	94353
4	Ambasamudram	59153	3602	13051	13455	1288	1425	2061	5019	19412	118466
5	Tenkasi	6762	833	8285	640	155	155	2472	9350	17735	46327
6	Alangulam	3351	995	2923	2388	256	510	1501	14670	6576	33170
7	V.K. Pudur	38	409	3651	1035	30	510	1666	12183	6559	26081
8	Shenkottai	9045	251	3531	176	157	403	81	688	10997	25329
9	Sankarankoil		1018	15797	1392	106	370	12292	48176	28830	107981
10	Srivaikundam	2520	2023	12420	5289	5235	774	4667	4519	22058	59495
11	Thiruchendur	5554	977	8313	7896	3	-	2864	6055	15946	47608

VAIPPAR BASIN

1. Reservoirs, Anicuts, Channels, Tanks and Ooranies

S.No.	Sub Basin	Anicuts No.	Direct channel Ayacut in ha	Supply Channel		System		Non system		Ooranies
				No.	Length in km	Tank	Ayacut in ha	Tank	Ayacut in ha.	
1.	Nichabanadhi	18	--	24	39.48	15	1709.81	151	3973.90	71
2.	Kalingalar	5	77.41	9	14.00	6	1129.07	25	1244.74	3
3.	Deviar	24	--	27	44.14	26	3454.50	90	4423.53	31
4.	Nagariar	15	92.38	11	14.83	16	1672.90	15	370.49	6
5.	Sevalperiyar (Mudangiyar)	6	--	6	14.27	15	982.78	24	598.52	37
6.	Kayalkudiar	9	42.10	8	15.30	8	559.62	34	968.91	24
7.	Vallampatti Odai	1	--	1	3.80	1	27.04	17	652.23	45
8.	Sindapalli Uppodai	--	--	--	--	--	--	25	842.60	52
9.	Arjunanadhi	32	532.15	65	124.24	62	4359.52	173	5564.27	327
10.	Kousiganadhi	1	--	1	4.5	1	122.07	121	3425.01	73
11.	Sinkottaiyar	--	--	--	--	4	239.80	36	740.20	94
12.	Uppathurar	4	--	4	4.79	--	--	37	2105.82	76
13.	Vaippar	** 3	--	3	14.65	5	699.42	54	2741.17	377
	Total	**117**	**744.04**	**159**	**294.00**	**159**	**14956.53**	**802**	**27651.39**	**1216**

2. Land use pattern in the Vaippar river basin

S.No	Land Use Type	Area (hectares)
1	Forest area	62105
2	Barren and Uncultivated (Including wasteland)	10711
3	Cultivated wasteland	6215
4	Permanent pastures and grazing land	1080
5	Current Fallows	36677
6	Other Fallows	48945
7	Net area sown	286479
8	Gross area sown	295281

3. Categorization of Blocks –January 2003

Over-exploited greater than 100%	Critical between 90 and 100 %	Semi critical 70 and 90 %	Safe less than 70 %	Saline
Virudhunagar District (11 Blocks)				
	1. Rajapalayam	1. Kariapatti	1. Aruppukottai	
	2. Watrap	2. Sivakasi	2. Narikudi	
		3. Srivilliputhur	3. Sattur	
		4. Vembakottai	4. Trichuli	
			5. Virudhunagar	
Tirunelveli District (3 Blocks)				
		1. Kuruvikulam 2. Vasudevanallur		
1. Sankarankoil				
Thoothukudi District (3 Blocks)				
1. Kovilpatti 2. Vilathikulam	1. Pudur			
Madurai District (2 Blocks)				
		1. Kallikudi 2. T. Kallupatti		

4. Ground Water Development - January 2003

S. No.	Category	Total Number
1	Over exploited	138
2	Critical blocks	37
3	Semi critical blocks	105
4	Safe blocks	97
5	Saline blocks	8
	Total	**385**

5. Total Water Requirement

S. No	Purpose	1999	2004	2019	2044
1.	Agriculture	1457.51	1457.51	1373.49	1261.65
2.	Domestic	55.01	66.02	98	152.01
3.	Industrial	30.93	41.24	72.17	123.72
4.	Live Stocks	13.76	13.76	13.76	13.76
5.	Power	-	-	-	-
	TOTAL	**1557.21**	**1578.53**	**1557.42**	**1551.14**
	Water Balance	**225.79**	**204.47**	**225.58**	**231.86**

6. Cropping pattern

S.No.	Crop	Season
1.	Paddy	Pishanam (September-October)
2.	Paddy	Samba (August)
3.	Paddy	Kar (May-June)
4.	Cotton	Irrigated (February-March).
5.	Cotton	Un-irrigated (September-October)
6.	Sugarcane	Mid Season (February-March)
7.	Groundnut	Un-irrigated (July-August)
8.	Pulses	Un-irrigated

		(October-November)
9.	Cumbu	Un-irrigated (September-October)
10.	Cholam	Un-irrigated (September-October)
11.	Chillies	Irrigated (February-August)

7. Cropping pattern

S. No.	Name of Taluk	Cropping pattern	
		Under irrigated condition	**Under rainfed condition**
I.	**Tirunelveli District**		
1.	Sankarankovil (part)	Paddy, Banana, Sugarcane, Chillies, Cotton, Vegetables	Millets, Pulses, Cotton, Sunflower
2.	Sivagiri	Paddy, Banana, chillies, Onion, Sugarcane, Vegetables	Cotton, Millets, Pulses,
II	**Virudhunagar District**		
1.	Rajapalayam	Paddy, Banana, Chillies	Millets, Pulses, Cotton
2.	Srivilliputhur	Paddy, Sugarcane, Chillies, Banana	Pulses, Millets, groundnuts, Gingelly
3.	Virudhunagar	Paddy, Chillies, Cotton	Millets, Pulses, Cotton
4.	Sattur	Paddy, Groundnut, Millets, Pulses, Chillies, Cotton	Cholam, Millets, Cotton, Coriander.
5.	Aruppukottai (part)	Paddy, Chillies, Groundnut, Cotton	Millets, Pulses, Groundnut, Cotton.
III.	**Thoothukudi District**		
1.	Kovilpatti, Ettayapuram, Vilathikulam (part)	Paddy	Cotton, Pulses, Millets
IV.	**Madurai District**		
1.	Peraiyur (part)	Sugarcane, (lesser extent)	Cotton, Pulses, Cholam
2.	Tirumangalam	Paddy, Cotton	Cotton, Pulses, Groundnut, Cholam

8. Water quality analysis

S.No	Parameter	Vnr BW	CP u/s v17	V17	V15	VRP Kondaneri Tank	VRP Periadhi Tank
1.	PH	7.4	7.1	7.0	7.0	7.2	6.7
2.	Ec.umho/cm	3000	700	400	250	1200	1700
3.	TDS, mg/l	1823	386	221	141	727	1015
4.	TSS, mg/l	4.5	3.5	2.5	2	4.5	5
5.	NH_3, mg/l	0	0	0	0	0	0
6.	NO3+NO2, as N mg/l	16	3	1	0	12	15
7.	Total P, mg/l	0	1.06	0.64	0.84	0.73	2.3
8.	BOD, mg/l	3.0	3.2	1.8	0.8	1.2	1.4
9.	COD, mg/l	11	26	11	3	28	20
10	Phen, mg $CaCo_3$/l	0	0	0	0	0	0
11	Total, mg $CaCo_3$/l	630	205	145	105	315	400
12	Total, mg $CaCo_3$/l	580	190	135	100	300	450
13	Ca mg $CaCo_3$/l	160	75	50	50	125	200
14	Ca mg/l	64	30	20	20	50	80
15	Mg, mg/l	102	28	21	12	42	61
16	Na, mg/l	460	67	23	14	92	161
17	K, mg/l	5	20	14	7	90	68
18	Cl, mg/l	525	78	32	11	184	266
19	So_4^2, mg/l	211	23	17	12	24	67
20	Co_3^2, mg/l	0	0	0	0	0	0
21	HCO3, mg/l	769	250	177	128	384	488
22	Si,mg/l	85.4	4.6	23.5	13.9	25.7	66
23	F, mg/l	1.00	0.88	0.49	0.48	0.51	0.52
24	B, mg/l	0.47	0.11	0.13	0.02	0.12	0.14
25	Total MPN/100 ml	2800	900	800	2800	2800	800
26	Faecal, MPN/100ml	1100	500	260	2800	1100	260
27	SAR	11.7	2.98	1.22	0.85	3.27	4.67

9. Major and medium industries — 76 No.

Cement industries	3 nos.
Sugar industry	1 no.
Textiles / spinning	24 nos.
Chemical and chemical products	
Including match industries	5 nos.
Metal and metal powder industries	6 nos.

Printing industries	31 nos.
Rubber industry	1 no.
Other industries manufacturing, Electronics, etc.	5 nos.
Small Scale Industires	**9486 Nos.**
1. Food products	702
2. Tobacco products	47
3. Cotton Textile products	441
4. Wool, Silk, Fibre products	88
5. Jute, Henfo, Mesta textiles	5
6. Textile products	260
7. Wood products	822
8. Paper products	1143
9. Leather products	26
10. Petroleum, Rubber products	365
11. Chemical products	3966
12. Non metal, mineral products	191
13. Basin metal Alloys products	24
14. Metal products	458
15.Machine tool products	251
16. Electrical machinery products	173
17. Transport Equipment products	218
18. Other products	306

10. Weeds

S. No.	Location	Taluk	Plant identified
1.	Kondaneri tank	Rajapalayam	Water hyacinth
2.	Periyathikulam tank	Rajapalayam	Water hyacinth
3.	Valaikulam	Srivilliputhur	Ipomea carnea
4.	Vasudeva nallur Periyakulam tank- left flank surplus course of Kalingalar river, a tributary of Nichabanadhi	Sivagiri taluk Vasudevanallur block	Ipomea carnea (Veli Kathan)
5.	Melapannandhikulam tank fed by Rasingaperikal of Ullar river	"	"
6.	South of Panaiyur village in	Sankaran koil	"

	Nichabanadhi river	taluk	
7.	South of Ammankulam village	"	"
8.	South of Thamarai anicut at Pandyan Nagar hamlet.	"	"
9.	Chinthalakarai, Meenakshipuram Karuppur, Thalaikattupuram and Vilathikulam	Vilathikulam taluk	Water hyacinth, Water lilly and Ipomea carnea

11. Soil Alkalinity, Salinity and Acidity

Sl.No.	Types of soil	Taluks Covered	Area in Hectare
1.	Alkaline	Rajapalayam & Srivilliputtur	610
		Sattur & Virudhunagar	1119
		Aruppukkottai & Tiruchuli	678
		Kovilpatti	1270
		Vilathikulam	440
		Total	**4117**
2.	Saline	Rajapalayam & Srivilliputtur	1827
		Sattur & Virudhunagar	1224
		Aruppukkottai & Tiruchuli	155
		Kovilpatti	1600
		Vilathikulam	440
		Total	**5246**
3.	Acidi	Rajapalayam & Srivilliputtur	290

12. Soil erosion

S.No	TALUK	Water shed Name	Extent	Villages Covered
1.	Rajapalayam	Solaiseri	High	Mettupatti, Solaiseri, Sundarajapuram.
		Sundarajapuram	High	Sundarajapuram, Solaiseri
		Mettupatti	High	Mettupatti, reserve forest
2.	Srivilliputtur	Khansapuram	Very High	Khansapuram
		S. Kodikulam	Very High	S. Kodikulam

3.	Sattur	Gangarkottai	High	Gangarkottai, Panduvarpatti
		O. Reddiapatti	High	O. Reddiapatti, Muthandipuram, Elayirampannai Gangarakottai
		Panayadipatti - I	High	Panayadipatti, Achankulam, Servaikkaranpatty, Elayirampannai, Gangarakottai.
		Panayadipatti - II	Very High	Panayadipatti, Vijayakarisalkulam, Thayilpatti, Ehirkottai, Kangarseval, Vembakottai.

13. Population

Districts	Region	Population		
		Persons	Male	Female
Madurai	Total	2562279	1295124	1267155
	Rural	1129028	569988	559040
	Urban	1433251	725136	708115
Virudhunagar	Total	1751548	870820	880728
	Rural	974186	482821	491365
	Urban	777362	387999	389363
Tirunelveli	Total	2801194	1372082	1429112
	Rural	1499062	729830	769232
	Urban	1302132	642252	659880
Thoothukudi	Total	1565743	764087	801656
	Rural	903811	437599	466212
	Urban	661932	326488	335444

14. Literacy level

Districts	Literate		
	Persons	Male	Female
Madurai	1795751	1003506	792245
Virudhunagar	1152516	650601	501915
Tirunelveli	1917238	1041964	875274
Thoothukudi	1140959	598669	542290

Population details of Tamil Nadu

District wise population of Tamil Nadu

State/District	Area (Sq. km)	Population								
		Total			Rural			Urban		
		Total	Male	Female	Total	Male	Female	Total	Male	Female
Tamil Nadu	130058	62405679	31400909	31004770	34921681	17531494	17390187	27483998	13869415	13614583
Chennai	174	4343645	2219539	2124106	---------- Not Arise ----------			4343645	2219539	2124106
Kancheepuram	4433	2877468	1457242	1420226	1342502	676095	666407	1534966	781147	753819
Thiruvallur	3424	2754756	1397407	1357349	1244674	629052	625622	1500082	768355	731727
Cuddalore	3678	2285395	1150908	1134487	1531034	771786	759248	754361	379122	375239
Villupuram	7217	2960373	1492442	1467931	2533456	1277415	1256041	426917	215027	211890
Vellore	6077	3477317	1741083	1736234	2169319	1088090	1081229	1307998	652993	655005
Thiruvannamalai	6191	2186125	1095859	1090266	1785364	895738	889626	400761	200121	200640
Salem	5220	3016346	1563633	1452713	1626162	852453	773709	1390184	711180	679004
Namakkal	3429	1493462	759551	733911	948230	482365	465865	545232	277186	268046
Dharmapuri	9622	2856300	1473597	1382703	2400354	1240122	1160232	455946	233475	222471
Erode	8209	2581500	1309278	1272222	1387537	705436	682101	1193963	603842	590121
Coimbatore	7469	4271856	2176031	2095825	1451653	734699	716954	2820203	1441332	1378871
The Nilgiris	2549	762141	378351	383790	307532	151874	155658	454609	226477	228132
Tiruchirappalli	11096	2418366	1208534	1209832	1279204	638617	640587	1139162	569917	569245
Karur		935686	465538	470148	624430	310922	313508	311256	154616	156640

Perambalur		493646	24614	247505	414426	206807	207619	79220	39334	39886
Ariyalur		695524	346763	348761	616539	307670	308869	78985	39093	39892
Thanjavur	3397	2216138	1096638	1119500	1467577	726493	741084	748561	370145	378416
Nagapattinam	2716	1488839	739074	749765	1158557	576010	582547	330282	163064	167218
Thiruvarur	2161	1169474	580784	588690	932231	463502	468729	237243	117282	119961
Pudukottai	4651	1459601	724300	735301	1211217	600511	610706	248384	123789	124595
Madurai	6565	2578201	1303363	1274838	1134025	573036	560989	1444176	730327	713849
Theni		1093950	552986	540960	502109	255152	246957	591841	297834	294007
Dindigul	6058	1923014	968137	954877	1249762	629073	620689	673252	339064	334188
Ramanathapuram	4232	1187604	583376	604228	885210	433290	451920	302394	150086	152308
Virudhunagar	4288	1751301	870376	880925	973956	482666	491330	777345	387750	389595
Sivagangai	4086	1155356	566947	588409	829272	405093	427179	326084	161854	164230
Tirunelveli	6810	2723988	1333939	1390049	1415742	388797	726945	1308246	645142	663104
Thoothukudi	4621	1572273	766823	805450	907500	439254	468246	664773	327569	337204
Kanyakumari	1685	1676034	832269	843765	582107	289516	292591	1093927	542753	551174

Source: Statistical Handbook of Tamil Nadu 2005

District wise literates in Tamil Nadu

State/District	Literates								
	Total			Rural			Urban		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
Tamil Nadu	40524545	22809662	17714883	20319498	11835689	8483809	20205047	10973973	9231074
Chennai	3336695	1799981	1536714	---------- Not Arise ----------			3336695	1799981	1536714
Kancheepuram	1952198	1088943	863255	791700	457846	333854	1160498	631097	529401

Thiruvallur	1865707	1047763	817944	736374	427393	308981	1129333	620370	508963
Cuddalore	1420488	820726	599762	872343	521901	350442	548145	298825	249320
Villupuram	1650528	977374	673154	1347727	809944	537783	302801	167430	135371
Vellore	2203552	1245076	958476	1276373	741671	534702	927179	503405	423774
Thiruvannamalai	1297151	761403	535748	1014930	605600	409330	282221	155803	126418
Salem	1734442	1021772	712670	819312	506149	313163	915130	515623	399507
Namakkal	903802	526412	377390	538212	320242	217970	365590	206170	159420
Dharmapuri	1516221	906943	609278	1204910	733162	471748	311311	173781	137530
Erode	1521955	887907	634048	726792	440042	286750	795163	447865	347298
Coimbatore	2945278	1648814	1296464	847250	493911	353339	2098028	1154903	943125
The Nilgiris	541099	296573	244526	202668	113834	88834	338431	182739	155692
Tiruchirappalli	1673478	926354	747124	787843	455246	332597	885635	471108	414527
Karur	566728	328103	238625	345850	206907	138943	220878	121196	99682
Perambalur	286197	167406	118791	230818	137385	93433	55379	30021	25358
Ariyalur	388605	232385	156220	334760	202879	131881	53845	29506	24339
Thanjavur	1476256	814354	661902	912445	515621	396824	563811	298733	265078
Nagapattinam	996580	548142	448438	751618	418324	333294	244962	129818	115144
Thiruvarur	788302	435421	352881	608297	340202	268095	180005	95219	84786
Pudukottai	907376	520281	387095	719477	419697	299780	187899	100584	87315
Madurai	1776654	991010	785644	673502	397156	576346	1103152	593854	509298
Theni	692797	398150	294647	2932508	174522	118686	399589	223628	175961
Dindigul	1181746	681698	500048	710461	421948	288513	710461	421948	288513
Ramanathapuram	757344	421041	336303	534155	302194	231961	223189	118847	104342
Virudhunagar	1136574	641062	495512	586525	339594	246931	550049	301468	248581
Sivagangai	738000	414755	323245	491768	283769	207999	246232	130986	115246
Tirunelveli	1829064	997278	831786	891282	490721	400561	937782	506557	431225
Thoothukudi	1131406	593868	537538	622745	329518	293227	508661	264350	244311
Kanyakumari	1308322	668667	639655	446153	228311	217842	862169	440356	421813

Source: Statistical Handbook of Tamil Nadu 2005

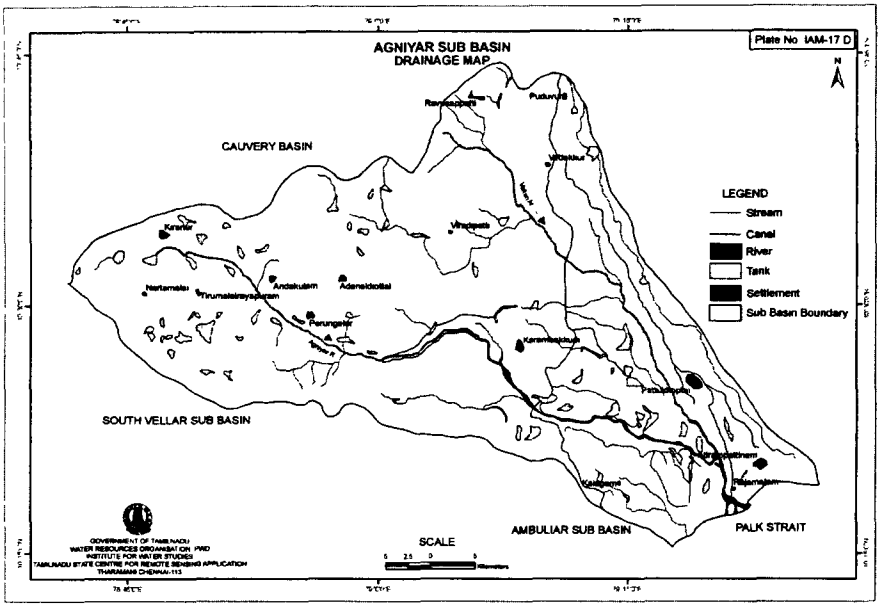
District wise Scheduled Castes population

State/District	Scheduled Castes								
	Total			Rural			Urban		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
Tamil Nadu	11857504	5932925	5924579	8308890	4159182	4149708	3548614	1773743	1774871
Chennai	598110	301835	296275	---------- Not Arise ----------			598110	301835	296275
Kancheepuram	721989	362097	359892	496932	249258	247674	225057	112839	112218
Thiruvallur	600658	301316	299542	400496	200050	200446	200362	101266	99096
Cuddalore	634479	318713	315766	514729	359264	255465	119750	59449	60301
Villupuram	810931	408234	402697	740441	373085	367356	70490	35149	35341
Vellore	714054	354551	359503	505677	251749	253928	208377	102802	105575
Thiruvannamalai	467532	233572	233960	412993	206740	206253	54539	26832	27707
Salem	475738	244391	231347	288559	149374	139185	187179	95017	92162
Namakkal	280776	143014	137762	212849	108271	104578	67927	34743	33184
Dharmapuri	416951	212136	204815	363285	185061	178224	53666	27075	26591
Erode	422204	213312	208892	273677	138667	135010	148527	74645	73882
Coimbatore	630675	315869	314806	310714	156044	154670	319961	159825	160136
The Nilgiris	238014	117792	120222	85485	42423	43062	152529	75369	77160
Tiruchirappalli	399493	197917	201576	261417	129181	132236	138076	68736	69340
Karur	190260	94194	96066	144327	71518	72809	459933	22676	23257
Perambalur	149145	73866	75279	128590	63753	34837	20555	10113	10442
Ariyalur	151220	75326	75894	140236	69792	70444	10984	5534	5450
Thanjavur	399653	198820	200833	332385	165344	167041	67268	33476	33792
Nagapattinam	441231	219933	221298	399441	199346	200095	41790	20587	21203
Thiruvarur	378314	188682	189632	342530	171053	171477	35784	17629	18155
Pudukottai	249471	123701	125770	221161	109583	111578	28310	14118	14192
Madurai	323252	162595	160657	223475	112697	110778	99777	49898	49879
Theni	211800	107109	104691	116509	59274	57235	95291	47835	47456
Dindigul	376170	189066	187104	269809	135694	134115	106361	53372	52989
Ramanathapuram	216312	107381	108931	186059	92158	93901	30253	15223	15030
Virudhunagar	332297	164930	167367	239324	118805	120519	92973	46125	46848
Sivagangai	188857	92590	96267	159256	77886	81370	29601	14704	14897
Tirunelveli	481052	233605	247447	294885	142786	152099	186167	90819	95348
Thoothukudi	288954	143013	145941	216801	107116	109685	72153	35897	36256
Kanyakumari	67712	33365	34347	26848	13210	13638	40864	20155	20709

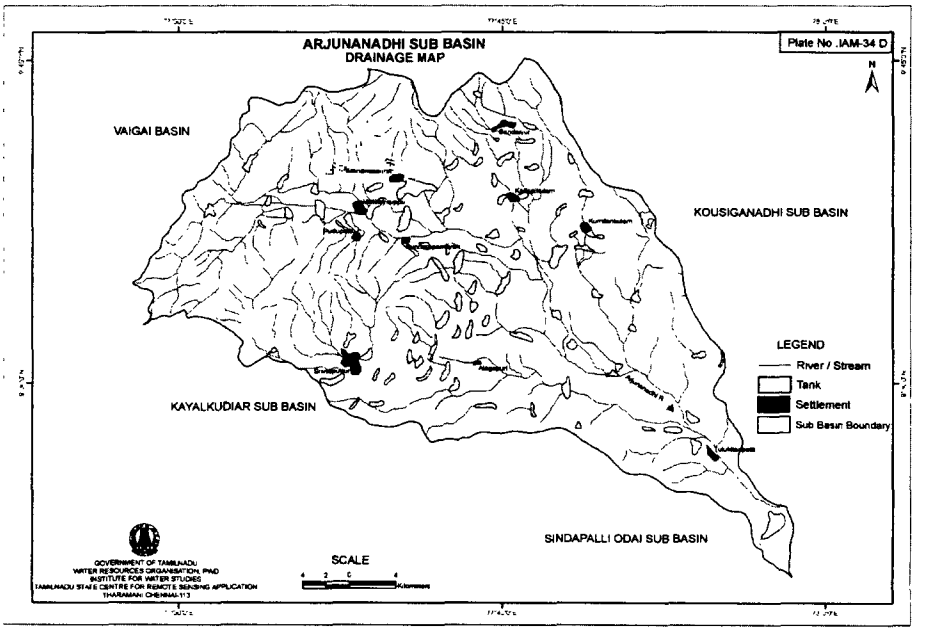
District wise Scheduled Tribes population

State/District	Scheduled Tribes								
	Total			Rural			Urban		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
Tamil Nadu	651321	328917	322404	551143	278746	272397	100178	50171	50007
Chennai	6728	3368	3360	---------- Not Arise ----------			6728	3368	3360
Kancheepuram	26508	13267	13241	18062	9066	8996	8446	4201	4245
Thiruvallur	37858	18880	18978	28885	14466	14419	8973	4414	4559
Cuddalore	11773	5920	5853	7241	3641	3600	4532	2279	2253
Villupuram	63920	32294	31626	61687	31149	30538	2233	1145	1088
Vellore	63040	31860	31180	58237	29455	28782	4803	2405	2398
Thiruvannamalai	72760	36928	35832	69198	35129	34069	3562	1799	1763
Salem	103921	52693	51228	98722	49988	48734	5199	2705	2494
Namakkal	51416	26039	25377	50454	25552	24902	962	487	475
Dharmapuri	59549	30520	29029	57763	29592	28171	1786	928	858
Erode	17693	8933	8760	15120	7573	7547	2573	1360	1213
Coimbatore	29103	14738	14365	19559	9880	9679	9544	4858	4686
The Nilgiris	28373	14017	14359	19600	9753	9847	8773	4261	4512
Tiruchirappalli	18912	9596	9316	14383	7324	7059	4529	2272	2257
Karur	1450	711	739	1075	533	542	375	178	197
Perambalur	3307	1708	1599	2768	1423	1345	539	285	254
Ariyalur	8529	4228	4301	7907	3926	3981	622	302	320
Thanjavur	3641	1773	1868	1302	649	653	2339	1124	1215
Nagapattinam	3420	1734	1686	1618	824	794	1802	910	892
Thiruvarur	2673	1310	1363	971	493	478	1702	817	855
Pudukottai	792	398	394	432	214	218	360	184	176
Madurai	5972	3060	2912	2054	1074	980	3918	1986	1932
Theni	1686	855	831	1046	531	515	640	324	316
Dindigul	6484	3320	3164	3512	1773	1739	2972	1547	1425
Ramanathapuram	1078	556	522	396	212	184	682	344	338
Virudhunagar	2357	1158	1199	953	485	468	1404	673	731
Sivagangai	1083	536	547	375	190	185	708	346	362
Tirunelveli	8358	4080	4278	3202	1574	1628	5156	2506	2650
Thoothukudi	3494	1762	1732	1060	504	556	2434	1258	1176
Kanyakumari	5443	2678	2765	3561	1773	1788	1882	905	977

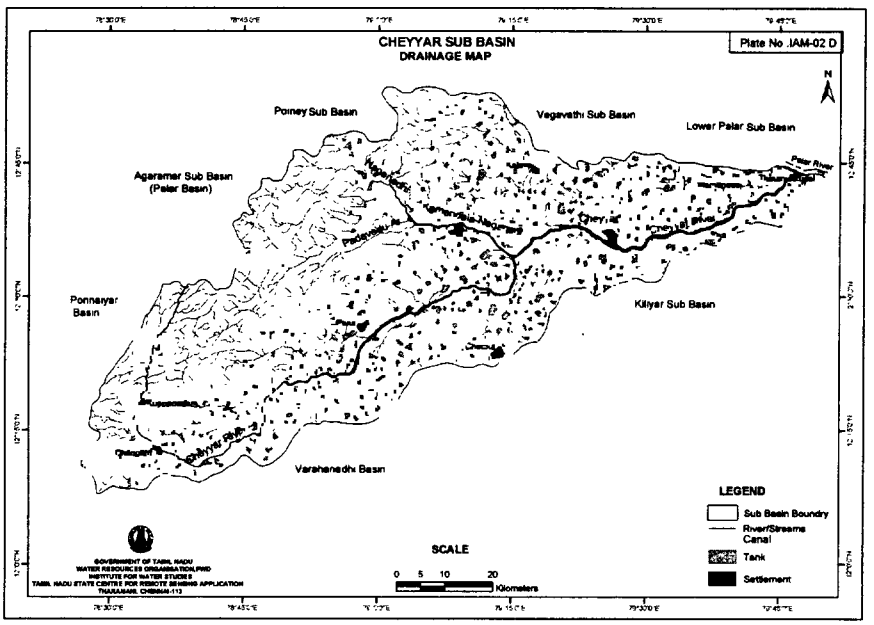
Agniyar Sub Basin (Drainage Map)



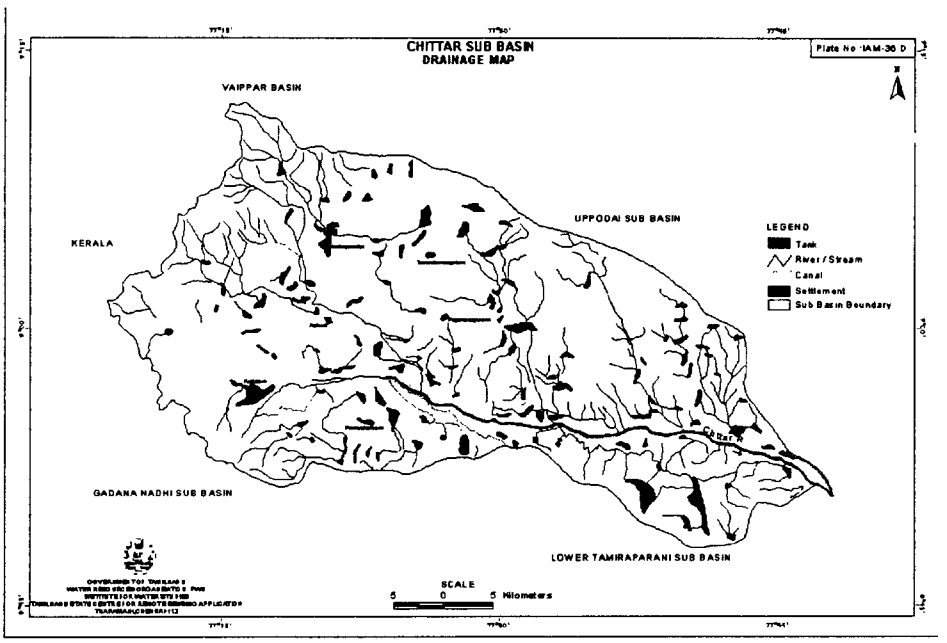
Arjunanadhi Sub Basin (Drainage Map)



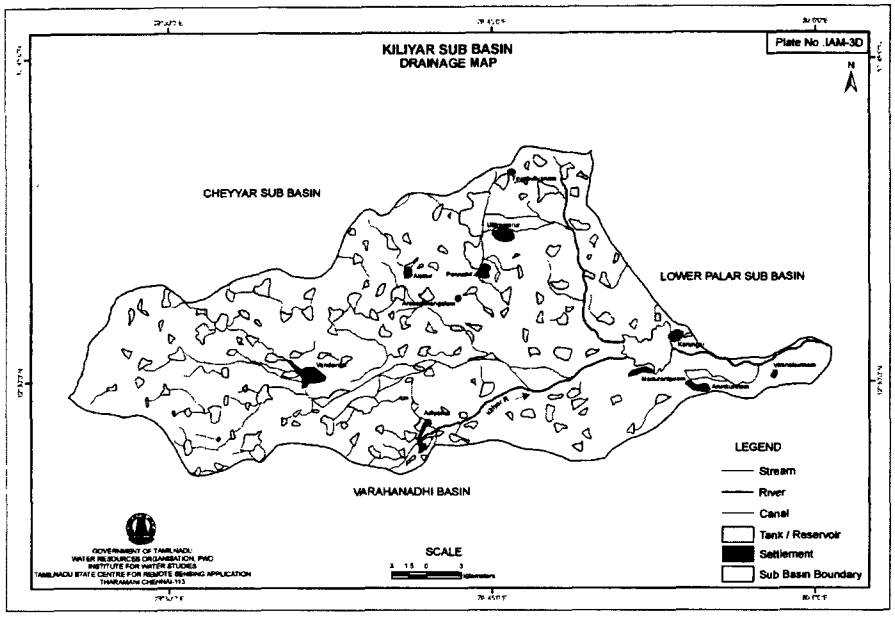
Cheyyar Sub Basin (Drainage Map)



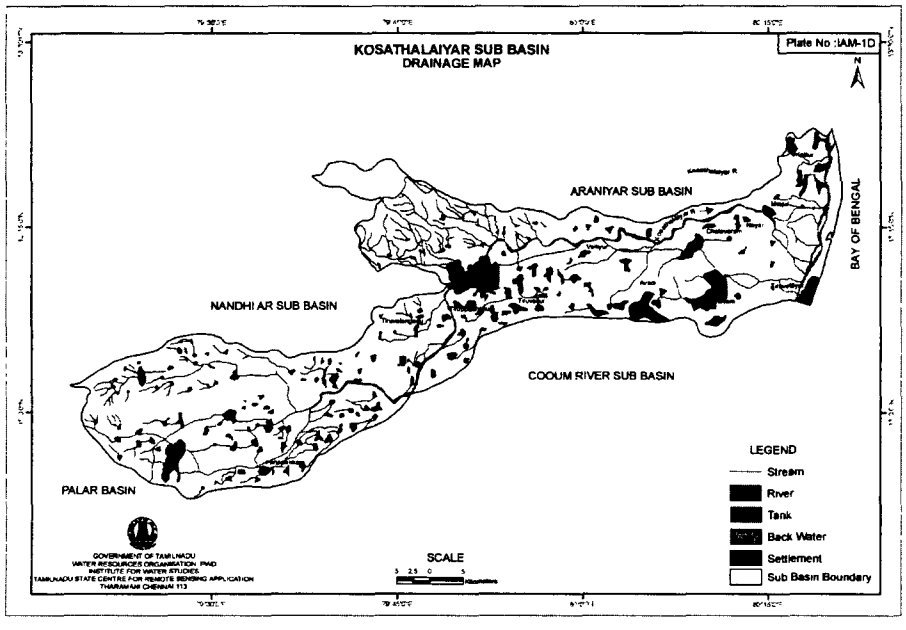
Chittar Sub Basin (Drainage Map)



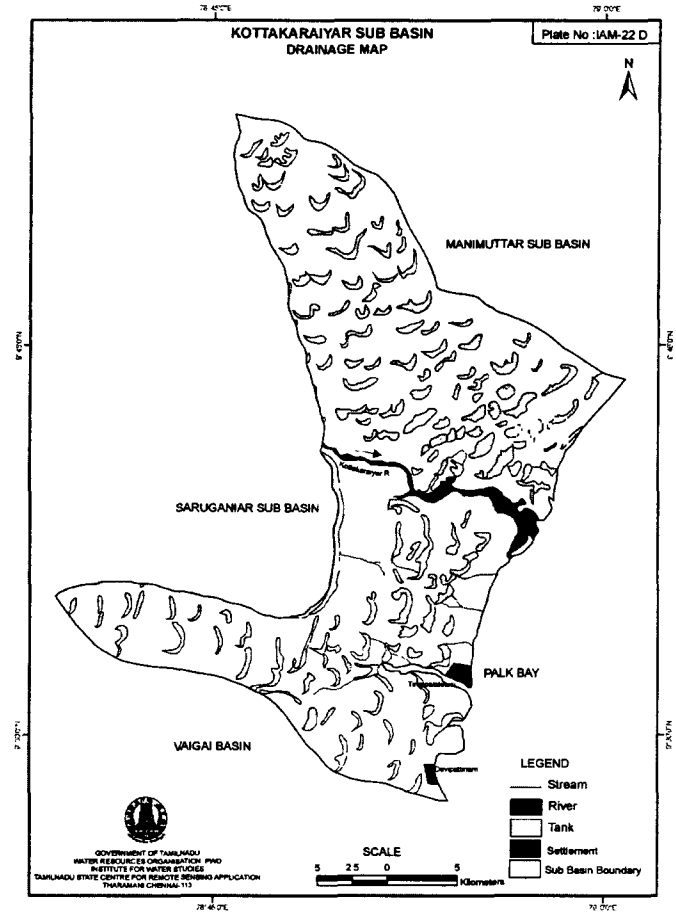
Kiliyar Sub Basin (Drainage Map)



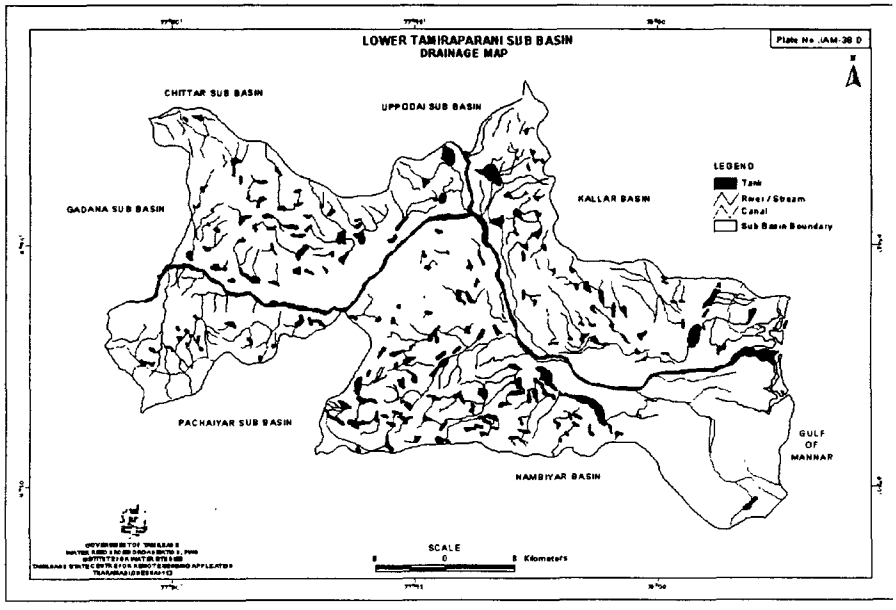
Kosathaliyar Sub Basin (Drainage Map)



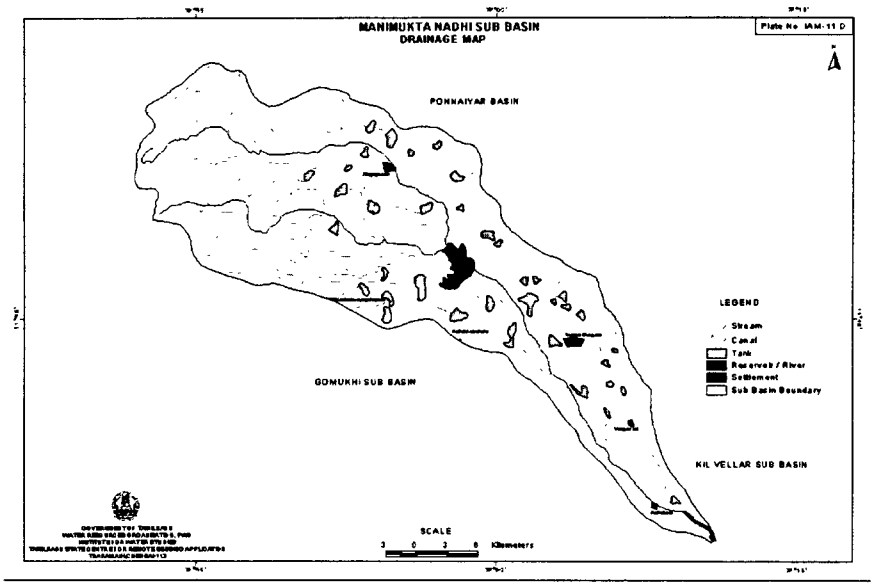
Kottakaraiyar Sub Basin (Drainage Map)



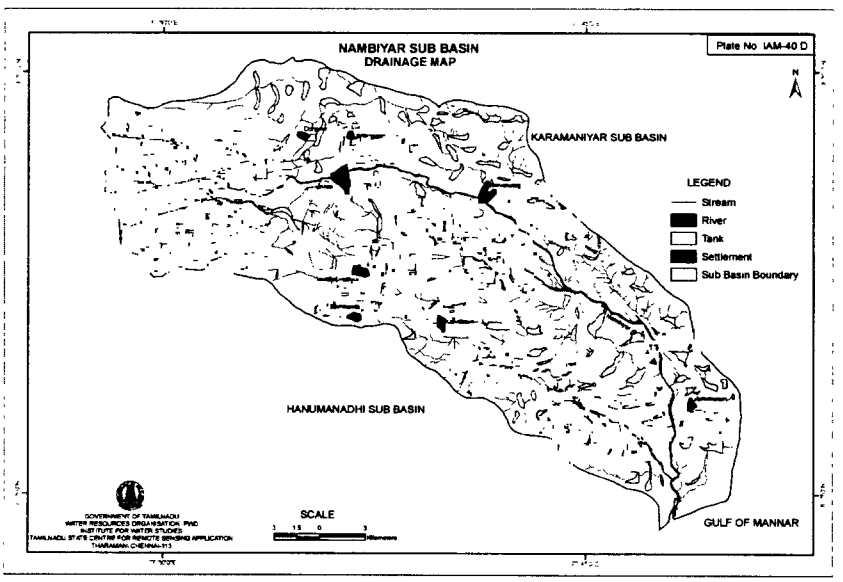
Lower Tamiraparani Sub Basin (Drainage Map)



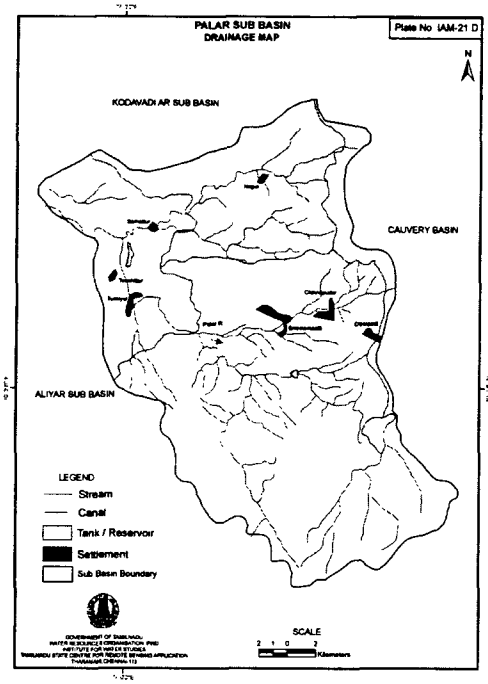
Manimukthanadhi Sub Basin (Drainage Map)



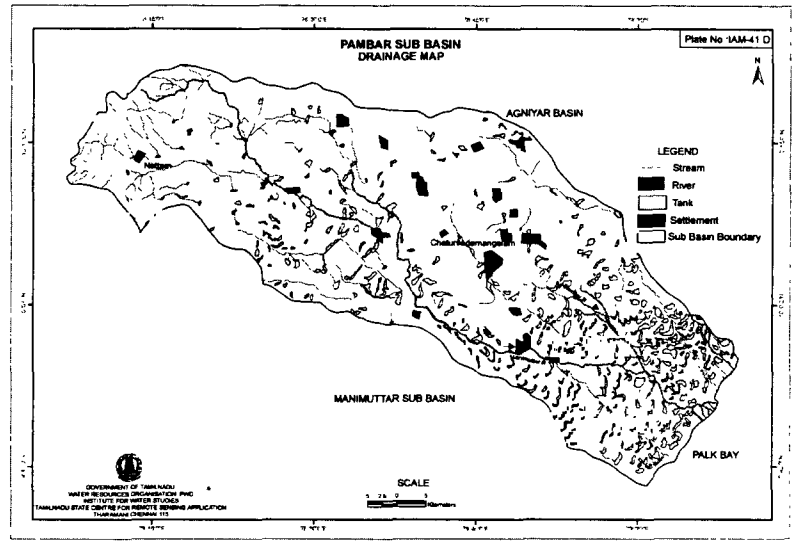
Nambiyar Sub Basin (Drainage Map)



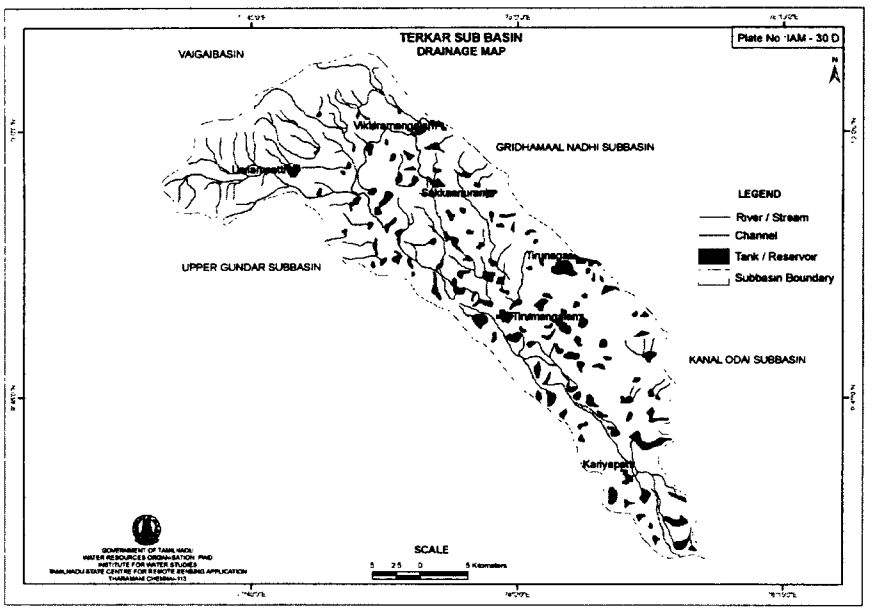
Palar Sub Basin (Drainage Map)



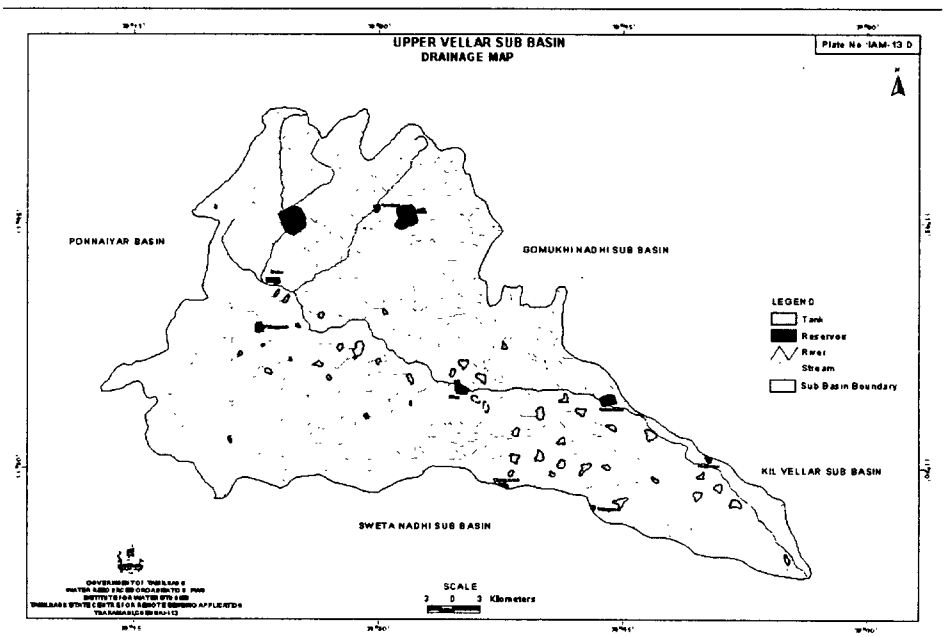
Pambar Sub Basin (Drainage Map)



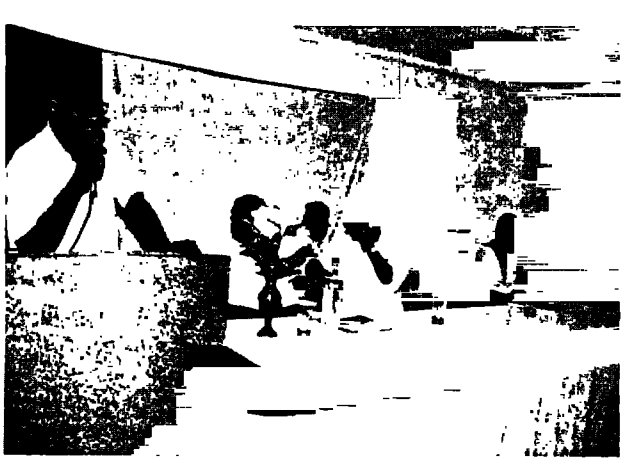
Terkar Sub Basin (Drainage Map)

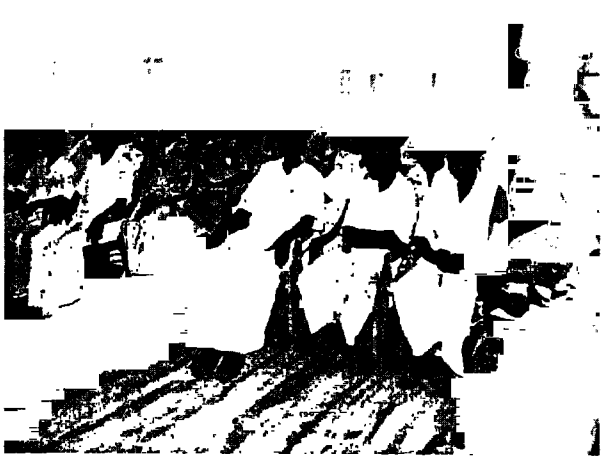


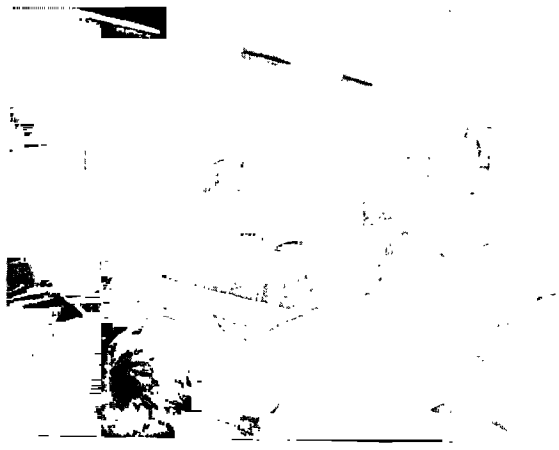
Upper Vellar Sub Basin (Drainage Map)

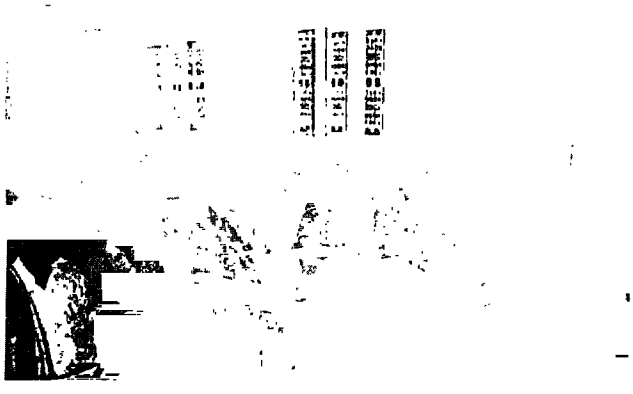


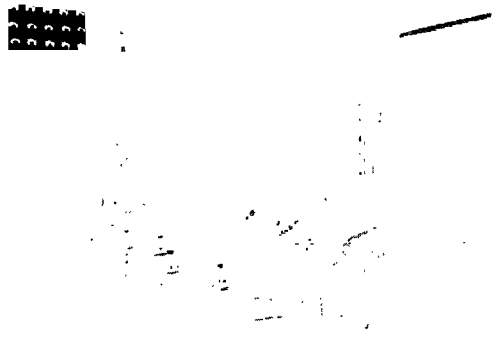
STAKEHOLDER CONSULTATIVE WORKSHOPS AT RIVER BASINS OF TAMIL NADU

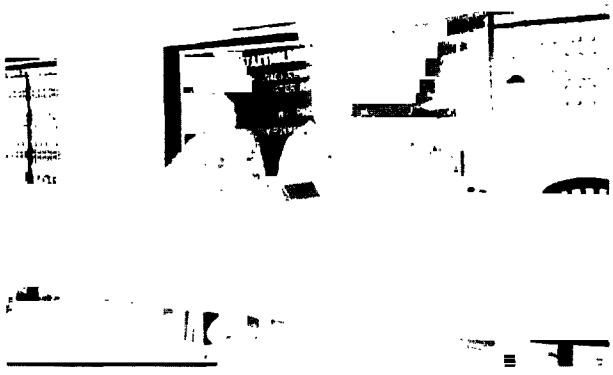












DAM SAFETY

Introduction

In pursuance of the resolution of the first conference of State Ministers of Irrigation held at New Delhi during July 17-18. 1975, Dam Safety Organization was established in the Central Water Commission in June 1979 to assist the State Governments to identify causes affecting safety of dams and allied structures and to render advise in providing suitable remedial measures. After carrying out detailed studies the organization has issued guidelines for Safety Inspection of dams.

Rationale For Dam Safety Plan

Dams are major structures storing large quantities of water and any out right failure may cause serious damage to Jives and property on the downstream. Even a partial failure may gradually lead to destruction and loss of effectiveness of the structure to hold water and provide benefits for which it was built. It is therefore, essential that the Dams are designed and constructed with meticulous care and maintained as stipulated in the O & M Manuals. In spite of this, it is possible that they develop conditions of distress or failure due to factors such as excess flow and deformations and failures due to improper evaluation and consequent design of foundations or unprecedented seismic conditions. To meet the normal day-to-day operational conditions and to account for unexpected conditions of water flow, the geology and seismicity, institutional capacity, work procedure and plan are essential.

Tamil Nadu Dam Safety Directorate

Dam safety Directorate in Tamil Nadu was established in 1991 to carry out regular monitoring works of all large dams for both PWD & TNEB as per the guidelines of the CWC.

Dam Safety Assurance & Rehabilitation Project (Dam Safety Project – 1) funded by the World Bank was carried out during the years 1991-98. Some of the important works carried out by the Sam Safety Directorate are as :

1. Preparation of Health Status Report of PWD & EB dams for 106 nos. for 4 monsoon periods in a year viz Pre Monsoon, Monsoon-I, Monsoon-II and Post Monsoon periods and sending them to Government and all the Regional Chief Engineers of PWD & TNEB for carrying out remedial works to the deficiencies pointed out therein and follow up action

2. Carrying out Phase-I inspection of all dams in a cycle of five years, by a Dam Safety Panel of five members headed by the Director, Dam Safety Directorate. Atleast 25 dams are to be covered in a year and inspection reports are to be prepared for taking follow up action on them.

3. Carrying Phase-II detailed investigation by an independent panel of experts for the required distressed dams.

4. Form the Health Status Reports of the four monsoon periods, Annual Consolidated Health Status Report is prepared and sent to Central Water Commission every year.

Now the Dam Safety and Improvement Project (DRIP) is likely to be approved by the World Bank in March 2006. Tamil Nadu is also included in the project. The total project cost is USD 400 million and the project period is six years. The implementation of the project is to be monitored by Dam Safety Directorate.

Dam Rehabilitation & Improvement Project (DRIP)

The following works are proposed under this project which is to be implemented with the World Bank assistance.

1. Adopting modern design tools in the dam safety works.
2. Carrying out dam safety status inventory & updating on a GIS platform.
3. Conducting Dam Brake analysis, Emergency Action Plan & preparation of inundation maps for few selected dams.
4. Organizing training in dam safety.
5. Arranging and accompanying with the Dam Safety Expert Committee inspection and interacting with them. Arranging collection of field particulars called for by them, follow up action on their inspection reports etc are to be carried out by the Dam Safety Directorate.
6. Getting approval of the World Bank for the bids in time.
7. The project shall be carried out as per Central Water Commission guidelines and their vetting are to be obtained them and there.
8. Consultancies are to be field for hydrology and review of for dams if not already done.
9. Prompt monitoring of execution of works by the Regional Chief Engineers are to be done by Dam Safety Directorate.
10. Any other dam safety works which will be taken in the course of the project.

The following project proposals are included under the project.

Project proposals under the Dam Rehabilitation and Improvement Project (DRIP)

Component – I: Institutional Strengthening

Sl.No.	Description	Estimated Cost Rs. in Million
1.	Strengthening the Dam Safety Directorate with total staff strength of 34 nos. (staff salary for the project period of six years)	26.60
2.	Organising Training on Dam Safety to the WRO personnel both National and International.	6.40

3.	Cost of Dam Safety Expert Committee (National Expert Team) visits for the project.	11.00
	Total	**44.00**

Component – II : Revised proposals for Dam Rehabilitation and Improvement

Sl.No.	Name of Dam and works proposed	Amount Rs. in Million	Identified rank
1.	**Pechiparai Dam** Providing upstream face treatment	90.00	1
2.	**Manimuthar Dam** Providing upstream face treatment	81.70	2
3.	**Perunchani Dam** i. Providing additional spillway. ii. Gates & hoists for additional spillway iii. Providing backing concrete.	200.00	3
4.	**Ponnaiar Dam** Providing fuse plug	35.00	4
5.	**Manimukthanadhi Dam** i. Standardization of earthern bund ii. Rehabilitation of stilling basin iii. Providing surplus regultor	39.00	5
6.	**Siddhamalli Dam** Providing breaching section	25.00	6
7.	**Amaravathy Dam** Rehabilitation of Amaravathy Dam with the following works: i. Special repairs to the Right side apron and revetments of Amaravathy River bridge below Amaravathy Dam. ii. Special repairs to the left side ghat road and Dam top road left flank of earth dam of Amaravathy Dam. iii. Special repairs to the right side ghat road and Dam top road right flank of earth dam of Amaravathy Dam iv. Special repairs to approach road from (D/S side of Dam) entrance gate to AMC culvert @ Amaravathy Nagar. v. Special repairs to approach road from AMC culvert (D/S side of Dam) to Kallapuram Regulator at Amaravathy Nagar. vi. Construction of additional Generator room @ Amaravathy Dam. vii. Providing lightening arrester and lighting arrangement in the earth dam portion of Amaravathy Dam. viii. Providing Additional 70 KVA Generator set in Amaravathy Dam. ix. Replacement of rubber seals in spillway, River sluice and canal sluice etc. in Amaravathy Dam. x. Rehabilitation of Earth Dam of Amaravathy Dam (raising the right flank bund, filling the cracks, reconstructing parapet wall, and forming black topped road etc.)	7.00	7
8.	**Vaigai Dam** Rehabilitation and strengthening measures to masonry dam, earth dam pick up anicut and link canal	60.00	8
9.	**Parambikulam Dam** Rehabilitation of Parambikulam Dam and earth saddle dam at Parambikulam in Palghat District	10.65	9
10.	**Aliyar Dam** Rehabilitation and moderisation of Aliyar Dam and its appurtenant	13.625	10

	structures under PAP system.		
11.	**Kodaganar Dam** Rehabilitation of shutters of old regulator and stilling basin and leading channel of right and left main canal.	13.95	11
12.	**Karuppanadhi Dam** Rehabilitation to embankment, river sluice gate and parapet wall.	4.50	12
13.	**Gundar Dam** Rehabilitation to embankment and access road	1.00	13
14.	**Gomukhi Dam** Rehabilitation to stilling basin and providing flood bank	4.00	14
15.	**Thirumoorthy Dam** Rehabilitation of earth dams	20.60	15
16.	**Kudhiraiyar Dam** Rehabilitation of Kudhiraiyar Dam	11.00	16
17.	**Lower Nirar Dam and Upper Nirar Weir** Rehabilitation of Lower Dam and Upper Nirar weir with the following works: **Lower Nirar Dam** i. Reaming of drainage shafts and uplift pressure holes. ii. Rehabilitation of spillway oghee portion, tunnel entry revetment and downstream revetment iii. Rehabilitation of ghat road leading from lower Niar Dam to Cinchona I.B. and road lead to left flank of lower Nirar Dam. **Upper Nirar Dam** i. Rehabilitation of oghee spillway portion entry revetment and cone rap revetment at upper Nirar Weir. ii. Rehabilitation of revetment to the right flank of leading channel to upper Nirar tunnel from 74 M to 110 M downstream left flank and right flank side revetment at Upper Nirar Weir.	6.80	17
18.	**Noyyal-Athupalayam Reservoir** Rehabilitation of Noyyal-Athupalayam Reservoir	6.74	18
19.	**Thunnakkadavu & Peruvari Pallam** Rehanilitation of Thunnakkadavu and Peruvari Pallam Dams with the following works. i. Special repairs to spillway pointing and construction of a gauge weir at Thunnacadavu Dam. ii. Special repairs to roads of Thunacadavu Dam.	10.30	19
	iii. Special repairs to Chutes and revetment of Thunacadavu Dam.		

	iv. Construction of masonry retaining wall above rock level from LS 1220 m to 3673 m ('4000 to 12050') of leading channel from Thunacadavu Reservoir to SPT entry. v. Desilting the leading channel from Thunnacavadu Reservoir to SPT entry. vi. Providing power supply arrangements @ 4000' of leading channel from Thunacadavu Reservoir to Sarkarpathy Tunnel Entry. vii. Supply of 12.5 KVA generator stand by to Thunacadavu Dam. viii. Special repairs to chutes, revetment and top drain of Peruvaripallam Dam. ix. Special repairs to roads of Peruvaripallam Dam.		
20.	**Ramanadhi Dam** Rehabilitation to access road, revetment, sluice shutter and parapet wall	13.00	20
21.	**Gatana Dam** Rehabilitation to access road, revetment and parapet wall	5.00	21
22.	**Polar Porundalar Dam** Rehabilitation of parapet wall, pointing the masonry and painting structures.	5.70	22
	Total	**664.565 or 665.00**	

Total cost for Component I & II = Rs. 709 Millions.

Action Plan

"Guidelines for Safety Inspection of Dams" issued by CWC gives a detailed description of works related to inspection and analysis for assessing safety of an existing dams. These are to be followed in conjunction with the CWC publication, which describes all the items in detail.

Size Classification

Size classification is done based on storage or height whichever gives the large size category as per Table

Table: Size classification

Category	Storage (ha)	Height (m)
Minor	<12.5 and ≥6	<12 and ≥8
Medium	≥12.5 and <6250	≥12 and <30
Major	≥6250	≥30

Selection of Dams to be investigated

The selection of dams to be investigated should be based upon an assessment of existing developments in flood hazard area. Dams that are high or having a significant hazard potential should be given first and second priorities, respectively. Inspection priorities within each category should be developed from a consideration of factors such

as size class, age of the dam, population size in the downstream flood area and potential developments anticipated in flood hazard areas. Engineering data for all the dams in a basin/sub-basin should be collected as per Format 1.

Field inspection

The field inspection of the dam, appurtenant structures, reservoir area, and downstream channel in the vicinity of the dam should be conducted in a systematic manner to minimize the possibility of any significant feature being overlooked. Based on the guidelines issued by CWC and the findings of the field works conducted for ESA-TN-IAM WARM, a checklist is prepared and presented in Format 2.

Evaluation of Hydraulic and Hydrologic features

The spillway capacities and free board allowances of a very vulnerable dam should be adequate to insure against failure of the dam during the most severe flood or sequence of floods considered reasonably possible irrespective of the apparent infrequency of occurrence of controlling conditions

Evaluation of Structural stability

This should be based on design and construction data, operating records post construction changes and seismic stability. If required more detailed investigation and analysis should be carried out as per "Phase II- Investigation" In addition, accessibility of the dam sites and control structures should be assessed. Proper public awareness programmes should be implemented for the population may be affected by any catastrophic condition or failure of dam. Representatives of population residing downstream of the dam should be involved in operation and maintenance of the dams.

Action plan for dam safety at different stages

Keeping in view the foregoing, a summary action plan is suggested as below:

(A) New Dams

New Dams shall be investigated, designed and constructed as per the guidelines, procedures, IS codes and the state-of-the art dam engineering. However, the designs can also be verified by the Dam Safety Organization of the state. It is necessary that a complete report giving all the details of hydrological evaluations, geological data and analysis, Construction material quality and construction details and all data and drawings be prepared along with the completion of the project. Work on this should be commenced by the Chief Engineer in-charge when 50% of the project work is completed. The report should contain all important drawings of the dam as constructed, including geological features, technical and quality control data that need to be kept for posterity. Preparation of design memorandum of all the aspects of design is a good practice, which should be applied to major and medium projects. It is desirable that all major and medium projects

are guided by a panel of experts even from the stage of design, if not investigation, till the project is completed. Each project should have an operation and maintenance manual prepared in consultation with the design and construction engineers. In addition, for each project, a disaster preparedness plan is to be prepared.

(B) Old Dams

(i) Pre- Planning Stage

All dams should have completion reports giving all requisite topographical, hydrological and geological details and construction drawings with details of foundations and superstructures and foundation treatment and other special provisions built in. These should be carefully preserved in the office of the Executive Engineer who should inspect once in a year all the dams above 30 m in height under his charge. The Assistant Engineers should inspect every year all the dams in their charge and prepare reports in Format 1 and also indicate, if in their opinion, any malfunction is observed so that the senior officer could look into the same. All inspection reports prepared by the Executive Engineer should be submitted to the Superintending Engineer who will examine these and forward the reports of those dams to the Chief Engineer. The Chief Engineer after considering the recommendations of Superintending Engineer and after making a detailed site visit may recommend these cases to the State Dam safety Organizations for their opinion and further action.

(ii) Planning Stage

Before planning the remedial measures, the dam would be inspected in detail by the Chief Engineer and / or the Experts in the State Dam Safety organization who will suggest further surveys and investigations, if required. Based on the data of the surveys and investigations, the rehabilitation works will be designed under the supervision of Chief Engineer or the Dam Safety Organization. Thus the planning phase will cover both planning, designs as well as the preparation of specifications and Tender documents

(iii) Implementation Stage

Implementation may be under contract or by department itself depending on the nature and quantum of work that will be executed according to the design. The work will be supervised by the officers In charge of the Dam. As far as major dams are concerned, the rehabilitation works would also be inspected by the Chief Engineer at as close intervals as he considers fit and by other junior officers at time intervals fixed by the Chief Engineer.

(iv) Post Implementation Stage

If the Rehabilitation works are done properly as per specifications under close departmental supervision, the structure is expected to provide benefit for a long time. Still, regular annual inspection is required and minor problems if any, should be attended to immediately.

Knowledge base and Information disclosure

All details of dams shall be incorporated into the knowledge base and used for planning and allocation of investments related to dam safety. This information shall be supplied with simple easily identifiable indicators to the people at risk as a part of information disclosure. This information shall be maintained at the WUA and sub project WRO offices. The contents should include:

- General details and status of the Dam, in terms of safety
- Indicators to identify safety hazards
- The people responsible for the effective functioning, their addresses and phone numbers
- Emergency plan, in case of dam break.

Record Maintained at Site

Records that may be required for proper inspection and maintenance shall be available at site. These should be properly maintained and kept up to date by including latest information available. Data in respect of upstream gauging stations, flood warning system and communication channels, if installed should be properly maintained.

General

1. Final detailed Project Report and details of modifications done during construction and a set of final drawing (as executed)
2. Index Plan of the area in which the dam is located showing important towns, roads, rail routes and communication facilities
3. Index Plan of downstream area showing natural flood zone, flood zones corresponding to spillway design, flood and dam break flood and all important towns/villages and properly laying in these flood zones
4. Contour map of dam site extending up to 200 m or 10 times the dam height (whichever is less) on upstream and downstream, showing all features of the dam like toe lines, fills, drains, relief wells, access roads etc.
5. Record drawings of longitudinal section of dam foundation or cut off trench showing details of foundation stratigraphy, stage wise construction of COT filling and raising of dam, section embankment, zoning details and foundation treatment.
6. Record drawings of cross-sections of dam showing details of foundation treatment, under seepage control, zoning, internal and external drainage all protective arrangements and stage-wise construction
7. Contour plan of dam site with foundation trench showing details of foundation treatment and foundation drainage
8. Contour plan of reservoir basin
9. Contour capacity and area capacity curve
10. Reservoir maps showing silted basin, if observed
11. Plan of the catchment area showing rain gauge stations and capacities of upstream storages
12. Material properties adopted for design
13. Details of design criteria followed

14. Design report on flood studies and spillway design flood
15. Design reports of outlets, power outlets, river sluices, intake, conduit, energy dissipation arrangements and details of gates of hoists
16. Geological data on the foundation and abutments
17. Copies of reports, details of special foundation and abutment treatment carried out
18. Record of tail channel geology and tail channel erosion
19. Instrumentation drawing with details
20. Instrumentation data and behavioural record
21. Details of communication systems such as telephones, wireless etc., directory of important key officers, flood-warning procedures
22. Flood forecasting system
23. Photographs showing various phases of construction, pre-construction etc.

Earth-Rock-fill Dams

1. Stage wise construction record of the dam showing volumes and heights achieved in each season and rate of progress
2. Record of special compaction done near concrete/masonry structures, abutment contracts and outlet locations, if available
3. Summarized records of compaction control, sampling and complete laboratory and field-test results on all recorded samples
4. Foundation details and geology as observed
5. Data of water intake test
6. Detailed drawings and record of relief well observations
7. Design report for the earth dam, covering the under seepage control, stability of embankments and junctions with masonry dam, instruments installed etc.
8. Drawings showing the typical cross sections including zoning, drainage arrangements, and details of slope protections provided for etc., as per actual construction
9. Details and location of instruments embedded / installed in and around the structures
10. Record of corrective measures, repairs and treatment that have been done subsequent to construction
11. Details of design criteria followed
12. Photographs showing all phases of construction
13. Important inspection reports and reports of consultants

Concrete/Masonry Dams

1. Details of construction history including stages of construction particularly in low blocks where considerable time has elapsed prior to resumption of work
2. Summarized data on control tests carried out during construction in respect of concrete, mortar and their constituent materials, if available
3. Reports on hydraulic model studies
4. Drawings showing the details of energy dissipation arrangements including foundation levels of apron, wells and end weir.

5. Details and location of instruments embedded/installed in and around the structure.
6. Summarized data collected by embedded/installed instruments
7. Detailed drawings of all service facilities like internal lighting, emergency lighting, drainage etc.
8. Drawing showing the uplift measurements and pressure relief arrangements
9. Summarized data of uplift pressure observed
10. Summarized data of seepage, leaching in the drainage gallery downstream face of the dam and their locations etc.
11. Record of corrective measures, repair treatment that have been done subsequent to completion
12. Important inspection reports and reports of consultants
13. Details of design criteria followed
14. Photographs showing all phases of construction

Operation and Maintenance

1. Gauge data of the river prior to and after completion of work
2. Detailed observations on flood discharges
3. Detailed observations of hydraulic performance of energy dissipation basins
4. Record of past performance stating briefly the defects developed and remedial measures carried out
5. Drawings of outlets, maximum discharge capacity, maximum design operating head
6. Standing orders regarding operation of the dam
    a. Designers operating criteria
    b. Standard operating procedure
    c. Flood forecasting procedures
    d. Gate operation procedures
    e. Emergency action plan

Format 1: Engineering Data Format

(A) General

- Name of the Dam - Project
- Location - River, Sub-basin, Basin, Village/Tehsil/District/State
- Type of Dam
- Year of completion
- Height of Dam (Elevation, Deepest foundation, River bed, FRL, MWL. Top of Dam)
- Impounding capacity at F.R.L., at M.W.L
- Index map showing location of dam, catchment area, downstream area subject to potential damage due to failure of dam or failure of operating equipment.
- Nearest downstream city, town, village which can be located on the map. Its distances from dam and population.
- Extent of economic development in downstream area.

(B) Project Features

- Salient features,
- Construction drawings indicating plans, elevation and sections of the dam and appurtenant structures including the details of the discharge facilities such as outlet works, spillways and operating equipment
- Emergency preparedness – Communications, Downstream Warning Systems Auxiliary power, Remote Operation and Security of the site

(C) Hydrology

- Description of Drainage basin-Drainage area and basin runoff characteristics
- Design flood-design assumptions and analysis, storage of flood control zone
- Spillway capacity and flood routing criteria
- Area capacity curves
- Elevation of crest, type, width, crest length, location of spillway. Number, size and type of gates
- Type, location, capacity, entrance and exit levels of other outlet works
- Emergency draw down capacity
- Type, location, observations and records of hydro meteorological data

(D) Geology and Foundation

- Rock types, logs of borings of geological maps, profiles and cross-section, location and special problems (fault. shear zones, solutions, channels, etc.)
- Effects of geology on design,
- Adequacy of investigation.
- Foundation treatment, grouting, drainage, etc.
- Cut-off

(E) Construction

- History-including diversion scheme, construction sequence, construction problems, alterations, repairs.

(F) Operation and regulation

- Plan under normal conditions and during floods and other emergency conditions

Flood Warning Systems

(G) Operation record

- Experience during past major floods.

(H) Stability and stress analysis of the dam

- Spillway and appurtenant structures and features including the assumed properties of materials and all pertinent applied loads

(I) Instruments and records of performance observations

- Any known deficiency that may pose a threat to the safety of the dam or to human life and property

FORMAT 2

Proforma for Periodic Inspection of Dams with Ungated Waste Water

Name of Dam :

District :

Circle :

Basin :

SRLD No :

Division :

A. General **Date of inspection**

S No.	Item	Remarks
1.	Name of Project	
2	Purpose of project: water supply / power / multipurpose / irrigation	
3	Name of Dam	
	(a) Latitude and longitude	
	(b) catchment area	
4	Year of completion	
5	First filling (year / levels)	
6	A . Benefits assured:	
	(a) Irrigation (RABI / KHARIF)(Hect)	
	(b) Water supply (Cum)	
	© Other benefits	
	B. Benefits achieved preceding year	
	(a) Irrigation (RABI / KHARIF)(Hect)	
	(b) Water supply	
	© Other benefits	
7.	Important controlling levels (in meters)	
	(a) Top of dam	
	(b) Maximum	

	© Full reservoir level	
	(d) Sill level of irrigation sluice	
	(e) Spillway crest level	
	(f) Minimum draw down level	
	(g) Lowest river bed level	
	(h) Deepest foundation level	
8.	Salient Features	
	(a) Dead storage capacity	
	(b) Area of foreshore at FRL	
	© Design flood adopted (PMF/SPF/ any other)	
	(d) Design spillway discharge capacity. Type and length of spillway with location	
	(e) Location still level and capacity of low level outlets and scouring sluices	
	(f) Height of the dam Above deepest foundation Above lowest river bed	
	(g) Gross storage capacity At FRL At MWL	
	(h) Length of the dam (at crest) in meters	
9	Name and designation of the inspecting officer	
10	Date of inspection and the corresponding reservoir water level	
11	Maximum and minimum water level reached during the fast season with dates	
12	Maximum overflow during proceeding monsoon with dates	
13	History of past distress, if any, and brief details of remedial measures carried out	
14	Does the officer in charge of the operation and maintenance of dam possesses all the records as given in the guidelines by the Dam Safety Organisation	
15	When and by whom was the dam inspected immediately preceding this inspection?	
16	Are the items pointed out during the fast inspection properly attended to? If not, state deficiencies yet to be corrected	
17	Whether catchment area has been verified on the basis of latest toposheet? If yes, state the out come	

Proposed Dams for Rehabilitation and Improvement

1. Pechiparai Dam
2. Manimuthar Dam
3. Perunchani Dam
4. Ponnaniar Dam
5. Manimukthanadhi Dam
6. Siddhamalli Dam
7. Amaravathy Dam
8. Vaigai Dam
9. Parambikulam Dam
10. Aliyar Dam
11. Kodaganar Dam
12. Karuppanadhi Dam
13. Gundar Dam
14. Gomukhi Dam
15. Thirumoorthy Dam
16. Kudhiraiyar Dam
17. Lower Nirar Dam & Upper Nirar Weir
18. Noyyal – Athupalayam Reservoir
19. Thunnakkadavu & Peruvari Pallam
20. Ramanadhi Dam
21. Gatana Dam
22. Palar Porundalar Dam

INTEGRATED PEST MANAGEMENT PLAN

Introduction

Pests and diseases cause enormous loss to agricultural production all over the world. Farmers use plant protection chemicals to control the insect / pests and disease to protect the crops. However, farmers use plant protection chemicals indiscriminately due to lack of knowledge and ignorance. Many a time, when the required chemicals are not available locally, the farmers have to manage with poor substitutes. Unwarranted and indiscriminate use of insecticides / pesticides results in developing resistance in the crop pests.

Although the use of pesticides is low in India as well as in the State of Tamil Nadu, the potential health hazards are enormous due to their widespread and persistent use and multiple exposures. Many a time, the residues of harmful pesticides are found in the food grains, fruits and vegetables beyond the permissible limits. It has been estimated that 20 per cent of all foodstuff in India contains pesticide residues above permissible limits compared to 2 per cent globally. The agro-chemicals / pesticides also serve as a source of non-point pollution of water sources. Pesticides also kill beneficial insects (predators), which are natural checks for many crop pests.

Rationale for Pest Management Plan

Constitutional and Legal Provisions

The Government of India and the State Government are striving hard to discourage the use of hazardous Plant Protection Chemicals (PPC) and to promote the use of environment friendly techniques under the Integrated Pest Management (IPM) programme. It encourages the use of botanicals, pheromones, bio-control agents and microbial pesticides, The " Prevention of Food Adulteration (PFA) Act " is the policy tool which regulates the quality of food products manufactured, sold and consumed in India.

Pesticides are noted contaminants and are defined as harmful to human health. Many of the formulations such as BenzeneHexaChloride (BHC), Carbofuran, Dimethoate, Endosulphan, Lindane, Monocrotophos, which are banned in the developed countries are still used as PPC in India and account for a sizable proportion of the PPC used. Thus, it is imperative to promote the awareness about the health impacts of these chemicals and the need to adopt more sustainable IPM techniques. Moreover, large quantities of spurious pesticides are sold in the market taking advantage of farmer's ignorance and illiteracy. The Insecticide Act of 1968 has been suitably amended by the Parliament during 2000 to ensure supply of quality pesticides to farmers and to deal with offenders. Under the Insecticide Act 1968 and Rules 1971, there is a provision for analyzing farmers' samples free of cost to discourage dealers of spurious pesticides.

World Bank provisions

The World Bank Safeguard Policy OP 4.09 on Pest Management aims to avoid excessive use of pesticides and promote environmentally sound and sustainable pest

management. The frameworks shall encompass IPM and integrated nutrient management with the overarching purpose of developing the project areas as organic - based production model. The IPM technique promotes to manage pest populations through use of biological control, cultural practices, and the development and use of crop varieties that are resistant or tolerant to pests.

Pests, Diseases and Nutrient Deficiencies

Depending upon crops grown and farming practices adopted in the project basins, pest problems occur in a variety of forms. Pre-eminence of certain crops in specific river basins and agro-climatic zones imparts eco-specificity of the pest problems.

Borer/cutworm caterpillar: Borer/cutworm caterpillar seriously affects Soybean and gram crops grown in most of the river basin areas.
Leafhoppers, grasshoppers and bugs: All pulses and oilseed crops grown in various river basins are affected to a varying extent by the hoppers and bugs.
Rats: They affect all kinds of field crops and storage products.
Storage pests: There are varieties of storage pests that affect stored grains.
Diseases: They occur in various forms and are caused through seed-borne/ soil-borne/ air-borne sources. Seed-borne diseases such as rusts and smuts affect mostly the wheat crop that is grown in most irrigated river basins. Soil-borne diseases such as wilts affect mostly pulses like gram. Air-borne diseases include powdery mildews, blasts and leaf spots, which affect both cereal and pulse crops.
Weeds: They cause serious limitations to achieving optimum crop yields by offering competition to crop plants for water, nutrients and light and also by serving as hosts to several pests.

Weed pressure is greater and more serious in competition to direct seeded rice because of the preponderance of Carbon 4 cycle (C4) weed species, while rice plants are Carbon 3 cycle (C3). Weed pressure is not serious in transplanted rice. Direct seeding of rice is a more common crop establishment practice in the rice growing areas. More than native weeds, exotic weeds like Phalaris minor and *Avena ludoviciana* (Wild oats) are highly menacing to the wheat crop.

In many basins other exotic weeds such as *Parthenium hysterophorus* (Congress grass), Lantana *crameri, Ipomea cornea*, Water hyacinth. etc. have invaded uncultivated areas including grazing lands, irrigation and drainage channels and ponds causing ecological/environmental problems.

Nutrient disorder in soils and crops: Even under the present sub-optional agricultural development scenario, the crop uptake of nutrients (macro, secondary and micro) far exceeds the amounts supplied through application of fertilizers, which is grossly inadequate and unbalanced. The results are multiple nutrient deficiencies in soils amounting to degradation of the productivity potential associated with nutritional disorder in crop plants consequent to lack of supply of depleted nutrients. Generally, secondary and micronutrients become more growth limiting.

The incidence of insect pests and disease problems as well as other problem manifestations (weed pressure. nutrient disorder. etc.) are likely to intensify with increased agricultural intensification in terms of enhanced cropping intensity and crop diversification with inclusion of fruits, vegetables and other high-value plants, requiring more stringent solution framework.

The existing remedial practices include, application of chemical pesticides, manual weeding techniques and application of chemical fertilizers to augment the productivity levels. The application levels are low as compared to the national average figures due to non-affordability *in lieu* of the marginal returns. This may well be considered as a potential for introducing sustainable pest management techniques.

Some of the experiences in the Tamil Nadu region in the use of appropriate pesticides and eco-friendly pest control are as below. These are concerned with paddy and grams.

- Paddy. The pests that infest paddy are stem borer, brown plant hopper (BPH), sheath blight and blast.
  Stem borer is effectively controlled by spraying chloropyriphos, and mixing carbofuran granules in the soil two weeks before transplantation.
  Brown plant hopper is effectively controlled by spraying thiomethaxame. Monocrotophos and imidacloprid are also found to be effective in pest control.
- Grams. The most common pest for grams is helicoverpa (Green Pod Borer). A spray of neem oil mixed with endosulfan or quinalphos is found to be effective in controlling this pest.
- Biological control. Use of bio-agents such as Nuclear Poly Hedrosis Virus (NPV) and Bacillus thuringensis (BT insecticides) is found to be quite effective in pest control.
- Non-insecticidal Pest Management. Spraying cow slurry (cow dung, cow urine and non-edible green leaves soaked together and fermented for three weeks) is one of the efficient methods for pest control for all crops. Further the residual cow slurry is also used as manure.

Support for IPM

As mentioned earlier improved access to water resources as a result of sub-project activities shall lead to intensification of agriculture, consequently leading to increased usage of plant nutrients and pesticides. The project proposes to increase farmers' awareness towards benefits of Integrated Pest Management (IPM) and Integrated Nutrient Management (INM) techniques through training in the sub-project region, and thus wean them away from excessive usage of chemical fertilizers and pesticides to environmentally benign organic substitutes and sound management measures.

Procedures for Preparation of IPM

The proposed activities related to IPM and INM are to be taken up by an external agency including monitoring and evaluation (facilitated by the MDPU and Agriculture Specialist). This team would evaluate the IPM component for effectiveness and scaling-up implications.

Integrated Pest Management (IPM)

IPM involves carrying out management activities that result in the density of the potential pest population being maintained below the problematic pest level, without endangering the productivity and profitability of the farming system, the health of humans and animals and the quality of the adjacent and downstream environments. The interventions underlying IPM address the following:

- Increasing biological diversity to disrupt pest habitat through periodic replacement of cultivated crop varieties, intercropping, crop rotation and crop diversification oriented to disruption of pest habitat and consequential minimization of pest incidence
- Adoption of farming practices to escape pest incidence through appropriate tillage practices, trash management and optimizing sowing date such that possibility of pest / disease occurrence is minimized
- Cultivating crop varieties resistant to pests and diseases
- Adoption of bio-control agents such as application of plant / bio-products (bio-pesticides) and augmenting insect pathogens or other natural enemies (including birds)
- Increasing the farmers' awareness levels on IPM through conduct of technical training courses at village level. The training should focus on philosophy and principle of IPM, identification of different insect pests and diseases, and application of different IPM strategies including selection and usage of chemical pesticides. Extension agencies and NGOs shall be involved in organizing the training courses.
- Extension agencies shall organize regular field demonstration activities pertaining to application of IPM technology.
- Mass Media such as TV and Vernacular Newspapers should transmit information and knowledge on IPM
- Pesticide retailers at village level should be provided with information materials to increase their knowledge on selection and usage of pesticides since farmers seek their advice on pesticide usage

Measures to Increase Farmers' Preference to IPM

- Making quality biocontrol agents/ bio pesticides available at village level through the involvement of local NGOs.
- Making available the seeds of improved pest/disease resistant HYVs (High Yeilding Varieties)
- Encouraging farmers to adopt IPM practices including use of chemical pesticides based on proper understanding of farmers resources, knowledge, attitudes and perceptions with respect to IPM
- Monitoring and forewarning farmers of pest and disease situations
- Providing subsidies to farmers for adopting IPM technology
- Allowing price premiums on agricultural produces based on IPM technology
- Facilitating certification and marketing of IPM - based products.
- Help create institutional arrangements for IPM enforcement
- Securing NGOs' involvement in persuading farmers to opt for adoption of IPM technology

Integrated Nutrient Management (INM)

Public consultations at various levels indicated that under the existing cropping systems, the nutrient outputs grossly exceed the nutrient inputs and the fertilizer use efficiency is sub-optimal The most appropriate strategy for reducing the scale of mining and for increasing fertilizer use efficiency is to practice INM. The basic principle of INM is the maintenance of soil fertility, sustaining agricultural productivity and improving farmers' profitability through judicious and efficient use of mineral fertilizers, organic manures and bio- fertilizers. The INM package has area-specific implications depending upon the availability and performance of the various components.

The interventions underlying INM shall:

- Adopt soil-tests based optimum nutrient use levels, ensuring adequacy of Phosphorus level to meet the competitive demands of crops and P-fixation capacity of soils
- Working model for integration of organic manures and NPK fertilizers for sustainable high yields/farmers' resource - based target yields
- Inoculation of soybean and other legume seeds
- Inclusion of legumes in rotation
- Adopt improved (modern) crop management practices to ensure cultivation of HYV, timely sowing and adequate crop stand establishment, timely weed control and plant protection and proper water management.

- Accelerate the adoption of INM through:
    - Technical training courses at village level for improving farmers' knowledge base. The training shall focus on concept and contents of INM, integration of organic and inorganic resources in consideration of farmers' resource base for mobilizing various nutrient sources, improvement of quality and quantity of FYM making use of NADEP compost system. Including vermiculture and use of bio - fertilizers. (Extension agencies and NGOs shall be involved in organizing training courses).
- Involved in NGO's:
    - Orienting farmers to organic and biodynamic farming approach involving the use of FYM, green manures, crop residues, vermicompost, biofertilizers and biopesticides while understanding their resources and targeted yields.
    - Facilitating certification and marketing of certified organic produces with appropriate price premiums through Government Departments
- Create institutional mechanism for facilitating adoption of INM in general and organic farming in particular, and for monitoring of practices adopted in producing organic products, keeping full track of production processes and products from field to sale point as well as for arranging organic certification and marketing

In addition to the above-mentioned interventions, the implementing agency shall ensure that the Pest Management Plan shall:

- Document the list of all pest control products and confirm that they comply with the selection criteria in OP 4.09
- Under the existing practices and pest management concerns to ascertain that, the project planning and implementation stages address the issues.
- Ensure that main elements of the plan are reflected in the work contractor

The implementing agency shall review the same periodically for effective implementation including the post implementation monitoring after one year to appreciate the level of achievement.

Monitoring and Evaluation (M & E)

The M & E will involve establishing a base line on the current status to evaluate the impact of project interventions. The M & E of IPM will be based on pre-defined parameters such as adoption of companion cropping system, planting of trap crops,

following crop rotation, adoption of biological and mechanical methods of pest control, use of parasites and predators, adoption of bio-pesticides.

IPM & INM Training Costs

As a part of the TN-IAM WARM, several programmes have been devised to generate awareness towards IPM and INM practices. The tentative costs of such programmes are given in following Table.

Table: Costs of IPM & INM programmes

Sl. No.	Item	Institution	Units	Total quantity for 6 years	Unit cost (Rs. '000)	Total cost (Rs. '000)
1	Farming Demonstration (INM)	Agricultural Department	Hectare	5,700	4	22,800
2	IPM village	Agricultural Department	No. of Villages	500	100	50,000
3	NADEP composting demonstrations	Agricultural Department	Numbers	40,000	15	60,000
4	Vermiculture demonstrations	Agricultural Department	Numbers	40,000	1	40,000
5	Demonstration for vegetable production clusters	Horticulture Department	Numbers	550	50	27,500
	Total					**2,00,300**

Organic Farming

Organic farming means a process of developing a viable and sustainable agro-ecosystem. In general, farming practices in these areas are geared to mono crop (usually paddy) in river basins and alluvial tracts, and poly crop agriculture (grams, millets, oil seeds etc) in the up lands. Watershed management also leads to increase in ground water resources in the river basins and sub basins. As this should facilitate more assured irrigation, crop diversification and selecting suitable crops according to soil and agro climatic conditions would be beneficial in getting income from a variety of crops.

The other aspects related to increased crop production/diversification is greater use of pesticides, insecticides and fertilizers. Excessive use of this chemicals leads to the development of resistant pests. This can be counteracted by laying equal importance to bio-fertilizers and manures (refer Integrated Pest Management Plan, Annex – II).

CULTURAL PROPERTY MANAGEMENT PLAN

Introduction

Cultural properties of significance in the State of Tamil Nadu may consist of one or more of the following: Religious Centers, Cultural heritage sites, Archaeological monuments, Sacred groves etc. Cultural property could also include sites, structures, objects and natural landscapes with archaeological, pale ontological, historical, architectural, and religious or other cultural significance. There exists a strong linkage between religious cultural properties and water bodies, be it a pond, a lake, a dam, a stream or a river in India. Over the years religious and cultural values develop surrounding such cultural properties. Thus, the project should not only include provisions to protect and enhance such properties, if impacted by physical interventions, but also address the religious sentiments and values attached to any physical feature or structure of the irrigation infrastructure

Rationale for Cultural Property Management

Legal Provisions

Certain Legal provisions exist with regard to the rehabilitation policy of the State of Tamil Nadu. The Archaeological Survey of India has its own guidelines regarding the development of any activity in vicinity of the monuments etc of archaeological importance. The plan for protection/relocation has to be made along with measures to deal with chance finds during project implementation according to the State and Central laws applicable to such finds. Requisite studies, investigations and consultations with local people have to be held. This may include study of available data and maps, carrying out of additional surveys as may be required, examination of possible alternatives and determination of mitigation measures which may be protective works around the site or relocation of the object in another location in similar surroundings as per local law in force. Specific consultations have to be held with project affected groups and local NGOs based on prior information of findings to be furnished to them.

Impacts on archaeological or other cultural sites of significance are remote in the proposed project. However, the centuries-old tanks mostly have associated cultural property that may be impacted during rehabilitation. This, and other potential cultural property issues should be further studied in detail with respect to the physical investments and an appropriate cultural Property Action Plan or a framework for such a plan should be developed that will include screening, mitigating and enhancing affected sites, as well as including chance finds and procedures for civil works contracts.

World Bank Provisions

The World Bank Policy on cultural property (OP/BP/GP4.11) aims to assist in the preservation of cultural property where part of a bank -financed operation, and to avoid its elimination. If any of the cultural properties are to be relocated or constructed afresh

due to proposed additional works under the TN-IAM WARM, then an inventory of the properties of cultural significance have to be made and measures suggested for their protection, enhancement or elimination after consulting the appropriate Authorities and the Stakeholders.

Cultural Property Management

The project procedures shall follow a consultative approach for the identification of cultural properties and religious and cultural values of the people in the sub-project region. Based on the intervention measures proposed, all concerned stakeholders should be consulted to adequately address any adverse impacts on cultural properties or on access to properties to which values are attached. In case of unavoidable relocation of such properties, agreement with relevant authorities shall be undertaken for replacement.

Procedures

Procedures to be followed for identification of cultural properties and values of significance attached to irrigation schemes have been presented in the following table. A Cultural Property Expert shall be hired as per requirement for cultural property assessment in the sub-projects

Table: Procedure and Indicators for Cultural Property Management

S.No.	Stages	Procedures	Coordinator	Process & Outcome Indicators
1		Stakeholders Consultation for identification of values & possible impacts	MDPU with the help of Cultural Property Expert	Number of Consultations. List of Issues (MDPU)
		Classification of cultural properties into: • National Archaeological significance • State Archaeological Significance • Regional Cultural Significance • Local Cultural Significance	MDPU with the help of Cultural Property Expert	List of Cultural Properties with associated significance (MDPU)
		Inclusion of issues and impacts into the SC1 and SC2 screening Matrices of the SEMF	MDPU with the help Cultural Property Expert	Requirement of clearances or detailed consultations for Planning Stage (MDPU & Cultural

				Property Expert)
2	Planning Stage	Stakeholders consultations for identification of impacts due to sub project interventions, agreement over mitigation, compensation and enhancement measures	MDPU with the help of Cultural Property Expert	Inclusion list of agreed safeguard measures in the draft plan (MDPU)
		Approval of Stakeholders on the final plan proposals	MDPU with the help of Cultural Property Expert	Signed Minutes of Meeting (MDPU)
3	Implementation Stage	Implementation of compensation, relocation and impact mitigation measures before initiating physical sub-project activities	MDPU with the help of Cultural Property Expert	OK card on implementation of all listed safeguard measures (MDPU)
		Monitoring for possible impacts during construction	MDPU with the help of Cultural Property Expert	Number of grievances (MDPU & Cultural Expert)
4	Post implementation Stage	Stakeholder Consultations to ensure proper implementation of safeguard measures for preparation of ICR	MDPU with the help of Cultural Property Expert	ICR (MDPU& Cultural Expert)

Criteria for selection of cultural properties – pre planning stage

The criteria for the selection of sites suitable for enhancement have to be based on four factors:

- The historical importance
- Importance for the local people
- The religious significance
- Scope for enhancement, if any

The importance of the site for the local people as well as the historical significance has to be identified through extensive discussions with the local community and general observations of the sites and structures. The scope for enhancement includes the possibility of any further improvement, availability of space for enhancement and the likely benefits for the local community. Poor condition of some historical structures could be a constraint in selecting sites for enhancement. Such sites though having high historical values may exist in a very bad physical condition. At such places, enhancement measures have no meaning without restoring the main structure, which is beyond the scope of the enhancement works.

Categorization of Properties - Pre-planning Stage

In case of non-avoidance of negative impacts, consultation with the communities and the various stakeholders including the Governmental and Non-governmental organizations in the project area has to be conducted as an integral part of the project preparation. Further, the properties have also to be categorised into different types based on their *usage,* social importance and historical /regional / national significance.

The information gathered should include the age of the structure, importance for the local people, religious significance, historical importance, the size of the population using it, suggestions for enhancements, willingness of people to participate, etc. The site observation also provides vital inputs in concept formulation. It provides the general information about the condition of the main structure and the surrounding, visibility of the enhancement site from the project area, the scenic beauty of the site as well as the surrounding area etc.

All relevant information like consultations, documentations, etc. of the Cultural Properties should be incorporated into the GIS Knowledge Base.

Consultation Process - Planning Stage

Community consultation has to be undertaken to make explicit the social factors that remain behind the importance of the site for the local people. Also, it may be carried out to know the associated social/historical significance, in discussions with the local community and general observations of the sites and structures. The consultation process includes the socio-cultural analysis and specifically addressed issue of how the community can get best benefit out of it. The consultations are normally held at local (community) level. The objective of the consultation is to minimize the negative impacts in the project area and their involvement in the enhancement process. The process further has to try to identify and assess all major economic and sociological characteristics of the village to enable effective planning and implementation. During the process, efforts may be made to ascertain the views and preferences of the stakeholders. Suitable Questionnaire should include formats for documenting the community consultations carried out, especially at the enhancement/relocation sites bringing out the key concerns of the stakeholders and actions/modifications taken with regard to those suggestions. Valid reasons should be placed in the documentation if certain suggestions are not incorporated in the plan proposals.

The likely impacts at different stages have to be documented along with corresponding mitigation measures and the responsible agency for undertaking the implementation of mitigation measures. The WRO shall be responsible for the monitoring of the activities that are implemented as part of any sub-project by the works contractor.

Proposed Actions / Mitigation Measures - Implementation Stage

Proposed actions refer to the positive actions to be undertaken during the implementation stage of the sub-project for the benefit of the stakeholders. The mitigation measures proposed for religious/cultural property/space shall be part of the project and will be solely finalized based on the concerns of the stakeholders.

In case of property having historical importance, wherein Archaeological Survey of India comes into picture, and procedures of the ASI along with World Bank requirements as mentioned earlier shall be complied.

Post Implementation Stage

Reconnaissance visits after a year to the completed sub-project sites by WRO for assessment and rectifications of any long-term impacts due to sub project interventions should be carried out. The department shall also review the outcome of the interventions, as documented in the previous stage of the project implementation to be aware of the accomplishments.

RESETTLEMENT FRAMEWORK

Introduction

The Government of Tamil Nadu through the WRO has initiated the TN-IAM WARM with an aim to pilot reforms options for enhancing the productivity of water, through crop diversification and over all well being of the people. The project would seek to restructure the Water Sector to significantly improve performance in water resources planning, allocation and management for sustained multi-sectoral use by adopting a river basin approach.

Sub-Project interventions proposed under TN-IAM WARM are limited to rehabilitation of existing structures and introduction of other software measures like extension works related to agriculture, fisheries, livestock development, etc. Since no new schemes are being proposed, resettlement issue will not crop up. However, as a safeguard measure a Resettlement Framework has been prepared to address any displacement as a result of any sub-project activity. Tamil Nadu State Policy on Rehabilitation (SPOR), 2002 also recognizes the need for a special focus on the resettlement and rehabilitation of affected people in the water sector.

Rational For Resettlement Framework

The ESA study looks into the likely resettlement impacts due to the TN-IAM WARM that follows a Programmatic approach wherein various sub projects shall be identified and taken up for improvement in different years. In the absence of precise sub project intervention measures at the present stage a Resettlement Plan or an Abbreviated Resettlement Plan (if impacts are minor or displaced persons are <200 as per WB OP 4.12) is not feasible. It is proposed that as per the Screening Exercise sub projects requiring Resettlement / Abbreviated Resettlement Plans shall be identified and such plans shall be prepared in conformity to the Resettlement Policy Framework for the present study. The Resettlement Policy Framework is an amalgamation of the SPOR and World Bank Policy on Involuntary Resettlement (OP/BP)

Based on the study, it is concluded that activities that may result in involuntary resettlement are:

1. Relocation of structures
2. Up gradation / Additional physical for improving and expanding the water storage or supply coverage
3. New physical works (if found necessary)
4. The interventions may require displacement of persons depending on the scale of the work and level of encroachments. The probable impacts include:
5. Impact / Loss of land and other immovable assets

6. Impact / Loss of livelihood systems/income opportunity (due to loss of productive land, due to impact to structure where livelihood activity is being carried out; etc.)
7. Impact / Loss of Community Property Resources (religious structures, grazing land etc.)
8. Impact / Loss of Access (between settlements, to agriculture lands, to markets etc.)

Support for Project Affected Persons-Broad Principles & Objectives of R&R framework

Both the TN State Policy on Rehabilitation 2002 and the OP/BP 4.12 in combination shall form the guidelines for the Resettlement & Rehabilitation Framework for this project. Resettlement Plans shall be prepared in accordance with this R&R Framework.

Principles (State Policy on Rehabilitation 2002)

Given below are the major Principles for Rehabilitation as laid down in the State Policy on Rehabilitation 2002.

1. Improve or at least regain the standard of living the displaced families had been enjoying prior to their displacement.
2. Special attention will be paid to rehabilitation of the displaced families belonging to scheduled castes and schedules tribes as well as those of small and marginal farmers. There will be no discrimination between families displaced from revenue and from forest villages.
3. Compensation will be paid to land owners and lease holders within the specified time limit, as far as possible Allotment of land to them as per their eligibility under the policies of the Government will also be considered. Allotment of land to non-lease holders will also be considered, on availability of land, as per the policy of the Government.
4. The oustees will be paid, suitable compensation for their agricultural land, residential plot and other properties. If land is allotted to them at the new place, appropriate price will be taken thereof from them.
5. Adequate civic facilities will be provided in the new settlement. As for as possible, efforts would be made to provide necessary physical and social infrastructures at the time of settlement itself.
6. In the process of rehabilitation it will be ensured that the families who were living in social groups in the affected village, are settled, as for as possible, in the same manner. If possible oustees shall be rehabilitated within the command area or near

about the submergence area. Efforts will be made to ensure that the rehabilitated families get mixed up with the families already living at the new place.

7. Priority will be given to members of displaced families in jobs in the project's construction works and other works, as per their skills. They will be the first claimants for allotment of any surplus land within the command area of the ongoing projects. In view of their number, reservation of land for them may also be considered. A certain percent will be set aside for allotment / distribution of shops in the township developed for the project area.

8. A grant scheme will be chalked out for the rehabilitation of agricultural labourers and non-agricultural families at the new place, to help them start self-employment. After completion of an irrigation project, the work of fishing and its sale will be given to cooperative societies of the oustees, as far as possible.

9. The work of land acquisition and rehabilitation will go side by side to minimize the inconvenience to the oustees. Land acquisition will be done phase-wise and first those areas will be acquired that are needed the first. Land more than necessary should not be acquired in any case.

10. In case any building etc remains unaffected after completion of the irrigation project, these can be used for community purposes for the new settlements.

11. Availability of food grains will be ensured at both old and new places right from the time the process of re-settlement starts.

Procedure for Preparing Resettlement Plan

Resettlement Plan Process

Planning for Project Affected Persons (PAPs) should be initiated in the Pre-Planning stage through regular consultations with the affected persons. Voluntary relocation should be encouraged to the extent possible, as most of the relocation shall pertain to encroachers. If the likely impacts are more the Resettlement Plan should be prepared for the project. The activities that will guide the preparation of such a Resettlement Plan are presented in table below:

Table: Procedure & Indicators for Resettlement

Sub project stage	Procedure	Coordinator	Process & Outcome Indicators (Monitoring Agency)
Pre-Planning	Identify locations in the sub-project that might lead to displacement of people affecting either private lands, encroached government lands, structures or assets linked to livelihood	MDPU helped by Resettlement Expert	List of issues that trigger Resettlement Plan (Resettlement Expert)
	Stretches where land acquisition is likely to be transferred on to the land revenue maps and alternatives sought to minimize acquisition	MDPU helped by Resettlement Expert	Maps showing land acquisition locations (MDPU)
	Consultations with the affected communities to arrive at agreeable solutions and encourage voluntary eviction from encroached areas	MDPU helped by Resettlement Expert	Video records, Photographs, Signed minutes of meeting (MDPU Resettlement Expert)
	Revision of sub-project intervention activities incorporating the outcomes of consultations	MDPU helped by Resettlement Expert	List of modified sub-project activities (MDPU Resettlement Expert)
	Inclusion of issues and unavoidable impacts identified into the SC1 and SC2 screening Matrices of the SEMF.	MDPU helped by Resettlement Expert	Requirement of Resettlement Plan (MDPU, Resettlement Expert)
Planning	Super imposition of Total Station Drawings of Irrigation Schemes on Revenue Maps.	MDPU helped by Resettlement Expert	List of tribal villages on sub-project map (MDPU, Resettlement Expert)
	Identification / location project interventions on the sub-project drawings and demarcating the area that would be required for implementing the interventions.	MDPU helped by Resettlement Expert	List of tribal villages on sub-project map (MDPU Resettlement Expert)
	Identification of the plots to	MDPU helped by	Maps showing land

	enlist the project-affected families.	Resettlement Expert	acquisition locations (MDPU, Resettlement Expert)
	Baseline survey that consists of 100% census survey of the affected families and the types of loss shall be undertaken. The day of such survey shall be treated as the 'cut off' date.	MDPU helped by Resettlement Expert	Final List of PAPs (MDPU, Resettlement Expert)
	Socio economic survey consisting of 20% sample of total affected families to establish the socio-economic status of the families affected.	MDPU helped by Resettlement Expert	List of key issues (MDPU, Resettlement Expert)
	Formulating compensation and assistances that need to be provided to compensate the loss the affected families	MDPU helped by Resettlement Expert	Budget for compensation & assistance by type and numbers (MDPU, Resettlement Expert)
	Preparation of the Land Acquisition Plan and Schedule required as per the Land Acquisition Act.	MDPU helped by Resettlement Expert	Number of households notified (MDPU, Resettlement Expert)
Implementation	Disbursement of compensation and Assistance as per the Rehabilitation Plan/Framework	MDPU helped by Resettlement Expert	Number of households compensated & assisted (MDPU, Resettlement Expert)
	Preference for jobs in the project as per RP	MDPU helped by Resettlement Expert	Number of persons offered jobs MDPU, Resettlement Expert)
Sub project stages	Procedure	Coordinator	Process & Outcome Indicators (Monitoring Agency)
	Training on agriculture and allied activities as a part of TN-IAM WARM	MDPU helped by Resettlement Expert	Number of persons trained (MDPU, Resettlement

			Expert)
	Implementation of safeguards measures as per Resettlement Plan proposals	MDPU helped by Resettlement Expert	OK card of implemented measures (MDPU, Resettlement Expert)
Post Implementation	Evaluation of the success of programs & safeguard measures undertaken & Follow up activities based on lessons learnt	MDPU helped by Resettlement Expert	See Table 9.2

The following table lists the Impact Indicators to be monitored in the Planning (through Socio-economic surveys) and Post Implementation Stages of the sub-project cycle to monitor and evaluate the impacts of the project.

Table: Impact Indicators for evaluation of PAP's

Item	**Impact Indicators**	**Frequency**	**Responsible Agency**
Economic Conditions	Income Project related & Independent means but assisted by the project Housing Changes in quality over a period of time. Changes in occupation Skill portfolio Migration profile	Planning Stage Post Implementation Stage	Independent agency/Internal monitoring by MDPU
Social Conditions	Verification of cases of voluntary donation of land, Representation in Community based institutions, Indicators of participation Empowerment, School enrolment Health and morbidity Household infrastructure, electricity, potable water, living space etc.	Planning Stage Post Implementation Stage	Independent agency/Internal monitoring by MDPU

Additional Details Related To Resettlement Plan

Resettlement Plan Contents

In accordance with the Social and Environmental Management Framework prepared to integrate Environmental and Social Safeguard measures in the main project,

all sub projects should be screened for their likely adverse impacts, in the Pre-Planning Stage. If the issues related to resettlement are triggered, a Resettlement Plan or an Abbreviated Resettlement Plan has to be prepared for the concerned sub project. Such a plan should be prepared at the Planning and Design Stage of the project preparation, wherein physical intervention measures shall be planned and designed.

The contents of the Resettlement Plan to be prepared for individual sub projects consistent to the Resettlement Framework are as follows:

- Baseline census and socio-economic survey information
- Specific compensation rates and standards
- Policy entitlements related to any additional impacts identified through the census or survey
- Description of resettlement sites and programs for improvement or restoration of livelihoods and standards of living
- Implementation schedule for resettlement activities
- Detailed cost estimate

Approval of Resettlement Plan

The following Committees as per the scale of Resettlement (Major or Minor) may review and approve the Resettlement Plan.

- State Level Committee (in case of Major Projects- those which necessitate transfer of 100 acre or more land due to land acquisition or for any other reason)
- District / Division Level Committees for minor projects

Likely Categories of Displaced persons

Involuntary Resettlement is remote in TN-IAM WARM given nature of project interventions that pertain to mere up gradation and modernization of existing irrigation schemes and other small physical works like improvement of ponds for fisheries development, canal and dam, hydro etc. Additional submergence in reservoirs shall only be restricted to projects where possibilities of creating additional storage exist. Thus estimated population displacement shall be limited in the present project.

The likely categories of displaced persons based on eligibility for entitlements as per the framework are given in table below:

Table: Eligibility Criteria

Sl. No.	Affected Population Category	Definition
		SPOR Definitions
1	Project Affected Person (PAP) / Project Displaced Person (PDP)	A person who has been ordinarily living in the area, which is likely to be submerged temporarily or permanently due to a project or which is required for a project, for at least one year from the date of publication of the notification Under Section 4 of the Land Acquisition Act, and has been practicing a business or occupation for a living there or has been cultivating a land for at least three years.
	Project Displaced Family (PDF)	A family comprising displaced persons as defined above includes the husband, wife and minor children and others such as window mother, widow sister, unmarried sister, unmarried daughter or aged father, depending on the head of family. Every major son/ daughter of a displaced family (who has become major on the date of notification Under Section 4 of the Land Acquisition Act, will be considered a separate family)
2	(a) Landless person / Agricultural laborer	A person who holds no agricultural land himself or a joint land with his family member or who has no other land for agriculture. Persons who work as agricultural laborers will also be placed under this category.
	(b) Small farmer	A person who owns 2 hectares un-irrigated or 1 hectare or less irrigated land.
	(c) Marginal farmer	A farmer who owns 1 hectare un-irrigated or 0.5 hectare or less irrigated land.
		Additional Definitions
3	Urban Oustees	Displaced families in urban areas (Areas identified as Urban by the Census of India, 2000)
4	Rural Oustees	Displaced families in rural areas (Areas identified as Rural by the Census of India, 2000)
5	Encroacher	A person who has trespassed into Government/ private/ community land to which he/ she is not entitled to
6	Squatters	Person who has unauthorized by settled on the land or building for shelter or livelihood
7	Below Poverty Line (BPL)	The subsistence level of income is called the Poverty line. BPL is a sum fixed by the Planning Commission, Government of India and families that have an income below this sum fall within the vulnerable or poor or disadvantaged class

8	Vulnerable Persons / Groups	All category of people who are socially distressed or economically backward fall under this group. They may include, but not limited to the following: People living Below Poverty Line and or are earning 25% above the poverty line Members of the Schedule Caste/ Tribe community/ Other Backward Caste Women headed households Orphans and destitute Disabled and aged Land less person
9	Title holder	This includes the persons who can establish their usufruct rights of the property they claim to be their own. Cut off for titleholder is the date of issuing notice under section 4(1) of the Land Acquisition Act (Amended) of 1984.
10	Non-title holder	Any person unable to establish his/her right to the property he/she is occupying without a legitimate evidence for being the owner is called a non-title holder. Cut off Date for Non titleholder refers to the date of Census Survey which should be completed 2 years prior to the section 4 (1) notice under the L A Act.

The present policy framework is a combination of the State Policy on Rehabilitation, 2002 and the World Bank Policies on Involuntary Resettlement, OP/BP 4.12. The State Policy on Rehabilitation, 2002 is a model policy for the state, provisions of which are minimum and mandatory in the respective policies of different departments. The SPOR provisions are similar in spirit to the WB Policies though, at places, certain provisions and entitlements are not explicitly spelt out. The Summary Entitlement Framework adopted for the TN-IAM WARM is given in the following table. Any other unforeseen impacts shall be documented and mitigated based on the principles agreed upon in this policy framework.

Table: Summary Entitlement Framework

Category of Impacts	Impacts and assistance criteria	Entitlement as per SPOR				Additional Entitlements conforming to WB Policies			
		Titleholders		Non Titleholders		Titleholders		Non Titleholders	
		V*	NV**	V	NV	V	NV	V	NV
LAND									
Loss of Agricultural Land	Compensation for land at full replacement cost, free of fees or other charges	Yes	Yes	Yes (If revenue or forest land occupied for min. 3 years from date of project sanction)	Yes (If revenue or forest land occupied for min. 3 years from date of project sanction)				
Agricultural Land	Land based resettlement options (if >25% and subject to availability)	Yes	Yes	No	No				
Loss of Residential Land (Rural / Urban)	Alternative Residential Plot	Yes	Yes	No	No				
Loss of Urban Land	Compensation for land at full replacement cost, free of fees or other charges	Yes	Yes	No	No				
OTHER IMMOVABLE ASSETS									
Loss of Structures	Replacement or compensation for structures	Yes	Yes	Yes	Yes				

	and other non-land assets								
Loss of trees	Compensation for perennial crops and trees, calculating as annual net product value multiplied by number of years required for new crop to start producing					Yes	Yes	No	No
Loss of crops	Advance notice to harvest non-perennial crops, or compensation for lost standing crop					Yes	Yes	Yes	Yes
Loss of reusable assets	Rights to salvage materials from existing structures, trees, and other assets					Yes	Yes	Yes	Yes
PHYSICAL RELOCATION									
Uncertainty of resettlement site	Consultation, counseling regarding resettlement alternatives and assistance in identifying new sites and opportunities and option of housing in resettlement sites in cases of cluster relocation	Yes	Yes	Yes	Yes				
Hardships in	Grant for accessing	Yes	Yes	Yes	No				

immediate reestablishment	housing schemes, or other support to assist poor and vulnerable tenants in reestablishing their homes								
Shifting hardships	Shifting (transportation) assistance	Yes	Yes	Yes	Yes				
LIVELIHOOD									
Hardships during Transition period	Transition Assistance – agricultural extension services, cooperatives, Employment Assurance Scheme, Insurance Scheme, etc.	Yes	Yes	Yes	Yes				
Lack of financial support during transition	Rehabilitation Grant in aid for 1 year	Yes	Yes	Yes	Yes				
Loss or diminished livelihood	Special support (financial) for additional 3 years	Yes (only landless)	No	Yes (only landless)	No				
Loss of original livelihood	Additional support mechanisms for vulnerable groups in reestablishing livelihood	Yes	No	Yes	No				
COMMUNITY RESOURCES									
Loss of Community Resources	Re-establishment or development of Community Resources like grazing					Yes	Yes	Yes	Yes

	lands, religious structures, etc.								
ACCESS									
Loss of access to Facilities	Creation of new Civic Facilities and Transportation routes	Yes	Yes	Yes	Yes				

V* - Vulnerable

NV** - Non Vulnerable

Valuation of Assets

The Valuation of assets lost as a result of Involuntary Resettlement should be calculated on the following basis:

- Valuation of lands in private possession - possible market price will be paid to the concerning person
- Valuation for house – The amount of compensation for all other properties like house, will be equal to the expenditure that would have been incurred on restoring it to its original condition. The compensation for house will be equal to the cost of a house under any Housing Schemes
- Valuation for trees – The price of fruit bearing trees will be determined on the basis of the annual income from fruits of the tree and the value of its wood

Organizational procedures for RP Implementation

The organizational procedure for implementation of the Resettlement Plan after its approval by the concerning administrative department is as follows:

- The outline of the project along with the Resettlement Plan after its approval by the concerning administrative department will be published in local dialect for public information in the project area and will also be presented before the gram sabhas and in case of urban areas before the urban units for their information. The same system will be followed in private schemes also
- Under section – 4 of the Land Acquisition Act, the process of primary notification may be started. During this process, and otherwise, too, people and their organizations will have the right to seek information about any aspect of the project. In case it is decided to retain the information for some reason, a notification to this effect should be issued giving the reason

- The resettlement sites will be selected in consultation with the affected as well as the host communities. For this, first the potential affected persons will be properly informed about the new area and their visits to the new areas will be organized to acquaint them with the families already living there. Any action for new settlement will be taken only as per the advice of the affected as well as the host communities

- Entitled persons, their eligibility and entitlements as identified in the RP shall be verified and the Project Authorities in co-ordination with the Revenue Department should disburse their entitlements

Grievance redress mechanism

The grievance redress mechanism as detailed in the SPOR is as follows:

- In small plans, where one fourth of the concerning people, particularly members of scheduled castes and schedule tribes do not agree to the plan presented for them, the cases will be considered by district / division level committee

- Such cases of major plans, too, will be first considered by district/ division level committee and in case the matter is not resolved, then alone these will be referred to the state level committee and its decision will be final

- Disputes pertaining to any matter within the ambit of the Resettlement Framework / SPOR and its implementation, such as identification of the beneficiaries, the benefits to them etc., will be, as far as possible, resolved by the district/ division level committee

- Special land acquisition courts will be established for disposal of cases pertaining to acquisition of lands, to avoid delay in their disposal through normal judicial process

Funding through Project

All resettlement funding shall be through the main project. Separate Resettlement Plans or Abbreviated Resettlement Plans shall be prepared for each sub project during the Planning & Design Stage. Detailed Cost Estimates based on intervention measures proposed shall be prepared and approved by the State or the District / Divisional Committees. The document shall then be submitted to the Bank for its approval and subsequent release of funds.

Contingency Fund

A special fund with an initial amount of Rs.50 crores will be created to help those in distress due to displacement or related reasons that cannot be provided assistance under the general procedures. For this, a special cess will be levied on mineral, power and forest based industries and the industries with heavy investment. *(Refer Section 27 of the SPOR).* This fund can be used by the rehabilitation department, in consultation with

the state level committee as a contingency measure. The Bank in the next disbursement shall replenish this additional amount.

State Requirements of Consultations

As per the State Policy on Rehabilitation, the following consultations are pre-conditions for any development work (Refer Section 14 of the SPOR):

- Gram Sabha should be consulted for acquisition of land for public purpose like construction of any project or for any other work and / or alternative use of other resources
- All economic establishments will require presenting their stand in an open forum.

The State government in such a situation shall stand for the weaker sections and to protect their interests. In case of tribal societies it will be specially seen that any step of the State or any action of the parties concerned does not create a rift in the society.

Guidelines for Implementation and Monitoring

The general features of implementation and monitoring mechanism includes the following:

Basic responsibility of R&R for these water resources projects is vested with the WRO. This should be carried in consultation and support from the concerned line departments. The project authorities shall constitute R&R cells within the department for timely preparation and effective implementation of the R&R program.

As the whole activity under R&R is multi-disciplinary in nature, it is an absolute necessity to have effective participation, cooperation and involvement of most of the basin level and project level officials to prepare and execute suitable rehabilitation plans. In case of any grievances regarding the rehabilitation, the project affected persons shall approach the R&R Cell that will be established at the head office level of the WRO.

TRIBAL DEVELOPMENT STRATEGY

Introduction

Tribal communities represent a vulnerable section of the community who are prone to exploitation and marginalization in the process of development, due to low levels of literacy and awareness. They are intimately dependent on the forest for almost all-human activities. At times, these tribal population centers become central points for activities, damaging their eco-system. Fire, grazing, shifting cultivation, smuggling and poaching are such activities.

The Government of India has identified tribal populations in Trichi, South Arcot, North Arcot, Dharmapuri and Salem who requires Integrated Tribal Development Programme for their upliftment. In order to improve the economic conditions of the tribals living in the above districts, Hill Area Development Programme (HADP) and other schemes were implemented. They have helped create forest-based assets in tribal areas besides providing employment opportunities at their doorsteps.

The concentration of tribal population in various blocks varies considerably with most of the tribal area being concentrated in different pockets in the State of Tamil Nadu. The Directorate of Tribal Welfare, GoTN, have identified 36 Scheduled Tribe communities in 13 districts. Of these, 6 Tribal communities, i.e., Toda, Kota, Kurumbas, Irular, Panian and Kattunayakan have been identified as Primitive Tribal Groups.

Rationale for Tribal Development Strategy

Constitutional and Legal provisions

Several legal provisions have been provided in the Indian Constitution and legislative organs, to ensure protection and assistance to the tribal communities of the Country. The Constitution of India in its 244 (1) and (2) in part X has listed Scheduled Areas and Tribal Areas under the Fifth and Sixth Schedules envisaging special system of administration. The provisions are meant to assist tribal populations in utilizing their rights and to develop their economic, educational and social status.

The 73rd Constitutional Amendment Act, 1992 has made provisions for reservations for Vulnerable Groups such as SC, ST and women for effective participation and involvement in decentralized governance. The tribal population is given opportunity for participation through reservation at three levels of Panchayats. Panchayats (Extension to Scheduled Areas) Act (PESA), 1996 has given control of land, forests and water in the hands of tribal through Gram Sabha (Village Assembly). Land tenancy act, controls marginalization of tribal household through restriction of transfer of land from tribal to non-tribal persons.

The Applicability of PESA provisions in Tribal Areas is as follows.

- The Gram Sabha shall be involved during the identification and planning of land uptake and resettlement in view of the mandatory provisions under the act that includes:

- Approval of development plans and programmes

- Acquisition of land for development projects and rehabilitation of persons affected in consultation with Gram Sabha or Panchayat. At the planning and implementation stage it will be coordinated at state level

- Consensus for any legislation with customary laws and practices for management of resources

- Panchayat to manage water bodies

- Ownership of minor forest produce

- Prevention of alienation of land

World Bank Operational Policy, (OP 4.10)

This policy contributes to the Bank's mission of poverty reduction and sustainable development by ensuring that the development process fully respects dignity, human rights, economies and cultures of indigenous peoples. For all projects that are proposed for Bank financing and affect Indigenous Peoples, the Bank requires the borrower to engage in a process of free, prior and informed consultation. Such Bank financed projects include measures to (a) avoid potentially adverse effects on the Indigenous Peoples' communities: or (b) when avoidance is not feasible, minimize, mitigate, or compensate for such effects. Bank financed projects are also designed to ensure that the Indigenous Peoples receive social and economic benefits that are culturally appropriate and gender intergenerationally inclusive.

- Because of the varied and changing contexts in which indigenous peoples live and because there is no universally accepted definition of "indigenous Peoples'', this policy does not define the term. Indigenous Peoples may be referred to in different countries by such terms as ``indigenous ethnic minorities,'' ``aboriginals'', "hill tribes", ``minority nationalities, "scheduled tribes" or ``tribal groups''.

For purposes of this policy, the term "Indigenous Peoples" is used in a generic sense to refer to a distinct, vulnerable, social and cultural group possessing the following characteristics in varying degrees:

(a) Self-identification as members of a distinct indigenous cultural group and recognition of this identity by others;

(b) Collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories;

(c) Customary cultural, economic, social, or political institutions that are separate from those of the dominant society and culture; and

(d) An indigenous language, often different from the official language of the country or region.

A group that has lost "collective attachment to geographically distinct habitats or ancestral territories in the project area"; (paragraph 4 (b)) because of forced severance remains eligible for coverage under this policy.[8] Ascertaining whether a particular group is considered as "Indigenous Peoples" for the purpose of this policy may require a technical judgment (see paragraph 8, OP 4.10).

In addition to the provisions under constitutional and legal provisions, several entitlements have been provided as appropriate mitigation measures. These are based on participatory approaches envisaged by the Center and State Governments involving tribal population in addressing the social issues accruing from the projects.

Socio Economic Profile of Tribals

Distribution of Tribals

Table: Tribal Population in Tamil Nadu

Sno	Name of the District	Name of the Tribal Area	Area (Sq.Km.)	Total Population of the area	Tribal Population
	Namakkal	Kolli Hills	224.85	38,449	30,665
2	Salem	Yercaud Hills	147.50	33,353	21,676
3	Salem	Kalrayan Hills	319.21	21,395	20,665
4	Salem	Arunuthumalai	29.02	11,879	6,604
5	Salem	Pachamalai	109.92	24,161	6,583
6	Tiruvannamalai	Jawadhu Hills	310.35	59,448	49,962
7	Villupuram	Kalrayan Hills	600.00	32,756	29,991
8	Dharamapuri	Sitheri Hills	188.00	29,890	14,353
9	Trichy	Pachamalai	128.83	13,397	7,894

Source: Annual Tribal Sub-Plan, 2003 – 04, Commissionarate of Tribal Welfare, Go TN.

Out of 5.74 lakhs of Tribals, 2.78 lakhs are non-workers and the remaining 2.96 lakhs workers, 1.34 lakhs are cultivators, 0.93 lakhs are Agricultural Labourers, 0.04

lakhs are House – hold workers, 0.47 lakhs are other workers and 0.18 lakhs are Marginal workers.

Characteristics of Tribal areas

Tribal people mostly live in hills and forests. The coverage of forest varies from one area to the other, but it can be said that about half of the tribal area is covered with forests. In such a situation, any programme of economic development must rest on the use and exploitation of the forests. The terrain, which the tribal cultivate, is hilly and undulating. With the increasing pressure on land, undulating areas and steep slopes have been brought under cultivation with consequent loss of fertility and soil erosion. In addition to this, no irrigation facilities are available. Agriculture is carried out in tribal areas under these conditions and circumstances. Sparseness of population is another special feature of tribal areas. Communication facilities are scanty and difficult in tribal areas. Such a situation raises a real problem as to how the benefits of the development programmes should be extended to a majority of the tribals living in interior areas.

Even today, the social customs and way of living of the tribals remind us of their dependence on natural environment. The most distinct aspect is their community-centered way of life and their social customs (like marriages, dispute resolution or celebration of festivals). Though development in some forms has reached their settlements, it has not influenced their dependence on natural resources and occupation. They still maintain their distinct way of life with a majority of their household tasks and livelihood dependent on the existing natural resources.

The following activities represent the dependence of the tribals on the natural resources:

Livelihood: The main economic activity of the tribal population is agriculture on which they are completely dependent for their only source of income. The land is cultivated once or twice a year, depending on the terrain, soil and monsoon. Almost all the tribal populations depend on animal husbandry for their secondary source of income, if not primary.

Animal Rearing: Rearing of animals has been the oldest form of subsistence and prime activity of many of the tribal groups. It provides additional income to the tribal households. The natural forestland, wasteland and natural vegetated area have been the most easily accessible source for fodder and grass for their animals. Though there has been a shift from the nomadic life to a settled agriculture based life, the tribal population is dependent on the natural vegetation and land for animal rearing.

Minor Forest Produce: The tribal groups were chiefly engaged in hunting / gathering or in sustenance agriculture. Access to their traditional resources like forests, streams and animals has been severely restricted with the Government's measures to reserve the forests with an intention to protect them. For the household tasks and other activities, the tribal people are dependent on the forest and its produce. Gathering of forest wood is an important activity, engaging the women folk of the tribal village. The nearby forest area provides the fuel for cooking and heating purposes.

Water: The main source of water for the tribals has been the rivers and streams along with other water bodies in proximity to the settlement. These provide water for the household and agricultural activities. In many areas, these water bodies provide food for the tribal people. In some cases, ground water extracted through tube wells also provides drinking water to them.

Irrigation: Though the agricultural activities are rain fed, other main sources of irrigation are ponds, tanks and wells. The tribal farmer depends on these sources for irrigational purposes when monsoon fails.

Grazing lands used by tribal people should not be impacted due to the project. Every single case acquisition of forestland for the project has to be studied and requisite clearances from the concerned departments have to be sought. State departments under the Forest Conservation Act will be responsible for providing the clearances in such cases. Any take over of lands belonging to other Government Departments should be carried out through the requisite clearance procedures of the concerned departments.

Support for Tribal Groups

Special measures should be undertaken for upliftment of the tribal communities residing in each sub-project area. In the Sub-projects where the tribal people form a part of the beneficiaries, steps should be undertaken to include them in all the stages of the project. Where existing schemes of the government are operational, effective linkages with the programmes shall be established to maximize project benefits to the tribes.

Tribal groups if directly affected by the project should be compensated and assisted as per the entitlement provisions laid down in the Resettlement Framework of the project. The project should endeavor to mainstream people from the tribal households residing in the sub-project area. An early consultation with such groups should be undertaken to identify measures to provide benefits of the intervention measures to tribal communities.

Special Measures for Tribal upliftment can be taken up through the following programs:

- Designing the sub-projects on a participatory framework where consultation with stakeholders at every stage remains the main focus of project activity
- Separate Focus Group Discussions for identification of opportunities for the tribes through sub-project physical and institutional interventions
- Provision of access to local resources like ponds for fisheries, grazing grounds for livestock development, minor forest produce for economic returns, handicrafts, etc.

- Inclusion mechanisms for adequate representation into Local Decision making bodies like Panchayats, WUAs, etc.

Procedure for Preparing Tribal Development Plan

Involvement of Tribal groups in problem identification and design of solutions has to be ensured through the entire cycle of sub-project interventions. Table 7.9 presents the activities to be undertaken by the implementing agency to ensure inclusion of tribal issues in the main project.

Table: Activities and Indicators for inclusion of Tribal issues

Sub project stage	Procedure	Coordinator	Process & Outcome Indicators (Monitoring Agency)
Pre planning	Identify locations of State declared Tribal pockets and villages with Tribal population above 25% through GIS database	EE, WRO helped by Information Management cell	List of tribal villages on sub-project map (Tribal Expert)
	Identification of Tribal community stakeholders at site	EE, WRO with Gram Sabhas	List of all Tribal community heads in the sub-project (Tribal Expert)
	Sensitization and consul tation through PRA and Focus group discussions with Tribal groups.	EE, WRO helped by PR & Media Experts, MDPU, WRO.	No. of discussions and minutes of the meeting (Tribal Expert)
	Identification of environmental and social issues of the tribals and possible impacts as a result of the project	EE, WRO helped by the Environmental, Social & Tribal experts, WRO	Documentation of the issues (Tribal Expert)
	Inclusion of issues and impacts identified in the previous row into the SC1 and SC2 screening Matrices of the SEMF.	EE, WRO helped by the Environmental, Social & Tribal experts, WRO	Justifications for preparing, Tribal Development Plan (Tribal Expert)
Planning and Design	Joint walk through, Consultations and PRA techniques to establish	EE, WRO helped by the Environmental,	List of Spatial & Non spatial issues (Tribal Expert)

	existing concerns related to: ▪ Land availability and Tenure ▪ Access to irrigation ▪ Representation in WUA's ▪ Existing Government schemes ▪ Dependency on Minor Forest Produce (MFP) and common property resources	Social Tribal experts, WRO & Gram Sabhas	
	Discussions on possible intervention measures through the project, their likely impacts and safeguard measures (mitigation and monitoring) to be incorporated into the project activities. ▪ Loss of agricultural & homestead land ▪ Loss of structure & immovable assets ▪ Loss of livelihood ▪ Loss of common property resources	EE, WRO helped by the Environmental, Social & Tribal experts.	List of Safe guard measures (Tribal Expert)
	Consultations with tribal groups on the Draft Plan & Tribal Development Plan Proposals for further suggestions.	EE, WRO helped by the Environmental, Social & Tribal experts.	List of safeguard measures into the Draft Plan.
Implementation	Disbursement of Compensation and Assistance as per the Rehabilitation Plan/Framework. Preference for jobs in the project as per RP. Training on agriculture and allied activities as a part of MPWSRP	EE, WRO, Other line agencies helped by the State / District Level Committee & Tribal expert	Measures undertaken as per Checklist suggested in Tribal Plan (Environmental, Social & Tribal experts)
	Implementation of safeguards measures as	EE, WRO helped by the	Measures undertaken as per

	per Tribal Development Plan proposals	Environmental, Social & Tribal experts	Checklist suggested in Tribal Plan (Environmental, Social & Tribal experts)
Post Implementation Stage	Evaluation of the success of programs & safeguard measures undertaken	EE, WRO helped by the Environmental, Social & Tribal experts	(See Relevant Table for Impact Indicators)
	Follow up activities based on lessons learnt	EE, WRO, Other line agencies helped by the Environmental, Social & Tribal experts	List of modified Programs implemented (Tribal Expert)

The following table lists the Impact Indicators to be monitored throughout the sub-project cycle to monitor and evaluate the impacts of the project.

Table7.10 Indicators for evaluation

Items	Impact Indicators	Frequency	Agency
Economic Conditions	Income Project related & Independent means but assisted by the project Housing Changes in quality over a period of time Food Security Changes in occupation Skill portfolio Migration profile	Planning Stage, Post Implementation Stage	Independent agency/Internal monitoring by MD
Social Conditions	Representation in Community based institutions: Indicators of participation Empowerment, School enrolment, Health and morbidity Household infrastructure: electricity, potable water, living space etc.	Planning Stage Post Implementation Stage	Independent agency/Internal monitoring by MDPU

Displacement of Tribes

Given below are some key aspects to be considered for tribal groups affected by displacement. While addressing key issues pertaining to compensation to the PAPs or group belonging to a tribal community the following are to be considered: Their socio-economic characteristics, type of land, land ownership, dependence of tribal population on such lands, tenure rights and access to various categories of lands. The following are key aspects to be addressed during the finalization of entitlement framework:

- Land has to be looked upon not only as source of livelihood but also as inevitable nexus for tribal identity.
- Special prerogative and rights of tribal communities associated with territories inhabited by them has to be considered.
- Recording of community rights on land has to be ensured.
- Failure of record of rights over land under cultivation or any other usage has to be eradicated.
- Faulty recording of chief as owner of land when he only manages community land has to be replaced by community ownership.
- Recording of actual usage of land has to be ensured.

The mitigation measures suggested for the various impacts identified during to the project should be in accordance with the various constitutional and legal provisions. These should have to be duly incorporated in preparation of entitlement framework for the PAP from tribal communities. The following part gives the options for entitlement framework for tribal population. The following are the options for entitlement framework:

- Compensation for Loss of Land
- Compensation for Loss of structures and assets
- Compensation for Loss of Livelihood
- Compensation for Loss of common property resources
- Compensation for Loss of Grazing/camping/passage/minor forest produce
- Compensation for Clearance of Encroachers / Squatters

At the project planning stage, approval of selected projects, assessment of land requirement, ascertaining land ownership, identification of affected population, tenurial rights, etc. should be undertaken and approved by the Gram Panchayat. This should be compulsory for the final selection of projects and prior to preparation of the DPR.

Suitable administrative framework consistent with traditional practices to safeguard traditions and customs of tribal communities to protect the tenurial rights and access to the MFP should also be complied with. This should be as per the conferring rights of the MFP on Panchayats or Gram Sabhas considered under PESA. Grievance redress should be in conformity with that proposed in the Resettlement Plan.

Institutional Arrangements

The WRO is the main responsible agency for identification of the impacted persons belonging to the indigenous groups. The WRO is accountable in terms of incorporating the existing traditional systems of these groups for the effective implementation of the projects. Involvement of Panchayats becomes important for incorporating and management of the impacts within the existing Joint Forest Management (JFM), approaches of rural decentralization and development. The Panchayats should also be engaged in carrying out the surveys and consultations with the tribal people.

The Gram Panchayat at the grassroots level may take care of land acquisition following PESA Act. At the District Level, an Assistant Engineer may look into aspects of land acquisition. Introduction a Social Cell within the WRO structure will strengthen it in taking care of redressing grievances and mitigating negative social impacts caused by the project, especially on indigenous peoples. The Cell should have staff fully aware of provisions of IPDP, adequate understanding on norms and customs of and respect to the indigenous peoples.

Implementation Strategy

The main guiding principle of the IPDP should be finalized to provide compensation mechanisms and measures required for the project. The Social Cell of the MDPU, WRO should appraise the plan and ensure proper implementation including grievance redressal. The MoU among all stakeholders before implementation should ensure that interests of the tribal population within the sub-project region are duly addressed.

Information pertaining to the schedule of the IPDP activities shall be provided to the community in advance, following Land Acquisition Act adopted by the State and the WRO. The rehabilitation measures shall continue during the construction stage. Some of the key aspects to be incorporated within the sub-project activities include:

- Building a knowledge base within the WRO to effectively plan for Tribal development
- Preparing a sound Monitoring and Evaluation Framework to assess the project impacts
- Training Programs for Tribals towards capacity enhancement and awareness building
- Effective implementation of the identified safeguard measures.

GENDER ISSUES

Introduction

Gender is one of the central determinants of differential access to, use of, and control over economically productive resources (land, labor, technology, capital, training, information). This in turn has implications on the productivity, flexibility, responsiveness and dynamism of the economy. The gender imbalance as regards access to and control of economically productive resources leads to a lower response to economic incentives than would be the case if these differentials were reduced. Women are excluded or benefited in a limited way, or some times even negatively impacted by projects. Past experiences have revealed that the magnitude of impacts of development projects is significant on women if simultaneous efforts are not undertaken to mainstream them into the project. Thus, there is an urgent need for providing social justice and welfare measures for reducing such impacts on probable project affected women.

Rationale for Gender Action Plan

Constitutional & Legal Provisions

The principle of gender equality is enshrined in the Indian Constitution in its Preamble, Fundamental Rights, Fundamental Duties and Directive Principles. Accordingly, the Constitution not only grants equality to women but also empowers the State to adopt measures of positive discrimination in favor of women. The National Commission for Women was set up by an Act of Parliament in 1990 to safeguard the rights and legal entitlement of women and the 73rd and 74th Amendments (1993) to the Constitution of India require seats to be reserved for women in local bodies at Panchayat and Municipal levels, thereby laying a strong foundation for their participation in decision making at the local levels. The National policy for the Empowerment of Women (2001) is intended to create a positive environment for the overall development of women.

In line with the National Policy, the GoTN too has formulated a Women's Policy, which aims at ensuring visibility to women in all spheres by strengthening their role, increasing self-confidence and empowering them. The policy has identified 14 major areas and concerns and defines concrete actions to address the issues related to the empowerment of women.

Support for Gender Issues

Special measures should be undertaken for the upliftment of the women in each sub-project area. In all Sub-Projects, conscious efforts shall be made to include the following provisions:

- Provision of equal voting rights to wives of farmers entitled to vote for WUAs.
- Parallel WUA Committees (of women members only) to manage supportive agricultural activities like vermin-compost, canal management, rights to turf on canal and dam embankments, etc.
- Support to Self Help Groups engaged in dairy, food processing, etc.
- Empowering women for sustainable income generation on their own
- Creating alternative livelihoods for women has to be integrated with project formulation
- Creating facilities for financing of women entrepreneurs
- Trainings on alternative livelihoods to women
- Encourage provision of inheritance rights to women
- Social justice to oppressed women members of rural societies
- Social protection measures have to for vulnerable women of the rural societies
- Encouragement of Women's participation in developmental process

Procedure for Preparation of Gender Action Plan

Involvement of women groups in identification of impacts and opportunities through sub-project activities shall from the basis for preparation gender sensitive sub-project activities. The procedure to be followed and Process and Outcome Indicators for constant monitoring are presented in the following table:

Table: Activities and Indicators for Inclusion of Gender Issues

Sub-Project Stage	Procedure	Process & Outcome Indicators
Pre-Planning	Identify Gender likely Issues of the project region through GIS database.	List of issues (Gender Expert, MDPU)
	Organize women stakeholders meeting to sensitize and discuss the preliminary findings	Number of consultations (Gender Expert, MDPU)
	Identify key areas of constraints that may be improved through the project such as access to Food, Water, Fuel wood, Fodder, Physical & Social Infrastructure, Decision Making Bodies, etc.	Number of consultations & signed minutes (Gender Expert, MDPU)

	Incorporate and highlight the issues in the Screening Formats SC1 & SC2	List of issues mentioned (Gender Expert, MDPU)
Planning	Joint Walkthrough (if possible), Consultations and PRA exercises with women groups to identify possible impacts and opportunities for preparation of Sub-Project Gender Action Plan	List of issues identified on sub-project map and their inclusion in Sub-Project Gender Action Plan (Gender Expert, MDPU)
	Consultations for fine tuning the proposals of Sub-Project Gender Action Plan	Number of meetings & signed minutes (Gender Expert, MDPU)
Implementation	Implementation of safeguard measures and grievance redress mechanism on compensation, assistance and training, etc. of Project Affected Women Headed Households	Measures undertaken as per Checklist to be prepared under in the Sub-Project Gender Action Plan. (Gender Expert, MDPU)
Post Implementation	Implementation of Awareness Building, Training, Assistance in availing Credit facilities, etc. to create an enabling environment of equal opportunities to women	See Table 7.3 for Impact indicators

Table: Impact Indicators of Post Implementation Stage

Items	Impact Indicators	Frequency	Agency
Economic Conditions	Income Project related & Independent means but assisted by the project Housing Changes in quality over a period of time Food Security Changes in occupation Skill portfolio Migration profile Wages obtained	Planning Stage Post Implementation Stage	Independent agency/Internal monitoring by MDPU
Social Conditions	Representation in Community based institutions Indicators of participation Empowerment	Planning Stage Post Implementation Stage	Independent agency/Internal monitoring by MDPU

	School enrolment Health and morbidity Household infrastructure electricity, potable water, living space, etc.		

Implementation Strategy

The implementation and monitoring mechanism should be designed to look into the benefit of women stakeholders through the following measures:

- Stakeholders' consultation process has to be opted for all the stages of planning and implementation of the projects under consideration where women as an important stakeholder group should be consulted for finalizing strategies for their welfare.
- All the strategies related to gender development actions for the water resources projects are vested with the MDPU (WRO). This should be carried out in consultation and support from the concerned line departments. The project authorities should constitute Social Cells with gender experts within the department for timely preparation and effective implementation of the gender action programmes.
- Basic responsibility of gender development actions for the water resources projects is vested with the MDPU (WRO). This should be carried out in consultation and support from the concerned line departments. The project authorities should constitute Social Cells for timely preparation and effective implementation of the gender action programmes.
- Activities under gender action programme should necessarily have effective participation, cooperation and involvement of most of the basin level and project level officials to prepare and execute suitable action plans. In case of any grievances regarding the gender action plan the project-affected women may approach the Social Cell that will be established at the basin and head office of the WRO
- It is proposed that Gender Experts be nominated at the level of CE in all the project basins.

Development of Consultative Strategies

Introduction

Purpose of consultation is to increase participation in the project, especially of those who have not been traditionally excluded an active role. Women and vulnerable persons and families have to participate more effectively. Consequently, there would be

higher participation of women and decreased gender disparity with respect to access, usage and fulfillment derived from water Increased participation would also help reduce poverty. Participation would generate awareness, enhance knowledge and allow for better income generating practices. Reorganized water sector would directly impact agricultural productivity that can be optimized by participative processes.

Purpose of participation is to increase productivity of water. Insufficient availability of water is only a part of the water problem. Water productivity does not stop at storage or conservation; it extends to its effective utilization. The utilization can be made more efficient by combining efforts of all those using or managing water. The conclave is fairly encompassing and includes a number of stakeholders. These stakeholders should be consulted to improve efficiency of usage and productivity.

Target Participants

Consultations should be held at different levels, starting from the community to key programme functionaries. Intermediary level would be Members of Water Users' Associations, NGOs, and elected representatives, especially those belonging to the Panchayati Raj Institutions, among others.

Time of Consultations

Consultations should be carried out at all stages of the project life cycle.

Process of Consultations

The process of consultations should be kept very simple and largely informal. The consultations should always be a two-way process between facilitators and the constituents of the consultative groups. The facilitators and the group members should not be pitched against each other and also not for cross purposes. Consultations should be carried out in a congenial environment at a venue, which is amenable to the participants. It is important to ensure that group composition is as per the purpose of consultations. For instance, an all male group is hardly likely to throw sufficient light on gender Issues or only-women group may not be able to come up with final solutions on water usage tariff. There is a need to debate the purpose of consultation before forming the group. These pre-consultative discussions should be carried out with key-informants of the area. It is important to familiarize with the group before the consultations. Usage of local language and phrases is highly recommended All group consultation facilitators must undergo training prior to initiating the process Consultations need to be recorded faithfully and analyzed without prejudices.

Forms of Consultations

There could be several forms that a consultation could take. The forms of consultations are tied to the purpose. Some possible examples are given in the following table.

Table: Consultative Type and Purpose

Consultation type	Purpose
Meetings (general , special)	Information generation or dissemination
Group discussions/Focus group discussions	To arrive at consensus or debate merits of issues in a focused manner
In – depth interviews	To prove concepts

Principles of Consultations

Consultations are norms of participatory management tools but it is essential to base project related consultations on some principles. Consultations for TN-IAM WARM was based on principles mentioned here and are proposed that these principles should serve as thumb rules for later phases of the project too.

- Water has infinite value (but finite potential/usage?)
- Women/Gender
- Poverty

Phase Wise Need of Consultations

The project life cycle has been divided several phases for effective management. Briefly the need for consultations through the phases is outlined here.

Preplanning Stage

The foremost requirement of this stage is Disclosure of Project Interventions to all concerned stakeholders in the sub-project area. This phase is for identification and prioritisation of the projects. Consultations here would be largely with the community and WUA to identify needs and concerns to identify appropriate projects and assign priorities. These consultations would be more to establish demand rather than what can be provided. Some official consultations could also be carried out to provide feedback from the community and also to fix priorities.

The foremost requirement of this stage is Disclosure of Project Interventions to all concerned stakeholders in the sub-project area.

Planning and Design Stage

It is necessary to develop a stakeholders' participation plan, eventually leading to consultations at this stage would be to develop physical plan for proposed projects. Some

consultations here would be carried with the community but most should be with WUA, DC and PCs. If the project is to become more participatory then it is necessary to carry out extensive consultations during this phase. The design phase would require technical inputs and thus primary consultations would be with project functionaries and design consultants. However, here also people should be a part of the consultations as the project is going to affect them. Some situation requiring extensive consultations with the people would include: preparation of Dam Safety Plan, Pest Management Plan, Cultural Property Management plan, Resettlement Policy framework. Tribal Development Strategy & Action Plan and Gender Action Plan.

The foremost requirement of this stage is to undertake a Joint Walk through with all concerned stakeholders in the sub-project area.

Implementation and Operational Stages

At the implementation phase, primary tasks would be rehabilitation of structures and strengthening of structures. There would be a need to enhance stakeholders' involvement during these processes. This phase would ensure maximized participation of all stakeholders. Consequently, at the operational stages, participation would ensure improved project performance and equitable distribution of project benefits. Regular consultations would decrease possibilities of conflicts.

Post Implementation Stage

Once the project has been implemented and peoples' demands have been factored in, occasional consultations would provide constant feedback as a project monitoring tool. There is need for consultations as a tool of agriculture extension. Consultations would help in agricultural diversification. A community monitoring system should be developed and implemented.

Village Immersions (an overnight stay in sub- project villages) to adequately record the success and shortfalls of the project should be undertaken as a lesson learning exercise.

INSTITUTIONS WORKING ON WATER RELATED ISSUES IN TAMIL NADU

Roles and Responsibilities of government organizations involved in utilization / management of Water Resources in Tamil Nadu

Table: Roles and Responsibilities of Government Organizations

Agency / Department	Roles and Functions
WRO – PWD	Water Resources Organization is in charge of the water bodies, its maintenance and operation and regulation mainly on irrigation
Agricultural Engineering Department (AED)	It is responsible for Command Area on farm development activities including establishing Farmers' Organizations, Catchment (water shed) Stabilization and Soil Conservation
Tamil Nadu Water Supply and Drainage Board	It is responsible for developing and implementing programmes for drinking water supplies and drainage facilities throughout Tamil Nadu except Chennai
Electricity Board	It is responsible for developing hydroelectric and other electric power and providing it to users
Pollution Control Board	It is responsible for prevention and control of water pollution and for restoring water quality to desirable levels
Agricultural Department	It provides extension services to farmers, soil testing, input on supply of seeds, fertilizers, pesticides and agricultural research
Revenue Department	It collects levy and water charges from farmers. The Collectors coordinate closely with PWD with respect to water deliveries
Forest Department	Responsible for protection of forest and enhancing the watershed
Department of Municipal Administration	Look after supply of drinking water to several municipalities and provision of sewerage facilities. It also provides for sinking bore wells and maintenance of all systems
Rural Development Department	Responsible for some tanks having a command area of less than 100 acres, related to irrigation only
Chennai Metropolitan Water Supply	Responsible for planned development and

and Sewerage Board	operation and maintenance of water supply and sewerage systems for the city of Chennai. It also prepares long term plans to meet future water supply and sewerage disposal needs
Transport Department	Takes care of transport facilities, mainly road transport and other inland water transport
Industries Department	Takes care of development activity in the field of Industry and also increases the marketing facilities of the market produced
Fisheries Department	The activities involved exploration and exploitation of marine resources, inland and brackish water fish and fish production. Activities also cover preservation of fish produced, export and extension and education of fishermen community
Tourism Department	Takes care of improving tourism facilities and development of Tourist Centers
Director of Animal Husbandry	Looks after the Welfare of animals
Department of Environment	Deals with the Environmental Management issues concerning the State

List of Universities/Educational Institutions

Alagappa Chettiar College of Engineering and Technology	Madural Kamaraj University
Anna Institute of Management, Chennai	Madural Kamaraj University : Directorate of Distance Distance Education
Anna University	Manonmaniam Sundaranar University
Annamalai University	National Institute of Technology, Tiruchirappalli (Formerly REC, Trichy)
Bharathiar University	Online Courses of Animal Sciences Academy
Bharathidasan Institute of Management	Periyar University
Bharathidasan University	Sarasvati Mahal Library, Thanjavur
Connemara Public Library	Stanley Medical College
Dr. MGR Medical University	Tamil Nadu Agricultural University
Gandhigram Rural Institute (Deemed University)	Tamil Nadu Dr. Ambedkar Law University
Indian Institute of Technology, Chennai (IIT, Madras)	Tamil Nadu Open University (TNOU)

Institute of Child Health and Hospital for Children	Tamil Nadu Science City
Institute of Community Medicine, Madras Medical College	Tamil Virtual University (TVU)
Institute of Mathematical Sciences, Chennai	University of Madras
Madras Medical College (MMC)	Universities in TN
Madras Institute of Development Studies	Veterinary & Animal Sciences University

List of NGOs

Thiruvallur

1 Integrated Rural Community Development Society (IRCDS)
Post Box No . 7
44/11, Thanthai Periyar Road,
Rajajipuram
Pin - 602 001

2 Integrated Women Development Institute (IWDI)
14/57, Thiru Nagar
Villivakkam
Pin - 600 049
6280970/6190489

3 Rural Institute Of Community Education Trust
31, Mettu Street
Periya Kuppam
Thiruvallur - 602 001

4 Thirupani Trust Associaton
No. 13-43/440, Cholan Street
New Rajaji Puram, Periya Kuppam
Thiruvallur - 602 001
04116-64416

Vellore

5 Village Education And Development Society (VEDS)
7 B Pillaiyar Kovil Street,
Sankaranpalayam,
Vellore North Arcot – 632 001
Phone No- 0416-227102

6 Exnora Green Cross,
1/15 Keseav Pillai Street,
I Cross, Dkm College Road,
Vellore – 632001
Phone No. 0416-2263500
Web :- www.exnora.org Email.
exnora_vellore@hotmail.com

7 Centre For Environment Friendly Technologies
8, Maligai Kandappa Chetty Street
Ambur
Pin - 635 802
04174-47962

8 Centre For Rural Education And Economic Development For Oppressed Mass Trust (CREEDM)
15/19, Shivsakthi Nagar
Pudupet Road, Tirupattur Post
Pin - 635 601
04179-21307

9 Gandhian Guild For Rural Education Employment And Nature (GREEN) Trust
9, Kangeyanellore Road
Municipal Colony, Gandhi Nagar
Pin - 632 006
0416-246838

10 Guru Samrat Trust (GST)
No.4, New Street
Chenguttai
Katpadi - 632 007
0416 - 242494, 244763

11 Integrated Human Development Society (IHDS)
No.141, Kilvadugunkuttai
Karasamangalam, Latteri, 0416 – 212301

12 Integrated Rural Development Society (IRDS)
No.2, Tiruppur Kumaran Street
Selavanpet
0416- 227019

13 Tribal Rural Urban Service Society (TRUSS)
79, S.R.P. Nagar
Karai Village And Post, Ranipet Via
Pin - 632 404
04172-23174

14 Trust In The Area Of Social Activities
No. 1, Polachi Amman Koil Ii Street
Arakkonam
Pin - 631 001
04177-30150

15 Victory Youth Association - Vicya
No. 8/1, Kanagadurgai Amman Koil Street
Palanipet, Arakonam
Pin - 631 002
04177-24346

16 Women's Awareness And Rural Development (Ward)
Chinnapalampakkam
Vellore
Pin - 632 113
04173 – 41507

17 Women's Welfare Association For Rural Development
Near Udayam Weigh Bridge,
Anna Nagar
Salem Road, Tirupattur
Pin - 635 601

18 Radhakrishan Educational Fountion Trust
4/ 56 Vadokankuti Anna Nagar
Archamagalam Post, Lithari-632202.
245354 / 245142

19 Neru Youth Welfare
Association
Srigaravel Manikagar Street
Viruthapitu Post – 632006.
16 Tribal Rural Arabian Severe
Society
79, S.R.P,Kari Post, Via
Ranipati-6032404.

Chennai

20 Aquaculture Foundation Of
India,
Old No- 4, New No-40,
Kapaleeswarar Nagar,
Neelankarai,
Chennai – 41
URL:
www.Aquaculturefoundation.In

21 Eco Science Research Foundation,
98, Baaz Nagar, 3/621 East Coast
Road,
Chennai- 600 041
URL: www.Erfindia.Org

22 Madras Naturalist Society,
No-8, Janaki Aveneue,
Abirampuram,
Chennai – 600 018
URL: www.Blackbuck.Org

23 Worldwide Fund For Nature India
123/5, New No.297, I St Floor,
T.T.K. Road, Alwarpet,
Chennai – 600 018
Phone No-044-24997107
Email: www.ftnso@Sify.Com

24 Trust For Restoration Of
Ecology And Environment
12, First Cross Street,
V.P.Colony,
Chennai – 600 023
Phone No – 044-24721444

25 Ryuan Foundation International
(RYFO),
8, West Mada Street,
Srinagar Colony,
Chennai – 600 015
Phone No: 044-2351993
Email: Felixryan@Sify.Com

26 National Water Harvesters
Network Tn Unit,
162 B, Greams Lane,
Thousand Lights,
Chennai -06
Phone No: 044-28290038
Email:
Sara2551970@Yahoo.Co.In

27 Madras Naturalists Society (MNS)
8, Janaki Avenue,
Abhiramapuram,
Chennai – 600 015
Phone: 044-24347943

28 Group For Nature Preservation And Education (GNAPE)
New No.30, Block Ii
Gandhi Mandapam Road,
Kotturpuram,
Chennai – 600 085
Phone No: 044-52016406
URL: www.Gnape.Org,

29 Citizen, Consumer And Civic Action Group (CAG)
6, Ii Cross Street,
Karpagam Gardens,
Adayar, Chennai – 600 020
Phone No- 044-24914358
Email: Bj@Cag.Ilmas.Ernet.In

30 Toxics Links
8, Fourth Street,
Venkateshwara Nagar,
Adayar,
Chennai – 600 020
URL: www. Toxicslink.Org

31 Centre For Indian Knowledge Systems,
30, Gandhi Mandapam Road,
Kotturpuram
Chennai – 600085
Phone No: 044- 24471085, 24475862
URL: www.cliks.org,

32 Madras Crocodile Bank Trust,
Post Bag No – 4,
Mamallapuram – 633 104
Phone No: 04114-272958
URL:
www.Madrascrocodilebank.Org

33 The Centre For Research On New International Economic Order, (CRENIEO), Muthukadu, Mahabalipuram, Chennai
Email: crenieo@vsnl.net

34 Amm Murugappa Chettiyar Research Centre,
Tharamani, Chennai – 600 113
Phone No. 044-22430937
URL: www.amm.org

35 C.P.R. Environmental Education Centre,
No. 1 Eldams Road, Alwarpet,
Chennai – 600 018
Phone No: 044 – 24320756
URL: www.cpreec@vsnl.com

36 Green Peace
New No.47, 2nd Cross Street,
Ellaiyamman Colony,
Gopalapuram, Chennai – 600086
URL: www.Greenpeace.Org

37 Centre For Action Research On Environment, Science And Society - CARESS
160, Sivananda Road
Gill Nagar Ext 2, Choolaimedu
Chennai - 600 094
Phone No: 4727691, 4725870

38 Centre For Women's
Development And Research
5/359, Annai Indira Nagar
Okkiyampet
Thuraipakkam,
Chennai - 600 096
Phone: 4482821,4963621

39 Ramanujam Foundation For
Agriculture And Human
Potential Development
8/4, I St Cross Street
Logiah Colony, Saligramam
Chennai - 600 093

40 M S Swaminathan Research
And Foundation
3rd Cross Street
Tharamani
Industrial Area
Chennai -600 013
Phone. No.044-
22541229,22541698,
URL: www.mssrf.org

41 Society For Social Forest Research
9,East Bogar Road
T.Nagar Chennai –17.
4343092.

42 Chennai Eco Club(CEC)
57,4th Street,Pathbanaba Nagar.
Adyar, Chennai – 600020.
Fax :4864095 / 4865938
Email: ushaven@vsnl.com

43 Pasumai Thaayagam
Pasumai Thaayam,
No: 9, Lathawood Anenue,
Mahalingapuram, Chennai – 34.

Kanchipuram

44 Madras Crocodile Bank Trust,
Post Bag No – 4,
Mamallapuram – 633 104
Phone No: - 04114-272958
Web: -
www.Madrascrocodilebank.org,
Email: - mcbtindia@vsnl.net

45 Humanitarian Organisation For
Rural Development
6, G.S.T. Road, 1st Floor
Madurantakam
Pin - 603 306
04115-52835,52319

46 K-Nelvoy Womens
Development Society
(KNWDS)
Mudugarai Village
New Mampakkam Post
Madurantakam Taluk - 603 306

47 Rural Education Development
Society (REDS)
1a, Brahmin Street
Old Mampakkam Post
Madurantakam Taluk - 603 306

48 The Rural Development Project
Post Bag. 3, Koman Nagar
46, Thaiyur Post
Pin - 603 103

49 'C Aims'
3,West Mada Street, Acharapakkam
603301.
04115-22019.

50 Rural Education And Economic Development Society (REDS)
16,Selvavinagar Temple Street,
Mathuratham –603306.

51 Social Education Development Society (SETS)
56,La.Endathure. Post,
Vuithramalur Via
603406.

Dharmapuri

52 Rural And Environemnt Development Centre,
280, New Oddapatty Quarters,
Valluvar Nagar, Collectorate Post, Dharmapuri – 636 705
Phone No – 04342-284868
EMAIL-
redcdp@rediffmail.com

53 Bommanur Society For Village Development
Bommanur Post
Palacode Taluk
Pin - 636 805 Phone 04348 – 38288

54 Dharmapuri Rural Management And Advancement Society (DHARMAAS)
No.H.11 Tnhb Colony
Eranahalli Post
Palacode - 636 808

55 Rural And Environment Development Centre (REDC)
280, New Oddappatty Quarters
Valluvar Nagar
Pin - 636 705

56 Social Transformation Economic Progress Society (STEPS)
Nadupatty Village And Post
Mathur(Via)
Potchampalli Taluk - 635 203

57 Rural And Environmental Development Center
280,Puduothampati Quarters
Vailvarnagar
Dharmapuri – 636705.
04342- 30868
Fax : 04342- 61240

58 Thehamallai Environmental Awareness Moment
5/96 Nellinagar, Pedamanarri
Dharmapuri – 636703.
04342-63573,
Fax : 04342-60459 pp

Salem

59 Social Education And Environmental Development, 101-A/10, Kalimammanpandel St, Annathanapatty, Salem – 636 002

60 Bureau Of Rural Environmental And Development Service Thumbal Post Attur Taluk Pin - 636 114

61 Karippatty Rural Organisation for Peoples Education A.N. Mangalam Post Karippatty Via Pin - 636 106

62 Omalur Block Women Welfare And Uplift Organisation 11/9, Telephone Exchange Road Omalur Post Pin - 636 455 04290-20509

63 Poolavari Agaraharam Mahalir Sangam Poolavari Post Pin - 636 010 0427-872253

64 Rural Education And Development Project (Read Project) 20, Opp Chitra Theatre Lane Attur Post, Pin - 636 141 04282-42847

65 Social Education And Environmental Development 10/4/10-Kaliamman Pandal Street Annathanapatty Pin - 636 002

66 Society For Development Of The Oppressed (Sdo) 40, Avaiyar Street Mullaivadi, Attur Taluk - 636 141

67 Society For Ecological Development Nalukkalpalam Sakkarachesttypatty Post, Omalur Taluk Pin - 636 05

Erode

68 Agitation Committee Air And Water Pollution Vellankadu Post Thindal, Erode – 638 009 Phone No: - 0424-76246

69 Peoples Society For Rural Education And Environmental Development (PSREED) 1/24, North Street Gobipalayam, Alukuli Post Gobichettypalyam Taluk - 638 453 04285-54754

70 Swami Vivekananda Sevashram (SVS)
Kanakkampalayam
Kallipatty Via
Pin - 638 505.
04285-63431

71 Human Integrated Life And Learning
Kadampur Post 638503
Sathiyamangalam Taluk

72 Sugam Gramiya Valrchi Niruvanam
Kadampur Post- 638503
Sathiyamangalam Taluk

73 Centre For Education And Environmental Development
Puthovatalli Post
Sathiyamangalam Via – 638401

74 Agar Social Service Centre
109, N G O Colony
Tharapuram-638666
Phone:04258-20541

75 Womens Organisation In Rural Development
442, Thiruchengodu Road
Pallipalayam, Erode-638006
Phone: 04288-40212

76 Rural Educational And Environment
Development Service
Plot No 10 Sivasakathi Nagar,
Tharapuram-638657, Phone
04258-24479

77 Rajendra Foundation For Agricultural
Research And Rural Development
Kasarimangalam Post
Chitthur-638302
Phone:04256-39258

78 Environmental Production Centre
Shikayanagar College
Erode
Phone: 0424-222271, 21348

Nilgiris

79 Save Nilgiris Society,
Nilgiri Centre,
Ootocamund,
Nilgiris – 0423-442530
EMAIL –
beejaykay@sifymail.com

80 Nilgiri Wildlife And Environment Association ,
C/o District Forest Officer,
Nilgiris North Division,
Mount Stewart Hill,
Ootacamund – 643 001
EMAIL – lamons@vsnl.com

81 Keystone Foundation,
Kotagiri – 646 217
Phone – 04266-272277,2722977
Web : - www.keystone-foundation.org,
Email:- sneh@keystone-foundation.org

82 Malayaha Makkal Maruvazhvu Manram
No:14-56, Club Road
Kotagiri
Pin - 643 217

83 Network Of Education Environment Development Society - NEEDS
23, Sterling Road
Bishop Town, Ooty
Pin - 643 001

84 Rural Development Society
Nallakotta, 643225
Phone: 68217

85 Village Development Centre
Gramiya Bhavan
Aruvangadu-643202
Nilgris
96285 12800
rdocnr@giasmd01.vsnl.net.in

86 Gris Wild Life Environment Association
District Forest Officer
Mounts Start Hill
Uthagamandalam

87 Rajendra Foundation For Agriculture Research Rural Development
Chettair-638302
Kesimangalam Post, Bhavani Taluk

Namakkal

88 India Vision Charitable Trust,
Punjaipudhupalayam,
Koothampoondi Post,
Thiruchengode Tk,
Namakkal – 637 202
Phone No – 04288-230833
Email – nalls1@sify.com

89 Foundation For Health Education And Economic Development - HEED
30, Subramaniapuram
Mohanur
Pin - 637 015
Off: 04286-55303
Res.: 04286-55603

90 Human Mirror Trust
Thuraiyur Main Road
Alanganatham Village And Post
Pin - 637 061
04286-20594,21309

91 Mahathma Gandhi Elainger Narpani Mandram
1a, Muniyan Shandu
Rasipuram Taluk
Pin - 637 408
04287-20895

92 Scientific Education And Art Development Society
2/4, Selliyaee Palayam Village
Oduvankurichi Post, Rasipuram Taluk
Pin - 637 406

93 Women's Organisation For Rural Development (Word)
Post Bag No. 1
Pandamangalam, P.Velur Taluk
Pin - 637 208
7 Meras
Poinusawmy Illam, West Kalvai Vatapari,Kumarpaliam

94 Women's Village Deveploment Organisation (World)
Post Box No:1, Padamagalam, 637208.
04268 – 22960.

95 Rotary Community Caries For Environment
32 –L –2 ,V.K.S Complex , 2nd Mokanular Road ,
Namakal – 637002.
04286 – 26007

96 Womens Organisation In Rural Development,
442, Tiruchengode Road,
Pallipalayam,
Namakal – 638 006
Phone No= 04288-240212

Ariyalur

97 Gandhi Gramodhaya Society
Velayuthanagar,
Jayankondam (Post)
Pin - 621 802
04331 – 50183

98 Rural Education And Action Development - READ
1926, 8/58, Sakthi Vinayagar Street
Viilandai- Andimadam
Pin - 621 801
04331-42583, 42483

Nagapattinam

99 Nehru Social Education Centre
Ayakkaranpulam - 2
Sethi (P.O.)
Pin - 614 707
04369-74431

100 Tamil Nadu Dalit Educational Development Trust
(TANDET)
Patthar Building
Manalmedu & Post, Mayiladuthurai Taluk
Pin - 609 202

101 Women's Association For Rural Development
No.39, Keelavadambokki Street(Upstair)
Kilvelur Taluk
Kilvelur - 611 104

Coimbatore

102 Zoo Outreach Organisation,
79, Bharathi Colony,
Peelamedu,
Coimbatore – 0422-2573629

103 Annamalai Environmental Society
15, Udumalai Road,
Pollachi, Coimbatore – 642 001
Phone No- 04259-28872
Email- ksureshn@hotmail.com

104 Salim Ali Centre For Ornithology And Natural History,
Anaikatty P.O, Coimbatore – 641 108
Phone No.0422-2657102, 2657088
URL: www.saconindia.org

105 Siruthuli,
Iii Floor, Raheja Apartments,
Avinashi Road, Coimbatore – 641018
URL: www.siruthuli.org

106 Centre For Environment Education ,
Tamil Nadu State Office,
734, Presidents Hall, Avinashi Road,
Coimbatore – 641018
Phone: 0422-2215885
URL: www.ceeindia.org

107 People's Education For Development Organisation (PEDO)
188, Elango Street, A.N. Palayam
Kaniyur, Udumalapet Taluk
Coimbatore - 642 203

108 Rural Health and Environment Development
Trust (RHEDT)
25, Main Vilas Street
Karamadaai, Coimbatore - 641 104

109 Non Conventional Energy And Rural Development
78 A Cithi Vinagar Colony
Vadavalli
Coimbatore 641041

110 Nature Conservation Foundation Field,
Ropeway, Valparai – 642 127
Web:- www.ncf-foundation.org
email:- podocarp@vsnl.net

111 Centre Of Environment Education
9 Valipalayam
2 Nd Street
Thirupur-641602
Phone 702276 Fax: 01-0421-743543

112 Tamil Nadu Green Centre
5/1/338 Main Road
Mettupalayam-641301
Phone 04254- 22166, 04266-72247
E-Mail: greentn@hotmail.com

113 Mettupalayam Wildlife Preservation Society
250, Main Road,
Metuupalayam – 641 301

114 Wildlife Preservation Society (WPS),
65, Velankani Temple,
Opp. Petrol Bank,
Karamadai Road,
Mettupalayam – 641 301

Karur

115 Inba Seva Sanga,
P.O Sevapur,
Tharangampatti,
Karur – 621 311

116 Gramium
38, M.B.S. Agraharam
Gopal Mahal (Near)
Kulithalai - 639 104
04323-22842,23709

117 Snekithi
V. Puthur,Sathiyamangalam Post
Kulithalai Taluk
Pin - 639 120
04323-45620

118 Social Welfare Organisation of Rural Development (SWORD)
13/25, South Street
Mylampatty Post
Kulithalai Taluk - 621 301
04551-73490

119 Society for Community Organisation and Rural Education - SCORE
Kosur Post
Thogamalai Via
Pin - 621 313
04323-52482

120 Society For Education And Environment Development - SEED
Puthur Village And Post
Thogamalai Via
Pin - 621 313

121 Society For Education And Peoples Action For Development (SEPAD)
Panchayat Union Office Road
K.Paramathy
Pin - 639 111
04324 - 383388

122 Society For Women Action And Rural Development (SWARD)
Mahadanapuram Post
Pin - 639 106
04323-42616

123 Village Improvement Association (VIA)
Post Box No. 14
Kulithalai
Pin - 639 104

124 Village People's Education For Rural Development
Association - VPERDA
16/A/2 East Mudaliyar Street
Kadambarkovil, Kulithalai
Pin - 639 104
04323-24739

125 Society For Community Organisation And Rural Education
Thondaman Sinam Post
Thogaimalai Via-621313

126 Inba Seva Sangam
Annai Genetic Garden
Savapur Post
Karur-621311
Phone: 04332- 79228, 79227, 79229

Thiruvarur

127 National Mother And Child Welfare Organisation
142/27, South Street
Tiruturaipoondi
Pin - 614 713
04369-20409

128 Pirabavathi Jeyapprakash Narayanan Women Welfare
And Development Association (PIRAJEWEDA)
Kudoor, Mangudi Post
Tiruvarur Taluk
Pin - 610 103

129 Society For Community Organisation And Rural Development
Alangottai Post
Mannargudi Taluk
Pin - 614 018
4367-70420

130 Jawarhalal Rural Centre For Economic Development Social Change
Mettupalayam Post-614715
Phone: 04369-32423
Thanjavur

131 Rural Development Federation (RDF),
1/52, South Street,
Thirunageswaram,
Thanjavur – 612 204
Phone No – 0435 -60352

132 Centre For Ecology And Research
538, Ranivaikkal Street,
Thanjavur – 613009

133 Centre For Ecology And Research
No.538, Ranivaikkal Street
Pin - 613 009
04362 – 50410

134 Chackratees Educational Society
53, Attumanthai Anjalkara Street
East Gate
Pin - 613 001

135 Earth
4/108, Main Road
Thippirajapuram, Kumbakonam
Pin - 612 402

136 Guild For Integrated Development Education (GUIDE)
158, Parvathi Nagar
Nanchikkottai Road
Nanchikkottai Post

137 Margarat Social Development Society
1345/4, New Vanakkara Street
Manampuchavadi
Pin - 613 001

138 Rural Institute For Community Health Trust (Rich Trust)
Post Bog No.1,
Pandanallur, Thiruvidaimaruthur (Tk)
Pin - 609 807
0435-50781

139 Centre For Ecology And Research
538, Rani Vaikkal St
Thanjore-613001
Phone: 04362-21410, Fax: 40459, Email richisoft@gemini

Theni District

140 Vidiyal
Kariyappan Post,
Theni – 625 528
Phone No.04546-229215
Email.
vidiyal386@rediffmail.com

141 Thiyana Malai Trust
3/66 Devidrapuram
Keezha Vadakarai
Periyakulam-625601
Theni District

142 Society for Rural Development and Protection Of Environment (SRDPE),
1588, periyakulam road,
allinagaram,
Theni – 625 531
phone no- 04546-74973
email- srdpe@hotmail.com

143 Association for Needy Growth and Environmental
Liberation - ANGEL
8-7/16a, Agraharam Street
Aundipatty
Pin - 625 512
04546-42738

144 Community Development Centre (C.D.C.)
Near Primary Health Centre
Devadanapatti
Pin - 625 602. 0456-35269

145 Kamala Nehru Mahalir Mandram
Anaaimaalaianpatti Post
Pin - 625 526

146 Literates Welfare Association (Law)
Main Road
Kadamalaikundu Post
Aundipatti Taluk - 625 579
04554-27324

147 Rural Education Environment Awareness and
Development Society
5-3/5, Kumarapuram 2nd Street
Aundipatty
Pin - 625 512 04546-43948

148 Vidiyal (Centre For Social Interaction)
Kariyappanpatti
Rasingapuram Post
Pin - 625 58

149 Vinoba Rural Development
Sevalaya - Vrds
Karkkayankottai
Chinnamanur Via
Pin - 625 552

150 Ganthi Sava Samithi
19 B Rathakrishnan Ricemil St
Cinnamannur-625515

151 Vaigai Natural Centre
V. Nee. Govt. Hr. School
Periyakulam-625601
Phone: 32968

152 Dhanam Trust
82 V O C Nagar
Cinnamanur-625515
Phone: 04554-47497

Madurai

153 Sustainable Agriculture And Environemental Voluntary Action
43, T.P.M. Nagar,
Virattipathu,
Madurai – 625 010
Phone No- 0452-604082

154 Institute Of Environmental Education
M-329 Ropw Type,
Ellis Nagar,
Madurai – 625 010

155 Environemnt Production And Improvement Council (EPIC),
Anbu Manai, Dr. Radhakrishnan Street,
Bibikulam, Madurai – 625 002
Phone No- 0452-531545

156 Seva (Sustainable Agriculture and Environmental Voluntary Action)
45, T. P.M. Nagar,
Virattipathu,
Madurai – 625 010.
Phone No – 0452-2380082
Web : - www.seva-ngo.org, Email:-
numvali@sancharnet.in

157 Development Of Humane Action Foundation,
18, Pilayar Kovil Street, S.S. Colony,
Madurai – 625 016
Phone.No. 0452-2610794, 2610805
Web. www.dhan.org Email. dhan@md3.vsnl.net.in

158 Annai Mary Foundation - AMF
A. Vethamuthu Illam
Bharathi Nagar
Pin - 625 018, Phone No- 69115

159 Association For Gramarajyam and Rural Integrated Development - AGRID
"Sarvodaya Illam", M.P. Nagar
Vadipatti Taluk
Pin - 625 218, Phone No-04543-54343

160 Centre For Rural Education And Development
3-1-309, Main Road
T. Vadipatty
Pin - 625 218 , 04543-54453

161 Institute Of Environmental Education
M-329, Row Type
Ellis Nagar
Madurai - 625 010
0452 – 608558

162 Integrated Rural People Development Society
23, Jj Street
Thiruppalai Post
Pin - 625 014

163 Madurai Institute Of Peace Science
Gandhi Museum
Pin - 625 020
91-452-530291

164 National Institute Of Women Child and Rural Health Trust
1, North Street
Mudhichiyam
Pin - 625 020
0452-520821

165 Organisation For Rural Development - ORD
5/22, Puliyagoundampatty
Karumathur Post,
Thirumangalam Taluk
Pin - 625 514
20952 Pp

166 People Association For Growth And Education - Page
No. 9, Sahayamatha Street
Gnanaoliviipuram
Pin - 625 016
0452-608805

167 People's Association For Rural Women Development Trust (PARWD)
Valayankulam (Village & Post)
Via Postal Training Centre
Pin - 625 022
0452-601713

168 People's Organisation For Rural Health, Education And Economic Development (PREED)
5/165, Gandhi Nagar
Kappalur Post
Pin - 625 008
04549-24365

169 Power Project
7-1-59, Kallar Street
Cholavandan
Pin - 625 214
04543-59236

170 Recard Society
Gsms Illam, 33/50a21, Ochathevar Street
Keelapudur, Usilampatti
Pin - 625 532
04543-27409

171 Reform Trust
Oviya Campus
Keeripatti, Usilampatti Taluk
Pin - 625 532, Ph: 04552-41156

172 Rural Action for Cooperation and Economic
Development Trust - Race Trust
Valanadu Kaikatti, Pirampatti Post
Kovilpatti Via, Manaparai Taluk
Pin - 621 305, Ph: 04332-74330

173 Rural Development Society
6/126, Main Road, Kalligudi Post
Tirumangalam
Pin - 625 701

174 Rural Development Trust
Plot No. 3/379a, Muneeswaran Nagar
Thiruppalai Post
Pin - 625 014, 682882

175 Shepherd (Society For Human Equality People's Health Education And Rural Development)
97, Ayynar Colony
Thanakkankulam Post
Pin - 625 006
0452-882438,98431-12453

176 Social Development And Peace Trust - SDPT
Vellaimalaipatti,
Uthappanayakkanur Post
Usilampatti Taluk
Pin - 625 537

177 Society For Training, Education And Motivation - Stream
Sadiyandi Mooper Street
Kallikudi Road, T. Kalluppatty
Pin - 625 702

178 Society For Women's Education Economic Development
328-B, Pandian Nagar
Melur
Pin - 625 106, 0452 - 816294

179 Socio Economic And
Educational Trust - See Trust
Post Box No. 8
Pin - 625 020
0452-538509

180 Socio Human Resource
Development Centre
43, Nalliah Naicker Street
Alanganallur
Pin - 625 501

181 Voc Rural Development Centre
Katchaikatty Post
Vadipatty Taluk
Pin - 625 218
04543/54164

182 Women's Action For Rural
Development - Ward
12, Nellaiappan Lane
Tirumangalam
Pin - 625 706
04549-20038/21219

183 Women's Emancipation And
Development Trust
Gandhinagar
Usilampatti (Tk)
Chellampatti - 625 566

184 Mother Thersa Jeen Rural Women
Development Association
Selva Vinayagam Kovil St
Parasana Colony
Avinapuram
Madurai-625012

185 Sool Nilai Eyal Kulu
O G P M Girls Hr. Sec. School
Thallakulam
Madurai-625002
Phone 530031

186 Institute of Environmental
Education
M 329 Row Type
Ellis Nagar
Madurai-625010
Phone: 0452-608558

187 Mma Pengal Munatra Sangam
8/73 P G S M Avenue
Solavanthan Main Road
Thengalpatti-625514

188 Rural Education and Comprehensive
Activities For Rural Devlopment
Oothadevar Vedi
Killaputhor
Uchilampatti-626532

189 The Govanet Centre for
Development
2/43 Kottai St
Nagamalai Puthokottai
Madurai-625019
Phone 0452-85457

190 Sugam Social Service
A Thotiyapatti
Thi Puthupatti Post
Madurai District-655704

191 Sathana Vigas
Kattachananthal
Kathakinaru Oët
Madurai-625107
Phone:0452-822846
Fax 0452 531451

192 Sarvathiya Trust
52 Rajive Steet
Muniswara Nagar
Thirupanai-625014

193 Peoples Association for Rural Development
Main Road
Valayankulam
Postal Trainning Centre
Madurai-625022

194 Educational Trust of India
Jeeva Streer
Pethoniyapuram
Madurai-625016
Phone: 0452-605927

195 Pandiyuor Ramasamy Pillai Trust
Kurungi Street
Bharathiyar Nagar Main Road
Krishnapuram Colony
Madurai-14
Phone: 532905/46380

196 Youth And Rural Development Centre
24 B Kasthuribai Nagar
Malur-625101
Phone: 0452-815947

197 Good Will Social Work Centre
No.5 South Streer Extn
Singarayar Colony
Madurai-2

198 Society for Training and Rural Reconstruction
7-5 6 A Suthanthira Pavanam
Podinakkanpatti Road
Vadipatti-625 218

199 Volandury Social Service Organisation
Kachaikatti Post
Vadipatti-625 218

200 Society for Education Action and Environment
12 Bharathi Nagar
Sigganthar Savadi
Madurai-625018

201 Integrated Rural People Development Society
23, J J Street
Thirupavai Post
Madurai
Phone: 682429

Virudhunagar

202 Annai Dr. Muthulakshmi Reddi Rural Women's and Child Development Society
Kottaipatti
Vembakottai Post, Sivakasi Taluk
Pin - 626 131

203 Institute For Social Awareness And Rural Development (INSARD)
13, Shanmugavel Nagar Main Road
Aruppukkottai
Pin - 626 101

204 Rose Institute Of Development Services (RIDS)
3/27, M.R. Pudur
M.Reddiapatty
Pin - 626 118
04566-84467

205 Sri Vivekananda Seva Sangam
1/1545, Pandian Nagar
Rosalpatti
Pin - 626 001
04562-365035

Ramanathapuram

206 Village Education for Action and Development Trust (VEAD)
21, P.O. Nagaram,
Via Nainarkoil,
Paramkudi Taluk,
Ramanatahpuram – 623 705

207 Bharatha Matha Seva Sangam (BHAMA)
Kottaiyour, Mandapasalai
Kamuthi Via
Pin - 626 118

208 Grama Makkal Munnetra Maiyam
Kalloor
Tiruvadanai Taluk
Pin - 623 407
04561-379241

209 Nehru Ilaingar Mandram
4/224, St. Oriyur Road
L.K. Nagar, Thiruvadanai
Pin - 623 407
04561-54415

210 Reconstruction of Economic Vision and Emancy Fashion of Women
Trust
2/4 2 C3 Punnmadai Road
R S Mangalam Post-623 525

211 Mayill Nature Club
No 41, Theniyursaliyr St
Vinayakar Colony
Koranad
Mailaduthurai

Tirunelveli

212 Tirunelveli Wild Life Association,
Abcoy Gardens,
Madurai Road N.H.7
Sankaranagar – 627 357
Phone No – 0462-300113
Email – tvl-radhika@sanchar.in

213 Smart Environmental Science Cell,
Ambai Road,
Araikulam, Munnirpalam,
Tirunelveli – 627 356

214 Action Group For Rural Organisation (AGRO)
336,S.R.R Nagar
Sethurayan Pudur Post
Tirunelveli – 627 358
Email:
agroganesan@yahoo.com

215 Samaritans
2/133, Maruthakulam And Post
Tirunelveli
Pin - 627 151
04635-56332

216 Society for Women Education and Economic Transformation (SWEET)
54, South Street
Perumbathu, Nanguneri
Pin - 627 108

217 Sri Manonmani Rural Development Society
Main Road
Alangulam
Pin - 627 851
04633-70275

218 Women and Child Development Society
26 Main Road
Nanguneri
Pin - 627 108

219 Womens' Renaissance Centre
9, Srinivasagam Nagar B Colony
V.M. Arockianathapuram, Maharaja Nagar Post
Pin - 627 011

220 Arumpugal Arakattlai
H 109 Anbu Nagar
Thirunelvali-627011
Phone: 0462-584373

221 Rural Association for Community Education Society
Chettiyar St
Rathapuram Post- 627111
Phone: 04637-35538

222 Thirunelvali Mavatta Exnora International Mayatta Kilai
4 A Minnagar
Thenkosi- 627818
Phone: 04633-24497

223 Indira Ganthi Educational Youth And Rural Development Society
1 T 3 Rd Street
N G O Colony
Mellagaram-627818
Phone: 04633-26274

224 Mahathama Ganthi Save Mandram
4/69 Main Road
Vannikonangal Post
Sangaran Kovil T K-627957
Phone: 04636-86186

225 Ammar Rajive Ordesen Welfare Association
3/52 Main Road
Mannuoor
Thirunelveli-627201
Phone: 0462-85105

226 Integrated Development
Inciavatives
And Alternatives Foundation
7 Perumal Kiol St
Krishnapuram
Kadayanullur-627759
Phone : 04633- 42026
Fax: 04366-4120

TUTICORIN

227 Programme For Rural Education
And Social Service
Trust (Press)
Shanmugasigamani Nagar
Koivilpatti
Pin - 628 501

228 Society for Education, Action and
Development (SEAD)
1, 2nd Floor, Vsr Compound
Madurai Road, Vilathikulam
Pin - 628 907

229 Society For Rural Development
Organisation
74/4, North Street
Pannikulam (Via Kayathar)
Pin - 628 952
04632-61738

230 Rural Economic Development
Society
9 Dr Edison Compuntor
Thiruchanduoor-628215
Phone: 04639-45612
Fax: 04639-45393

231 Suganthi Devathasan Marine
Research Instuite
44 Katarkarai Salai
Thothoogudi-628001
Phone: 0431-340350
Fax: 91- 461- 340550
WEB:- www.sdmri.org
EMAIL:- jkpatti@sancharnet.in

232 Chevalier Roche Society,
Derose Centre, Nehru Nagar,
Old State Bank Colony,
Thoothukudi – 628 002
WEB- www.chevaliar.org

233 Community Eco Balance
Construction Network
Post Box No: Nazareth
628617
Phone: 91-4639-77553

KANYAKUMARI

234 Young Men's Christian Association
P.O Mullankinavilai,
Kanniyakumari – 629 157
Phone No -04652-232700
Email –
deema_smal@rediffmail.com

235 Natural Resources Development Project
Vivekananda Puram,
Kanniyakumari – 629 702
Phone No- 04652-246296
Email –
ngc_vknardep@sanchernet.in

236 Society for Environmental Education and Development ,
52, F, Nanjil Nagar,
Nagercoil – 629 002
Phone No – 04652-203924

237 Conservation Of Nature Trust,
43-C, Lagrace Water Tank Road,
Nagercoil – 629 001
Phone No- 04652-23527
Email- manian@md2.vsnl.net.in

238 Vivekananda Kendra – Nardep,
Vivekanandapuram,
Kanniyakumari – 629 702
Phone:- 04562-246296
Web: - www.vkendra.org Email.
ngc_vkendra@sancharnet.in

239 Action Group For Rural Organisation(AGRD)
1/239 Periyar Nagar
Suthumalai, Thirunelveli-627604
04362-342302
Fax: 331035
ualagam@md3.vsnl.com.in

CUDDALORE

240 Association for Integrated Rural Welfare
2/86, North Street
C. Kotthangkudi Thopu,
Chidambaram
Pin - 608 002

241 Health Education Association For Rural And Tribals - Heart
Annapoorna Illam
1-A. Indira Nagar, Vridhachalam
Pin - 606 001
04143-63123

242 Manushe
49, Kottathangarai Street
Parangipettai
Pin - 608 502
04144-53247, 23326

243 Swami Ramakrishna Educational Society
Omampuliyur Village And Post
Via - Ayyangudi, Kattumannarkoil Taluk
Pin - 608 306

244 Womens Education and Economic Development Society - WEEDS
No. 49/365,
4th North Cross Road
Mariyappa Nagar,
Chidambaram
Pin - 608 002

245 Pace Organization Center
Post Bag No: 54,
Sethaparam – 608001

246 Trust run by D.Murugaiyan
D.Murugaiyan, 3/261,
Thirumalai Illam, Madappuram,
Thiruthuraipoondi, Thiruvarur

247 Vairam Thelisis Education Centre
K.Vairakannu, 32, Kannuthoppu street, Thiruthuraipoondi 614 713

248 Trust run by A.Ganesan
A.Ganesan, Nalangattalai,
Vishnupuram post, Iravancheri via, Thiruvarur-609506

249 Thiruvalluvar Uzhavar Mandram
S.Balashanmugam, Sembangudi post, Thiruvarur-612603

Krisnnagiri

250 Jayabharathi educational trust
M.Theerthagiri, Thiruvanapatti village, Uthangarai, Krishnagiri 635 304,

251 Trust run by K.Poongodi
K.Poongodi, 308 Nethaji road,
Pazhaiyapettai post, Krishnagiri-635001

Sivagangai

252 Viva Organic farm
P.R.V. Varadharajan,
Kamaleshvari Illam, Rajendra Prasad St., Paganeri, 630 558.

Virudhanagar

253 Action for Rural integration and social eduation(ARISE)
A.Selvakumar, Sivalingapuram,
Mudukkankulam post
Kariyapatti via, Virudhunagar,
626 106

254 Rural Institute for community Health (RICH)
P.Srinivasa raghavan,
Krishnapuram, P.Thottiankulam
(Po), Thiruchuli 626 129

255 Sun Bio tech,
S.Mukesh, 2/181 A North street,
Sethu Narayanapuram,
Vathira irruppu via,
Virruthunagar 626 132.

256 People's Organisation and Social institution of transformation Development
POSITIVE TRUST No.16, TNHB Colony, Madurai road, Palayampatti 626 112

257 Rehoboth Agribusiness Consultancy
R.Nakkeeran, 4/323 Thangam Nagar, Vathirayiruppu post,
Virudunagar-626132

258 Trust run by
S.Ramar, 34, Perumalpatti nadar, Ist East street, Srivilliputhur,
Virudhunagar 626 125.

259 JEYPEE Biotechs
R.Palaneeshwar, 25, Chinnaiah school street, Virudunagar-626001

260 VISION Trust
Vision, 44, D.M.P. Kittangi street,
Virudunagar

Namakkal

261 Women's organisation for Rural Development
R.Sivakamavvalli,P.O.Box No.1. Pandamangalam Post,P.Velur Taluk, Namakkal District. 637 208

262 Radio Farmer's Association
R.Thangamani, M.A. 36. Paraiyur Ayyampalayam, Kumarapalayam,
Trichengode, 638 183

263 Heals Rural Training Centre,
Opp. To Sugar Mills,
Moganaur, 637 015

264 Vasantham Iyarkai Velan Pannai
S. Manivannan,
3/116,Kannimarkadu,Samayasangili,
Pallipalayam, Namakkal-638008

265 Sustainable life trust
S.Prathapan, 19/20,
S.B.M.Compound, Semmedu Village Post, Kolli hills,
Namakkal 637 411

Coimbattore

266 Imayam Social Welfare Association
S.Jayakumar,10/35 K.Sathya Nagar, Ganapathy, Coimbatore - 6 41 006

267 Positive sign foundation
8A/12. 10th. Street cross, Anna Nagar, Peelamedu, Coimbatore 641 004

268 Sulabha Agriculture organisation
Sulabha Agriculture Organisation, Oorupannadi nivas, Kottur, Malayandipattinam, Pollachi 642114,

269 National Agricultulral Development Trust.
M.shanmugam, Lawyers Garden, Eripatti post, Pollachi 642 205.

270 Coimbatore Eco Farmers Association
CEFA, 25 Periyannan Nagar, Thadagam road, Coimbatore - 25.

271 Kalpaviruksha
Dr. B.A. Uma, Thekupalayam, Coimbatore 641 020

272 Indian society for certification of organic products
ISCOP, RASI building 162/163, Ponnaiah rajapuram Coimbatore 641 001

273 Green Kovai, AIM for Seva
D.S.Raman,
Arsha Vidya Gurukulam
Anaikatti
Coimbatore-641108

Erode

274 Eden Organic Farm creators
21, Arulagam Building,
Udumalai Road,
Dharapuram 638 656

275 Sri Amman Organic Farm,
Vengiyampalayam, Pasur, Erode 638 154

276 Rajendra Foundation for Agrl. Research and Rural Development,
Kesarimangalam P.O, Bhavani Taluk, Erode

277 Pasumai Angadi,
Shop No. 65, Velayuthasami Complex, Muthur Road,
Vellakovil 638 111

278 The Falcon Bio control (Selvi B. Vanathi)
Tamil Nadu Vermi culture Hatcheries, Reliance Tower Road, Mettankattuvalasu, Erode 638 109

279 Trust run by
C. Loganathan, 55, Nethaji street, Vairapalayam, Erode 638 003

280 Ever Agro Corporation, 122, Park Road, Vaiyapuri complex, Moolapattarai, Erode 3.

281 Trust run by
A.S.Kumar, 44 Mariamman koil street, Iyyampalayam,
Kavunthapadi, Bhavani taluk, Erode.

282 P.Dhanasekaran,
Maniampalayam,
Iyyampalayam post,
Kavunthapadi via, Erode

283 Service unit for development activities in rural areas
SUDAR, 435 A, Rangasamuthram,
Murthy tyres building, Upstair,
Sathyamangalam 638 402

284 Trust run by
S.P. Ramalingam, Annur
Gounder Thottam, Uthandiyur
post, Sathyamangalam, Erode
638 402

285 Trust run by Elanchezhiyan
S.Elanchezhiyan Athanikarar
thottam Uthandiyur post,
Sathyamangalam, Erode 638 402

286 Thalaimurai Organic farm
M.Kumar, 69, Kenchanur post,
Sathyamangalam,
Erode 638 401

287 Iyarkai Organic farm
M.V.Shanmugah raj
3/250 K.K.Thottam,Mangalapatti
Post, Muthur via, Erode 638105

288 Iyarkai Agricultural Farmers
Group
Iyarkai Agricultural Farmers
Group, 5/339, Ramapuram
Thottam, Thalavadi, Erode-
638461

Karur

289 R.N.Agro Farms
Chinnadharapuram,
Karur -639202

290 Centre for Human Resource
Development Trust, (CHRD)
N. Subramanyan, CHRD Trust,
8/139 B, Kumarapalayam,
Chellandipatti post, Vellianai, Karur
639 118

291 Cherur trust
E. Vellaichamy, Panikampatti,
Kulithalai taluk, Karur

Madurai

292 Kokila Hospital and Herbal
Training Centre
Dr. J.Jeyavenkatesh,
Kokila Hospital 27/1D -1,
Jaihindpuram
Ist Street,
Madurai - 625 011

293 Indian Medicine and herbal
promoters organisation
Kokila hospital and Herbal training
centre campus, 27/1D-1
Jaihindpuram
1st street,
Madurai 625 011.

294 Association for rural
development
K. Joseph Binsant, 41 D, 7/800,
Jawahar street, Melakuilkudi
road, Nagamalai pudukottai,
Madurai 625019

295 Annai mary Foundation
Haven for positives
V.Denes Amaladevi
Vethamuthu Illam, Bharathi nagar,
Madurai-625018

296 Rural Development Trust
S.Chinnasamy,
Agro Project Coordinator,
Anaikaraipatti,
Vandari post, Peraiyur taluk,
Madurai 625 705

297 Sakthi Vermicompost unit
K.Sivaswamy
Sanampatti
Pandiarasapuram post, Madurai-625209

298 SUMAREES Trust
B.Rajagopal
66, Devarayan street,
Thirumagal Nagar,
Madurai-625009

Thiruvannamalai

299 Sugarcane grower Farmers Welfare Association, 17/A CC Road, Pollur 606 803.

300 Rural Health and Economic Development Society (RHEDS)
Meyyur Village and Post,
Vanapuram, Thiruvannamalai 606 753.

301 Rural Development Society, (RDS), Kanji.
M.Kannabiran, Pillaiyar koil chetty street, Kanji village,
Thiruvannamalai 606 702.

302 Trust run by P.Dhandapani, 3/520, Vaiyapuri chetty street,
Melsozhankuppam, Adhamangalam via, Polur Taluk, Thiruvannamalai

303 Trust run by R.Krishnamoorthy
R.Krishnamoorthy, North street,
Veeranur post, Adhamangalam post, Polur Taluk,
Thiruvannamalai

304 Sai Jothi Charitable trust
Sai Jothi Charitable Trust,No. 3
Poomalai Sales Complex, Anna Salai, Thiruvannamalai 606 601

305 Voice of nature
V. Ramakrishnan, HIG 507/75,
TNHB, Tamarai Nagar,
Thiruvannamalai

306 Association for Rural Tribes
582/3, Bharathiyar street, Mullipet,
TNHB opposite, Thiruvannamalai-632316

307 Thiruvannamalai Taluk farmer's Exnora
S.Natarajan, 62 A, Krishnan street, Thiruvannamalai

Trichy

308 Community Organisation and Rural Education (CORE)
Secretary, CORE,
28 Thuraiyur Road,
R.S.Complex,
Musiri 621 211

309 Association For Human Integrated Massive Social Action (AHIMSA)
1-207 C, Sona Complex, Tiruchy Road, Vaiyampatti 621 315.

310 Srimath Andavan Arts and Science College,
108, Ganapathy Nagar,
Thiruvanaikovil Trichy 5.

311 G.B. Food Oils private Ltd, 108,
Ganapathy Nagar, Thiruvanaikoil,
Trichy-5.

312 Mavalipatty Nanbargal Narpani Mandram & Youth Development Centre.
K.Jeya Thirupathi, Mavalipatty (Po) Musiri, Trichy 621 205

313 Bringing Integration and Rural Development
P.Ramasamy, 4/44. Nadupaty (Po), Vaiyampattu (via), Trichy, 621 315.

314 Awareness and Community transformation foundation.
ACT, 144 Main road,
Kovilpatti, Manaparai taluk,
Trichy 621 305.

315 Sarvodhya Foundation
B. Sathya. 158/1 13th cross. Anbu Nagar, Crawford, Trichy 620 012.

316 PENI-'EL' Educational trust
S. Johnson, Peniel Nagar,
Angarai post, Lalgudi taluk,
Trichy 621 703

317 Tamil Nadu Agri Clinic
N.Rajasekaran, 14 Premier Towers,
Karur road, Trichy 620 002

318 Individual Development Foundation
Nangil Vedha, Room No.2, 3rd floor, N.S. Building, Opp. To Premier towers, Trichy 620 002.

319 Rajiv Gandhi Social Service Trust,
A.R.Velu, 58/1Kovilpatti road,Manapparai,Trichy 621 306

320 Integrated Rural Development Foundation
S.R. Naveen Balaji
104, Raja colony, First cross,
Cantonment, Trichy-620001

Thanjavur

321 KKM Bio tech
C/o. Chitra Agency, 74
Abraham Pandithar Street,
Thanjavur 613 001.

322 A. Veeraya Vandayar Memorial Sri Pushpam College
Sri Pushpam College,
Poondi 613 503 Thanjavur Dist.

323 Periyar Maniyammai College of Technology for Women
Periyar Maniyammai College.,
Vallam, 613 403, Thanjavur

324 MENS Service trust
S.G. Selvi, Padapannar Vayal,
Sornakadu post, Peravurani taluk,
Thanjavur 614 804

325 Integrated Women Development Centre
K.Murugaiyan, 135 Main road, Ammanpettai, Vethiyapuram post, Thanjavur 613 205

326 Organic farming awareness association
Thiruvenkadam, Irandingattalai post, Kumbakonam-612202

Dharmapuri

327 Development Education and environment protection society (DEEPS)
M. Sankar,
BDO OfficeRoad, Pennagaram 636 810

328 Council for Integrated Development, A.Pallipatti post, Pappireddypatti Taluk, Dharmapuri 636 905.

329 R. Dharmalingam, Rural Development Society, 4/9 A, Agraharam st., Kadathur, Pappireddypatti 635 303.

330 Heritage Herbs India
1/213 A1. Aisshwaryam Nest, Vivekananda colony, Near Silk Farm, Avalapalli Road, Hosur, 635 109

331 ARIMA Service trust
V. Kirubanandham, FTC Convenor, Mookareddi patti, A Pallipatti, Pappiredi patti taluk, Dharmapuri 636 905

332 Tribal Health Initiative
Dr. Lalitha Regi, Theerthamalai Post, Dharmapuri District 636 906.

333 Institute of Enterpreneurship Development(IED)
IED
5/1358, T.A.M.S Colony,Elakkiampatti, Dharmapuri-636705

Nilgiri

334 Centre for tribals and rural development trust, Ealamanna, Mango range,
The Nilgiris 643 220

335 The Earth Trust,
13/19 A6 Hema College, Bharathi Nagar, Kethi post, Nilgiris.

336 A.M.Agro Products
A.M.Abibulla, Panthalur post, Panthalur taluk,
Nilgiris 643 233

337 Jeyam Agrotech
6/440, Isaac lane,
Aruvankadu,
Nilgris-643202

338 Bacto Agro Culture care PVT Limited
E. Radhakrishnan, Bharatha Nagar, Kolapally post, Nilgris-643253

Tuticorin

339 Kokulam Arakattalai, Jamin Kodankipatti, Kuruvarpatti post, Vilathikulam, Tuticorin dist.

340 Women's Education and Employment Development Society.
S.Charles, Mudalur post, Tuticorin Dt. 628 702.

341 Centre for education social welfare and agricultural rural development
L.Rajan, S.D.A. Church street, Muthugai nagar,Nalathinputhur, Tuticorin 628 716

342 Rural Agroservice and institute of Natural farming
P.Rosari, 8/74, Rajapalayam, Arockiapuram post, Tuticorin-628002

343 Rural Service Trust
V.Ganapathi raman,Masarpatti Nenmeni,Tuticorin 626 202

344 Paathai Trust
V.Kennady 1/42. South Street, Kamanayakkanpatty Thoothukkudi Dist. 628 720

345 Vishwa export,
5/322, E.P. Colony, Alampatti, Kovilpatti 628 501.

Theni

346 Agent for Organic Fertiliser and Herbal pesticideT.Tamilselvan, Vinobaji nagar, Karuppasamy Koil street, Bodi

347 Malar social society,
M.Shanthi 4/9Ramugowdar street, Kamayakoundanpatti, Theni

Pudukottai

348 Pasumai Thangam Arakattalai, 275, North street, Pokishakaranpatti, Vaithur post, 622 203

349 Indian Microbial Agricultural centre, Anandha solai Pisanathur village, Kandharvakottai 613 301

350 Rural Development Organisation, 45, Meenakshipuram road, Arimalam post, Pudukottai 622 201

351 Goshakthi Arakkattalai Bharathipuram,Vaithur post Pudukkottai 622203

352 Rights Trust A.Kanagavalli,1/81, Vamban Nal Road, Kalyanipuram, Kotthakottai post, Thiruvarangulam via, Pudukkottai dist-622303

Dindigul

353 Trust run by M.Jayaseelan. Sengulam post, Natham taluk, Dindigul

354 Trust run by K. Subrarayan, Chellakuttiyur, Kovilur post, Vedasanthur taluk 624706

355 Village Welfare trust, 5/199, Teachers Quarters, NGO Colony, Dindugal 624 005,

356 Serene Secular Social Service Society, S. James Victor, South Street, Kosavapatti post, Sanarpatti via Dindugal 624 304

357 Rural organization for social education trust. M.Palaniammala, West Street, Old Batlagundu, Dindigal Dist. 624 202

358 Sirumalai Evergreen Multipurpose community Development society G.F.Viswasam, 7-8, Little Flower Home, A.Vellodu, 624 307

359 Child Trust Chandra Saravanan, No.4-12-2 Arunaslapuram, Dindigul Road, Batlagundu, 624 202

360 The Health Wealth Social Service trust 17/3 /5 Aarthi Theatre road, YMR Patti. Dindigul 624 005

361 Jaya Bharath Agro Agencies S. Kandasamy, 246/9 B2 Balu complex, Gandhi Market, Ottanchatram 624 619

362 RELIEF Trust 23 NGO Colony, Dindigul 624 005

363 Rural social Education &WelfareCentre C.R.Tamilvanan 5/166 St.Marys Teachers Colony, N.G.O.Colony Post, Dindigal 624 005

364 Peace Trust, Thasaripatti, Kuttam post, Vedasanthur 624 711

365 Rural Integrated Development Organisation
RIDO, 9-3-56, North street,
Sithayankottai-624708

366 Peoples Welfare Trust
T.Perumal
69, East car street
Dindigul-624001

Chennai

367 Medi herbal nature and food products,
41/31, Manickam Nagar, Ajax,
Thiruvotriyur, Chennai 600 019.

368 Bio track technology pvt. Ltd.
32, Ist floor, C 60, Anna Nagar
Plaza, Iind Avenue, Anna Nagar,
Chennai 600 040.

369 Service civil International
193/8 Asiad Colony, Anna
Nagar West Exten,
Chennai 600 101

370 Bharat Krishak Samaj
37, Lake view Road,Adambakkam,
Chennai-600088

371 Madras social service society,
Kolping tower, IInd floor, 329,
T.T.K road, Alwarpet,
Chennai-18

372 EVERGREENS Agency for Natural Resources
N.K. Shanmugam, 36, 18 th Avenue
Ashok Nagar, Chennai- 6000083

373 Chinu Exports
Bio Products Division
26/636 27th.St.Korattur
Chennai.80

Kanyakumari

374 Green mark Agro inputs Ltd.,No.3, Ist floor, Lakshmi Complex, Aralvoimozhi,
Kanyakumari

375 Green land Organic manure,
Bersil & Co., 78, New Assist
building Muthamil Street,
Nagercoil 1

376 Trust run by
T. Glori bai, Kakavilaiparambu,
Moovatrumugam post,
Kanyakumari 629 177

377 Jayam united service trust,
13/15 A, Krishna Illam, Thamburan
Koil street, Vadakur,
Thovalai 629 302

378 Kumari Eco-Friendly Farming Services (P) Ltd.,
G.C.Prateep, Kumari Eco Friendly Farming Services (P) Ltd., Chankai, Kanjiracode
Martandam 629 155

379 TSUNAMI Trust
A.Dimon Arul
Kodimunai post, Colachel via,
Kanyakumari-629251

380 Rural Uplift Centre
S.Chrishtopher
Theepam Dhumpali Iranipuram
Kanyakumari 629197

381 Victory Organic farm
Dr.C.Thiruvaranganathan
A.155, N.G.O Colony
Kottar post
Kanyakumari-629002

Cuddalore

382 Centre for Agricultural awarenss and rural development (CAARD)
CAARD,
S. Bharathi Raja,M.Sc.(Ag),
CAARD, Vilathur,
Thirupaniyapuram,
Melavanniyur post, Cuddalore 608 302.

383 EID Parry Ltd.,
Nellikuppam Sugarcane factory,
Cuddalore

384 Indo Europian Institute for Natural Medicine
Indo Europian Institute for Natural Medicine,
No. 5, Bharathithasan Street,Manjakuppam, Cuddalore 607 001.

385 V.V.V Club
Nabard, district dev. Office, 223, nethaji road, manjakuppam, cuddalore

386 Basarass Biocon(India) PVT.Limited
Basarass Biocon LTD
3/320, MainRoad, Eraiyur,
Pennadam, Cuddalore-606111

387 RA Agro Traders
JP Rajasekar, 7 first cross, Friends Nagar, Opp. To Employment Office, Cuddalore 607 001

388 Mega Agricultural Service Trust, 240 East street,
Karmangudi post,
Cuddalore 606 110

389 Biodyanamic trust
V.R. Raaja Murugan
Biodynamic Association, 19, south street, Vridachalam, Cuddalore-606110

390 Biodyanamic trust
A.K.V.Raja Inthren,
Biodynamic Association, 19,
South street, Vridachalam,
Cuddalore-606110

Salem

391 Trust run by
R.Sivam, Virudhampatti P.O.
Mecheri via, Mettur taluk,
Salem

392 Mettur Nature Society, 83 A, Pudu Colony, Karumalaikudal,
Metturdam, 636 402

393 Green Star Agri.consultancy
K.Shanmugavel, B.Sc(Ag),
Founder & Director, Green Star Agi consultancy, Muthampatti,
Tholasampatti(via), Mettur (Tk)
Salem, 636 503

394 Rural Education and Development Project
READ, 37 A Avvaiyar street,
Mullaivadi, Athur post, Salem
636141.

395 SAMRAT,
172/1, Sukkampatti, Salem-636122

396 Jai Agro Service,
Opposite to Ponni Co- peratives,
Middle Street,Thammampatty,
Salem-636113

397 Rural awareness of Environment and social organization
RAESO, 77-5/2-39-C9, 4th cross, Shivayanagar,
Salem 636 004

398 Trust run by
Manigandan,1/1,
M.Perumapalayam, Salem-636111

399 Omalur block women welfare uplift organization
K.Saroja, 11/9, Telephone exchange road, Omalur post,
Salem-636455

400 Trust run by
C.Nallathambi,4/11, New street,
Kadaiyampatti post, Omalur taluk,
Salem-636351

Kancheepuram

401 Rasi Agricultrual Consultancy Centre, 154/2, GST Road,
(Rattinakinaru) Chengalpet 1

402 Foundation for organic agriculture,
348/166, Anna salai,
Chengalpet 603 002.

403 Tamil Nadu Organic farming and Herbal farmers Association
N.Dhayanidhi, 21 Devarajan street, Vedhachalam Nagar,
Chengalpet, Kancheepuram

404 Natural Educational Environmental Agricultural Development Society.
G.Gopalakrishnan, 66 B,
Sengazhuneerodai Street,
Kancheepuram 631 502.

Thirunelvelli

405 Organic farming association St. Fathima Annai Agricultural farm
Organic farming association St. Fathima Annai Agricultural farm, South Kuniyur, Cheranmagadevi 627 426

406 "Ilayabharatha" (M) Guidance Centre, 1/271, Youth Club building, North St., Mannur 627 201.

407 . Sri Parasakthi Trust, 226, LRS Palayam St., Tenkasi 627 811.

408 Viswa Export 5/322 EB Colony, Alampatti, Kovilpatti, 628 501

409 Health Trust 6-121. Esckiamman Koil St., Sanganapuram (Po), Tirunelveli, 627 114

410 Brindha Agro FarmService, 18, St. Xavier's Shopping Complex, St. Johna's College Road, Palayamkottai, Tirunelveli 627 002.

411 TANWA Self Help Group C. Ramathilagam, Shenbaga kal Oadai street, Vasudevanallur, Sivakiri Taluk, Tirunelveli 627 758

412 Sri Ganga Seva Sangam A. Ponnuvel, 49/3, Middle street, Duraisamiyapuram, Sivakiri taluk, Tirunelveli

413 ESR Chairtable trust, 82, Sanror North street, Chinthamani, Puliyangudi post, Sivakiri taluk, Nellai dist. 627 855

414 Iyarkai Velanmai Mempattu sangam,70/2, South street,Sanarpatty, Tirunelveli-627201

Villupuram

415 Village Development Society. F. Joseph, Village Development Society Nilayam, Karunanidhi Chettiyar Illam, Valathi Post, Villupuram 604 208

416 Pasumai Farmers Association, Thirukovilur Road, Devapandalam 606 402

417 Paasumai Thamilagam, 1 Nattarmangalam, Vallam post, Gingi, Villupuram 604 206

418 Sri Bio Natural India, KK Nagar, Salamedu, Villupuram 605 602

419 Udayam Trust, Kakanoor Post, Kedar Via, Villupuram 605 402

420 Greenworld Agri Clinic,10 Town panchayat vanigavalagam, Salem main Road, Chinnasalem-606201

Nagapattinam

421 Farm women discussion group
Poornima Mary kanth, Farm Women discussion group,
PUshpavanam 614820

422 Annai Indira Social Education centre.
1/249. Sumaykha Eazilaham,
pushpavanam, Vedaranyam (TK)
Nagapattinam Dist. 614 809

423 Trust run by V.Sadasivam
V.Sadasivam, Elumichampatty,
Kodangudy post,
Mayiladuthurai, Nagapattinam-609314

424 K.P.T. Organic farm
K.S. Ramiyan, Konari Rajapuram,
Mailaduthurai taluk, Nagapattinam 612201

Vellore

425 Gramapura Magalir Muligai Vivasaya Mempattu Sangam
Vadagarai ,
Minnur (P.O)-635807.

426 Velanmai Vithai Mayam.No.5,
IELC Complex, MC Road, Ambur-635 802

427 SOLAI PROGRAM,
Dr. R.D.Rajan,
Christian pet village, Post,
Vellore - 632 059

428 Organic farming and Vermiculture Hatcheries CAH College.R.Yusuff Sheriff, Technical Section, CAH College, Melvisaram.

429 Rajiv Gandhi Educational and Charitable Trust.
G.Anbalagan, 63/1 Maniyakara street, Arakonam,
631 001. Vellore District

430 REACH trust,
71/50 Chellaperumal street,
Sholingar 631102.

431 Trust run by M.Ramamoorthy
M.Ramamoorthy,
Sokkalampatti, Vettapattu post,
Nattrmpalli via, Vellore-635852

432 Guru Samrot Trust
V.Dakshinamurthy, No. 4, New Street, Senguttai, Katpadi post,
Vellore 632 007

433 Maha Organic Inputs private Ltd.,
M. Mahalingam, 1/367 Katpadi Road,
Latteri, Katpadi Taluk.
Vellore 632 202.632 509.

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Sri A.P. Jaya Prakash Executive Engineer, WRO, PWD, Tindivanam	Sri V. Balasubramaniam Assistant Engineer WRO, PWD, Athur
Sri S. Sundara Murthy Assistant Executive Engineer WRO, PWD, Pudukottai	Sri R. Radhakrishnan Assistant Executive Engineer WRO, PWD, Pudukottai
Sri S. MohanRaj Assistant Executive Engineer WRO, PWD, Pudukottai	Sri S. Prabhakar Junior Engineer WRO, PWD, Pudukottai
Sri K.Gopalakrishnan Executive Engineer, WRO, PWD, Sivagangai	Sri S.Ayub Khan Assistant Executive Engineer WRO, PWD, Sivagangai
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Sri Selvaraj Assistant Engineer WRO, PWD, Madurai	Sri Rustham Ali Executive Engineer, WRO, PWD, Srivalliputtur
Sri G.Rajesh Assistant Engineer WRO, PWD, Madurai	Sri C.Chelladurai Assistant Executive Engineer WRO, PWD, Srivalliputtur
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Sri Rajbandra Bose Assistant Executive Engineer WRO, PWD, Srivalliputtur	Sri R.M. Subramanian Assistant Executive Engineer WRO, PWD, Perambalur
Sri K.Chandrasekharan JE,PWD, Perambalur	Sri P.S. Rajamaniakam JE,PWD, Perambalur
Sri V.Anantham Assistant Engineer WRO, PWD, Perambalur	Sri V.Sundaram Assistant Engineer WRO, PWD, Perambalur
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Sri Pasumalaithavan, Consultant, Technical Secretariat, IWS, Taramani, Chennai.	Sri.Santhanam' GIS, Consultant, Technical Secretariat, Taramani, Chennai
Sri Siva Subramaniam Assistant Executive Engineer Dam safety dept. PWD, Chennai	Ms. Seethalakshmi, Joint Coordinator,Marketing TN Women Development Corporation Chennai
Sri Subramanian Murugeshan HR & Admn TN Social welfare Dept TN Pudhu vazhvu Society Chennai	Dr. Raja Ram, IAS, Director, Department of Rural Development, Saidapet, Chennai
Sri Gandhi System Manager,CDD, Social welfare Dept Chennai	Sri Thyagi, Additional Director, Dept. of Environment, Saidapet, Chennai
Dr. Thomson Jacob Dept. of Environment Saidapet Chennai	Dr. Vidyasagar Consultant, Dept. of Agriculture MDPU, Chennai
Sri M.SeethaRaman Dept. of Agriculture MDPU, Chennai	Ms. Mangalam Balasubramanian Coordinator, Women SHG's T.Nagar, Chennai
Ms. Mangala Agriculture Officer Dept. of Agriculture Chennai	Ms. Valarmati Agriculture Officer Dept. of Agriculture Chennai
Sri M.Kesavulu Assistant Executive Engineer MDPU, Chennai	Sri Vijay Anand Assistant Engineer WRO, PWD, Chennai
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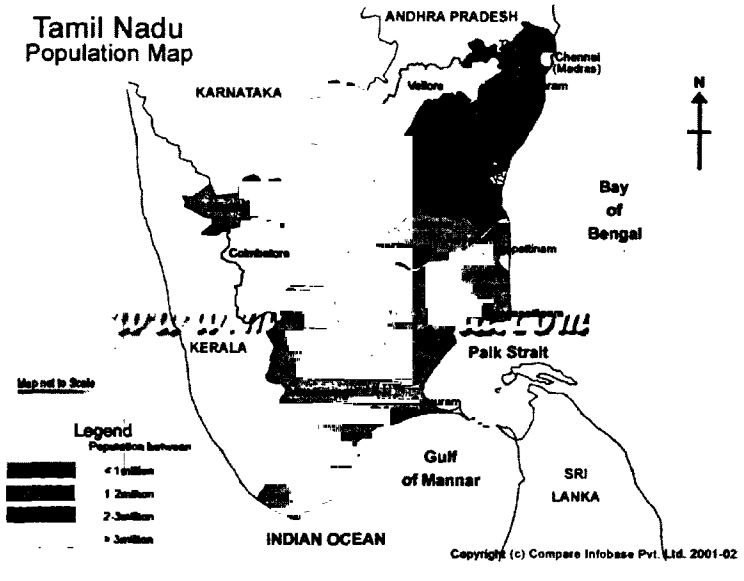
Ms Vijayalakshmi Assistant Engineer WRO, PWD, Chennai	Ms. Susheela Assistant Engineer WRO, PWD, Chennai
Sri Arivelagan Assistant Engineer, ICRP dam WRO, PWD, Krishnagiri	Sri S. Ayyappan Assistant Engineer, ICRP dam WRO, PWD, Krishnagiri
Sri A.Rajendran JE, WRO, PWD Athur	Sri D. Shanthinathan JE, WRO, PWD Tindivanam
Sri N.Jayaraj JE, WRO, PWD Kanchipuram	Sri Elangovan Executive Engineer WRO, PWD, Coimbatore
Dr. SundaraRaj Rtd.Dean.Fisheries College, Tuticorin Chennai	Dr. Samuel Pal Raj Prof & HOD, Natural Resource and waste recycling dept. Madurai
Dr. Manimaran Associate Professor Fisheries Research Institute Tuticorin	Sri P. Anbazhagan IDA,Chennai
Sri M.Ramadasu IDA,Chennai	Sri.Edgar, Agricultural Engineer, Agriculture Engineering Department, Valliyoor, Chennai.
Sri.M.Mali Arasan, Assistant Executive Engineer, WRO/PWD, Nagercoil, Chennai.	

ANNEXURE-XI

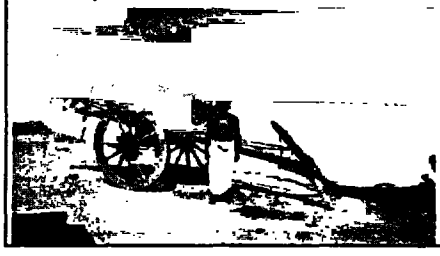
SCHEMATIC PRESENTATIONS

TAMILNADU POPULATION MAP



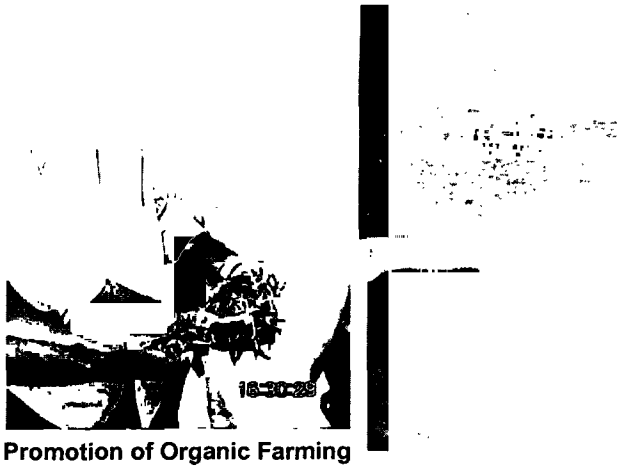
Social Development

Land Acquisition and Economic Rehabilitation



Cultivation by Women Self-Help Groups

ENVIRONMENT

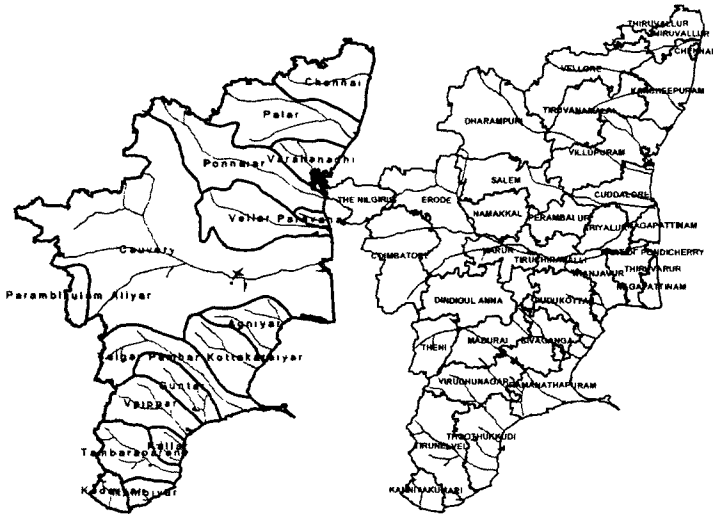


Gabion Structure near Kalimangalam Village

Soil Erosion Management in Noyyal Catchment

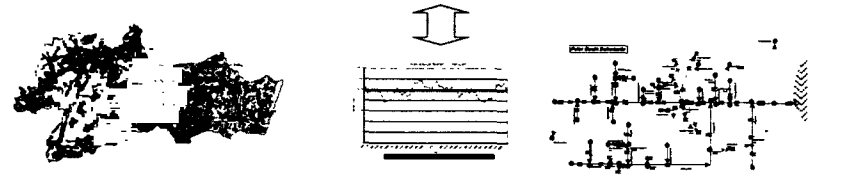
Promotion of Organic Farming

IAMWARM PROJECT AREA

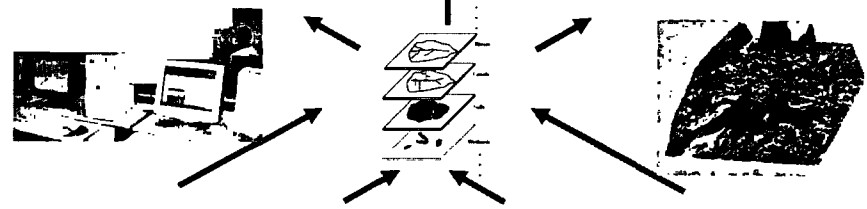


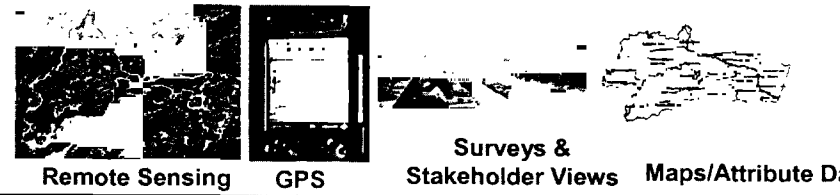
Activities: Information/Analysis

Stakeholder Decisions on Water Supply, Demand Planning & Management



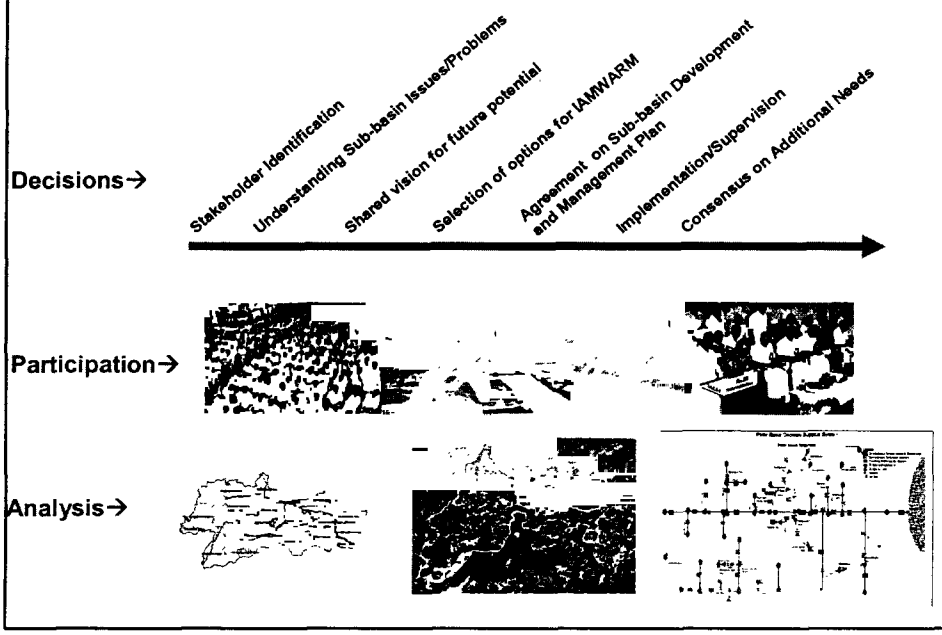
Spatial & Non-Spatial Analyses **Models/Decision Support Systems**



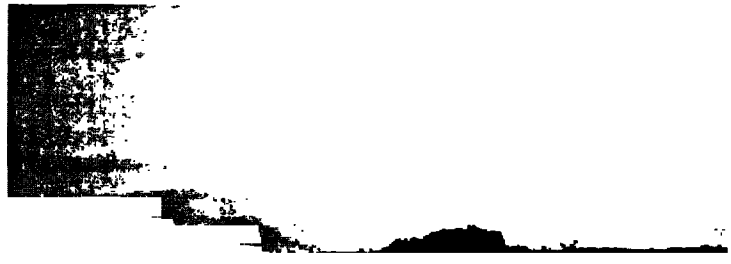


Remote Sensing **GPS** **Surveys & Stakeholder Views** **Maps/Attribute Data**

Merging Analysis with Participation

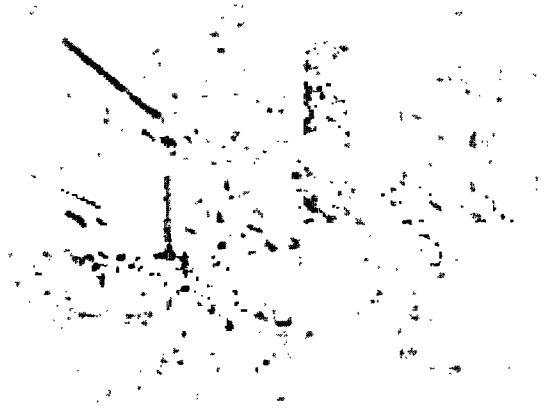


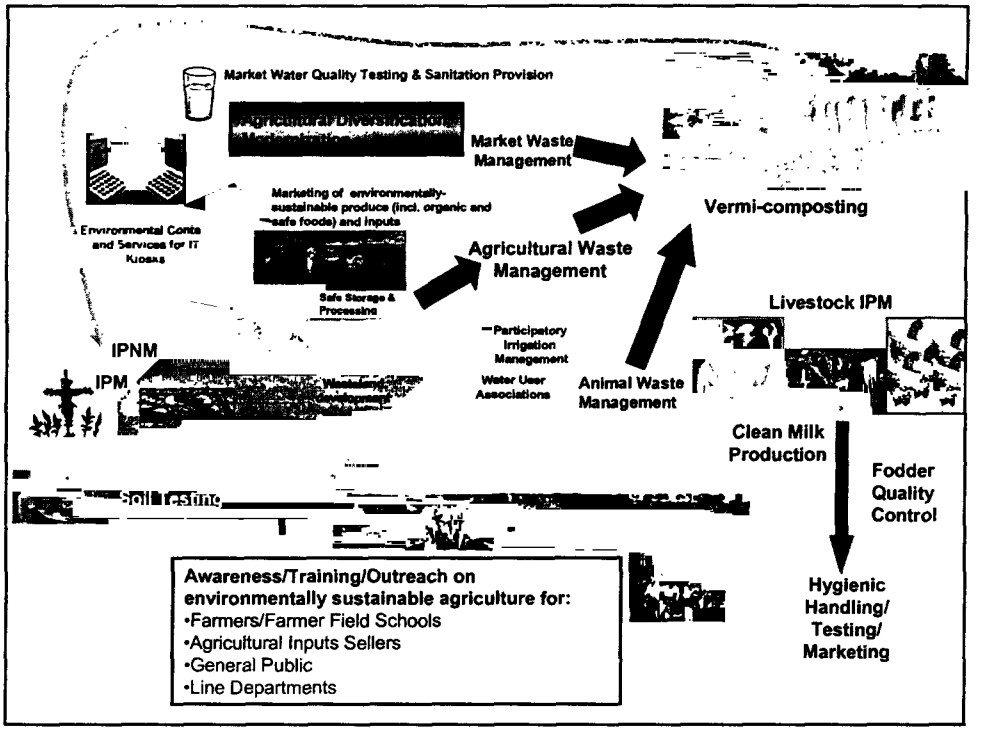
TANKS IN TAMILNADU

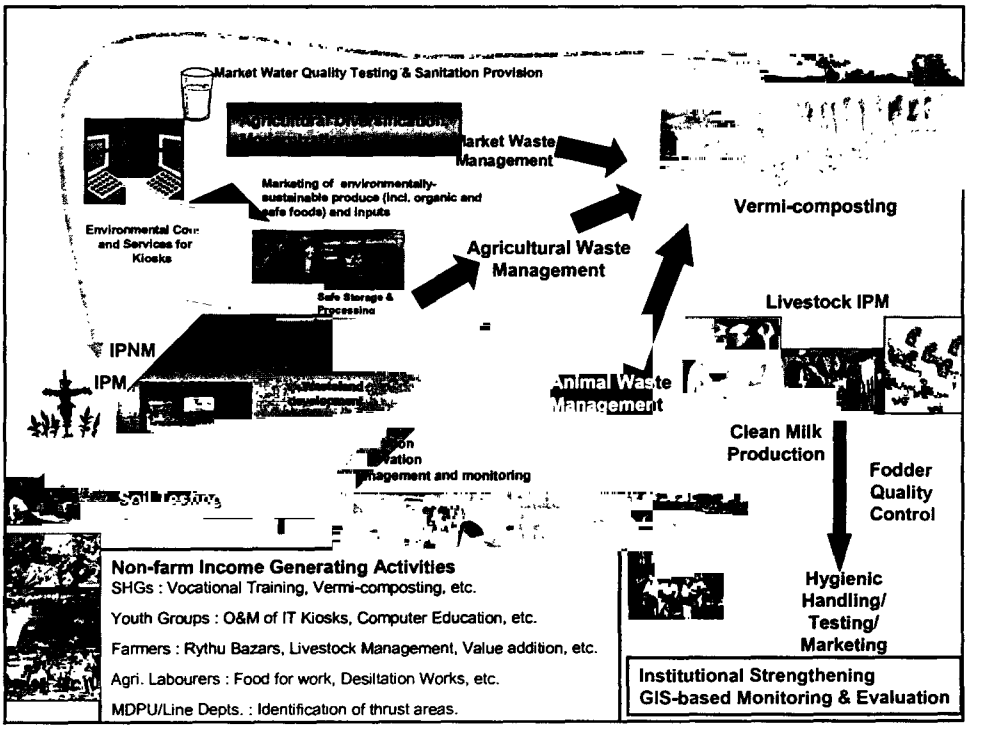


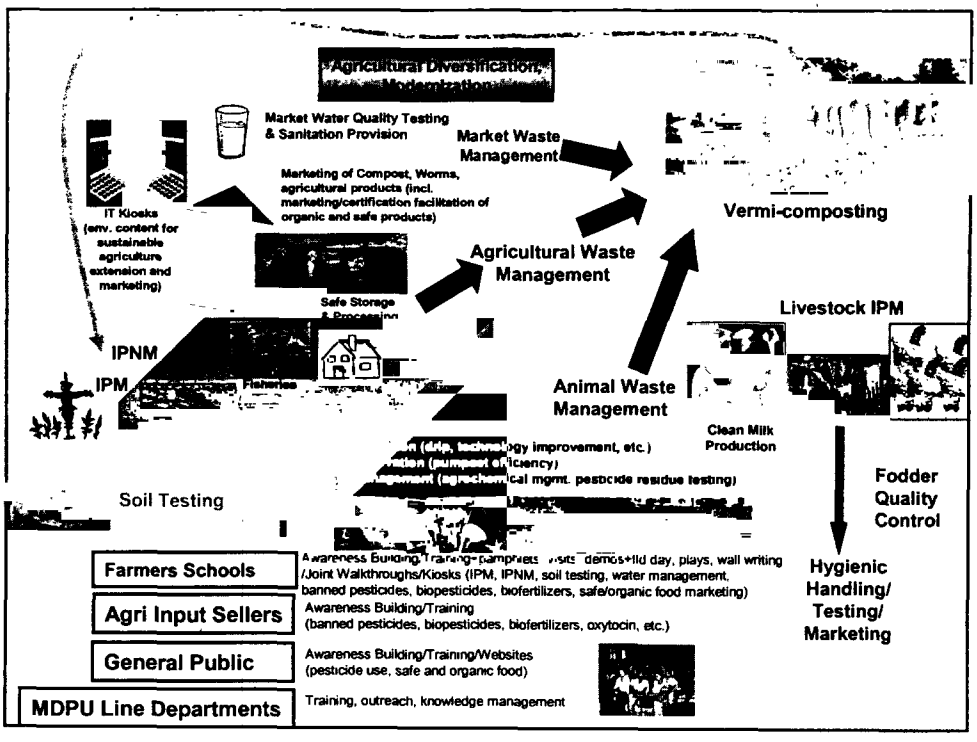
TANK IRRIGATION IN TAMILNADU

DRIP IRRIGATION SYSYEMS




Market Water Quality Testing & Sanitation Provision
Market Waste Management
Vermi-composting
Marketing of environmentally-sustainable produce (incl. organic and safe foods) and inputs
Environmental Conts and Services for IT Kiosks
Agricultural Waste Management
Safe Storage & Processing
Livestock IPM
Participatory Irrigation Management
Water User Associations
IPNM
IPM
Animal Waste Management
Clean Milk Production
Fodder Quality Control
Hygienic Handling/ Testing/ Marketing
Awareness/Training/Outreach on environmentally sustainable agriculture for:
•Farmers/Farmer Field Schools
•Agricultural Inputs Sellers
•General Public
•Line Departments


Market Water Quality Testing & Sanitation Provision
Market Waste Management
Vermi-composting
Marketing of environmentally-sustainable produce (incl. organic and safe foods) and inputs
Environmental Cont and Services for Kiosks
Agricultural Waste Management
Safe Storage & Processing
Livestock IPM
IPNM
IPM
Animal Waste Management
Clean Milk Production
Fodder Quality Control
Hygienic Handling/ Testing/ Marketing
Non-farm Income Generating Activities
SHGs : Vocational Training, Vermi-composting, etc.
Youth Groups : O&M of IT Kiosks, Computer Education, etc.
Farmers : Rythu Bazars, Livestock Management, Value addition, etc.
Agri. Labourers : Food for work, Desiltation Works, etc.
MDPU/Line Depts. : Identification of thrust areas.
Institutional Strengthening
GIS-based Monitoring & Evaluation


Agricultural Diversification/ Modernization
Market Water Quality Testing & Sanitation Provision
Market Waste Management
Marketing of Compost, Worms, agricultural products (incl. marketing/certification facilitation of organic and safe products)
IT Kiosks (env. content for sustainable agriculture extension and marketing)
Vermi-composting
Agricultural Waste Management
Safe Storage & Processing
Livestock IPM
IPNM
IPM
Animal Waste Management
Clean Milk Production
Fodder Quality Control
Soil Testing
Farmers Schools
Awareness Building/Training/pamphlets /visits/ demos+fld day, plays, wall writing /Joint Walkthroughs/Kiosks (IPM, IPNM, soil testing, water management, banned pesticides, biopesticides, biofertilizers, safe/organic food marketing)
Agri Input Sellers
Awareness Building/Training (banned pesticides, biopesticides, biofertilizers, oxytocin, etc.)
General Public
Awareness Building/Training/Websites (pesticide use, safe and organic food)
MDPU Line Departments
Training, outreach, knowledge management
Hygienic Handling/ Testing/ Marketing

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26. www.wetlands.org
27. www.indiastat.com
28. www.ppi-ppic.org
29. www.lenntech.com
30. www.eicinformation.com
31. www.chennaicorporation.org
32. www.hppcb.nic.in
33. www.irrigationscheduling.com
34. www3.grips.ac.gp
35. www.mapsofindia.com