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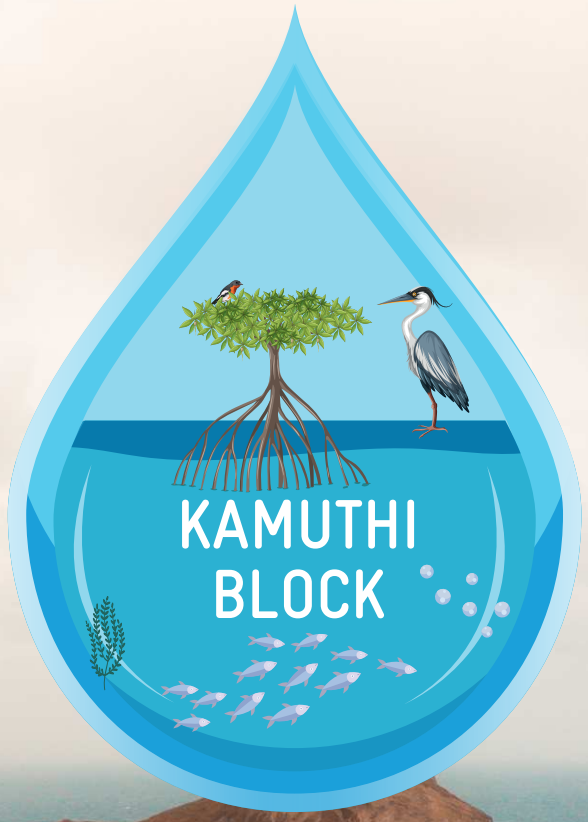
WATER SECURITY AND CLIMATE ADAPTATION IN RURAL INDIA



SUSTAINABLE DEVELOPMENT GOALS

Block Level Composite Water Resources Management Plan under Mahatma Gandhi NREGS

District Rural Development Agency, Ramanathapuram &
WASCA, GIZ, New Delhi

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Directorate of Rural Development and Panchayat Raj
Panagal Building, 4th and 5th floor, Jeenis Road, Saidapet, Chennai-600015
T : +91 44 24336105/24337436/24337440/24336102; E : drd@tn.nic.in; I: https://tnrd.gov.in/

Bonn and Eschborn, Germany
Water Security and Climate Adaptation in Rural India
A2/18, Safdarjung Enclave, New Delhi 110 029, India
T : +91 11 4949 5353; F : + 91 11 4949 5391; E : info@giz.de; I : www.giz.de

Responsible:
Thiru. Praveen Nair I.A.S
Director, Rural Development & Panchayat Raj Department, Govt of Tamil Nadu
E: mgnrgs.drd@gmail.com

Thiru. Shankar Lal Kumawat I.A.S
District Collector, Ramanathapuram, Govt of Tamil Nadu
Email: collrrmd@nic.in

Mr. Rajeev Ahal
Director, Natural Resource Management and Agroecology, GIZ India
E: rajeev.ahal@giz.de

Authors:
Dr. Anushiya J, Consultant - Climate & NRM, Mr. Pradeep M S, Consultant - RS & GIS, Mrs. Sabari V K - Editorial Support

GIZ
Mr. V.R. Sowmithri - Technical Expert, Dr. Radha Priya P - Jr. Technical Expert

MSSRF
Dr. Rengalakshmi R - Director, Mr. Nagarajan R, Dr. Selvamukilan B, Ms. Bhavani S, Ms. Yogalakshmi R,
Mr. Gopalakrishnan P, Mr. Dharma Muneeswaran B

Content Review:
GIZ
Krishan Tyagi

Directorate of Rural Development and Panchayath Raj
Thiru. Kumar S S - ADRD (MGNREGS), Thiru. Harikrishnan R - CE, Thiru. Saravanakumar A - SE,
Thiru. Ashokan N - AD (MGNREGS)

District Rural Development Agency
Thiru. K J Praveen Kumar I.A.S - Additional Collector (Development), Thiru. Sundaresan A - EE, Mrs. Hemalatha K - AE

Design and Layout:
Mr. Manikandan T

Image Credits: RD & PR, DRDA and GIZ India

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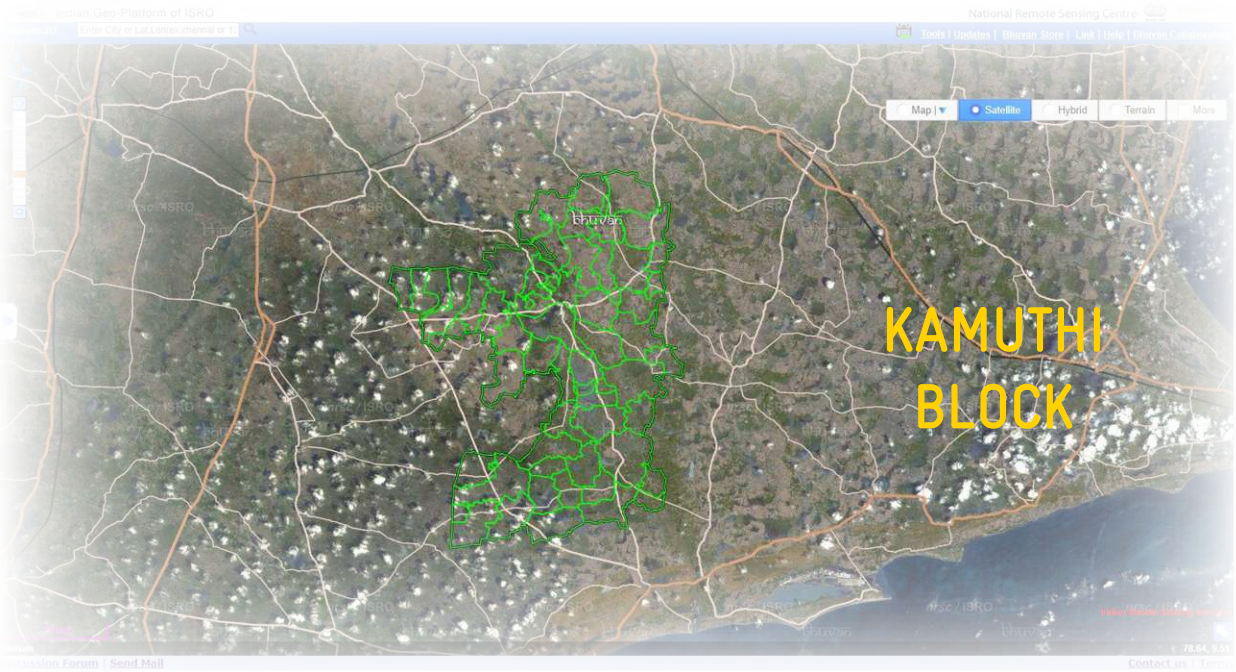
WATER SECURITY AND CLIMATE ADAPTATION IN RURAL INDIA



Block Level Composite Water Resources Management Plan under Mahatma Gandhi NREGS

District Rural Development Agency, Ramanathapuram &
WASCA, GIZ, New Delhi

FOREWORD

Thiru. Praveen P. Nair, IAS
Director of Rural Development
and Panchayat Raj

Tamil Nadu government is implementing the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) by assuring adequate and accessible wage employment while simultaneously creating productive individual and community assets to fulfil the infrastructure and livelihood needs of the people in rural areas. The Government intends to prioritise the strategies under this scheme to focus on creating Climate Resilient Villages and individual income generating assets and works in the coming years in a convergence model.

> "Close to 10 lakh NRM and Non- NRM works are identified, verified, approved by Gram Panchayat"

There will be a reorientation of priorities under MGNREGS with livelihood promotion and poverty alleviation as goals in addition to Natural Resource Management, asset creation and agriculture development. The approach to Natural Resource Management will be on a saturation mode with GIS based planning. The impact of each intervention will be maximised through convergence.

In this context, implementation of Water Security and Climate Adaptation (WASCA) a technical cooperation project GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH) Indo-German Technical Cooperation project in Tamil Nadu is of paramount importance. WASCA is being implemented in Tiruvannamalai and Ramanathapuram district.

The project focused on GP level planning driven by scientific data, climate information, climate risk, climate vulnerability assessments & ranking, watershed approach, water budgeting (Ground and surface water), land use, agriculture, livestock, soil parameters and GIS thematic maps. A Composite Water Resources Management Planning (CWRMP) frame works is adopted. The GP level works thus identified are mapped to climate vulnerabilities, SDG goals and its Indicators, Intended Nationally Determined Contributions (INDC) for climate Change. This mapping exercise is unique and first of its kind in the country for a plan at GP level.

This approach helped to complete 1,289 GP level plans in holistic way for a period of three years. Close to 10 lakh NRM and Non- NRM works are identified, verified, approved by Gram Panchyat. Out of the shelf

of projects, in the year 2021-22 FY, 2,80,000 works are uploaded in NREGA soft GIS planning portal. This is one of the largest number of works uploaded by any district or state for the current financial year.

Under WASCA four major interventions are being undertaken in pilot districts.

1.	Development of Public and Common lands
2.	Development of Agriculture and allied activities
3.	Development of Rural Infrastructure Management
4.	Development of Climate Resilience Measures

Under the leadership of District Collector, Additional Collector (Development), Engineers of District Rural Development Agencies (DRDA), line departments and GP office bearers the implementation of approved works from WASCA are discussed during monthly district level convergence meetings.

The present Block report is a synthesis of all GPs in the Block discussed in detail on four major heads, Socio-Economic, Climate, Water and Agriculture the key for any rural development. The Block level CWRM book will help the GP, Block officers and Gram Panchayats in planning, implementing works in holistic manner, reducing water scarcity in the district.

I take this opportunity to thank GIZ, the technical partners, District WASCA resource Centres for their continued effort to work with DRDA and State RDPR for making MGNREGS more integrated.

"The block level CWRM book will help the GP, Block officers and Gram Panchayats in planning, implementing works in holistic manner, reducing water scarcity in the district"

Thiru. Praveen P. Nair, IAS
Director of Rural Development
and Panchayat Raj

FOREWORD

Rajeev Ahal
Director,
NRM & Agroecology, GIZ India

The Block Level, Composite Water Resources Management Plan is an unique initiative of District Rural Development Agency, Tiruvannamalai & the Indo German project on Water Security and Climate Adaptation in Rural India (WASCA) implemented by GIZ. This is the culmination of three years of efforts by the project team and government officials, assisted by knowledge partners and a myriad of departments. At the national level, this process is anchored in the Ministry of Rural Development and supported by National Water Mission, Ministry of Jal Shakti.

> **Block level report uses strong scientific data and analysis using GIS and statistical data to develop a medium-term picture of water**

The state government of Tamil Nadu, with core support from Director Thiru. Praveen Nair I.A.S., Department of Rural Development and a host of water related departments, under the active leadership of the District Collector, Thiru. B.Murugesh, I.A.S., has embarked on this strategic response to the strong crisis of water security which is affected by climate change that we are increasingly witnessing. This Block level report uses strong scientific data and analysis using GIS and statistical data to develop a medium-term picture of water and climate and their interactions. These have driven a scenario projection, to respond to which key thrust areas of actions, with their inherent strategies and resultant activities have been brought together into a plan that will work to change this possible reality.

As humans, we have to plan to avert the future potential disasters and capture latent opportunities, using the human, technical and financial resources available to us. As wise humans, we should do it strategically to not only adapt to that reality, but to initiate actions that help to mitigate that possible future also along with.

The Block report focuses on sustainable water resource management, as it is the true driver for all development in a natural resource dependent rural livelihood scenario. The climate actions initiated not through

separate climate funds, but by leveraging existing public programmes and schemes, such as Mahatma Gandhi NREGA, to act now and decisively.

We sincerely hope that this innovative Block Level plan is not only a success for itself but shows that way how the state government can plan for all of its …. Blocks!

We look forward to its success!

Rajeev Ahal
Director,
NRM & Agroecology, GIZ India

MESSAGES

Thiru. S.S Kumar
Additional Director (MGNREGS),
RD&PR

The Mahatma Gandhi National Rural Employment Guarantee Scheme in Tamil Nadu focuses on Natural Resources Management, Grey Water Management, Farm Ponds in individual lands, afforestation and plantations in community areas, water harvesting and conservation measures. To implement works in saturation mode, it is important to have holistic plans prepared in every Gram Panchayat.

GIZ technical cooperation project on Water Security and Climate Adaptation (WASCA) being implemented in Tiruvannamalai and Ramanathapuram district is an example of holistic GP plans considering the land, water, soil, geology and social aspects.

> **Water Security and Climate Adaptation (WASCA) is an example of holistic GP plans considering the land, water, soil, geology and social aspects**

Through District level GIS resource centres, GIZ with the partners MSSRF build capacity of Block, GP level technical officers of Rural Development Department in completion of 1,289 GP plans. In preparation of GP level plans, Nationally approved Comprehensive Water Resources Management (CWRMP) framework is adopted along with Bhuvan NRSC ISRO GIS platform.

Total 3,00,000 works identified through CWRM are uploaded in NREGA Soft. The works focused on treatment of all-natural drainage lines, rejuvenation of traditional waterbodies, afforestation, trench cutting, gully plugs, recharge-shaft, farm ponds, check dams, farm bunds, soak pits etc. These works identified through GIS planning are verified on ground and approved by Gram Panchayat.

The Block level report provides the details of the parameters used for preparing plans, analysis of the situation, works for over coming the short term and long-term goals of climate resilience and productive assets. This report will be useful for all functionaries implementing MGNREGS.

Thiru. S.S Kumar
Additional Director (MGNREGS),
RD&PR, Government of Tamil Nadu

MESSAGES

Thiru R. Harikrishnan
Cheif Engineer,
MGNREGS, RD&PR

Water Security and Climate Adaptation (WASCA) a bilateral project of Ministry of Rural Development (MoRD) (MGNREGS), Ministry of Jalsakthi (National Water Mission) and GIZ (German Corporation for International Cooperation GmbH) started in the year 2019-20 and for next three years.

In our state, Centre for Climate Change and Disaster Management (CCCDM-Anna University) has conducted the scoping study based on 18 Vulnerability parameters (Socio-economic, agriculture, water and climate parameters) and identified the most vulnerable two districts for project implementation. The two districts are Tiruvannamalai in Northern Tamil Nadu and Ramanathapuram South coastal aspirational district. For implementing WASCA project Composite Water Resource Management (CWRM) Plan is used.

> "Whole planning process followed a bottom-up approach in identifying appropriate actions based on scientific analysis"

The CWRM plans assessed both the supply and demand for water using data pertaining to land resources, climate parameters, catchment areas, soil, surface runoff, agriculture and prepared a water budget. Besides, it has identified a set of key water actions for the development of public and common land, agriculture and allied activities and rural infrastructure. The whole planning process followed a bottom-up approach in identifying appropriate actions based on scientific analysis. I consider such decentralized level of planning is necessary in ensuring water security in the context of increasing climate change impacts.

Thiru R. Harikrishnan
Cheif Engineer,
MGNREGS, RD&PR

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ABBREVIATIONS AND ACRONYMS

A - D

%
Percentage

^{0}C
Degree Celsius

AR
Assessment Report

CCB
Contour Continuous Bunds

CCCDM
Centre for Climate Change and Disaster Management

CRM
Climate Resilient Measures

CuM
Cubic Meter

CVI
Climate Vulnerability Index

CWRM
Composite Water Resource Management

CWRMP
Composite Water Resource Management Plan

DEM
Digital Elevation Model

D - G

DLSC
District Level Steering Committee

DLT
Drainage Line Treatment

DRD&PR
Department of Rural Development & Panchayat Raj

EC
End Century

ET
Evapo-transpiration

FPO
Farmer Producer Organization

FY
Financial Year

GIS
Geographical Information System

GIZ
Deutsche Gesellschaft für Internationale

Govt.
Government

GP
Gram Panchayat

GW
Ground Water

H - K

ha
Hectare

ha.m
Hectare Meter

HH
Households

ICAR
Indian Council for Agriculture Research

IMD
Indian Meteorological Department

INR
Indian Rupees

IPCC
Intergovernmental Panel on Climate Change

IWRM
Integrated Water Resources Management

Kharif crop
Sown in Monsoon and harvested close to Autumn

km
Kilometer

KML
Keyhole Markup Language

L - M

LULC
Land use and land cover

Max
Maximum

MCM
Million Cubic Meter

MC
Mid Century

Mahatma Gandhi NREGA
Mahatma Gandhi Rural Employment Guarantee Act

Mahatma Gandhi NRGES
Mahatma Gandhi Rural Employment Guarantee Scheme

Min
Minimum

mm
Millimeter

MoEFCC
Ministry of Environment, Forest and Climate Change

MoJS
Ministry of Jal Shakti

MoRD
Ministry of Rural Development

m
Meters

N - P

NAPCC
National Action on Climate Change

NARP
National Agricultural Research Project

NADEP
Nadepkaka

NDC
Nationally Determined Contributions

NEM
North-East monsoon

NGO
Non-Governmental Organization

NITI
National Institution for Transforming India

No.
Number

NRM
Natural Resource Management

NRSC
National Remote Sensing Centre

NWC
National Water Commission

PWD
Public Works Department

R - S

Rabi crop
Sown in winter and harvested in monsoon

RDPR
Rural Development & Panchayat Raj

RF
Reserve Forest

RTRWHS
Roof top rain water harvesting structures

RWHS
Rain Water Harvesting System

SAPCC
State Action Plan on Climate Change

SC
Scheduled Caste

SDG
Sustainable Development Goal

SDMA
State Disaster Management Authority

SDMRI
Suganthi Devadasan Marine Resources Institute

SECC
Socio Economic and Caste Census

S - W

SHG
Self Help Group

SLSC
State Level Steering Committee

ST
Scheduled Tribe

SWM
South-West monsoon

SW
Surface Water

TN
Tamil Nadu

UN
United Nations

WASCA
Water Security and Climate Adaptation

WCWH
Water Conservation and Water Harvesting

வான்நின்று உலகம் வழங்கி வருதலால்
தான்அமிழ்தம் என்றுணரற் பாற்று

குறள் - 11

The genial rain ambrosia call
The world but lasts while rain shall fall

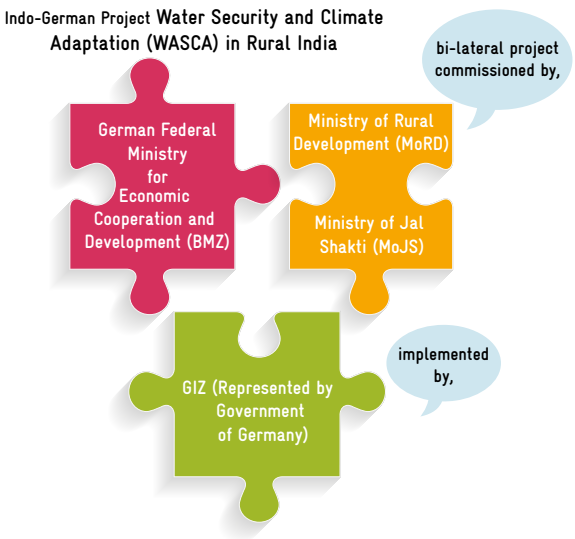
Thirukkural - 11

EXECUTIVE SUMMARY

> "Aims to improve water resource management with respect to water security and climate adaptation"

Water security is one of the most alarming issues and key challenges that the world is facing today given the rapid changes in climate. India is not an exception and is facing a similar challenge. Water security is of prime concern especially in the rural areas due to scarce resources and a high dependency on natural resources. To mitigate the ill effects of climate change and focus on efforts to improve water resource management requires a thorough understanding of all key issues. Climate change adaptation and water security strategies have to be evolved with the help of technical knowledge and integrated into the development planning processes across the Nation, State and local level, for holistic and sustainable impacts.

The Indo-German Project "Water Security and Climate Adaptation in Rural India" (WASCA), is a bi-lateral project commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ) in partnership with the Ministry of Rural Development (MoRD) and Ministry of Jal Shakti (MoJS) and implemented by GIZ (Represented by Government of Germany). This project aims to improve water resource management with respect to water security and climate adaptation with an effort to establish a framework for integrating water perspectives into planning and implementing adaptation actions that promotes climate resilience. It is implemented under technical cooperation from BMZ-GIZ with implementation under Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA/S) and National Water Mission (Catch the Rain Campaign) under MoRD, MoJS respectively. In Tamil Nadu State, the project is jointly implemented by the Department of Rural Development & Panchayat Raj, (DRD&PR) Government of Tamil Nadu, Chennai and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.



Initially WASCA Tamil Nadu conducted a preliminary state level scoping study on the State's Rural Water Security using the 18 vulnerable indicators, which covered four important and interconnected parameters/areas of Climate extremities, water resource, agriculture and socio-economic at the District level. Based on the outcomes of the assessment, Tiruvannamalai and Ramanathapuram districts were given priority by the State Level Steering Committee headed by the Additional Chief Secretary, RD&PR in November 2019 for implementing the WASCA. These 18 indicators were further studied at the Gram Panchayat (GP) level integrating the Composite Water Resource Management (CWRM) and MGNREGA/S approach to identify the key problems and propose key actions for implementation in each district.

With focus on water-related climate action and integrated water resource management (IWRM) principles, the project WASCA aims to significantly contribute towards Sustainable Development Goals for ensuring efficient, sustainable, and inclusive water outcomes. Implementation of key water actions also support the National Water Mission, one of the eight missions under the National Action Plan for Climate Change (NAPCC) to achieve their objective of promoting basin level IWRM. It also explored possible contributions towards the larger goals of Nationally Determined Contribution's (NDC) of climate adaptation through its work on improving water efficiency in agriculture and allied sectors and ecosystem development. The State and District Steering Committee approved the process during May 2020 and the whole progress was jointly accomplished with research organizations and key sectoral experts in February 2021.

Subsequently, the District Collector, Tiruvannamalai, entrusted preparing Block level reports of water security and climate adaptation for each Block. This Block level report is intended for all planners and managers responsible for addressing issues of adaptation in natural resource management and water-dependent economic sector and for those who provide support to achieve a coherent and strategic response to adaptation planning. This report also helps all stakeholders involved to understand the issues related to water security in the context of climate change in rural areas and actions through Mahatma Gandhi NREGS and the need for convergence with concerned line departments.

Block level report is intended for all planners and managers responsible for addressing adaptation in natural resource management and water-dependent economic sector

This report is structured with nine complete chapters

1

The First chapter outlines the generic demographic, socio economic and hydrological aspects of the Block

2

The Second chapter addresses water security through the lens of changing climate. The past and future climate change scenarios are discussed along with climate risks. The 18 vulnerability indicators used in WASCA TN's scoping study are summarized and analysis on Block level vulnerability assessment are briefed

3

The Third chapter elaborates the process of CWRM approach and its framework along with categorization of GPs, collection and analysis of spatial and non-spatial data of climate, water, agriculture and socioeconomic areas

4

The Fourth chapter discusses the Intergovernmental Panel on Climate Change (IPCC) vulnerability assessment and GP vulnerability scores based on the degree of vulnerability through sensitivity and adaptive capacity in 4 areas

5

The Fifth chapter explores key water actions under Mahatma Gandhi NREGA convergence and its proposed actions as developments in public and common land, agriculture and allied sectors, rural infrastructures and climate resilient measures

6

The Sixth chapter sketches the projected outcomes of planning and development in public and common land, agriculture and allied sectors, rural infrastructures and its linkage with NDC and SD goals

7

The Seventh chapter provides the process of GP plan implementation, its integration in to Mahatma Gandhi NREGA soft and about NRM and Non NRM works progress

8

The Eight chapter provides model case study on one micro-watershed and GP from the Block to illustrate how CWRM planning processes unfolds into analysis, results and impacts from macro-watershed to the lowest planning unit GP

9

The Ninth chapter concludes with the significance of Block level study and recommendations

துப்பார்க்குத் துப்பாய துப்பாக்கித் துப்பார்க்குத்
துப்பாய தூஉம் மழை

குறள் - 12

The rain begets the food we eat
And forms a food and drink concrete

Thirukkural - 12

CHAPTER 1

1 ABOUT THE BLOCK

Kamuthi Block of Ramanathapuram district, Tamil Nadu lies between 9°10'58.449"N to 9°32'18.218"N latitude and 78°12'30.423"E to 78°28'0.697"E longitude. This Block is surrounded by Paramakudi, Mudhukulathur and Kadaladi Blocks of Ramanathapuram in the east and Virudhunagar district in west side (Figure 1.1). The total geographical area of Block is 59,168 ha (591.68 Km^2). This Block has 53 Gram Panchayats with 346 hamlets.

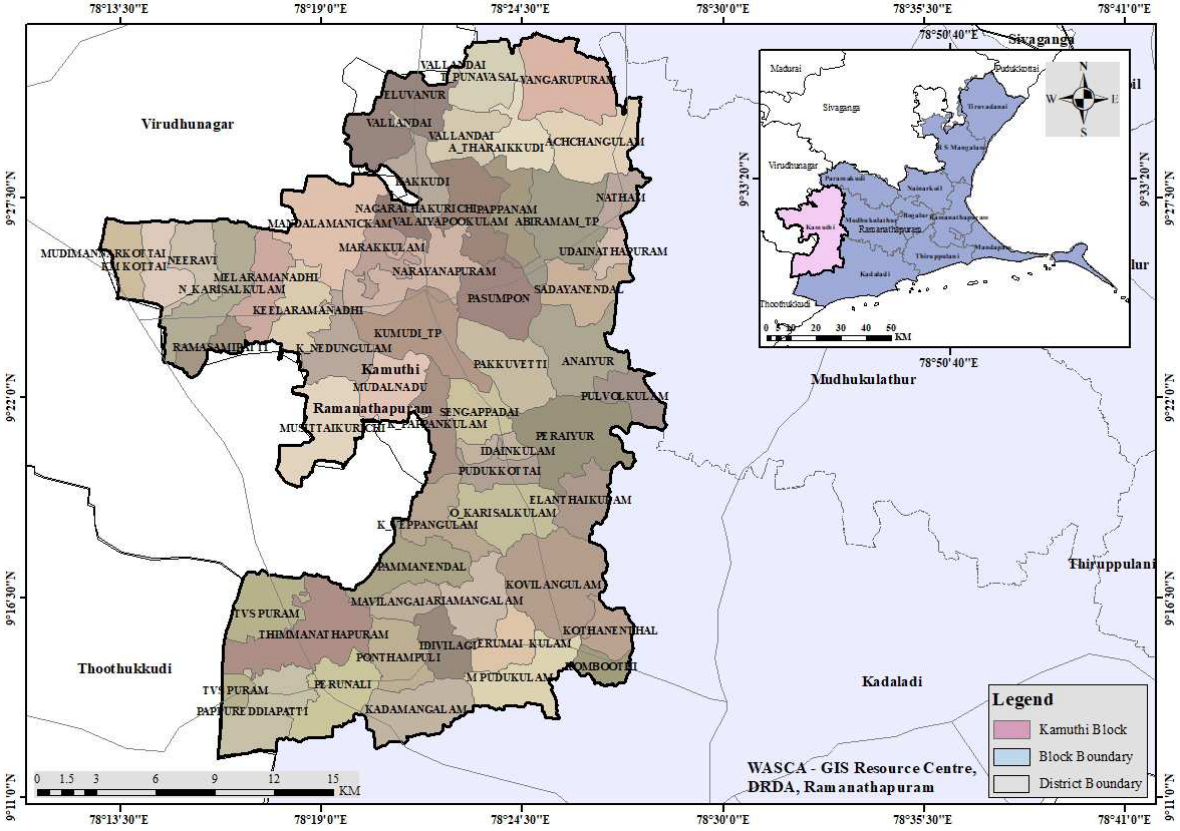


Figure 1.1. Kamuthi Block and it's environ

According to Census 2011, the population of the Block is 1,35,658 The population density of the Block is 235 per Km^2 which is much lower than the district (331Km^2) and the State's density (555 Km^2). The population growth has increased in the last decade with an increase of 19.56% in population, observed since 2001. The proportion of sex ratio is 982 females for 1000 males. The average literacy rate of this Block is 77.33 % which is much higher than the national average (72.98%). The male literacy rate is high (85.96%) than female literacy rate (68.57%). Vulnerable population, Scheduled Castes and Scheduled Tribes accounted for 21.09 % of the total population. Economically, this rural Block is one of the backward Blocks of the district in terms of poverty, industrial backwardness, drought and health. According to the State Planning Commission, Government of Tamil Nadu's Human Development Report – 2017, 31.45 % families are in below poverty line (BPL). The % of BPL families are high than district BPL status. Agriculture is the main occupation and this Block has higher percentage of agricultural labourers of 51.54 %. 40.45% of the area is cultivated with Paddy. The rest of the area is cultivated with Dry chilli, Other pulses, Jowar, Cotton, Maize, Coriander, Bajra, Sunflower, Minor Millets, Groundnut and Onion. The Block has 12 milk societies with 1.9

> The proportion of sex ratio is 982 females for 1000 males.

> The average literacy rate of this Block is 77.33 % which is much higher than the national average (72.98%).

lakh liters of milk being produced. Kamuthi Solar Power Project, a large solar power plant spread over an area of 2,500 acres (the world's 12th largest solar park based on capacity) is situated in this Block.. Hydrologically, Kamuthi Block comes under Vembar, Lower Gundar, Paralaiyar, Gridhambal, Kanal Odai and Upper Gundar sub-basins of Gundar basin. Gundar, Malattar and Vegavathi Rivers flow through the Block.

> 31.45 % families are in below poverty line (BPL).

Hydrologically, Kamuthi Block comes under Vembar, Lower Gundar, Paralaiyar, Gridhambal, Kanal Odai and Upper Gundar sub-basins of Gundar basin. Gundar, Malattar and Vegavathi Rivers flow through the Block. Gridhambal, Gundar and Vembar macro- watersheds covers the Block with 167 micro-watersheds. (Figure 1.2). Situated in the rain shadow area, Ramanathapuram District has the extraordinary tank irrigation system which was built hundreds of years ago. The tanks were designed in such a way that the outflow from one tank would serve as the inflow for the next tank after it has reached its capacity, allowing the excess water to flow out into the next tank.

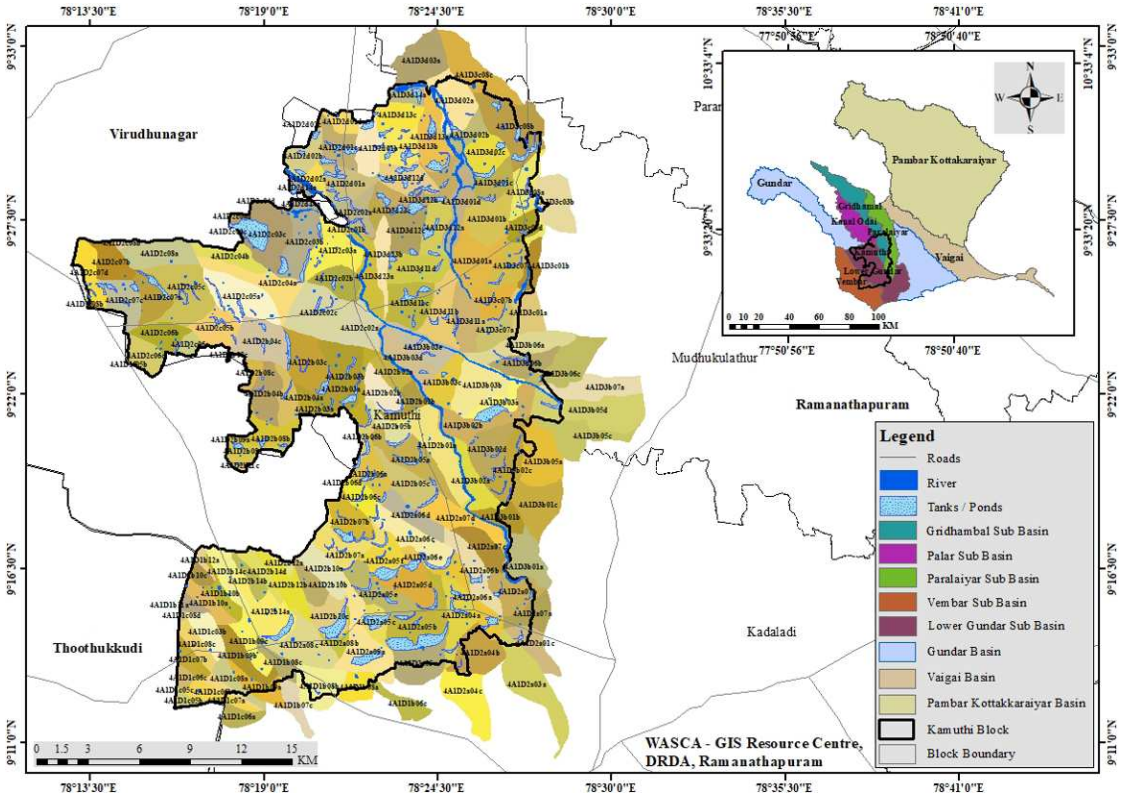


Figure 1.2. Watersheds – Kamuthi Block

Water harvesting structures 'Ooranis' also play a huge role in groundwater conservation and recharge, guaranteeing availability of safe drinking water and also useful for farmers who do not have water source for irrigation or find it expensive. There are 252 major and minor tanks in this Block, 45 Ex Zamin MI tanks, 169 Panchayat MI tanks, and 38 Gundar basin (PWD) tanks (Human Development Report 2017). Figure 1.3 shows the spatial distribution of water bodies in this Block. Four firkas viz., Abiramam, Kamuthi West, Kovilankulam and Perunaazhi cover the Block, and all four firkas are safe in ground water development (CGWB's ground water assessment report 2017).

GROUND WATER LEVEL OF THIS BLOCK

SAFE - <70%	Abiramam, Kamuthi West, Kovilankulam, Perunaazhi

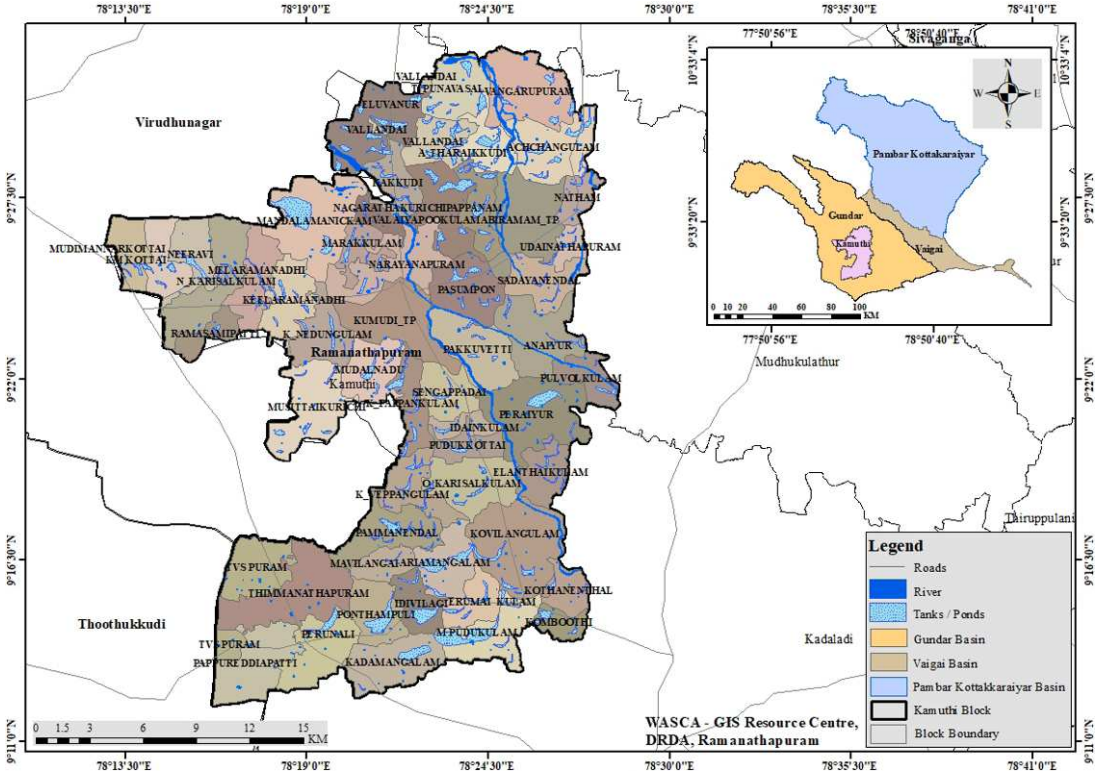
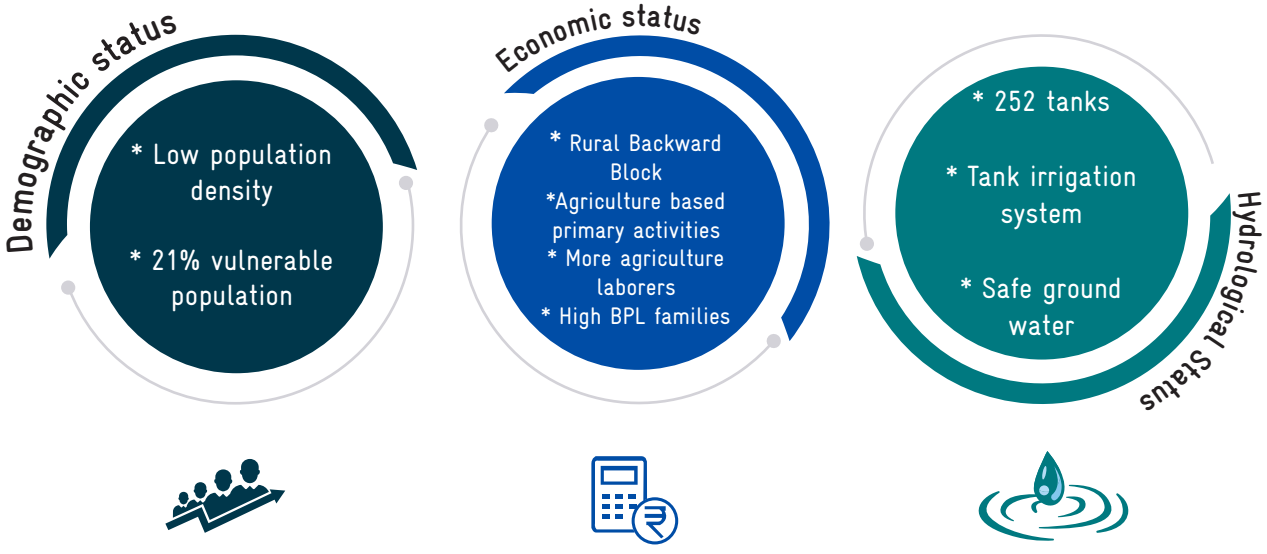


Figure 1.3. Spatial distribution of waterbodies



விண்இன்று பொய்ப்பின் விரிநீர் வியனுலகத்து
உள்நின்று உடற்றும் பசி

குறள் - 13

Let clouds their visits stay, and dearth
Distresses all the sea-girt earth

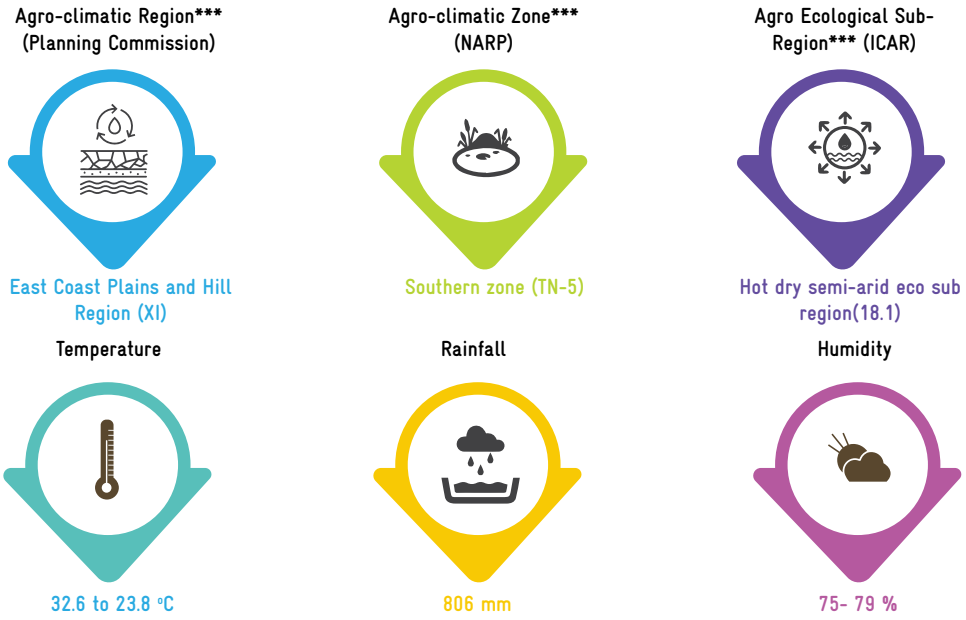
Thirukkural - 13

CHAPTER 2

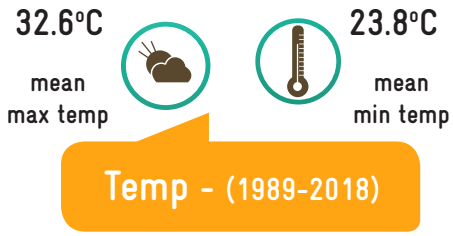
2 CLIMATE AND WATER SECURITY

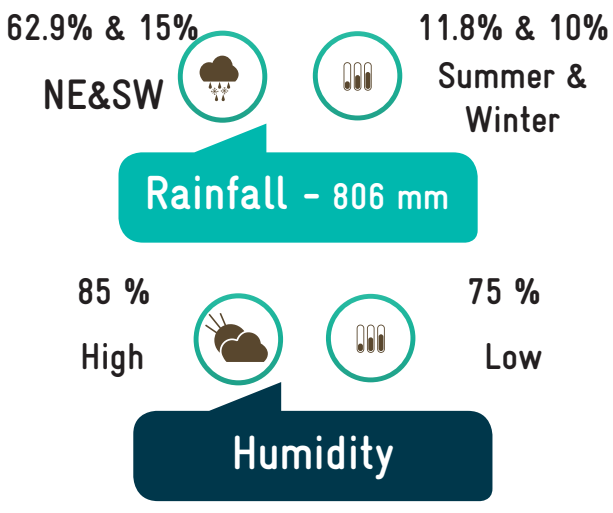
Water has always been a contentious subject in this region. This semi-arid region is classified as southern agro-climatic zone of State and East coast plains and Hills region according to the agro climatic regional classification of the Planning Commission. The general climate description of this region is given below (Table 1).

TABLE 1. GENERAL CLIMATE DESCRIPTION



In general, this semi-arid region has dry and hot weather. The mean maximum temperature is 32.6°C and mean minimum temperature is 23.8°C during the last 30 years (1989-2018) (IMD). In summer months the maximum temperature goes up to 45°C for a few days. The monthly average temperature characteristic during June 2018 to May 2019 is shown in Figure 2.1.





The annual rainfall of this region is 806 mm (IMD) which is less than State's average rainfall. Normally this region receives major rainfall from North East Monsoon (NEM) (October to December) followed by South West Monsoons (SWM) (June to September), winter and summer months. NEM contribute a maximum of 62.9 % (507.4mm) of the total annual rainfall and SWM contributes 15% (121.7mm). This region normally receives rainfall during Summer (March to May) and winter (January, February) months also. Summer rainfall accounts for 11.8 % (95.5mm) and winter season accounts for 10% (82.2nn) of the annual rainfall (WRIS, GoI) (Figure

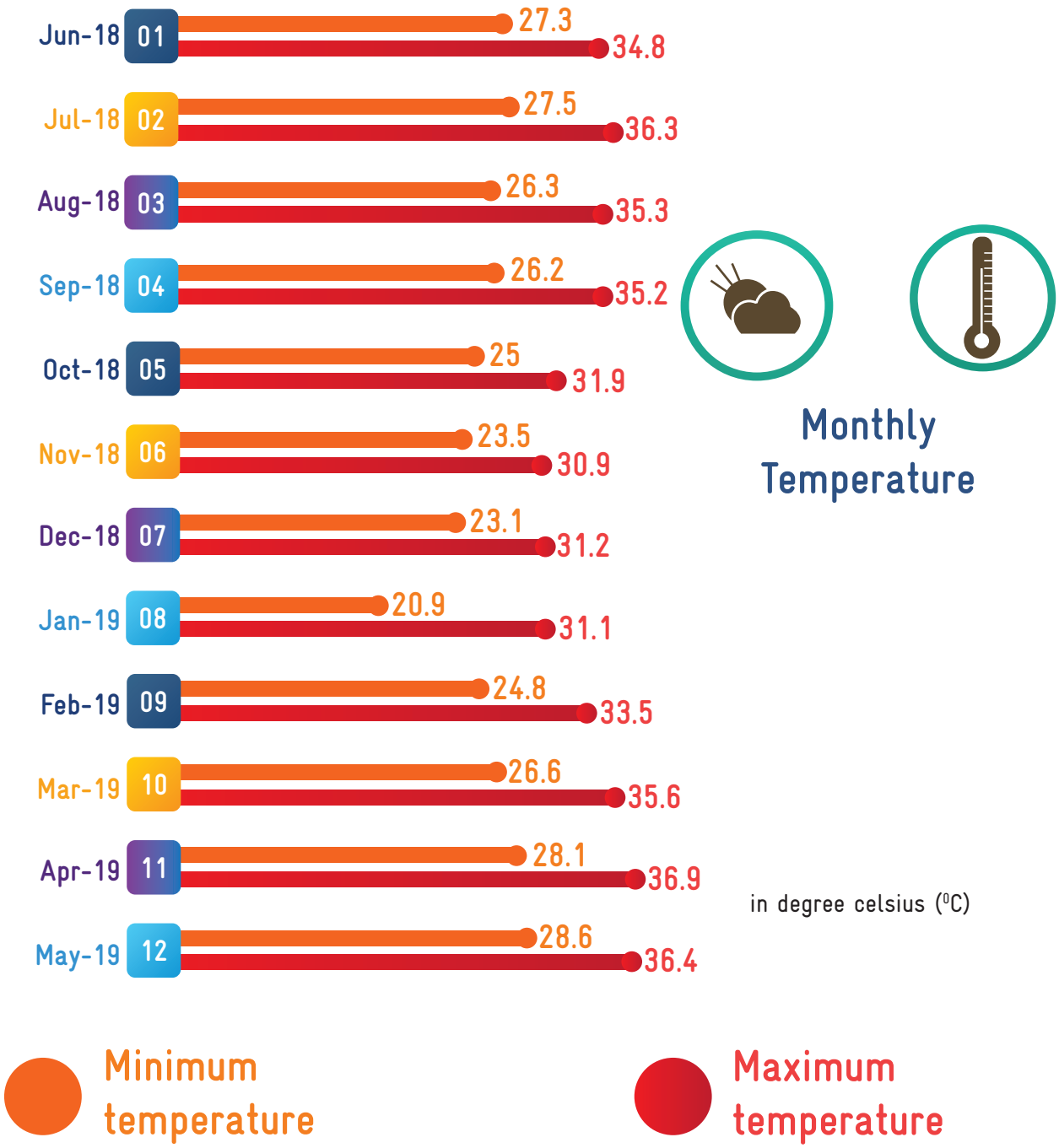


Figure 2.1. Monthly average maximum and minimum temperature

2.2). The average annual rainfall days are 107 days in which a majority of 84 days are from NEM. Next to NEM, summer months have major rainy days as 10 followed by 9 days in SWM and 4 days in winter months. Onset of NEM rainfall starts in the first week of October and cessation is at fourth week of December. In general, the humidity percentage ranges between 75% to 79%. the highest relative humidity percentage of 85% is recorded during month of November and the lowest relative humidity percentage of 75% is recorded during month of May in this southern zone.

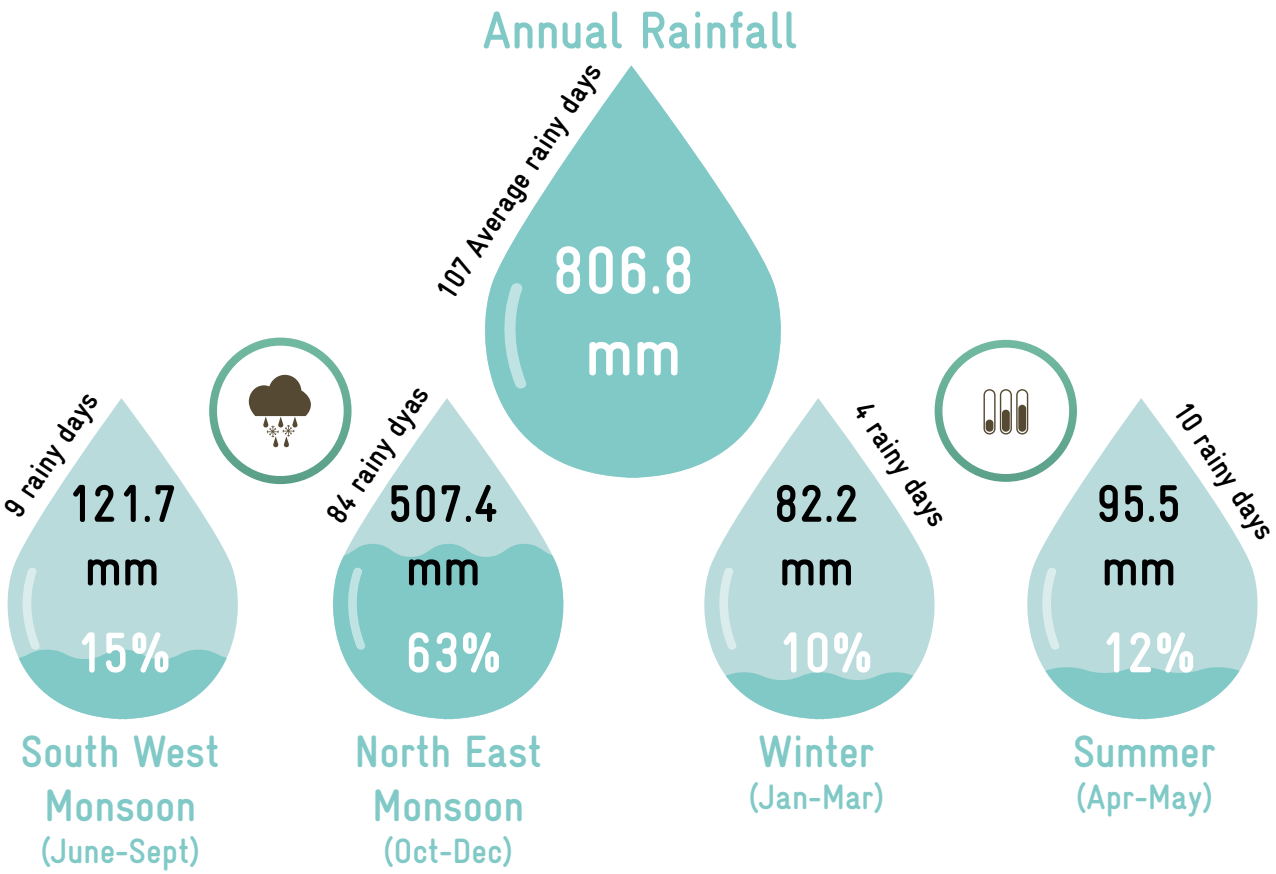


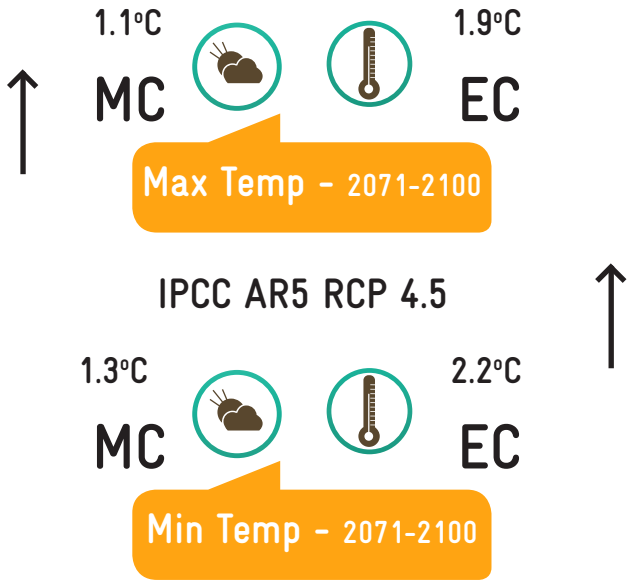
Figure 2.2. Season wise distribution of annual rainfall

In recent decades, the world has witnessing significant changes in its climate. These changes include increase in average temperature, variations in the rainfall intensity and its frequency. This region is also no exception, and 1.4°C and 0.4°C increase in maximum and minimum temperature was observed during 1951 to 2015 (IMD). The rainfall variability is also well observed. During 1951 to 2015, 18 deficient rainfall years (below normal rainfall) were recorded. The deficient rainfall years are highest among the rest of the districts of Tamil Nadu. Since this region is heavily dependent on NEM monsoon rains alone, consecutive deficient rainfall leads to severe drought. As rainfall is the major source for determining water storage, existing water resources, major and minor tanks fail along with deficient rainfall years.

The continuous assessment reports of Intergovernmental Panel on Climate Change (IPCC) cautioned that the changes in climate have a key role in intensifying and triggering extreme events, such as floods, droughts, heatwaves, and tropical cyclones, which are all likely to increase in the future also.

Recent IPCC Assessment Report 6 (AR 6) outlines that climate changes will increase in all regions of the globe over the coming decades and that even with 1.5°C of global warming, there will be increasing heat waves, longer warm seasons, and shorter cold seasons – which will become more intense at 2°C of warming.

Climate projection based on global climate models indicated that there would be 1.1°C increase in maximum temperature in mid-century (MC) period (2041-2070) and 1.9°C increase in end-century (EC) period (2071-2100) from the baseline scenario under RCP 4.5 climate scenario in this region. The minimum temperature would increase nearly 1.3°C and 2.2°C during MC and EC periods. Average annual rainfall for IPCC AR5 RCP4.5 scenarios is projected to increase about 1 percent towards MC to EC period.



The observed and projected climate changes will have serious impacts in the areas of,

* surface and ground water availability
* water quality
* soil moisture
* evapo-transpiration
* sea water intrusion

* 1.4°C increase in maximum temperature during 1951-2015
* 0.4°C increase in minimum temperature during 1951-2015
* 1.5°C increase in max temp during 2041-2070 (RCP4.5)
* 1.9°C increase in max temp during 2071-2100 (RCP 4.5)

Being a water scarce and drought prone region coupled with saline ground water, the changes in climate pose severe threats to dependent sectors such as agriculture and allied activities, industry, and livelihoods of people, particularly the vulnerable sector.

2.1 CLIMATE RISKS

Increasing temperature, fluctuating rainfall patterns and its extremities creates shorter rainy seasons and longer dry seasons making the river basins more vulnerable. This district experiences frequent droughts, cyclones, floods, and storm surges. Being a coastal district, sea level rise is also a distressing issue under the changing climate scenario.

* Frequent Droughts
* Cyclones
* Flood inundation

Drought

Generally, this rain shadow region has a prolonged dry climate. Majority of the lands are rain fed which depends on monsoons, especially NEM. Thus, frequent and consecutive monsoon failures (less than 40% of normal rainfall) coupled with the erratic behavior of the monsoon makes the district more vulnerable to droughts. This district experiences drought once in 3 years which impacts the ground water levels, reservoir levels, crop conditions, and soil moisture. Sandy soils in the region are more prone to severe drought. The district experienced consecutive droughts in recent decades particularly in 2003, 2009, 2016, 2017 and 2019. All parts are affected by drought and its consequences are large areas of crop losses and drinking water scarcity.

Cyclones

A tropical cyclone is a multi-hazard weather phenomenon, as it leads to heavy rainfall, gale wind and storm surge during the landfall. The winds, heavy rainfall and storm surge associated with the cyclone result in flooding of coastal areas, erosion, saline intrusion, loss of life, property, belongings, disruption of communication facilities, damages to agricultural and plantation crops and livestock etc., Being a coastal region, this district faces hazard due to cyclone forms in Bay of Bengal. The 1964 Rameswaram cyclone was regarded as one of the most powerful storms to ever strike India on record and worst to hit the district. In recent years, some of the tropical cyclones such as Burevi (2020), Gaja (2018) cyclones had its impacts here. This district also experiences storm surges exceeding 6m above the concurrent sea level. IMD, High soil erosion is also noticed here. Ministry of Earth Science, Govt. of India, prepared Cyclone hazard proneness of districts based on frequency of total cyclones, total severe cyclones, actual/estimated maximum wind strength, Probable Maximum Storm Surge (PMSS) associated with the cyclones and Probable Maximum Precipitation (PMP). The report indicates Ramanathapuram district is highly prone (Cyclone warning in India, IMD, March 2021).

Flood

Though it is a low rainfall region, it experiences heavy rain and flood during deep depressions/ cyclones forms in the Bay of Bengal. State Disaster Management Authority (SDMA), Government of Tamil Nadu has identified 39 locations of Ramanathapuram district as flood vulnerability of medium category (inundation of water from 2 to 3 feet) based on past events (Ramanathapuram District Disaster Management Plan 2020-2021). Sengampadai, Mandalamanickam, Kamuthi and Pakkuvetti locations in Sengampadai, Mandalamanickam, and Pakkuvetti GPs have medium vulnerability for floods.

Sea level rise

Sea level rise (SLR) is one of the greatest challenges of the low-lying coastal regions of the world. Recent Intergovernmental Panel on Climate Change (IPCC) 2021 report cautioned that there The average rate of SLR was 1.3mm/yr (1901-1971) and rose by 03.7mm yr (2006-2018), and it would continue to rise to 2 m by the end of the Century under a very high emissions scenario (SSP5-85 low confidence) (IPCC, 2021). IPCC cautions that coastal areas will get continued SLR throughout the 21st century, contributing to more frequent and severe coastal flooding in low-lying areas and coastal erosion. This coastal region will also face sea level rise and future SLR projection studies indicates there would be 4.51 cm (low range)/ 7.21cm (medium range) increases for the year 2025 and it would be 30.29 (low range), 49.10 cm (medium range) under IPCC AR5-RCP 4.5 scenario (CCCDM, Anna University).

2.2 WASCA CLIMATE VULNERABILITY INDICATORS

During 2019, WASCA TN conducted preliminary State level scoping study on the State's rural water security through the lens of climate and identified climate and water security hotspots/potential geographical areas for project demonstration through scientific criteria, jointly with the Centre for Climate Change and Disaster Management (CCCDM), Anna University. The vulnerability of a region to the climate depends on several intrinsic factors such as physical, social, economic, and environmental conditions. On the basis of the ground reality and accurate observations, WASCA TN study proposed 18 indicators to reflect the State's rural water security through four interconnected CWRM areas viz., climate extremities, water resources, agriculture and socio-economic to assess climate-water vulnerability at the district level (Table 2).

TABLE 2. BIOPHYSICAL AND SOCIO-ECONOMIC INDICATORS USED IN VULNERABILITY ASSESSMENT

CWRM	Indicators of Rural water security vulnerability	Indicators label	Linked SDG
Climate	Changes in max temperature (^{O}C)	C1	Goal 13
	Changes in min temperature (^{O}C)	C2	
	Changes in rainfall (%)	C3	
	Excess rainfall years	C4	
	Deficient rainfall years	C5	

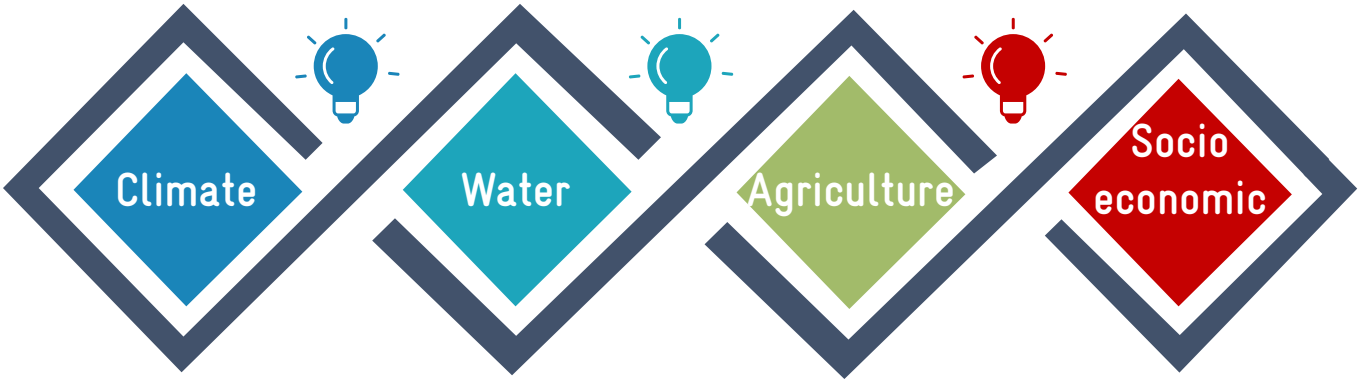
Water	Ground water extraction (%)	W1	Goal 6
	Ground water Recharge (m^3)	W2	
	Surface water availability (mm)	W3	
	Water gap (mcm)	W4	
	% of contamination	W5	
Agriculture	Rainfed area (%)	A1	Goal 15
	Cropping intensity (%)	A2	Goal 2
	Soil moisture (Kg/m^2)	A3	Goal 15
	Evapo-transpiration (Kg/m^2)	A4	
Socio-economic	Rural proportion (%)	S1	Goal 2
	Multidimensional poverty index	S2	Goal 1
	Source of drinking water within premises in rural (%)	S3	Goal 6
	Marginal farmers land holdings (%)	S4	Goal 1

Data for these 18 biophysical and socio-economic indicators were collected at the district level and categorized into exposure, sensitivity and adaptive capacity for the analysis. The vulnerability ranking was given based on IPCC protocol of vulnerability assessment methodology. Based on the analysis, Tiruvannamalai and Ramanathapuram districts were selected by the State Level Steering Committee headed by the Secretary RD&PR in Nov 2019 for implementing the WASCA. Subsequently, all the key water actions, CWRM planning and implementation works were envisaged for the above two districts through these influencing indicators collectively under four CWRM areas viz. climate, water, agriculture and socio-economic.

2.3 COMPREHENSIVE ANALYSIS OF BLOCK LEVEL VULNERABILITY

WASCA TN has progressed towards Block level climate vulnerability mapping in order to strengthen water resources and build context specific climate resilient models at GP level. The 18 vulnerability indicators at district level under four areas via climate, water, agriculture and socio-economic are further explored at the GP level through Composite Water Resource Management (CWRM) approach by GIZ, Department of Rural Development (Mahatma Gandhi NREGS), National Water Mission, Tamil Nadu along with three technical partners of WASCA project Viz., MS Swaminathan Research Foundation (MSSRF), Sugandhi Devadasan Marine Resources Institute (SDMRI), Prime Meridian and key sectoral experts. Based on the national level workshop on WASCA for GIS based planning using IWRM principles, a Composite Water Resources Management plan framework was customized to suit to Tamil Nadu State's conditions, including climate vulnerability as per the scoping study recommendations, Major CWRM parameters were thus identified under four areas via climate, water, agriculture and socio-economic for advancements towards actions. The major parameters identified at Block level (Table 3) are collected both from primary and secondary sources and analyzed statistically and geospatially.

TABLE 3. MAJOR PARAMETERS IDENTIFIED FOR BLOCK LEVEL VULNERABILITY ASSESSMENT



Climate	Water	Agriculture	Socio economic
Drought, Locations based on past disasters and vulnerability	Watershed and drainage network, traditional water bodies, canal networks, irrigation facilities, catchments area wise available runoff, ground water and surface water utilization, ground water status, ground water availability, evapo-transpiration losses, and water demand for drinking, agriculture and livestock, water quality, sea water mixing and salinity	Land resources, land use under different categories, catchment area, means of water extraction, irrigation methods, crop details, status of soil resources including macro and micro nutrients, soil physical condition, soil moisture, and livestock details	Area, population, gender, vulnerable population and household, details of MGNREGA job seekers, drinking water sources and grey water generation

ஏரின் உழாஅர் உழவர் புயலென்னும்
வாரி வளங்குன்றிக் கால்

குறள் - 14

Unless the fruitful shower descend
The ploughman's sacred toil must end

Thirukkural - 14

CHAPTER 3

GRAM PANCHAYAT PLANNING IN MAHATMA GANDHI NREGS

3 CONVERGENCE OF WASCA AND MAHATMA GANDHI NREGA

WASCA, GIZ has evolved a GP based CWRM planning approach for facilitating convergent planning under Mahatma Gandhi NREGA as per the recommendations of the National Level Workshop organized by MoRD, MoJS, GIZ along with State Rural Development Department of WASCA implementing states in February 2020. While developing the framework, inputs from all the relevant stakeholders including communities, public institutions, civil society, research organizations, and private agencies were taken into consideration. Both the Annual Master Circular issued by MoRD during 2021-22 and the Annual Planning Circular issued in September 2020 focused on developing GIS based planning in all Gram Panchayats.

The planning exercise for Mahatma Gandhi NREGS will be a part of the convergent planning exercise for the Ministry. The thrust is on planning for works related to Natural Resource Management (NRM), agriculture and allied activities and livelihood related works on individual lands leading to sustainable livelihoods as well as provisioning of livestock shelters for the individual households. The NRM related works under Mahatma Gandhi NREGS shall be taken up in convergence with Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), Integrated Watershed Management Programme (IWMP) and Command Area and Water Management (CAD&WM) schemes for better outcomes of the water conservation and water harvesting measures. Technical inputs for planning shall be drawn from the technical resources available in the district under Mahatma Gandhi NREGS, CSO partners and other line department agencies. In case of planning for NRM works, the technical inputs will be drawn from the joint pool of technical personnel of IWMP in Watershed Cell cum Data Centre (WCDC), Mahatma Gandhi NREGS unit, Water Resource Department and the Agriculture Department. The technical inputs relating to Excavation, Renovation & Modernization (ERM)/ water bodies may also be sought from Regional Office of Central Ground Water Commission (CWC). The Gram Panchayats, while deliberating and finalizing prioritization of shelf of projects, will keep in perspective, the macro and micro- watersheds of 500-1000 hectares that often comprise 1-10 Gram Panchayats.

The special focus on vulnerable households and communities are considered while preparing estimates for anticipated demand, list of works on individual land, and list of other works that provide direct individual benefits. The Convergent Planning Exercise shall make use of automatically included and deprived Households of SECC to ensure full coverage of poor and vulnerable households. Infrastructure built under Mahatma Gandhi NREGS leads to increased water availability for irrigation, groundwater recharge, increased agricultural production, and carbon sequestration. The Ministry of Environment, Forest and Climate Change recognizes Mahatma Gandhi NREGA as one of the 24 key initiatives to address the problem of climate change, while simultaneously improving the livelihoods of the poor. Mahatma Gandhi NREGA, particularly Category A activities, which are public works relating to natural resource management. Planning and design of works under Mahatma Gandhi NREGS should take into account, impacts of climate change in order to ensure resilience of vulnerable rural communities and make the benefits sustainable in the long run.

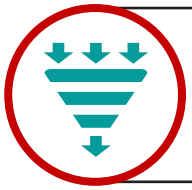
262 Total Kinds of works in Schedule-I of Mahatma Gandhi NREGA

182 Kinds of works relate to NRM alone

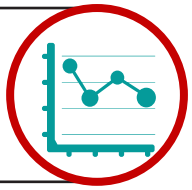
164 Kinds of works related to Agriculture & allied works

85 Water related works out of NRM

In pursuance of Schedule-I of Mahatma Gandhi NREGA, 262 kinds of works/ activities have been identified as permissible works, of which 182 kinds of works relate to NRM alone and out of the 182 NRM works, 85 are water related and 164 are related to Agriculture and allied works. The works taken up in Mahatma Gandhi NREGS should change from taking up individual, standalone works in a typical 'relief works mode' to an INRM perspective. Planned and systematic development of land and harnessing of rainwater following watershed principles should become the central focus of Mahatma Gandhi NREGS work across the country to sustainably enhance farm productivity and income of poor people. Even the works on private lands should be taken up following the principles of watershed management in an integrated manner. To facilitate evidence based scientific NRM planning process, Technological support shall be taken from National Remote Sensing Centre, ISRO for identification and holistic planning of permissible works to be taken up in the watersheds using GIS Technology (BHUVAN). The GIS plans shall be comprehensive ones incorporating all eligible works under Mahatma Gandhi NREGS and the same shall be implemented in a phased manner. Section 22 of the Annual Master Circular provides key steps for GIS based planning.



The Geographical Information System (GIS) plans shall be comprehensive ones incorporating all eligible works under Mahatma Gandhi NREGS and the same shall be implemented in a phased manner.

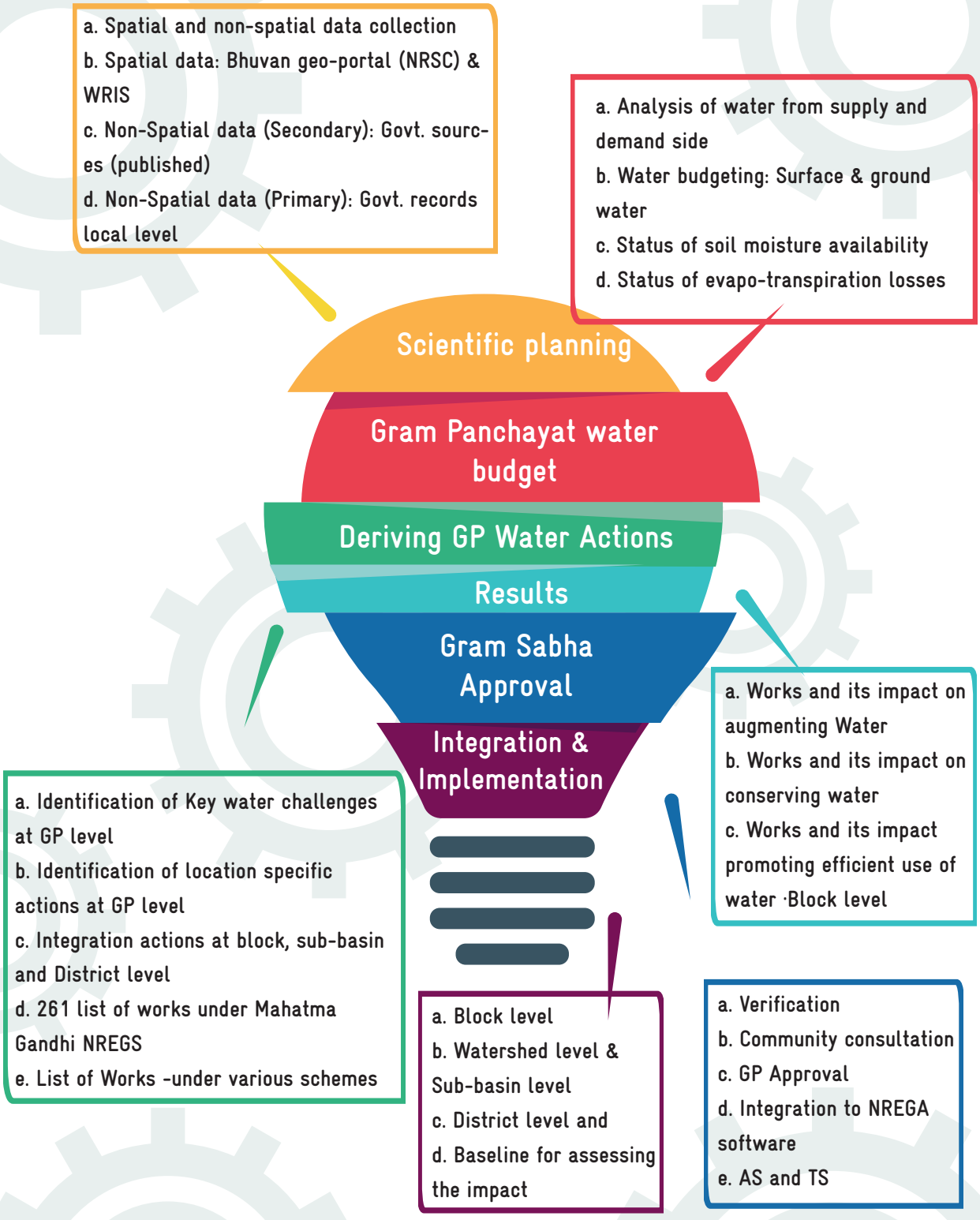


3.1 COMPOSITE WATER RESOURCE MANAGEMENT APPROACH

CWRM approach for Water Security and Climate Adaptation uses simple scientific tools that can help Block or GP level officer to organize, analyze and prepare a draft plan for participatory discussion at the Gram Panchayat level. This approach involves analyzing key water challenges using both non-spatial and geo-spatial data in GIS (Geographical Information System) coupled with extensive ground truth verification. The non-spatial data includes socio-economic, climatic, hydrological, edaphic and agricultural areas which are concurrently used for analysis along with the spatial data obtained from remote sensing in GIS platform. It starts with mapping of the administrative (habitations/panchayat/ revenue village, Block/taluk), agro-ecological (regional and sub-regional, climatic and agricultural zonation's) and hydrological (drainage points/watersheds/sub basin) units keeping Gram Panchayat as the lowest unit of planning and execution. Following this, a detailed socio-economic profile was mapped covering male/female population, proportion of SC and ST population, vulnerable households, access to employment in Mahatma Gandhi NREGS and proportion of works carried out in the village through amount of budget utilized as well as actual works completed. The climatic parameters including maximum and minimum temperature, season-wise rainfall and rainy days, evapo-transpira-

tion and soil moisture are used to understand the climate related issues. Lastly, land use, watersheds, drainage networks and surface runoff, existing water supply and storage systems, water management for the key sectors and water demand are assessed to prepare the water budget for the GP (Box 1).

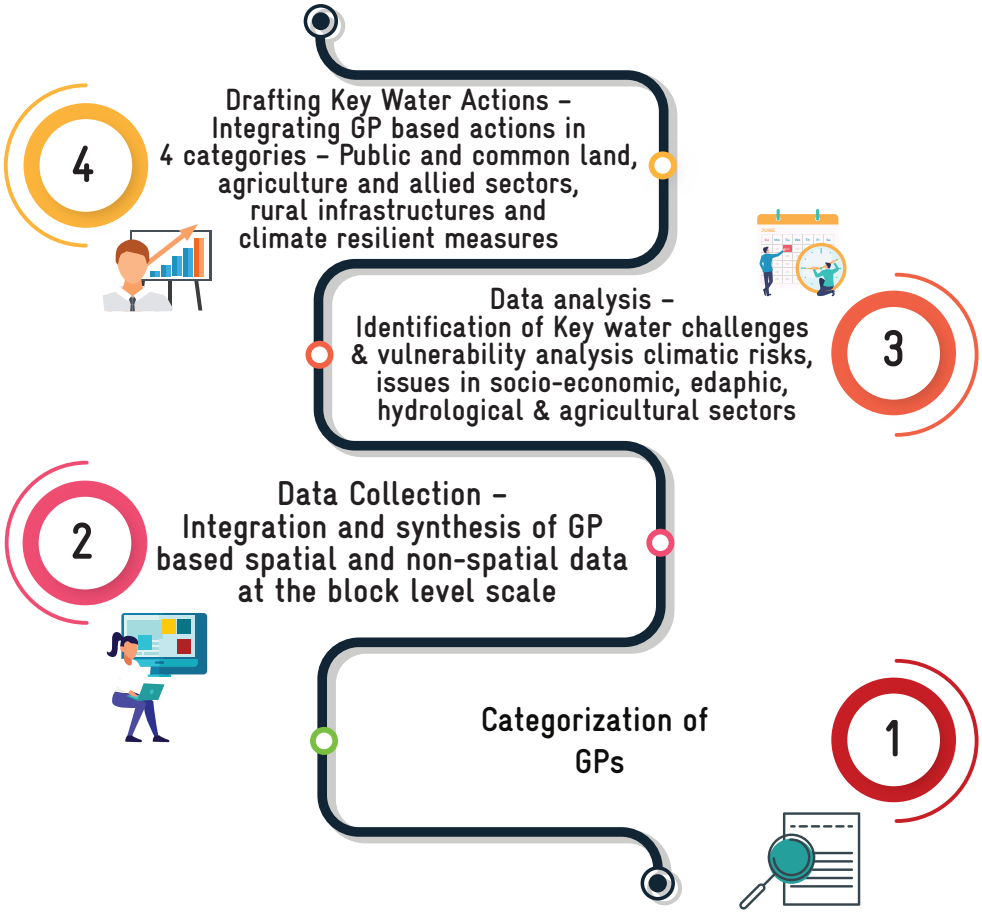
BOX 1. MAJOR COMPONENTS INVOLVE IN CWRM PLANNING WORKOUTS



Such a comprehensive analysis in preparing the water budget integrating ground water, surface water through runoff from rainfall, evapo-transpiration and soil moisture helps to identify potential areas of action to augment the water resources in public and common land, agriculture and allied sectors and rural infrastructure dimensions. The analysis also helps to understand the areas of interest and appropriate climate resilient measure as an adaptive measure to the emerging climate change scenarios. The water challenge linked water actions are the key in developing the perspective plan for the water secured GPs, and serve as shelf of projects. The shelf of projects is again mapped with the available schemes and financial plans for execution, adopting convergence and inter-sectoral principles. In the execution process the District level technical and administrative teams are involved in planning, monitoring and evaluation in terms of outcome/impact mapping. In the execution stage, the approach of saturation of works, planning at watershed approach (ridge to valley), and convergence is some of the key aspects which needs attention for a tangible outcome in both Natural Resource Management as well as livelihoods.

The District WASCA resource centers established in the project area, facilitates this whole process for planning and implementation. This comprehensive and integrated approach has been accepted nationally and by state governments as a comprehensive and climate adapted planning approach for water security. The whole process has been categorized in to four stages – pre planning, planning, review and verification and integration and approval (Box 2).

STEPS INVOLVED IN BLOCK LEVEL ANALYSIS THROUGH CWRM APPROACH



This integrated approach has been accepted by National, State, and District Level Steering Committees headed by Additional Chief Secretary RD&PR and District collector respectively in the project area of Tamil Nadu government as a comprehensive and climate adapted planning approach for water security under Mahatma Gandhi NREGS and National Water Mission.

BOX 2. STAGES OF CWRM PLANNING PROCESS

PRE-PLANNING STAGE

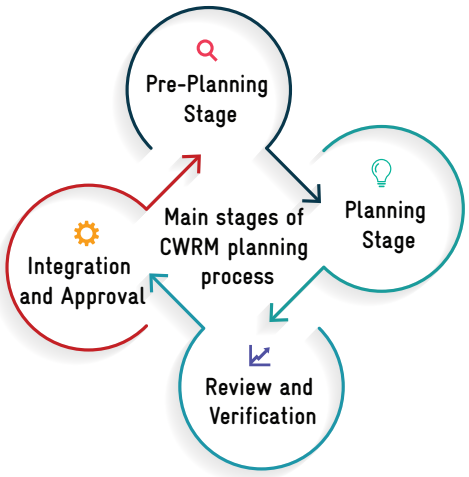
1. Categorizing GPs for planning as per Mahatma Gandhi NREGS guidelines
2. Human resource and capacity building at administrative levels for planning facilitation
3. Capacity Building of State, District level officers towards implementing the Mahatma Gandhi NREGS
4. Building District specific CWRM framework and indicators suitable to the terrain and geography
5. Identification of Phases for pre pilot GPs for planning (4 GP Plans per Block) as per DLSC and SLSC

PLANNING STAGE

1. Collection on Non-Spatial statistical data as per MoRD guidelines and CWRMP
2. Collection of Spatial as per MoRD guidelines and CWRMP
3. Water Budget Estimation (as per CWRMP guidelines)
4. Conducting district specific studies on Ground Water Assessment as per CWRM
5. Inclusion on Non-NRM activities under Mahatma Gandhi NREGS with CWRMP
6. Identification of Key Water Challenges - CWRMP
7. Identification of Key Water Actions -CWRMP

FOUR LEVELS OF CWRM PLANNING UNDER WASCA

1. DEVELOPING PLANS AT LOWEST ADMINISTRATIVE LEVEL: GP LEVEL PLANS
2. INTEGRATING GP LEVEL PLANS AT BLOCK LEVEL



FOUR LEVELS OF CWRM PLANNING UNDER WASCA

3. INTEGRATING GP PLANS AT WATERSHED AND SUB-BASIN (CATCHMENT) LEVEL ON NRM
4. INTEGRATING GP PLANS TO DEVELOP WASCA DISTRICTS CWRM PLANS

INTEGRATION AND APPROVAL

1. Preparation of Integrated plans (at Block, Watershed levels)
2. District Level WASCA Plan
3. Approval at GP level for preparation of Labour budget using CWRM frame work outcomes
4. Approval of District plan at DLSC as per above recommendations of GP level
5. Submitting approved District WASCA plan from DLSC to SLSC for financing and convergence

REVIEW AND VERIFICATION

1. Matching spatial data as per Mahatma Gandhi NREGA- MoRD guidelines on GIS based planning
2. Field Verification, GP level Meetings for inclusion in labour budget 2021-22
3. Approvals of verified works at GP by the Block and GP level officers implementing Mahatma Gandhi NRGES
4. Integrating verified, approved works into NREGA soft (MORD NIC Portal) for mainstreaming WASCA
5. Regular review on progress at each level

3.2 CATEGORIZATION OF GPs

The CWRM uses both spatial and non-spatial data for developing GP level plans. Most of the non-spatial data are available at the revenue village level. To synchronize planning at GP, keeping data availability and administrative boundaries for GIS planning, various GP's are categorized based on revenue village boundaries, for collecting and organizing the datasets. Based on the above factors, five different types of GPs are classified as Type I, II, III, IV and V. The description of categorization of GP's is given in Annexure 1. Details of categorization of GPs in Kamuthi Block is tabulated in Table 4.

TABLE 4. CATEGORIZATION OF KAMUTHI BLOCK GPs

NUMBER OF GP	GP TYPE	NAME OF THE PANCHAYAT
16	GP and revenue village data and boundary match (Type-I)	K.Nedungulam, K.Veppangulam, Perunali, Keelaramanadhi, Musittaikurichi, Mavilangai, Sengappadai, Kadamangalam, O.Karisalkulam, Mandalamanickam, Thimmanathapuram, Pakkuvetti, Ponthampuli, Peraiyur, T. Valasubramaniapuram, Pammanendal
9	Having more than one GPs in one Revenue Village (Type-II)	Pudukottai, Idayankulam, Maraikkulam, Valayapookulam, Melaramanadhi, Ramasamypatti, Natham, Udayanathapuram, Pappurediyapatti
28	GPs having more than one GP, one Revenue Villages data, boundary (Type IV)	Tharaikudi, T.Punavasi, Anayur, Sadayanendhal, Pasumbon, Ariamangalam, Erumaikulam, Kakkudi, M.Pudukulam, Idivillagi, Eluvanur, Vallandhai, Ilanthaikulam, Mudalnadu, K.Pappankulam, Nagarathakurichi, Narayanapuram, Pappanam, Keelamudimannarkottai, Neeravi N, Karisalkulam, Kovilangulam, Melamudimannarkottai, Kathanendal, Kamboothi, Achchangulam, Pulvoikulam, Vangarupuram

3.3 DATA COLLECTION – SPATIAL & NON SPATIAL

The CWRM planning framework has four vulnerability areas, integrating both non-spatial and spatial parameters with 18 indicators based on the IWRM and climate adaptation principles. The planning process comprises of the following dimensions in a scientific and organized manner to prepare a meaningful plan at the lowest administrative unit i.e. GP plans.

SPATIAL DATA

The spatial datasets are supportive evidence to understand the existing conditions and issues in the area/ region. Considering the spatial datasets such as morphology, ground water potential, slope terrain, erosion, Land Use and Land Cover (LULC), waste land, salt and erosion affected lands, drainage lines, and slope will play a significant role in contributing to preparation of the most appropriate and suitable science-based decision plans towards holistic development of the region, emphasized with the water actions. The use of different spatial data to assess and confirm the key water challenges along with the non-spatial data is discussed below:

NON SPATIAL DATA

- Characterization of catchment landscapes based on the ten-fold land use classification to know available land area in both public and individual land ownership and its current position in terms of available area and use, its links with surface runoff as good, average and bad runoff

- Watershed based analysis is to understand the hydrological and administrative boundaries. This aids in understanding the profile and condition of the watershed at macro or micro level for planning relevant water actions

- Soil characteristics including the macro and micro nutrient status, physical quality of the land using pH values and textural soil quality to understand its permeability, infiltration and water holding capacity which are crucial for soil moisture content

- The agriculture and livestock datasets help in understanding the quantum of water requirement of the key crops and type of cropping systems adopted, number and type of different livestock resources and its water requirement vis-a-vis its linkage to livelihoods of the vulnerable population in the village

- Grey water generation at GP level to understand the quantum of grey water available and existing methods of its use. This information is essential to plan effective strategies for recycle and reuse

- Water budgeting at GP level to demonstrate the sector wise water demand and available water through the traditional water harvesting and storage bodies and the potential runoff that can be conserved through appropriate actions on the supply side. The difference between demand and supply at the GP level helps the communities to understand the gap and practice the necessary water actions

ASSESSMENT OF GROUND WATER QUALITY AND SEA WATER INTRUSION

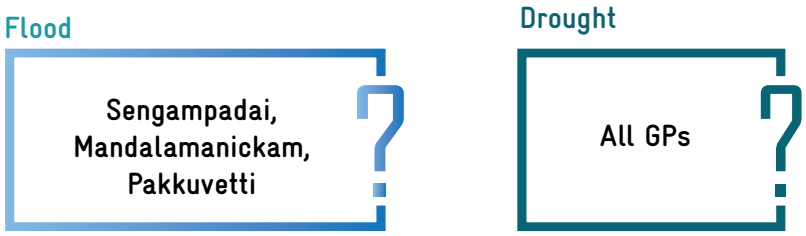
The vulnerability of the groundwater quality, seawater intrusion in the aquifers were assessed and spatially mapped for the Ramanathapuram District. The water quality samples were collected from 380 locations throughout the district during pre-monsoon and post-monsoon season. The collected samples were analyzed using standard methodology for calculating Water Quality Index (WQI) and Sea Water Mixing Index (SMI). This data helps to identify the suitability of water for domestic purpose and to detect the concentration of major ionic constituents in seawater at GP level.

Over all, data from 102 parameters were collected, out of which 16 parameters are from primary source, collected from GP administrative units by GPs officers, 65 parameters are from secondary source, collected from Govt. sources and authentic websites and the remaining 21 requisite parameters for water budgeting and grey water were calculated using standards/suitable methods or formulas. CWRM parameters and its data sources is attached in the Annexure 3.1 to 3.3. The methods, and formulas used for water budgeting is attached in Annexure 3.4 and for grey water generation in Annexure 3.5. The water quality standards and formula used are in Annexure 3.6.

3.4 CWRM PLANNING ANALYSIS – CLIMATE

All the CWRM parameters are intended at Block level. On the other hand, all the climate change observations and projections are at district or regional level. As the current data at the Block level is not available at present, previous hydro-meteorological disasters are considered to denote Block's flood and coastal vulnerability which was assessed by State Disaster Management Agency, 2020 as given in Table 5.

TABLE 5. CLIMATE RISKS AND VULNERABLE GP'S



3.5 CWRM PLANNING ANALYSIS – WATER

For effective planning, the available traditional water storage and conveyance structures along with its supply and demand status for different sectors at Block level is necessary. Both spatial and non-spatial data including details and status on watershed and drainage network, canal network, irrigation facilities, catchments area wise available runoff, conserved runoff, present ground water extraction, water demand for domestic, agriculture and livestock, ground water utilization for domestic, agriculture and livestock are collected from authorized open sources and analysed at Block level.

3.5.1 SPATIAL DATA

Spatial data of geomorphology, lineament, terrain, slope drainage network, surface waterbodies, ground water potential, and watershed were collected to understand the site-specific problems and together with non-spatial data, take decisions to draft scientific key water actions. Available Bhuvan source thematic spatial maps/website view was referred to understand, interpret and analyze the spatial parameters of the Block.

3.5.1.1 Geomorphology: Geomorphology deals with the scientific study of "landforms and landscapes, including their description, type, and genesis". Landform is the end product resulting from the interactions of the natural surface genesis and the type of rock. The scope of geomorphology was further expended with landform maps, which are widely used in various fields of hydrology, pedology, geoscience, urban and regional planning etc. Kamuthi Block is mainly engrossed with Dentational, fluvial and coastal origin landform units (Figure 3.1). GP-wise detailed view of the landforms with area in percentage is shown in the illustration below. This fundamental information of landforms by its units will act as a critical input while identifying suitable sites for NRM activities under CWRM plan preparation.

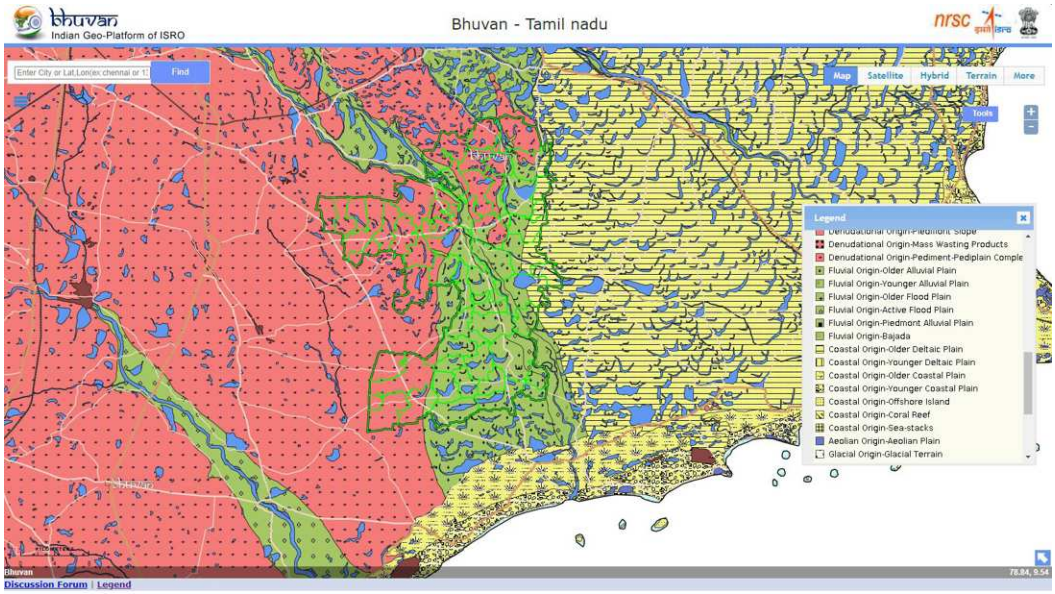


Figure 3.1. Geomorphology map

Origin	Area coverage in %	Gram Panchayat
Denudational origin -pediment-pediplain complete		
	70%	K.Nedungulam, Keelaramanadhi, Melaramanadhi, Mudimannarkottai, Musittaikurichi, N.Karisalkulam, Narathakurchi, Neeravi, Pappureddiapatti, Ramasamipatti, T.Punavasel, Thimmanathapuram, Vallandai - 100%, Marakkulam - 95%,Vangarupuram - 85%, Mandalamanickam, Narayanapuram - 80%, A.Tharaikudi, Eluvanur, Perunali, Valaiyapookulam - 75%, Mandalamanickam - 65,Papanam, Pasumpon - 55%, Mudalnadu - 45%, Achangulam, Kakkudi, Kamudi , Mudalnadu - 25%, Pammanendal - 20%, Mavilangai, Pammanendal - 15%, Mavilangai - 5%
Fluvial Origin- older Alluvial Plain		
	62%	Erumaikulam, Idvilagi, K.Papankulam, K.Veepangulam, Kadamangalam, Kovilangulam - 100%,Abiramam - 95%, Ariyamangalam, Mavilangai - 85%, Idaiyankulam, Kathanethal, Pakkuvetti, Sengapadai - 75%, Pudukottai - 65%, Elathaikulam, Mudalnadu - 55%, M.Pudukulam, Ponthampuli - 50%,Papanam, Pasumpon, Sadayanethal - 45%,Achangulam, Kakkudi, Pammanendal, Perunali - 35%, Perunali, Vangarupuram - 25%, A.Tharaikudi - 15%,Natham - 5%
Fluvial origin- Younger Alluvial Plain		
	35%	Komboothi - 95%, Kakkudi - 75%, Elathaikulam - 35%, Eluvanur, Pakkuvetti - 25%, Narayanapuram - 20%, Kovilangulam, Peraiyur - 15%, Vangarupuram - 10%
Fluvial Origin- Active Flood Plain		
	26%	O.Karisalkulam - 45%, Kovilangulam, Pudukottai - 35%, Idaiyankulam, Kathanethal, Mandalamanickam, Sengapadai, Valaiyapookulam - 25%, Kakkudi - 15%, Komboothi - 5%
Costal origin-older deltaic		
	59%	Pulvolkulam, Udaiyanathapuram - 100%, Natham - 95%, Anaiyur, Sadayanethal - 55%, Peraiyur - 50%, Achangulam - 45%,Elathaikulam - 30%, Abiramam - 5%

3.5.1.2 Lineament: Lineament is also a lithological unit which reveals the hidden architecture of rock basement, representation of an underlying geological structure such as a fault or fracture (Figure 3.2). Lineament plays a significant role in identification of ground water and oil exploration sources. Lineament is represented with linear feature where two different landforms converge or diverges. This site allows water to percolate at a high rate. GP-wise lineament type is illustrated in the table below. These observations are widely used to locate points of high-water flow especially in groundwater exploration.

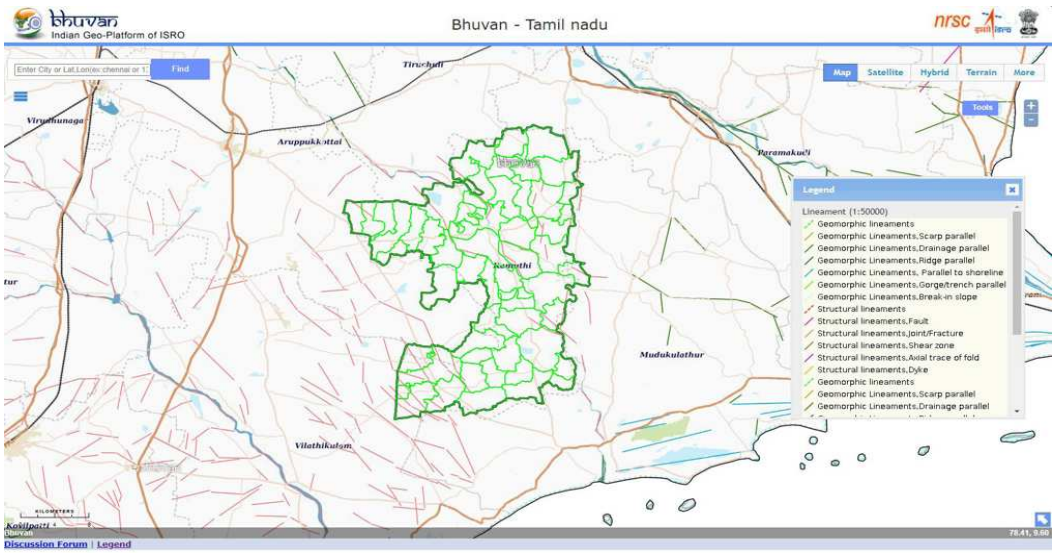


Figure 3.2. Lineament map

Lineament type	Gram Panchayat
Structural lineaments , joint /Fracture	Elanthaikulam, Eluvanur, Mandalamanikkam, Pappureddiapatti, Pasumpon, Pakkuvetty, Kmkottai, Sadayanethal, Thimmanathapuram, Peraiyur, Abiramam, Kakkudi, Anaiyur, Kamudi, Mudimanarkottai, Perunali, K.Nedugulam, O Karisalkulam, Pulvolkulam, Kovilangulam, Udainathapuram

3.5.1.3 Terrain: The terrain map gives information related to elevation from above sea level. A terrain of the same range is noticed over the Block area at the available scale map (Figure 3.3). This map will be useful in identification of better sites suitable for proposing water and soil conservation related activities.

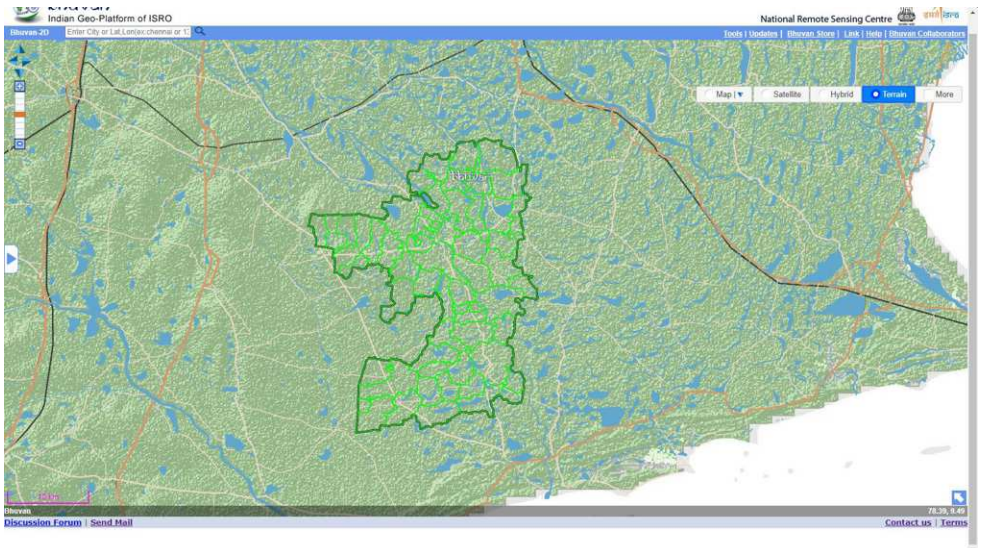


Figure 3.3. Terrain map

3.5.1.4 DEM: The DEM is an important element in the representation of the terrain and only one which determines relief forms such as valleys and hills, and the steepness or gentleness of slopes geometrically. In the Block, higher elevated area in the North-West region is noticed and elevation gradually decreases as we move towards the coastal shore (Figure 3.4). The map plays a vital role in delineation of watershed and its units, used in planning and identifying recharge structures, farm ponds and construction of grey water drain network etc.

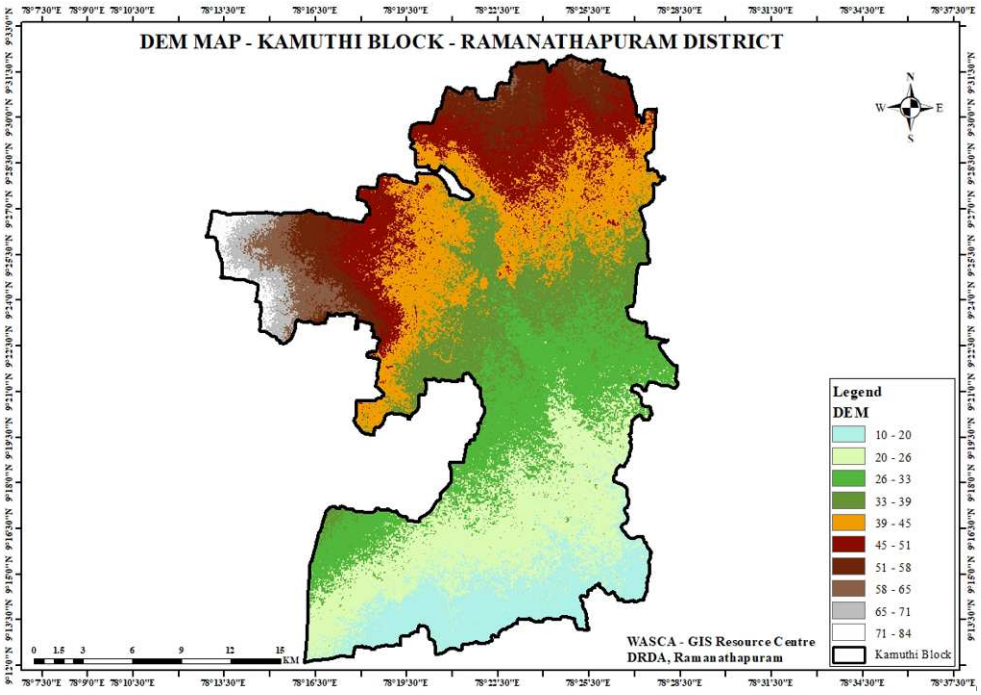


Figure 3.4. DEM map

3.5.1.5 Slope: The average slope of a terrain feature is calculated from contour lines on a topology map or DEM. Slope is typically expressed in percentage, angle, or in ratio. Slope map illustrates the measure of steepness or the degree of inclination of a feature relative to the horizontal plane. Very flat (0 to 1 %) to flat (1 to 3 %) range slope ranges are noticed in the Block (Figure 3.5). Details of GP-wise slope area in percentage is shown in the illustration below. Slope information plays a significant role in identification of soil eroded sites, depth profiles, also used in analyzing / proposing soil conservation measures such as check dam, bunding land development, farm ponds etc.

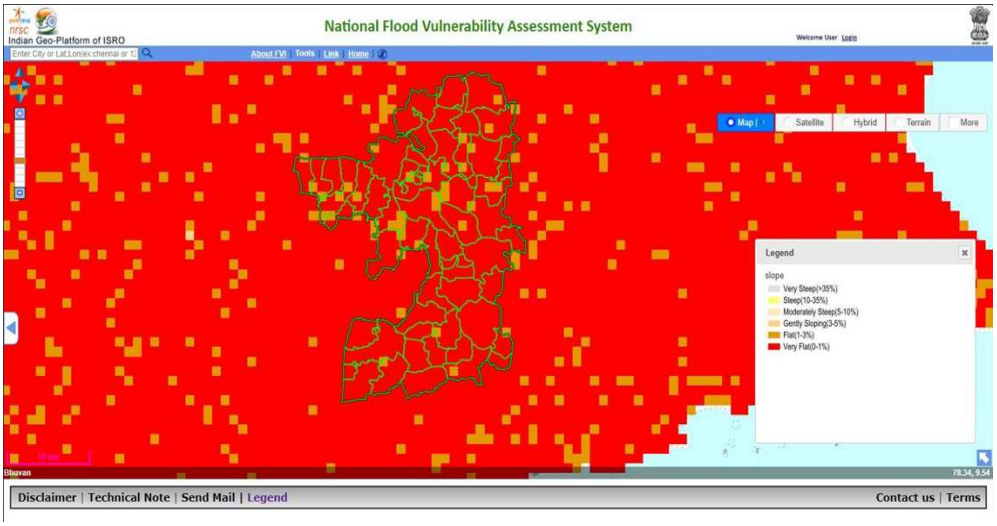


Figure 3.5. Slope map

Slope range	Area in %	Gram Panchayat
Flat (1-3%)	7.8%	Abiramam - 35%, Narayanapuram - 25%, M.PudukulamL, N.Karisalkulam, Pappanam, Sadayanedal - 10%, Achchangulam, Anaiyur, Ariamangalum, K.M.Kottai, K.Nedugulam, Kamudi, Mandaiamanikam, Marakkulam, Mavilangai, Melaramanadi, Mudalnadu, Musittaikurichi, Nagarathakurichi, Neeravi, Pakkuvettai, Pasumpon, Perunali, Thimmanathapuram, Vangarupuram - 5%
Very Flat (0-1%)	97%	A.Tharaikudi, Eluvanur, Erumaikulam, Idaiyankulam, Idivilagi, Ilandaikulam, K.Veppangulam, Kadamangalam, Kakkudi, Kathanendal, Keelaramanathi, Komboothi, Kovilangulam, Melamudimannarkottai, Natham, O.Karisalkulam, Pammanendal, Pappangulam, Pappurettiapatti, Peraiyur, Ponthampuli, Pudukkottai, Pulvoikulam, Ramasamypatti, Sengappadai, T.Punavasal, T.Valasubramaniapuram, Udaiyanathapuram, Valaiyapookulam, Vallanthai - 100%, Abiramam, Achchangulam, Anaiyur, Ariamangalum, K.M.Kottai, K.Nedugulam, Kamudi, M.Pudukulam, Mandaiamanikam, Marakkulam, Mavilangai, Melaramanadi, Mudalnadu, Musittaikururichi, Nagarathakurichi, Narayanapuram, Neeravi, Pakkuvettai, Pasumpon, Perunali, Thimmanathapuram, Vangarupuram - 95%, N.Karisalkulam, Pappanam, Sadayanedal - 90%

3.5.1.6 Drainage Network : The drainage network pattern of a region is particularly dependent on the lithological characteristics, regional slope, structural control, climate condition etc. Very less dense drainage network is noticed over the Block while the area is drained by Gunder River (minor) which flows towards the South from North (Figure 3.6). Drainage network is referred to while identifying suitable sites for soil and water conservation measures such as dams, ponds, bunding, restoration of gullied region etc.

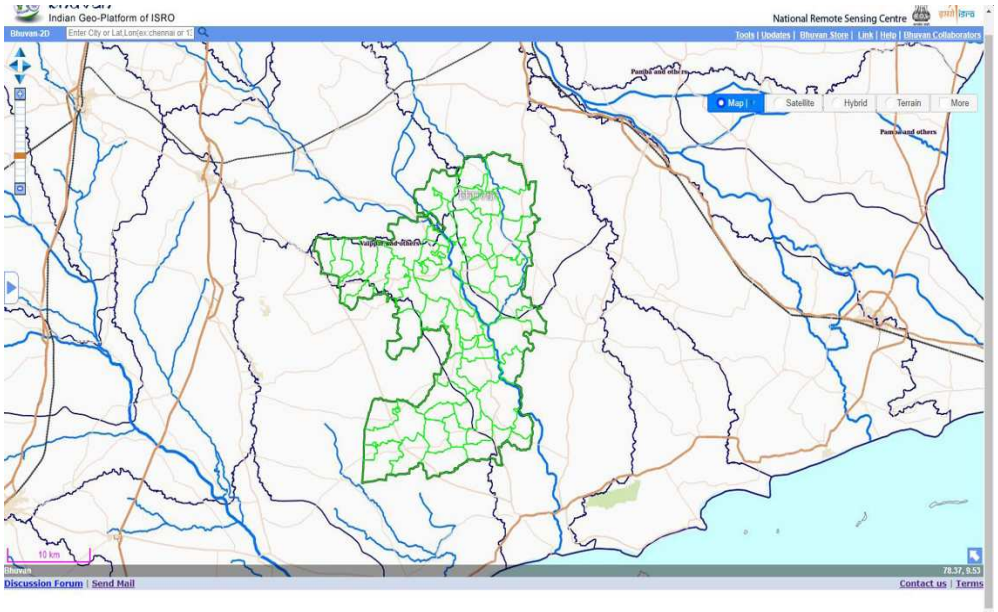


Figure 3.6. Drainage network

3.5.1.7 Watershed: Implementation of any water management measure requires a suitable hydrological unit. A properly delineated watershed forms a convenient hydrological unit for computation of water balance parameters and thus implementation of water management schemes. Also, in achieving a better sustainability in development mainly NRM at the grass root level, watersheds are recognized as viable and effective management units and adopted in most of the developmental programmes such as IWMP, MGNREGA etc. A watershed is the area/region of land where all of the water that falls in it and drains off goes into the common outlet. Kamuthi Block watershed map is illustrated in Figure 3.7. Watershed is used for the interventions based on Ridge to Valley (R2V) concept and sequencing the plan accordingly. R2V approach intends to conserve each drop of rain water from ridge to a reasonable extent and it ensures the better surface water flow management also aids in strengthening the durability of land, soil and water conservation structures downstream.

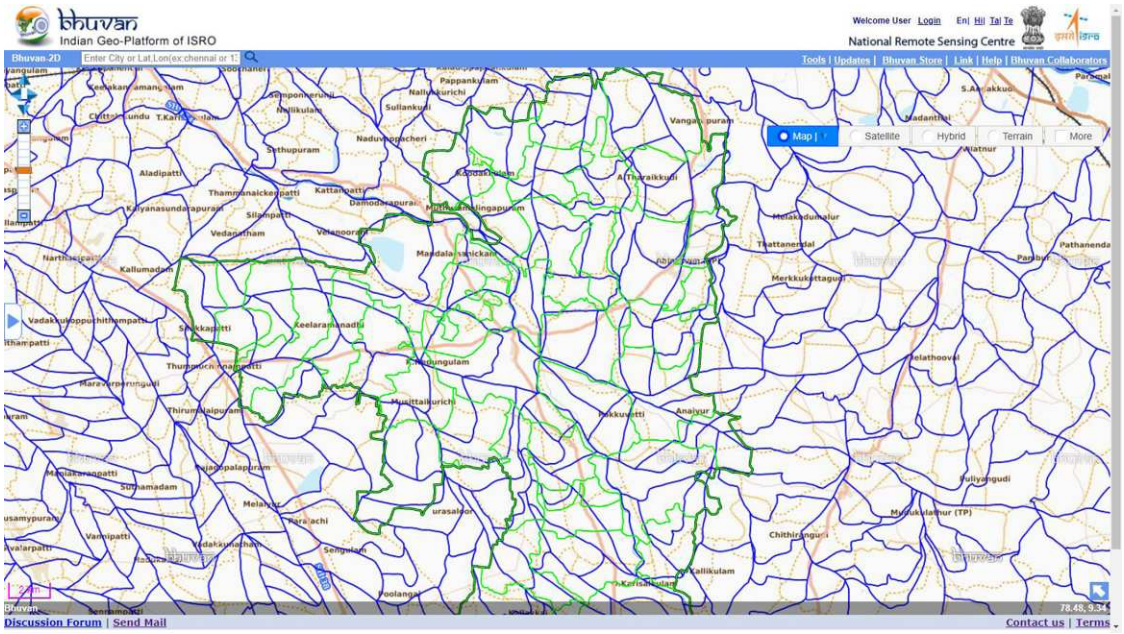


Figure 3.7. Watershed map

3.5.1.8 Ground water perspectives: Ground water is one of the important natural resources in a semi-arid region like Kamuthi Block. The ground water perspectives map is the integration of lithology, geomorphology, geological structures, hydro geomorphic datasets, which provides the required information related to ground water exploration and the probable ground water prospects. This map will help in identification of tentative locations for construction of recharge structures. In the Block area, ground water is available from 30 m itself (Figure 3.8). The GPs wise details of GW prosperity is showcased in the below illustration. This specific information will play a crucial role in identifying sites for recharge structures in order to address water scarcity issues in the Block.

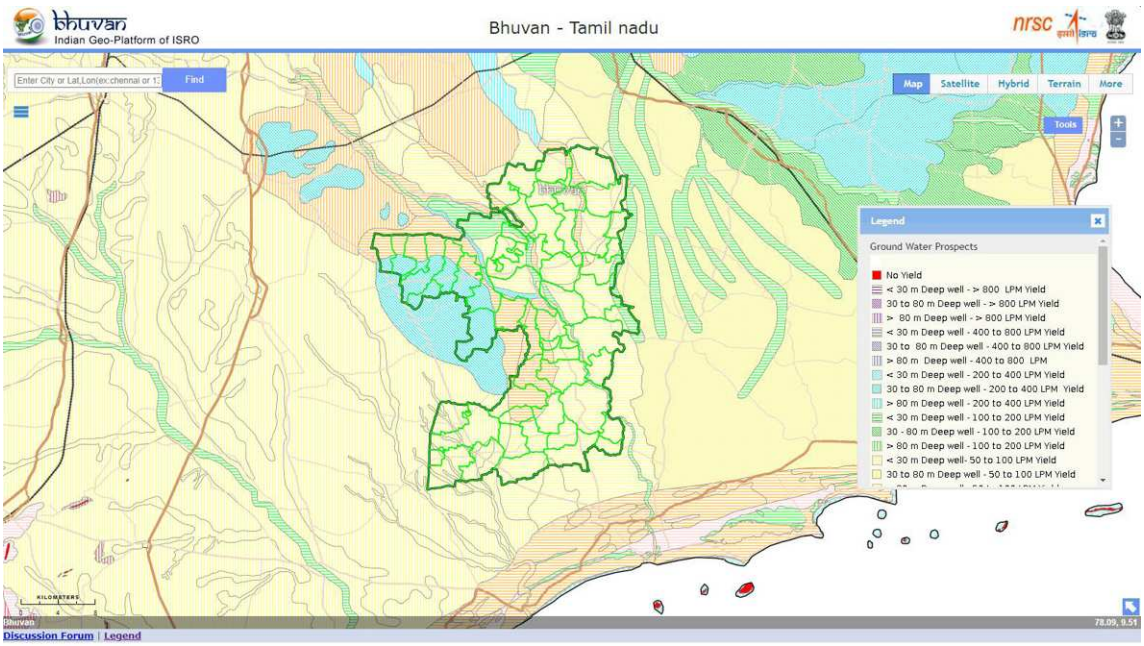


Figure 3.8. Ground water perspective map

Groundwater Prospects	Area in %	Gram Panchayat
<30 Deep Well-30 to 50 LPM Yield		
	35%	K.Veppangulam, Muthalnadu, Pappangulam - 100%, Neeravi - 80%, Keelamudimannarkottai, Mavilangai, Melamudimannarkottai - 75%, Idaiyankulam, Sengappadai - 50%, Pudukkottai - 40%, Keelaramanathi, Melaramanathi - 30%, Abiramam, Ariamangalam, Kamudi, O.Karisalkulam, Pammanendal - 25%, K.Nedungulam, N.Karisalkulam, Narayanapuram - 20%, A.Tharaikudi, Eluvanur, Kakkudi, T.Punavasal - 15%, Achangulam, Nagaratharkurichi, Sadayanendal, Vangarupuram - 10%, Idivilagi - 5%
<30 to 80 Deep Well 200 to 400 LPM yield		
	53%	Mustakuruchi, Ramasamipatti - 100%, K.Nedugulam, N.Karisalkulam - 80%, Keelaramanathi, Melaramanathi - 70%, K.M Kottai, Mudimannarkottai - 25%, Neeravi - 20%
<30m Deep well 50 to100 LPM yield		
	51%	Ariamangalam, O.Karisalkulam - 75%, Pudukkottai - 60%, Idaiyankulam, Sengappadai - 50%, Mavilangai, Pammanendal - 25%
<30m Deep well - 100 to 200 LPM yield		
	23%	Valaiyapookulm - 65%, Mandalamanikam - 60%, Kakkudi - 30%, Kamudi, Narayanapuram - 20%, Pakkuvetti - 15%, Kovilangulam, O.Karisalkulam, Peraiyur - 10%, Elanthaikulam, Kathanethal - 5%
<30 to 80 m Deep well- 30 to 50 LPM yield		
	59%	Pappurettiapatti, Thimmanathapuram, Vangarupuram - 100%, Pammanendal - 30%, Ponthampuli - 15%, Mavilangai - 10%
<30m Deep well - 50 to 100 LPM yield		
	84%	Anaiyur, Erumaikulam, Idivilagi, Ilandaikulam, Kadamangalam, Kathanethal, Komboothi, Kovilangulam, M.Pudukulam, Marakkulam, Natham, Pappanam, Pasumpon, Pulvoikulam, Sadayanendal, Udaiyanathapuram, Vallanthai - 100%, T.Punavasal - 90%, A.Tharaikudi, Achangulam, Mavilangai - 90%, Mustakuruchi, Ponthampuli - 85%, Eluvanur, Narayanapuram, Pakkuvetti, Peraiyur - 80%, Abiramam, Ariamangalam, Idaiyankulam, O.Karisalkulam, Ponthampuli, Pudukkottai - 75%, Kakkudi, Pammanendal - 70%, Sengappadai - 60%, Kamudi - 55%, Mandalamanikam - 40%, Valaiyapookulm - 35%, Mavilangai - 10%

3.5.2 NON SPATIAL DATA

Water resource based non-spatial secondary data related to irrigation facilities such as canal, traditional waterbodies, water quality, demand and supply were collected from Govt. sources (Table 6). GP wise current water resources status and its supply and demand side are shown in Annexure 3.7.

TABLE 6. CWRM PARAMETER-BASED WATER RESOURCES STATUS IN THE BLOCK

Key CWRM Parameter	Total/Average
Canal Network (m)	
Length of Main Canal (m)	1,70,789
Length of Minor Canal (m)	46,350
Length of Distributaries (m)	67,080
Water Courses (Field Channels) (m)	1,78,137
Traditional Water bodies (No.)	
Number of Tanks (PWD & Union)	139
Number of Ooranis	394
Irrigation Facilities (ha)	
Tank Irrigation	8,417.44
Open & Tube Well Irrigation	2,593.05
Catchment Area wise Available Runoff (ha.m)	
Good Catchment Area	1,992.87
Average Catchment Area	170.52
Bad Catchment Area	5,223.01
Watershed and Drainage Networks	
Length of Natural Drainage Lines (m)	3,44,185.48
Number of Natural Drainage Lines (No.)	325
Number of Micro-watersheds (No.)	382
Water Demand	
For Humans (ha.m)	377.04
For Livestock (ha.m)	66.43
For Agriculture (ha.m)	16,878.38
GW Utilization for Drinking (%)	74.47
GW Utilization for Livestock (%)	51.00
GW Utilzation for Agriculture. (%)	21.53
SW Utilization for Drinking (%)	25.53
SW Utilization for Livestock (%)	49.00
SW Utilization for Agriculture (%)	78.47

3.5.2.1 Existing Water Structures

Waterbodies are the life lines of local communities for their lives and livelihoods. The Block has structured traditional water storage units such as tanks, and ooranis. It is noticed that the number of ooranis are more (394) than tanks (139) structures (Figure 3.9).

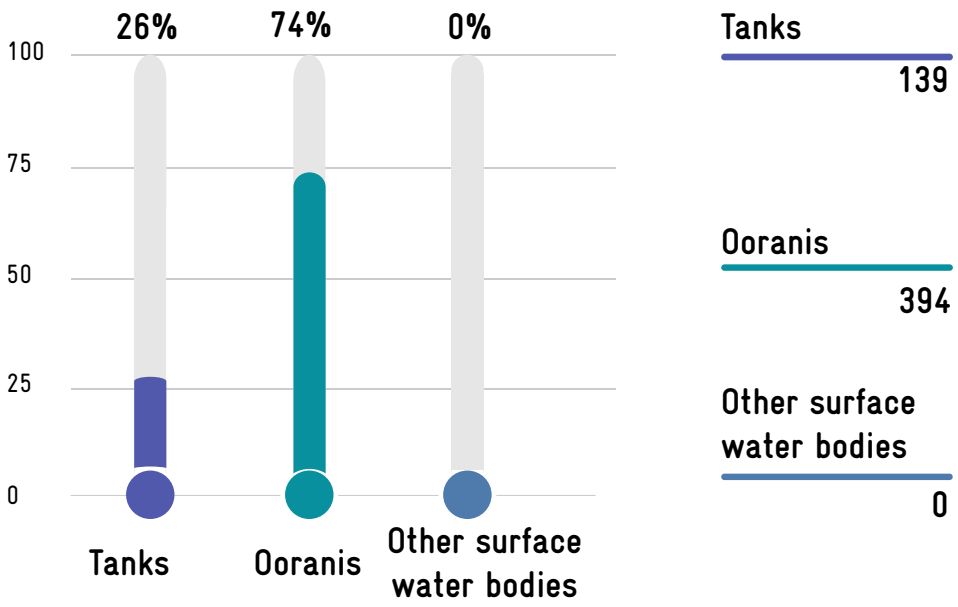


Figure 3.9. Traditional waterbodies

3.5.2.2 Sources of Irrigation

The total area under irrigation in the Block is 11,010.49 ha, of which 76.45 % (8,417.44 ha) area is irrigated through tanks and rest of 23.55 % (2,593.05 ha) through open/tube well (Figure 3.10).

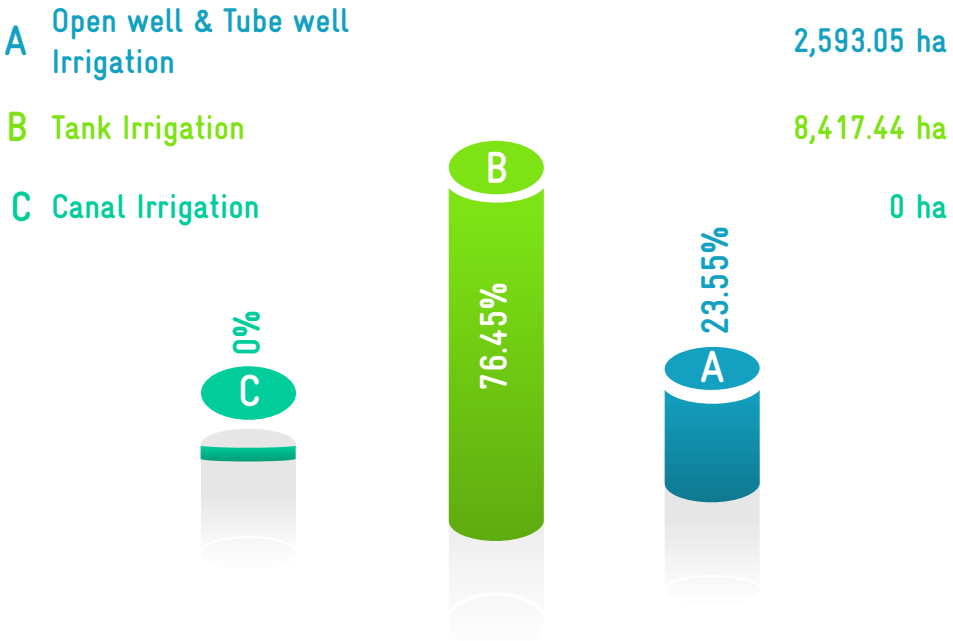


Figure 3.10. Irrigation sources

3.5.2.3 Available Run off

The total available runoff in the catchment area is 7,386.40 ha.m out of which highest of 70.71 % is from bad catchment area followed by 26.98 % is good catchment area and the remaining 2.31 % is of average catchment area. As the area has worse catchment area, the runoff generated is more (Figure 3.11).

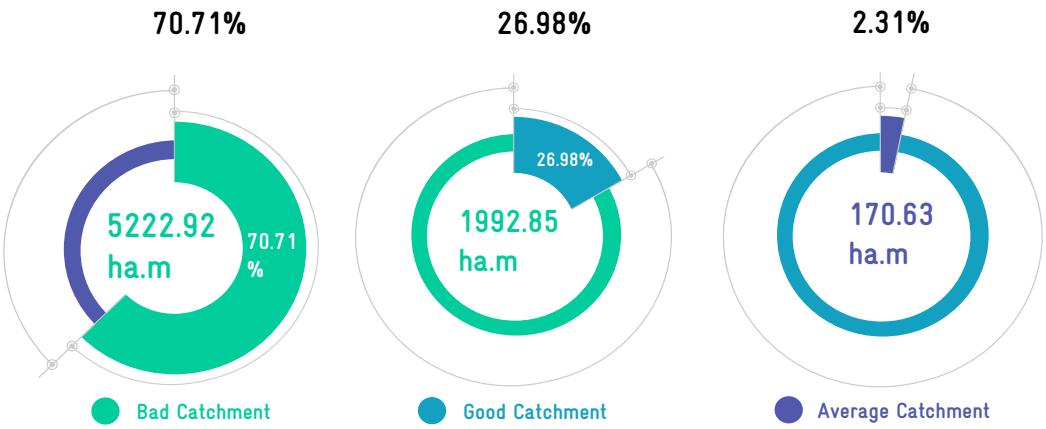
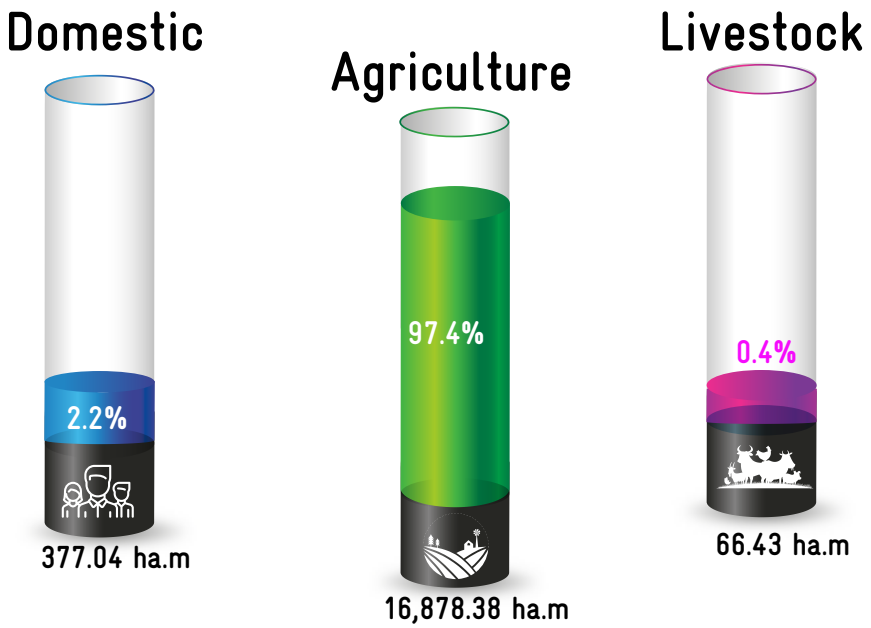


Figure 3.11. Runoff from catchments

3.5.2.4 Water Demand

The total demand for water including domestic, agriculture and livestock purpose is 17,321.85 ha.m. The highest demand is from the agriculture sector of 16,878.38 ha.m (97.44 %) followed by domestic use demand of 377.04 ha.m (2.18 %) and rest is from livestock.



Out of the total water demand, 74.47 and 51 % for domestic and livestock purpose usage of water is met through ground water, while 78.47 % for Agriculture purpose is met through surface water sources (Figure 3.12).

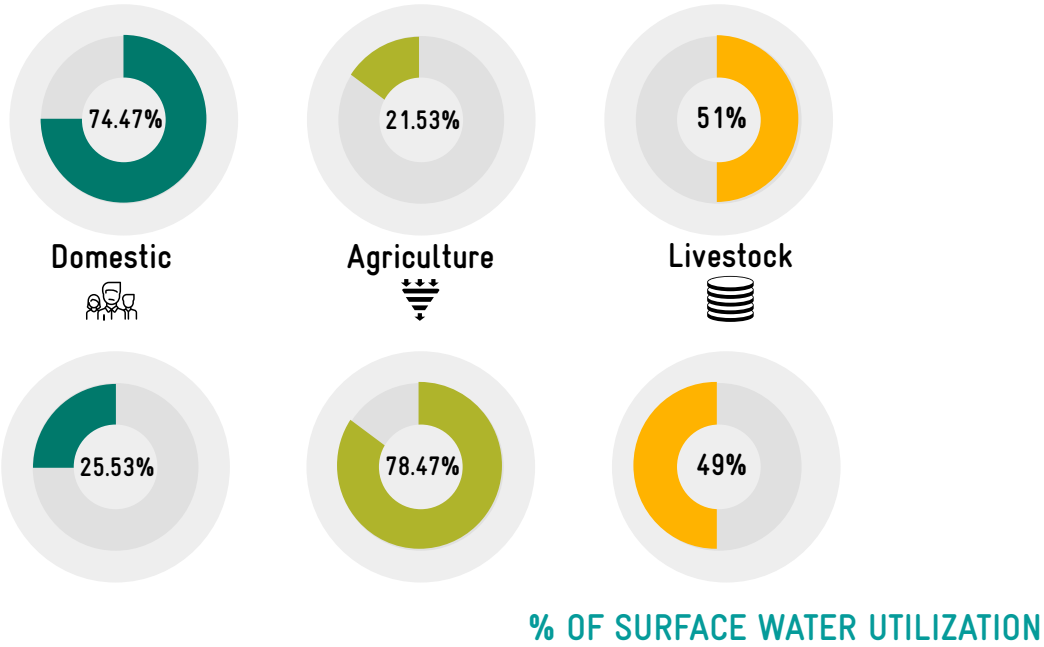


Figure 3.12. Sector-wise water utilization

3.5.3 ANALYSIS OF PHYSICOCHEMICAL PARAMETERS

Physicochemical parameters were assessed to understand their influences on nature of water through Water Quality Index (WQI), Seawater Mixing Index (SMI) and Salinity. To understand WQI and SMI, 30 water samples were collected across Block area, out of which 18 samples were of open well water and the remaining were from ground water (Figure 3.13).

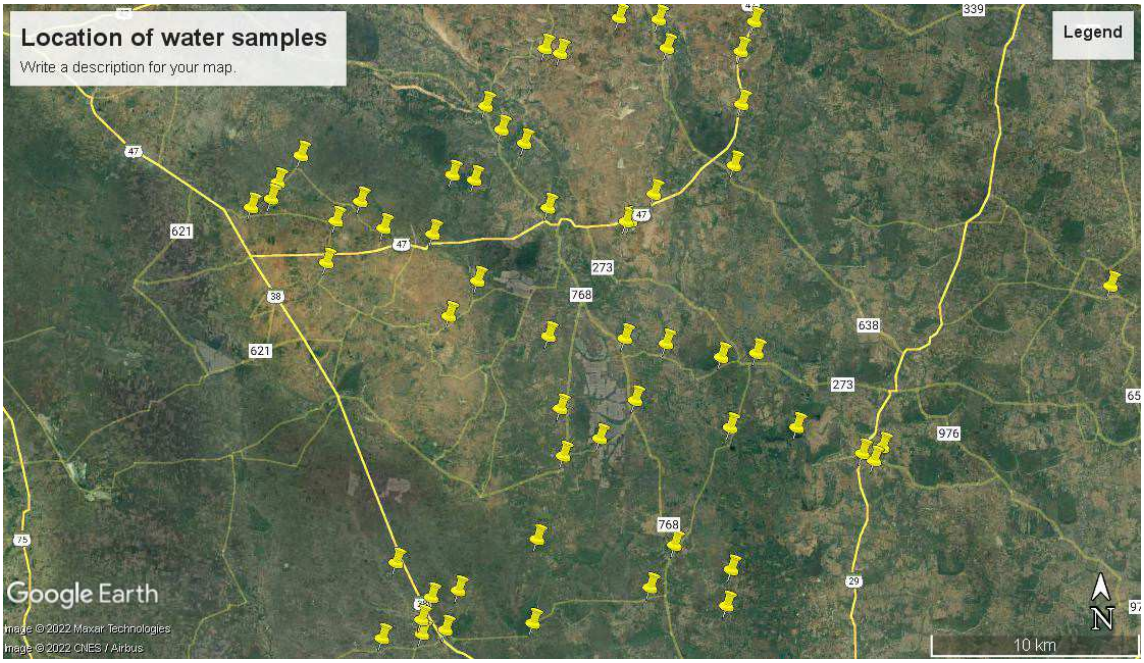


Figure 3.13. Location of water samples

3.5.3.1 Water Quality Index

The WQI is defined as a measure of rating that provides the composite influence of individual water quality parameter to overall water quality. WHO (2004) recommended ten parameters such as pH, TDS, HCO_3, Cl, SO_4, NO_3, Ca, Mg, Na and K to determine the quality of water. The results showed that the average content of ions was as follows: Cl > TH > TA > HCO_4 > Na > Ca > Mg > CO4 > S04 > NO_4 > K. The predominant hydro-chemical facies are Chloride (Cl) followed by Sodium while Potassium (K) is witnessed in minute quantities. The excellent water quality /suitable water for domestic purpose is found in almost 12 sites over the Block (blue colour in Figure 3.14) while very poor-quality water/ unsuitable water for domestic purpose with index value >300 is found in three spots. Buffer area of very poor sites falls under poor quality water of index zone ranging from 200 to 300. However major area of the Block falls under good water quality zone of index value range 50-100 (Figure 3.14). These zones act as inputs in identifying suitable sites to propose appropriate treatment measures. GP wise water quality during pre and post monsoons are attached in Annexure 3.8 and 3.9.

Physicochemical parameters	Cl	TH	TA	HCO_4	Na	Ca	Mg	CO4	$S0_4$	NO_4	K
Average in mg/l	656.07	404.11	379.63	274.32	257.13	181.61	138.46	77.02	64.28	25.70	18.81

(TH = Total hardness, TA = Titratable acidity, Ca =calcium, Na= Sodium, Cl= Chloride, HCO3=Bicarbonate, Mg= Magnesium, SO_4= Sulphate, NO_3= Nitrate, K= Potassium, CO_4= Carbonate)

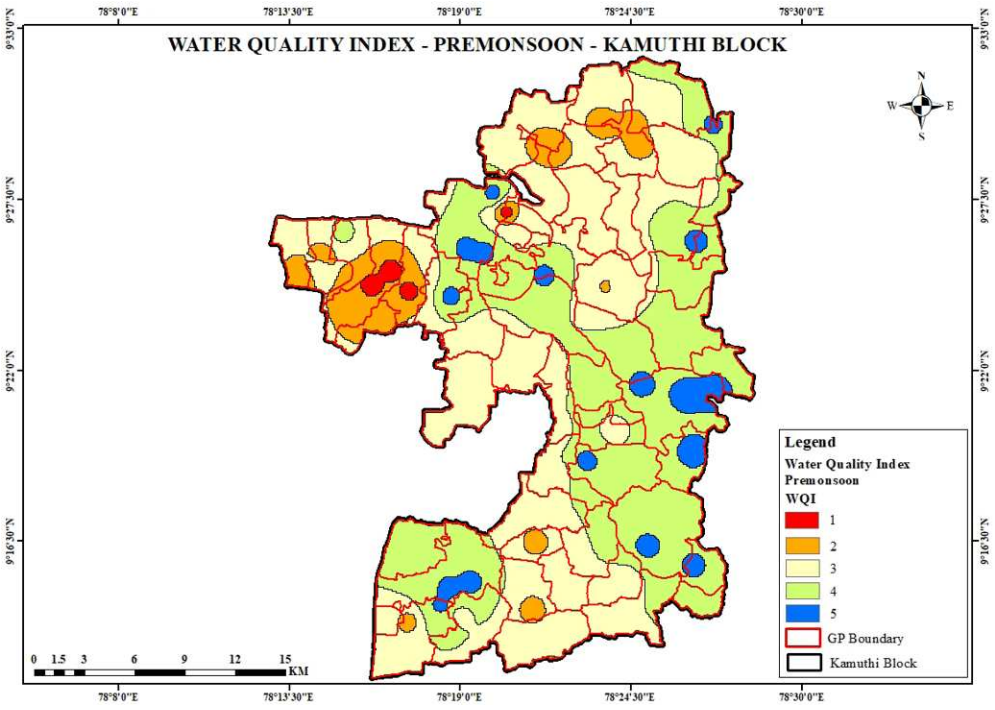


Figure 3.14. Water Quality Index

3.5.3.2 Seawater Mixing Index

SWI parameter is calculated based on mixing of major ionic constituents (Na, Cl, Mg, and SO_4) of sea water to ground water during pre-monsoon season. The results show that the average content of ions was as follows: Na > Ca > Mg > $S0_4$. The predominant hydro-chemical facies are Sodium followed by Calcium while Sulphate is less. Geographically three spots were found with high SWI while three zones were with less sea water mixed. However, most of the Block area falls under the index value range 1-2 which is moderate (Figure 3.15).

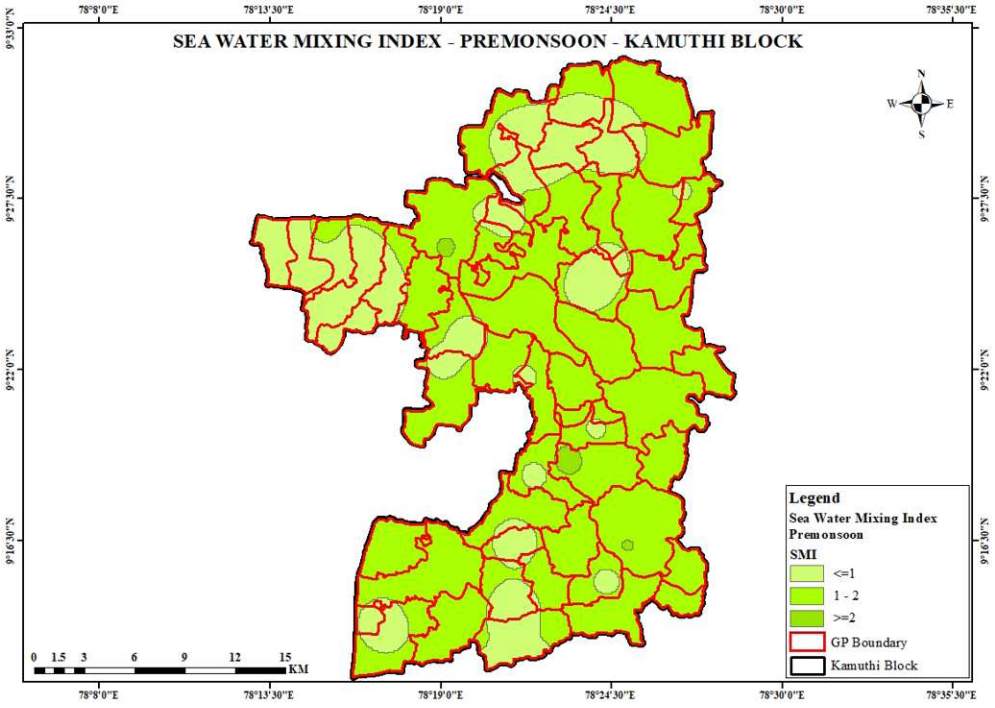


Figure 3.15. Seawater Mixing Index

3.5.3.3 Salinity

Seawater mix and salinity in the water are directly proportional, higher the sea water mix higher the salinity in the water (Figure 3.16).

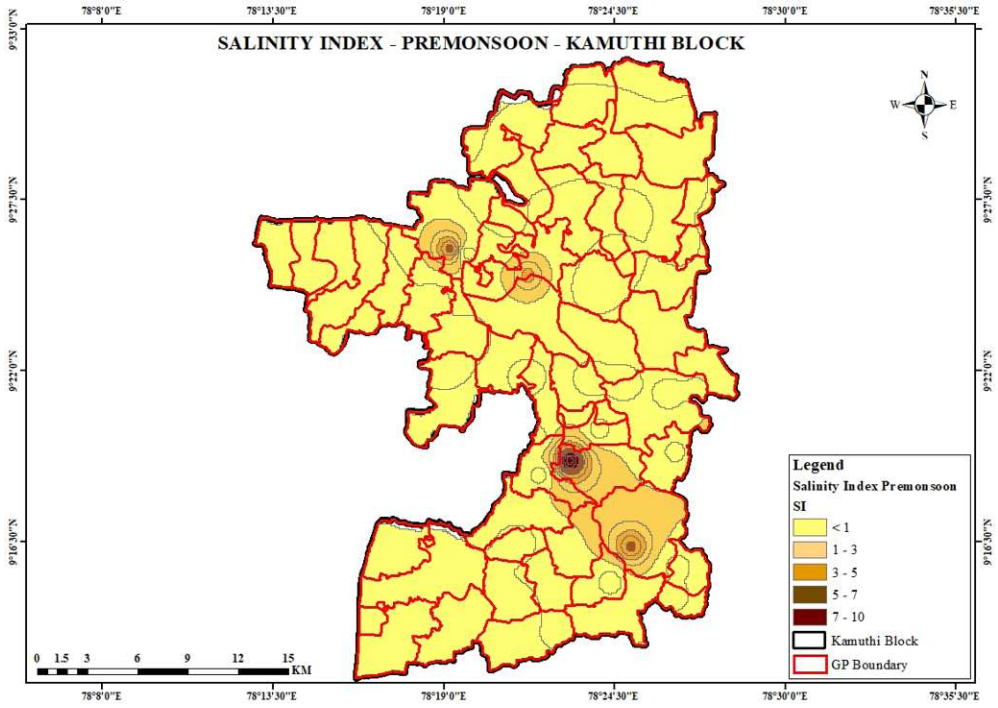


Figure 3.16. Salinity Index

3.6 CWRM PLANNING ANALYSIS-AGRICULTURE

Agriculture is the primary livelihood of the households in Kamuthi Block followed by livestock resources. Considering water and monsoon patterns, the key agriculture factors such as soil, land, crop and livestock related parameters are employed in CWRM planning.

3.6.1 SPATIAL DATA

Bhuvan based spatial data for LULC, waste land, salt affected land, soil erosion and soil texture were taken into consideration to understand Kamuthi Block's problems in order to draft scientific key water actions.

3.6.1.1 Soil texture: The soil consistency of particle size is distinguished through soil texture types, especially determined by the amount of sand, silt or clay. The Block has diverse soil types and predominant in vertisol and alfisol. With reference to soil texture, the proportion of fine and fine loamy type is dominant across the Block (Figure 3.17). Soil texture helps in determining the properties of the soil such as water holding capacity, permeability, soil workability and also the ability of plants to grow. This data will help in proposing relevant conservation measures for natural resources.

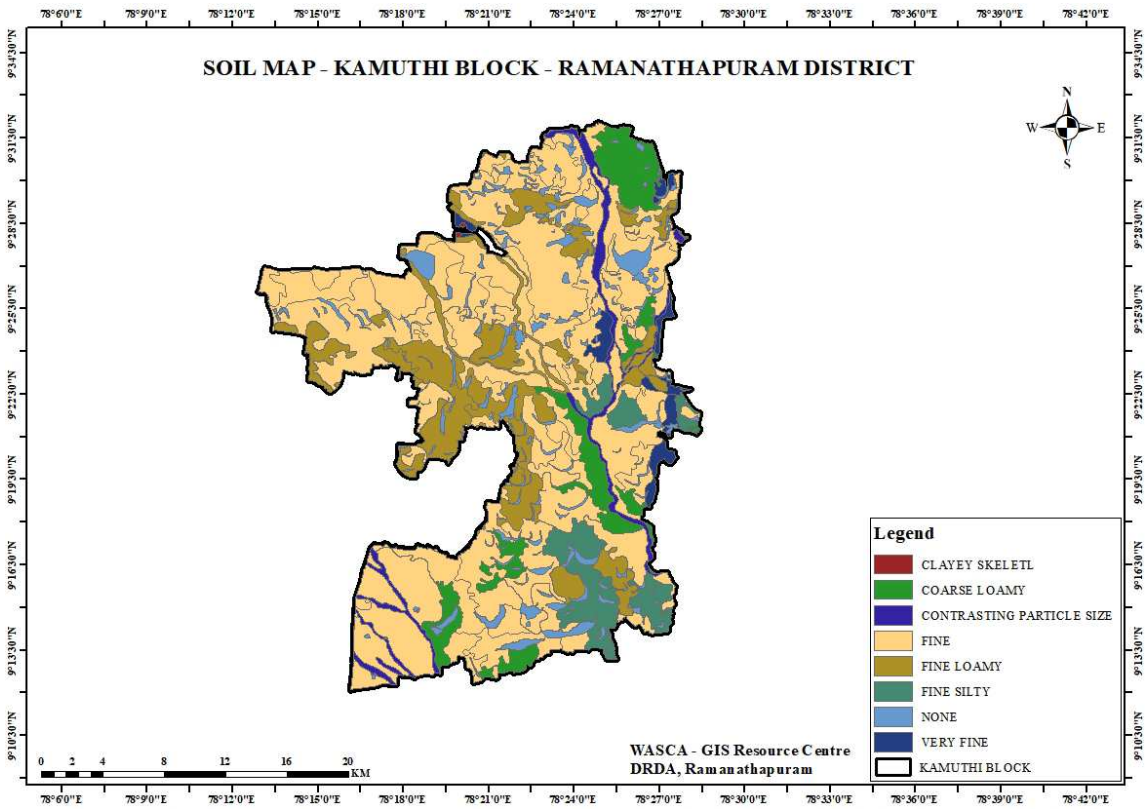


Figure 3.17. Soil texture

3.6.1.2 Soil erosion: Soil erosion is a natural process of displacement of upper layer of soil caused by dynamic erosion agents i.e. water, air, plants and humans. Sheet erosion type soil erosion sites are found in the North and North-West region of the Block (Figure 3.18). Below illustration table gives area wise soil erosion details respect to GPs. Soil eroded sites will help in preparing plans, to suggest soil conservation and watershed management activities.

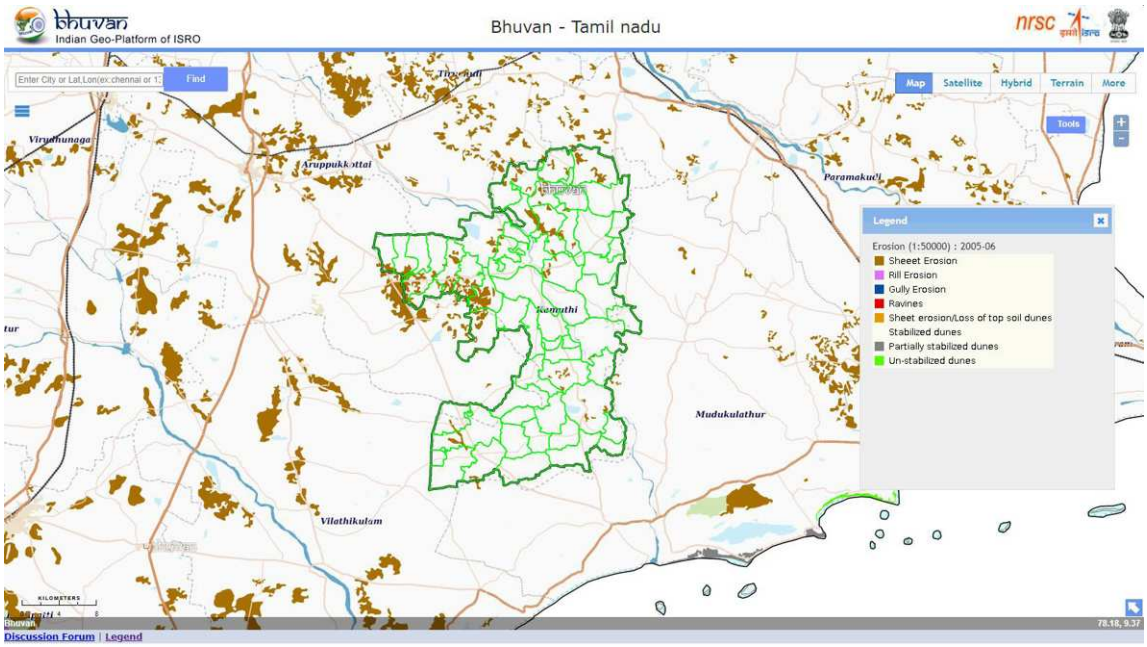


Figure 3.18. Soil erosion map

Erosion type	Area in %	Gram Panchayat
Sheet Erosion	14%	K.Nedungulam - 55%, N.Karisalkulam, Nagaratharkurichi - 25%, O.Karisalkulam - 20%, Kakkudi, Keelamudimannarkottai, Keelaramanathi, Mustakkurichi, T.Valasubramaniapuram, Vangarupuram - 15%, Eluvanur, Kovilangulam, Melamudimannarkottai, Melaramanathi, T.Punavasal, Thimmanathapuram, Vallanthai - 10%, Mandalamanickam, Neeravi, Pappanam, Pasumpon, Perunali - 5%

3.6.1.3 Land Use & Land Cover (LULC): LULC are two separate terminologies which are often used interchangeably. In general, land cover is defined as 'the observed biophysical cover on the Earth's surface'. It includes vegetation and man-made features as well as bare rock, bare soil, and inland water surfaces; while land use refers to 'the way in which land has been used by humans and their habitat, usually with the accent on the functional role of land for economic activities'. LULC has become an increasingly important factor playing a major role in making environment-development policies. Kamuthi Block is majorly covered by agricultural crop followed by agriculture fallow land (Figure 3.19). The GP wise LULC is tabulated in the below table. LULC map helps the decision makers and planners to focus on the fallow land development activities.

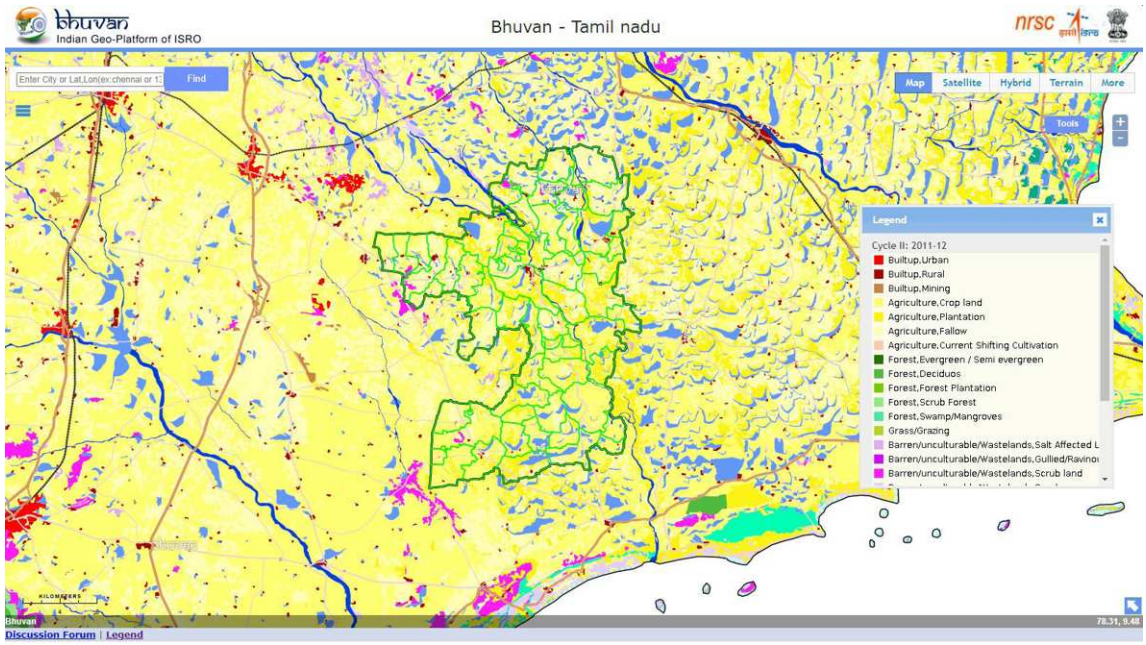
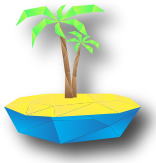


Figure 3.19. Land Use Land Cover map

Land Use	Area coverage in %	Gram Panchayat

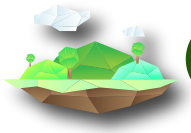
Agriculture, Fallow lands



35%

Achangulam, Vangarupuram - 85%, Pappurettiapatti, Perunali - 75%, Keelaramanathi, Mustakkurichi - 70%, Melaramanathi, Sengappadai - 65%, Idaiyankulam, K.Nedungulam, Muthalnadu, Pasumpon - 55%, Eluvanur - 50%, K.Veppangulam, Komboothi, Pakkuvetti, Sadayanendal - 45%, Kathanendal, Melamudimannarkottai - 40%, Keelamudimannarkottai, M.Pudukulam, N.Karisalkulam, T.Punavasal - 35%, Kakkudi, Mandalamanickam - 30%, A.Tharaikudi, Ariamangalam, Erumaikulam, Ilandaikulam, Kovilangulam, Marakkulam, Nagaratharkurichi, Natham, Pappangulam, Peraiyur, Ramasamypatti, T.Valasubramaniapuram, Vallanthai - 25%, Anaiyur, Idivilagi, Mavilangai, Narayanapuram, Pammanendal, Pappanam, Pudukkottai - 20%, Kadamangalam, O.Karisalkulam, Ponthampuli, Pulvoikulam, Thimmanathapuram - 15%, Neeravi - 10%, Udaiyanathapuram, Valaiyapookulam - 5%

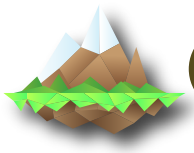
Agriculture, Crop lands



35%

Kovilangulam, Natham, O.Karisalkulam, Pappurettiapatti - 75%, Nagaratharkurichi, Neeravi, Pammanendal, Ponthampuli - 65%, Mavilangai, Peraiyur - 55%, Idivilagi, Mandalamanickam, Melamudimannarkottai, N.Karisalkulam, Pappanam, Perunali, T.Valasubramaniapuram, Thimmanathapuram - 45%, Ariamangalam - 40%, Erumaikulam, K.Nedungulam, Kathanendal, Mustakkurichi, Pasumpon, Pudukkottai, Ramasamypatti, T.Punavasal, Udaiyanathapuram, Valaiyapookulam - 35%, Pakkuvetti - 30%, Anaiyur, M.Pudukulam, Pulvoikulam, Sadayanendal - 25%, Keelaramanathi, Komboothi, Sengappadai - 20%, Achangulam, Keelamudimannarkottai, Vallanthai - 15%, A.Tharaikudi, Eluvanur, Ilandaikulam, Kadamangalam, Melaramanathi, Narayanapuram, Vangarupuram - 10%, Idaiyankulam, Kakkudi, Marakkulam - 5%

Agriculture, Plantation



9%

Anaiyur- 55%, Pakkuvetti - 25%, Ilandaikulam, Mandalamanickam - 20%, Ariamangalam - 15%, Achangulam, Melaramanathi, Muthalnadu, Narayanapuram, O.Karisalkulam, Pammanendal, Pudukkottai, Pulvoikulam, Sadayanendal, Sengappadai, Valaiyapookulam - 10%, A.Tharaikudi, Eluvanur, Erumaikulam, Idaiyankulam, K.Nedungulam, K.Veppangulam, Kakkudi, Keelaramanathi, Kovilangulam, Marakkulam, Mavilangai, Mustakkurichi, N.Karisalkulam, Natham, Pappanam, Pappangulam, Pappurettiapatti, Pasumpon, Peraiyur, Perunali, Ponthampuli, Thimmanathapuram, Udaiyanathapuram - 5%

Builtup, Rural

5%

Kadamangalam, Komboothi, A.Tharaikudi, Achangulam, Kakkudi, Kamuthi, Keelamudimannarkottai, Keelaramanathi, Mandalamanickam, Melamudimannarkottai, Melaramanathi, Mustakkurichi, N.Karisalkulam, Narayanapuram, Natham, Neeravi, Pappurettiapatti, Pasumpon, Peraiyur, Perunali, Ponthampuli, Sengappadai, T.Punavasal, Thimmanathapuram

Barren/unculturable/ wastelands/ sandy area

5%

Keelaramanathi, Melaramanathi, N.Karisalkulam

3.6.1.4 Waste land: A Parcel of land that is not suitable for any agriculture activity and mostly covered with dense or open scrub is called as wasteland. The extent of wasteland will act as a direct input for preparation of plans for land development activities or greenery. Scrub type wastelands is noticed in Kamuthi Block (Figure 3.20). GP wise details is shown in the illustration below. During planning for the GPs, plantation measures have been taken up in the identified portions to convert the wasteland into productive land.

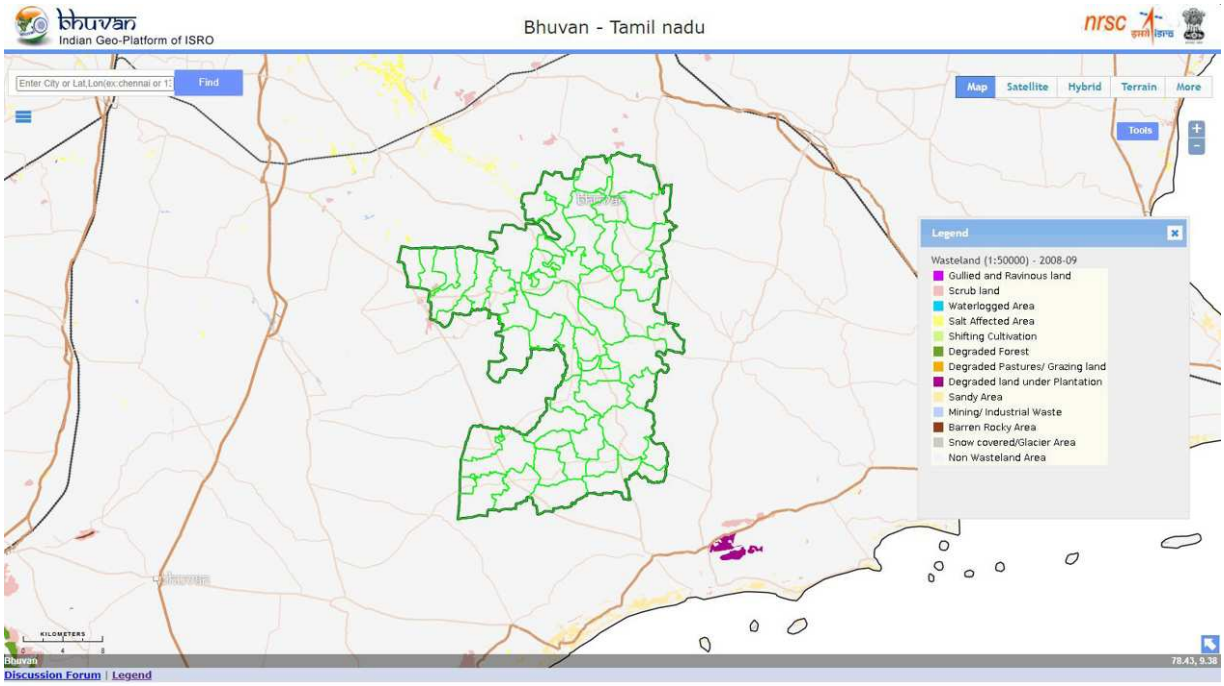
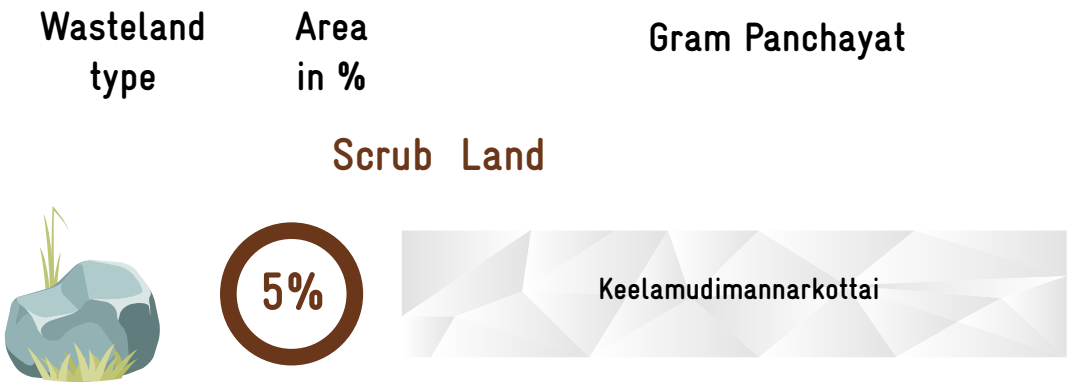


Figure 3.20. Wasteland map



3.6.1.5 Salt affected area: Due to the Block's proximity to coastal region, Block area is affected with sodic and same was also salinity (Figure 3.21). GP-wise details of salt affected area is shown in the illustration below. These parcels will act as a direct input in the planning process to propose soil conservation measures, mainly activities to reduce salinization and suggestions for alternative cropping.

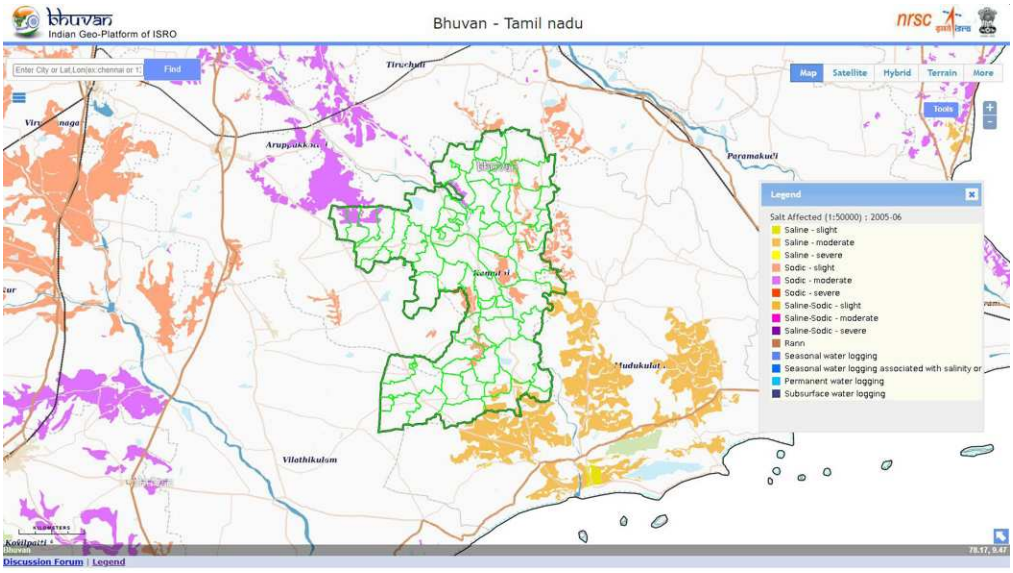


Figure 3.21. Salt affected area

Thematic unit	Area in %	Gram Panchayat
Sodic – Moderate		
	11%	Neeravi - 20%, Kakkudi - 15%, Mudimannarkottai, N.Karisalkulam - 5%
Saline- Moderate		
	20%	M.Pudukulam - 30%, Komboothi - 20%, Erumaikulam - 10%
Sodic - slight		
	14%	K.Papankulam, Sadayanendal - 35%, Pakkuvetti - 25%, Peraiyur - 20%,Abiramam, Anaiyur, Pammanendal - 10%, A.Tharaikudi, Achchangulam, Ariamangalam, K.Veppangulam, Pulvolkulam - 5%

3.6.2 NON SPATIAL DATA

Agriculture based non-spatial secondary data related to land resources, catchment, crop type, soil micro-macro nutrient, moisture, ET and livestock data were collected from govt. sources (Table 7). The key CWRM parameters of agriculture area for all GPs are tabulated in Annexure 3.10.

TABLE 7. CWRM PARAMETER-BASED AGRICULTURE RESOURCES STATUS IN THE BLOCK

Key parameter	Extent
Area under Land Resources (ha.)	
Non-Agricultural Uses	8,951.25
Area under Barren & Un-cultivable Land	31.00
Area under Permanent Pastures and Other Grazing Land	4.00
Land Under Miscellaneous Tree Crops etc.	720.29
Cultivable Waste Land	277.12
Fallows Land other than Current Fallows	8,422.75
Current Fallow land	11,556.97
Unirrigated Land	20,706.72
Area Irrigated by Source	5,292.27
Land under Catchment Area (ha)	
Good Catchment	8,982.25
Average Catchment	1,001.41
Bad Catchment	45,978.71
Crop Details	
Irrigated Area (ha)	7,272.18
Rainfed area (ha)	12,661.56
Paddy Cultivation (ha)	9,076.77
Crop Water Requirement - Irrigated condition (ha.m)	7,207.82
Crop Water Requirement - Rainfed condition (ha.m)	9,586.83
Soil Resources: Status of Available Nitrogen (%)	
Very Low	41
Low	48
Medium	5
High	1
Very High	4
Status of Organic Carbon (%)	
Very Low	30
Low	26
Medium	20
High	15
Very High	9
Status of Soil Micro Nutrients (%)	
Sufficient	65.74
Deficient	34.26

Status of Physical condition of the soil (%)	
Moderately Acidic	2
Strongly Acidic	1
Highly Acidic	8
Moderately Acidic	19
Slightly Acidic	13
Neutral	2
Moderately Alkaline	54
Strongly Alkaline	2
Soil Texture (%)	
Clay soil	0.01
Fine Soil	79.94
Coarse loamy	8.44
Soil Water Permeability (Low, Moderate, high)	Moderate to low (5-20 mm/hr)
Soil moisture and ET	
Volumetric Soil Moisture (%)	17.00
Estimated Soil Moisture (ha.m)	7,991.89
ET Losses (ha.m)	13,949.55
Means of Water Extraction (%)	
Gravity	46.74
Lifting	53.26
Irrigation Methods (%)	
Wild Flooding	74.32
Control Flooding	25.89
Livestock (No.)	
Cattle Population	10,204
Sheep Population	36,202
Goat Population	35,109
Poultry	57,688

3.6.2.1 Land utilization

The standard land use classification helps to understand the distribution and the extent of different land use categories. As the runoff and water harvesting actions are linked to the land use systems, its distribution across the geographical boundary of the Block is necessary to take decisions. Of the total land area of 55,962.37 ha, the highest of 37 % is unirrigated land, followed by 20.65 % is unirrigated land, while less than a percent of cultivable wasteland, barren and uncultivated and pasture grazing land is found (Figure 3.22).

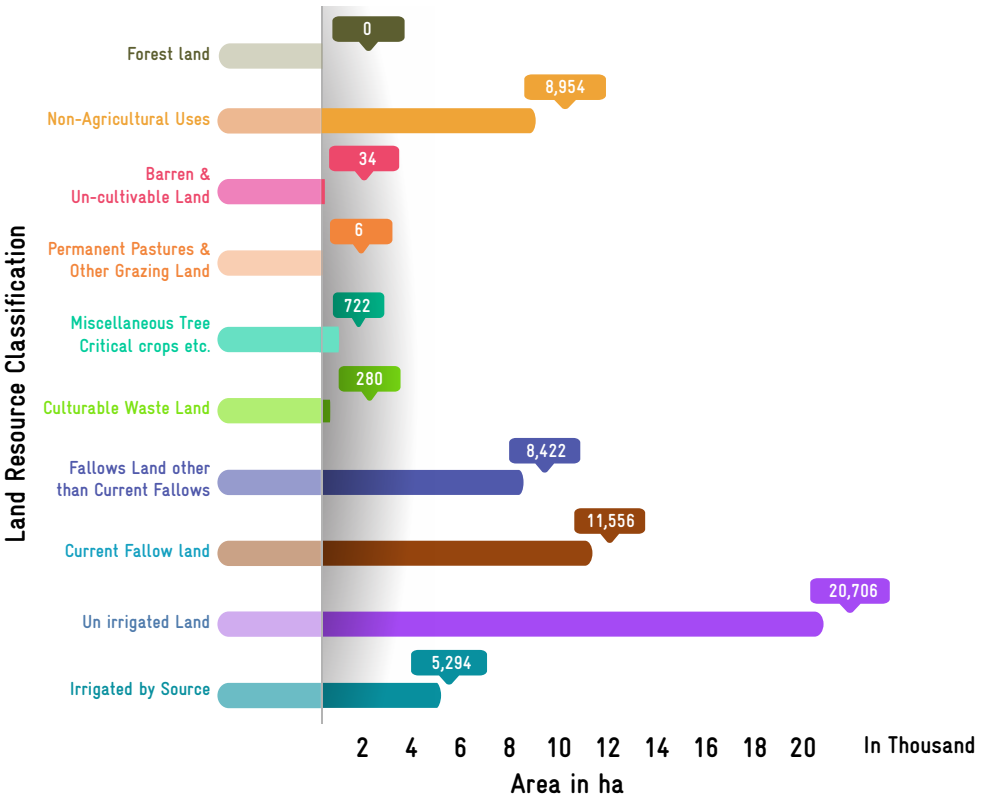


Figure 3.22. Land utilization

3.6.2.2 Catchment Area

The land use types in each of the GPs are categorized into three different types of runoffs; good, average and bad catchment area. Out of the total catchment area of 55,962.37 ha, of the Block, the highest of about 82.16 % is from bad catchment area followed by 16.05 % from good catchment area and remaining is under average catchment area. This analysis helps to focus on prioritizing the works in the land use systems under the good and bad catchment areas (Figure 3.23).

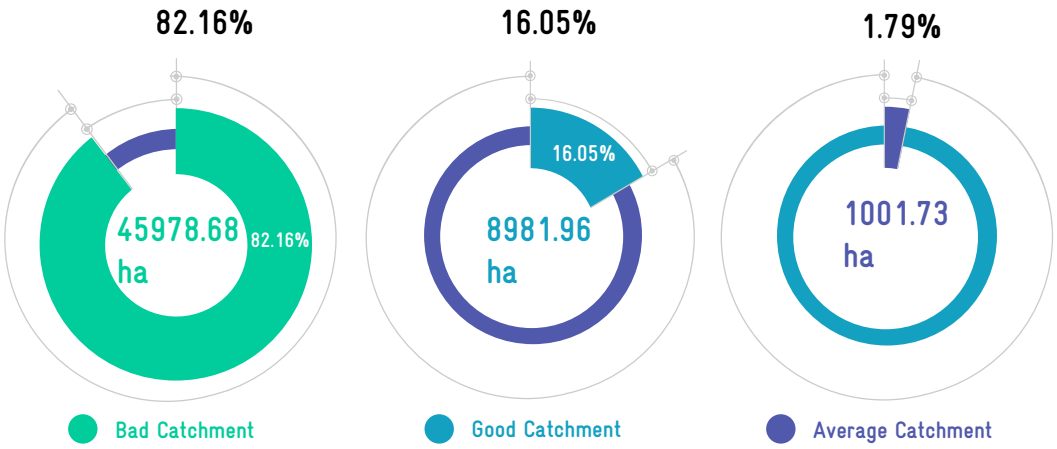


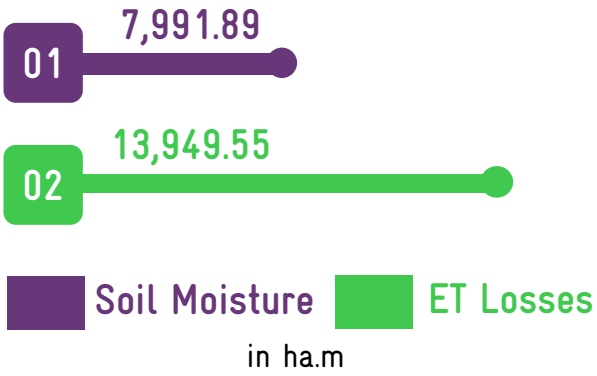
Figure 3.23. Catchment area

3.6.2.3 Soil moisture

Soil is an important medium to store the available water and the storage capacity varies with the type of soil especially its textural composition. In overall composite water budgeting, estimation of stored water in the soil assumes greater significance in this Block because of its significant proportion of area under rain-fed cultivation. The annual average volumetric soil moisture of this Block (17%), is taken for estimating the amount of water stored as soil moisture which accounts to 7,991.89 ha.m

3.6.2.4 ET losses

The transformation of liquid state of water state from earth surface to vapour state of water to atmosphere is the ET loss. The loss of water through ET is important in water budgeting. The Block area witnessed an annual total ET loss of 13,949.55 ha.m during 2018-19, with a monthly average of 799 ha.m.



3.6.2.5 Macro-nutrients
Nitrogen (N)

Nitrogen content varies between very low and very high in the tested soil samples. 48 % of samples witnessed low Nitrogen quantity followed by 41 % samples with very low Nitrogen quantity,while Nitrogen is high for 1 % of the tested samples (Figure 3.24). According to soil resource map, this Block is identified as one of the Nitrogen deficient Blocks (Ramanathapuram District profile 2020).

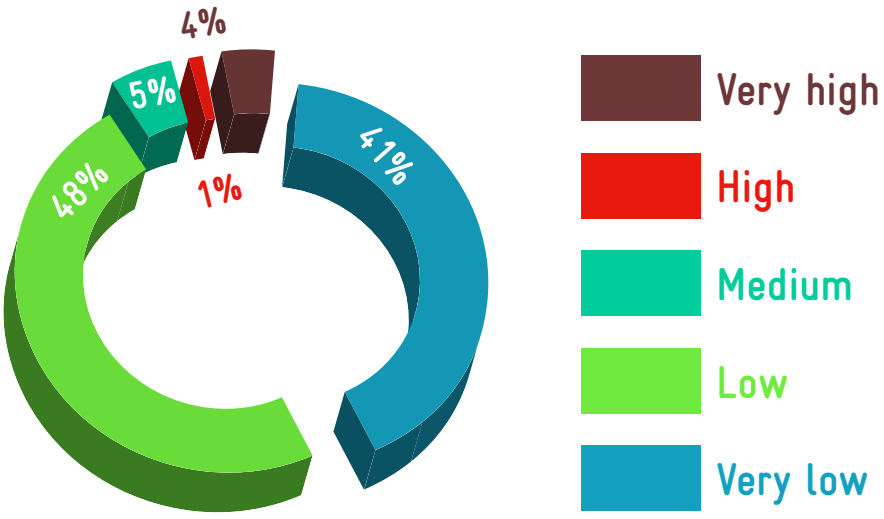


Figure 3.24. Status of available Nitrogen

Organic Carbon

Soil organic carbon ranges between very low and very high in the tested soil samples. 30 % of the soil samples tested fall under low category followed by 26 % falls under low category while less of 9 % samples are witnessed with very high organic carbon (Figure 3.25). This indicates that the soil fertility is moderately poor.

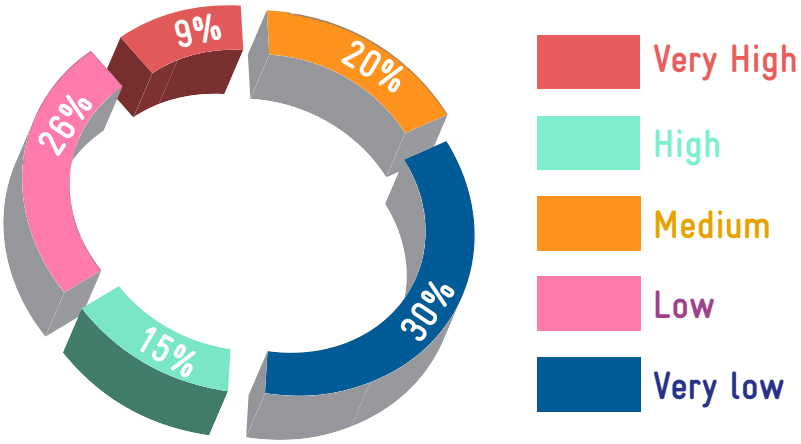


Figure 3.25. Status of soil Organic Carbon

3.6.2.6 Status of the soil micro-nutrients

This Block is one of the Nitrogen, Zinc and Ferrous deficient Blocks of Ramanathpuram District. The micro-nutrient status of the soil with specific reference to Manganese, Boron and Zinc, Ferrous, Copper, and Sulphate are deficient in 34.26 % and 65.746 % sufficient in the soils tested (Figure 3.26).

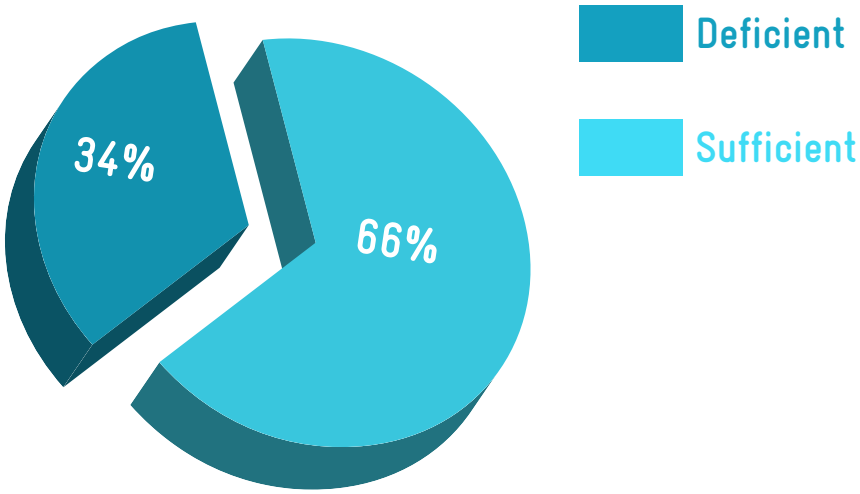


Figure 3.26. Status of soil micro-nutrients

3.6.2.7 Physical parameters – pH status

With reference to the physical parameters, 54 % of the soil is moderately alkaline in nature followed by 19 % is moderately acidic while 2 % is neutral (Figure 3.27).

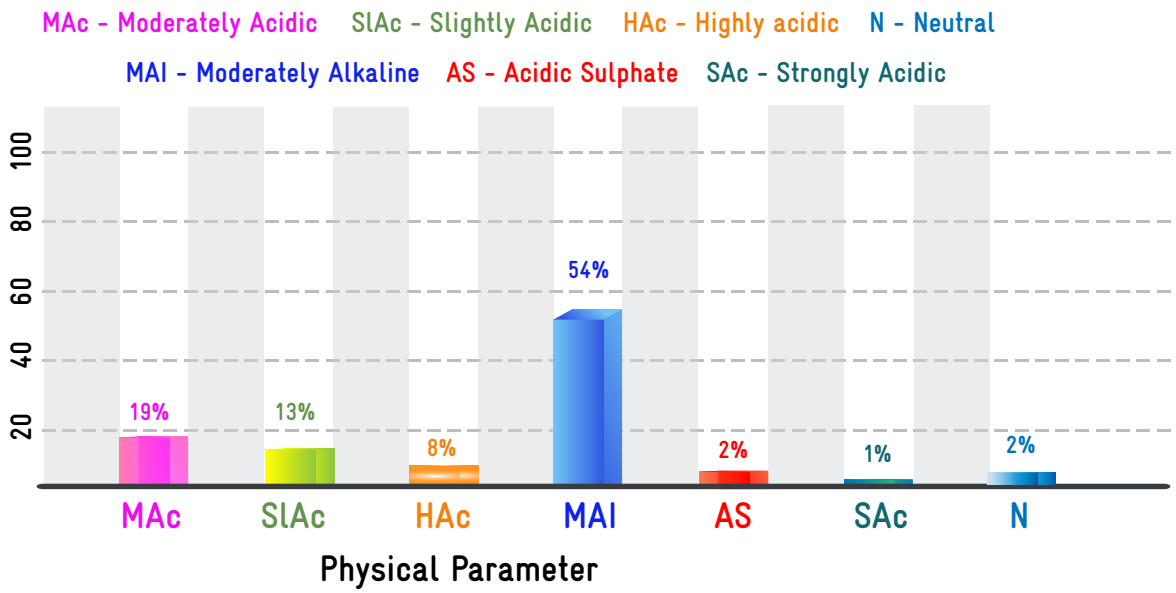


Figure 3.27. Status of pH of soil

3.6.2.8 Cropping pattern and the irrigation

A total area of 19,933.74 ha is used for crop cultivation in which 36.48 % area is cultivated using irrigation sources and the rest or the area is cultivated using rain fed irrigation. Paddy is a dominant crop in both water source field which accounts to 26 % of total cultivated area followed by dry chilli of 21.8 % while cultivation of minor millets, ragi, coconut, garlic, jowar, other pulses, sugar cane, maize, guava, brinjal, soybean accounts to less than one percent of the cultivated area.

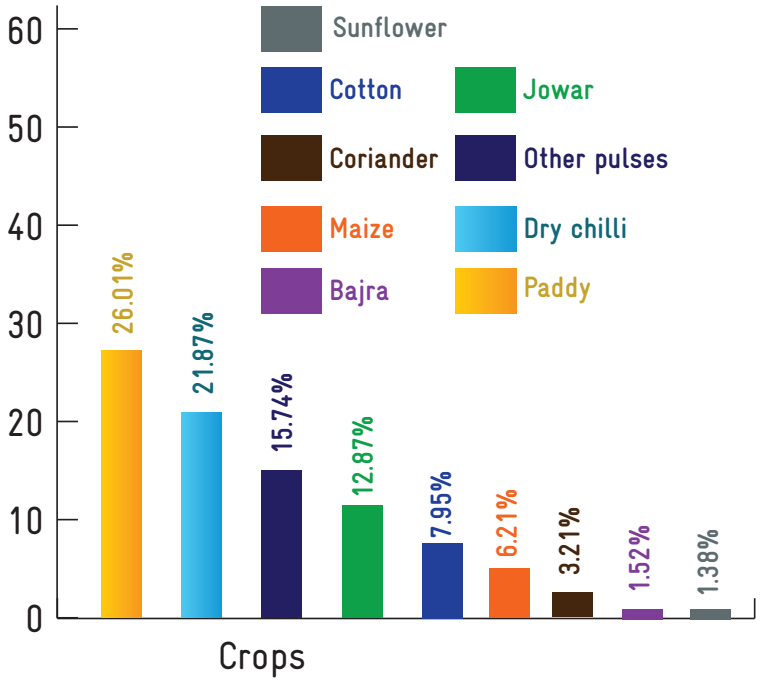


Figure 3.28. Crop pattern (including rain-fed and irrigation area)

3.6.2.9 Irrigation methods

In case of the surface water resources, wild flooding is the primary method of irrigation. But in case of ground water resources, the predominant type of irrigation is control flooding. In the Block, 74.32 % of the irrigation is done by wild flooding and rest of the irrigation is done by control flooding (Figure 3.29).

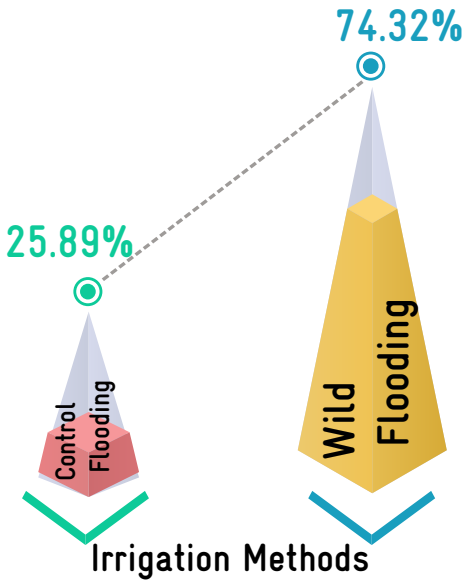


Figure 3.29. Irrigation methods

3.6.2.10 Means of water extraction

Water is extracted in two ways, one by gravity and the other is by lifting. Water is drawn from surface water sources such as tanks, ponds etc., by using gravity method and that of ground water sources such as open well, hand pump, bore well by using lifting method. In the Block, 46.74 % of the water extraction is through gravity and rest comes under lifting means of water extraction (Figure 3.30).

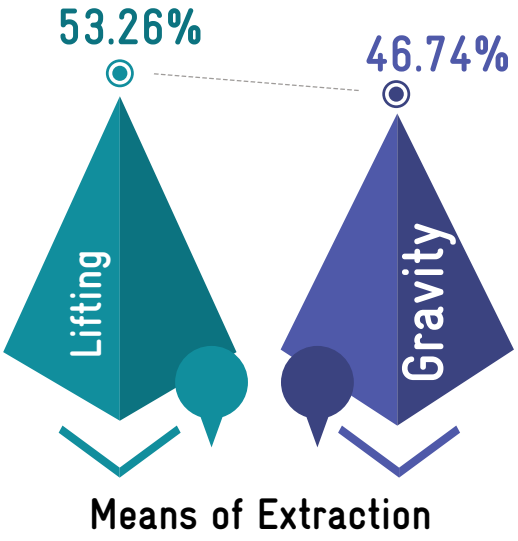


Figure 3.30. Means of water extraction

3.6.2.11 Livestock details

This Block has considerable proportion of livestock resources about 1,39,203. Of which small ruminants poultry populations is high 41.44 % (57,688) followed by sheep`s of 26.01 % (36,202) and 25.22 % of goats (35,109), while cattle population is about 7.33 % (10,204) (Figure 3.31). The total water requirement for live-stock is 66.43 ha.m. Of the total water demand of 51% is met through ground water and remaining is from surface water resources.

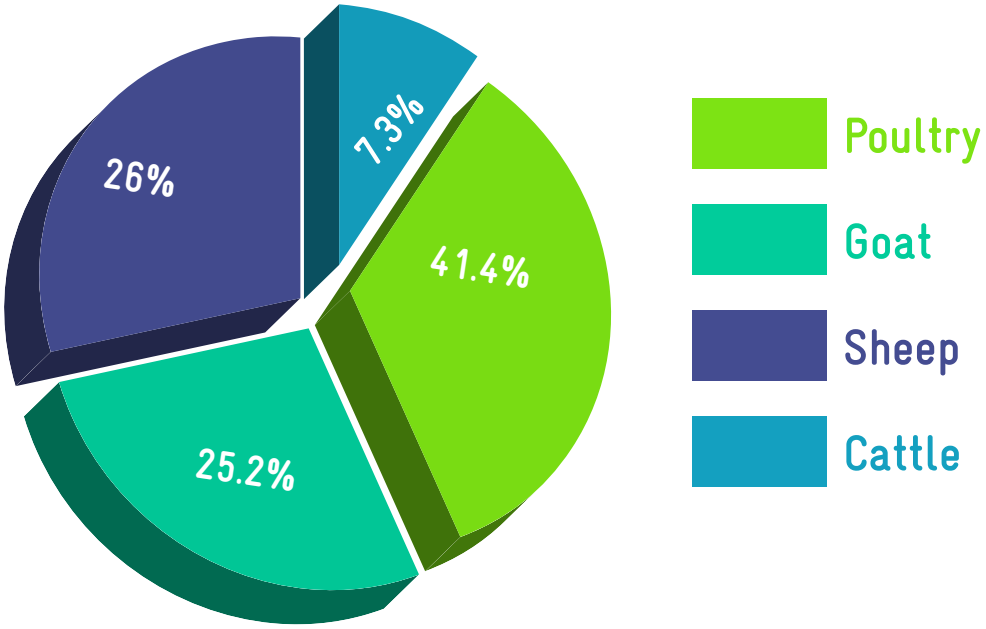


Figure 3.31. Livestock details

3.7 CWRM PLANNING ANALYSIS-SOCIO-ECONOMIC

The demographic details such as population, gender, vulnerable population/ households, drinking and grey water details are collected from authentic primary and secondary sources and analyzed. Data of MGNREGA job holders is also taken for the analysis. Table 8 lists the demographic and socio-economic status of Kamuthi Block. GP wise demographic and socio-economic status are attached in Annexure 3.11.

TABLE 8. CWRM PARAMETER BASED SOCIO-ECONOMIC STATUS IN THE BLOCK

Sl.No.	Parameter	Total
1	Key CWRM Parameter	Total/Average
2	Geographical Area (ha)	53,235.54
3	Male Population (No.)	70,689
4	Female Population (No.)	67,157
5	Total Population (No.)	1,37,746
6	SC Population (No.)	24,646
7	ST Population (No.)	968
8	Vulnerable population (No.)	25,614
9	Households (HH's) (No.)	34,061
10	Only one room HH's (SECC) (No.)	8,640
11	Female Headed HH's (SECC) (No.)	2,355
12	Vulnerable Households (SECC) (No.)	6,757

13	% of Vulnerable Households (%)	20%
14	Registered MGNREGA Job cards (Persons)	43,327
15	Active person working in MGNREGA job Cards (Persons)	31,324
16	Drinking Water Sources (No.)	4,488
17	HH's have tap water connection for drinking water (No.)	31,571
18	HH's dependent on other sources for drinking water (No.)	70,658
19	Annual Greywater Generation (ha.m)	251.23

3.7.1 Population:

The total population of this Block is 1.38 Lakhs in which the male proportion is slightly higher than female population. In the CWRM planning process, due attention is given for the intersecting variables such as gender, class, caste and marital status and availability of safe drinking water resources. In the Block, about 19 % of the total population are under vulnerable population (Figure 3.32).

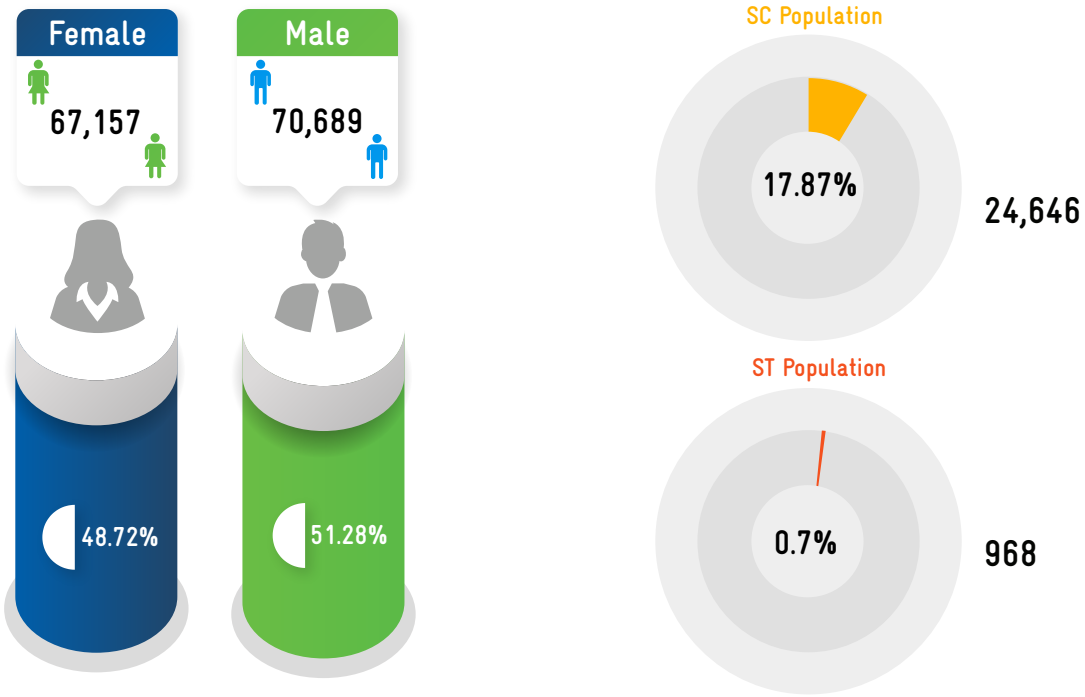


Figure 3.32. Population details

**population figures may differ from Census 2011 due to categorization of GPs based on revenue panchayat boundaries*

3.7.2 Details of households

There are a total of 34,061 households in which 25 % households have only one room, 7 % households are headed by women and 20 % are vulnerable households (Figure 3.33)

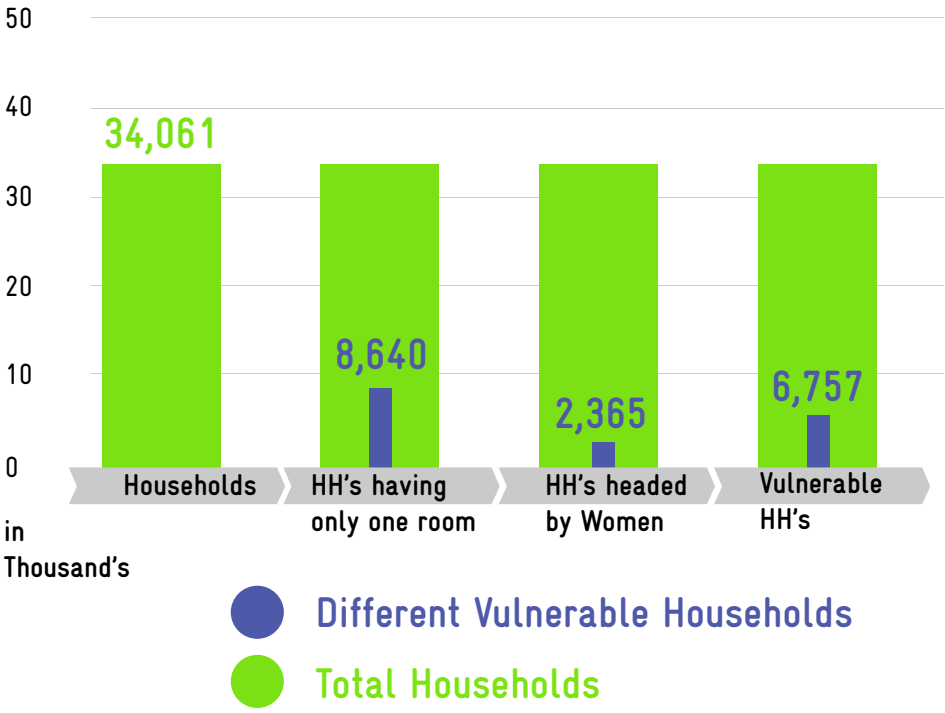


Figure 3.33. Details of households

3.7.3 Status of Mahatma Gandhi NREGA - job card status

In the Block, of the total population of 1.38 Lakhs, 43,327 are registered for job cards in Mahatma Gandhi NREGA scheme in which 72 % of the job cards are in active category (Figure 3.34)

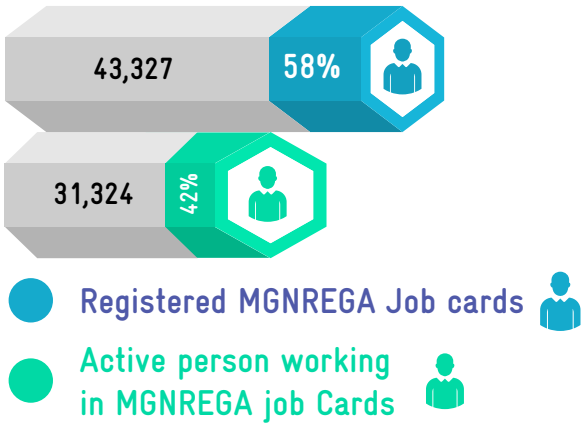


Figure 3.34. Status of MGNREGA job cards

3.7.4 Drinking Water Sources

Nearly 31,600 households have tap water connection and 70,658 households depend on other water sources for domestic use, where other sources include RTRWHS / Tanka (roof rain water harvesting systems, hand pump, open wells, bore wells, tank/ pond/ oorani, springs and river/ streams.

Tap water connection

31,600 Households

Other sources include RTRWHS / Tanka (Roof Rain Water Harvesting Systems), Hand pump, Open well, Bore well, Tank/ Pond/ Oorani, Springs and River/ Streams

70,658 Households

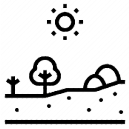
3.7.5 Annual Greywater Generation

The grey water generation estimated across this Block is 251.23 ha.m which is available for reuse or recycle.

SPATIAL DATA DERIVED AREA SCOPE FOR TREATMENT MEASURES IN GP'S

Morphology

Elanthaikulam, Eluvanur, Pulvolkulam



Wasteland

Keelamudimannarkottai, Komboothi, A.Tharaikudi

Soil erosion

K.Nedungulam, N.Karisalkulam, Nagaratharkurichi

Physicochemical parameters

Mandalamanickam, S P Kottai, O Karisalkulam, Peraiyur

Upland/Slope

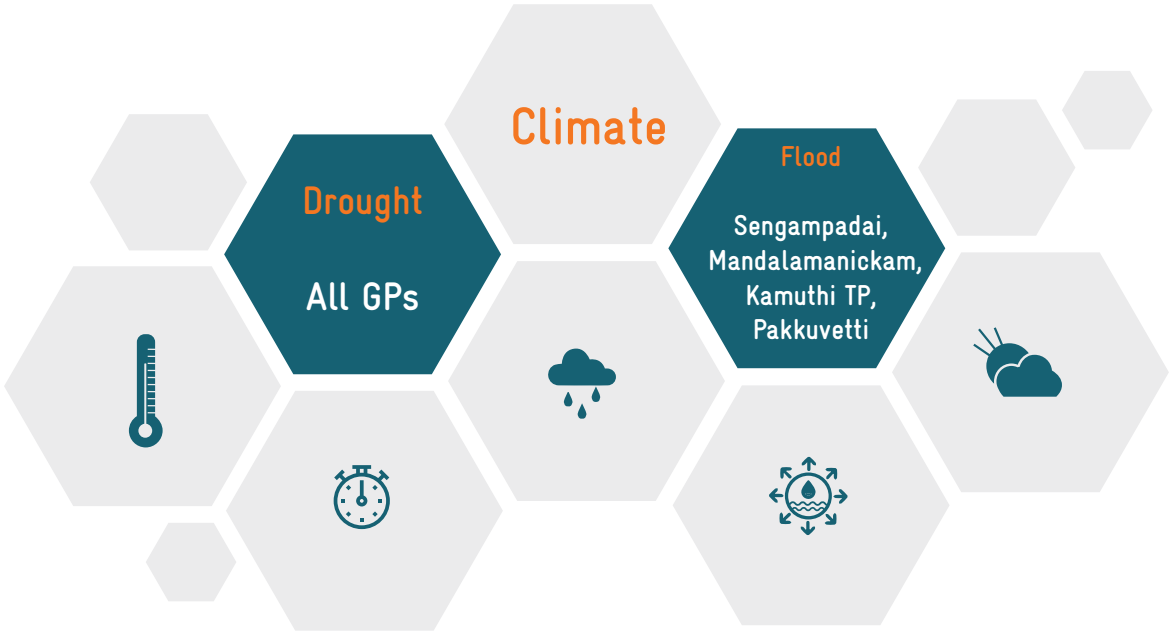
Abiramam, Narayanapuram, M.Pudukulam

Ground water prosperity

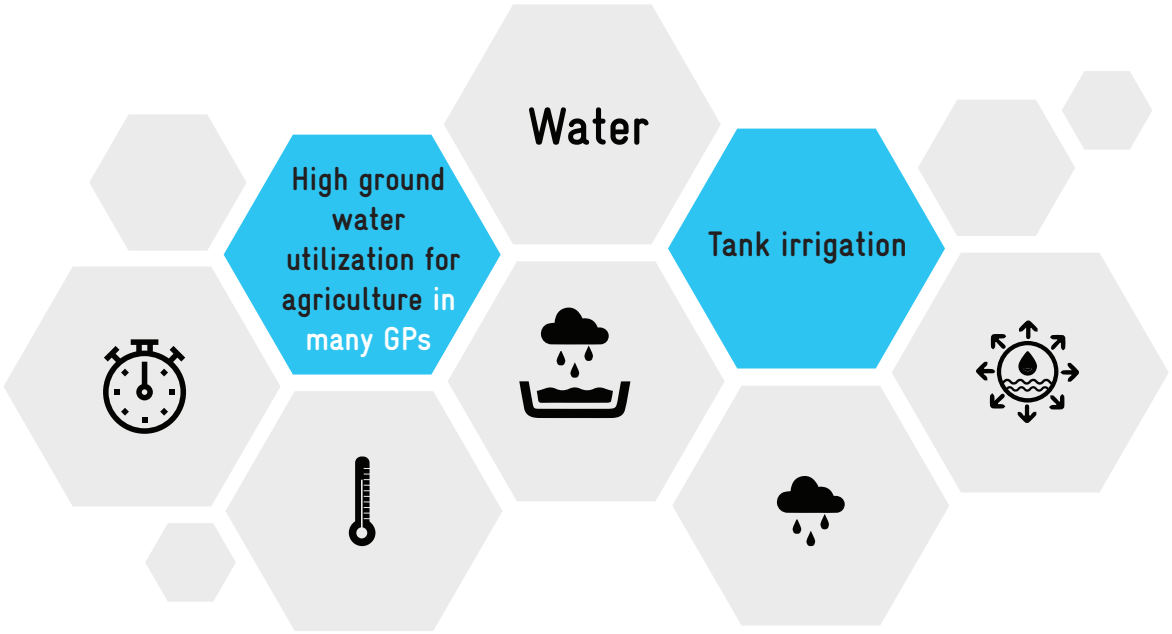
Idivilagi, Neeravi, Kathanethal, Mavilangai

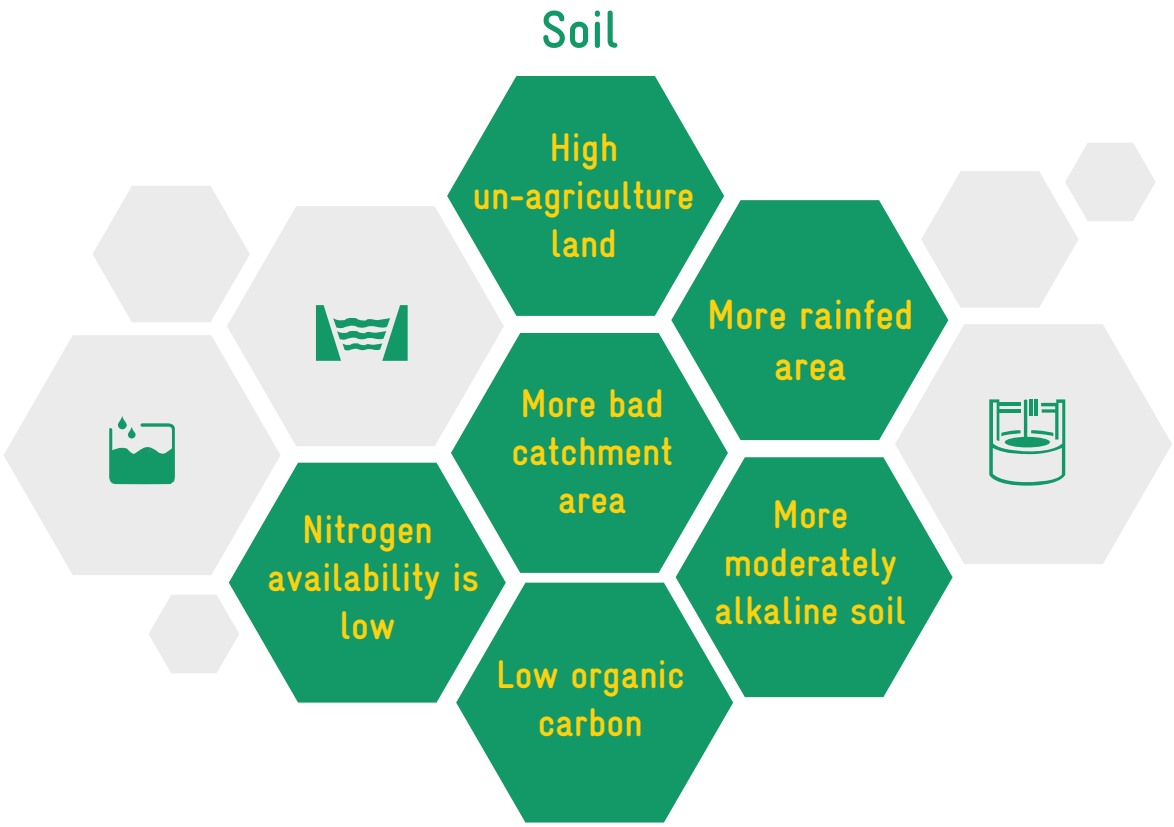
Salt affected area

Km Kottai, M.Pudukulam, Komboothi


Climate
Drought
All GPs
Flood
Sengampadai, Mandalamanickam, Kamuthi TP, Pakkuvetti


Socio economic
Population density high in GPs Udayanathapuram, Ramasamypatti, Natham
Vulnerable population high in Peraiyur, Mandalamanickam
% of vulnerable households high in Kathanendal, Kamboothi, Peraiyur
No. of households and female headed households high in Peraiyur, Melaramanadhi, Ramasamypatti, Natham, Udayanathapuram
Total population, Female population high in Peraiyur, Narayanapuram, Mandalamanickam
Grey water generation more in Peraiyur, Udayanathapuram
Most of GP HH's have tap water connection for drinking water in Keelamudimannarkot-tai, Mandalamanickam
Registered MGNREGA job cards and active persons working are low in Mavilangai, Pammanendal, Ariamangalam


Water
High ground water utilization for agriculture in many GPs
Tank irrigation


Soil
High un-agriculture land
More rainfed area
More bad catchment area
Nitrogen availability is low
More moderately alkaline soil
Low organic carbon

கெடுப்பதூஉம் கெட்டார்க்குச் சார்வாய்மற் றாங்கே
எடுப்பதூஉம் எல்லாம் மழை

குறள் - 15

Destruction it may sometimes pour
But only rain can life restore

Thirukkural - 15

CHAPTER 4

4 VULNERABILITY RANKING OF GP

The vulnerability assessment has been carried out using IPCC methodology. Intergovernmental Panel on Climate Change (IPCC) defined Vulnerability as 'the propensity or predisposition to be adversely affected' (IPCC 2014). Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and the lack of capacity to cope and adapt. It is determined by sensitivity and adaptive capacity of the system (Figure 4.1).

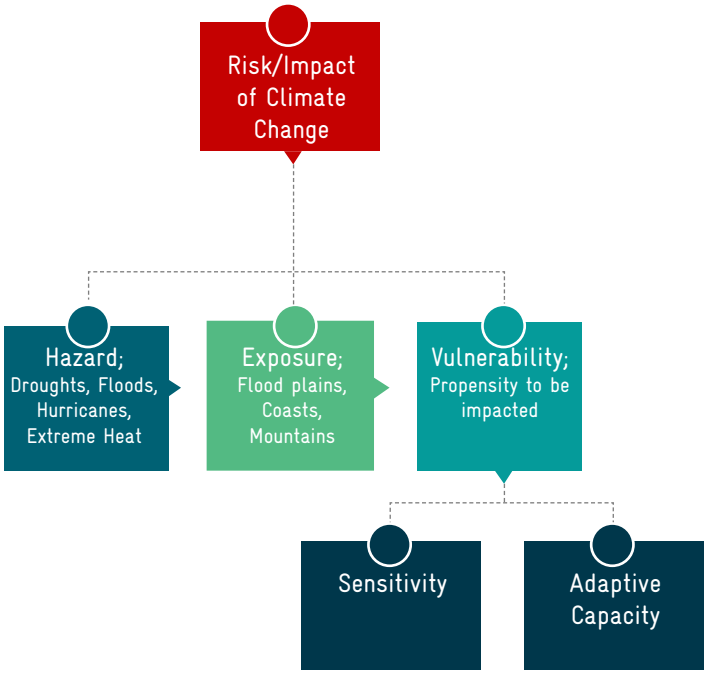


Figure 4.1. Vulnerability of the system as defined by IPCC

Generally, vulnerability assessments are made to identify.

- current and potential hotspots
- entry points for intervention
- drivers of vulnerability
- priorities adaptation interventions

The CWRM parameters which been explored through rigorous study were considered here to address the key water challenges at GP level. About 73 spatial and non-spatial parameters/ indicators under 4 dimensions via Climate (3), Water (28), Agriculture (31) and Sociodemographic (11) are categorized into adaptive capacity, sensitivity and exposure indicators for vulnerability analysis as per IPCC norms. Table 9 lists CWRM parameters/indicators, its rationale to vulnerability, source of data and its linkage with WASCA TN's primary 18 indicators.

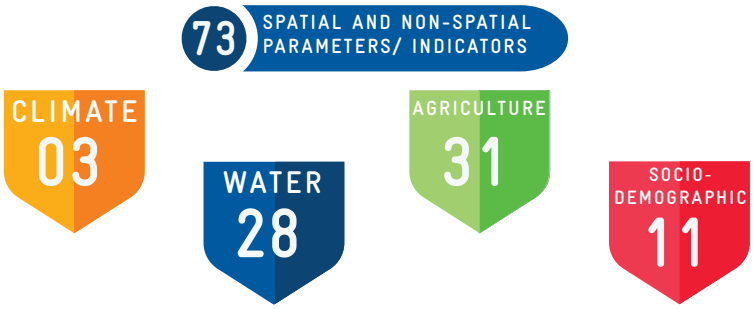


TABLE 9. CWRM PARAMETERS/INDICATORS SELECTED FOR BLOCK LEVEL VULNERABILITY

	Key CWRM Parameter	Vulnerability relationship
Climate	Drought	Climate risk/Sensitivity
	Flood locations	
	Heat Wave	
Water	**Canal Network (in m)**	
	Length of main canal	Adaptive capacity
	Length of minor canal	
	Length of distributaries	
	Water courses (Field channels)	
	Traditional water bodies (in No.)	
	No. of Tanks	Adaptive capacity
	No. of Ooranis	
	Other surface waterbodies	
	Irrigation Facilities (in ha)	
	Area under Tank irrigation	Sensitivity
	Area under canal irrigation	
	Area under open & tube well irrigation	
	Catchment Area wise Available Runoff (ha.m)	
	Good Catchment Area	Sensitivity
	Average Catchment Area	
	Bad Catchment Area	
	Watershed and Drainage Networks	
	Length of Natural Drainage Lines (m)	Adaptive capacity
	Number of Natural Drainage Lines	
	Number of Micro-watersheds	
	Water demand (ha.m)	
	For Humans	Sensitivity
	For Livestock	
	For Agriculture	
	% GW utilization for Drinking	
	% GW utilization for Livestock	
	% GW utilization for Agriculture	
	% SW utilization for Drinking	
	% SW utilization for Livestock	
	% SW utilization for Agriculture	
	Watershed and Drainage Networks	
	Water Quality Index	
	Sea Mixing Index	
	Salinity Index	
Agriculture	**Area under land resources (in ha)**	
	Forest land	Adaptive capacity
	Non-Agricultural Uses	
	Barren & Un-cultivable Land	
	Permanent pastures and Other grazing land	
	Land under miscellaneous tree crops etc.	
	Cultivable wasteland	

Agriculture	Fallows land other than current fallows	Sensitivity
	Current fallow land	
	Unirrigated land	
	Area irrigated by source	
	Land under catchment area (ha)	
	Good Catchment	Adaptive capacity
	Average Catchment	
	Bad Catchment	Sensitivity
	Crop Area details (in ha)	
	Irrigated Area	Sensitivity
	Rainfed area	
	Soil Resources: Status of available Nitrogen (in %)	
	Very low to low	Sensitivity
	Status of Organic Carbon (in %)	
	Very low to low	Sensitivity
	Status of Soil Micro Nutrients (in %)	
	Deficient	Sensitivity
	Status of Physical condition of the soil (in %)	
	Highly acidic/alkaline	Sensitivity
	Slightly acidic	Adaptive capacity
	Neutral	
	Moderately alkaline	
	Soil Texture (in %)	
	Clay	Sensitivity
	Fine	Adaptive capacity
	Coarse loamy	
	Soil Water Permeability (Low, Moderate, high)	
	Soil moisture and ET (in ha.m)	
	Estimated soil moisture	Adaptive capacity
	ET losses	Sensitivity
	Means of Water Extraction (in %)	
	Lifting	Sensitivity
	Irrigation Methods (in %)	
	Wild flooding	Sensitivity
	Livestock (in No.)	
	Livestock density (cattle, sheep, Goat, poultry)	Sensitivity
Socio economic	Population density (persons per ha)	Sensitivity
	Demographic (in %)	
	Female Proportion	Sensitivity
	Vulnerable population Proportion	
	Economic (In %)	
	Only one room HH's	Sensitivity
	Female headed HH's	
	Vulnerable households	
	MGNREGA (in %)	
	Registered MGNREGA Job cards	Adaptive capacity
	Active person working in MGNREGA job Cards	

Socio economic	**Water accessibility (in %)**	
	HH's have tap water connection for drinking water	Adaptive capacity
	HH's dependent on other sources for drinking water	Sensitivity
	Annual Greywater Generation (in ha.m)	

The identified indicators are from different sources and measured in different units. As the vulnerability assessment is about ranking, the indicators have to be in common units. This is done through normalization. The normalized indicators are aggregated and categorized to different vulnerability levels very high, high, medium, low and very low category. The vulnerability assessment methodology is given in Annexure 4. The GPs categorized based on vulnerability scores are shown in Figure 4.2. Peraiyur GP has very high rural water security vulnerability to climate risks followed by Kamboothi, Udayanathapuram, Kathanendal, Pappurediyapatti, Kovilangulam GPs with high vulnerability. Melamudimannarkottai, K.Nedungulam, M.Pudukulam, Nagarathakurichi, Anayur, N.Karisalkulam, Maraikkulam, Keelamudimannarkottai, K.Veppangulam, Pasumbon and Neeravi GPs have very low vulnerability.

Upto	Category	Color range
0.575	Very High	
0.544	High	
0.514	Medium	
0.483	Low	
0.453	Very low	

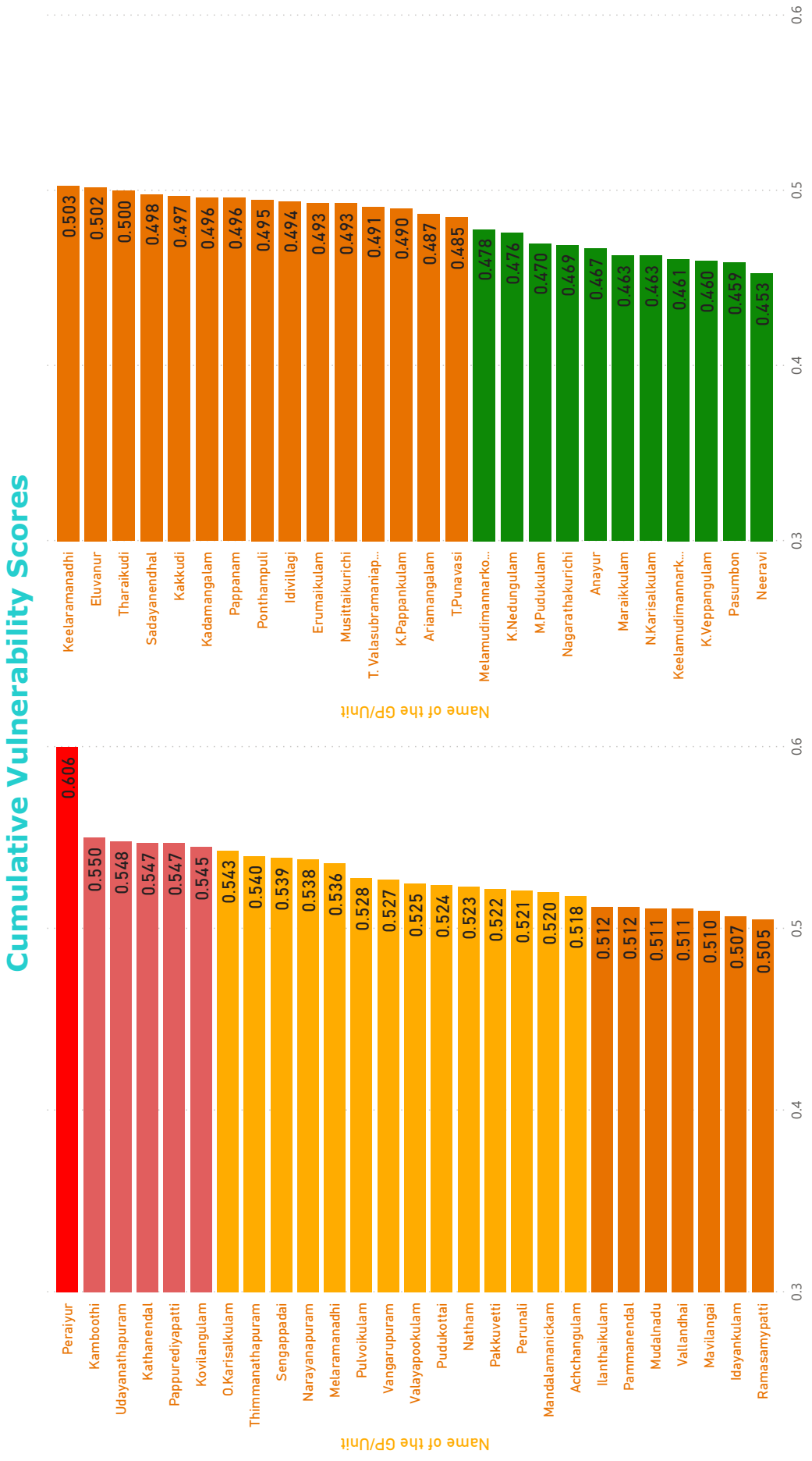


Figure 4.2. Final cumulative vulnerability scores

Sectoral vulnerability

The vulnerability indices were calculated within climate risks, water resource, agriculture and socio-economic dimensions and are shown in Figure 4.3 to identify area wise vulnerable GPs.

Climate risks vulnerability

The climate risk vulnerability index shows that all GPs in this Block are affected with droughts in last decades. Sengampadai, Mandalamanickam, Pakkuvetti GPs have medium flood vulnerability.

SENGAMPADAI, MANDALAMANICKAM, PAKKUVETTI

Water resource vulnerability

The water resources vulnerability index shows that Peraiyur, O.Karisalkulam, Narayanapuram GPs have high vulnerability

PERAIYUR,O.KARISALKULAM, NARAYANAPURAM

Agriculture resources vulnerability

In agriculture and allied sectors, Melaramanadhi, Pappurediyapatti, Mavilangai, Ramasamypatti GPs have high vulnerability

MELARAMANADHI, PAPPUREDIYAPATTI, MAVILANGAI, RAMASAMYPATTI

Socio-economic vulnerability

Peraiyur, Kathanendal, Kamboothi, Pulvoikulam and Kovilangulam GPs have high socio-economic vulnerability

PERAIYUR, KATHANENDAL, KAMBOOTHI, PULVOIKULAM, KOVILANGULAM

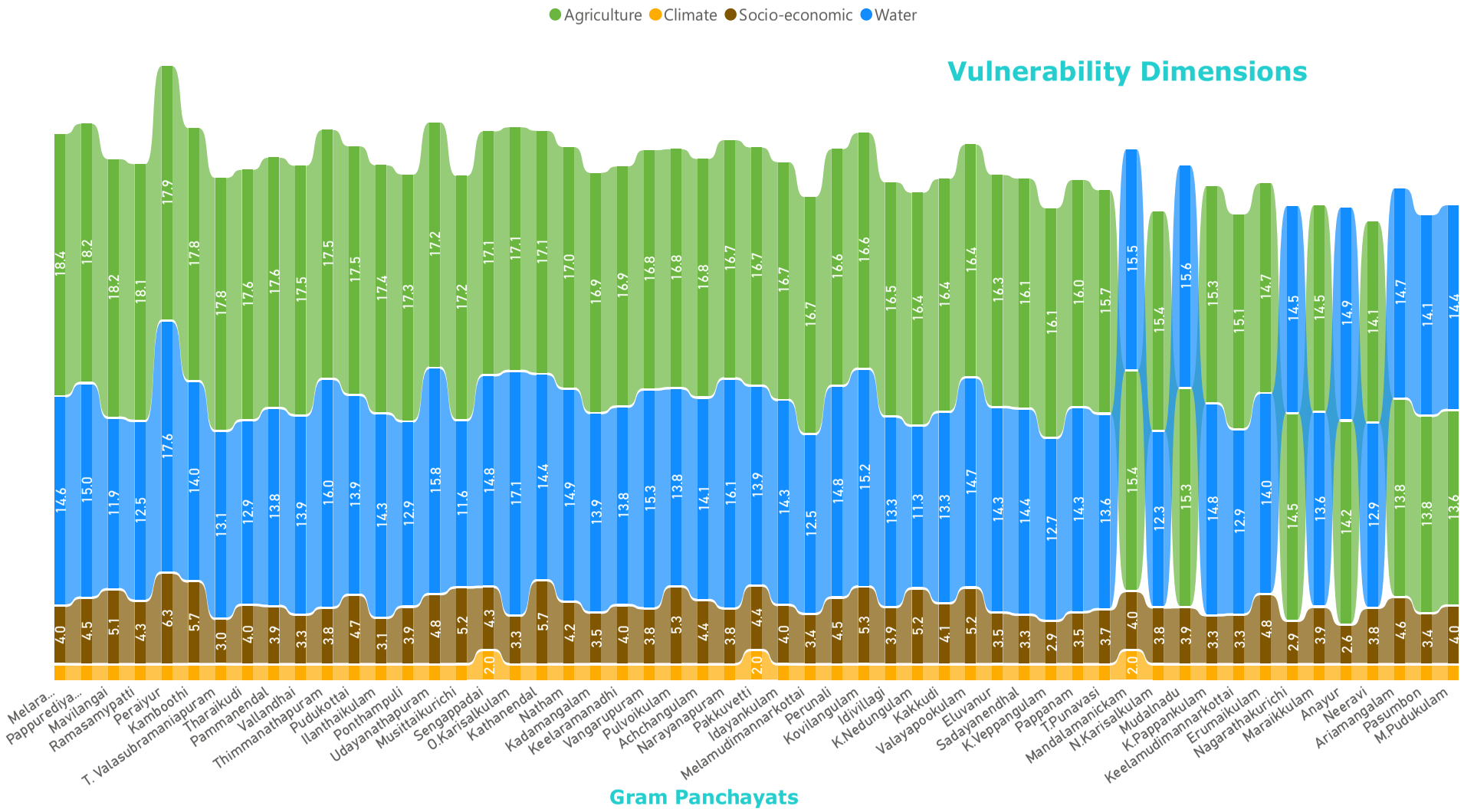
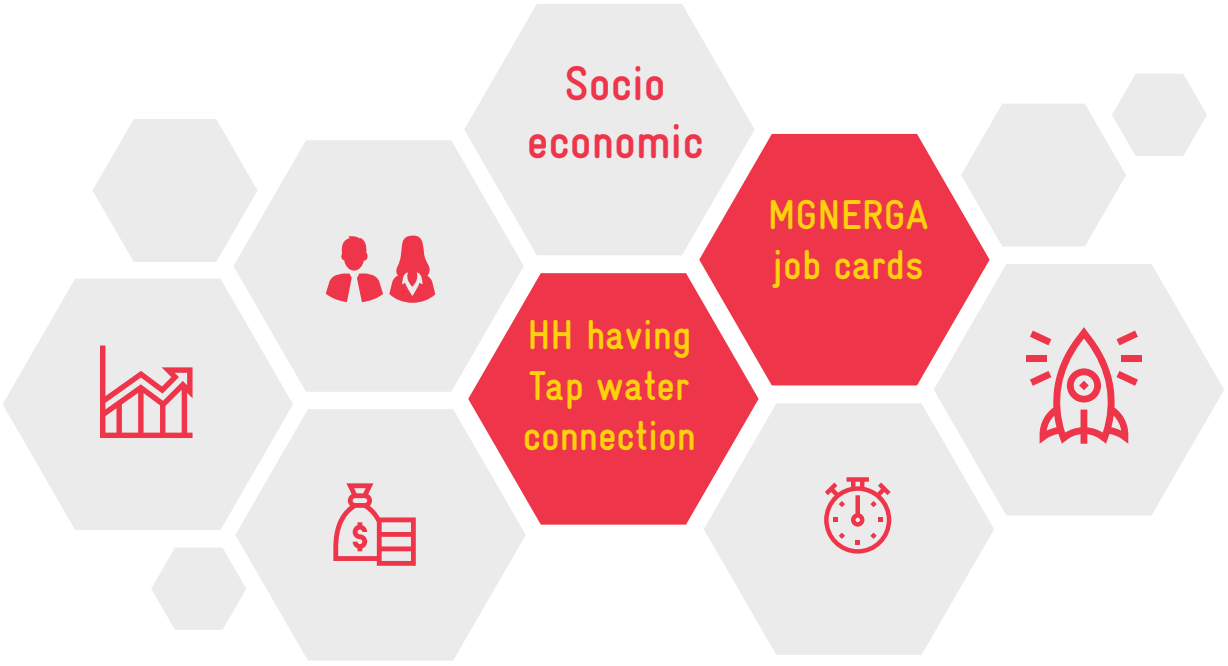
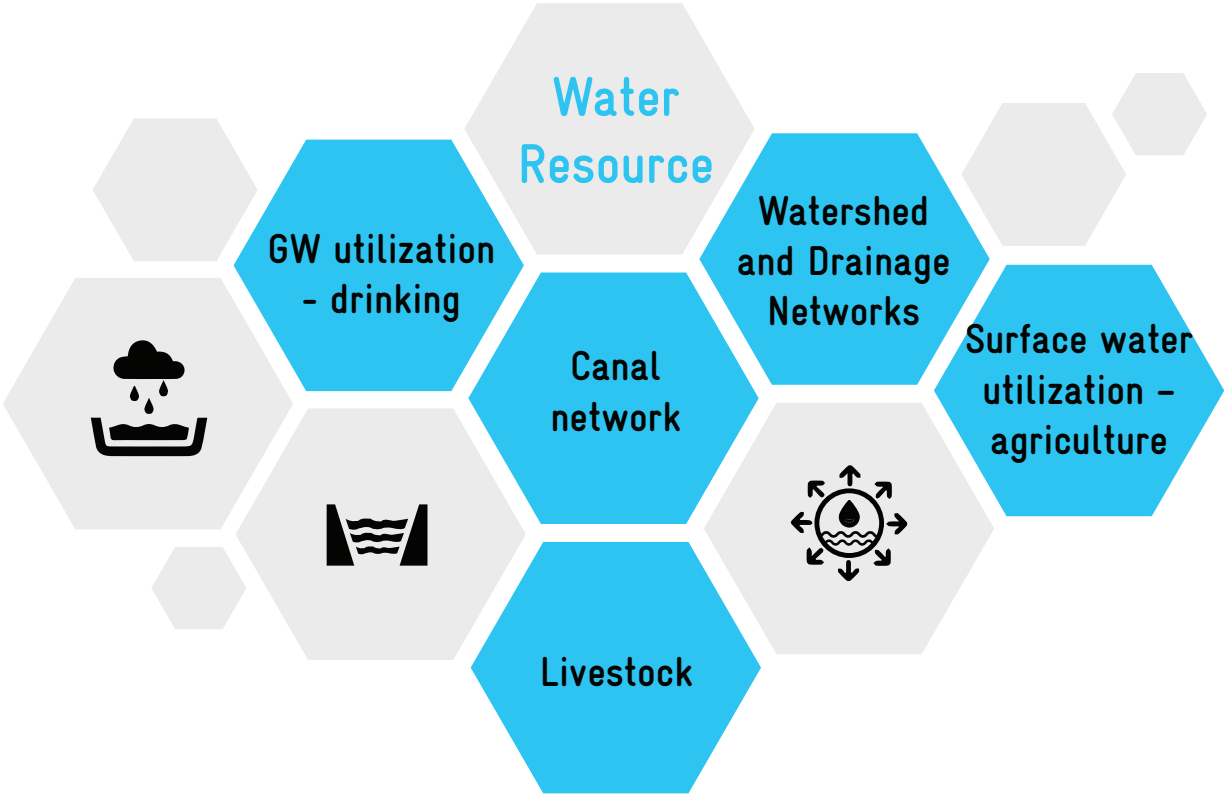
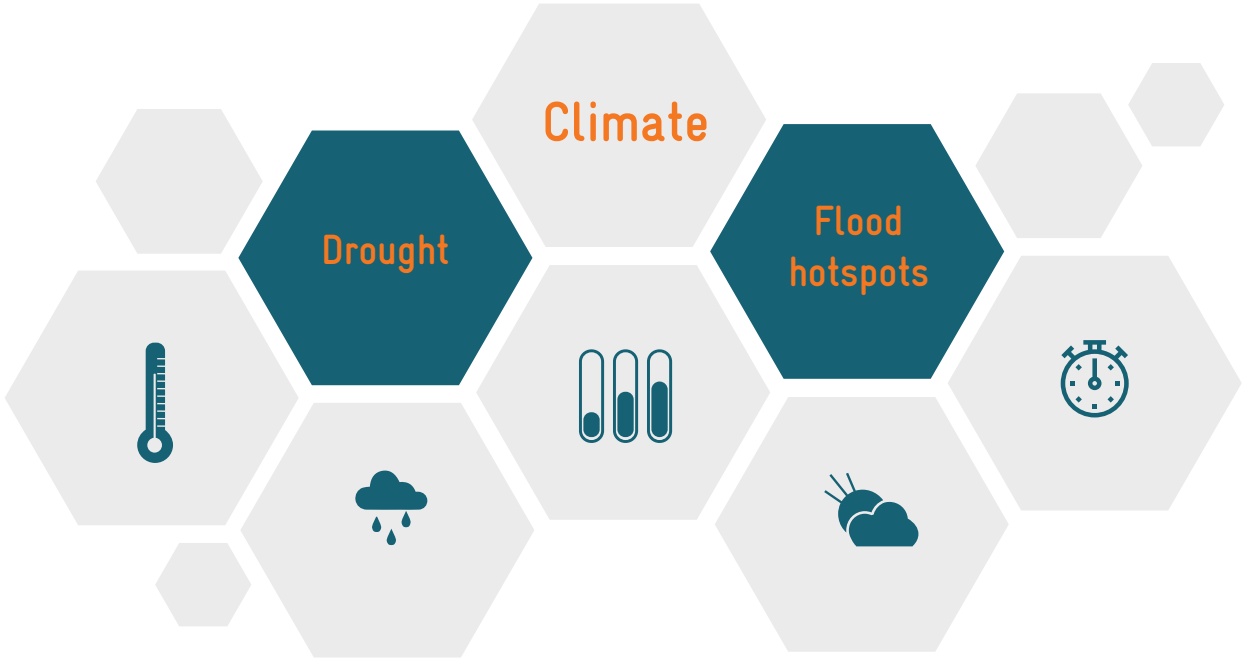


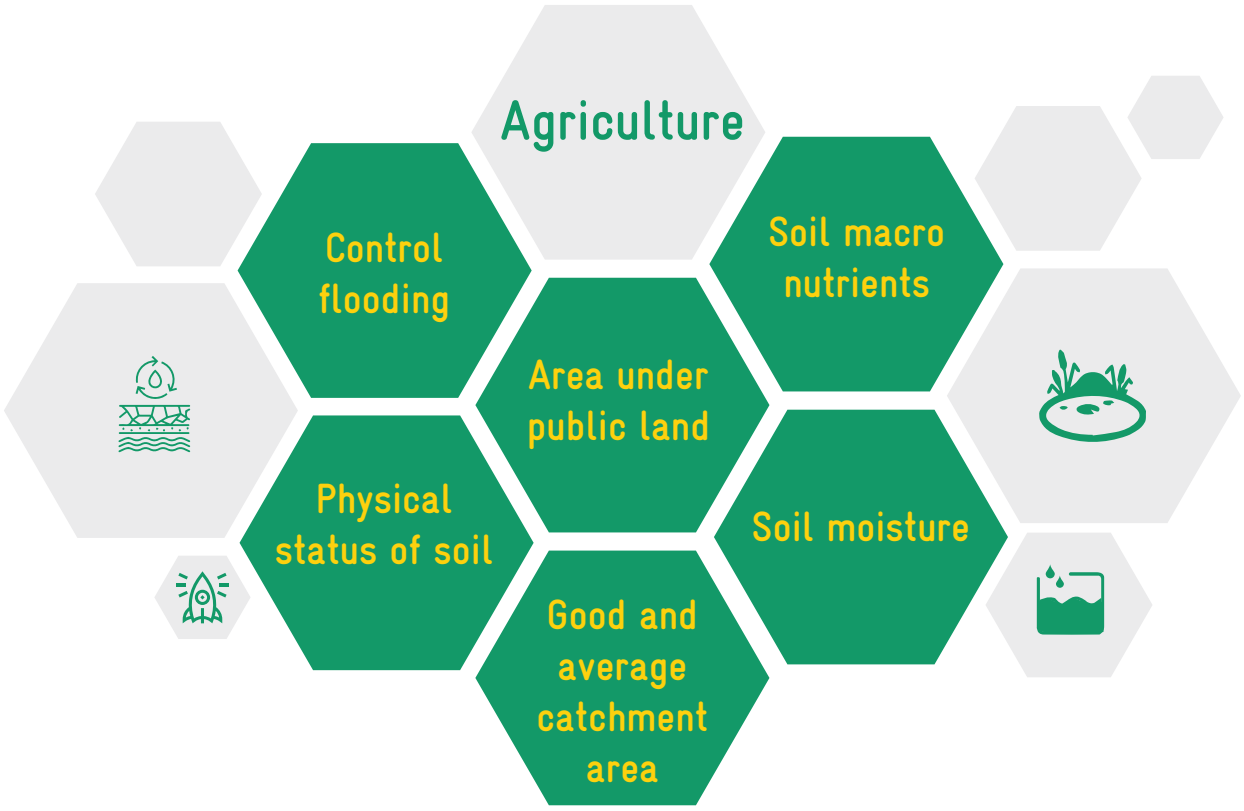
Figure 4.3. GP wise vulnerability dimensions

Contributing indicators to the total vulnerability









Based on the vulnerability assessment, high attention has been provided to identify more shelf of works/actions in the resource management in order to reduce the vulnerability and increase its adaptive capacity towards climate change.

விசும்பின் துளிவீழின் அல்லால்மற் றாங்கே
பசும்புல் தலைகாண்பு அரிது

குறள் - 16

No grassy blade its head will rear
If from the cloud no drop appear

Thirukkural - 16

CHAPTER 5

PROPOSED KEY WATER ACTIONS UNDER MAHATMA GANDHI NREGS CONVERGENCE

5 PROPOSED TREATMENT ACTIONS UNDER WASCA, CWRM AND CRM IN THE BLOCK

After identifying the key water issues at GP level through vulnerability analysis, the area for key water action treatments were proposed. The comprehensive and holistic understanding of the key water challenges adopting the eco-system approach enable to identify water action works in public and common land (afforestation, soil and water conservation, improving the traditional water storage and catchment assets etc.,), agriculture and allied sector (farm ponds, artificial recharge structures, on-farm plantation, irrigation methods, livestock - fodder development etc.,) and rural infrastructure (on safe drinking water and efficient handling of grey water).

THE PROPOSED AREA UNDER WASCA TREATMENT

Out of 55,962.37 ha available land in Kamuthi Block, 9,573 ha (17.11 %) area is proposed for treatment under WASCA TN– CWRM planning. A major portion of Key Water Actions is proposed in 3,886.13 ha of land of unirrigated (40.59 % of total proposed area), followed by 1,898.55 ha of irrigation land (19.83 % of total proposed area) while least of 3.40 ha area permanent pastures and other grazing land was considered for treatment. The detailed land wise proposal for WASCA treatments is given in the Table 10 and Figure 5.1. GP wise proposed area for treatment is also attached in Annexure 5.1.

TABLE 10. THE PROPOSED AREA FOR WASCA TREATMENT

Land use	Total available land (ha)	WASCA proposed treatment area (ha)
Unirrigated Land	20,706.72	3,886.13
Current Fallow land	11,556.97	1,898.55
Fallows Land other than Current Fallows	8,422.75	1,690.30
Area Irrigated by Source	5,292.27	827.48
Land Under Miscellaneous Tree Crops etc.	720.29	612.23
Non-Agricultural Uses	8,951.25	393.01
Cultivable Waste Land	277.12	235.55
Barren & Un-cultivable Land	31.00	26.35
Permanent Pastures and Other Grazing Land	4.00	3.40

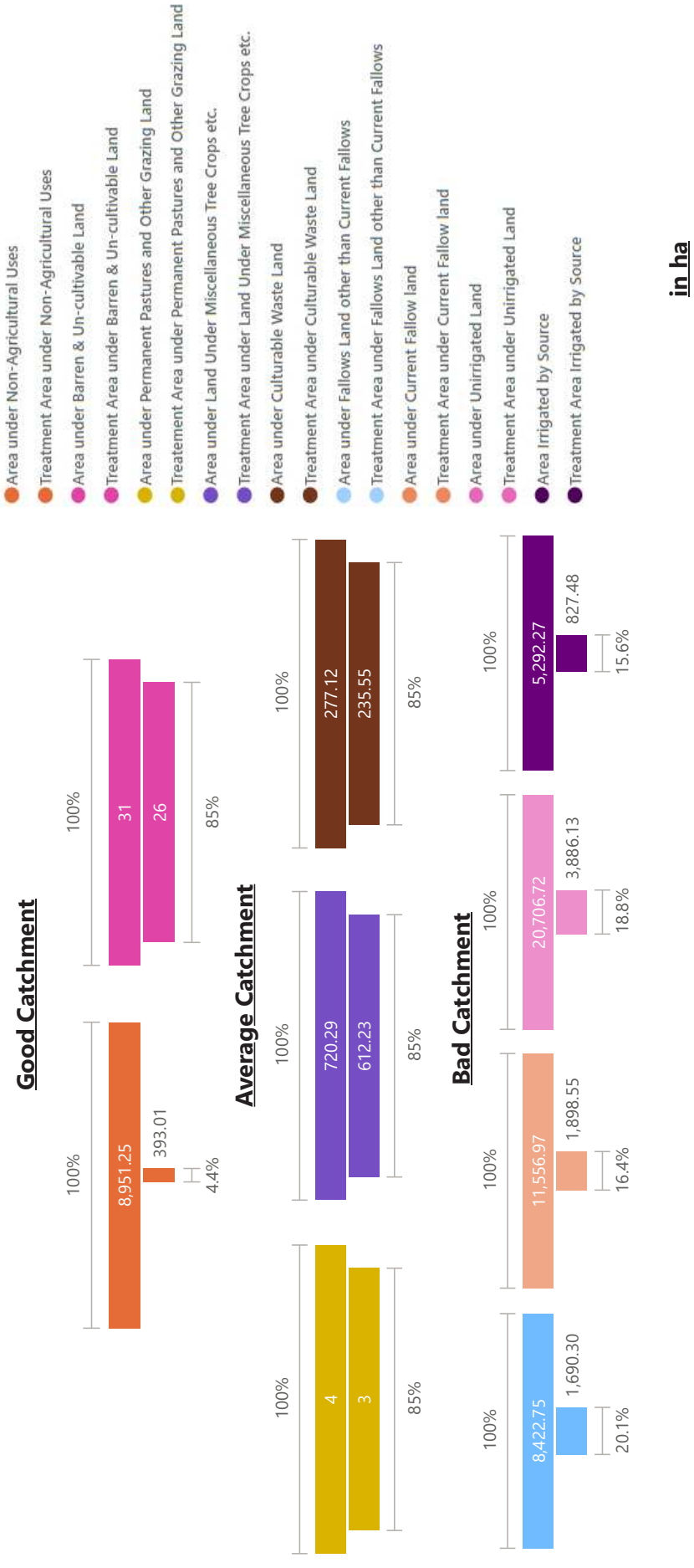


Figure 5.1. WASCA treatment area in percentage

Expected Runoff Conservation after WASCA treatment

The productive developmental activities that were taken up in the WASCA proposed areas are termed as Key Water Actions. With the above proposed treatment area, the expected runoff harvested due to WASCA intervention would be around 1,769.60 ha.m which is 23.96 % of the total runoff. Of the expected runoff conservation, the highest of 50.65 % from bad catchment area followed by 41.62 % of good and rest from average catchment area (Figure 5.2).

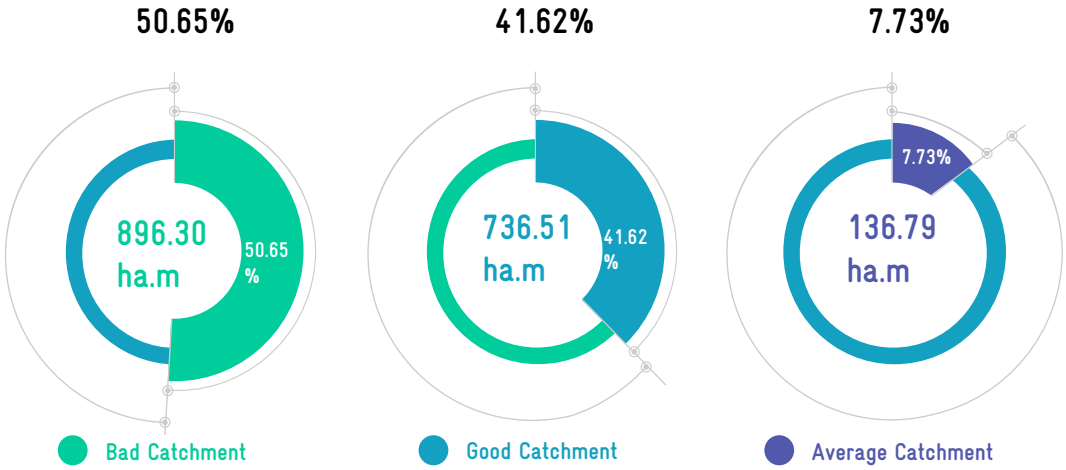


Figure 5.2. Expected conservation after WASCA treatment

The GP wise expected runoff conservation after completion of WASCA treatment is shown in Figure 5.3 (Annexure 5.2).

All the works are proposed based on watershed and livelihood approaches. GP wise proposed works are shown in Annexure 5.3

Work (unit)	Abbreviation (unit)	No.	Extent (area in ha or length in m)
Azolla units - Individual (Number of units)	Az	653	2,685
Cattle Shelters (Number of units)	CS	653	2,685
Cattle Trough(Number of units)	CT	653	2,685
Fodder development - Community & Individual	FD	653	2,685
Goat Sheep Shelters (Number of units)	GSS	2,766	27,649
Poultry Shed (Number of units)	PS	955	9,525
Silvi-pasture Development (ha)	SPD	2,720	3
Soak Pits (Community) (Number of units)	SPC	367	36,770
Soak Pits (Individual) (Number of units)	SPI	3,679	36,770

Artificial Recharge Structure(Number of units)	ARS	1,025	2,561
Construction of Farm Ponds - Individual (Number of units)	FP	2,988	8,302
Restoration of water bodies:PWD and Union Tanks(Number)	RPWDT	139	
Restoration of water bodies:Ooranis(Number)	Roo	394	
Restoration of water bodies:Ponds(Number)	RP	-	
Roof Rain Water Harvesting (Number of units)	RRWH	106	
Water Course - Irrigation Channels - Desilting (Mtrs)	WCICD	55,884	
Afforestation in Public/common lands(ha)	Aff	3,35,483	419
Avenue plantation(km)	AVP	63,814	2,55,230
Block Plantation (Community)(ha)	BP	6,78,222	851
Canal Bund Plantation(ha)	CBP	42,479	1,69,906
Contour Continuous Bunds (CCB) for Afforestation area(Mtrs)	CCBF	83,870	419
Drainage Line Treatment (Mtrs)	DLT	50,999	2,03,985
Dry land Horticulture/Agro-forestry - Individual (ha)	DLHAI	1,663	4,152
Irrigation Channel Plantation (Mtrs)	ICP	13,976	55,884
Linear Plantation(km)	LP	17,200	68,801
Micro Irrigation(ha)	MI	332	827
Nursery Development (Number of units)	ND	1,83,850	36,770
Composting(Number of units)	Co	4,765	8,302
Farm Bunding with Boundary Trenches - Individual (ha)	FBBTI	3,322	8,302
Land development - Individual (ha)	LDI	1,494	3,738
NADEP Vermi compost (Number of units)	NADEP	653	2,685


Proposed works are included the drought proofing, livelihood, land development and WCWH, measures
Land development works over 6,423 ha area
More than 14.56 Lakhs plants planting
4,652 sites for WCWH
13,000 livelihood works

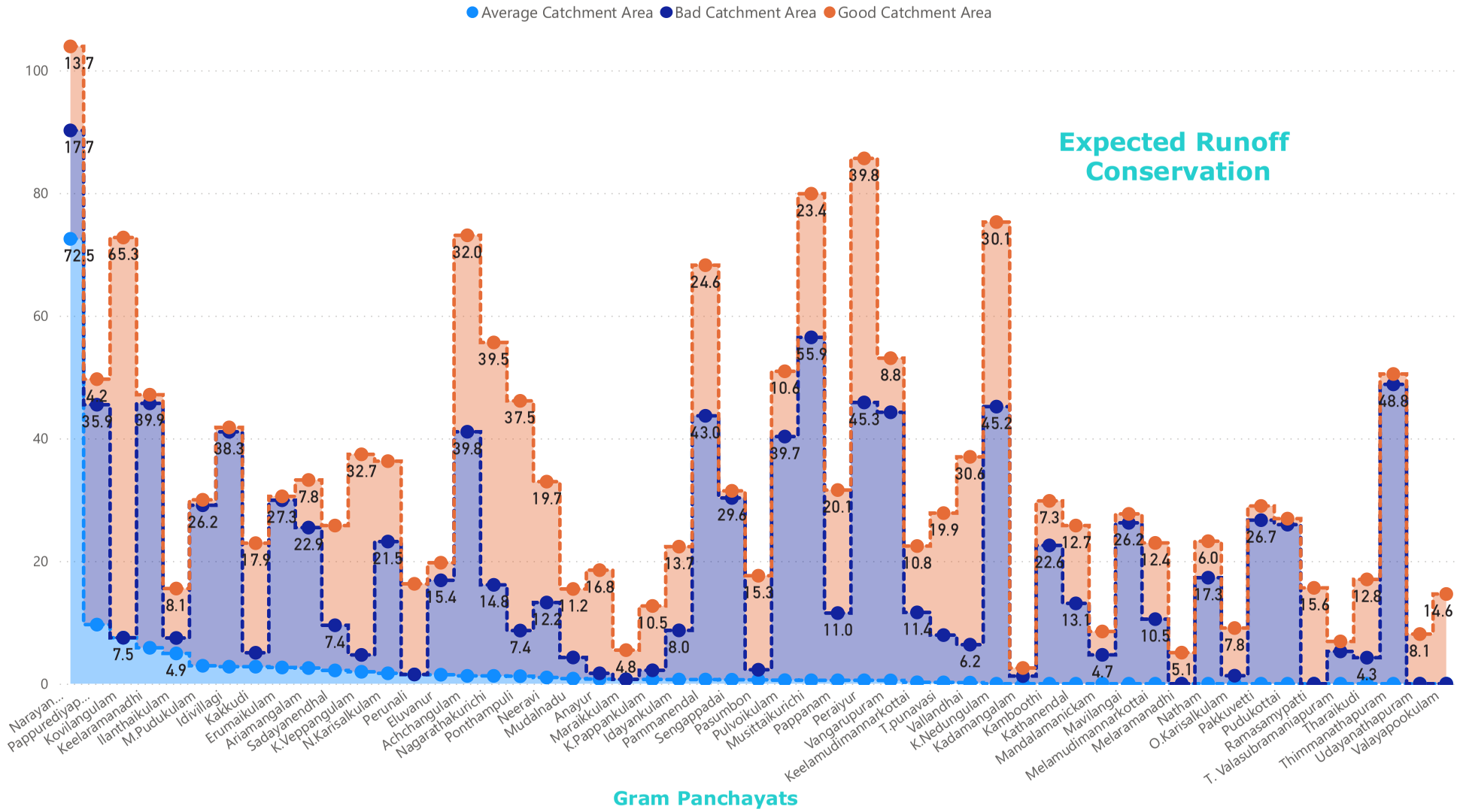


Figure 5.3. Expected GP wise runoff conservation after WASCA treatment

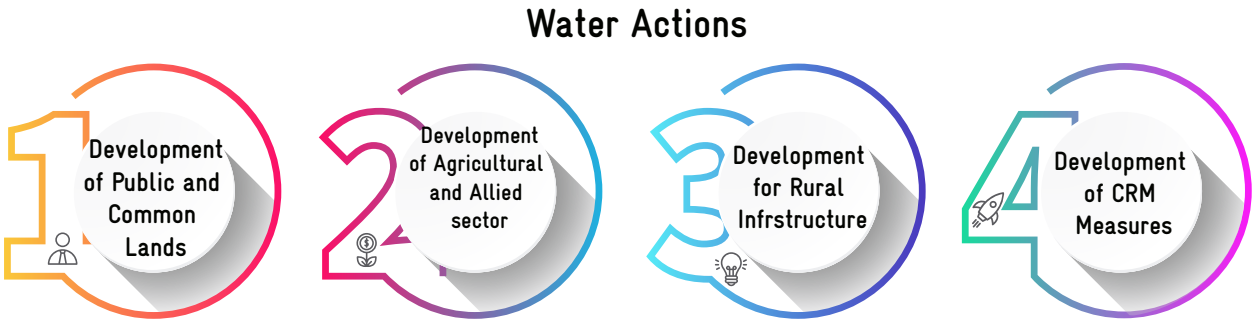
MAHATMA GANDHI NREGS Annual circular 2020-21 (Clause 6.3)

Planning and design of works under Mahatma Gandhi NREGS should take into account, impacts of climate change in order to ensure resilience of vulnerable rural communities and make the benefits sustainable in the long run. Specifically, the following things should be ensured:

I. Historical and projected climate change data, especially incidence of droughts and floods, along with vulnerability assessment at the District, Block or gram panchayat level should be used in the planning and design of Mahatma Gandhi NREGS works.

II. Different kinds of complementary Natural Resource Management (NRM) works such as land development with plantation on the bunds, farm ponds, and compost pits should be combined, in order to ensure durability of assets and resilience of communities that depend on such assets.

The Key Water Actions proposed under 4 categories through Mahatma Gandhi NREGS convergence of considering its models under Right to Plan and Prepare a Shelf of Projects (Clause 6) are



5.1 DEVELOPMENT OF PUBLIC & COMMON LANDS

The effective water augmentation measures are proposed in public and common lands via massive tree plantation, restoration of waterbodies etc., as listed in Table 11 and Figure 5.4.

DEVELOPMENT OF PUBLIC AND COMMON LANDS

TABLE 11. DETAILS OF WORK PROPOSED TO DEVELOP PUBLIC AND COMMON LANDS

	NO. OF WORKS	PERSON DAYS PER UNIT	UNIT COST IN INR (LAKHS)	ESTIMATED COST IN INR (LAKHS)	ESTIMATED PERSON DAYS
CONTOUR CONTINOUS BUNDS (CCB) FOR AFFORESTATION AREA(m)	1,677	10	0.025	41.94	16,774
COMPOSTING (NUMBER OF UNITS)	4,765	15	0.17	810.05	71,475
AFFORESTATION IN PUBLIC/ COMMON LANDS (ha)	419	3,344	8.6	3603.40	14,01,136
BLOCK PLANTATION (COMMUNITY) (ha)	851	4,320	11.1	9446.10	36,76,320
SILVI-PASTURE DEVELOPMENT (ha)	3	6,664	17.1	51.30	19,992
LINEAR PLANTATION (km)	69	703	1.8	123.84	48,366
CANAL BUND PLANTATION (ha)	350	2,930	7.5	2621.63	10,24,182
IRRIGATION CHANNEL PLANTATION (m)	18,211	6	0.015	273.17	1,09,266
AVENUE PLANTATION(km)	255	703	1.8	459.41	1,79,427
NURSERY DEVELOPMENT (NUMBER OF UNITS)	919	2,344	15	13788.75	21,54,722
RESTOTARATION OF WATER BODIES: PWD AND UNION TANKS (NUMBER)	134	800	5	670	1,07,200
RESTORATION OF WATER BODIES: OORANIS (NUMBER)	336	200	2	672	67,200
RESTORATION OF WATER BODIES: PONDS (NUMBER)	0	200	1	0	0
ARTIFICIAL RECHARGE STRUCTURE (NUMBER OF UNITS)	397	391	2.5	992.50	1,55,227
WATER COURSE - IRRIGATION CHANNELS - DESILTING (M)	18,211	3	0.0075	136.58	54,633
DRAINAGE LINE TREATMENT (m)	5,100	5	0.03	153	25,500

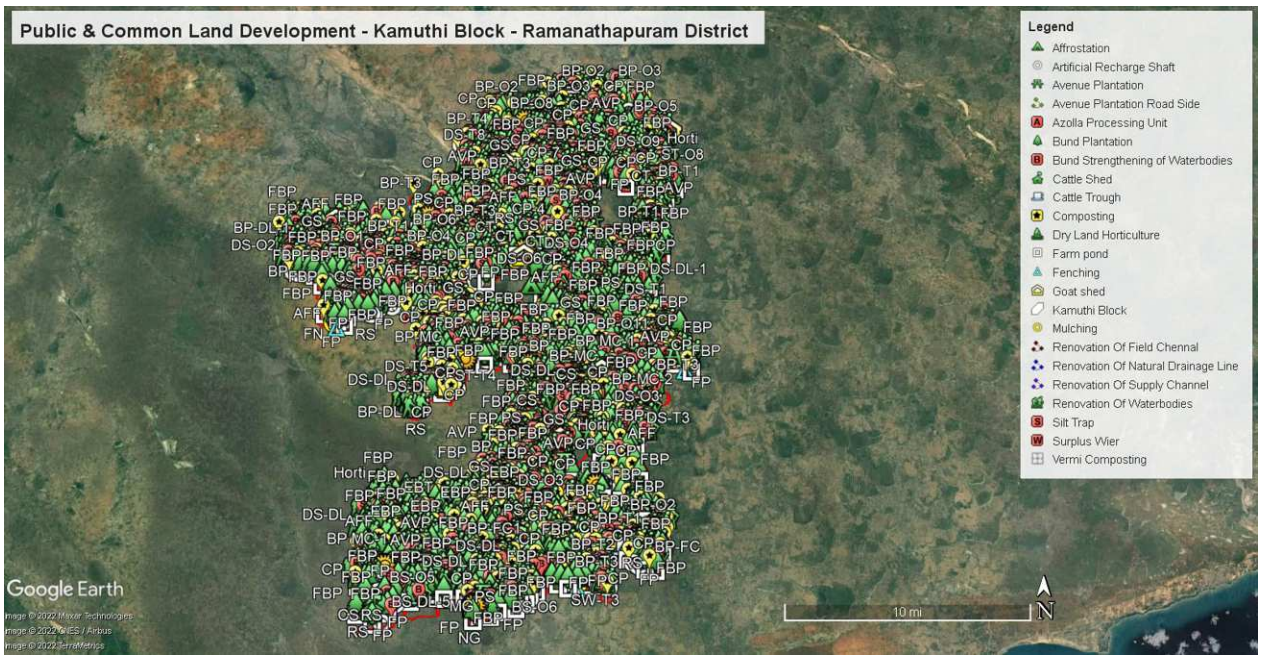


Figure 5.4. Proposed development activities in public and common land

5.2 DEVELOPMENT OF AGRICULTURE AND ALLIED SECTOR

Based on the assessment, the works which enhance agriculture and allied sectors particularly for irrigation, soil and livestock are proposed in the lands under individual ownership (Table 12& Figure 5.5).

DEVELOPMENT OF AGRICULTURE AND ALLIED ACTIVITIES

TABLE 12. DETAILS OF WORKS PROPOSED TO DEVELOP AGRICULTURE AND ALLIED SECTORS

	NO. OF WORKS	PERSON DAYS PER UNIT	UNIT COST IN INR (LAKHS)	ESTIMATED COST IN INR (LAKHS)	ESTIMATED PERSON DAYS
FARM BUNDING WITH BOUNDARY TRENCHES - INDIVIDUAL (ha)	8,302	586	1.5	12,453	48,64,972
MICRO IRRIGATION (ha)	332	-	1	332	-
CONSTRUCTION OF FARM PONDS - INDIVIDUAL (NUMBER OF UNITS)	2,988	781	2	5,976	23,33,628
LAND DEVELOPMENT - INDIVIDUAL (ha)	3,738	3,906	10	37,380	1,46,00,628
DRY LAND HORTICULTURE/AGRO-FORESTRY - INDIVIDUAL (ha)	4,152	3,321	8.5	35,292	1,37,88,792
AZOLLA UNITS - INDIVIDUAL (NUMBER OF UNITS)	653	23	0.15	97.95	15,019
NADEP VERMI-COMPOST (NUMBER OF UNITS)	653	27	0.18	117.54	17,631
FODDER DEVELOPMENT - COMMUNITY & INDIVIDUAL	653	2,344	1.48	966.44	15,30,632
CATTLE SHELTERS (NUMBER OF UNITS)	653	331	2.12	1,384.36	2,16,143
GOAT SHEEP SHELTERS (NUMBER OF UNITS)	2,766	355	2.27	6,278.82	9,81,930
CATTLE TROUGH (NUMBER OF UNITS)	653	6	0.05	32.65	3,918
POULTRY SHED (NUMBER OF UNITS)	955	10	0.09	85.95	9,550

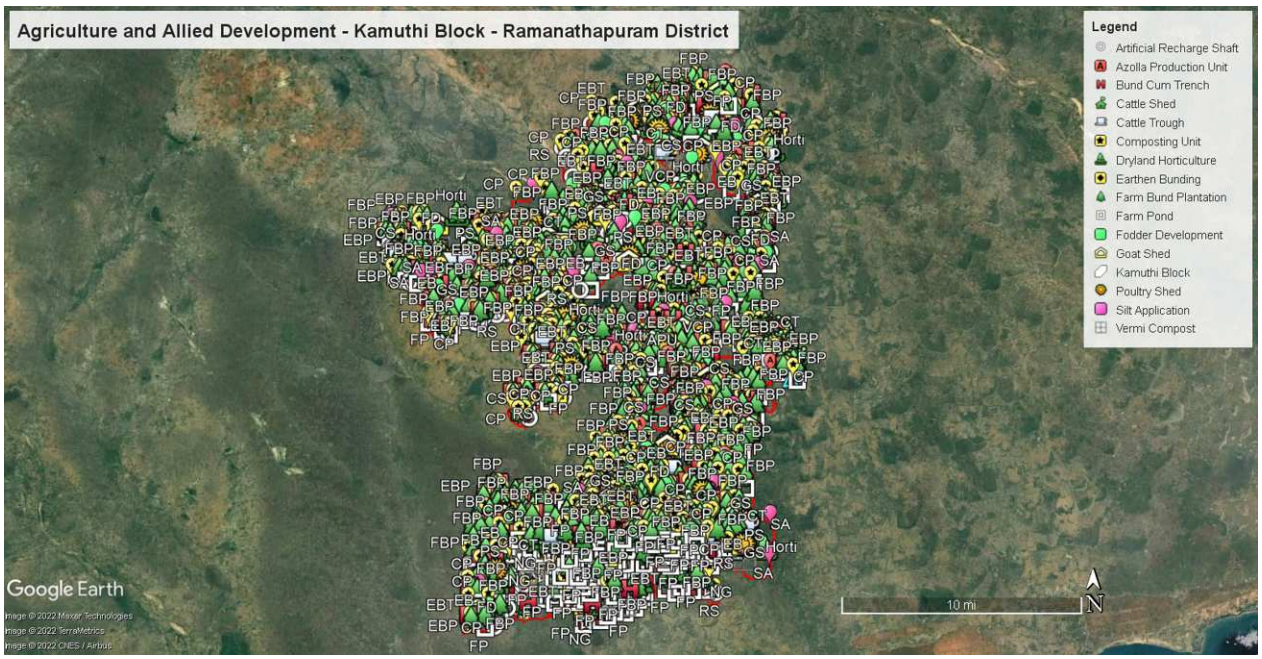


Figure 5.5. Proposed development activities in Agriculture and allied Sectors

5.3 DEVELOPMENT OF RURAL INFRASTRUCTURE

The prominent works on constructing structures for water harvesting and grey water management are proposed as in Table 13 and Figure 5.6.

DEVELOPMENT OF RURAL INFRASTRUCTURE

TABLE 13. DETAILS OF WORK PROPOSED TO DEVELOP RURAL INFRASTRUCTURE

	NO. OF WORKS	PERSON DAYS PER UNIT	UNIT COST IN INR	ESTIMATED COST IN INR (LAKHS)	ESTIMATED PERSON DAYS
SOAK PITS (COMMUNITY) (NUMBER OF UNITS)	367	20	0.13	47.71	7,340
SOAK PITS (INDIVIDUAL) (NUMBER OF UNITS)	3,679	16	0.1	367.90	58,864
ROOF RAIN WATER HARVESTING (NUMBER OF UNITS)	106	625	4	424	66,250
TANKA - COMMUNITY LEVEL (NUMBER OF UNITS)	-	300	30	-	-

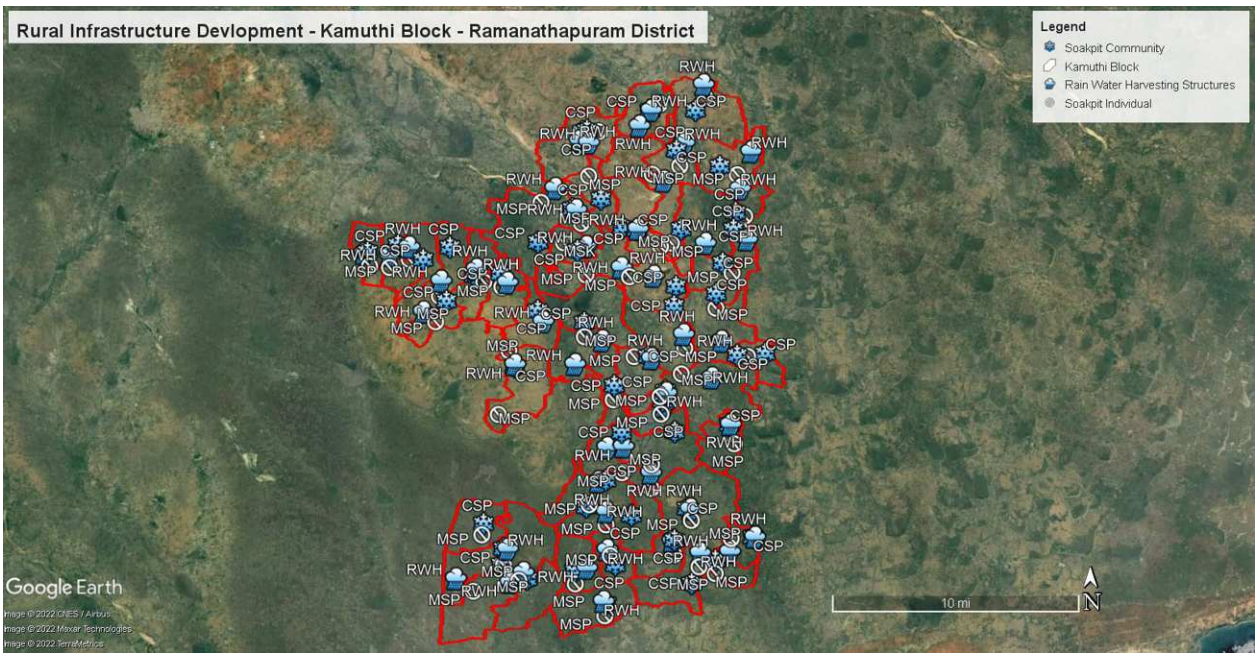


Figure 5.6. Proposed rural infrastructure activities

5.4 PROPOSED CLIMATE RESILIENCE MEASURES

Climate resilient measures are proposed to enable the system to cope up with future climate risks such as droughts, heatwaves and floods (Figure 5.7). Proposed CRM includes public, agriculture and rural infrastructure activities, whereas focus is given on public and common land development measures followed by agriculture and allied development (Table 14). Measures such as farm ponds (Table 15), horticulture park (Table 16), mega forest plantation (Table 17), Avenue plantation (Table 18), mini forest (Table 19), tanka (Table 20), and GP level nursery development (Table 21) were proposed in this Block in saturation mode.

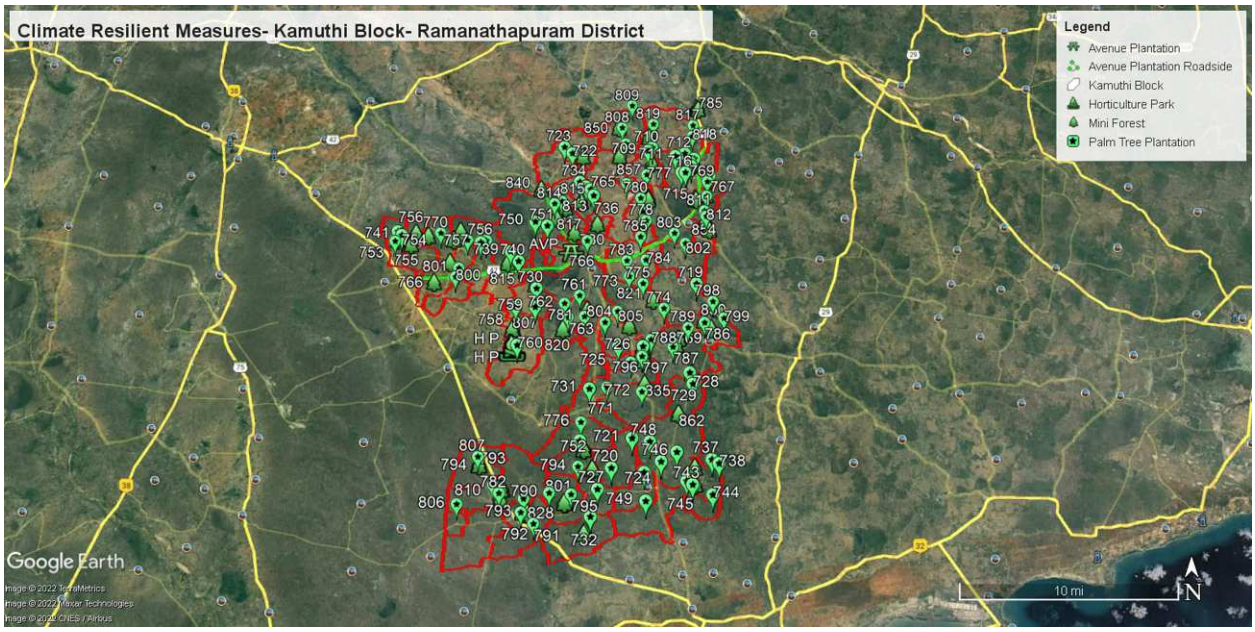


Figure 5.7. Proposed climate resilient measures

TABLE 14. GP WISE PROPOSED CRM

GP	Public or common land	Agriculture and allied	Rural infrastructure
A.Tharaikudi	Mini forest	GP level Nursery	
Abiramam	Avenue Plantation		
Achangulam	Mega forest	GP level Nursery	Tanka
	Avenue Plantation		
	Mini forest		
Anaiyur	Mini forest	GP level Nursery	Tanka
Ariamangalam	Mini forest	GP level Nursery	Tanka
Elanthaikulam			Tanka
Eluvanur	Mini forest	GP level Nursery	
Erumaikulam	Mini forest	GP level Nursery	Tanka
Idainkulam	Mini forest	GP level Nursery	Tanka
Idivilagi	Mini forest	GP level Nursery	
Ilandaikulam	Mini forest	GP level Nursery	
K.M.Kottai	Mini forest		
K.Nedungulam	Mega forest	GP level Nursery	Tanka
K.Nendungulam	Mini forest		
K.Pappangulam	Mega forest		Tanka
	Mini forest		
K.Veppangulam	Mini forest	GP level Nursery	Tanka
Kadamangalam	Mega forest	GP level Nursery	
	Mini forest		
Kakkudi	Mini forest	GP level Nursery	
Kathanendal	Mini forest	GP level Nursery	
Keelamudimannarkot-tai		GP level Nursery	
Keelaramanathi	Mini forest	GP level Nursery	Tanka
Komboothi	Mini forest	GP level Nursery	Tanka
Kothanenthal			Tanka
Kovilangulam	Mini forest	GP level Nursery	Tanka
M Pudukulam			Tanka
M.M.Kottai	Mega forest		
	Mini forest		
M.Pudukulam	Mini forest	GP level Nursery	
Mandalamanickam	Mini forest	GP level Nursery	Tanka
Marakkulam	Mega forest	GP level Nursery	Tanka
	Mini forest		
Mavilangai	Mini forest	GP level Nursery	
Melamudimannarkottai		GP level Nursery	
Melaramanathi	Mini forest	GP level Nursery	Tanka
Musitakurichi	Horticulture Parks	GP level Nursery	Tanka
	Mini forest		
Muthalnadu	Mini forest	GP level Nursery	Tanka
N.Karisalkulam	Mini forest	GP level Nursery	
Nagaratharkurichi	Mini forest	GP level Nursery	

Narayanapuram	Mini forest	GP level Nursery	Tanka
Natham	Avenue Plantation	GP level Nursery	Tanka
	Mini forest		
Neeravi	Mega forest	GP level Nursery	
	Mini forest		
O.Karisalkulam	Mini forest	GP level Nursery	Tanka
Pakkuvetti	Mini forest	GP level Nursery	Tanka
Pammanendal	Mini forest	GP level Nursery	Tanka
Pappanam	Mega forest	GP level Nursery	
	Mini forest		
Pappangulam		GP level Nursery	
Pappureddiapatti	Mini forest	GP level Nursery	Tanka
Pasumbon	Avenue Plantation	GP level Nursery	
	Mini forest		
Peraiyur	Mini forest	GP level Nursery	Tanka
Perunali	Mini forest	GP level Nursery	Tanka
Ponthampuli	Mini forest	GP level Nursery	
Pudukottai	Mega forest	GP level Nursery	Tanka
	Mini forest		
Pulvoikulam	Mini forest	GP level Nursery	Tanka
Ramasamypatti	Mini forest	GP level Nursery	
Sadayanendal	Mini forest	GP level Nursery	Tanka
	Avenue Plantation		
Sengapadai	Mega forest	GP level Nursery	Tanka
	Mini forest		
T.Punavasal	Mega forest	GP level Nursery	Tanka
	Mini forest		
T.Valasubramaniapu-ram	Mini forest	GP level Nursery	Tanka
Thimmanathapuram	Mega forest	GP level Nursery	Tanka
	Mini forest		
Udainathapuram	Mini forest	GP level Nursery	Tanka
Valaiyapookulam	Mini forest	GP level Nursery	
Vallanthai	Mega forest	GP level Nursery	
	Mini forest		
Vangarupuram	Mini forest	GP level Nursery	Tanka

TABLE 15. DETAILS OF PROPOSED FARM PONDS ACTIVITY UNDER CRM

Block Target	Community Farm Ponds	Community Farm Ponds Completed	Community Farm Ponds Ongoing	Individual Farm Ponds	Individual Farm Ponds Completed	Individual Farm Ponds Ongoing
155	120	6	114	35	26	9

TABLE 16. DETAILS OF PROPOSED HORTICULTURE PARK ACTIVITIES UNDER CRM

Name of the Block	GP	Area for Plantation (In ha)	Total No. of Plants(1 ha - 10000 saplings)	Classification of land
Kamuthi	Musitakurichi	1.04	750	Govt Purampokku land

TABLE 17. DETAILS OF PROPOSED MEGA FOREST ACTIVITY UNDER CRM

Sl. No.	GP	Area for Plantation (In ha)	Total No. of Plants(1 ha - 10000 saplings)	Classification of land
1	Achangulam	1.01	5,000	Govt Purampokku land
2	K.Nedungulam	1.00	5,000	
3	K.Pappangulam	3.60	5,000	
4	Kadamangalam	2.02	5,000	
5	M.M.Kottai	1.01	5,000	
6	Marakkulam	2.60	5,000	
7	Neeravi	2.01	5,000	
8	Pappanam	2.00	5,000	
9	Pudukottai	2.36	5,000	
10	Sengapadai	2.00	5,000	
11	T.Punavasal	2.24	5,000	
12	Thimmanathapuram	1.02	5,000	
13	Vallanthai	2.00	5,000	
Total		**24.87**	**65,000**	

TABLE 18. DETAILS OF PROPOSED AVENUE PLANTATION ACTIVITY UNDER CRM

GP	Road Length (in km)	Number of Big Trees	Number of Small Trees	Total No. of Plants	Classification of Land
Achchangulam	6	554	1,308	1,862	Govt Purampokku land
Natham	4	362	1,124	1,486	
Sadayanendhal	1	74	148	222	
Abiramam	4	440	1,280	1,720	
Pasumbon	5	508	1,416	1,924	
Total	**19**	**1,938**	**5,276**	**7,214**	

TABLE 19. DETAILS OF PROPOSED MINI FOREST ACTIVITY UNDER CRM

GP	Area for Plantation (In a)	Total No. of Plants (1 ha - 10000 saplings)
A.Tharaikudi	0.25	2,500
Achangulam	0.15	1,500
Anaiyur	0.10	1,000
Ariyamangalam	0.10	1,000
Eluvanoor	0.05	500
Erumaikulam	0.10	1,000
Idaiyangulam	0.15	1,500
Idivilagi	0.10	1,000
Ilanthaikulam	0.10	1,000
K.M.Kottai	0.15	1,500
K.Nendungulam	0.10	1,000
K.Pappangulam	0.05	500
K.Veppangulam	0.10	1,000
Kadamangalam	0.10	1,000
Kakkudi	0.10	1,000
Kathanendal	0.10	1,000
Keelaramanathi	0.10	1,000
Kompoothi	0.15	1,500
Kovilangulam	0.10	1,000
M.M.Kottai	0.10	1,000
M.Pudukulam	0.10	1,000
Mandalamanickam	0.10	1,000
Marakkulam	0.10	1,000
Mavilangai	0.10	1,000
Melaramanathi	0.05	500
Mustakuruchi	0.10	1,000
Muthalnadu	0.05	500
N.Karisalkulam	0.10	1,000
Nagartharkurichi	0.05	500
Narayanapuram	0.25	2,500
Natham	0.15	1,500
Neeravi	0.10	1,000
O.Karisalkulam	0.10	1,000
Pakkuvetti	0.10	1,000
Pammanendal	0.10	1,000
Pappanam	0.15	1,500
Pappureddiyapatti	0.10	1,000
Pasumpon	0.10	1,000
Peraiyur	0.25	2,500
Perunali	0.10	1,000
Ponthampuli	0.10	1,000
Pudukottai	0.05	500
Pulvoikulam	0.10	1,000

Ramasamypatti	0.15	1,500
Sadayanendal	0.15	1,500
Sengapdai	0.10	1,000
T.Punavasal	0.10	1,000
T.V.S.Puram	0.15	1,500
Thimmanathapuram	0.10	1,000
Udaiyanathapuram	0.15	1,500
Valaiyapookulam	0.10	1,000
Vallanthai	0.10	1,000
Vangarupuram	0.15	1,500
Total	**6**	**60,000**

TABLE 20. DETAILS OF PROPOSED TANKAS ACTIVITY UNDER CRM

Sl. No.	GP
1	Achchangulam
2	Anaiyur
3	Ariamangalam
4	Elanthaikulam
5	Erumai Kulam
6	Idainkulam
7	K_Nedungulam
8	K_Pappankulam
9	K_Veppangulam
10	Keelaramanadhi
11	Komboothi
12	Kothanenthal
13	Kovilangulam
14	M Pudukulam
15	Mandalamanickam
16	Marakkulam
17	Melaramanadhi
18	Mudalnadu
19	Musittaikurichi
20	Narayanapuram
21	Natham
22	O_Karisalkulam
23	Pakkuvetti
24	Pammanendal
25	Pappureddiapatti
26	Peraiyur
27	Perunali
28	Pudukkottai
29	Pulvolkulam
30	Sadayanendal

31	Sengappadai
32	T_Punavasal
33	Thimmanathapuram
35	Udainathapuram
36	Vangarupuram

TABLE 23. DETAILS OF PROPOSED FALLOW LAND DEVELOPMENT ACTIVITY UNDER CRM

Sl. No.	GP	Total No.of Plants
1	A.Tharaikudi	1,000
2	Achangulam	1,000
3	Anaiyur	1,000
4	Ariamangalam	1,000
5	Eluvanur	1,000
6	Erumaikulam	1,000
7	Idaiyankulam	1,000
8	Idivilagi	1,000
9	Ilandaikulam	1,000
10	K.Nedungulam	1,000
11	K.Veppangulam	1,000
12	Kadamangalam	1,000
13	Kakkudi	1,000
14	Kathanendal	1,000
15	Keelamudimannarkottai	1,000
16	Keelaramanathi	1,000
17	Komboothi	1,000
18	Kovilangulam	1,000
19	M.Pudukulam	1,000
20	Mandalamanickam	1,000
21	Marakkulam	1,000
22	Mavilangai	1,000
23	Melamudimannarkottai	1,000
24	Melaramanathi	1,000
25	Mustakkurichi	1,000
26	Muthalnadu	1,000
27	N.Karisalkulam	1,000
28	Nagaratharkurichi	1,000
29	Narayanapuram	1,000
30	Natham	1,000
31	Neeravi	1,000
32	O.Karisalkulam	1,000
33	Pakkuvetti	1,000
34	Pammanendal	1,000
35	Pappanam	1,000
36	Pappangulam	1,000

37	Pappurettiapatti	1,000
38	Pasumpon	1,000
39	Peraiyur	1,000
40	Perunali	1,000
41	Ponthampuli	1,000
42	Pudukkottai	1,000
43	Pulvoikulam	1,000
44	Ramasamypatti	1,000
45	Sadayanendal	1,000
46	Sengappadai	1,000
47	T.Punavasal	1,000
48	T.Valasubramaniapuram	1,000
49	Thimmanathapuram	1,000
50	Udaiyanathapuram	1,000
51	Valaiyapookulam	1,000
52	Vallanthai	1,000
53	Vangarupuram	1,000
Total		**53,000**

நெடுங்கடலும் தன்நீர்மை குன்றும் தடிந்தெழிலி
தான்நல்கா தாகி விடின்

குறள் - 17

The ocean's wealth will waste away
Except the cloud its stores repay

Thirukkural - 17

CHAPTER 6

PROJECTED OUTCOMES OF PLANNING

6 PROJECTED OUTCOMES OF PLANNING

In view of Mahatma Gandhi NREGS guidelines, Key Water Actions are proposed based on climate vulnerability assessment and challenges at GP level for three years period from 2021- 2022 to 2023-2024. At the end of the implementation period during 2024, the following productive outcomes are envisaged on successful accomplishment of all proposed Key Water Actions. The anticipated outcome will reduce the water security vulnerability and increase the resilience of the GPs under current and projected climatic change scenarios.

6.1 OUTCOMES OF DEVELOPMENT OF PUBLIC AND COMMON LANDS

OUTCOMES OF DEVELOPMENT OF PUBLIC AND COMMON LANDS

	INDICATOR	OUTCOMES/ IMPACT
1	Proportion of Land development under WASCA treatment	9,573 ha (17.11 %) of the total area treated under WASCA
2	Percentage reduction of run off	1,769.60 ha.m i.e. 24 % of the total runoff harvested due to WASCA interventions
3	No. of waterbodies restored	470 waterbodies (tanks/pond and ooranis) restored
4	Area under afforestation	419 ha area under afforestation with 3,35,483 plants
5	Length of drainage line treated	204 km length of drainage line treated
6	Canal Bund Plantation	More than 69 thousand plants through 350 works
7	Nursery development	919 units

9,573 ha
AREA TREATED

1,769.60 ha.m
TOTAL RUNOFF HARVESTED

470
WATER BODIES RESTORED

419 ha
AREA AFFORESTATION

204 km
DRAINAGE LINE TREATED

3,345,483
PLANTS

919 UNITS
NURSERY DEVELOPMENT

6.2 OUTCOMES OF DEVELOPMENT OF AGRICULTURE AND ALLIED SECTOR

OUTCOMES OF DEVELOPMENT OF AGRICULTURE AND ALLIED ACTIVITIES

	INDICATOR	OUTCOMES/ IMPACT
1	Assessment of sources of water for live-stock and agriculture demand No of structures established for on-farm (in-situ) water harvesting in dry lands	2,988 farm ponds established which target the harvest of 52,58,880 cu.m of water which has the potential to irrigate 1,046 ha area
2	Improvement in soil health	653 NADEP vermicomposting units for soil health improvement
3	Dry land development with agro-forestry	4,152 ha under dry land horticulture
4	Households established fodder plots	6,757 vulnerable households established fodder plots
5	Sheds for livestock's (cattle, goat, poultry)	4,374

2,988 FARM PONDS

653 COMPOST UNITS

6,757 FODDER PLOTS

4,152 ha DRY LAND HORTICULTURE

4,374 SHEDS FOR LIVESTOCK'S

6.3 OUTCOMES OF RURAL INFRASTRUCTURE DEVELOPMENT

OUTCOMES OF RURAL INFRASTRUCTURE DEVELOPMENT

	INDICATOR	OUTCOMES/ IMPACT
1	No. of villages having liquid waste management systems	3,679 individual and 367 community level soak pits established for recycle of grey water benefiting 34,061 HHs
2	Roof rain water harvesting measures	106 common roof rainwater harvesting and storage structures with a target to harvest and store 0.13 ha.m of rainwater for use
3	Nutri-garden	34,061 HHs established nutri-gardens in homesteads and planted 1,70,305 saplings

367 COMMON & **3,679** INDIVIDUAL SOAK PITS

106 COMMON ROOF RAINWATER HARVESTING

34,061 NUTRI-GARDENS

1,70,305 SAPLINGS

6.4 OUTCOMES OF CLIMATE RESILIENCE MEASURES

OUTCOMES OF CLIMATE RESILIENCE MEASURES

	INDICATOR	OUTCOMES/ IMPACT
1	Climate resilient measures are identified for climate risks	7 models are identified via., farm ponds, horticulture park, avenue plantation, mini forest, mega forest, tankas, and GP level nursery development 155 farm ponds Horticulture Park in 1.04 ha with 750 plants. Mega forest in 24.87 ha area with 65,000 plants Avenue plantation along the road of length 19 km with 1,938 plants Mini forest in 6 ha with 60,000 plants Tankas in 36 GPs 53 GP Nursery development sites with 53,000 plants (1,000 plants per GP)

155 FARM PONDS

1.04 ha HORTICULTURE PARK

53 GP LEVEL NURSERY

24.87 ha MEGA FOREST

6 ha MINI FOREST

19 km AVENUE PLANTATION

36 TANKAS

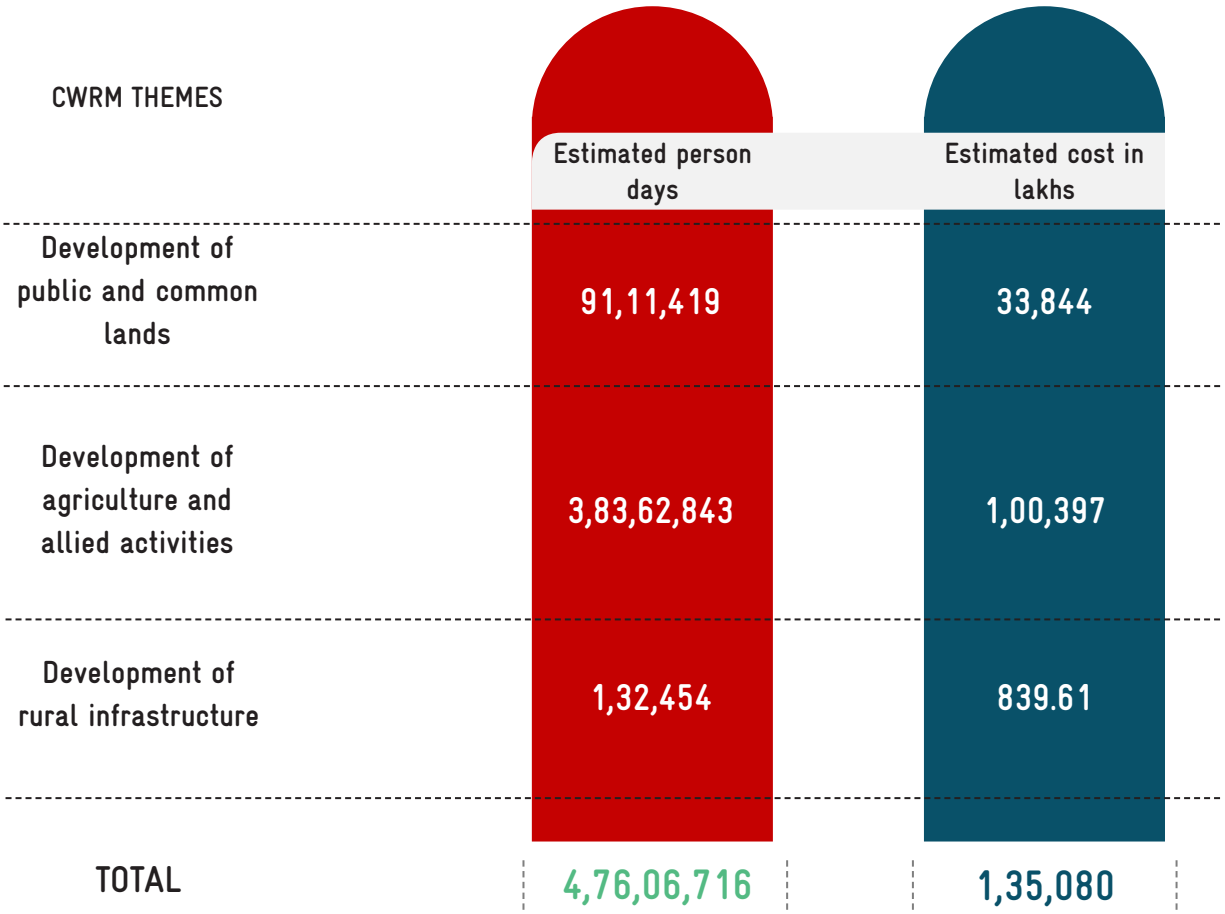
53,000 plants GP NURSERY

Estimated person days

The total estimated person days required for the above propose activities are 4,76,06,716 as specified below Figure 6.1.

Estimated Cost

The total estimated cost budgeted for the above propose activities is Rs. 1,35,080 Lakhs as specified below in Figure 6.2.



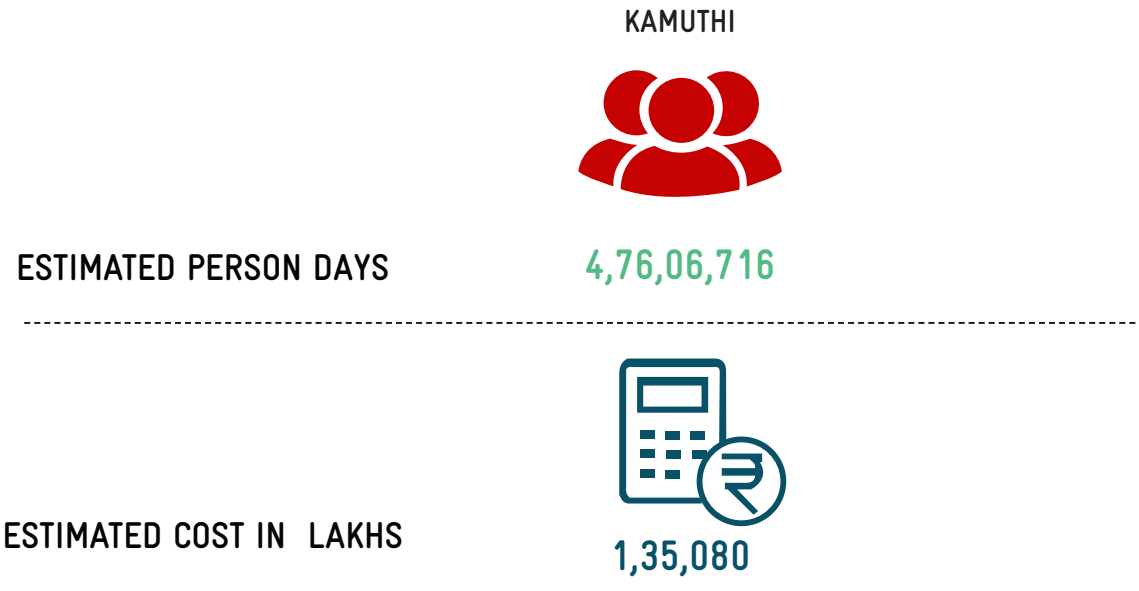


Figure 6.1 & 6.2. Estimated person days & cost for all water actions

6.5 LINKAGES TO SDGS, NDCS

The 2030 Agenda and the Paris Agreement put forth an innovative and complementary framework for accelerating action and achieving ambitious sustainable development objectives. Under the 2030 Agenda, a series of 17 global Sustainable Development Goals (SDGs) have been agreed that are to be universally achieved. Under the Paris Agreement, countries are committed to reduce greenhouse gas emissions through Nationally Determined Contributions (NDC) in order to strengthen resilience to climate change. Both The SDGs and Paris Agreements demands urgent climate action and linking WASCA activities with these two agendas is indispensable.

6.5.1 NATIONALLY DETERMINED CONTRIBUTION GOALS AND WASCA TN PROGRESS THROUGH NDC

2015 was a historic year in which 196 Parties came together under the Paris Agreement to transform their development trajectories so that they set the world on a course towards sustainable development, aiming at limiting warming to 1.5 to 2 ◦ C above pre-industrial levels. Through the Paris Agreement, Parties also agreed to a long-term goal for adaptation – to increase the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production. Additionally, they agreed to work towards making finance flows consistent with a pathway towards low greenhouse gas emissions and climate- resilient development. Nationally Determined Contributions (NDCs) are at the heart of the Paris Agreement and the achievement of these long-term goals. NDCs embody efforts by each country to reduce national emissions and adapt to the impacts of climate change. The Paris Agreement (Article 4, Paragraph 2) requires each Party to prepare, communicate and maintain successive NDCs that it intends to achieve. Parties shall pursue domestic mitigation measures, with the aim of achieving the objectives of such contributions.

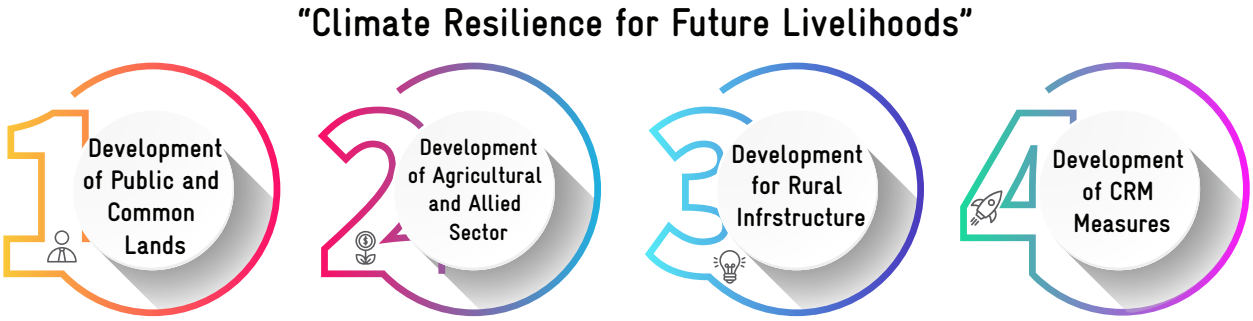
Internationally, the recent process on NDC Enhancement (2020) significantly acknowledge the climate change vulnerability on national sectors including agriculture, energy, and urban areas, especially through impacts on water resources. The role that water and water-related activities play in national economies has been increasingly recognized in most Nationally Determined Contributions (NDCs). Many parties included measures related to flooding and drought and chose to include qualitative information on the likely effect of climate change on key sectors.

WASCA TN marching on the road to support India's NDC vision by,

1. Supporting creation of an additional carbon sink of 2.5–3 billion tonnes through additional forest and tree cover
2. Enhancing investments in development programs for climate change adaptation in vulnerable sectors
3. Implementing programs to achieve the sustainable natural resource management and efficient utilization of natural resources, leading to a reduction in the "ecosystem footprint"
4. Providing qualitative information on the likely effect of climate risks on key sectors via, water, agriculture and allied sector and socio economic

6.5.2 WASCA TN SUPPORTS SDG

WASCA – TN's four major actions for making "Climate Resilience for Future Livelihoods" are envisaged through SDGs



TN WASCA will achieve the above actions working closely with Mahatma Gandhi NREGA programme of Ministry of Rural Development and National Water Mission programme of (MoJS). These two ministries are the key stakeholders for WASCA. Apart from these two ministries, the works under WASCA TN are closely linked with Ministry of Agriculture and MoEFCC. The commitments of the above mentioned four ministries towards SDG goals achievements are mapped in connection with the interventions under WASCA Tamil Nadu. The intervention under WASCA TN has direct and indirect contribution to the SDGs and its national targets set as per NITI Aayog.

6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.A, 6.B

SDG GOAL 6

SDG 6 by 2030 : Ensure availability and sustainable management of water and sanitation for all

6.1	Achieve universal and equitable access to safe and affordable drinking water for all
6.2	Achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations

6.3	Improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
6.4	Increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity
6.5	Implement integrated water resources management at all levels (6.5.1)
6.6	Protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes
6.A	Expand international cooperation and capacity-building support to developing countries in water-and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies
6.B	Support and strengthen the participation of local communities in improving water and sanitation management

Indicators considered for district and Block level vulnerability assessment of WASCA TN which is also used in SDG India 2020-21 report (Table 22).

TABLE 22. COMMON VULNERABILITY INDICATORS USED IN WASCA TN & SDG INDIA 2020-21

Head count ratio as per the multidimensional poverty index (%)	
	Persons provided employment as a percentage of persons who demanded employment under MGNREGA

Percentage of rural population getting safe and adequate drinking water within premises through piped water supply

Percentage of rural population having improved source of drinking water

Percentage of ground water withdrawal against availability

Percentage of Blocks/Mandals/Talukas over-exploited

Percentage of area covered under afforestation schemes to the total geographical area

Percentage of degraded land over total land area

Percentage increase in area of desertification

The indicators used for district level vulnerability assessment along with its linked SDGs are already tabulated in (Table 2). The detailed proposed water actions in CWRM which was assessed based on the vulnerability dimensions are linked with climate vulnerability index and SGDs are tabulated in Table 23 to 25.

TABLE 23. WATER ACTIONS ON DEVELOPMENT OF PUBLIC & COMMON LANDS & ITS LINKED SDG

Name of the work	No. of CWRM works	Climate Vulnerability Index Impacting (WASCA TN)	Linked SDG Goal
Contour Continuous Bunds for Afforestation area (m)	1,677	W3	SDG 1,2, 6,13&15
Composting (No. of units)	4,765	W1	SDG1& 6
Afforestation in Public/common lands (ha)	419	C1,C2,C3, W3,	SDG 1, 2,6,13&15
Block Plantation (Community) (ha)	851	C1,C2,C3,W3,S2	SDG 1,2, 6 &13, 15
Silvi-pasture Development (ha)	3	C1,C2,C3,W3	SGG 12 &15
Linear Plantation (km)	69	C1,C2,C3,W3,S2	SDG 1,2,6,12&13, 15
Canal Bund Plantation (ha)	350	C1,C2,C3,W3,S2	SDG 1, 6&13, 15
Irrigation Channel Plantation (m)	18,211	W4,W5,S2	SDG 1,2& 6, 15
Avenue plantation (km)	255	C1,C2,C3,W3,S2	SDG 1, 6&13

Nursery Development (No. of units)	919	C1,S2,S4	SDG 1,2 &6
Restoration of waterbodies :PWD and Tanks (No.)	134	S2, S1	SDG 6, 1, 13
Restoration of water bodies : Ooranis (No.)	336	S2, S1	SDG 6, 1, 13
Restoration of waterbodies :Ponds (No.)	0	S2, S1	SDG 6,1, 13
Artificial Recharge Structure (No. of units)	397	W3	SDG 1, 2, & 6
Water Course - Irrigation Channels - Desilting (m)	18,211	C1,C2,C3,W3,S2	SDG 1, 6&13
Drainage Line Treatment (m)	5,100	W1,W3,W4	SDG1 & 6

TABLE 24. WATER ACTIONS ON DEVELOPMENT OF AGRICULTURAL AND ALLIED SECTOR & IT'S LINKED SDG

Name of the Work	No. of CWRM works	CVI	SDG
Farm Bunding with Boundary Trenches - Individual (ha)	8,302	A1,A3,W1,W3	SDG 1,2&6
Micro Irrigation(ha)	332	A1,A3,A5,W5	SDG 1, 2&6
Construction of Farm Ponds - Individual (No. of units)	2,988	A1,A3,W5,W1, W3	SDG 2& 6
Land development - Individual (ha)	3,738	W1,W5,A1,A3,S2,S4	SDG 2, 6&
Dry land Horticulture/Agro-forestry - Individual (ha)	4,152	A1,A3,A4,W1,S4,S2,C1	SDG 1& 2,15
Azolla units - Individual (No. of units)	653	A3,A4,S4	SDG 1& 2
NADEP Vermi compost (No. of units)	653	A3, W1, S4	SDG 1& 2,6
Fodder development - Community & Individual	653	A3, S4	SDG 1& 2, 15
Cattle shelters (No. of units)	653	S4	SDG 1& 2
Goat/sheep shelters (No. of units)	2,766	S4	SDG 1& 2
Cattle trough(No. of units)	653	W5,S4	SDG 1& 2
Poultry Shed (No. of units)	955	S2,S4	SDG 1& 2

TABLE 25. WATER ACTIONS ON RURAL WATER MANAGEMENT & IT'S LINKED SDG

Name of the work	No. of CWRM works	CVI	Linking SDG
Soak Pits (Community) (No. of units)	367	W3,S2	SDG 1& 6
Soak Pits (Individual) (No. of units)	3679	W3,S2	SDG 1& 6
Roof Rain Water harvesting (No. of units)	106	W3,S1,S3	SDG 1& 6

சிறப்பொடு பூசனை செல்லாது வானம்
வறக்குமேல் வானோர்க்கும் ஈண்டு

குறள் - 18

The earth beneath a barren sky
Would offerings for the gods deny

Thirukkural - 18

CHAPTER 7

IMPLEMENTATION OF GP PLANS

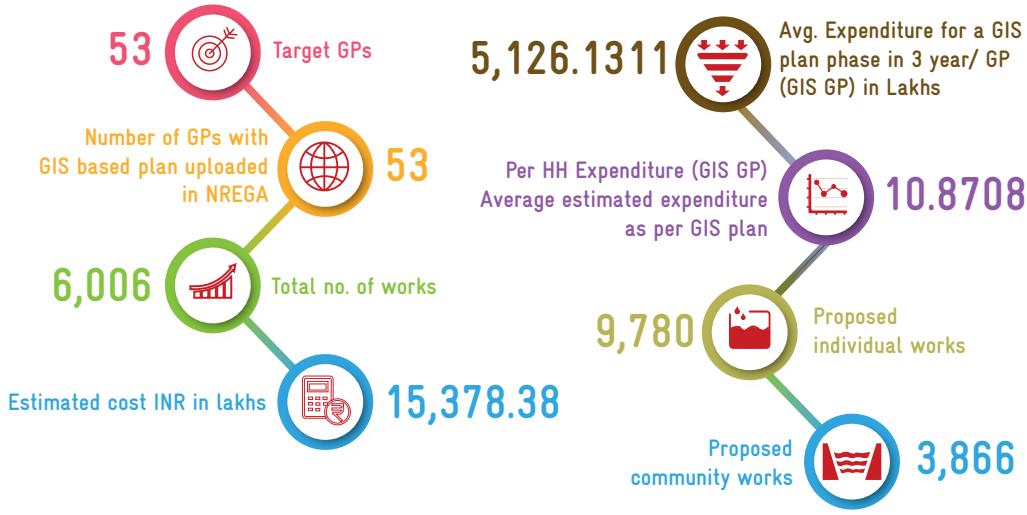
7 IMPLEMENTATION OF GP PLANS

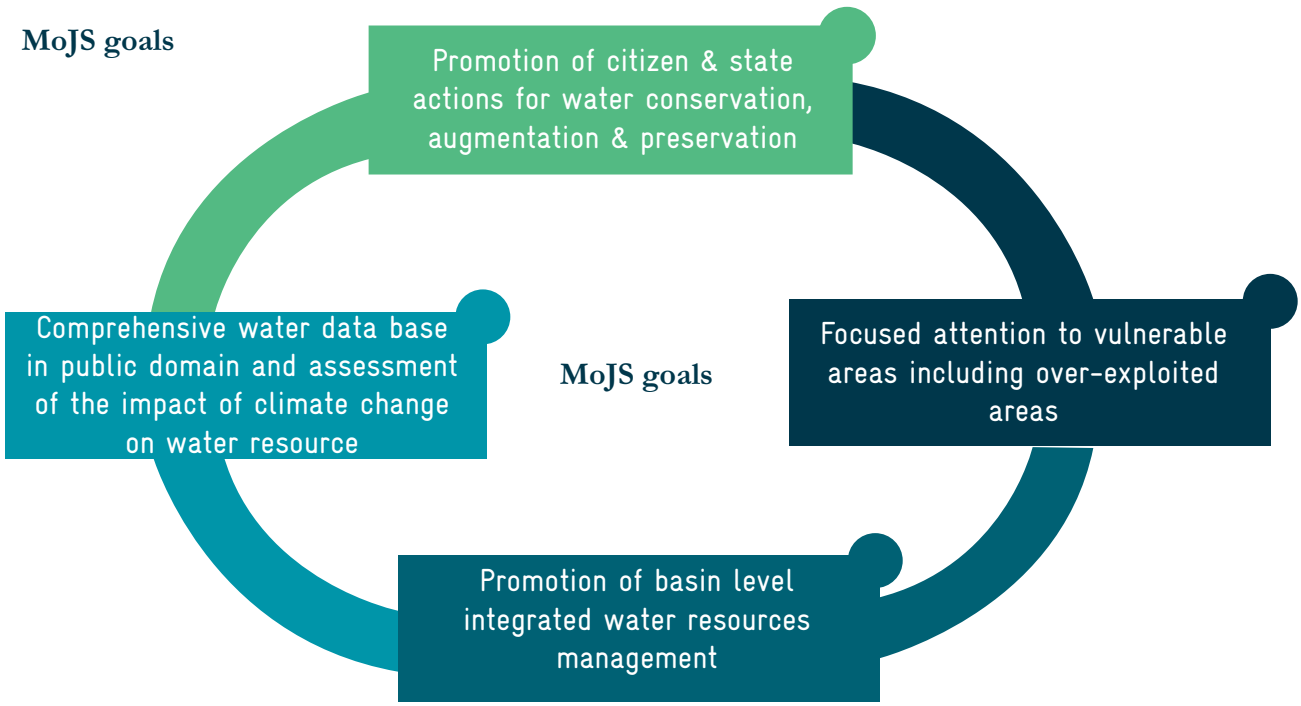
Execution of GP plans includes integrating all verified, approved works in MORD's web enabled application NREGA Soft (https://nrega.nic.in) for mainstreaming WASCA. The target GPs are identified first, the status of GIS based plans and total works along with its expenditure and category wise estimation cost of works as per GIS Plan, GIS based planning cumulative report are uploaded as given below

7.1 INTEGRATION INTO NREGA SOFT

WASCA is progressing towards digitizing and integrating GP level GIS based plans, both NRM and Non-NRM into Mahatma Gandhi NREGS portal. The performance and implementation of GP plans of Kamuthi Block is listed in Table 26 and work progress, expenditure during the past 3 financial years are shown in Figure 7.1 and 7.2. The Total No. of works, ongoing and completed GIS works are shown in Figure 7.3. The GP wise recommendations and works uploaded are given in Annexure 7.1.

TABLE 26. GIS-BASED PLAN IMPLEMENTATION- KEY PARAMETERS PERFORMANCE IN KAMUTHI BLOCK





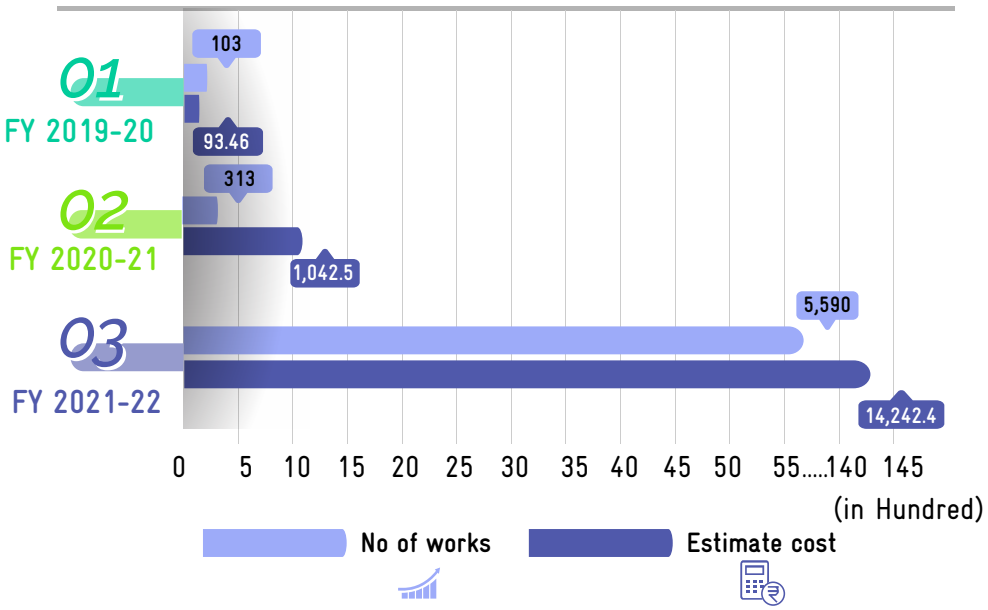


Figure 7.1. Work progress in last 3 years

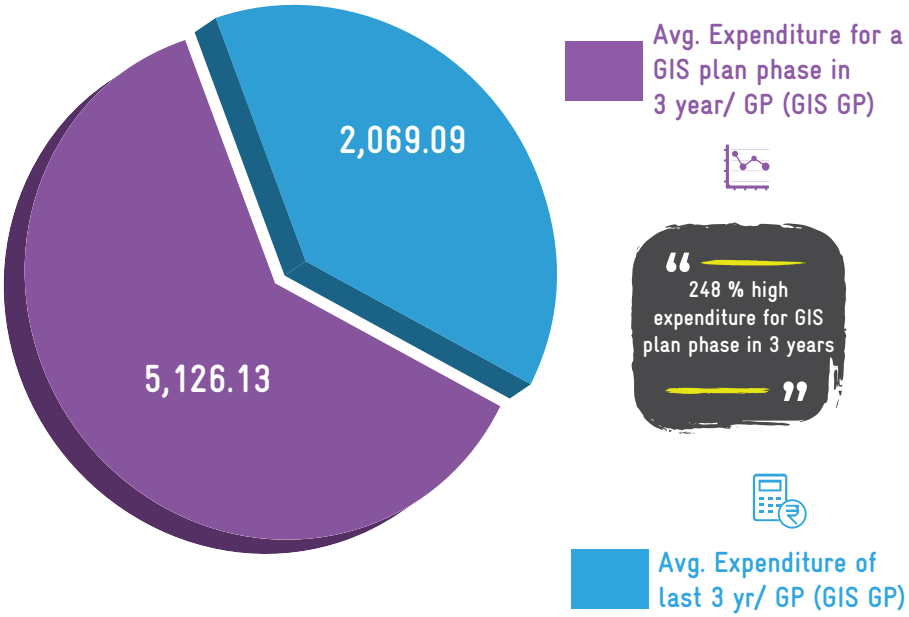
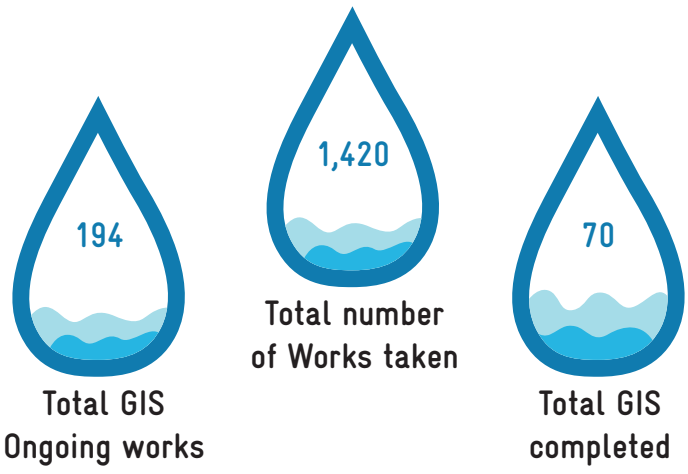


Figure 7.2. Average Expenditure for GIS plan in last 3 years



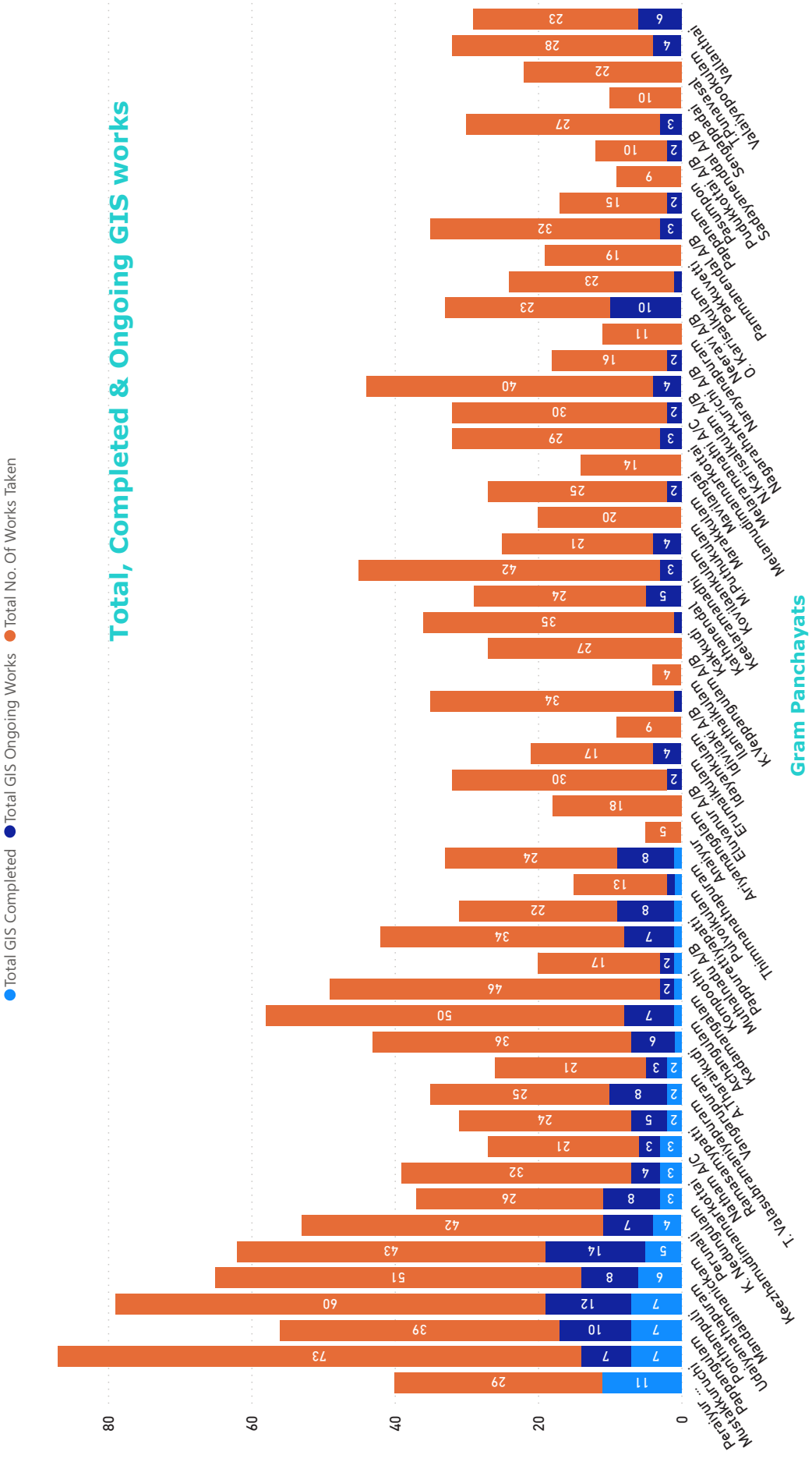
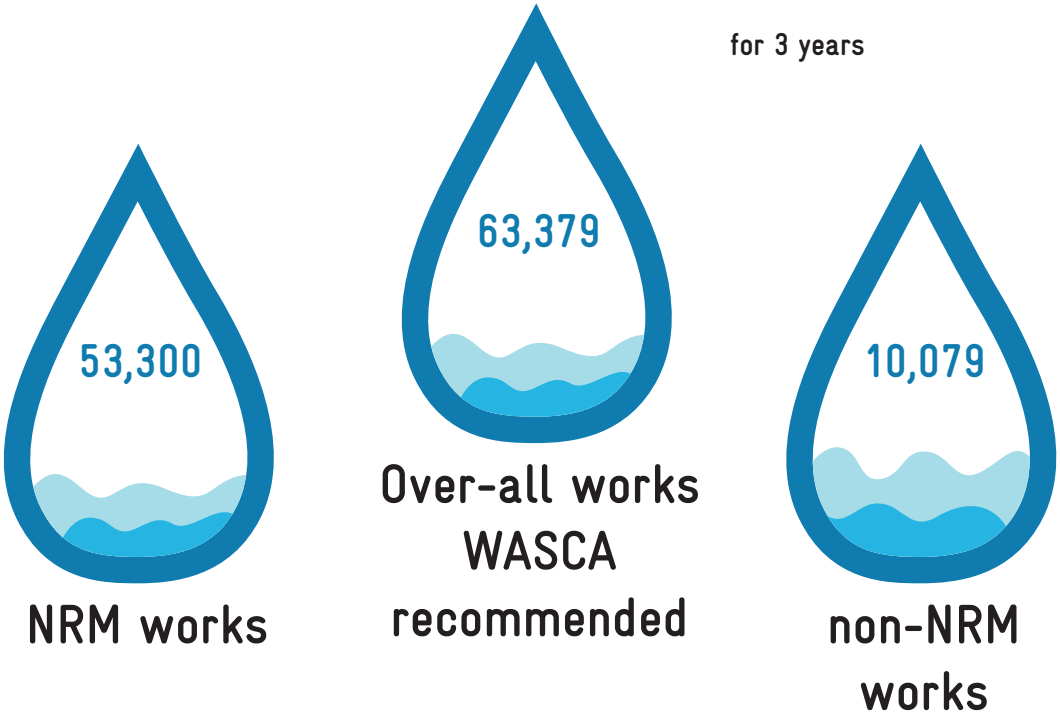


Figure 7.3. GP wise total, completed and ongoing GIS works (2021-22)

7.2 WASCA RECOMMENDED NRM AND NON-NRM WORKS

WASCA recommended 63,379 works for a period of 3 years, out of which 53,300 are NRM works and 10,079 are non NRM works (Figure 7.4). A total of 5,483 works has been uploaded so far for the financial year 2021-22 as on 11/03/2022.



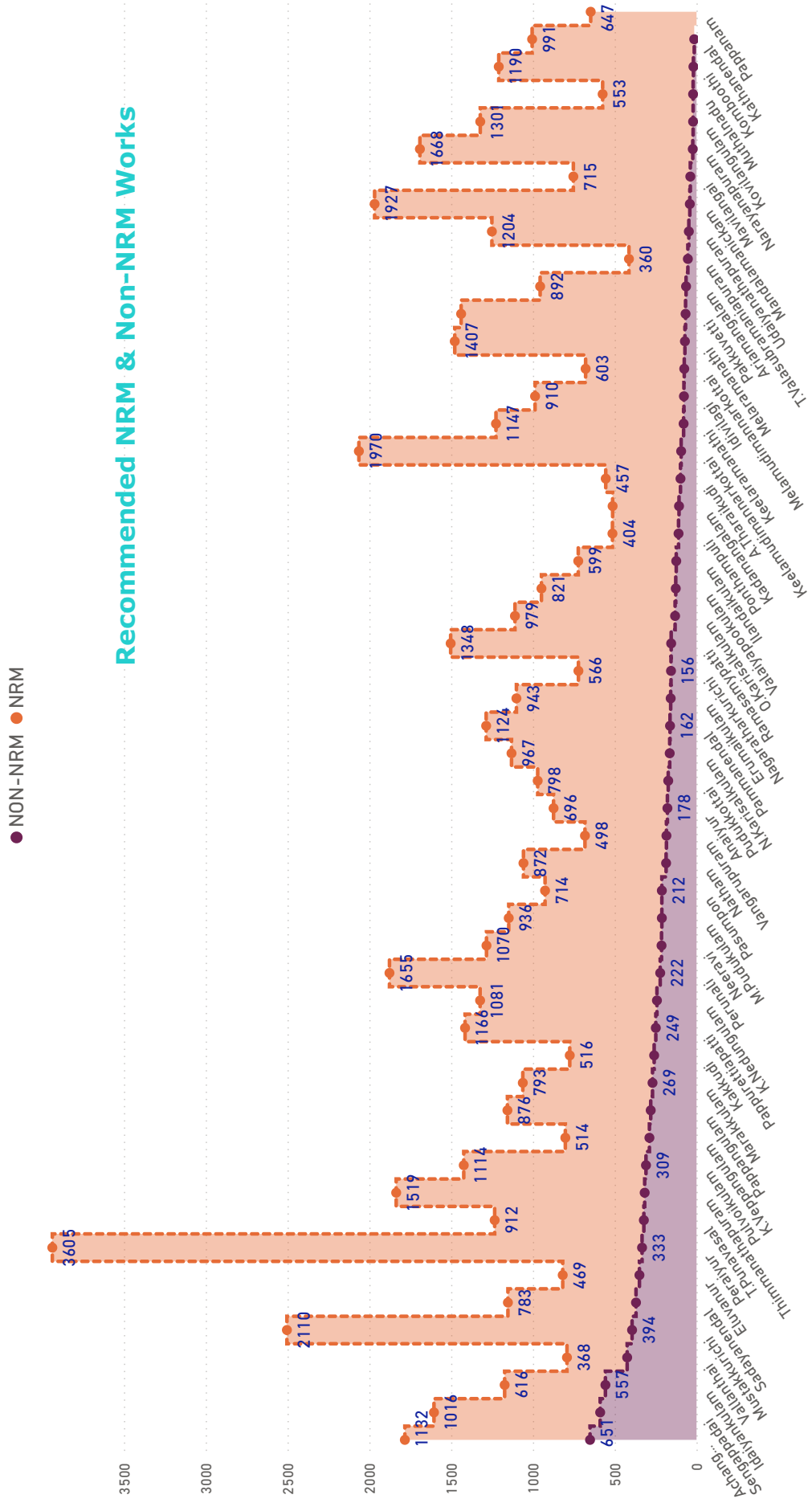


Figure 7.4. GP wise recommended NRM and Non-NRM works

7.3 ONGOING WORKS

The ongoing works in Kamuthi Block includes Water Conservation and Water Harvesting, Works on Individuals Land (Category IV), Rural Connectivity, and Drought Proofing. A total of 390 works are ongoing in the Block, in which individual beneficiaries works are more followed by WCWH works while rural infrastructure works are less in numbers (Figure 7.5), GP and work category wise ongoing works are tabulated in Annexure 7.2.

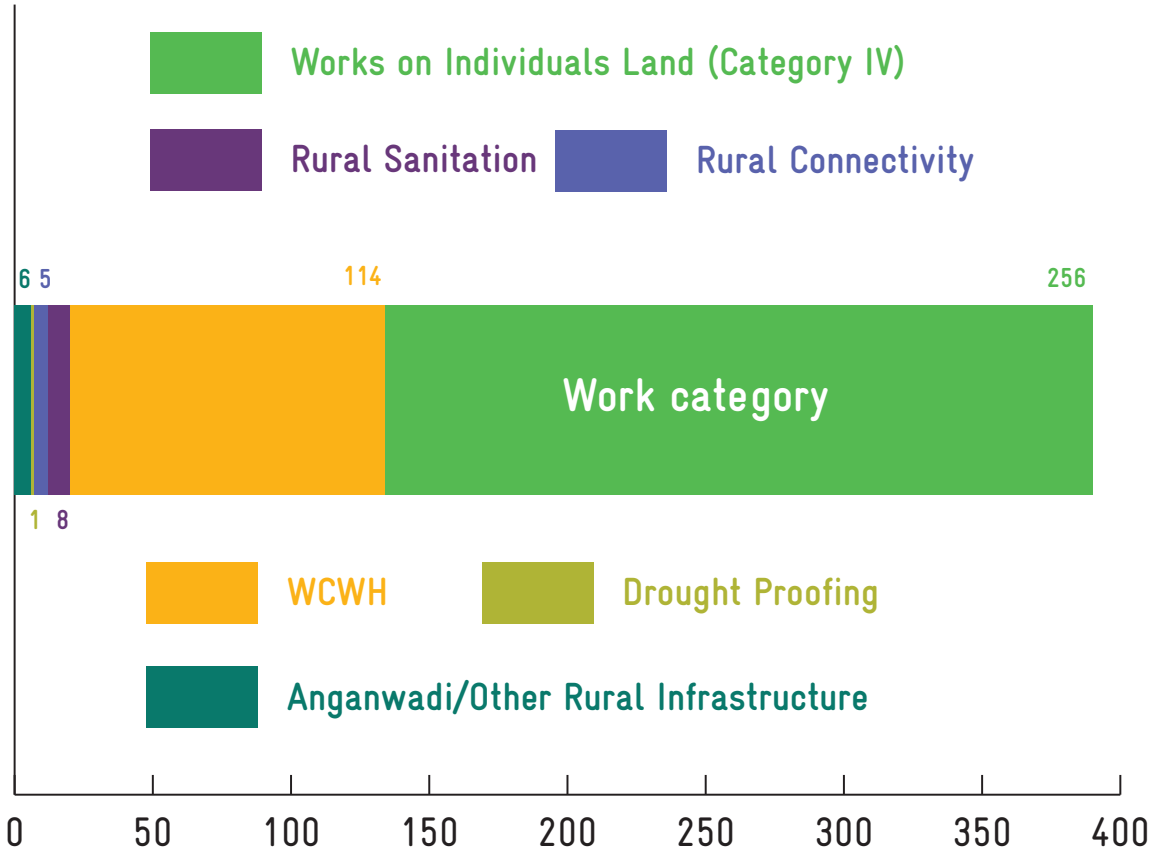


Figure 7.5. Category-wise ongoing works in Kamuthi Block

7.4 CATCH THE RAIN

The NWM's campaign "Catch The Rain" with the tagline "Catch the rain, where it falls, when it falls" is to nudge the states and stakeholders to create appropriate Rain Water Harvesting Structures (RWHS) suitable to the climatic conditions and sub-soil strata before monsoon season. Under this campaign, drives to make check dams, water harvesting pits, rooftop RWHS, removal of encroachments and de-silting of tanks to increase their storage capacity, removal of obstructions in the channels which bring water to them from the catchment areas, repairs to step-wells and using defunct bore wells and unused wells to put water back to aquifers etc., are to be taken up with the active participation of people. The total expenditure towards progressive works on Catch the Rain campaign of Kamuthi Block is Rs. 2,987.6 Lakhs and nearly 89.4 % of the expenditure utilized for water conservation and Rain water harvesting (Figure 7.6).

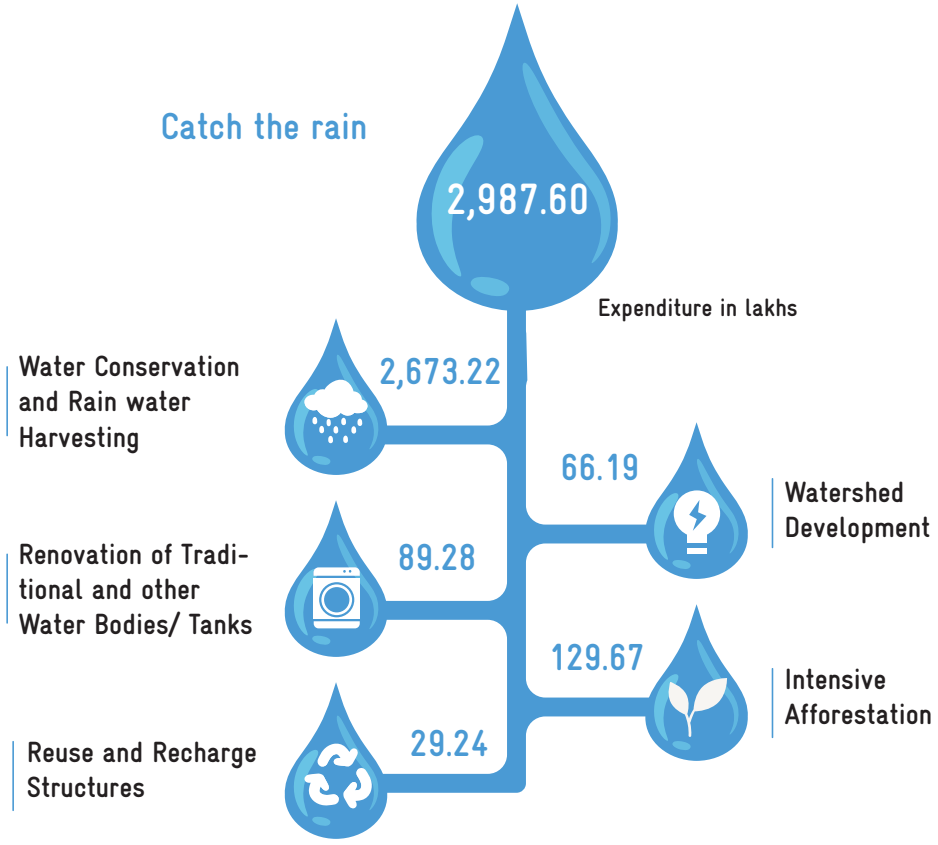
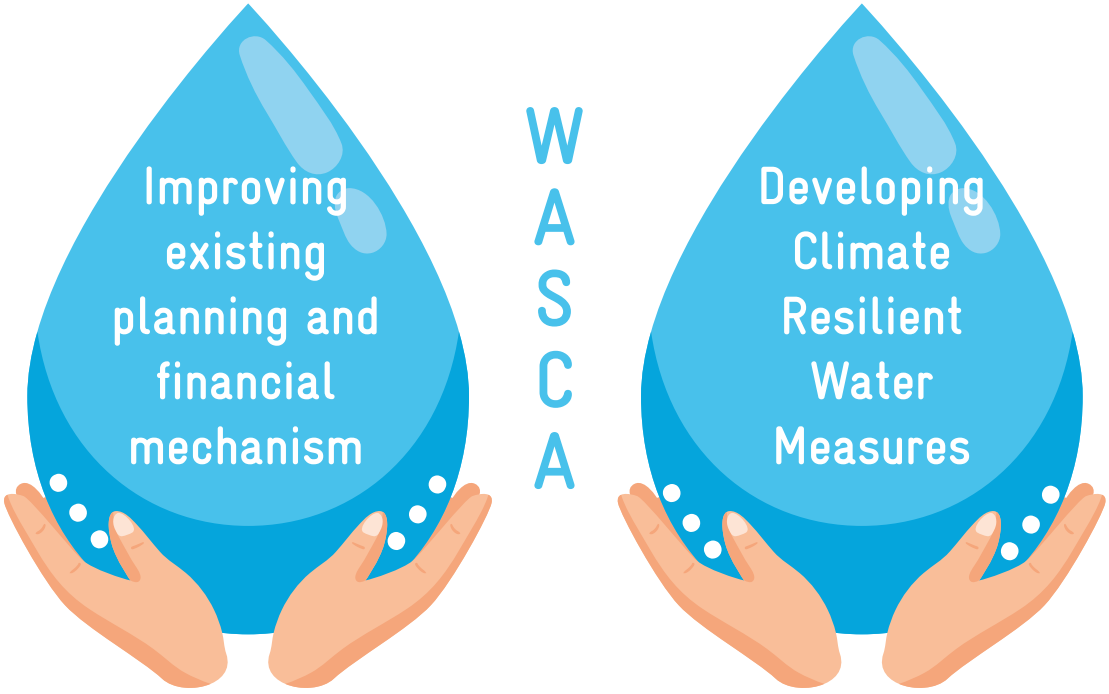


Figure 7.6. Expenditure for Catch the Rain campaign in Kamuthi Block



தானம் தவம்இரண்டும் தங்கா வியன்உலகம்
வானம் வழங்கா தெனின்

குறள் - 19

Were heaven above to fail below
Nor alms nor penance earth would show

Thirukkural - 19

CHAPTER 8

8 CASE STUDY

This chapter illustrates how CWRM planning processes unfolds the analysis, results and impacts from macro-watershed to the lowest planning unit, the GP through case studies. Case studies explain the need for an integrated multi-tier approach to address the issues of water conservation seen through the lens of climate change. Case studies on micro-watersheds and GP are expounded holistically through macro-watersheds to warrant long-term benefits. This integrated approach will help in watershed assessment, management and monitoring of implementation projects efficiently.

8.1 MACRO-WATERSHEDS OF KAMUTHI BLOCK

Kamuthi Block comes under Vembar, Lower Gundar, Paralaiyar, Gridhambal, Kanal Odai and Upper Gundar sub-basins of Gundar basin. Gundar Malattar and Vegavathi Rivers flow through the Block. Giridhambal, Gundar and Vembar macro- watersheds cover the Block and has 167 micro-watersheds. Giridhambal watershed (4A1D3) has 52 micro-watersheds covering an area of 18770.04 ha. Gundar watershed (4A1D2) has 88 Micro-watersheds covering an area of 34332.98 ha. Vembar watershed (4A1D1) consists of 27 micro-watersheds covering an area of 4001.61 ha (Table 27). Out of 53 GPS in Kamuthi Block, 16 GPs fall under Giridhambal watershed (4A1D3), 32 GPs fall under Gundar watershed (4A1D2) and 5 GPs fall under Vembar watershed (4A1D1) (Table 28). The map below shows the boundary of Giridhambal, Gundar and Vembar watershed boundaries on Kamuthi Block boundary. The micro-watershed based works are identified using Basin, Sub-basin, and Micro-watershed with GP administrative boundaries through Composite Water Resources Management plan approach.

TABLE 27. GENERAL DESCRIPTION OF MACRO-WATERSHEDS COVERING KAMUTHI BLOCK

Macro-watershed	Area in ha	No. of micro-watersheds
Giridhambal	18770.04	52
Gundar	34332.98	88
Vembar	4001.61	27

TABLE 28. NO. OF GPs COVERED UNDER WATERSHEDS IN KAMUTHI BLOCK

Name of watershed	No. of GPs
Giridhambal	16
Gundar	32
Vembar	5

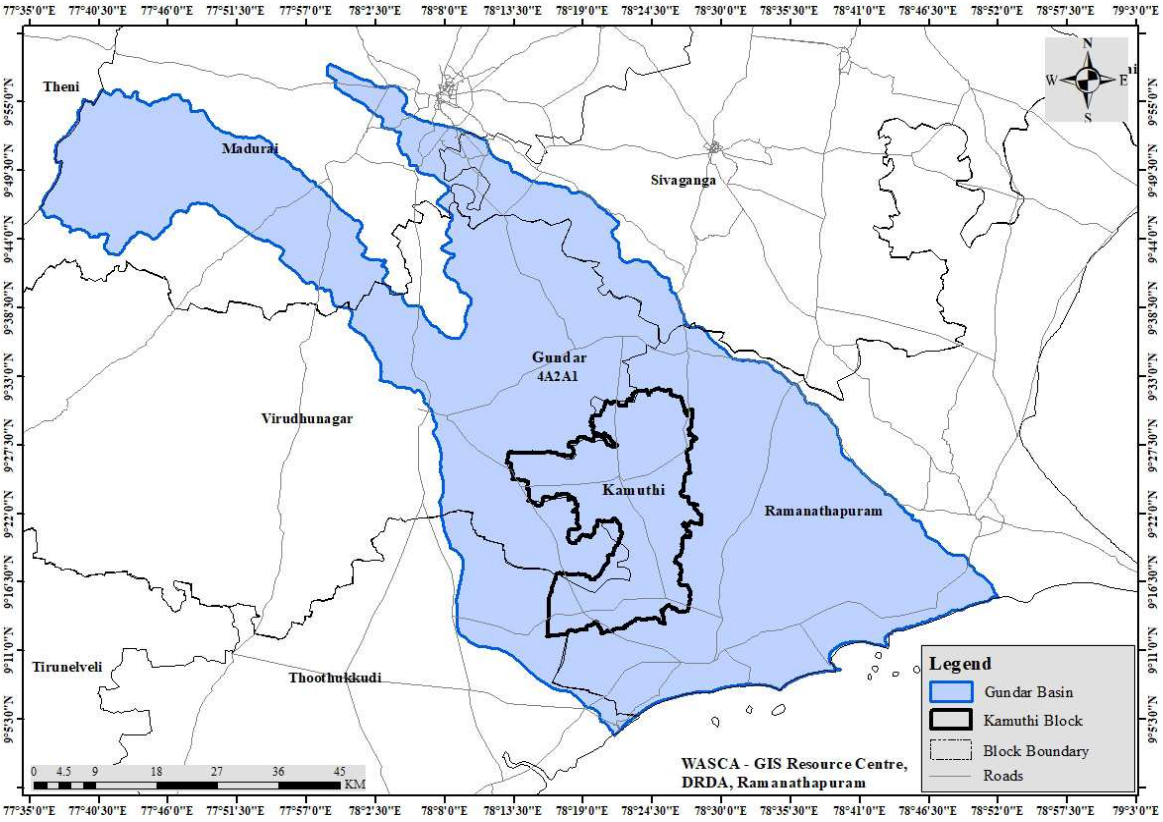


Figure 8.1. Macro-watershed map - Kamuthi Block

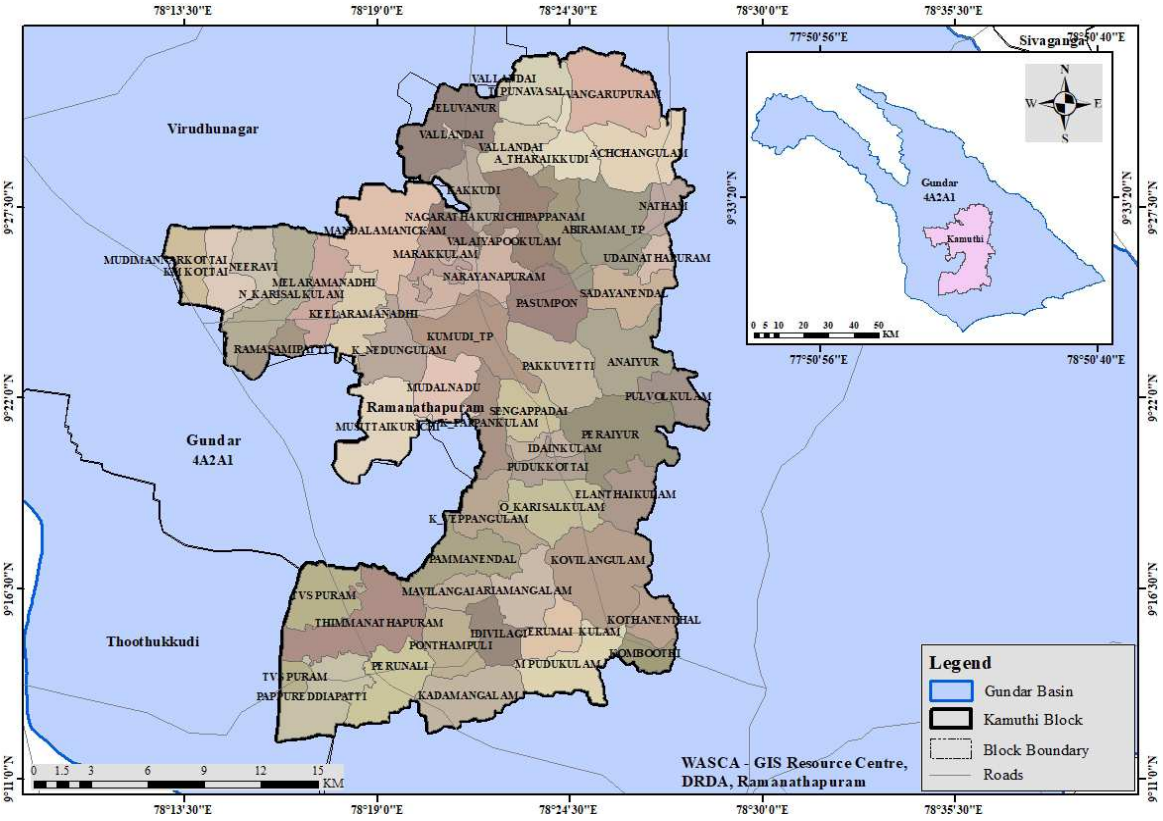


Figure 8.2. Macro-watershed with GPs

All the proposed works are identified using basin, sub-basin, and micro-watershed with GP administrative boundaries through Composite Water Resources Management plan approach. The ridge details, proposed works in all macro-watersheds of GPs in Kamuthi Block are listed in Tables 29 to 37.

TABLE 29. MICRO-WATERSHED FALLING UNDER GIRIDHAMBAL MACRO-WATERSHED IN KAMUTHI BLOCK

S.No	Micro-watershed Code	Micro-watershed Area in ha.	Ridge Type
1	4A1D3d03a	24.79906984	Lower
2	4A1D3c08c	66.59569115	
3	4A1D3d14a	206.0802776	
4	4A1D3d02a	610.7445499	
5	4A1D3d13a	595.2809097	
6	4A1D3c08b	722.8432667	
7	4A1D3d13c	393.2375757	
8	4A1D3d02b	259.7961328	
9	4A1D3d13b	420.7849633	
10	4A1D3d02c	474.5311562	
11	4A1D3d01d	572.5116129	
12	4A1D3c08a	384.6069188	
13	4A1D3d12b	616.3045581	
14	4A1D3d01c	359.1851156	
15	4A1D3d12d	469.5494072	
16	4A1D3c03b	28.26453086	
17	4A1D3d23c	136.9405779	
18	4A1D3d01b	596.6570739	
19	4A1D3d12a	423.2665359	
20	4A1D3d12c	470.4445791	
21	4A1D3c07d	219.7452266	
22	4A1D3d01a	744.5663144	
23	4A1D3d23b	322.368804	
24	4A1D3d23a	505.7002914	
25	4A1D3c01b	87.80771163	
26	4A1D3c07c	436.5744239	
27	4A1D3d11d	567.525917	
28	4A1D3d11b	563.297758	
29	4A1D3d11a	493.6442465	
30	4A1D3c07b	305.717313	
31	4A1D3d11c	617.4900842	
32	4A1D3c01a	117.904825	
33	4A1D3c07a	357.0055653	
34	4A1D3b03d	500.9535904	
35	4A1D3b03e	485.9622109	
36	4A1D3b06a	199.8907746	
37	4A1D3b06c	56.69650473	
38	4A1D3b06b	253.9902815	

39	4A1D3b03c	400.8686909	Lower
40	4A1D3b03b	696.6723716	
41	4A1D3b07a	21.55073071	
42	4A1D3b03a	337.3295595	
43	4A1D3b02b	673.5512156	
44	4A1D3b05d	251.8611519	
45	4A1D3b05a	62.40117623	
46	4A1D3b02c	403.4737303	
47	4A1D3b05c	10.96999165	
48	4A1D3b02d	559.9886657	
49	4A1D3b02a	486.3757553	
50	4A1D3b01c	0.015476991	
51	4A1D3b01b	115.5714959	
52	4A1D3b01a	80.14959021	

TABLE 30. LIST OF GPs WITH TYPE OF RIDGE FALLING UNDER GIRIDHAMBAL MACRO-WATERSHED IN KAMUTHI BLOCK

S.No	GP Name	Ridge Type
1	Achangulam	Lower
2	Anaiyur	
3	A.Tharaikudi	
4	Ilandaikulam	
5	Nagaratharkurichi	
6	Narayanapuram	
7	Natham	
8	Pakkuvetti	
9	Pappanam	
10	Pasumpon	
11	Peraiyur	
12	Pulvoikulam	
13	Sadayanendal	
14	T.Punavasal	
15	Vallanthai	
16	Vangarupuram	

TABLE 31. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPE OF RIDGE FALLING UNDER GIRIDHAMBAL MACRO-WATERSHED IN KAMUTHI BLOCK

S.No	Proposed Work	Ridge Type	Extent
1	Contour Continuous Bunds (CCB) for Afforestation area (m)	Lower	3,169
2	Afforestation in Public/common lands (ha)		316.95
3	Drainage Line Treatment (m)		65.14
4	Block Plantation (Community) (ha)		502.36
5	Avenue plantation (km)		90.05
6	Composting (No.)		1,066

7	Canal Bund Plantation (km)	Lower	61.24
8	Restoration of water bodies: Tanks and Ooranis (No.)		177
9	Artificial Recharge Structure (No.)		369
10	Farm Bunding with Boundary Trenches - Individual (ha)		219.31
11	Construction of Farm Ponds - Individual (No.)		737
12	Land development - Individual (ha)		921.94
13	Azolla units - Individual (No.)		74
14	NADEP Vermi compost (No.)		74
15	Fodder development - Community & Individual (No.)		74
16	Cattle Shelters (No.)		74
17	Goat Sheep Shelters (No.)		1,151
18	Cattle Trough (No.)		74
19	Soak Pits (Community) (No.)		122
20	Soak Pits (Individual) (No.)		1,208
21	Roof Rain Water Harvesting (No.)		32
22	Poultry Shed (No.)		430
23	Silt application (No.)		370
24	Mini Forest (No.)		45

TABLE 32. MICRO-WATERSHED FALLING UNDER GUNDAR MACRO-WATERSHED IN KAMUTHI BLOCK

S.No	Micro-watershed Code	Micro-watershed Area in ha.	Ridge Type
1	4A1D2d01d	188.0379081	Lower
2	4A1D2d01b	435.9826329	
3	4A1D2d02c	29.64001175	
4	4A1D2d01c	448.3465868	
5	4A1D2d02b	340.8665311	
6	4A1D2d14a	178.9512422	
7	4A1D2d02a	215.614989	
8	4A1D2d01a	470.002773	
9	4A1D2c04d	21.89315025	
10	4A1D2c01a	355.5895866	
11	4A1D2c08b	43.48762974	
12	4A1D2c04c	0.775813311	
13	4A1D2c03c	959.4500159	
14	4A1D2c03b	622.1058534	
15	4A1D2c01b	51.26022677	
16	4A1D2c03a	624.5340014	
17	4A1D2c08a	603.4238919	
18	4A1D2c04b	364.507077	
19	4A1D2c07b	392.8382442	
20	4A1D2c07d	404.3657346	
21	4A1D2c04a	621.8517773	
22	4A1D2c05c	918.3407867	

23	4A1D2c02b	391.3052774	
24	4A1D2c05a	798.8293737	
25	4A1D2c07a	429.8571068	
26	4A1D2c07c	444.7130582	
27	4A1D2c02c	899.4929204	
28	4A1D2c02a	473.7901591	
29	4A1D2c05b	460.5707213	
30	4A1D2b04c	716.8367934	
31	4A1D2c06b	385.4984245	
32	4A1D2b03c	654.9633218	
33	4A1D2c06a	132.218365	
34	4A1D2c06c	331.9703075	
35	4A1D2b03b	883.2507103	
36	4A1D2b03a	370.5059894	
37	4A1D2b08c	128.5019212	
38	4A1D2b02a	268.5737644	
39	4A1D2b04b	479.5915186	
40	4A1D2b02b	379.5639218	
41	4A1D2b04a	309.8138269	
42	4A1D2b01b	240.5937814	
43	4A1D2b08b	408.2802723	
44	4A1D2b05b	248.540271	
45	4A1D2b06b	159.7743089	Lower
46	4A1D2b01a	796.9384919	
47	4A1D2b09a	17.96649192	
48	4A1D2b05a	665.4839551	
49	4A1D2b06d	0.027710984	
50	4A1D2b06a	403.7592352	
51	4A1D2b08a	210.7770935	
52	4A1D2b11c	55.10624893	
53	4A1D2b05c	507.7300802	
54	4A1D2b07b	498.1185328	
55	4A1D2b06c	288.6219549	
56	4A1D2b07a	545.7730921	
57	4A1D2a06d	390.408796	
58	4A1D2a07d	524.0350226	
59	4A1D2b14c	365.2740156	
60	4A1D2a06c	624.8626496	
61	4A1D2b14d	220.5078986	
62	4A1D2b10a	433.5053987	
63	4A1D2b12a	51.7954982	
64	4A1D2a06b	533.3898793	
65	4A1D2a07c	379.8566905	
66	4A1D2b12b	461.1752319	
67	4A1D2a05f	407.4201711	
68	4A1D2b14b	204.1739656	

69	4A1D2a06e	116.4490591	Lower
70	4A1D2a06a	459.5427232	
71	4A1D2b10b	277.4209369	
72	4A1D2a05e	604.1635976	
73	4A1D2a05d	503.1697827	
74	4A1D2a05b	837.5578829	
75	4A1D2a08a	823.2471681	
76	4A1D2b14a	599.9559571	
77	4A1D2a07b	434.9217315	
78	4A1D2a04a	545.8054835	
79	4A1D2a07a	150.2641132	
80	4A1D2b10c	412.1025807	
81	4A1D2a05c	256.248565	
82	4A1D2a08b	129.5226662	
83	4A1D2a08c	707.5016355	
84	4A1D2a04b	139.7444919	
85	4A1D2a01c	106.9328206	
86	4A1D2a03a	52.79483161	
87	4A1D2a05a	292.5572225	
88	4A1D2a04c	7.463526704	

TABLE 33. LIST OF GPs WITH TYPE OF RIDGE FALLING UNDER GUNDAR MACRO-WATERSHED IN KAMUTHI BLOCK

S.No	GP Name	Ridge Type
1	Ariamangalam	Lower
2	Eluvanur	
3	Erumaikulam	
4	Idaiyankulam	
5	Idivilagi	
6	Kakkudi	
7	Kathanendal	
8	Keelamudimannarkottai	
9	Keelaramanathi	
10	K.Nedungulam	
11	Komboothi	
12	Kovilangulam	
13	K.Veppangulam	
14	Mandalamanickam	
15	Marakkulam	
16	Mavilangai	
17	Melamudimannarkottai	
18	Melaramanathi	
19	M.Pudukulam	
20	Mustakkurichi	
21	Muthalnadu	

22	Neeravi	Lower
23	N.Karisalkulam	
24	O.Karisalkulam	
25	Pammanendal	
26	Pappangulam	
27	Ponthampuli	
28	Pudukkottai	
29	Ramasamypatti	
30	Sengappadai	
31	Udaiyanathapuram	
32	Valaiyapookulam	

TABLE 34. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPE OF RIDGE FALLING UNDER GUNDAR MACRO-WATERSHED IN KAMUTHI BLOCK

S.No	Proposed Work	Ridge Type	Extent
1	Contour Continuous Bunds (CCB) for Afforestation area (m)	Lower	843
2	Afforestation in Public/common lands (ha)		84.3
3	Drainage Line Treatment (km)		108.26
4	Block Plantation (Community) (ha)		279.01
5	Avenue plantation (km)		134.44
6	Composting (No.)		2,795
7	Canal Bund Plantation (km)		97.37
9	Restoration of water bodies: Tanks and Ooranis (No.)		67
10	Artificial Recharge Structure (No.)		489
11	Farm Bunding with Boundary Trenches - Individual (ha)		498.33
12	Construction of Farm Ponds - Individual (No.)		1817
13	Land development - Individual (ha)		227.33
14	Dryland Horticulture/Agroforestry - Individual (ha)		2,492
15	Azolla units - Individual (No.)		563
16	NADEP Vermi compost (No.)		563
17	Fodder development - Community & Individual (No.)		563
18	Cattle Shelters (No.)		563
19	Goat Sheep Shelters (No.)		1,447
20	Cattle Trough (No.)		563
21	Soak Pits (Community) (No.)		212
22	Soak Pits (Individual) (No.)		2,133
23	Roof Rain Water Harvesting (No.)		62
24	Poultry Shed (No.)		497
25	Nutri Garden (No.)		32
26	Silt application (No.)		31
27	Mini Forest (No.)		57

TABLE 35. MICRO-WATERSHED FALLING UNDER VEMBAR MACRO-WATERSHED IN KAMUTHI BLOCK

S.No	Micro-watershed Code	Micro-watershed Area in ha.	Ridge Type
1	4A1D1f08b	12.85897161	Lower
2	4A1D1f05c	0.293390444	
3	4A1D1f05b	5.319540063	
4	4A1D1c08d	20.58286152	
5	4A1D1b10c	131.5744788	
6	4A1D1b12a	82.86609712	
7	4A1D1b10a	268.2736867	
8	4A1D1b10b	235.464771	
9	4A1D1b11a	118.4390785	
10	4A1D1b09c	357.7560491	
11	4A1D1c03b	327.6632641	
12	4A1D1c08c	243.5060922	
13	4A1D1b09b	376.4716782	
14	4A1D1c07b	227.115673	
15	4A1D1b08c	203.6778331	
16	4A1D1c06c	112.5732112	
17	4A1D1c08a	203.5285245	
18	4A1D1c05c	4.940643372	
19	4A1D1b09a	163.3464508	
20	4A1D1b08b	364.4524412	
21	4A1D1b08a	143.750081	
22	4A1D1c07a	91.88486901	
23	4A1D1b06c	4.884920376	
24	4A1D1b07c	2.924425062	
25	4A1D1c06b	191.2445009	
26	4A1D1c05b	81.07216732	
27	4A1D1c06a	25.1422525	

TABLE 36. LIST OF GPs WITH TYPE OF RIDGE FALLING UNDER VEMBAR MACRO-WATERSHED IN KAMUTHI BLOCK

S.No	GP Name	Ridge Type
1	Kadamangalam	Lower
2	Pappurettiapatti	
3	Perunali	
4	T.Valasubramaniapuram	
5	Thimmanathapuram	

TABLE 37. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPE OF RIDGE FALLING UNDER VEMBAR MACRO-WATERSHED IN KAMUTHI BLOCK

S.No	Proposed Work	Ridge Type	Extent
1	Contour Continuous Bunds (CCB) for Afforestation area (m)	Lower	156.4
2	Afforestation in Public/common lands (ha)		15.64
3	Drainage Line Treatment (m)		297
4	Block Plantation (Community) (ha)		65.83
5	Avenue plantation (km)		26.48
6	Composting (No.)		900
7	Canal Bund Plantation (km)		8.75
9	Restoration of water bodies: Tanks and Ooranis (No.)		36
10	Artificial Recharge Structure (No.)		90
11	Farm Bunding with Boundary Trenches - Individual (ha)		1,113.27
12	Construction of Farm Ponds - Individual (No.)		430
13	Land development - Individual (ha)		537.22
14	Dryland Horticulture/Agroforestry - Individual (ha)		557
15	Azolla units - Individual (No.)		15
16	NADEP Vermi compost (No.)		15
17	Fodder development - Community & Individual (No.)		15
18	Cattle Shelters (No.)		15
19	Goat Sheep Shelters (No.)		112
20	Cattle Trough (No.)		15
21	Soak Pits (Community) (No.)		26
22	Soak Pits (Individual) (No.)		264
23	Roof Rain Water Harvesting (No.)		10
24	Poultry Shed (No.)		15
25	Nutri Garden (No.)		5
26	Silt application (No.)		515
27	Mini Forest (No.)		11

8.2 MODEL MICRO -WATERSHED- ACHCHANGULAM

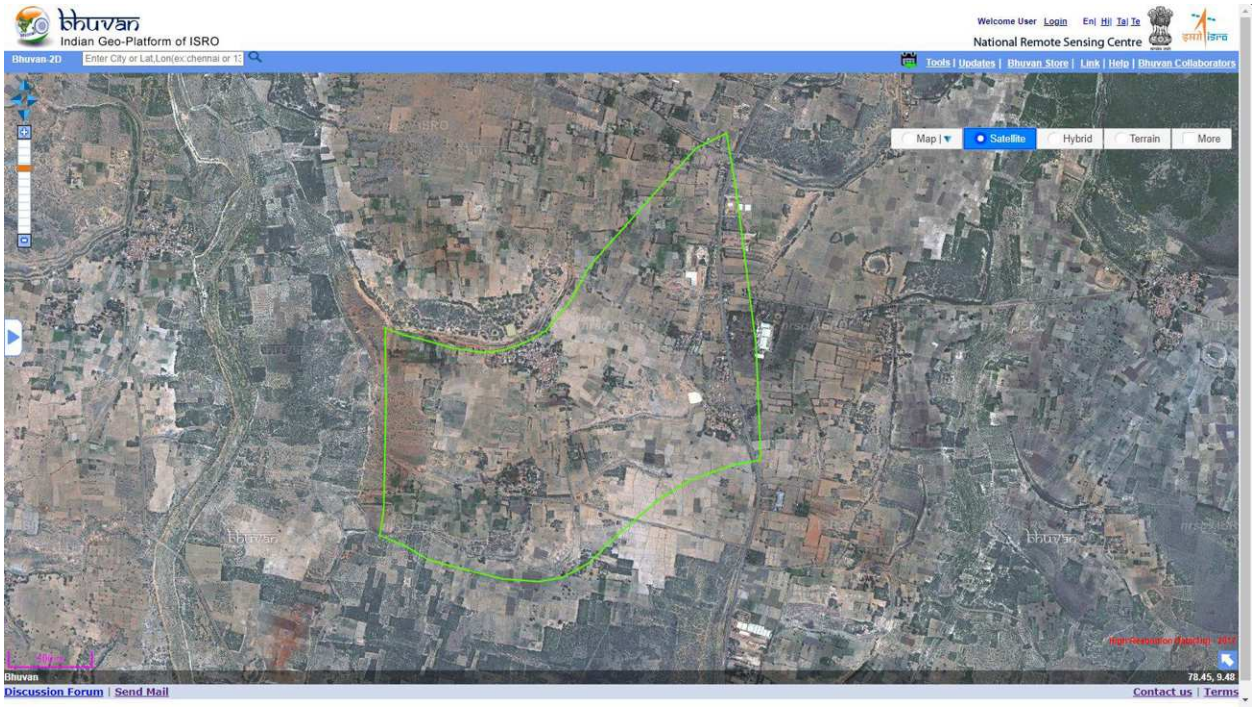


Figure 8.3. Satellite image of Achchangulam micro-watershed

The micro-watershed case study addresses the issues of water conservation and climate change through an integrated approach. The decentralized micro-watershed planning has been conceived for holistic development and management to ensure sustainable long-term benefits. The micro-watershed plan has been sequenced from ridge to valley for proper implementation of different development programs. This includes coordination of various natural components like groundwater, surface water, geology, hydrogeology, catchment, land use, soil, population, salt affected water along with various water resource supply and demand component. The ultimate goal is to achieve and maintain a balance between resources development to increase the welfare of the population.

ABOUT ACHCHANGULAM MICRO-WATERSHED

Achchangulam micro-watershed falls under Achchangulam GP, in Kamuthi Block, Ramanathapuram District. The satellite image of the micro-watershed is shown in Figure 8.3. This micro-watershed is the part of Giridhambal macro-watershed in Gundar sub-basin. The general information, geology, hydrogeology, natural drainage line, catchment area, ground water status, water budget of Achchangulam micro-watershed is given below in separate sections followed by proposed works, ridge wise proposed treatment area, estimated cost and required person days and key outcomes (Table 38 to 49 & Figure 8.4). The key CWRM parameters for the GPs falling in this micro-watershed is given in Annexure 8.

TABLE 38. GENERAL INFORMATION OF THE MICRO-WATERSHED

Description	Name/ Number/ Quantity/ Status
Name of the Micro-watershed	Achchangulam Micro-watershed
Micro-watershed Number	4A1D3d061c
Name of the Basin	Gundar Basin
Name of the sub basin	Gundar Sub Basin
Name of the Macro-watershed	Giridhambal
Number of GPs covered under the Micro-watershed	1
Name of the GP	Achchangulam
Latitude of Micro-watershed (From To)	9°28'11.549"N to 9°28'54.969"N
Longitude of Micro-watershed (From To)	78°25'37.843"E to 78°26'54.489"E
Total area of the Micro-watershed in ha	359.18
% of Micro-watershed area in Achchangulam GP	100
Area of Micro-watershed falling in Achchangulam GP (ha)	623.77
Total Population of Achchangulam GP	2,445
Annual Average Rainfall (mm)	821
Annual maximum Temperature (°C)	32.6
Annual Minimum Temperature (°C)	23.8
Evapo-Transpiration Losses of Achchangulam GP (ha.m)	55.30
Volumetric soil moisture availability (%)	17
Climate Risk	Drought
CVI Index Value for Achchangulam (Based on WASCA Climate study)	0.518 (High Water Vulnerability)
Agro-Climatic Zone	Southern Zone (TN 05)
Agro Ecological Sub-Region (ICAR)	Hot dry semi - arid eco sub region (18.1)
Status of Ground water in Achchangulam GP	Safe

TABLE 39. HYDROGEOLOGY & OTHER CHARACTERISTICS IN MICRO-WATERSHED

Type of Geomorphology	Fluvial Origin - Younger Alluvial Plain
Geomorphology occurrence in %	100
Principle Aquifer	Alluvium
Salt Affected Area passing through the micro-watershed	Sodic - Moderate
Type of lineaments passing through the micro-watershed	Nil
Barren & waste lands	Nil

TABLE 40. EXISTING WATER HARVESTING STRUCTURES IN ACHCHANGULAM GP

Sl.No.	Name of Structure	Achchangulam GP
		Existing Structures
		No.
1	Oorani	4
2	Tank	1
3	Farm Ponds	0
	Total	**5**

TABLE 41. CATCHMENT AREA OF MICRO-WATERSHED (STRANGE METHODOLOGY - CGWB)

Catchment Area in ha	Achchangulam GP
Good catchment area	744
Average catchment area	9
Bad catchment area	1,366

TABLE 42. GROUND WATER STATUS OF MICRO-WATERSHED

Firka Assessment Unit for Achchangulam GP in ha.m	
Name of the Firka (Assessment Unit) falling under micro-watershed	Abiramam
Recharge from other sources during monsoon season (ha.m)	1,290.46
Recharge from other sources during non-monsoon season (ha.m)	432.42

TABLE 43. SALINITY AND SEA WATER INTRUSION IN THE MICRO-WATERSHED

Pre monsoon Water Quality Index	Poor Quality
Post monsoon Water Quality Index	Poor Quality
Pre monsoon Sea Water Mixing Index	<=1
Post monsoon Sea Water Mixing Index	<=1

TABLE 44. WATER BUDGET OF GP'S FALLING IN MICRO-WATERSHED- ACHCHANGULAM GP

Water Budget in ha.m	Achchangulam GP
Water for Human	6.69
Water for agriculture	456.02
Water for livestock	0.77
Village wise water required	463.50
Available run-off from rain water (derived from Strange method)	321.50
Harvested Runoff from Water Harvesting Activities	3.5
Potential Harvesting from proposed Interventions	39.8
Total Water harvested	43.3
Water demand and Supply Difference	-420.2
Water demand supply gap status	Deficient
Per capita Water Availability in cum	1314.92
International Standard per capita water Availability (cum)	1,700
Water Availability Gap (cum)	-385.08
Water security status	Water Stress

TABLE 45. GP WISE PROPOSED MICRO-WATERSHED WORKS – ACHCHANGULAM GPs

Proposed Work	Achchangulam GP
Proposed works in Upper Ridge	0
Proposed works in Middle Ridge	0
Proposed works in Lower Ridge	70
Total works	70

TABLE 46. RIDGE WISE TREATMENT AREA ESTIMATED COST AND PERSON DAYS REQUIRED- ACHCHANGULAM GPs

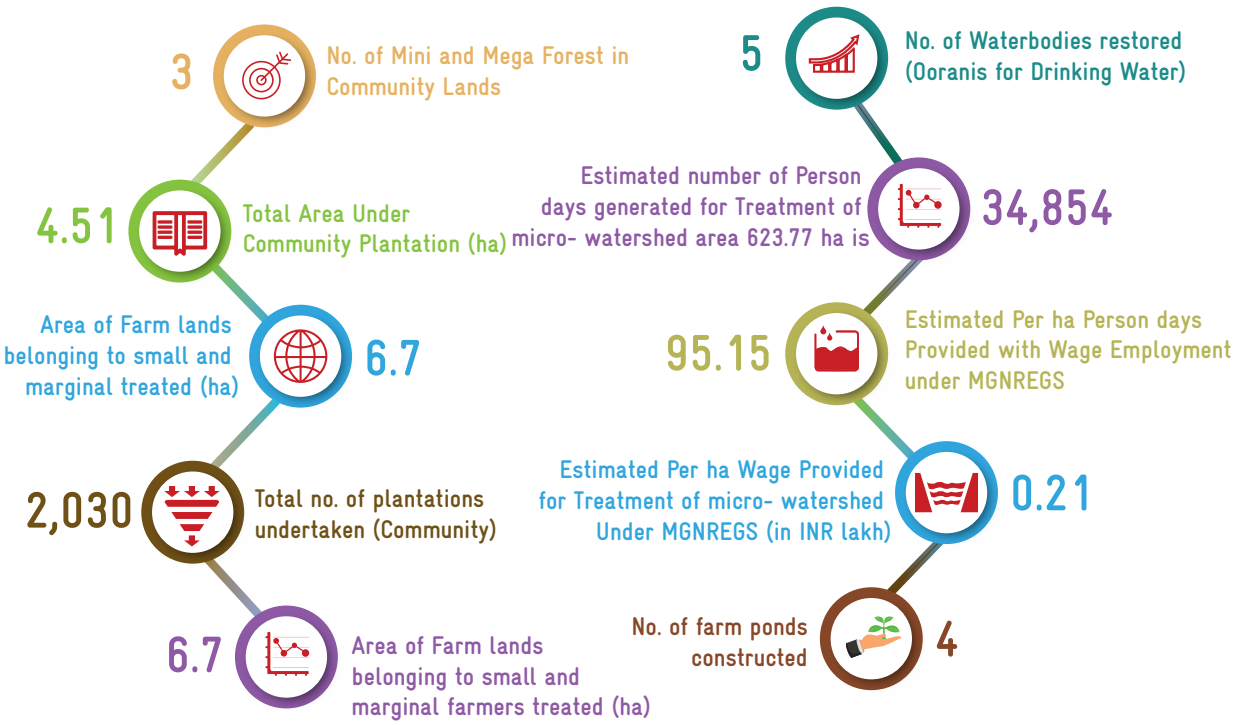
Ridge Type	Sathanoor GP
Upper Ridge	
Estimated cost for Upper Ridge area (INR in Lakhs)	No Upper Ridge Falling in the GP
Total area in ha of Upper Ridge	
Treatment cost (INR in Lakhs)	
Middle Ridge	
Estimated cost for Middle Ridge area	No Upper Ridge Falling in the GP
Total area in ha of Middle Ridge	
Treatment cost of Middle Ridge (INR in Lakhs)	
Upper & Middle Ridge	
Estimated Person days generated for Treatment of Upper and Middle Ridge	No Upper & Middle Ridge Falling in the GP
Lower Ridge	
Estimated cost for Lower Ridge area (INR in Lakhs)	104.40
Total area in ha of Lower Ridge	623.77
Estimated Person days generated for Treatment of Lower Ridge	**34,854**
Treatment cost of Lower Ridge Lakhs/ha	**0.167**

Achchangulam GP	Treatment cost (INR in lakhs)	Estimated person days
Upper Ridge	NA	NA
Middle Ridge	NA	NA
Lower Ridge	0.167 lakh/ha	34,854
	0.167 lakh/ha	34,854

TABLE 47. NATURE AND NO. OF WORKS IN MICRO-WATERSHED

Description	Number
Total No. of works in Micro-watershed area (Arable, Non arable & DLT)	48
Total No. of works in Micro-watershed including livelihood Activities	12
Total No. of works in Micro-watershed including Rural Greywater Management Activities	10

TABLE 48. KEY OUTCOMES OF INTERVENTION



Expenditure for FY 2020-21 (in INR lakh)

Achchangulam GP	140.77 lakh

TABLE 49. ESTIMATES OF MICRO-WATERSHED IN ACHCHANGULAM GP

Proposed Work	Ridge Type	Status of Work	Quantity (Area or No.)	No. of works as per KML	Estimate cost (INR in Lakhs)	Person days
NRM works in Public and Community Lands						
Restoration of Traditional water bodies: (Oorani & Tank) (No,)	Lower	Not commenced	5 (4+1)	5	38	13,903
Oorani bund Plantation (No,)			815	5	3.75	1,374
Avenue plantation (km)			3.1	2	2.86	1,045
Block Plantation (ha)			1.41	1	2.88	625
Afforestation (ha)			3.1	1	6.42	2,355
Dry Land Horticulture (No,)			1	1	5	1,794
Mini Forest (No,)		Completed	1,500	3	6.9	4,740
Roof Rain Water Harvesting in GP Building (No,)		Not commenced	3	3	0.9	45
Sub total				**21**	**66.71**	**25,881**
Works in Individual Farmer lands (Agriculture and Allied Activities)						
Recharge Shaft for bore well farmers for Salinity Reduction (No,)	Lower	Not commenced	6	6	1.62	72
Farm Bunding with Boundary Trenches - Individual (ha & No,)			10	4		
			4	4	6.7	2,344
Construction of Farm Ponds - Individual (No,)			6	6	10.8	3,720
Composting (No,)			5	5	0.45	155
NADEP Vermi compost (No,)			1	1	0.12	5
Fodder development - Individual (No,)			1	1	1.48	2,344
Sub total				**27**	**21.17**	**8,640**
Total no. of works for treatment of micro-watershed (Arable, Non arable & DLT)				**48**	**87.88**	**3,4521**
Livelihood enhancement activities for Individual Farmers (Coastal Area)						
Azolla Production Unit (No,)	Lower	Not commenced	1	1	0.15	14
Cattle Shelters (No,)			2	2	3.2	66
Poultry Shed (No,)			4	4	8	88
Goat Sheep Shelters (No,)			3	3	3.45	90
Cattle Trough (No,)			2	2	0.4	22
Sub total				**12**	**15.2**	**280**
Rural Greywater and Roof Rainwater Management						
Soak Pits (Individual) (No,)	Lower	Not commenced	4	4	0.432	24
Soak Pits (Community) (No,)			3	3	0.39	24
Nutri Garden (No,)			3	3	0.5	5
Sub total				**10**	**1.322**	**53**
Total no. of works under Achchangulam GP for Micro-watershed development (IWRM)				**70**	**104.4**	**34,854**

TOTAL ESTIMATES OF MICRO-WATERSHED IN ACHCHANGULAM GP

	No. of works as per KML	Estimate cost in INR (Lakhs)	Person days
Achchangulam GP	70	104.4	34,854

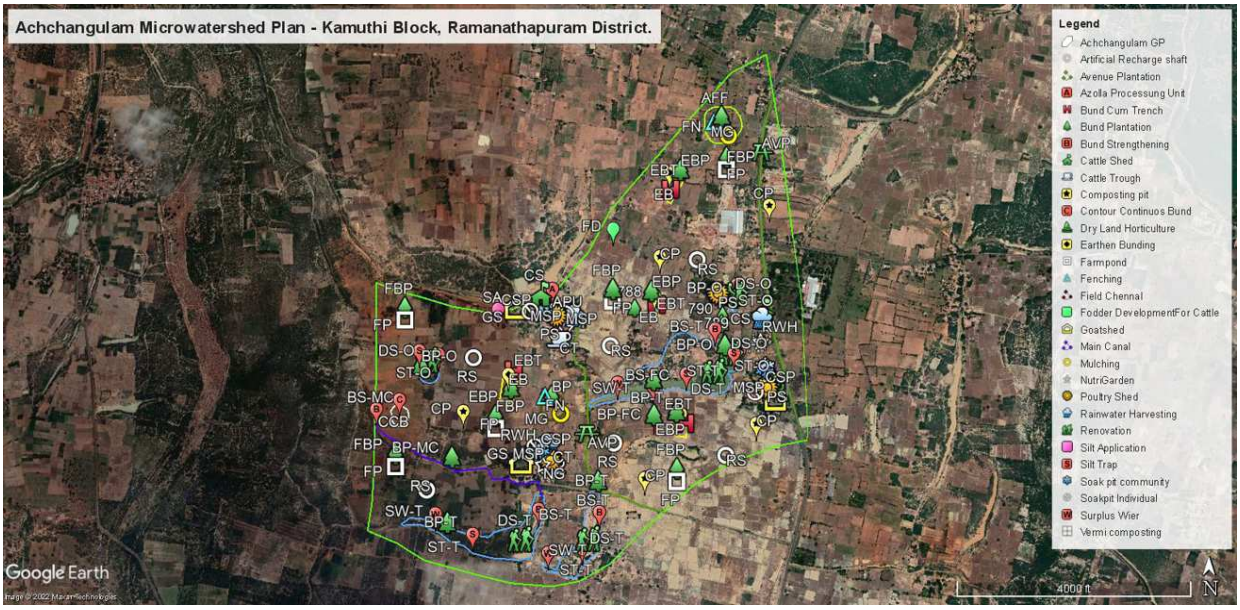


Figure 8.4. Proposed activities in Achchangulam Micro-watershed

8.3 MODEL GP - KOMPOOTHI -KAMUTHI BLOCK

8.3.1 BACKGROUND OF GRAM PANCHAYAT - KOMPOOTHI

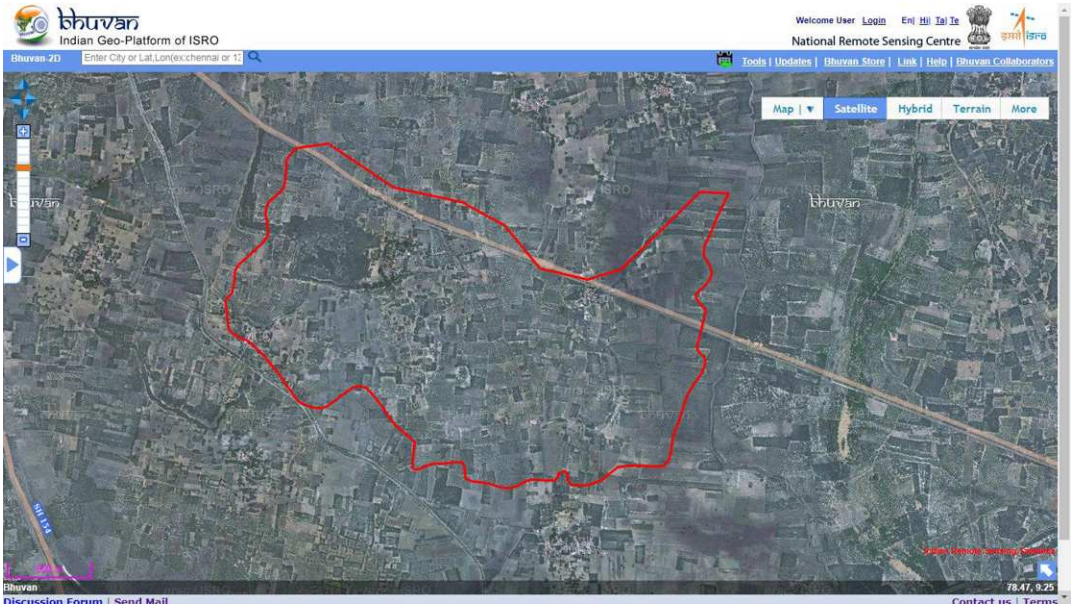
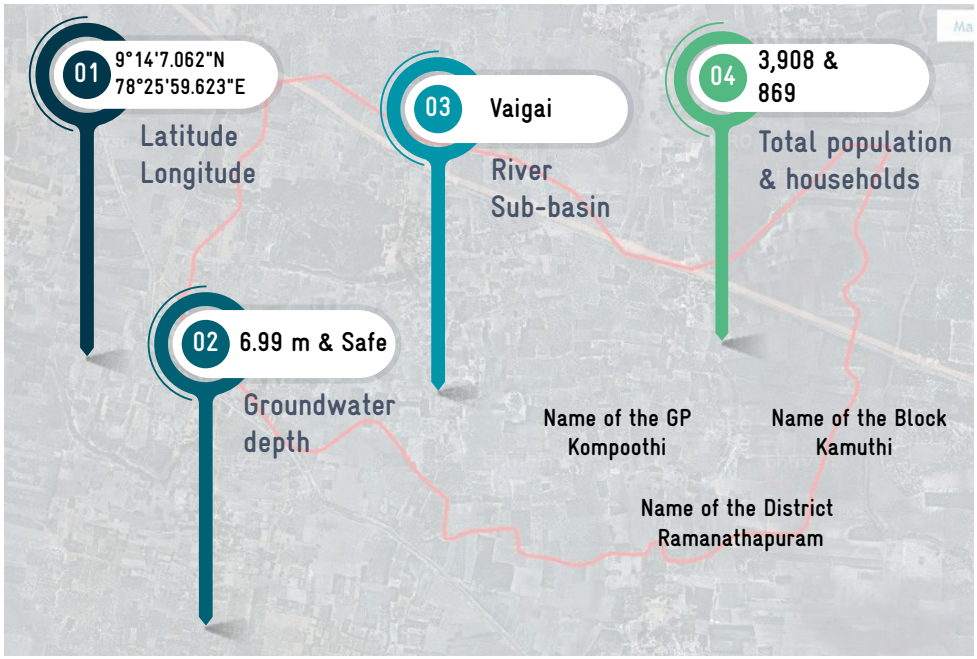


Figure 8.5. Satellite Image of Kompoothi GP

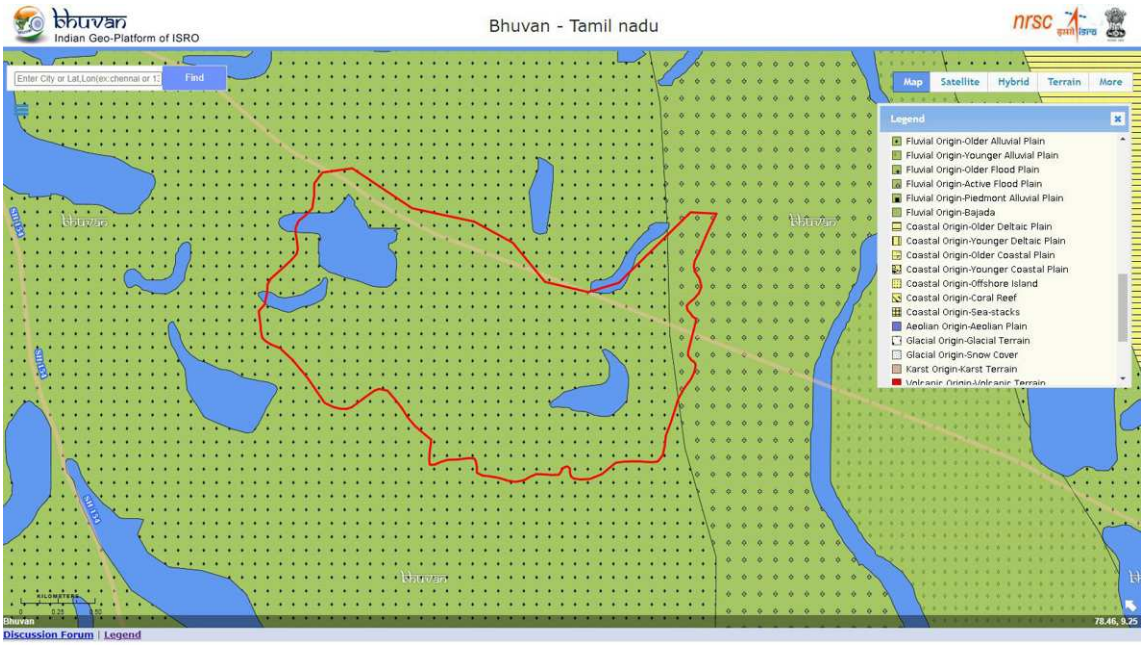
Kompoothi GP is located in Kamuthi Block of Ramanathapuram District, Tamil Nadu. The total geographic area of this village is about 384 ha. As per the Population Census 2011, the total population of the GP is 3,908 out of which 1,968 are males, 1,940 are females. There are 869 HHs in the village. 3.55% of the population comprises of SC population. There is no ST population (Table 50).

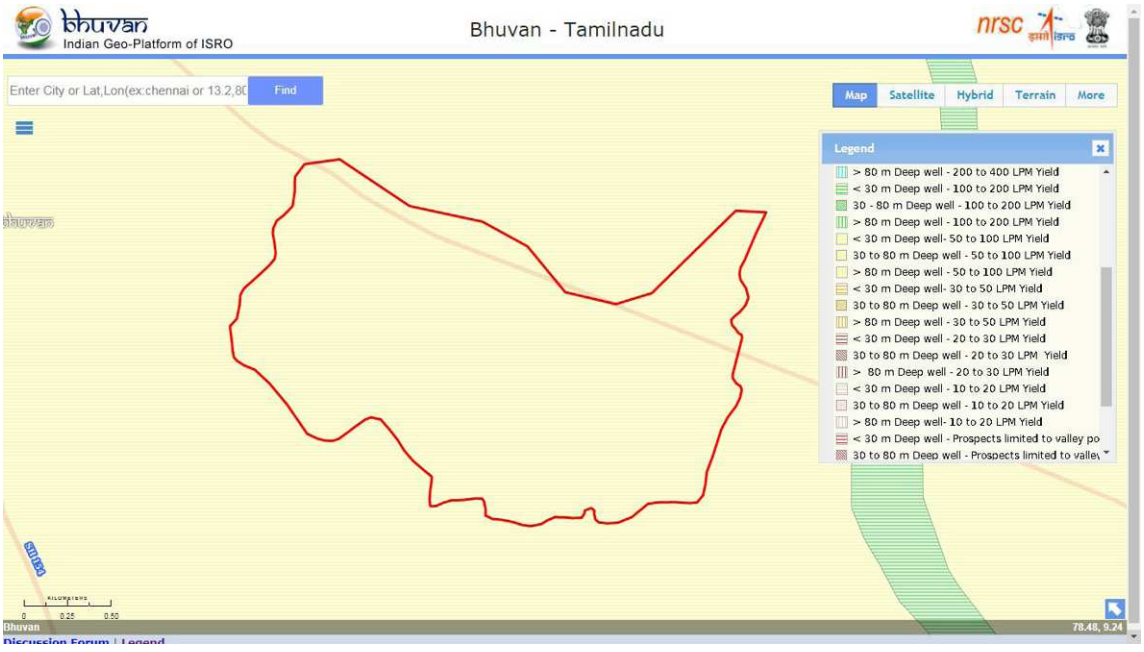
TABLE 50. GENERAL DESCRIPTION OF KOMPOOTHI GP, KAMUTHI BLOCK

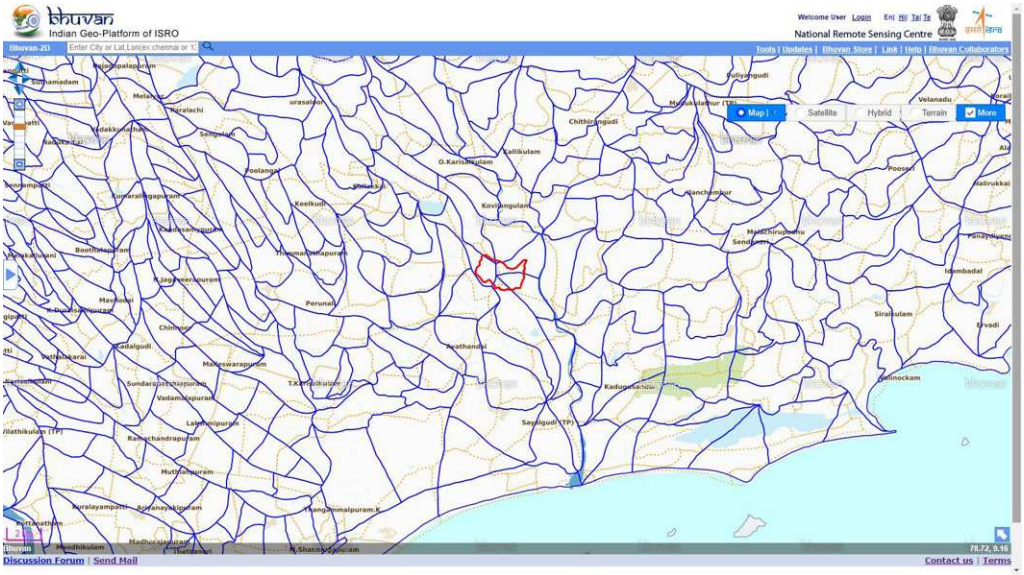


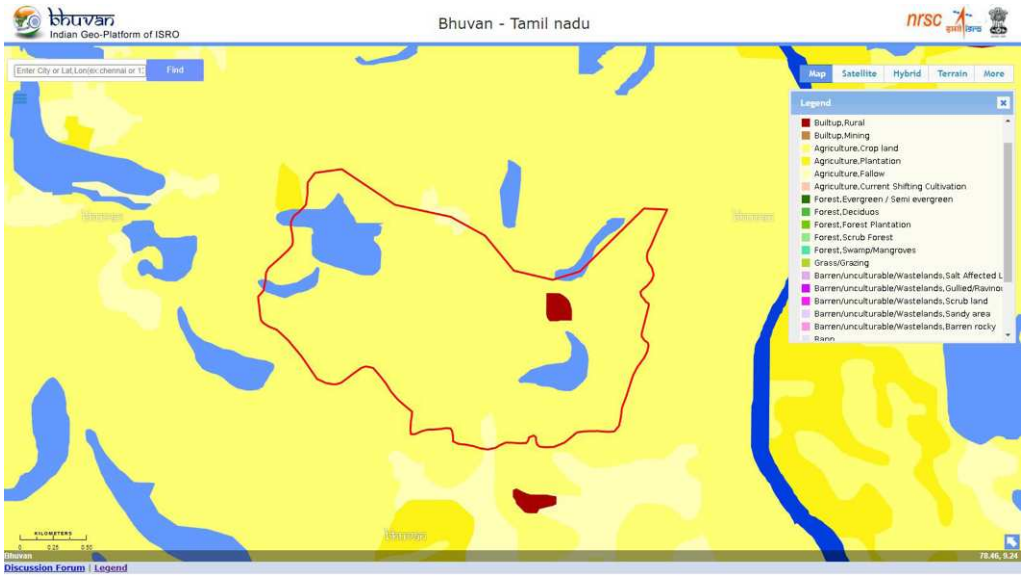
8.3.2 CWRM PLANNING - SPATIAL DATA

CWRM adapted the geospatial technologies in its process of plan preparation towards climate-resilient infrastructure, Water Conservation Water Harvesting etc. at cadastral levels. Geospatial datasets allow players to understand the study area in terms of geomorphology, lineaments, salt-affected area, erosion, watershed, LULC, and wasteland. In some cases, spatial data will serve as a direct input for a particular activity to be implement towards conservation of resources. Various thematic datasets for Kompoothi GP shown in Figure 8.6 (A, B,C,D,E) and discussed below.









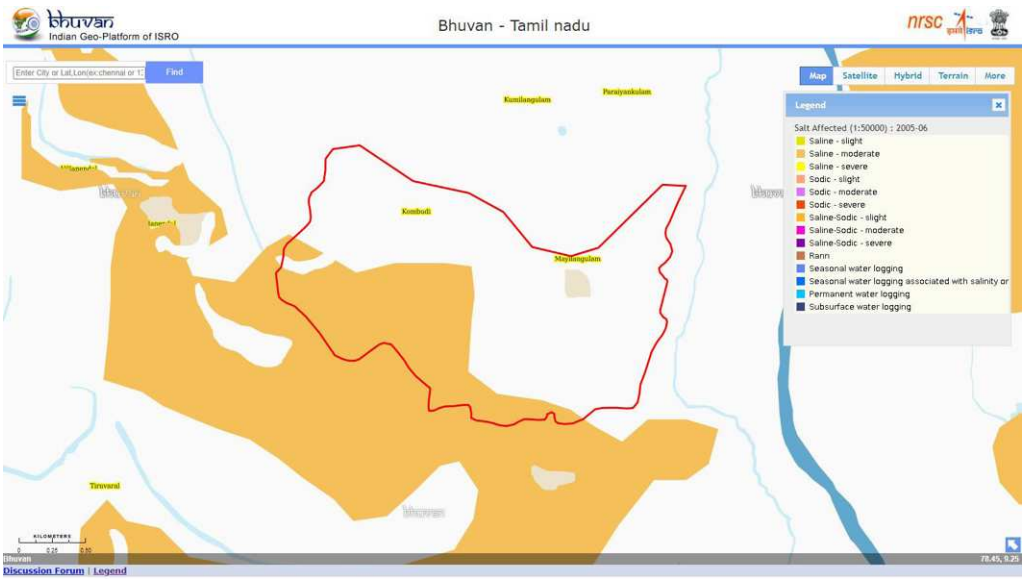


Figure 8.6. Spatial thematic maps of Kompoothi GP. A. Geomorphology, B. GW prosperity, C. Watershed, D. LULC, E. Salt affected area

The entire GP is under fluvial origin older alluvial plain (A). The groundwater is available between 30-80 m deep well with yield of 50 to 100 LPM (B). GP area is falls under seven micro-watershed units (C). More than 80 % of land is used for agriculture purpose (D). The one third of Kompoothi GP is covered with moderate Salinity (E).

8.3.3 CWRM PLANNING- NON-SPATIAL DATA

The non-spatial data covered four important themes – socio economic, climate, water and agriculture with 116 parameters (Table 51). These non-spatial data are concurrently used for analysis along with the spatial data mentioned above to identify the key water challenges, prepare water budget by understanding the supply and demand and develop water actions to the different land use and slope categories. The process starts with mapping of the administrative (habitations/panchayat/revenue village, Block/taluk), agro-ecological (regional and sub-regional, climatic and agricultural zonation's) and hydrological (drainage points/watersheds/sub basin) units keeping the GP as the lowest unit of planning and execution.

TABLE 51. NON-SPATIAL DATA-KOMPOOTHI GP

Key CWRM Parameter	Details
Socio-Economic	
Geographical Area	384
Male Population	1,968
Female Population	1,940
Total Population	3,908
SC Population	139
ST Population	0
Vulnerable Population	139
Households (HH's)	869
Only one room HH's (SECC)	678
Female Headed HH's (SECC)	46
Vulnerable Households (SECC)	488
% of Vulnerable Households	56
Registered MGNREGA Job cards	210
The active person working in job Cards	180
Drinking Water Sources	26
HH's have tap water connection for drinking water	852
HH's dependent on other sources for drinking water	598
Annual Greywater Generation (ha.m)	7.13
Water Resources	
Canal Network (m)	
Length of Main Canal (km)	2,000
Water Courses (Field Channels) (km)	1,000
No. of Tanks (PWD & Union)	3
No. of Ooranis	4

Irrigation Facilities (ha)	
Area under Tank Irrigation	44
Area under Open & Tube Well Irrigation	28
Catchment Area wise Available Runoff (ha.m)	
Good Catchment Area	12.9
Bad Catchment Area	39.2
Watershed and Drainage Networks	
Length of Natural Drainage Lines (km)	1,862
No. of Natural Drainage Lines	2
No. of Micro Watersheds	7
Water Demand (ha.m)	
Water Demand for Humans	10.7
Water Demand for Livestock	0.65
Water Demand for Agriculture	215.31
% G.W Utilization for Drinking	65
% G.W Utilization for Livestock	56
% G.W Utilization for Agriculture.	39
% SW Utilization for Drinking	35
% SW Utilization for Livestock	44
% SW Utilization for Agriculture	61
Agriculture	
Area Under Land Resources (ha)	
Area under Non-Agricultural Uses	58.25
Area under Fallows Land other than Current Fallows	96.05
Area under Current Fallow land	44.1
Area under Unirrigated Land	167.22
Area Irrigated by Source	38.03
Catchment Area (ha)	
Land under Good Catchment	58.25
Land under Bad Catchment	345.4
Crop Details (ha)	
Irrigated Area	198.55
Rainfed area	158.2
Area under Paddy Cultivation	356.75
Crop Water Requirement - Irrigated condition (ha.m)	297.83
Crop Water Requirement - Rainfed condition (ha.m)	158.2
Soil Resources: Status of Available Nitrogen (%)	
Very Low	94
Low	28
Medium	5

Status of Organic Carbon (%)	
Low	1
Medium	33
High	100
Very High	100
Status of Soil Micro Nutrients (%)	
Sufficient	72
Deficient	28
Status of Physical condition of the soil (%)	
Strongly Acidic	3
Highly Acidic	33
Moderately Acidic	44
Slightly Acidic	3
Moderately Alkaline	17
Soil Texture	
% of Fine Soil	92
Soil Water Permeability	Moderate to Low (5-20 mm/hr)
Soil moisture and ET	
Volumetric Soil Moisture (%)	17
Estimated Soil Moisture (ha.m)	58.72
ET Losses (ha.m)	107.14
Means of Water Extraction (%)	
Gravity	59
Lifting	41
Irrigation Methods (%)	
Wild Flooding	61
Control Flooding	39
Livestock (No)	
Cattle Population	99
Sheep Population	402
Goat Population	353
Poultry	561
Livestock Water Requirement (ha.m)	0.65

8.3.3 KEY WATER CHALLENGES

Socio-Economic

1. Female population almost equal to male population
2. 3.55 percent of the population belong to the SC category, according to SECC data
3. 56% of the households are vulnerable, 46 HH are female headed
4. 678 HH have only one room.
5. 7.13 ha.m grey water from 869 households living on the coast needs attention

Water

1. 4 Ooranis and 3 tanks in the GP
2. 65% Ground Water utilized for drinking water purpose
3. 61% of surface water utilized for agriculture
4. More water for agriculture (215.31 ha.m)
5. 52.1 ha.m of water is an available runoff in which 75.23% of the runoff is from the bad catchment area, 24.76 % of the conservation is from the good catchment area

Agriculture and Allied Sector

1. 85.56 % is under Individual lands
2. More bad catchment area (85.56%)
3. Rainfed area (44.34%), 55.65% irrigated area
4. Very Low soil Nitrogen and very high Organic Carbon
5. 71 % moderately Acidic
6. 92% fine soil
7. 61% Wild flooding
8. Area under paddy cultivation 356.75 ha

8.3.5 PERSPECTIVE PLAN - WORKS PROPOSED: WATER ACTIONS

The appropriate and site-specific works are identified for the development of public and common land, agriculture and allied activities, rural infrastructures, and climate-resilient measures to reduce the vulnerability in the GP. About 48.16% of the total land area is taken for WASCA activities like plantation, conservation works. The total proposed area for treatment is 194.42 ha out of which 99.49% of the proposed work is under individual lands and the rest is under common land. (Figure 8.7). Through the proposed conservation activities, 29.81 ha.m run off would be harvested in which, about 75.64 % of the runoff is from the bad catchment area and 24.35% is from the good catchment area (Figure 8.8).

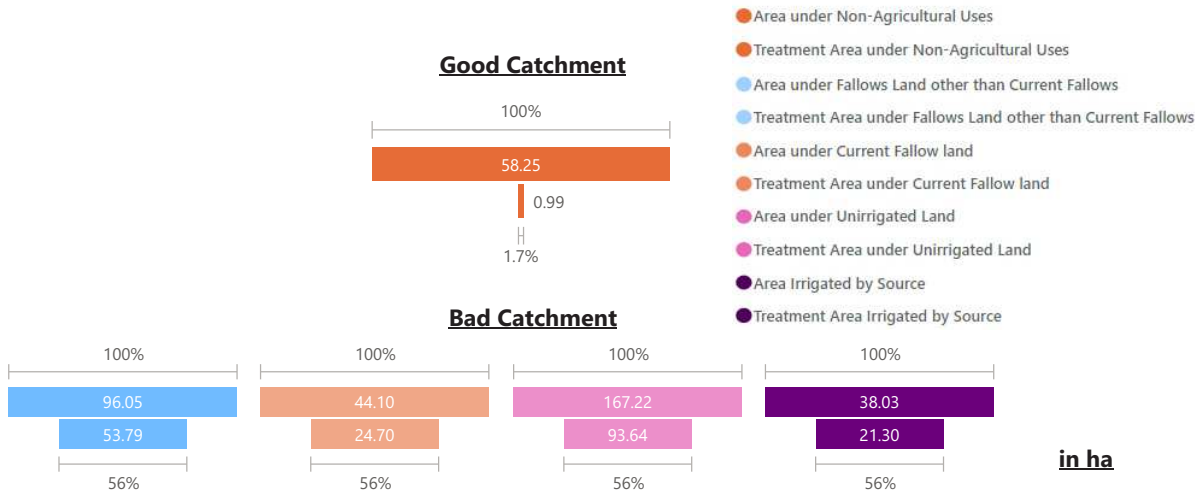


Figure 8.7. Proposed land resource treatment area in Kompoothi GP

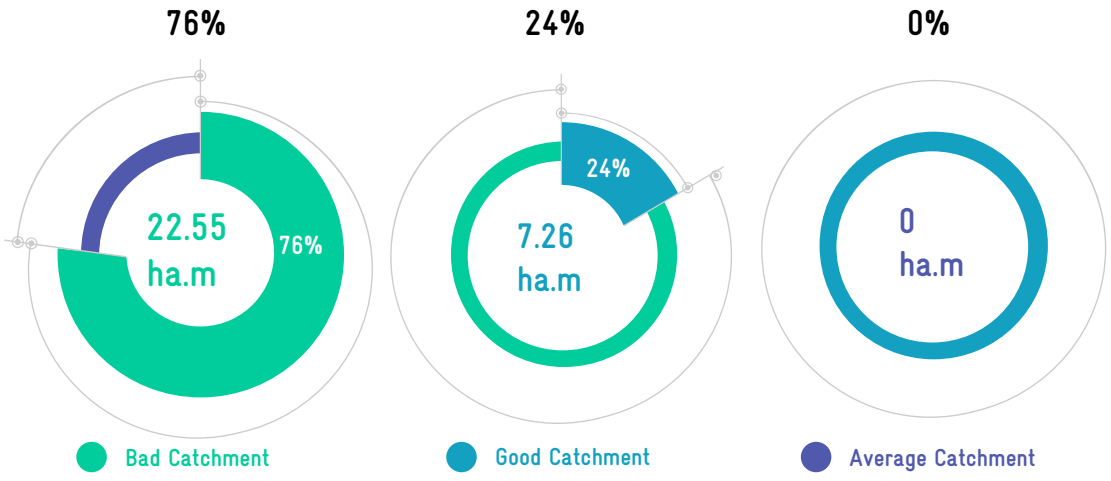


Figure 8.8. Expected run off conservation after treatment in Kompoothi GP

Table 52 shows the detailed perspective plan and estimates of the work, budget, and person-days for three years from 2021-2022 to 2023-2024 in Kompoothi GP. Since it is a vulnerable village, attention was given to include appropriate works to improve the common and public land development.

TABLE 52. PERSPECTIVE PLAN OF KOMPOOTHI GP - FY (2021-2024)

CWRM Water Action 1: Improvement of Public & Common Lands Development				
CWRM Water Action 1: Works in Upper& Middle Ridge				
Name of the work	**Ridge Type**	**No of Works**	**Estimated cost (INR in lakhs)**	**Estimated Person Days**
Afforestation in Public/common lands (ha)	Lower	0.99	8.51	3,310.56
Contour Continuous Bunds (CCB) for Afforestation area (m)		3.96	0.1	39.6
Composting (No.)		69	11.73	1,035
Drainage Line Treatment (m)		179	5.37	895.5
Avenue plantation (km)		4.459	8.03	3,134.677
Restoration of water bodies (No.)		7	26	3,800
Artificial Recharge Structure (No.)		11	27.5	4,301
Subtotal Water Action - I		**276**	**87**	**16,516**
CWRM Water Action 2: Agricultural and allied Sector development				
Farm Bunding (ha)	Lower	193	290.13	1,13,344
Micro Irrigation (ha)		9	9	0
Construction of farm ponds (No.)		69	138	53,889
Land development (ha)		86	860.6	3,36,150
Cattle Shelters (No.)		2	4.24	662
Goat Sheep Shelters (No.)		45	102.15	15,975
Fodder development for cattle (No.)		2	2.96	4,688
Azolla units (No.)		2	0.3	46
Cattle Trough (No.)		2	0.1	12
Poultry shed (No.)		14	1.26	140
Dry land Horticulture/Agro-forestry (ha)		97	824.5	3,22,137
Vermi Compost (No.)		2	0.36	54
Subtotal Water Action - II		**523**	**2,234**	**8,47,097**
CWRM Water Action 3: Rural Water Management				
Soak pits (Community) (No.)	Lower	9	1.17	180
Soak pits (Individual) (No.)		87	8.7	1,392
Roof rain Water Harvesting (No.)		2	8	1,250
Community Tanka (Rajasthan Model) (No.)		1	30	300
Subtotal Water Action - III		**99**	**47.87**	**3,122**
Overall Total GP		**898**	**2,369**	**8,66,736**

Water actions

Regarding CWRM themes, of the total number of projects identified, 30.73 percent works are in public and common land, 58.24 percent in agriculture and allied sector while it is 11.02 percent under rural infrastructure. (Table 53)

TABLE 53. SUMMARY OF WORKS IDENTIFIED AND ESTIMATED PERSON-DAYS FOR 2021-2024

CWRM themes	No of works	Estimated budget (INR in lakhs)	Estimated person days
Public and common land development	276	87	16,516
Agriculture and Allied sector development	523	2,234	8,47,097
Rural water management	99	47.87	3,122
TOTAL	898	2,369	8,66,736

8.3.6 IMPACTS

The proposed water actions based on the above key water challenges cover three years from 2021-2022 to 2023-2024. At the end of the implementation period the following impacts are envisaged (Table 54). It is expected that the impacts have potentially reduced the vulnerability and improved the resilience of the system to the projected climatic change events and ensured water security.

TABLE 54. WASCA- WATER ACTIONS AND INDICATORS

WASCA CWRM ACTION PLAN

DEVELOPMENT OF PUBLIC AND COMMON LAND

	INDICATOR		OUTCOMES/ IMPACT
1	Number of water bodies restored in the village	1	7 water bodies restored
2	Quantum of water harvested/recharge	2	46.9 ha.m surface runoff is harvested due to WASCA interventions
3	The proportion of land treated under WASCA	3	48 percent of the total area treated under WASCA (194.71 ha)
4	Area under afforestation	4	8.51 ha area under afforestation
5	Length of drainage line treated	5	Nil

7
TRADITIONAL WATER BODIES RESTORED

8.51 ha
AFFORESTATION

46.9 ha.m
RUNOFF HARVESTED

48 %
AREA OF THE VILLAGE TREATED

WASCA CWRM ACTION PLAN

DEVELOPMENT OF AGRICULTURE AND ALLIED ACTIVITIES

	INDICATOR		OUTCOMES/ IMPACT
1	Assessment of sources of water for live-stock and agriculture demand	1	21.3 ha covered under micro-irrigation
2	No of structures established for on-farm (in-situ) water harvesting in drylands	2	69 farm ponds established
3	Improvement in soil health	3	69 compost units for soil health improve-ment
4	Changes in the irrigation practices	4	193.42 ha Farm bunding with trenches
5	Dryland development with agro-forestry	5	97 ha under dryland horticulture
6	Households established fodder plots	6	25 vulnerable households established fodder plots

69
FARM PONDS

69
VERMI COMPOST

193.42 ha
FARM BUNDING

97 ha
DRYLAND HORTICULTURE

25
FODDER PLOTS

WASCA CWRM ACTION PLAN

DEVELOPMENT OF RURAL INFRASTRUCTURE

	INDICATOR		OUTCOMES/ IMPACT
1	No. of units having complete liquid waste management systems	1	9 common and 87 individual soak pits were established for recycling greywater benefiting 872 households
2	Roof rainwater harvesting measures	2	2 common roof rainwater harvesting and storage and 872 individual level roof rainwater harvesting
3	Greywater drains	3	Nill
4	Nutri gardens	4	872 Households established Nutri-gardens in homesteads

9 COMMUNITY & **87** INDIVIDUAL SOAK PITS

872 NUTRI-GARDENS

2 COMMON ROOF RAINWATER HARVESTING

Table 55 provides both the prospective plan for three years and the annual plan for the one year from 2021-2022 on the shelf of projects/number of works and number of person-days.

TABLE 55. PROPOSAL FOR THE MGNREGS, KOMPOOTHI GP, KAMUTHI BLOCK

	No of works	No of person days
Perspective plan	898	8,66,736
Annual plan	359	3,46,694

PROPOSED ACTIVITY MAP

The proposed activity map (Figure 8.9) for Kompoothi GP, Kamuthi Block shows a shelf of projects for all three year works from 2021-2024.

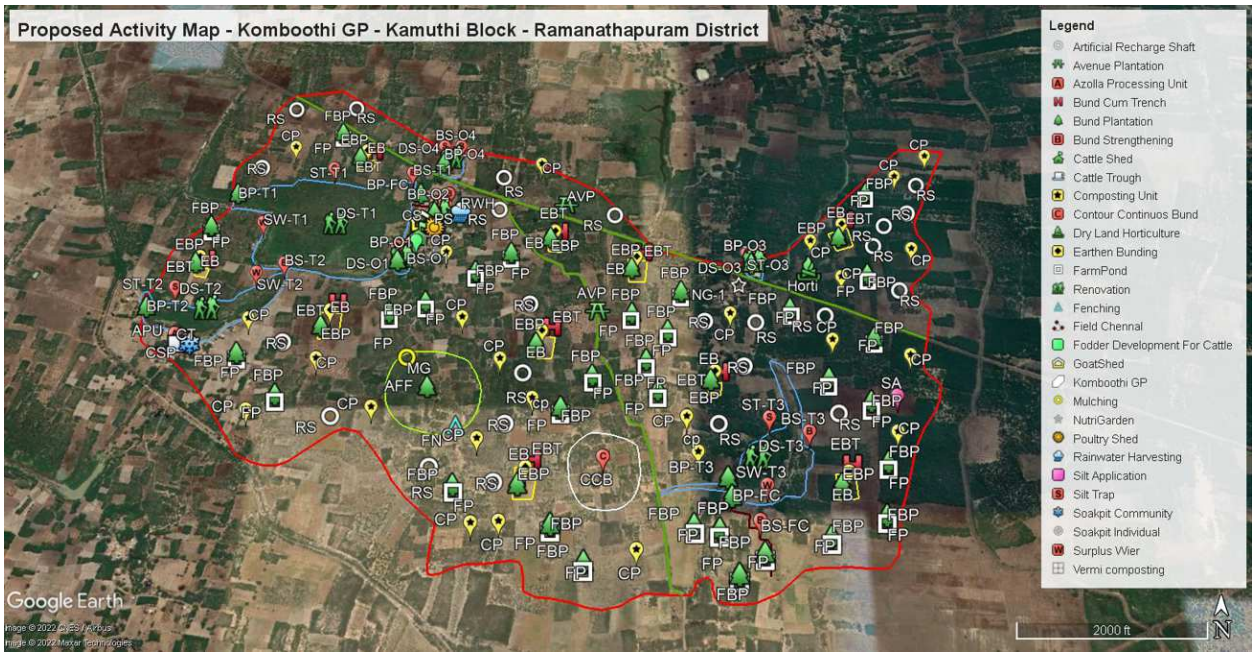
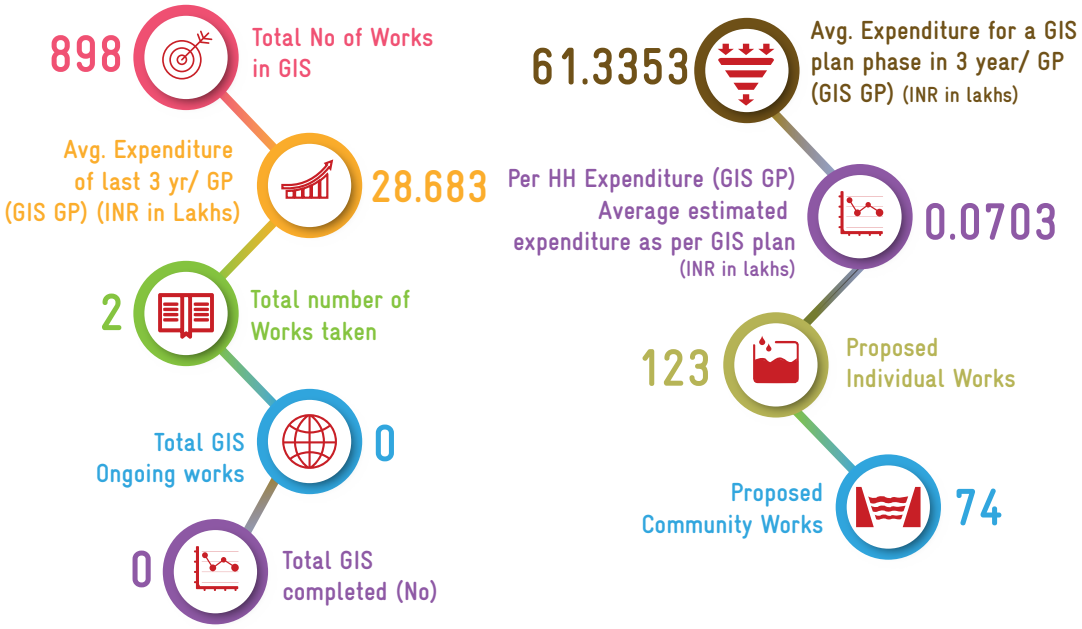


Figure 8.9. Proposed action plan of Kompoothi GP

GIS PLAN IMPLEMENTATION AND KEY PARAMETERS

The GIS plan implementation and performance of Kompoothi GP, Kamuthi Block is represented in Table 56.

TABLE 56. GIS PLAN IMPLEMENTATION, KEY PARAMETERS PERFORMANCE IN NUMBERS



நீர்இன்று அமையாது உலகெனின் யார்யார்க்கும்
வான்இன்று அமையாது ஒழுக்கு

குறள் - 20

Water is life that comes from rain
Sans rain our duties go in vain

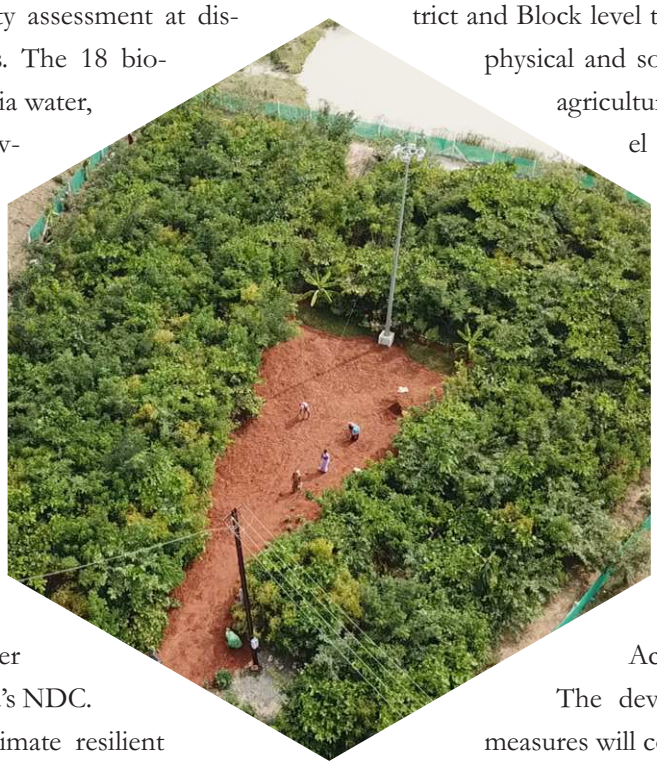
Thirukkural - 20

CHAPTER 9

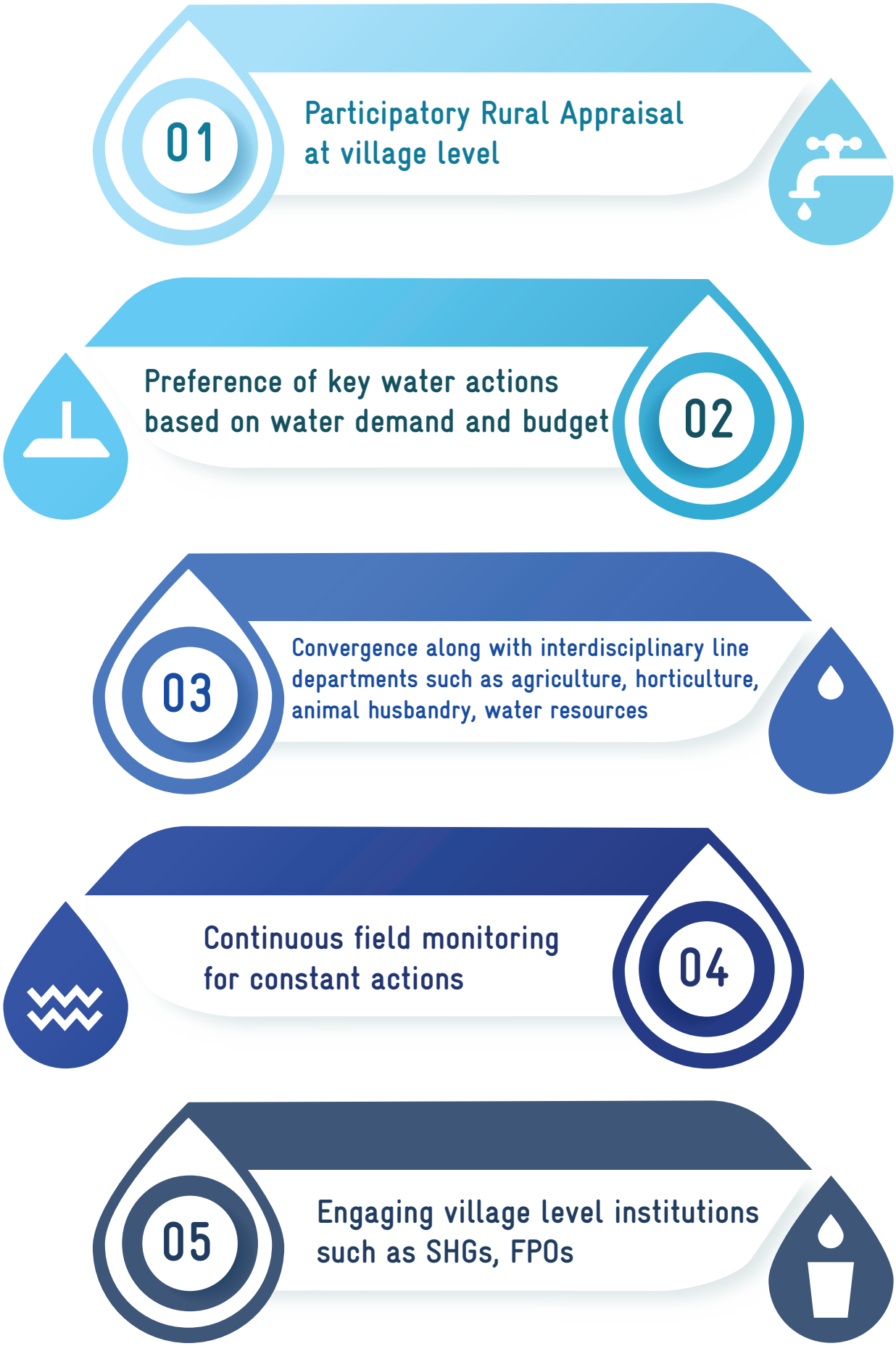
CONCLUSION

> **"WASCA TN took an initiate to address the problem holistically through comprehensive vulnerability assessment at district and block level to identify the vulnerable area and its key problems"**

In recent decades, the demand for water is increasing at a fast rate due to rapid increase in population, industrial and economic growth. The evident changes in climate and its extremities are bringing more threats to water security. Frequent monsoon failures lead to acute water scarcity and severe droughts. Thus, dependency on ground water has increased many folds during recent years which resulted in lowering of ground water levels and even drying up of wells. WASCA TN took an initiative to address the problem holistically through comprehensive vulnerability assessment at district and Block level to identify the vulnerable area and its key problems. The 18 bio-physical and socio-economic indicators of four interrelated areas via water, agriculture, socio economic and climate used at district level are further expanded to 110 parameters at Block level. The spatial and non-spatial CWRM parameters for the above mentioned four interrelated areas are used to represent risk, sensitivity and adaptive capacity of the GPs, which eventually reflects rural water security. The key problems of the Blocks are identified and the best possible adaptation options 'Key Water Actions' are drawn up under WASCA initiatives in public and common land, agriculture and allied sector, rural infrastructure areas. All the indicators/parameters and Key Water Action are aligned to the appropriate SDG and India's NDC. The developmental activities in the 3 areas along with climate resilient measures will contribute in reducing the vulnerability and building the resilience of the local communities at the GP level. The GP based planning and integration at the Block level based on macro and micro-watershed enables to adopt an ecosystem approach in promoting nature-based solutions. The productive impacts are visualized through a convergence approach by mobilizing necessary finance, knowledge and technologies at the end of the three years of implementation. This integrated Block level approach will be more effective with Block level climate information which is not currently available.



Recommendations towards stable development and its progressive outcome are:


01
Participatory Rural Appraisal at village level
Preference of key water actions based on water demand and budget
02
03
Convergence along with interdisciplinary line departments such as agriculture, horticulture, animal husbandry, water resources
Continuous field monitoring for constant actions
04
05
Engaging village level institutions such as SHGs, FPOs

ANNEXURES

ANNEXURE 1

TYPES OF GPs

Type of GP	Description
I	Both GP and revenue village data and boundary match
II	Having more than one GPs in one Revenue Village
III	One GP is falling under more than Type 1 one Revenue Village
IV	GPs having more than one GP, one Revenue Villages data, boundary
V	Newly formed GP after 2011 census publication

* Note: The CWRM uses spatial and non-spatial data for developing Gram Panchayat level plans. Most of the data for non-spatial are available at revenue village level in the project area. To synchronize planning at GP keeping data availability and administrative boundary for GIS planning, various GP's are categorized based on revenue village boundaries, for collecting and organizing the datasets. Based on the above factors, five different types of GPs are classified as above.

ANNEXURE 3.1

KEY CWRM PARAMETER FROM SECONDARY SOURCES

Key CWRM Parameter	Secondary Source
Socio economic	
Geographical Area	Census-2011, MoHA, GOI *https://censusindia.gov.in/2011census/dchb/DCHB.html*
Male Population	
Female Population	
Total Population	
SC Population	
ST Population	
Vulnerable population	
Households (HH's)	Socio-economic caste census (SECC) 2011 *https://secc.gov.in/homePageLgd.htm*
Only one room HH's	
Female Headed HH's	
Vulnerable Households	
% of Vulnerable Households	
Registered MGNREGA Job cards	*http://mnregaweb4.nic.in/netnrega/app_issue.aspx?page=s&lflag=eng&state_name=TAMIL%20NADU&state_code=29&fin_year=2020-2021&source=national&Digest=3ics8+9Z9fEQ8yzj5E3qcQ*
Active person working in MGNREGA job Cards	
Water Resources	
Irrigation Facilities	Census-2011, MoHA, GOI *https://censusindia.gov.in/2011census/dchb/DCHB.html*
Area under Tank Irrigation	
Area under Canal Irrigation	
Area under Open & Tube Well Irrigation	
Water Quality	*https://ejalshakti.gov.in/IMISReports/Reports/WaterQuality/WQ/rpt_WQ_DistrictProfile_S.aspx?Rep=0&RP=Y*
Chemical Contaminants	
Bacterial and Other Contaminants	
Watershed and Drainage Networks	NRSC, ISRO, GoI
Length of Natural Drainage Lines	
Number of Natural Drainage Lines	
Number of Micro-watersheds	
Agriculture	
Land Resources	*https://censusindia.gov.in/2011census/dchb/DCHB.html*
Area under Forest land	
Area under Non-Agricultural Uses	
Area under Barren & Un-cultivable Land	
Area under Permanent Pastures and Other Grazing Land	
Area under Land Under Miscellaneous Tree Crops etc.	
Area under Cultivable Waste Land	
Area under Fallows Land other than Current Fallows	

Area under Current Fallow land	*https://censusindia.gov.in/2011census/dchb/DCHB.html*
Area under Unirrigated Land	
Area Irrigated by Source	
Soil Resources: Status of Available Nitrogen	*https://soilhealth.dac.gov.in/NewHomePage/NutriPage*
Very Low (VL)	
Low (L)	
Medium (M)	
High (H)	
Very High (VH)	
Status of Organic Carbon	
Very Low (VL)	
Low (L)	
Medium (M)	
High (H)	
Very High (VH)	
Status of Soil Micro Nutrients	
Sufficient	
Deficient	
Status of Physical condition of the soil	*https://soilhealth.dac.gov.in/NewHomePage/NutriPage*
Acidic Sulphate	
Strongly Acidic	
Highly Acidic	
Moderately Acidic	
Slightly Acidic	
Neutral	
Moderately Alkaline	
Strongly Alkaline	
Soil Texture	NRSC
% of Clay Soil	
% of Fine Soil	
% of Coarse loamy	
Soil Water Permeability	standard table
Soil moisture and ET	*https://indiawris.gov.in/wris/#/*
Volumetric Soil Moisture	
Livestock	*https://farmer.gov.in/livestockcensus.aspx*
Cattle Population	
Sheep Population	
Goat Population	
Poultry	

ANNEXURE 3.2

KEY CWRM PARAMETERS FROM PRIMARY SOURCES

Key CWRM Parameter	Primary Data
Water sources	
Drinking Water Sources	Block level officer/ GP level assistants
HH's have tap water connection for drinking water	
HH's dependent on other sources for drinking water	
Canal network	
Length of Main Canal	Block level officer/ GP level assistants
Length of Minor Canal	
Length of Distributaries	
Water Courses (Field Channels)	
Traditional water bodies	
Number of Tanks (PWD & Union)	Block level officer/ GP level assistants
Number of Ooranis	
Other Surface Water Bodies	
Crop details	
Irrigated Area	Village G return data
Rainfed area	
Area under Paddy Cultivation/irrigated	

ANNEXURE 3.3

KEY CWRM PARAMETER GENERATED -PRIMARY DATA

Key CWRM Parameter	Methods/Formulas Used
Water Demand	Standard Norms are in Annexure 3.4
Water Demand For Drinking	
Water Demand for Livestock	
Water Demand For Agriculture	
% G.W Utilization for Drinking	
% G.W Utilization for Livestock	
% G.W Utilization for Agriculture.	
% SW Utilization for Drinking	
% SW Utilization for Livestock	
% SW Utilization for Agriculture	
Annual Greywater Generation	Standard Norms are in Annexure 3.5
Available Runoff	Strange table method (based on rainfall, land area)
Run Off Conserved	Formula (based on tank storage, built up, linear measurement)
Estimated Soil Moisture	calculation & formula
ET Losses	calculation & formula
Means of Water Extraction (Gravity/ Lifting)	(Number of Gravity or lifting /Total number of extraction)*100
Irrigation Methods (Wild/Control)	(corresponding irrigation area/ total irrigation area)*100

ANNEXURE 3.4

STANDARD NORMS FOR CALCULATING WATER DEMAND

	Water Users	Total Annual Requirement (ha.m)
1	Human	population*0.0027375
2	Animals	Total water requirement for animals
3	Agriculture	Total volume of water in agriculture (Both irrigated and rainfed)
4	Others (Industrial)	
	Total water De-mand	Addition of all 4 category
	Water Users	**Requirement met by Ground Water**
1	Human	water demand for human* Ground water percentage (coming from drinking water sources)
2	Animals	water demand for animals* Ground water percentage (coming from Livestock table)
3	Agriculture	Total volume of water in irrigated source
4	Others (Industrial)	
	Total water De-mand	Addition of all 4 category
	Water Users	**Requirement met by Surface Water**
1	Human	water demand for human* Surface water percentage (coming from drinking water sources)
2	Animals	water demand for animals* surface water percentage (coming from Livestock table)
3	Agriculture	Total volume of water in rainfed source
4	Others (Industrial)	
	Total water De-mand	Addition of all 4 category
	Water Users	**% of Ground Water**
1	Human	Ground water percentage (coming from drinking water sources)
2	Animals	Ground water percentage (coming from Livestock table)
3	Agriculture	(Total volume of water in irrigated source/Total ground water requirement)*100
4	Others (Industrial)	
	Total water De-mand	Addition of all 4 category
	Water Users	**Requirement met by Surface Water**
1	Human	Surface water percentage (coming from drinking water sources)
2	Animals	surface water percentage (coming from Livestock table)
3	Agriculture	(Total volume of water in rainfed source/Total surface water requirement)*100
4	Others (Industrial)	
	Total water De-mand	Addition of all 4 category

* Based on the land use, slope, and soil type, the catchments are classified as good, average and bad. In the CWRM framework, we used land use as a key factor for the classicization of catchments.

Good catchment area: It consists of the runoff generated from sloppy lands with dense forest cover and areas where the ground is covered with a reduced rate of infiltration. It includes area under forest, area under non-agricultural use, barren and un-cultivable lands, and area under permanent pastures and other grazing land areas.

Average catchment area: It denotes the land uses related to the types of land under miscellaneous tree crops, culturable waste, and fallow land other than current fallow areas where the land surfaces are undulated terrain, moderately sloppy along with a medium infiltration rate.

Bad catchment area: It covers the area where the terrain is flat with very less vegetative cover, the land use categories under current fallow, total unirrigated and irrigated area with less surface runoff

ANNEXURE 3.5

STANDARD NORMS FOR GREY WATER GENERATION CALCULATION

	Waste water generation Source	Per day/unit waste water generation in L (Standard Value)
1	Bathing	15
2	Washing	10
3	Toilet	10
4	Cleaning	5
5	Cooking and cleaning Utensils	5
6	Others	5
	Total	**50**
	Waste water generation Source	**Daily volume of Grey water in L**
1	Bathing	Bathing water requirement in litres * Total population
2	Washing	washing water requirement in litres * Total population
3	Toilet	Toilet water requirement in litres * Total population
4	Cleaning	Cleaning water requirement in litres * Total population
5	Cooking and cleaning Utensils	cooking and cleaning utensils water requirement in litres * Total population
6	Others	other purpose water requirement in litres * Total population
	Total	**50*total population**
	Waste water generation Source	**Annual Grey water in CuM**
1	Bathing	(Daily volume of grey water for bathing in litres *365) / 1000
2	Washing	(Daily volume of grey water for washing in litres *365) / 1001
3	Toilet	(Daily volume of grey water for toilet in litres *365) / 1002
4	Cleaning	(Daily volume of grey water for cleaning in litres *365) / 1003
5	Cooking and cleaning Utensils	(Daily volume of grey water for cooking and washing utensils in litres *365) / 1004
6	Others	(Daily volume of grey water for other purposes in litres *365) / 1005
	Total	**(Total daily volume of grey water in litres *365)/ 1000**
	Annual Grey water generated in ha.m	**Annual Grey water in Cum/10000**

ANNEXURE 3.6

WATER QUALITY STANDARDS AND FORMULA USED

RELATIVE WEIGHTS ASSIGNED FOR DIFFERENT WATER QUALITY PARAMETERS

S. No.	Physical and chemical pa-rameters	World Health Organization (WHO 2004)	Weight (w)	Relative weight (wi)
1	pH	8.5	4	0.133
2	Total dissolved solids (mg/l)	500	5	0.167
3	Bicarbonate (mg/l)	200	1	0.033
4	Chloride (mg/l)	200	4	0.133
5	Sulphate (mg/l)	200	3	0.1
6	Nitrate (mg/l)	45	3	0.1
7	Calcium (mg/l)	75	2	0.067
8	Magnesium (mg/l)	30	2	0.067
9	Sodium (mg/l)	200	4	0.133
10	Potassium (mg/l)	100	2	0.067

$$SI_i = W_i \times Q_i \qquad WQI = \sum_{i=1}^{n} SI_i$$

Where qi is the quality rating, Ci is the concentration of individual element in water samples represented in mg/l and Si is the drinking water standard for individual chemical constituents (in mg/l)

Sea water mixing index (SMI) (Park et al. (2005)

$$SMI = a\ X\frac{C\ Na}{T\ Na} + b\ X\frac{C\ Mg}{T\ Mg} + c\ X\frac{C\ Cl}{T\ Cl} + d\ X\frac{CSO_4}{TSO_4}$$

The measurements a, b, c and d represent the relative concentration percentage of Na+, Mg2+, Cl^- and SO_4^{2-} assumed

ANNEXURE 3.7

GP WISE STATUS OF WATER RESOURCE AND ITS SUPPLY AND DEMAND

Gram Panchayat	Canal Irrigation				Tradational Water bodies	
	Length of Main Canal (m)	Length of Minor Canal (m)	Length of Distributaries (m)	Water Courses (Field Channels) (m)	Number of Tanks (PWD & Union) (No.)	Number of Ooranis (No.)
K.Nedungulam	5,000	3,000	3,000	10,000	5	40
K.Veppangulam	5,000	3,000	5,000	15,000	7	7
Perunali	-	-	600	350	1	6
Keelaramanadhi	5,000	3,000	4,500	1,500	-	4
Musittaikurichi	15,000	10,000	25,000	25,000	12	15
Mavilangai	-	-	1,200	3,500	-	5
Sengappadai	-	-	1,200	3,500	1	6
Kadamangalam	2,500	-	250	850	2	7
O.Karisalkulam	1,500	-	-	1,000	4	6
Mandalamanickam	18,000	-	-	21,500	4	10
Thimmanathapuram	5,000	-	-	-	-	7
Pakkuvetti	5,000	3,000	8,000	1,000	7	3
Ponthampuli	6,000	-	800	8,000	1	6
Peraiyur	5,000	1,200	-	3,000	3	15
T. Valasubramaniapuram	6,000	-	-	5,000	-	12
Pammanendal	-	6,000	-	850	7	6
Pudukottai	4,000	-	-	1,000	-	3
Idayankulam	2,000	-	-	500	1	5
Maraikkulam	7,500	-	-	8,000	4	6
Valayapookulam	750	-	-	1,250	-	3
Melaramanadhi	4,000	1,200	-	500	1	6
Ramasamypatti	5,560	-	-	3,250	2	5
Natham	1,200	1,000	-	3,000	4	7
Udayanathapuram	1,300	850	-	2,000	2	7

Gram Panchayat	Canal Irrigation				Tradational Water bodies	
	Length of Main Canal (m)	Length of Minor Canal (m)	Length of Distributaries (m)	Water Courses (Field Channels) (m)	Number of Tanks (PWD & Union) (No.)	Number of Ooranis (No.)
Pappurediyapatti	-	-	-	-	-	8
Tharaikudi	2,000	-	-	6,000	7	6
T.punavasi	2,079	-	-	527	4	10
Anayur	-	-	-	500	2	6
Sadayanendhal	1,500	-	-	6,000	4	5
Pasumbon	1,500	-	-	1,000	4	7
Ariamangalam	3,000	1,000	-	500	-	6
Erumaikulam	1,500	700	-	1,600	-	7
Kakkudi	3,800	-	-	800	5	6
M.Pudukulam	7,000	-	-	2,000	-	6
Idivillagi	1,500	-	-	500	2	5
Eluvanur	1,500	1,000	3,000	500	-	6
Vallandhai	1,500	650	-	7,800	8	11
Ilanthaikulam	1,800	1,000	4,000	500	5	4
Mudalnadu	2,000	-	-	3,000	-	7
K.Pappankulam	4,000	2,100	-	3,000	-	7
Nagarathakurichi	1,500	600	-	6,000	-	3
Narayanapuram	2,500	1,000	-	1,000	2	5
Pappanam	1,000	-	-	6,000	6	4
Keelamudimannarkottai	1,700	-	-	850	-	7
Neeravi	4,800	-	-	1,200	1	6
N.Karisalkulam	5,000	-	2,580	500	2	6
Kovilangulam	-	3,000	450	310	4	22
Melamudimannarkottai	4,800	-	-	1,000	2	5
Kathanendal	2,000	1,000	-	5,000	2	5
Kamboothi	2,000	-	-	1,000	3	4
Achchangulam	2,500	850	3,000	500	-	13
Pulvoikulam	1,500	450	2,000	500	2	5
Vangarupuram	1,500	750	2,500	500	6	5

Gram Panchayat	Irrigation Facilities (ha)		Catchment Area wise Available Runoff (ha.m)			Watershed and Drainage Networks		
	Tank Irrigation	Open & Tube Well Irrigation	Good Catchment Area	Average Catchment Area	Bad Catchment Area	Length of Natural Drainage Lines (m)	Number of Natural Drainage Lines (No.)	Number of Micro-watersheds (No.)
K.Nedungulam	66.00	10.01	30.70	-	91.70	6,891.03	5	8
K.Veppangulam	133.55	13.89	50.20	2.20	89.40	1,225.60	1	6
Perunali	42.00	12.35	31.40	2.10	125.40	13,424.23	11	11
Keelaramanadhi	47.73	27.85	22.60	6.70	110.90	8,646.81	13	6
Musittaikurichi	258.00	4.00	67.70	1.00	151.30	8,782.49	11	10
Mavilangai	30.00	5.81	12.90	-	53.30	6,796.84	7	6
Sengappadai	23.00	7.07	14.10	0.70	80.20	2,667.25	4	6
Kadamangalam	147.00	-	42.90	-	121.90	5,543.23	6	9
O.Karisalkulam	27.87	182.11	30.90	-	127.60	6,477.63	3	9
Mandalamanickam	132.00	20.10	69.17	0.32	157.31	14,984.42	11	7
Thimmanathapuram	607.00	-	17.50	-	198.20	22,864.88	14	10
Pakkuvetti	20.12	-	63.00	-	108.30	4,100.29	5	8
Ponthampuli	607.03	-	42.10	3.20	80.50	6,532.33	7	6
Peraiyur	809.00	404.00	64.60	1.60	200.60	14,287.91	11	10
T. Valasubramaniapuram	404.00	20.02	10.40	-	102.70	13,591.13	9	9
Pammanendal	470.00	-	37.00	1.10	116.40	11,061.09	5	8
Pudukottai	80.52	20.58	18.40	-	64.80	5,054.65	3	4
Idayankulam	69.62	28.40	27.40	2.30	60.40	1,014.46	2	4
Maraikkulam	170.35	80.52	18.30	1.60	40.30	939.16	2	5
Valayapookulam	153.28	53.00	17.40	-	103.00	2,777.31	2	4
Melaramanadhi	262.95	152.92	9.40	-	55.50	9,276.08	10	6
Ramasamypatti	153.28	53.00	19.60	-	45.40	5,243.87	6	5
Natham	187.43	70.00	12.20	-	43.20	1,159.38	1	6
Udayanathapuram	187.43	70.00	13.10	-	30.20	-	-	4
Pappurediyapatti	206.00	80.45	11.30	11.00	158.80	17,885.18	13	8
Tharaikudi	131.60	-	62.60	-	69.00	1,899.57	5	5
T.punavasi	122.47	-	48.30	0.30	125.20	7,100.23	6	7

Gram Panchayat	Irrigation Facilities (ha)		Catchment Area wise Available Runoff (ha.m)			Watershed and Drainage Networks		
	Tank Irrigation	Open & Tube Well Irrigation	Good Catchment Area	Average Catchment Area	Bad Catchment Area	Length of Natural Drainage Lines (m)	Number of Natural Drainage Lines (No.)	Number of Micro-watersheds (No.)
Anayur	40.81	-	20.80	0.90	46.00	13,900.07	6	11
Sadayanendhal	25.50	-	73.30	2.50	179.30	5,655.57	6	6
Pasumbon	35.71	-	18.20	0.70	40.30	4,470.77	3	9
Ariamangalam	19.95	7.96	18.40	2.90	45.50	3,094.35	4	5
Erumaikulam	24.81	5.69	21.30	3.00	54.20	1,309.06	4	4
Kakkudi	77.90	46.73	43.50	3.20	73.70	-	-	9
M.Pudukulam	22.80	9.10	21.00	3.40	52.00	3,126.11	6	7
Idivillagi	24.55	-	27.90	3.20	103.60	8,901.20	7	7
Eluvanur	199.40	43.15	79.40	1.70	136.40	3,337.51	3	9
Vallandhai	266.16	4.55	35.50	0.20	86.10	-	-	9
Ilanthaikulam	128.00	39.00	24.10	5.70	81.90	3,066.10	4	6
Mudalnadu	132.00	273.00	56.30	1.00	112.00	2,198.84	1	4
K.Pappankulam	86.00	192.00	32.30	0.80	48.40	1,541.75	4	8
Nagarathakurichi	133.00	116.00	160.20	1.50	103.30	2,038.99	4	10
Narayanapuram	183.00	25.00	20.00	83.10	287.10	6,990.65	7	10
Pappanam	132.00	74.00	35.20	0.60	76.30	1,819.33	4	8
Keelamudimannarkottai	106.47	68.00	17.30	0.30	79.40	10,583.91	12	5
Neeravi	165.27	72.54	24.60	1.20	85.10	6,966.62	13	5
N.Karisalkulam	94.51	28.00	25.40	1.90	149.50	23,685.80	21	9
Kovilangulam	78.00	20.00	81.70	15.00	139.20	8,560.12	6	13
Melamudimannarkottai	81.73	18.36	14.10	-	73.30	10,681.97	11	4
Kathanendal	58.00	35.00	17.20	-	52.30	1,165.12	3	6
Kamboothi	44.00	28.00	12.90	-	39.20	1,861.86	2	7
Achchangulam	44.00	28.00	164.90	1.50	155.10	4,551.40	5	9
Pulvoikulam	170.64	2.89	29.70	1.50	54.50	7,543.19	8	9
Vangarupuram	494.00	140.00	52.50	0.60	157.80	6,908.14	8	6

Gram Panchayat	Water Demand								
	For Humans (ha.m)	For Livestock (ha.m)	For Agriculture (ha.m)	% GW Utilization for Drinking (%)	% GW Utilization for Livestock (%)	% GW Utilization for Agriculture. (%)	% SW Utilization for Drinking (%)	% SW Utilization for Livestock (%)	% SW Utilization for Agriculture (%)
K.Nedungulam	5.59	1.54	548.77	35	58	13	65	42	87
K.Veppangulam	4.65	2.20	135.36	64	63	9	36	37	91
Perunali	10.28	0.76	445.69	70	69	23	30	31	77
Keelaramanadhi	4.37	1.36	549.16	100	62	37	-	38	63
Musittaikurichi	12.31	4.64	949.05	100	28	2	-	72	98
Mavilangai	2.82	0.61	163.11	57	43	16	43	57	84
Sengappadai	4.75	1.17	230.05	50	59	24	50	41	76
Kadamangalam	4.47	0.54	204.20	63	32	-	37	68	100
O.Karisalkulam	6.76	1.97	513.73	11	28	55	89	72	45
Mandalamanickam	13.66	8.66	661.90	98	89	13	2	11	87
Thimmanathapuram	6.07	1.80	840.00	61	40	-	39	60	100
Pakkuvetti	9.89	1.51	359.94	74	52	-	26	48	100
Ponthampuli	1.83	0.53	307.02	98	52	-	2	48	100
Peraiyur	20.35	2.29	862.88	98	49	33	2	51	67
T. Valasubramaniapuram	2.33	0.82	402.15	95	62	5	5	38	95
Pammanendal	3.22	0.47	336.20	61	51	-	39	49	100
Pudukottai	4.57	0.42	108.54	81	19	20	19	81	80
Idayankulam	2.66	0.51	132.67	74	18	29	26	82	71
Maraikkulam	7.57	1.86	203.31	96	79	32	4	21	68
Valayapookulam	7.57	1.00	109.50	41	79	26	59	21	74
Melaramanadhi	13.36	0.70	485.88	77	45	37	23	55	63
Ramasamypatti	13.36	0.40	261.63	84	42	26	16	58	74
Natham	9.75	1.58	206.80	91	67	27	9	33	73
Udayanathapuram	16.01	1.06	137.55	87	67	27	13	33	73
Pappurediyapatti	6.83	0.70	733.94	70	41	28	30	59	72
Tharaikudi	3.69	1.23	242.03	75	50	-	25	50	100
T.punavasi	8.09	1.13	355.69	86	59	-	14	41	100

Gram Panchayat	Water Demand								
	For Humans (ha.m)	For Livestock (ha.m)	For Agriculture (ha.m)	% GW Utilization for Drinking (%)	% GW Utilization for Livestock (%)	% GW Utilzation for Agriculture. (%)	% SW Utilization for Drinking (%)	% SW Utilization for Livestock (%)	% SW Utilization for Agriculture (%)
Anayur	8.18	1.36	361.69	69	21	-	31	79	100
Sadayanendhal	8.18	1.06	239.34	77	64	-	23	36	100
Pasumbon	8.18	0.17	444.41	82	31	-	18	69	100
Ariamangalam	6.44	0.52	163.38	84	54	29	16	46	71
Erumaikulam	6.44	0.66	163.38	54	53	19	46	47	81
Kakkudi	4.08	0.94	153.32	86	33	37	14	67	63
M.Pudukulam	6.44	0.59	163.38	78	54	29	22	46	71
Idivillagi	3.45	0.29	117.90	71	53	-	29	47	100
Eluvanur	2.27	1.25	270.77	67	74	18	33	26	82
Vallandhai	2.92	0.74	181.71	100	23	2	-	77	98
Ilanthaikulam	4.29	0.67	227.37	83	92	23	17	8	77
Mudalnadu	2.98	0.87	301.40	78	32	67	22	68	33
K.Pappankulam	5.15	0.50	301.40	53	36	69	47	64	31
Nagarathakurichi	2.58	1.16	489.94	76	61	47	24	39	53
Narayanapuram	16.70	2.58	196.67	85	71	12	15	29	88
Pappanam	3.70	1.30	489.94	80	62	36	20	38	64
Keelamudimannarkottai	8.00	0.75	8.60	72	36	39	28	64	61
Neeravi	6.88	1.20	8.60	97	36	31	3	64	69
N.Karisalkulam	8.13	0.73	114.20	96	42	23	4	58	77
Kovilangulam	9.11	2.27	411.13	38	50	20	62	50	80
Melamudimannarkottai	3.37	0.67	22.78	71	37	18	29	63	82
Kathanendal	10.70	0.75	215.31	62	64	38	38	36	62
Kamboothi	10.70	0.65	215.31	65	56	39	35	44	61
Achchangulam	6.69	0.77	456.02	71	61	39	29	39	61
Pulvoikulam	10.57	0.89	456.02	77	49	2	23	51	98
Vangarupuram	4.10	1.63	217.66	78	39	22	22	61	78

ANNEXURE 3.8

LOCATION WISE WATER QUALITY IN KAMUTHI BLOCK DURING PRE-MONSOON SEASON

Gram Panchayat	Location	Latitude	Longitude	Well type	pH	Salinity	Ec	TDS (ppm)	TA (mg/l)
A Tharaikudi	Tharaikudi	E 78° 24' 49.349"	N 9° 29' 13.362"	Bore well	8.13	-	828	413	481
Abiramam	Abiramam	E 78° 26' 35.02"	N 9° 26' 10.889"	Bore well	7.59	-	5,170	3,260	416
Achchangulam	Periyanaikulam	E 78° 27' 7.243"	N 9° 29' 54.377"	Bore well	7.22	-	9,660	6,000	335
Achchangulam	Kodumalur	E 78° 26' 46.104"	N 9° 29' 8.279"	Bore well	7.65	-	3,131	1,950	434
Elanthaikulam	Illanthaikulam	E 78° 26' 28.727"	N 9° 19' 23.567"	Bore well	7.44	-	7,680	4,740	394
Eluvanur	Pothanathi	E 78° 22' 1.196"	N 9° 29' 5.237"	Open well	7.63	-	817	506	428
Enathi	Poongulam	E 78° 29' 57.347"	N 9° 18' 43.168"	Bore well	7.59	3.00	1,031	615	415
Erumaikulam	Erumaikulam	E 78° 24' 22.511"	N 9° 15' 14.702"	Bore well	7.76	-	1,973	1,185	445
K Nedungulam	K. Nedugulam	E 78° 19' 50.675"	N 9° 23' 11.353"	Bore well	6.4	-	7,250	329	257
K Pappankulam	Mudalnadu	E 78° 21' 42.419"	N 9° 21' 45.482"	Bore well	7.51	-	1,974	1,187	404
K Pappankulam	Poomavilangai	E 78° 22' 1.261"	N 9° 19' 53.087"	Bore well	7.18	-	2,964	1,783	333
K Veppangulam	Vepungallam	E 78° 22' 5.714"	N 9° 18' 39.334"	Bore well	7.59	-	1,132	668	414
Kaakudi	Koodakulam	E 78° 21' 37.127"	N 9° 29' 12.512"	Bore well	7.39	-	811	498	383
Kamuthi	Kamudi	E 78° 21' 41.918"	N 9° 25' 4.796"	Bore well	7.46	4.00	8,473	5,310	396
Kandilan	Enathi	E 78° 30' 15.66"	N 9° 18' 32.094"	Bore well	7.55	-	3,670	2,233	408
Kandilan	Kandian	E 78° 30' 29.102"	N 9° 18' 53.039"	Open well	7.26	-	11,120	7,056	346
Kathanendhal	Kathanendhal	E 78° 26' 30.577"	N 9° 15' 42.613"	Bore well	7.26	-	8,670	5,330	346
Keelamudimannarkottai	KeelamudiMannarkottai	E 78° 15' 11.97"	N 9° 26' 26.473"	Bore well	7.22	-	3,615	2,206	334
Keelamudimannarkottai	KK Kottai	E 78° 14' 35.754"	N 9° 25' 44.321"	Bore well	7.46	-	1,121	672	354
Keelamudimannarkottai	Near KK Kottai	E 78° 14' 25.112"	N 9° 25' 19.009"	Bore well	7.23	-	1,410	869	347
Keelaramanathi	Keelaramanathi (Farm)	E 78° 18' 40.19"	N 9° 24' 24.055"	Bore well	6.4	-	7,250	4,620	257
Komboothi	Kumboddi	E 78° 26' 23.23"	N 9° 14' 46.19"	Bore well	7.37	-	4,620	2,731	369
Kovilangulam	Kovilangulam	E 78° 25' 1.038"	N 9° 16' 20.741"	Bore well	6.88	6.00	21,700	13,250	301
Mandalamanickam	Near Mandalamanickam	E 78° 20' 28.435"	N 9° 27' 6.415"	Bore well	7.42	-	617	365	392
Mandalamanickam	Mandalamanickam	E 78° 20' 3.631"	N 9° 27' 43.229"	Bore well	7.04	-	5,890	3,680	312
Mandalamanickam	Yedaisoorani	E 78° 19' 45.646"	N 9° 25' 48.22"	Bore well	7.63	-	6,640	4,120	428
Mandalamanickam	Perumaldevanpatti	E 78° 19' 11.219"	N 9° 25' 56.294"	Bore well	7.02	6.00	17,650	10,860	311

Gram Panchayat	Location	Latitude	Longitude	Well type	pH	Salinity	Ec	TDS (ppm)	TA (mg/l)
Maviangai	Maviangai	E 78° 21' 24.602"	N 9° 16' 29.932"	Bore well	6.55	-	1,058	581	267
Melaramanadhi	Kavadipatti	E 78° 17' 22.726"	N 9° 24' 33.275"	Bore well	7.74	-	489	283	443
Mudimannarkottai	KeelaMandapasalai	E 78° 13' 53.573"	N 9° 25' 5.664"	Open well	7.35	-	1,099	699	365
Mussittakurichi	Thirusiluvaipuram	E 78° 19' 5.434"	N 9° 22' 16.619"	Bore well	7.38	-	1,496	845	381
N Karisalkulam	N. Karisalkuam	E 78° 16' 7.381"	N 9° 24' 44.561"	Open well	7.69	-	497	308	438
N Karisalkulam	Ramasamypatti	E 78° 15' 52.308"	N 9° 23' 39.905"	Bore well	7.01	-	540	326	311
N Karisalkulam	NeeraviChinnakarusalkulam	E 78° 16' 46.085"	N 9° 25' 14.905"	Bore well	7.77	-	549	301	448
Natham	Sabathi	E 78° 26' 47.112"	N 9° 27' 46.04"	Bore well	7.18	-	2,118	1,258	333
O Karisalkulam	Shokalingapuram	E 78° 23' 3.304"	N 9° 19' 6.47"	Bore well	7.09	10.00	30,360	14,180	315
Papporettiyapatti	Ramasamuthiram	E 78° 17' 20.184"	N 9° 13' 55.564"	Open well	7.58	-	1,290	805	411
Pappuraddiapatti	Pappuraddiapatti	E 78° 18' 22.399"	N 9° 14' 24.464"	Bore well	7.25	-	6,300	3,950	345
Pasumbon	Pasumpon	E 78° 23' 44.772"	N 9° 24' 43.607"	Bore well	7.62	-	778	494	424
Pasumbon	Pasumpon (Near)	E 78° 23' 51.407"	N 9° 24' 44.374"	Bore well	7.81	-	840	480	457
Pasumbon	Nanthiseri	E 78° 24' 28.901"	N 9° 25' 26.537"	Bore well	7.58	-	1,963	1,180	413
Peraiyur	Peterpuram	E 78° 27' 10.292"	N 9° 21' 19.022"	Bore well	7.16	-	7,460	4,730	328
Peraiyur	Mettupatti	E 78° 26' 14.878"	N 9° 21' 12.845"	Bore well	6.91	-	5,810	3,600	302
Peraiyur	Keelavalasai	E 78° 24' 47.833"	N 9° 21' 33.98"	Bore well	7.01	-	7,980	4,990	310
Perunali	Near Perunali	E 78° 18' 23.087"	N 9° 14' 2.123"	Bore well	7.31	-	3,589	2,097	353
Perunali	Perunali	E 78° 18' 59.958"	N 9° 14' 8.837"	Bore well	7.51	-	3,226	1,812	403
Pirabakkallur	Meesal	E 78° 36' 29.639"	N 9° 23' 3.541"	Bore well	7.57	-	6,800	4,270	410
Ponthampuli	Ponthampuli	E 78° 21' 18.018"	N 9° 14' 19.309"	Bore well	7.69	-	596	331	437
Pudhukottai	Pudukottai	E 78° 23' 59.017"	N 9° 20' 5.892"	Bore well	7.76	-	1,973	1,085	445
S P Kottai	SonaiPiriyanKottai	E 78° 28' 13.926"	N 9° 19' 23.761"	Bore well	7.09	10.00	30,360	17,180	315
Sangappadai	Sangappadai	E 78° 23' 42.965"	N 9° 21' 41.998"	Bore well	7.23	-	4,369	2,687	337
T Punavasal	ManikaThootam	E 78° 23' 33.652"	N 9° 30' 0.475"	Bore well	7.79	-	935	544	452
T.Balasubramaiapuram	T.Balasubramaiapuram	E 78° 17' 42.216"	N 9° 15' 53.251"	Bore well	7.45	-	3,952	2,431	394
Thimmanathapuram	Veeramanachipatti	E 78° 19' 20.374"	N 9° 15' 10.015"	Bore well	7.18	-	8,610	5,410	333
Thimmanathapuram	Thimmanathapuram	E 78° 18' 37.624"	N 9° 14' 59.309"	Bore well	6.81	-	6,320	3,860	292
Valayapokulam	Valayapokulam	E 78° 21' 4.464"	N 9° 26' 45.478"	Bore well	7.89	-	1,960	1,123	467
Vangarupuram	T Kallikulam	E 78° 24' 36.4"	N 9° 29' 57.919"	Bore well	7.64	-	806	487	475

Gram Panchayat	CO_3 (mg/l)	HCO_3 (mg/l)	TH (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K(mg/l)	$S0_4$ (mg/l)	Cl (mg/l)	NO_3 (mg/l)	WQI	SMI
A Tharaikudi	99	363	99	45	25	125	13	18	168	19	61.60	0.14
Abiramam	109	293	616	282	158	731	5	15	1,120	41	314.30	0.71
Achchangulam	55	248	1,152	526	295	63	2	39	1,824	51	462.90	0.84
Achchangulam	141	282	373	171	96	262	6	58	819	21	193.60	0.52
Elanthaikulam	98	286	916	419	234	106	2	38	1,274	46	363.20	0.63
Eluvanur	97	304	97	45	25	102	11	12	159	13	60.00	0.12
Enathi	108	270	123	56	32	296	7	19	367	19	94.30	0.27
Erumaikulam	117	293	235	108	60	214	6	26	586	10	131.90	0.35
K Nedungulam	36	197	864	395	221	122	18	23	186	36	136.10	0.20
K Pappankulam	97	283	235	108	60	310	5	46	617	31	145.60	0.43
K Pappankulam	66	246	353	162	91	279	26	56	629	86	189.50	0.45
K Veppangulam	107	269	310	200	90	83	8	16	462	8	111.40	0.25
Kaakudi	132	218	420	80	112	57	3	24	208	8	81.00	0.17
Kamuthi	84	286	1,010	462	259	985	13	25	1,596	15	464.80	1.01
Kandilan	97	293	450	120	134	315	5	42	831	36	213.60	0.52
Kandilan	96	225	1,326	606	339	463	4	33	2,147	26	561.20	1.08
Kathanendhal	78	255	1,034	472	265	156	9	15	1,681	16	417.30	0.76
Keelamudimannarkottai	95	229	320	280	22	573	13	29	971	18	223.90	0.60
Keelamudimannarkottai	87	215	203	112	54	156	2	39	261	19	90.20	0.23
Keelamudimannarkottai	78	237	267	134	78	93	7	14	367	26	107.20	0.21
Keelaramanathi	84	141	864	395	221	852	2	50	1,920	42	445.00	1.13
Komboothi	69	270	551	252	141	325	22	34	978	8	248.10	0.56
Kovilangulam	58	226	490	120	291	1,356	13	24	2,841	11	812.10	1.60
Mandalamanickam	119	255	74	34	19	73	2	19	91	9	45.10	0.10
Mandalamanickam	95	199	702	321	180	734	13	31	1,173	18	335.80	0.77
Mandalamanickam	96	286	792	362	203	1,354	25	22	1,632	34	436.00	1.12
Mandalamanickam	95	184	680	160	470	1,347	28	33	3,417	64	827.00	1.86
Maviangai	69	174	283	106	33	126	7	10	250	3	73.10	0.16
Melaramanadhi	108	318	58	27	15	43	6	8	85	12	39.30	0.06
Mudimannarkottai	96	237	346	122	72	26	7	57	316	48	98.50	0.25

Gram Panchayat	CO_3 (mg/l)	HCO_3 (mg/l)	TH (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K(mg/l)	$S0_4$ (mg/l)	Cl (mg/l)	NO_3 (mg/l)	WQI	SMI
Mussittakurichi	94	248	160	80	45	157	11	124	318	47	105.90	0.42
N Karisalkulam	136	263	59	27	15	55	1	5	126	6	41.80	0.08
N Karisalkulam	58	232	260	120	90	49	2	21	212	3	75.60	0.15
N Karisalkulam	103	327	65	30	17	59	6	2	124	9	43.40	0.07
Natham	97	216	252	115	65	196	13	19	674	53	149.50	0.36
O Karisalkulam	95	205	3,619	1,654	927	456	15	11	5,568	16	1,243.50	2.44
Papporettiyapatti	110	286	154	70	39	196	17	23	293	21	93.20	0.22
Pappuraddiapatti	58	254	751	343	192	386	4	16	1,390	16	339.20	0.71
Pasumbon	93	306	253	69	102	72	8	31	129	38	81.10	0.15
Pasumbon	114	306	450	360	67	61	3	17	337	58	115.60	0.19
Pasumbon	105	277	234	107	60	195	10	39	392	24	121.20	0.30
Peraiyur	94	211	810	120	650	564	5	47	1,855	12	490.60	1.10
Peraiyur	66	226	693	317	177	678	7	55	1,586	44	362.30	0.95
Peraiyur	97	175	951	435	244	1,356	5	40	2,163	32	514.30	1.36
Perunali	63	259	420	196	110	479	10	21	864	8	216.30	0.54
Perunali	59	315	385	176	99	386	15	53	781	24	196.60	0.54
Pirabakkallur	114	263	811	371	208	796	3	17	2,186	35	441.00	1.15
Ponthampuli	117	284	370	160	157	66	3	12	260	8	96.50	0.17
Pudhukottai	113	312	235	108	60	210	6	11	426	5	115.70	0.26
S P Kottai	66	235	3,619	1,654	927	93	3	29	834	15	1,003.60	0.59
Sangappadai	68	249	521	238	133	156	12	73	1,047	59	249.40	0.61
T Punavasal	111	316	111	51	29	96	4	14	181	30	67.40	0.13
T.Balasubramaiapuram	97	286	471	215	121	206	15	11	1,380	23	216.30	0.63
Thimmanathapuram	95	216	410	200	202	433	6	13	1,430	12	382.20	0.74
Thimmanathapuram	73	190	753	344	193	362	12	15	1,580	22	348.70	0.77
Valayapokulam	97	344	234	107	60	237	7	24	401	13	119.70	0.28
Vangarupuram	85	278	148	72	36	163	9	29	203	38	77.50	0.19

ANNEXURE 3.9

LOCATION WISE WATER QUALITY IN KAMUTHI BLOCK DURING POST-MONSOON SEASON

Gram Panchayat	Location	Latitude	Longitude	Well type	pH	Salinity	Ec	TDS (ppm)	TA (mg/l)
A Tharaikudi	Tharaikudi	E 78° 24' 49.349"	N 9° 29' 13.362"	Bore well	7.64	0	652	404	143
Abiramam	Abiramam	E 78° 26' 35.02"	N 9° 26' 10.889"	Bore well	6.95	0	2,914	1,807	387
Achchangulam	Periyanaikulam	E 78° 27' 7.243"	N 9° 29' 54.377"	Bore well	6.63	1	9,430	5,847	769
Achchangulam	Kodumalur	E 78° 26' 46.104"	N 9° 29' 8.279"	Bore well	6.96	0	2,888	1,791	228
Elanthaikulam	Illanthaikulam	E 78° 26' 28.727"	N 9° 19' 23.567"	Bore well	7.06	0	4,360	2,703	551
Eluvanur	Pothanathi	E 78° 22' 1.196"	N 9° 29' 5.237"	Open well	7.14	0	703	436	155
Enathi	Poongulam	E 78° 29' 57.347"	N 9° 18' 43.168"	Bore well	6.49	3	9,740	6,039	1,056
Erumaikulam	Erumaikulam	E 78° 24' 22.511"	N 9° 15' 14.702"	Bore well	7.22	0	568	352	158
K Nedungulam	K. Nedugulam	E 78° 19' 50.675"	N 9° 23' 11.353"	Bore well	7.16	0	736	456	175
K Pappankulam	Mudalnadu	E 78° 21' 42.419"	N 9° 21' 45.482"	Bore well	7.36	0	864	536	148
K Pappankulam	Poomavilangai	E 78° 22' 1.261"	N 9° 19' 53.087"	Bore well	6.6	0	3,387	2,100	356
K Veppangulam	Vepungallam	E 78° 22' 5.714"	N 9° 18' 39.334"	Bore well	7.28	0	1,271	788	252
Kaakudi	Koodakulam	E 78° 21' 37.127"	N 9° 29' 12.512"	Bore well	6.71	0	1,564	970	218
Kamuthi	Kamudi	E 78° 21' 41.918"	N 9° 25' 4.796"	Bore well	7.24	0	566	351	136
Kandilan	Enathi	E 78° 30' 15.66"	N 9° 18' 32.094"	Bore well	7.16	0	1,164	722	257
Kandilan	Kandian	E 78° 30' 29.102"	N 9° 18' 53.039"	Open well	7.4	0	966	599	213
Kathanendhal	Kathanendhal	E 78° 26' 30.577"	N 9° 15' 42.613"	Bore well	6.95	2	6,490	4,024	657
Keelamudimannarkottai	KeelamudiMannarkottai	E 78° 15' 11.97"	N 9° 26' 26.473"	Bore well	6.39	0	3,599	2,231	378
Keelamudimannarkottai	KK Kottai	E 78° 14' 35.754"	N 9° 25' 44.321"	Bore well	7.37	0	493	306	125
Keelamudimannarkottai	Near KK Kottai	E 78° 14' 25.112"	N 9° 25' 19.009"	Bore well	7.34	0	893	554	147
Keelaramanathi	Keelaramanathi (Farm)	E 78° 18' 40.19"	N 9° 24' 24.055"	Bore well	7.07	0	1,733	1,074	197
Komboothi	Kumboddi	E 78° 26' 23.23"	N 9° 14' 46.19"	Bore well	7.32	0	3,170	1,965	796
Kovilangulam	Kovilangulam	E 78° 25' 1.038"	N 9° 16' 20.741"	Bore well	6.95	2	7,600	4,712	678
Mandalamanickam	Near Mandalamanickam	E 78° 20' 28.435"	N 9° 27' 6.415"	Bore well	6.64	0	1,698	1,053	246
Mandalamanickam	Mandalamanickam	E 78° 20' 3.631"	N 9° 27' 43.229"	Bore well	6.67	0	1,655	1,026	213
Mandalamanickam	Yedaisoorani	E 78° 19' 45.646"	N 9° 25' 48.22"	Bore well	6.82	0	3,421	2,121	754
Mandalamanickam	Perumaldevanpatti	E 78° 19' 11.219"	N 9° 25' 56.294"	Bore well	6.92	6	20,770	12,877	1,089

Gram Panchayat	Location	Latitude	Longitude	Well type	pH	Salinity	Ec	TDS (ppm)	TA (mg/l)
Maviangai	Maviangai	E 78° 21' 24.602"	N 9° 16' 29.932"	Bore well	6.68	0	851	528	234
Melaramanadhi	Kavadipatti	E 78° 17' 22.726"	N 9° 24' 33.275"	Bore well	7.58	0	658	408	105
Mudimannarkottai	KeelaMandapasalai	E 78° 13' 53.573"	N 9° 25' 5.664"	Open well	6.85	0	2,114	1,311	484
Mussittakurichi	Thirusiluvaipuram	E 78° 19' 5.434"	N 9° 22' 16.619"	Bore well	7.33	0	2,407	1,492	313
N Karisalkulam	N. Karisalkuam	E 78° 16' 7.381"	N 9° 24' 44.561"	Open well	7.23	0	727	451	167
N Karisalkulam	Ramasamypatti	E 78° 15' 52.308"	N 9° 23' 39.905"	Bore well	7.46	0	503	312	126
N Karisalkulam	NeeraviChinnakarusalkulam	E 78° 16' 46.085"	N 9° 25' 14.905"	Bore well	7.2	0	558	346	136
Natham	Sabathi	E 78° 26' 47.112"	N 9° 27' 46.04"	Bore well	6.99	0	2,512	1,557	554
O Karisalkulam	Shokalingapuram	E 78° 23' 3.304"	N 9° 19' 6.47"	Bore well	6.79	9	22,790	14,130	1,128
Papporettiyapatti	Ramasamuthiram	E 78° 17' 20.184"	N 9° 13' 55.564"	Open well	7.79	0	802	497	176
Pappuraddiapatti	Pappuraddiapatti	E 78° 18' 22.399"	N 9° 14' 24.464"	Bore well	7.17	0	1,546	959	392
Pasumbon	Pasumpon	E 78° 23' 44.772"	N 9° 24' 43.607"	Bore well	6.78	0	1,095	679	161
Pasumbon	Pasumpon (Near)	E 78° 23' 51.407"	N 9° 24' 44.374"	Bore well	6.87	0	1,644	1,019	286
Pasumbon	Nanthiseri	E 78° 24' 28.901"	N 9° 25' 26.537"	Bore well	7.02	0	1,328	823	293
Peraiyur	Peterpuram	E 78° 27' 10.292"	N 9° 21' 19.022"	Bore well	6.72	1	10,030	6,219	648
Peraiyur	Mettupatti	E 78° 26' 14.878"	N 9° 21' 12.845"	Bore well	7.45	0	2,581	1,600	276
Peraiyur	Keelavalasai	E 78° 24' 47.833"	N 9° 21' 33.98"	Bore well	7.37	0	1,264	784	195
Perunali	Near Perunali	E 78° 18' 23.087"	N 9° 14' 2.123"	Bore well	7.1	0	3,440	2,133	372
Perunali	Perunali	E 78° 18' 59.958"	N 9° 14' 8.837"	Bore well	7.22	0	2,941	1,823	933
Pirabakkallur	Meesal	E 78° 36' 29.639"	N 9° 23' 3.541"	Bore well	6.6	0	764	474	176
Ponthampuli	Ponthampuli	E 78° 21' 18.018"	N 9° 14' 19.309"	Bore well	7.57	0	1,426	884	317
Pudhukottai	Pudukottai	E 78° 23' 59.017"	N 9° 20' 5.892"	Bore well	7.24	0	2,225	1,380	633
S P Kottai	SonaiPiriyanKottai	E 78° 28' 13.926"	N 9° 19' 23.761"	Bore well	6.29	10	19,100	11,842	1,079
Sangappadai	Sangappadai	E 78° 23' 42.965"	N 9° 21' 41.998"	Bore well	6.59	0	3,669	2,275	377
T Punavasal	ManikaThootam	E 78° 23' 33.652"	N 9° 30' 0.475"	Bore well	7.24	0	1,116	692	246
T.Balasubramaiapuram	T.Balasubramaiapuram	E 78° 17' 42.216"	N 9° 15' 53.251"	Bore well	7.27	0	1,134	703	283
Thimmanathapuram	Veeramanachipatti	E 78° 19' 20.374"	N 9° 15' 10.015"	Bore well	7.01	0	5,500	3,410	573
Thimmanathapuram	Thimmanathapuram	E 78° 18' 37.624"	N 9° 14' 59.309"	Bore well	7.2	0	1,579	979	263
Valayapokulam	Valayapokulam	E 78° 21' 4.464"	N 9° 26' 45.478"	Bore well	7.15	0	1,456	903	228
Vangarupuram	T Kallikulam	E 78° 24' 36.4"	N 9° 29' 57.919"	Bore well	7.55	0	900	558	198

Gram Panchayat	CO_3 (mg/l)	HCO_3 (mg/l)	TH (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K(mg/l)	$S0_4$ (mg/l)	Cl (mg/l)	NO_3 (mg/l)	WQI	SMI
A Tharaikudi	9	134	62	21	30	28	6.2	32	58.4	3.546	42.7	0.189
Abiramam	48	326	227	124	91	186	35	92	261.1	15.86	142.6	0.97
Achchangulam	135	617	622	321	286	357	72	121	844.9	36	396.4	0.633
Achchangulam	43	174	171	86	73	186	19	48	182	15.719	126.2	0.411
Elanthaikulam	162	381	306	169	124	256	73	245	386	78	221	0.531
Eluvanur	16	145	67	38	16	22	6.7	46.62	53	3.827	41.3	0.173
Enathi	140	904	623	326	281	464	109	184	966	79	432.3	0.986
Erumaikulam	31	111	49	16	22	29	12	28	59	9	39.4	0.275
K Nedungulam	11	152	72	24	34	32	7	48.76	65.9	4.002	46.5	0.205
K Pappankulam	12	118	64	28	23	38	8.2	57.32	77.5	4.704	49.1	0.408
K Pappankulam	49	298	339	109	117	147	32.2	124	303.5	18.431	158.5	0.561
K Veppangulam	53	184	83	29	37	56	18	86	126	24	71.5	0.228
Kaakudi	16	194	31	16	2	116	8.4	109.6	289.9101	1.24176	78	0.299
Kamuthi	8	117	56	18	26	25	5.4	37.53	50.7	3.081	38.5	1.068
Kandilan	17	183	92	49	32	54	13	79	116	34	70.5	0.453
Kandilan	14	206	98	46	36	67	21	73	114	26	70	0.598
Kathanendhal	193	449	422	184	216	285	89	262	678	59	305.7	0.756
Keelamudimannarkottai	78	286	244	106	124	224	35	133	346	43.8048	178.1	0.891
Keelamudimannarkottai	7	102	51	16	23	21	4.7	39	49	8	37	0.221
Keelamudimannarkottai	13	124	73	29	33	43	8.5	59.24	82	12	54.4	0.192
Keelaramanathi	28	157	160	66	81	78	16.5	81	155.2	9.426	93.5	1.029
Komboothi	145	643	247	96	138	145	16	186	386	23	167.1	0.706
Kovilangulam	176	476	469	216	234	267	76	198	635	63	328.3	1.908
Mandalamanickam	36	196	170	93	64	127	21	93	204	18	100.1	0.266
Mandalamanickam	26	175	177	86	77	116	15.7	76	194	9.005	97	0.924
Mandalamanickam	52	263	238	104	119	206	42	127	306.5	26	166.2	1.663
Mandalamanickam	246	824	1,245	603	618	843	86	206	1627	125	839.5	2.457
Maviangai	32	186	56	26	23	58	13	38	94	17	52.2	0.212
Melaramanadhi	12	86	49	21	17	26	6.2	43.63	49	3.581	39.5	0.109
Mudimannarkottai	30	436	188	68	99	92	20.1	94	189.5	11.506	109.7	0.217

Gram Panchayat	CO_3 (mg/l)	HCO_3 (mg/l)	TH (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K(mg/l)	$S0_4$ (mg/l)	Cl (mg/l)	NO_3 (mg/l)	WQI	SMI
Mussittakurichi	60	239	161	88	71	168	10.4	112.4	429.8667	3.1824	131.7	0.483
N Karisalkulam	16	150	66	23	34	38	6.9	38	65.2	3.958	46.1	0.126
N Karisalkulam	13	106	30	12	9	23	3.2	10	38	2.738	32.3	0.079
N Karisalkulam	15	106	49	23	13	19	3	26	48	3.037	34.4	0.109
Natham	36	218	208	81	113	134	23.9	69	225	13.666	127.2	0.388
O Karisalkulam	214	904	1,650	734	894	967	127	237	2686	126	1037.4	2.143
Papporettiyapatti	26	143	74	29	32	39	8	53.15	71.8	4.362	50	0.287
Pappuraddiapatti	92	279	109	38	58	72	16	88	139	36	87	0.548
Pasumbon	14	142	159	82	62	71	13	71	69	11	70.5	0.178
Pasumbon	54	219	142	53	77	134	15.6	108.97	169	8.944	95.2	0.252
Pasumbon	19	174	119	43	62	58	12.6	73	156	12	77.4	0.349
Peraiyur	126	507	556	264	278	368	61	186	688	48	397.5	1.121
Peraiyur	37	232	209	83	111	132	24.5	73	231.2	14.043	129.7	0.887
Peraiyur	28	161	105	41	52	59	12	83.84	113.3	6.881	70.9	1.522
Perunali	66	287	299	158	127	301	12	136	364	36	183.9	0.807
Perunali	126	807	238	121	104	227	21	137	258	18	150.5	0.657
Pirabakkallur	11	158	65	25	28	38	7.3	50.69	63	4.16	45.3	0.892
Ponthampuli	49	157	123	49	57	64	17	67	146	14	80	0.207
Pudhukottai	132	486	190	83	99	116	47	138	214	38	127.2	0.455
S P Kottai	174	894	1,232	637	573	988	126	239	2283	133	856.5	1.528
Sangappadai	53	313	231	118	98	259	34.8	143	428	19.967	178.1	0.512
T Punavasal	16	137	71	36	23	18	10.6	34	51	6.074	51.1	0.156
T.Balasubramaiapuram	56	213	89	36	41	59	14	68	114	19	67.2	0.332
Thimmanathapuram	179	385	413	162	236	296	74	142	691	68	284.5	0.945
Thimmanathapuram	47	193	100	38	49	96	23	126	156	17	86.6	0.564
Valayapokulam	21	189	117	57	49	63	13.8	77	167	7.926	79.1	0.399
Vangarupuram	18	165	70	35	19	23	8.5	46	62	4.897	47.4	0.24

ANNEXURE 3.10

GP WISE STATUS OF AGRICULTURE RESOURCE

Gram Panchayat	Land Resources (ha)								
	Non-Agri-cultural Uses	Area under Barren & Un-cultiva-ble Land	Area under Per-manent Pastures and Other Grazing Land	Land Under Miscellaneous Tree Critica-lops etc.	Cultivable Waste Land	Fallows Land other than Current Fallows	Current Fal-low land	Unirrigated Land	Area Irri-gated by Source
K.Nedungulam	138.56	-	-	-	-	148.84	116.45	466.14	76.01
K.Veppangulam	226.40	-	-	-	13.09	253.15	143.57	257.80	132.89
Perunali	141.60	-	-	-	12.52	368.25	285.58	395.66	54.35
Keelaramanadhi	102.05	-	-	39.42	-	-	180.75	720.26	75.58
Musittaikurichi	305.01	-	-	-	5.87	-	45.44	1126.70	160.00
Mavilangai	57.98	-	-	-	-	212.35	38.72	181.87	35.81
Sengappadai	63.75	-	-	-	4.40	100.00	81.80	494.46	30.07
Kadamangalam	193.46	-	-	-	0.09	1.02	480.61	444.16	147.00
O.Karisalkulam	139.19	-	-	-	-	0.44	163.49	890.81	68.88
Mandalamanickam	298.60	13.17	-	-	1.90	521.34	279.94	431.39	152.10
Thimmanathapuram	78.85	-	-	-	-	624.50	85.40	1020.48	14.05
Pakkuvetti	283.85	-	-	-	-	350.61	106.27	475.92	20.32
Ponthampuli	189.77	-	-	-	18.71	308.20	216.19	92.72	91.52
Peraiyur	291.16	-	-	3.28	6.28	360.00	683.04	434.43	288.59
T. Valasubramaniapuram	46.98	-	-	-	-	0.03	464.89	438.88	-
Pammanendal	166.79	-	-	-	6.17	452.60	385.54	111.58	74.79
Pudukottai	82.82	-	-	-	0.01	41.10	63.32	423.46	42.61
Idayankulam	55.22	-	-	-	0.01	27.40	42.22	282.31	28.40
Maraikkulam	123.48	-	2.40	-	11.28	47.14	230.22	174.04	80.45
Valayapookulam	82.32	-	1.60	-	7.52	31.42	153.48	116.03	53.64
Melaramanadhi	78.33	-	-	0.13	-	83.90	362.97	307.35	152.40
Ramasamypatti	42.18	-	-	0.07	-	45.17	195.44	165.49	82.06
Natham	88.57	-	-	-	-	83.52	187.14	58.73	70.01
Udayanathapuram	59.05	-	-	-	-	55.68	124.76	39.15	46.68
Pappurediyapatti	42.42	8.33	-	64.83	-	482.62	286.36	548.47	80.45

Gram Panchayat	Land Resources (ha)								
	Non-Agri-cultural Uses	Area under Barren & Un-cultiva-ble Land	Area under Per-manent Pastures and Other Grazing Land	Land Under Miscellaneous Tree Critica-lops etc.	Cultivable Waste Land	Fallows Land other than Current Fallows	Current Fal-low land	Unirrigated Land	Area Irri-gated by Source
Tharaikudi	280.78	1.43	-	-	0.27	80.16	194.15	187.18	145.73
T.punavasi	209.57	8.07	-	-	1.51	325.87	187.21	466.88	122.48
Anayur	93.58	-	-	0.69	4.42	122.96	96.49	144.70	40.81
Sadayanendhal	330.30	-	-	3.85	10.76	460.00	325.00	615.90	177.85
Pasumbon	81.88	-	-	0.60	3.63	107.59	84.43	126.61	35.71
Ariamangalam	82.72	-	-	-	17.23	105.53	197.74	69.72	27.91
Erumaikulam	96.08	-	-	-	17.86	165.16	193.75	87.94	30.50
Kakkudi	195.90	-	-	7.89	10.84	106.40	55.20	292.25	194.63
M.Pudukulam	94.54	-	-	-	19.69	120.60	225.98	79.68	31.91
Idivillagi	125.65	-	-	-	18.71	247.92	351.63	291.20	21.55
Eluvanur	357.83	-	-	-	9.86	235.27	252.86	469.70	242.55
Vallandhai	159.95	-	-	0.42	0.79	13.29	332.30	141.91	270.72
Ilanthaikulam	108.83	-	-	0.53	32.69	42.38	39.90	510.64	128.00
Mudalnadu	253.84	-	-	-	5.60	226.23	271.52	357.26	131.01
K.Pappankulam	145.50	-	-	-	4.71	126.71	191.83	22.01	85.46
Nagarathakurichi	722.18	-	-	-	8.58	40.00	116.26	619.90	133.00
Narayanapuram	90.04	-	-	487.58	0.34	18.68	1383.48	924.89	200.31
Pappanam	158.89	-	-	-	3.74	60.00	74.94	404.08	132.70
Keelamudimannarkottai	77.93	-	-	1.39	0.17	55.87	106.94	467.78	68.07
Neeravi	110.76	-	-	6.17	0.66	164.98	165.27	346.11	72.54
N.Karisalkulam	114.62	-	-	11.44	-	28.50	94.51	1128.46	64.60
Kovilangulam	368.40	-	-	85.49	2.66	140.68	239.06	737.66	108.02
Melamudimannarkottai	63.65	-	-	-	-	18.33	81.73	484.13	61.07
Kathanendal	77.66	-	-	-	-	128.06	58.80	222.96	50.71
Kamboothi	58.25	-	-	-	-	96.05	44.10	167.22	38.03
Achchangulam	743.26	-	-	1.09	7.51	412.38	290.79	348.56	313.98
Pulvoikulam	133.73	-	-	5.42	3.44	11.60	2.61	302.12	163.05
Vangarupuram	236.54	-	-	-	3.60	162.27	494.90	590.98	140.71

Gram Panchayat	Land under Catchment Area (ha)			Crop Details				
	Good Catchment	Average Catchment	Bad Catchment	Irrigated Area (ha)	Rainfed area (ha)	Paddy Cultivation (ha)	Crop Water Requirement - Irrigated condition (ha.m)	Crop Water Requirement - Rainfed condition (ha.m)
K.Nedungulam	138.56	-	807.44	152.14	431.29	430.16	143.36	405.41
K.Veppangulam	226.40	13.09	787.41	51.61	70.90	107.86	65.54	69.83
Perunali	141.60	12.52	1103.84	235.86	598.37	30.70	146.25	299.44
Keelaramanadhi	102.05	39.42	976.59	179.39	499.75	311.35	135.09	414.07
Musittaikurichi	305.01	5.87	1332.14	295.49	604.48	760.11	390.49	558.56
Mavilangai	57.98	-	468.75	121.52	111.61	42.35	91.93	71.18
Sengappadai	63.75	4.40	706.33	84.71	298.54	5.50	48.51	181.54
Kadamangalam	193.46	0.09	1072.79	102.36	119.72	116.12	109.42	94.78
O.Karisalkulam	139.19	-	1123.62	402.89	351.78	103.86	284.75	228.98
Mandalamanickam	311.77	1.90	1384.77	600.74	217.55	77.07	511.37	150.54
Thimmanathapuram	78.85	-	1744.43	212.75	1400.28	-	120.22	719.78
Pakkuvetti	283.85	-	953.12	103.13	412.99	178.01	71.45	288.49
Ponthampuli	189.77	18.71	708.63	281.66	175.85	71.39	191.92	115.10
Peraiyur	291.16	9.56	1766.06	511.10	630.53	290.90	413.55	449.33
T. Valasubramaniapuram	46.98	-	903.80	226.96	565.11	-	131.14	271.02
Pammanendal	166.79	6.17	1024.51	399.48	68.11	91.04	291.58	44.62
Pudukottai	82.82	0.01	570.49	24.94	146.33	-	13.79	94.75
Idayankulam	55.22	0.01	380.33	30.49	178.85	-	16.86	115.81
Maraikkulam	123.48	13.68	531.85	104.17	114.06	97.16	113.45	89.85
Valayapookulam	82.32	9.12	354.57	56.11	61.44	52.33	61.11	48.39
Melaramanadhi	78.33	0.13	906.62	167.62	388.96	309.82	148.01	337.87
Ramasamypatti	42.18	0.07	488.16	90.23	209.63	166.78	79.60	182.03
Natham	88.57	-	399.40	95.42	96.24	152.20	119.22	87.59
Udayanathapuram	59.05	-	266.27	63.56	63.52	101.47	79.45	58.10
Pappurediyapatti	50.75	64.83	1397.90	501.76	912.39	-	272.94	461.01
Tharaikudi	282.21	0.27	607.22	138.63	36.33	171.75	206.65	35.38
T.punavasi	217.64	1.51	1102.44	132.06	178.72	274.41	192.61	163.08

Gram Panchayat	Land under Catchment Area (ha)			Crop Details				
	Good Catchment	Average Catchment	Bad Catchment	Irrigated Area (ha)	Rainfed area (ha)	Paddy Cultivation (ha)	Crop Water Requirement - Irrigated condition (ha.m)	Crop Water Requirement - Rainfed condition (ha.m)
Anayur	93.58	5.11	404.96	25.71	412.09	245.76	33.66	328.04
Sadayanendhal	330.30	14.61	1578.75	67.41	156.98	197.66	93.75	145.59
Pasumbon	81.88	4.23	354.34	87.98	312.44	400.42	131.97	312.44
Ariamangalam	82.72	17.23	400.90	26.76	123.25	150.01	40.13	123.25
Erumaikulam	96.08	17.86	477.35	26.76	123.25	150.01	40.13	123.25
Kakkudi	195.90	18.73	648.48	81.93	30.43	112.36	122.89	30.43
M.Pudukulam	94.54	19.69	458.17	26.76	123.25	150.01	40.13	123.25
Idivillagi	125.65	18.71	912.30	30.17	72.65	102.82	45.26	72.65
Eluvanur	357.83	9.86	1200.38	121.24	88.91	210.15	181.86	88.91
Vallandhai	159.95	1.21	758.22	104.76	24.57	129.33	157.14	24.57
Ilanthaikulam	108.83	33.22	720.92	59.42	138.24	197.66	89.13	138.24
Mudalnadu	253.84	5.60	986.02	88.42	168.77	257.19	132.63	168.77
K.Pappankulam	145.50	4.71	426.01	200.19	189.67	389.85	300.28	189.67
Nagarathakurichi	722.18	8.58	909.16	43.21	131.85	175.06	64.82	131.85
Narayanapuram	90.04	487.92	2527.36	200.19	189.67	389.85	300.28	189.67
Pappanam	158.89	3.74	671.72	4.75	1.49	6.23	7.12	1.49
Keelamudimannarkottai	77.93	1.56	698.66	4.75	1.49	6.23	7.12	1.49
Neeravi	110.76	6.83	748.90	19.60	84.80	104.40	29.40	84.80
N.Karisalkulam	114.62	11.44	1316.07	142.00	359.00	230.50	124.65	286.48
Kovilangulam	368.40	88.15	1225.42	7.08	12.16	19.24	10.62	12.16
Melamudimannarkottai	63.65	-	645.26	42.51	151.55	194.06	63.76	151.55
Kathanendal	77.66	-	460.53	42.51	151.55	194.06	63.76	151.55
Kamboothi	58.25	-	345.40	198.55	158.20	356.75	297.83	158.20
Achchangulam	743.26	8.60	1365.71	198.55	158.20	356.75	297.83	158.20
Pulvoikulam	133.73	8.86	479.38	27.15	176.94	204.09	40.72	176.94
Vangarupuram	236.54	3.60	1388.86	27.15	176.94	204.09	40.72	176.94

Gram Panchayat	Soil Resources: Status of Available Nitrogen (%)					Status of Organic Carbon (%)					Status of Soil Micro Nutrients (%)	
	Very Low	Low	Medium	High	Very High	Very Low	Low	Medium	High	Very High	Sufficient	Deficient
K.Nedungulam	-	39.00	-	-	-	-	34.00	28.00	-	-	52.00	48.00
K.Veppangulam	-	43.00	-	-	-	-	43.00	-	-	-	64.00	36.00
Perunali	-	51.00	-	-	-	100.00	27.00	7.00	-	-	63.00	37.00
Keelaramanadhi	-	44.00	-	-	-	-	4.00	86.00	12.00	-	66.00	34.00
Musittaikurichi	100.00	54.00	-	-	-	-	45.00	9.00	-	-	74.00	26.00
Mavilangai	-	65.00	-	-	-	100.00	24.00	35.00	14.00	-	81.00	19.00
Sengappadai	59.00	4.00	-	-	2.00	32.00	68.00	28.00	-	-	60.00	40.00
Kadamangalam	-	58.00	-	-	-	100.00	27.00	17.00	-	-	72.00	28.00
O.Karisalkulam	15.00	69.00	40.00	-	-	72.00	17.00	-	-	-	61.00	39.00
Mandalamanickam	-	98.00	-	-	-	-	1.00	100.00	-	-	64.00	36.00
Thimmanathapuram	12.00	39.00	-	-	-	84.00	34.00	-	-	-	73.00	27.00
Pakkuvetti	-	61.00	-	-	-	100.00	39.00	17.00	-	-	70.00	30.00
Ponthampuli	100.00	45.00	-	-	-	-	46.00	-	-	-	62.00	38.00
Peraiyur	33.00	55.00	-	-	-	33.00	45.00	3.00	17.00	50.00	67.00	33.00
T. Valasubramaniapuram	60.00	34.00	-	-	-	40.00	34.00	-	-	-	57.00	43.00
Pammanendal	42.00	8.00	-	-	-	34.00	32.00	-	-	-	69.00	31.00
Pudukottai	64.00	-	-	-	-	31.00	83.00	22.00	-	-	60.00	40.00
Idayankulam	33.00	62.00	2.00	-	-	-	38.00	17.00	31.00	6.00	78.00	22.00
Maraikkulam	33.00	62.00	2.00	-	-	-	38.00	17.00	31.00	6.00	78.00	22.00
Valayapookulam	-	45.00	-	-	-	100.00	44.00	-	-	-	83.00	17.00
Melaramanadhi	-	45.00	-	-	-	100.00	44.00	-	-	-	83.00	17.00
Ramasamypatti	-	52.00	-	-	-	-	48.00	5.00	-	-	70.00	30.00
Natham	64.00	-	-	-	-	31.00	83.00	22.00	-	-	60.00	40.00
Udayanathapuram	-	52.00	-	-	-	-	48.00	5.00	-	-	70.00	30.00
Pappurediyapatti	-	46.00	-	-	3.00	60.00	35.00	5.00	2.00	2.00	60.00	40.00
Tharaikudi	50.00	38.00	25.00	-	-	25.00	-	9.00	100.00	70.00	61.00	39.00
T.punavasi	80.00	48.00	-	-	1.00	10.00	-	-	100.00	99.00	65.00	35.00
Anayur	30.00	36.00	-	-	-	-	-	-	100.00	100.00	40.00	60.00

Gram Panchayat	Soil Resources: Status of Available Nitrogen (%)					Status of Organic Carbon (%)					Status of Soil Micro Nutrients (%)	
	Very Low	Low	Medium	High	Very High	Very Low	Low	Medium	High	Very High	Sufficient	Deficient
Sadayanendhal	14.00	39.00	14.00	-	-	4.00	7.00	48.00	100.00	-	71.00	29.00
Pasumbon	-	53.00	-	-	-	-	46.00	7.00	-	-	89.00	11.00
Ariamangalam	53.00	40.00	11.00	-	-	-	-	67.00	22.00	90.00	49.00	51.00
Erumaikulam	42.00	55.00	-	-	-	53.00	40.00	11.00	-	-	49.00	51.00
Kakkudi	100.00	31.00	12.00	-	-	-	-	41.00	100.00	100.00	66.00	34.00
M.Pudukulam	43.00	100.00	-	-	-	-	-	-	-	86.00	68.00	32.00
Idivillagi	42.00	25.00	19.00	35.00	-	-	-	21.00	26.00	100.00	46.00	54.00
Eluvanur	100.00	36.00	-	-	-	-	4.00	48.00	-	-	60.00	40.00
Vallandhai	-	53.00	-	-	-	100.00	31.00	12.00	-	-	66.00	34.00
Ilanthaikulam	25.00	69.00	-	-	-	50.00	31.00	51.00	2.00	-	64.00	36.00
Mudalnadu	57.00	-	-	-	-	43.00	100.00	-	-	-	68.00	32.00
K.Pappankulam	-	53.00	-	-	-	94.00	25.00	15.00	-	-	68.00	32.00
Nagarathakurichi	-	39.00	19.00	-	-	50.00	-	28.00	100.00	-	70.00	30.00
Narayanapuram	89.00	-	-	-	-	-	49.00	12.00	-	-	69.00	31.00
Pappanam	-	39.00	19.00	-	-	50.00	-	28.00	100.00	-	70.00	30.00
Keelamudimannarkottai	44.00	23.00	-	-	1.00	-	-	-	67.00	99.00	66.00	34.00
Neeravi	21.00	24.00	60.00	39.00	-	-	-	-	51.00	93.00	60.00	40.00
N.Karisalkulam	-	42.00	-	-	-	-	-	41.00	50.00	98.00	62.00	38.00
Kovilangulam	100.00	51.00	-	-	-	-	31.00	20.00	-	-	57.00	43.00
Melamudimannarkottai	32.00	27.00	73.00	33.00	-	44.00	23.00	-	-	1.00	66.00	34.00
Kathanendal	94.00	28.00	5.00	-	-	-	1.00	33.00	100.00	100.00	72.00	28.00
Kamboothi	94.00	28.00	5.00	-	-	-	1.00	33.00	100.00	100.00	72.00	28.00
Achchangulam	3.00	59.00	-	-	-	97.00	40.00	-	-	-	64.00	36.00
Pulvoikulam	54.00	33.00	-	-	-	43.00	51.00	11.00	6.00	-	59.00	41.00
Vangarupuram	28.00	49.00	4.00	-	-	70.00	31.00	13.00	3.00	-	70.00	30.00

Gram Panchayat	Status of Physical condition of the soil (%)								Soil Texture (%)			
	Moderately Acidic	Strongly Acidic	Highly Acidic	Moderately Acidic	Slighly Acidic	Neutral	Moderately Alkaline	Strongly Alkaline	Clay soil	Fine Soil	Coarse loamy	Soil Water Permeability (Low, Moderate, high)
K.Nedungulam	-	-	-	-	-	-	98.88	1.12	-	92.82	-	Moderate to low
K.Veppangulam	-	-	52.38	19.05	-	-	28.57	-	-	89.96	-	Moderate to low
Perunali	-	-	-	1.03	23.71	19.59	55.67	-	-	56.10	31.22	Moderate to low
Keelaramanadhi	1.23	-	17.28	19.75	7.41	1.23	53.09	-	-	98.13	-	Moderate to low
Musittaikurichi	-	-	-	31.75	53.44	2.65	12.17	-	-	87.96	-	Moderate to low
Mavilangai	-	-	-	53.49	4.65	-	41.86	-	-	50.49	45.63	Moderate to low
Sengappadai	-	-	-	18.37	20.41	8.16	53.06	-	-	82.55	13.89	Moderate to low
Kadamangalam	-	-	-	2.00	16.00	2.00	80.00	-	-	62.26	27.49	Moderate to low
O.Karisalkulam	-	-	-	-	1.61	3.23	95.16	-	-	65.25	26.49	Moderate to low
Mandalamanickam	-	-	-	-	-	-	100.00	-	0.42	84.85	-	Moderate to low
Thimmanathapuram	-	-	1.80	2.99	18.56	1.80	74.85	-	-	81.64	10.80	Moderate to low
Pakkuvetti	-	-	-	5.13	94.87	-	-	-	-	0.97	0.08	Moderate to low
Ponthampuli	-	-	-	1.54	-	-	98.46	-	-	81.82	7.03	Moderate to low
Peraiyur	-	-	-	-	-	-	76.55	12.78	-	79.69	6.00	Moderate to low
T. Valasubramaniapuram	-	-	-	0.74	-	0.74	98.53	-	-	87.41	-	Moderate to low
Pammanendal	-	-	-	44.90	36.73	2.04	16.33	-	-	78.76	13.59	Moderate to low
Pudukottai	-	-	-	27.54	23.19	5.80	43.48	-	-	70.46	26.06	Moderate to low
Idayankulam	2.04	-	-	8.16	28.57	-	61.22	-	-	92.62	-	Moderate to low
Maraikkulam	2.04	-	-	8.16	28.57	-	61.22	-	-	95.00	-	Moderate to low
Valayapookulam	-	2.17	17.39	62.32	10.87	-	7.25	-	-	95.00	-	Moderate to low
Melaramanadhi	-	2.17	17.39	62.32	10.87	-	7.25	-	-	99.00	-	Moderate to low
Ramasamypatti	-	-	10.26	28.21	6.41	-	48.72	6.41	-	82.00	0.44	Moderate to low
Natham	-	-	-	27.54	23.19	5.80	43.48	-	-	68.35	24.65	Moderate to low
Udayanathapuram	-	-	10.26	28.21	6.41	-	48.72	6.41	-	60.00	21.33	Moderate to low
Pappurediyapatti	-	-	14.37	-	4.79	-	80.84	-	-	82.00	0.22	Moderate to low
Tharaikudi	-	-	16.51	70.64	3.67	-	9.17	-	-	74.00	-	Moderate to low
T.punavasi	-	-	-	-	28.24	-	69.41	2.35	-	76.00	14.53	Moderate to low

Gram Panchayat	Status of Physical condition of the soil (%)								Soil Texture (%)			
	Moderately Acidic	Strongly Acidic	Highly Acidic	Moderately Acidic	Slighly Acidic	Neutral	Moderately Alkaline	Strongly Alkaline	Clay soil	Fine Soil	Coarse loamy	Soil Water Permeability (Low, Moderate, high)
Anayur	-	-	-	-	3.85	-	96.15	-	-	66.00	3.74	Moderate to low
Sadayanendhal	-	-	-	6.00	4.00	-	84.00	6.00	-	64.00	19.64	Moderate to low
Pasumbon	-	-	-	-	-	-	100.00	-	-	92.00	-	Moderate to low
Ariamangalam	-	-	-	-	21.05	-	78.95	-	-	90.00	-	Moderate to low
Erumaikulam	-	-	-	-	21.05	-	78.95	-	-	83.00	-	Moderate to low
Kakkudi	-	-	28.79	42.42	15.15	1.52	12.12	-	-	91.00	-	Moderate to low
M.Pudukulam	-	-	-	-	-	8.33	91.67	-	-	82.00	-	Moderate to low
Idivillagi	-	-	3.64	36.36	5.45	1.82	49.09	3.64	-	83.00	2.00	Moderate to low
Eluvanur	-	1.27	27.85	11.39	7.59	-	51.90	-	-	91.00	0.58	Moderate to low
Vallandhai	-	-	28.79	42.42	15.15	1.52	12.12	-	-	85.00	-	Moderate to low
Ilanthaikulam	-	-	27.27	50.00	4.55	-	18.18	-	-	72.00	20.00	Moderate to low
Mudalnadu	-	-	-	-	-	8.33	91.67	-	-	93.00	-	Moderate to low
K.Pappankulam	-	-	1.20	6.02	18.07	1.20	73.49	-	-	84.00	-	Moderate to low
Nagarathakurichi	58.75	-	-	-	-	-	33.75	7.50	-	94.00	-	Moderate to low
Narayanapuram	-	-	4.17	79.17	-	-	16.67	-	-	97.00	-	Moderate to low
Pappanam	58.75	-	-	-	-	-	33.75	7.50	-	88.00	-	Moderate to low
Keelamudimannarkottai	-	-	-	29.59	34.69	2.04	33.67	-	-	98.00	-	Moderate to low
Neeravi	-	-	-	-	-	4.76	95.24	-	-	93.00	-	Moderate to low
N.Karisalkulam	-	-	-	1.01	2.02	1.01	95.96	-	-	98.00	-	Moderate to low
Kovilangulam	-	20.00	68.89	4.44	-	-	6.67	-	-	75.00	13.00	Moderate to low
Melamudimannarkottai	-	-	-	29.59	34.69	2.04	33.67	-	-	95.00	-	Moderate to low
Kathanendal	-	2.78	33.33	44.44	2.78	-	16.67	-	-	90.19	1.13	Moderate to low
Kamboothi	-	2.78	33.33	44.44	2.78	-	16.67	-	-	92.00	-	Moderate to low
Achchangulam	-	-	5.36	60.71	20.54	-	8.93	4.46	-	68.00	21.91	Moderate to low
Pulvoikulam	-	-	0.72	3.62	3.62	2.90	71.01	18.12	-	80.00	20.00	Moderate to low
Vangarupuram	-	-	-	6.67	0.95	-	86.67	5.71	-	17.57	76.00	Moderate to low

Gram Panchayat	Soil moisture and ET			Means of Water Extraction (%)		Irrigation Methods (%)		Livestock (No.)			
	Volumetric Soil Moisture (%)	Estimated Soil Moisture (ha.m)	ET Losses (ha.m)	Gravity	Lifting	Wild Flooding	Control Flooding	Cattle Population	Sheep Population	Goat Population	Poultry
K.Nedungulam	17	137.26	283.00	62	38	86	14	243	991	706	1,904
K.Veppangulam	17	136.09	203.94	38	62	46	54	371	1,277	976	1,510
Perunali	17	189.78	234.91	38	62	77	23	141	217	421	608
Keelaramanadhi	17	172.72	436.01	36	64	63	37	225	723	526	1,879
Musittaikurichi	17	227.46	671.66	85	15	97	3	358	6,155	806	-
Mavilangai	17	79.69	113.63	37	63	83	17	69	693	258	532
Sengappadai	17	120.82	273.80	37	63	76	24	185	856	479	864
Kadamangalam	17	182.39	308.59	33	67	100	-	45	328	673	450
O.Karisalkulam	17	191.02	500.96	5	95	13	87	303	1,286	1,030	1,036
Mandalamanickam	17	237.97	304.58	25	75	86	14	2,097	612	1,572	3,130
Thimmanathapuram	17	296.55	540.02	15	85	-	100	193	1,724	897	1,176
Pakkuvetti	17	162.03	259.04	46	54	35	65	208	738	1,114	2,342
Ponthampuli	17	123.65	96.17	11	89	100	-	73	273	435	637
Peraiyur	17	301.86	379.13	14	86	66	34	295	1,272	1,841	3,875
T. Valasubramaniapuram	17	153.65	229.10	85	15	99	1	137	275	573	818
Pammanendal	17	175.22	97.29	46	54	100	-	62	424	205	617
Pudukottai	17	96.99	243.29	60	40	80	20	22	152	778	161
Idayankulam	17	64.66	162.19	55	45	71	29	26	186	952	197
Maraikkulam	17	92.74	134.10	55	45	68	32	403	500	536	720
Valayapookulam	17	61.83	89.40	55	45	74	26	217	268	288	388
Melaramanadhi	17	154.15	240.06	73	27	63	37	86	138	834	1,994
Ramasamypatti	17	83.00	129.26	55	45	74	36	46	138	449	1,073
Natham	17	67.90	67.20	56	44	73	27	292	255	538	339
Udayanathapuram	17	45.27	44.80	56	44	73	27	195	170	358	226
Pappurediyapatti	17	250.08	362.14	18	82	72	28	78	473	618	973
Tharaikudi	17	103.52	173.78	27	73	100	-	167	1,171	397	1,150
T.punavasi	17	189.04	307.65	36	64	100	-	184	502	416	935

Gram Panchayat	Soil moisture and ET			Means of Water Extraction (%)		Irrigation Methods (%)		Livestock (No.)			
	Volumetric Soil Moisture (%)	Estimated Soil Moisture (ha.m)	ET Losses (ha.m)	Gravity	Lifting	Wild Flooding	Control Flooding	Cattle Population	Sheep Population	Goat Population	Poultry
Anayur	17	69.71	97.20	100	-	100	-	79	1,363	1,566	667
Sadayanendhal	17	270.87	416.35	100	-	100	-	186	393	626	906
Pasumbon	17	60.96	85.04	73	27	73	27	14	82	224	189
Ariamangalam	17	71.08	50.96	70	30	72	29	76	290	340	745
Erumaikulam	17	84.19	61.83	78	22	81	19	96	326	490	690
Kakkudi	17	113.43	258.27	20	80	63	37	86	1,167	524	585
M.Pudukulam	17	81.24	58.25	67	33	71	29	87	331	389	851
Idivillagi	17	158.27	163.26	78	22	100	-	42	120	247	158
Eluvanur	17	205.74	371.79	13	87	82	18	253	530	279	2,425
Vallandhai	17	129.10	215.61	15	85	98	2	46	502	1,031	1,498
Ilanthaikulam	17	128.20	333.65	21	79	63	37	168	62	80	143
Mudalnadu	17	168.58	254.88	27	73	63	37	77	510	958	1,047
K.Pappankulam	17	73.22	56.10	41	59	63	37	49	284	489	539
Nagarathakurichi	17	156.02	393.01	44	56	53	47	195	619	577	834
Narayanapuram	17	512.60	841.87	33	67	88	12	502	646	707	5,285
Pappanam	17	114.83	280.20	55	45	64	36	223	601	726	546
Keelamudimannarkottai	17	119.04	280.44	55	45	61	39	75	467	626	797
Neeravi	17	128.47	221.76	55	45	70	30	120	682	900	1,481
N.Karisalkulam	17	225.68	628.75	55	45	77	23	84	600	526	910
Kovilangulam	17	223.31	486.07	68	32	80	20	301	1,245	1,697	2,444
Melamudimannarkottai	17	109.69	284.59	17	83	82	18	69	459	574	668
Kathanendal	17	78.29	142.86	41	59	62	38	132	236	471	748
Kamboothi	17	58.72	107.14	59	41	61	39	99	402	353	561
Achchangulam	17	233.63	346.41	59	41	61	39	128	295	490	945
Pulvoikulam	17	83.00	245.65	59	41	98	2	121	692	475	961
Vangarupuram	17	236.72	381.94	15	85	78	22	175	1,501	1,068	1,531

ANNEXURE 3.11

GP WISE DEMOGRAPHIC AND SOCIO ECONOMIC STATUS

Gram Panchayat	Geographical Area (ha)	Male Population (No.)	Female Population (No.)	Total Population (No.)	SC Population (No.)	ST Population (No.)	Vulnerable popupation (No.)	Households (HH's) (No.)	Only one room HH's (SECC) (No.)	Female Headed HH's (SECC) (No.)
K.Nedungulam	946	1,037	1,005	2,042	498	-	498	464	306	28
K.Veppangulam	1,027	875	824	1,699	10	-	10	455	5	29
Perunali	1,258	1,918	1,837	3,755	461	-	461	868	355	50
Keelaramanadhi	1,118	835	762	1,597	68	-	68	393	185	26
Musittaikurichi	1,643	2,204	2,292	4,496	1,414	-	1,414	1,072	518	78
Mavilangai	527	531	500	1,031	22	-	22	236	158	8
Sengappadai	774	884	850	1,734	519	-	519	480	144	32
Kadamangalam	1,266	840	794	1,634	144	-	144	410	1	8
O.Karisalkulam	1,263	1,216	1,254	2,470	394	-	394	643	3	44
Mandalamanickam	1,698	2,549	2,440	4,989	877	968	1,845	1,230	232	79
Thimmanathapuram	1,823	1,162	1,057	2,219	-	-	-	573	179	36
Pakkuvetti	1,237	1,855	1,758	3,613	562	-	562	892	212	61
Ponthampuli	917	300	369	669	88	-	88	221	14	35
Peraiyur	2,067	3,764	3,669	7,433	6,064	-	6,064	1,898	559	105
T. Valasubramaniapuram	951	403	448	851	45	-	45	212	12	10
Pammanendal	1,197	590	588	1,178	40	-	40	317	160	12
Pudukottai	547	842	829	1,671	75	-	75	437	222	56
Idayankulam	359	550	423	973	46	-	46	437	222	56
Maraikkulam	596	1,360	1,404	2,764	318	-	318	742	36	84
Valayapookulam	345	1,360	1,404	2,764	318	-	318	437	222	56
Melaramanadhi	954	2,446	2,436	4,882	168	-	168	1,359	129	98
Ramasamypatti	473	2,446	2,436	4,882	168	-	168	1,359	129	98
Natham	455	1,753	1,809	3,562	122	-	122	1,558	265	107
Udayanathapuram	300	3,300	2,550	5,850	580	-	580	1,558	265	107
Pappurediyapatti	1,369	1,195	1,300	2,495	25	-	25	570	168	31

Gram Panchayat	Geographical Area (ha)	Male Population (No.)	Female Population (No.)	Total Population (No.)	SC Population (No.)	ST Population (No.)	Vulnerable popupation (No.)	Households (HH's) (No.)	Only one room HH's (SECC) (No.)	Female Headed HH's (SECC) (No.)
Tharaikudi	786	666	682	1,348	248	-	248	360	3	64
T.punavasi	1,015	1,461	1,495	2,956	982	-	982	818	35	67
Anayur	1,476	1,659	1,329	2,988	499	-	499	337	5	7
Sadayanendhal	935	1,659	1,329	2,988	499	-	499	335	10	17
Pasumbon	1,203	1,659	1,329	2,988	499	-	499	638	19	36
Ariamangalam	990	1,215	1,138	2,353	190	-	190	565	386	21
Erumaikulam	716	1,215	1,138	2,353	190	-	190	565	386	21
Kakkudi	740	763	828	1,491	360	-	360	447	1	41
M.Pudukulam	1,196	1,215	1,138	2,353	190	-	190	363	182	7
Idivillagi	693	662	599	1,261	8	-	8	374	181	22
Eluvanur	1,562	411	417	828	591	-	591	527	70	37
Vallandhai	872	544	521	1,065	727	-	727	249	4	46
Ilanthaikulam	789	850	718	1,568	85	-	85	287	6	28
Mudalnadu	958	520	568	1,088	11	-	11	439	119	12
K.Pappankulam	780	921	962	1,883	38	-	38	447	1	41
Nagarathakurichi	1,254	480	464	944	45		45	392	62	33
Narayanapuram	1,470	3,400	2,700	6,100	920	-	920	891	62	26
Pappanam	792	700	650	1,350	350	-	350	392	62	33
Keelamudimannarkottai	747	1,541	1,382	2,923	52	-	52	893	58	74
Neeravi	780	1,287	1,228	2,515	79	-	79	485	24	47
N.Karisalkulam	1,432	1,479	1,491	2,970	81	-	81	649	61	51
Kovilangulam	1,677	1,680	1,648	3,328	1,479	-	1,479	778	262	54
Melamudimannarkottai	660	616	615	1,231	81	-	81	893	58	74
Kathanendal	531	1,968	1,940	3,908	139	-	139	869	678	46
Kamboothi	384	1,968	1,940	3,908	139	-	139	869	678	46
Achchangulam	1,426	1,210	1,235	2,445	809	-	809	609	201	29
Pulvoikulam	634	1,939	1,923	3,862	1,538	-	1,538	393	185	26
Vangarupuram	1,628	786	712	1,498	791	-	791	376	140	15

Gram Panchayat	Vulnerable Households (SECC) (No.)	% of Vulnerable Households (%)	Registered MGNREGA Job cards (Persons)	Active person working in MGNREGA job Cards (Persons)	Drinking Water Sources (No.)	HH's have tap water connection for drinking water (No.)	HH's dependent on other sources for drinking water (No.)	Annual Greywater Generation (ha - m)
K.Nedungulam	223	0	783	518	46	300	844	4
K.Veppangulam	12	0	560	424	42	400	676	3
Perunali	264	0	645	555	37	600	1,550	7
Keelaramanadhi	137	0	580	460	175	392	826	3
Musittaikurichi	386	0	1,490	991	28	658	319	8
Mavilangai	113	0	257	155	23	220	1,013	2
Sengappadai	110	0	829	489	22	60	342	3
Kadamangalam	3	0	389	343	19	-	2,200	3
O.Karisalkulam	15	0	971	764	46	560	820	5
Mandalamanickam	186	0	1,925	1,566	207	1,718	1,358	9
Thimmanathapuram	136	0	670	515	31	650	1,730	4
Pakkuvetti	167	0	1,241	730	38	150	559	7
Ponthampuli	20	0	376	324	58	374	810	1
Peraiyur	423	0	3,600	1,700	866	1,402	7,072	14
T. Valasubramaniapuram	11	0	527	333	19	373	650	2
Pammanendal	116	0	257	233	33	310	620	2
Pudukottai	172	0	452	354	16	400	448	3
Idayankulam	172	0	452	354	34	320	552	2
Maraikkulam	50	0	455	399	67	600	770	5
Valayapookulam	172	0	463	413	142	650	810	5
Melaramanadhi	120	0	1,245	928	26	1,100	950	9
Ramasamypatti	120	0	1,245	928	19	1,100	1,500	9
Natham	218	0	775	628	117	615	1,369	7
Udayanathapuram	218	0	1,495	1,055	70	1,000	1,350	11
Pappurediyapatti	127	0	598	400	47	500	1,750	5
Tharaikudi	21	0	773	634	63	320	1,480	2
T.punavasi	45	0	1,245	1,046	95	948	1,806	5

Gram Panchayat	Vulnerable Households (SECC) (No.)	% of Vulnerable Households (%)	Registered MGNREGA Job cards (Persons)	Active person working in MGNREGA job Cards (Persons)	Drinking Water Sources (No.)	HH's have tap water connection for drinking water (No.)	HH's dependent on other sources for drinking water (No.)	Annual Greywater Generation (ha - m)
Anayur	6	0	411	346	36	490	495	5
Sadayanendhal	12	0	791	567	64	575	1,326	5
Pasumbon	24	0	774	465	73	701	1,381	5
Ariamangalam	277	0	227	198	63	450	290	4
Erumaikulam	277	0	425	363	24	520	1,170	4
Kakkudi	13	0	527	451	88	424	2,560	3
M.Pudukulam	130	0	309	280	23	500	748	4
Idivillagi	133	0	227	199	42	350	512	2
Eluvanur	60	0	742	558	73	545	1,090	2
Vallandhai	17	0	936	733	205	822	822	2
Ilanthaikulam	13	0	850	580	53	520	1,318	3
Mudalnadu	87	0	722	280	50	365	860	2
K.Pappankulam	13	0	840	623	30	725	1,387	3
Nagarathakurichi	53	0	560	490	34	280	616	2
Narayanapuram	51	0	1,800	1,100	206	1,100	2,023	11
Pappanam	53	0	958	610	61	452	1,050	2
Keelamudimannarkottai	63	0	1,242	956	47	`1700	3,526	5
Neeravi	31	0	539	524	309	780	3,040	5
N.Karisalkulam	58	0	742	665	295	610	2,577	5
Kovilangulam	200	0	975	702	68	760	3,906	6
Melamudimannarkottai	63	0	425	305	28	420	859	2
Kathanendal	488	1	1,106	680	26	852	1,000	7
Kamboothi	488	1	210	180	26	852	598	7
Achchangulam	149	0	1,347	1,105	94	98	1,750	4
Pulvoikulam	137	0	662	559	43	600	1,180	7
Vangarupuram	103	0	682	566	41	360	400	3

ANNEXURE 4

IPCC VULNERABILITY ASSESSMENT METHODOLOGY

Normalization of Indicators:

In order to make the indicators free from the units, normalization has done. The normalization process varies depending on the nature of relationship of that particular indicator with the vulnerability. The following formula are used,

- for indicators with positive relationship with vulnerability

$$x_{ij}^{p} = \frac{Xij - Min\, i\{Xij\}}{(Max\, i\{Xij\} - Min\, i\{Xij\}}$$

- for indicators with negative relationship with vulnerability

$$x_{ij}^{n} = \frac{Max\, i\{Xij\} - Xij}{Max\, i\{Xij\} - Min\{Xij\}}$$

Aggregation and categorization of Indicators

The normalized values of indicator sets are aggregated to obtain the vulnerability index and categorized in to high, medium and low vulnerability classes.

$$VI = \frac{\sum_{i}^{N} K_i S_i}{K_i}$$

X_{ij} is the value of j^{th} indicator for i^{th} GP and X^{P}_{ij} is the normalized value

X_{ij} is the value of j^{th} indicator for i^{th} GP and x^{n}_{ij} is the normalized value

ANNEXURE 5.1

GP WISE WASCA PROPOSED TREATMENT AREA

Gram Panchayat	Non-Agricultural Uses	Barren & Un-cultivable Land	Permanent Pastures and Other Grazing Land	Land Under Miscellaneous Tree Criticalops etc.	Cultivable Waste Land	Fallows Land other than Current Fallows	Current Fallow land	Unirrigated Land	Treatment Area Irrigated by Source
K.Nedungulam	2.36	-	-	-	-	71.44	55.90	223.75	36.48
K.Veppangulam	3.94	-	-	-	11.13	7.59	4.31	7.73	3.99
Perunali	2.41	-	-	-	10.64	110.48	85.67	118.70	16.31
Keelaramanadhi	1.74	-	-	33.51	-	-	63.26	252.09	26.45
Musittaikurichi	5.19	-	-	-	4.99	-	16.36	405.61	57.60
Mavilangai	0.99	-	-	-	-	101.93	18.59	87.30	17.19
Sengappadai	1.09	-	-	-	3.74	36.00	29.45	178.01	10.83
Kadamangalam	3.29	-	-	-	0.08	0.01	4.81	4.44	1.47
O.Karisalkulam	2.37	-	-	-	-	-	1.63	8.91	0.69
Mandalamanickam	5.08	11.19	-	-	1.62	5.21	2.80	4.31	1.52
Thimmanathapuram	1.34	-	-	-	-	149.88	20.50	244.92	3.37
Pakkuvetti	4.83	-	-	-	-	84.15	25.50	114.22	4.88
Ponthampuli	3.23	-	-	-	15.90	27.74	19.46	8.34	8.24
Peraiyur	4.96	-	-	2.79	5.34	79.20	150.27	95.57	63.49
T. Valasubramaniapuram	0.80	-	-	-	-	-	23.24	21.94	-
Pammanendal	2.84	-	-	-	5.24	162.94	138.79	40.17	26.92
Pudukottai	1.41	-	-	-	0.01	16.03	24.70	165.15	16.62
Idayankulam	0.94	-	-	-	0.01	10.69	16.46	110.10	11.08
Maraikkulam	2.10	-	2.04	-	9.59	3.30	16.12	12.18	5.63
Valayapookulam	1.40	-	1.36	-	6.39	2.20	10.74	8.12	3.75
Melaramanadhi	1.33	-	-	0.11	-	7.55	32.67	27.66	13.72
Ramasamypatti	0.72	-	-	0.06	-	4.07	17.59	14.89	7.39
Natham	1.51	-	-	-	-	11.69	26.20	8.22	9.80
Udayanathapuram	1.00	-	-	-	-	7.80	17.47	5.48	6.53
Pappurediyapatti	0.72	7.08	-	55.11	-	106.18	63.00	120.66	17.70
Tharaikudi	27.62	1.22	-	-	0.23	4.81	11.65	11.23	8.74
T.punavasi	3.57	6.86	-	-	1.28	19.55	11.23	28.01	7.35

Gram Panchayat	Non-Agricultural Uses	Barren & Un-cultivable Land	Permanent Pastures and Other Grazing Land	Land Under Miscellaneous Tree Criticalops etc.	Cultivable Waste Land	Fallows Land other than Current Fallows	Current Fallow land	Unirrigated Land	Treatment Area Irrigated by Source
Anayur	1.59	-	-	0.58	3.76	2.46	1.93	2.89	0.82
Sadayanendhal	5.62	-	-	3.27	9.15	18.40	13.00	24.64	7.11
Pasumbon	1.39	-	-	0.51	3.09	4.30	3.38	5.06	1.43
Ariamangalam	1.41	-	-	-	14.65	51.71	96.89	34.16	13.68
Erumaikulam	1.64	-	-	-	15.18	80.93	94.94	43.09	14.95
Kakkudi	3.33	-	-	6.71	9.21	3.19	1.66	8.77	5.84
M.Pudukulam	1.61	-	-	-	16.74	59.09	110.73	39.04	15.64
Idivillagi	2.14	-	-	-	15.90	89.25	126.59	104.83	7.76
Eluvanur	6.09	-	-	-	8.38	25.88	27.81	51.67	26.68
Vallandhai	2.72	-	-	0.35	0.67	0.93	23.26	9.93	18.95
Ilanthaikulam	1.85	-	-	0.45	27.79	1.27	1.20	15.32	3.84
Mudalnadu	4.32	-	-	-	4.76	6.79	8.15	10.72	3.93
K.Pappankulam	2.48	-	-	-	4.00	3.80	5.75	0.66	2.56
Nagarathakurichi	147.73	-	-	-	7.29	5.60	16.28	86.79	18.62
Narayanapuram	1.53	-	-	414.44	0.29	1.12	83.01	55.49	12.02
Pappanam	2.70	-	-	-	3.18	8.40	10.49	56.57	18.58
Keelamudimannarkottai	1.33	-	-	1.18	0.14	7.82	14.97	65.49	9.53
Neeravi	1.89	-	-	5.24	0.56	23.10	23.14	48.46	10.16
N.Karisalkulam	1.95	-	-	9.72	-	3.99	13.23	157.98	9.04
Kovilangulam	6.27	-	-	72.67	2.26	36.58	62.16	191.79	28.09
Melamudimannarkottai	1.08	-	-	-	-	2.57	11.44	67.78	8.55
Kathanendal	1.32	-	-	-	-	17.93	8.23	31.21	7.10
Kamboothi	0.99	-	-	-	-	53.79	24.70	93.64	21.30
Achchangulam	95.51	-	-	0.92	6.38	103.09	72.70	87.14	78.50
Pulvoikulam	1.71	-	-	4.61	2.92	4.06	0.92	105.74	57.07
Vangarupuram	4.03	-	-	-	3.06	43.81	133.62	159.56	37.99

Land Resources - WASCA Treatment Proposed Area	logic
Treatment Area under Forest Land	40% of the total Area (area after removal of potential voids)
Treatment Area under Non-Agricultural Uses	Identifying Additional Area available for recharge & plantation(if area is above 20 %: consider all the additional area for treatment(ex 24.86 %, 4.86 % is proposed): if the % area is between 15-20 % only, consider 50 % of additional area)
Treatment Area under Barren & Un-cultivable Land	75% of the total Area (area after removal of potential voids)
Treatment Area under Permanent Pastures and Other Grazing Land	75% of the total Area (potential area for treatment after removal of voids)
Treatment Area under Land Under Miscellaneous Tree Crops etc.	75% of the total Area (non- voids area)
Treatment Area under Cultivable Waste Land	75% of the total Area (non- voids area)
Treatment Area under Fallows Land other than Current Fallows	Factor arrived as per Vulnerability Assessment in Table 1 and out of which 50% is for horticulture or AF
Treatment Area under Current Fallow land	Factor arrived as per Vulnerability Assessment in Table 1 and out of which 50% is for horticulture or AF
Treatment Area under Unirrigated Land	Factor arrived as per Vulnerability Assessment in Table 1 and out of which 50% is for horticulture or AF
Treatment Area Irrigated by Source	Bore Well Farmer Factor arrived as per Vulnerability Assessment in Table 1 and out of which 50% is for horticulture or AF

ANNEXURE 5.2

GP WISE EXPECTED RUNOFF CONSERVATION AFTER WASCA TREATMENT

Key CWRM Parameter	Good Catchment Area	Average Catchment Area	Bad Catchment Area
K.Nedungulam	30.09	-	45.18
K.Veppangulam	32.70	1.95	2.75
Perunali	14.78	1.51	-
Keelaramanadhi	1.41	5.86	39.85
Musittaikurichi	23.42	0.56	55.91
Mavilangai	1.46	-	26.23
Sengappadai	1.16	0.65	29.64
Kadamangalam	1.32	-	1.25
O.Karisalkulam	7.77	-	1.31
Mandalamanickam	3.81	-	4.71
Thimmanathapuram	1.69	-	48.81
Pakkuvetti	2.31	-	26.67
Ponthampuli	37.45	1.23	7.44
Peraiyur	39.79	0.56	45.30
T. Valasubramaniapuram	1.63	-	5.27
Pammanendal	24.56	0.68	43.00
Pudukottai	0.98	-	25.94
Idayankulam	13.65	0.68	8.02
Maraikkulam	4.77	0.71	-
Valayapookulam	14.63	-	-
Melaramanadhi	5.07	-	-
Ramasamypatti	15.63	-	-
Natham	5.95	-	17.29
Udayanathapuram	8.10	-	-
Pappurediyapatti	4.17	9.64	35.85
Tharaikudi	12.76	-	4.25
T.punavasi	19.89	0.22	7.71
Anayur	16.82	0.76	0.94
Sadayanendhal	16.26	2.17	7.36
Pasumbon	15.33	0.63	1.65
Ariamangalam	7.76	2.56	22.90
Erumaikulam	0.63	2.65	27.27
Kakkudi	17.87	2.78	2.27
M.Pudukulam	0.89	2.93	26.17
Idivillagi	0.72	2.78	38.29
Eluvanur	2.87	1.47	15.39
Vallandhai	30.62	0.18	6.19
Ilanthaikulam	8.06	4.94	2.52
Mudalnadu	11.17	0.83	3.45
K.Pappankulam	10.49	0.70	1.49
Nagarathakurichi	39.52	1.28	14.84
Narayanapuram	13.70	72.53	17.68

Pappanam	20.06	0.56	10.96
Keelamudimannarkottai	10.82	0.23	11.40
Neeravi	19.71	1.02	12.22
N.Karisalkulam	13.11	1.70	21.48
Kovilangulam	65.25	7.50	-
Melamudimannarkottai	12.43	-	10.53
Kathanendal	12.69	-	13.10
Kamboothi	7.26	-	22.55
Achchangulam	32.03	1.28	39.80
Pulvoikulam	10.64	0.58	39.72
Vangarupuram	8.82	0.54	43.72

ANNEXURE 5.3

GP WISE PROPOSED WORKS BASED ON WATERSHED AND LIVELIHOOD APPROACH (AREA IN ha / LENGTH IN m / PLANTS IN No.)

Gram Panchayat	Aff		ARS	AVP		Az	BP		CBP		CS
	No.	Area	No.	No.	Length	No.	No.	Area	No.	Length	No.
Achchangulam	76,406	96	-	1,259	5,036	3	5,845	7	1,862	7,449	3
Anayur	1,274	2	-	1,650	6,601	2	3,472	4	430	1,721	2
Ariamangalam	1,126	1	3	928	3,710	2	11,716	15	1,384	5,537	2
Eluvanur	4,872	6	17	3,139	12,554	6	6,705	8	-	-	6
Erumaikulam	1,308	2	2	760	3,041	2	12,145	15	348	1,392	2
Idayankulam	752	1	28	945	3,779	-	5	0	541	2,165	-
Idivillagi	1,711	2	-	649	2,597	1	12,723	16	934	3,737	1
Ilanthaikulam	1,482	2	16	-	-	4	22,591	28	1,949	7,795	4
K.Nedungulam	1,887	2	4	560	2,241	6	-	-	2,750	11,000	6
K.Pappankulam	1,981	2	77	1,066	4,263	1	3,203	4	639	2,555	1
K.Veppangulam	3,155	4	6	1,288	5,151	9	8,901	11	372	1,486	9
Kadamangalam	2,634	3	-	2,710	10,838	1	61	0	688	2,750	1
Kakkudi	2,667	3	31	1,465	5,860	2	12,736	16	990	3,958	2
Kamboothi	793	1	11	1,115	4,459	2	-	-	-	-	2
Kathanendal	1,057	1	-	351	1,405	3	-	-	385	1,541	3
Keelamudimannarkottai	1,061	1	27	1,352	5,406	2	1,059	1	-	-	2
Keelaramanadhi	1,390	2	11	1,288	5,151	6	26,806	34	2,875	11,500	6
Kovilangulam	5,016	6	-	2,140	8,560	411	59,942	75	863	3,450	411
M.Pudukulam	1,287	2	4	2,150	8,598	2	13,389	17	615	2,461	2
Mandalamanickam	13,021	16	-	643	2,570	52	1,292	2	450	1,800	52
Maraikkulam	1,681	2	-	857	3,426	6	7,670	12	138	553	6
Mavilangai	789	1	-	994	3,975	2	-	-	300	1,200	2
Melamudimannarkottai	867	1	7	373	1,493	2	-	-	826	3,304	2
Melaramanadhi	1,066	1	10	1,402	5,609	2	88	0	159	635	2
Mudalnadu	3,456	4	109	1,463	5,851	2	3,807	5	275	1,100	2

Gram Panchayat	Aff		ARS	AVP		Az	BP		CBP		CS
	No.	Area	No.	No.	Length	No.	No.	Area	No.	Length	No.
Musittaikurichi	4,153	5	2	994	3,975	9	3,992	5	3,032	12,126	9
N.Karisalkulam	1,561	2	11	1,124	4,497	2	7,778	10	2,418	9,672	2
Nagarathakurichi	118,183	148	46	2,307	9,228	5	5,834	7	-	-	5
Narayanapuram	1,226	2	10	914	3,657	13	331,786	415	-	-	13
Natham	1,206	2	47	1,029	4,115	7	-	-	518	2,073	7
Neeravi	1,508	2	29	1,315	5,258	3	4,647	6	298	1,193	3
O.Karisalkulam	1,895	2	73	694	2,774	8	-	-	375	1,500	8
Pakkuvetti	3,865	5	-	1,170	4,680	5	-	-	4,000	16,000	5
Pammanendal	2,271	3	-	90	359	2	4,196	5	1,062	4,246	2
Pappanam	2,163	3	30	1,123	4,492	6	2,542	3	462	1,849	6
Pappurediyapatti	6,242	8	82	945	3,779	2	44,084	55	-	-	2
Pasumbon	1,115	1	-	1,208	4,831	-	2,876	4	515	2,060	-
Peraiyur	3,964	5	162	1,894	7,574	7	6,501	8	1,550	6,200	7
Perunali	1,928	2	-	1,786	7,145	4	8,514	11	-	-	4
Ponthampuli	2,584	3	-	748	2,991	2	12,723	16	1,700	6,800	2
Pudukottai	1,128	1	8	1,029	4,116	1	8	0	700	2,799	1
Pulvoikulam	1,366	2	-	1,064	4,257	3	6,023	8	918	3,673	3
Ramasamypatti	574	1	8	1,088	4,353	1	48	0	456	1,824	1
Sadayanendhal	4,497	6	-	914	3,657	5	9,935	12	555	2,218	5
Sengappadai	868	1	3	994	3,975	5	2,992	4	-	-	5
T.Punavasal	8,341	10	-	2,325	9,298	5	1,027	1	520	2,079	5
T.Valasubramaniapuram	640	1	8	569	2,275	3	-	-	1,500	6,000	3
Tharaikudi	23,068	29	-	2,072	8,289	4	182	0	937	3,748	4
Thimmanathapuram	1,074	1	-	610	2,439	5	-	-	-	-	5
Udayanathapuram	804	1	28	819	3,275	5	-	-	-	-	5
Valayapookulam	1,121	1	57	857	3,426	5	5,114	8	97	387	5
Vallandhai	2,178	3	2	1,543	6,173	1	816	1	156	622	1
Vangarupuram	3,221	4	56	2,042	8,168	4	2,448	3	937	3,748	4

Gram Panchayat	CT	Co		FP	CCBF		DLT		DLHAI		FBBTI	
	No.	No.	Area	No.	No.	Area	Plants	Length	No.	Area	No.	Area
Achchangulam	3	105	341	105	19,102	96	1,239	4,956	68	171	137	341
Anayur	2	3	8	3	319	2	4,909	19,634	2	4	3	8
Ariamangalam	2	73	196	73	282	1	-	-	39	98	79	196
Eluvanur	6	42	132	42	1,218	6	1,613	6,451	26	66	53	132
Erumaikulam	2	88	234	88	327	2	-	-	47	117	94	234
Idayankulam	-	55	148	55	188	1	-	-	30	74	59	148
Idivillagi	1	128	328	128	428	2	-	-	66	164	131	328
Ilanthaikulam	4	7	22	7	370	2	197	786	4	11	9	22
K.Nedungulam	6	140	388	140	472	2	1,723	6,891	78	194	155	388
K.Pappankulam	1	4	13	4	495	2	206	825	3	6	5	13
K.Veppangulam	9	20	24	8	789	4	581	2,325	5	12	9	24
Kadamangalam	1	9	11	4	659	3	1,386	5,543	2	5	4	11
Kakkudi	2	5	19	5	667	3	867	3,467	4	10	8	19
Kamboothi	2	69	193	69	198	1	1,791	7,162	39	97	77	193
Kathanendal	3	23	64	23	264	1	317	1,268	13	32	26	64
Keelamudimannarkottai	2	35	98	35	265	1	1,199	4,796	20	49	39	98
Keelaramanadhi	6	315	342	126	347	2	2,162	8,646	68	171	137	342
Kovilangulam	411	116	319	116	1,254	6	2,140	8,560	64	159	127	319
M.Pudukulam	2	84	225	84	322	2	271	1,085	45	112	90	225
Mandalamanickam	52	12	14	5	3,255	16	3,996	15,984	3	7	6	14
Maraikkulam	6	13	37	13	420	2	-	-	7	19	15	37
Mavilangai	2	208	225	83	197	1	1,699	6,796	45	113	90	225
Melamudimannarkottai	2	33	90	33	217	1	1,791	7,162	18	45	36	90
Melaramanadhi	2	27	82	27	267	1	478	1,911	16	41	33	82
Mudalnadu	2	10	30	10	864	4	435	1,741	6	15	12	30
Musittaikurichi	9	422	480	169	1,038	5	581	2,325	96	240	192	480
N.Karisalkulam	2	70	184	70	390	2	534	2,137	37	92	74	184
Nagarathakurichi	5	43	127	43	29,546	148	-	-	25	64	51	127

Gram Panchayat	CT	Co		FP	CCBF		DLT		DLHAI		FBBTI	
	No.	No.	Area	No.	No.	Area	Plants	Length	No.	Area	No.	Area
Narayanapuram	13	56	152	56	306	2	-	-	30	76	61	152
Natham	7	18	56	18	301	2	309	1,236	11	28	22	56
Neeravi	3	38	105	38	377	2	1,354	5,417	21	52	42	105
O.Karisalkulam	8	11	11	4	474	2	1,619	6,477	2	6	4	11
Pakkuvetti	5	224	229	90	966	5	1,025	4,100	46	114	91	229
Pammanendal	2	342	369	137	568	3	-	-	74	184	148	369
Pappanam	6	30	94	30	541	3	-	-	19	47	38	94
Pappurediyapatti	2	116	308	116	1,560	8	-	-	62	154	123	308
Pasumbon	-	5	14	5	279	1	1,603	6,412	3	7	6	14
Peraiyur	7	325	389	130	991	5	3,572	14,287	78	194	155	389
Perunali	4	315	331	126	482	2	-	-	66	166	132	331
Ponthampuli	2	56	64	22	646	3	1,633	6,533	13	32	26	64
Pudukottai	1	82	222	82	282	1	-	-	44	111	89	222
Pulvoikulam	3	44	168	44	342	2	839	3,356	34	84	67	168
Ramasamypatti	1	15	44	15	144	1	-	-	9	22	18	44
Sadayanendhal	5	22	63	22	1,124	6	1,129	4,517	13	32	25	63
Sengappadai	5	243	254	97	217	1	67	266	51	127	102	254
T.Punavasal	5	24	66	24	2,085	10	-	-	13	33	26	66
T.Valasubramaniapuram	3	45	45	18	160	1	340	1,359	9	23	18	45
Tharaikudi	4	11	36	11	5,767	29	538	2,150	7	18	15	36
Thimmanathapuram	5	415	419	166	268	1	5,716	22,865	84	209	167	419
Udayanathapuram	5	12	37	12	201	1	214	856	7	19	15	37
Valayapookulam	5	8	25	8	280	1	-	-	5	12	10	25
Vallandhai	1	14	53	14	544	3	-	-	11	27	21	53
Vangarupuram	4	135	375	135	805	4	926	3,702	75	187	150	375

Gram Panchayat	FD	GSS		ICP		LDI		LP		MI	
	No.	No.	Extent	Plants	Length	No.	Area	Plants	Length	No.	Area
Achchangulam	3	56	564	141	564	53	131	203	811	31	79
Anayur	2	191	1,907	-	-	1	4	337	1,347	-	1
Ariamangalam	2	41	413	182	727	37	91	152	607	5	14
Eluvanur	6	41	412	288	1,151	21	53	11	43	11	27
Erumaikulam	2	57	572	-	-	44	109	17	67	6	15
Idayankulam	-	100	999	164	656	27	69	84	335	4	11
Idivillagi	1	28	277	-	-	64	160	513	2,050	3	8
Ilanthaikulam	4	10	96	-	-	4	9	153	611	2	4
K.Nedungulam	6	95	954	217	868	70	176	619	2,475	15	36
K.Pappankulam	1	56	560	244	977	2	5	202	807	1	3
K.Veppangulam	9	16	161	687	2,746	4	10	672	2,688	2	4
Kadamangalam	1	8	84	213	850	2	5	53	210	1	1
Kakkudi	2	82	816	-	-	3	7	355	1,420	2	6
Kamboothi	2	45	454	-	-	34	86	511	2,042	9	21
Kathanendal	3	53	530	-	-	11	29	-	-	3	7
Keelamudimannarkottai	2	74	743	687	2,748	18	44	213	850	4	10
Keelaramanadhi	6	9	89	-	-	63	158	13	52	11	26
Kovilangulam	411	-	-	49	194	58	145	5,680	22,720	11	28
M.Pudukulam	2	47	472	412	1,646	42	104	11	43	6	16
Mandalamanickam	52	19	188	538	2,150	2	6	74	294	1	2
Maraikkulam	6	13	125	205	819	6	16	-	-	2	6
Mavilangai	2	6	60	793	3,170	42	104	3	12	7	17
Melamudimannarkottai	2	69	689	-	-	16	41	251	1,004	3	9
Melaramanadhi	2	87	869	125	500	14	34	111	445	5	14
Mudalnadu	2	109	1,086	193	770	5	13	202	810	2	4
Musittaikurichi	9	39	389	-	-	84	211	455	1,818	23	58
N.Karisalkulam	2	68	676	49	194	35	88	252	1,006	4	9
Nagarathakurichi	5	73	732	723	2,893	22	54	97	389	7	19

Gram Panchayat	FD	GSS		ICP		LDI		LP		MI	
	No.	No.	Extent	Plants	Length	No.	Area	Plants	Length	No.	Area
Narayanapuram	13	87	869	-	-	28	70	153	612	5	12
Natham	7	60	602	60	240	9	23	320	1,279	4	10
Neeravi	3	107	1,071	235	940	19	47	402	1,607	4	10
O.Karisalkulam	8	17	167	250	1,000	2	5	145	578	-	1
Pakkuvetti	5	15	148	250	1,000	45	112	9	38	2	5
Pammanendal	2	4	42	398	1,592	68	171	813	3,250	11	27
Pappanam	6	88	876	388	1,551	15	38	403	1,612	7	19
Pappurediyapatti	2	74	736	-	-	58	145	14	58	7	18
Pasumbon	-	24	245	280	1,120	3	6	313	1,250	1	1
Peraiyur	7	25	248	750	3,000	65	163	800	3,200	25	63
Perunali	4	5	53	-	-	63	157	-	-	7	16
Ponthampuli	2	6	57	2,000	8,000	11	28	550	2,200	3	8
Pudukottai	1	82	816	112	446	41	103	8	31	7	17
Pulvoikulam	3	65	648	-	-	22	55	212	849	23	57
Ramasamypatti	1	48	484	288	1,153	7	18	181	725	3	7
Sadayanendhal	5	72	724	126	505	11	28	311	1,244	3	7
Sengappadai	5	9	91	-	-	49	122	8	30	4	11
T.Punavasal	5	54	542	132	527	12	29	351	1,403	3	7
T.Valasubramaniapuram	3	7	71	1,250	5,000	9	23	20	80	-	-
Tharaikudi	4	69	690	805	3,221	6	14	117	467	3	9
Thimmanathapuram	5	18	176	-	-	83	208	9	35	1	3
Udayanathapuram	5	40	401	91	363	6	15	32	129	3	7
Valayapookulam	5	36	355	177	708	4	11	4	15	2	4
Vallandhai	1	116	1,157	246	982	7	17	630	2,519	8	19
Vangarupuram	4	146	1,463	228	913	67	169	157	630	15	38

Gram Panchayat	NADEP	ND		PS	RPWDT	Roo	RP	RRWH	SPD		SPC	SPI	WCICD
	No.	Plants	HH	No.	No.	No.	No.	No.	No.	Area	No.	No.	Length
Achchangulam	3	3,110	622	24	-	13	-	2	-	-	6	62	564
Anayur	2	3,270	654	17	2	6	-	2	-	-	7	65	-
Ariamangalam	2	2,775	555	19	-	6	-	2	-	-	6	56	727
Eluvanur	6	1,095	219	61	-	6	-	2	-	-	2	22	1,151
Erumaikulam	2	2,775	555	17	-	7	-	2	-	-	6	56	-
Idayankulam	-	1,710	342	-	1	5		2			3	34	656
Idivillagi	1	1,870	374	4	2	5	-	2	-	-	4	37	-
Ilanthaikulam	4	2,600	520	4	5	4	-	2	-	-	5	52	-
K.Nedungulam	6	2,330	466	48	5	40	-	2	-	-	5	47	868
K.Pappankulam	1	3,685	737	13	-	7	-	2	-	-	7	74	977
K.Veppangulam	9	2,010	402	8	7	7	-	2	-	-	4	40	2,746
Kadamangalam	1	1,740	348	2	2	7	-	2	-	-	3	35	850
Kakkudi	2	2,125	425	15	5	6	-	2	-	-	4	43	-
Kamboothi	2	4,360	872	14	3	4	-	2	-	-	9	87	-
Kathanendal	3	4,360	872	19	2	5	-	2	-	-	9	87	-
Keelamudimannarkottai	2	8,810	1,762	20	-	7	-	2	-	-	18	176	2,748
Keelaramanadhi	6	1,965	393	9	-	4	-	2	-	-	4	39	-
Kovilangulam	411	3,845	769	8	4	22	-	2	-	-	8	77	194
M.Pudukulam	2	2,775	555	21	-	6	-	2	-	-	6	56	1,646
Mandalamanickam	52	9,225	1,845	16	4	10	-	2	-	-	18	185	2,150
Maraikkulam	6	3,540	708	-	4	6	-	2	1,632	2	7	71	819
Mavilangai	2	1,135	227	3	-	5	-	2	-	-	2	23	3,170
Melamudimannarkottai	2	2,120	424	17	2	5	-	2	-	-	4	42	-
Melaramanadhi	2	6,245	1,249	50	1	6		2			12	125	500
Mudalnadu	2	1,825	365	26	-	7	-	2	-	-	4	37	770
Musittaikurichi	9	5,475	1,095	-	12	15	-	2	-	-	11	110	-
N.Karisalkulam	2	3,175	635	23	2	6	-	2	-	-	6	64	194
Nagarathakurichi	5	1,550	310	21	-	3	-	2	-	-	3	31	2,893

Gram Panchayat	NADEP	ND		PS	RPWDT	Roo	RP	RRWH	SPD		SPC	SPI	WCICD
	No.	Plants	HH	No.	No.	No.	No.	No.	No.	Area	No.	No.	Length
Narayanapuram	13	7,000	1,400	132	2	5	-	2	-	-	14	140	-
Natham	7	3,575	715	8	4	7		2			7	72	240
Neeravi	3	4,270	854	37	1	6	-	2	-	-	9	85	940
O.Karisalkulam	8	4,230	846	5	4	6	-	2	-	-	8	85	1,000
Pakkuvetti	5	4,220	844	12	7	3	-	2	-	-	8	84	1,000
Pammanendal	2	1,555	311	3	7	6	-	2	-	-	3	31	1,592
Pappanam	6	2,260	452	14	6	4	-	2	-	-	5	45	1,551
Pappurediyapatti	2	2,900	580	-		8		2			6	58	-
Pasumbon	-	3,270	654	5	4	7	-	2	-	-	7	65	1,120
Peraiyur	7	13,210	2,642	19	3	15	-	2	-	-	26	264	3,000
Perunali	4	4,635	927	3	1	6	-	2	-	-	9	93	-
Ponthampuli	2	1,200	240	3	1	6	-	2	-	-	2	24	8,000
Pudukottai	1	2,165	433	4		3		2			4	43	446
Pulvoikulam	3	4,410	882	24	2	5	-	2	-	-	9	88	-
Ramasamypatti	1	6,245	1,249	27	2	5		2			12	125	1,153
Sadayanendhal	5	3,270	654	23	4	5	-	2	-	-	7	65	505
Sengappadai	5	2,235	447	4	1	6	-	2	-	-	4	45	-
T.Punavasal	5	3,850	770	23	4	10		2			8	77	527
T.Valasubramaniapuram	3	1,070	214	4		12		2			2	21	5,000
Tharaikudi	4	1,785	357	29	7	6	-	2	-	-	4	36	3,221
Thimmanathapuram	5	2,860	572	6	-	7	-	2	-	-	6	57	-
Udayanathapuram	5	5,500	1,100	6	2	7		2			11	110	363
Valayapookulam	5	3,540	708	10		3		2	1,088	1	7	71	708
Vallandhai	1	1,245	249	37	8	11	-	2	-	-	2	25	982
Vangarupuram	4	1,850	370	38	6	5	-	2	-	-	4	37	913

ANNEXURE 7.1

GP WISE WASCA RECOMMENDATION AND WORKS UPLOADED

Sl. No	GP	WASCA Recommendation for 3 Years	WASCA Uploaded for FY-2021-22 as on 11-03-2021
1	Achangulam	1,783	481
2	Anaiyur	874	136
3	Ariamangalam	956	63
4	A.Tharaikudi	555	-
5	Eluvanur	818	-
6	Erumaikulam	1,101	-
7	Idaiyankulam	1,173	140
8	Idivilagi	987	87
9	Ilandaikulam	723	135
10	Kadamangalam	513	-
11	Kakkudi	775	187
12	Kathanendal	1,005	61
13	Keelamudimannarkottai	2,064	125
14	Keelaramanathi	1,226	-
15	K.Nedungulam	1,323	273
16	Komboothi	1,209	85
17	Kovilangulam	1,322	-
18	K.Veppangulam	802	203
19	Mandalamanickam	1,968	-
20	Marakkulam	1,062	-
21	Mavilangai	753	71
22	Melamudimannarkottai	678	62
23	Melaramanathi	1,478	167
24	M.Pudukulam	1,148	-
25	Mustakkurichi	2,504	-
26	Muthalnadu	574	146
27	Nagaratharkurichi	722	71
28	Narayanapuram	1,691	-
29	Natham	1,058	188
30	Neeravi	1,284	141
31	N.Karisalkulam	1,131	146
32	O.Karisalkulam	1,110	14
33	Pakkuvetti	1,439	213
34	Pammanendal	1,286	102
35	Pappanam	647	24
36	Pappangulam	1,156	226
37	Pappurettiapatti	1,415	-
38	Pasumpon	926	167
39	Peraiyur	3,938	-
40	Perunali	1,877	73
41	Ponthampuli	514	224
42	Pudukkottai	971	-
43	Pulvoikulam	1,423	182

Sl. No	GP	WASCA Recommendation for 3 Years	WASCA Uploaded for FY-2021-22 as on 11-03-2021
44	**Ramasamypatti**	1,503	-
45	**Sadayanendal**	1,153	248
46	**Sengappadai**	1,605	164
47	**Thimmanathapuram**	1,836	185
48	**T.Punavasal**	1,234	147
49	**T.Valasubramaniapuram**	413	-
50	**Udaiyanathapuram**	1,251	-
51	**Valaiyapookulam**	948	155
52	**Vallanthai**	792	242
53	**Vangarupuram**	682	149

ANNEXURE 7.2

GP AND WORK CATEGORY-WISE ONGOING WORKS IN KAMUTHI BLOCK

GP	Work Category	Ongoing works
A.Punavaasal	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	1
A.Usilankulam	Water Conservation and Water Harvesting	1
Appanur	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	7
Avathandai	Water Conservation and Water Harvesting	3
Chithirangudi	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	17
Elajembur	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	137
Enathi	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	1
Ervadi	Water Conservation and Water Harvesting	3
	Works on Individuals Land (Category IV)	4
Ithampadal	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	3
Kaanikoor	Water Conservation and Water Harvesting	2
Kadaladi	Rural Connectivity	1
	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	1
Kadugusandai	Rural Connectivity	1
	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	1
Kandilan	Water Conservation and Water Harvesting	2
Kannirajpuram	Water Conservation and Water Harvesting	1
Karunkulam	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	3
Keelachirupodhu	Water Conservation and Water Harvesting	2
Keelakidaram	Anganwadi/Other Rural Infrastructure	2
	Water Conservation and Water Harvesting	1
Keelasakulam	Water Conservation and Water Harvesting	3
Keelaselvanur	Rural Connectivity	1
	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	1
Kidathirukkai	Water Conservation and Water Harvesting	2
Kokkarasankottai	Anganwadi/Other Rural Infrastructure	1
	Water Conservation and Water Harvesting	1
Kondunallanpatti	Water Conservation and Water Harvesting	1
Kotthangulam	Water Conservation and Water Harvesting	3
	Works on Individuals Land (Category IV)	7
M.Karisalkulam	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	8

GP	Work Category	Ongoing works
Mangalam	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	2
Marandai	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	2
Mariyur	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	6
Meenagudi	Water Conservation and Water Harvesting	3
	Works on Individuals Land (Category IV)	2
Melachirupodhu	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	1
Melakidaram	Rural Sanitation	1
	Water Conservation and Water Harvesting	2
Melaselvanur	Water Conservation and Water Harvesting	3
	Works on Individuals Land (Category IV)	1
Mookkaiyur	Water Conservation and Water Harvesting	3
Narippaiyur R.F	Anganwadi/Other Rural Infrastructure	1
	Rural Connectivity	1
	Rural Sanitation	2
	Water Conservation and Water Harvesting	4
	Works on Individuals Land (Category IV)	4
Oppilaan	Water Conservation and Water Harvesting	2
Orivayal	Drought Proofing	1
	Rural Connectivity	1
	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	2
Oruvanenthal	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	6
P.Keeranthai	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	8
Panivasal	Water Conservation and Water Harvesting	3
	Works on Individuals Land (Category IV)	2
Pannanthai	Water Conservation and Water Harvesting	3
Peikulam	Anganwadi/Other Rural Infrastructure	1
	Water Conservation and Water Harvesting	3
	Works on Individuals Land (Category IV)	2
Periakulam	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	2
Pillaiarkulam	Water Conservation and Water Harvesting	3
	Works on Individuals Land (Category IV)	2
Pothikulam	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	1
S. Keeranthai	Water Conservation and Water Harvesting	2
S. Vagaikulam	Water Conservation and Water Harvesting	2
S.P.Kottai	Water Conservation and Water Harvesting	1

GP	Work Category	Ongoing works
S.Tharaikudi	Anganwadi/Other Rural Infrastructure	1
	Water Conservation and Water Harvesting	2
Senjadainathapuram	Water Conservation and Water Harvesting	2
Sevalpatti	Rural Sanitation	1
	Water Conservation and Water Harvesting	2
Severiyarpattinam	Water Conservation and Water Harvesting	3
	Works on Individuals Land (Category IV)	1
Sikkal	Rural Sanitation	4
	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	7
Siraikulam	Water Conservation and Water Harvesting	2
Sokkanai	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	3
T.Karisalkulam	Water Conservation and Water Harvesting	2
T.Veppangulam	Water Conservation and Water Harvesting	2
Thanichiyam	Water Conservation and Water Harvesting	1
Thirumalugandankottai	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	1
Uchinatham	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	6
V.Sethurajapuram	Water Conservation and Water Harvesting	1
Valinokkam	Works on Individuals Land (Category IV)	4

ANNEXURE 8

CWRM KEY INDICATORS FOR GPs IN ACHCHANGULAM MICRO-WATERSHED

CWRM Parameter	Achchangulam
Soil Resources: Status of Available Nitrogen (%)	
Very Low	3.00
Low	59.00
Status of Organic Carbon (%)	
Very Low	97.00
Low	40.00
Status of Soil Micro Nutrients (%)	
Sufficient	64.00
Deficient	36.00
Status of Physical condition of the soil (%)	
Highly Acidic	5.36
Moderately Acidic	60.71
Slighly Acidic	20.54
Moderately Alkaline	8.93
Strongly Alkaline	4.46
Soil Texture (%)	
Fine Soil	68.00
Coarse loamy	21.91
Soil Water Permeability (Low, Moderate, high)	Moderate to low (5-20 mm/ hr)
Soil moisture and ET	
Volumetric Soil Moisture (%)	17.00
Estimated Soil Moisture (ha.m)	233.63
ET Losses (ha.m)	346.41
Soil Water Permeability (Low, Moderate, high)	
Gravity	59.00
Lifting	41.00
Irrigation Methods (%)	
Wild Flooding	61.00
Control Flooding	39.00
Livestock (No.)	
Cattle Population	128
Sheep Population	295
Goat Population	490
Poultry	945
Land Resources (ha)	
Non-Agricultural Uses	743.26
Land Under Miscellaneous Tree Criticalops etc.	1.09
Cultivable Waste Land	7.51
Fallows Land other than Current Fallows	412.38
Current Fallow land	290.79
Unirrigated Land	348.56
Area Irrigated by Source	313.98

Department of Rural Development &
Panchayat Raj,
Government of Tamil Nadu
Panagal Building, 4th and 5th floor
Jeenis Road, Saidapet, Chennai-600015
T : +91 44-24336105/24337436/24337440/24336102
E: drd@tn.nic.in; I: https://tnrd.gov.in/

Deutsche Gesellschaft für Internationale
Zusammenarbeit (GIZ) GmbH
A2/18, Safdarjung Enclave
New Delhi-110029, India
T : +91 11-49495353
E : info@giz.de; I: www.giz.de