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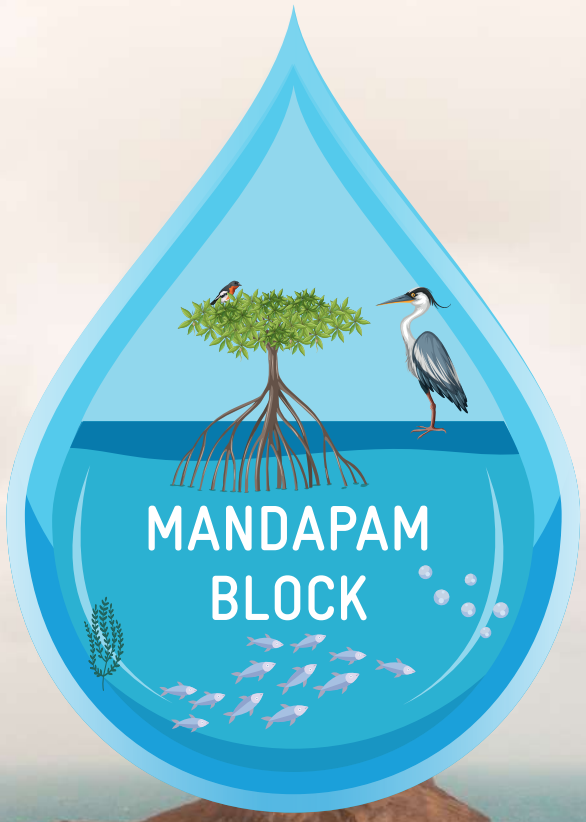
WATER SECURITY AND CLIMATE ADAPTATION IN RURAL INDIA



SUSTAINABLE DEVELOPMENT GOALS

Block Level Composite Water Resources Management Plan under Mahatma Gandhi NREGS

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

Published by:
Department of Rural Development & Panchayat Raj,
Government of Tamil Nadu, Chennai

Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices:
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

On behalf of
German Federal Ministry for Economic Cooperation and Development (BMZ)
GIZ is responsible for the content of this publication.
New Delhi, India, Mar 2022

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) frame works 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

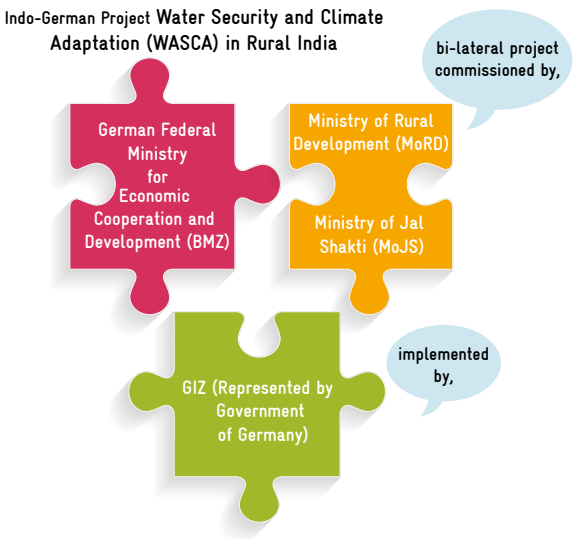
Thirukkural - 11

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

Mandapam is one of the coastal Blocks of Ramanathapuram Districtwhich lies between 9°9'16.17"N to 9°25'32.701"N latitude and 79°20'26.154"E to 78°50'42.701"E longitude. This Block has long coastal stretch in East side along the Bay of Bengal and surrounded by Thiruppullani and Ramanathapuram (Figure 1.1). The total geographical area of Block is 22,637 ha (226.37 Km^2). Administratively, this Block comes under Ramanathapuram taluk, and it has 28 Gram Panchayats with 228 hamlets.

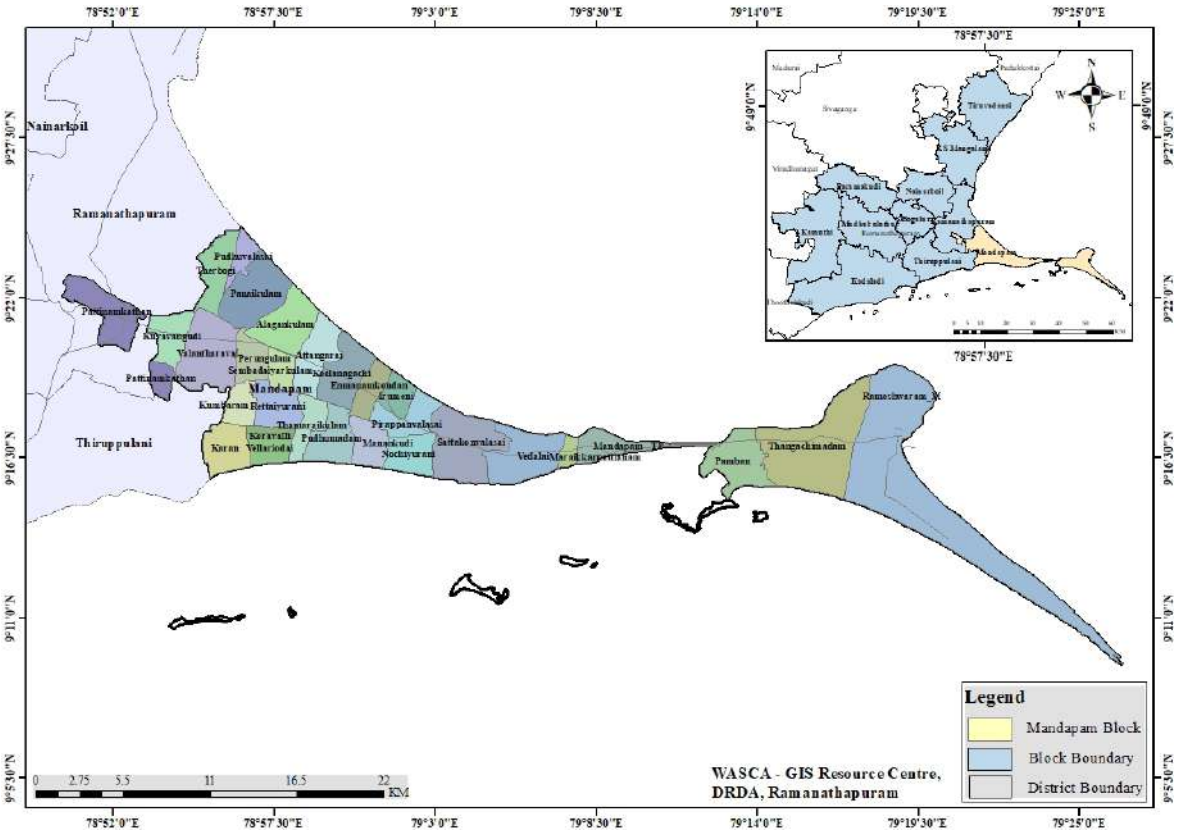


Figure 1.1. Mandapam Block and it's environ

According to Census 2011, the population of the Block is 2,10,334. The population density of the Block is 728 per Km^2 which is much higher 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 23.28% in population, observed since 2001. The proportion of sex ratio is 982 females for 1000 males. The average literacy rate of this Block is 85.09 % which is much higher than the national average (72.98%). The male literacy rate is high (89.39%) than female literacy rate (80.70%). Vulnerable population, Scheduled Castes and Scheduled Tribes accounted for 5.62 % of the total population.

Economically, this Block is one of the backward Block has high employment opportunities with high secondary and tertiary sectors growth rate. Tourism is an emerging opportunity, it consists of Rameshwaram with historically famous pilgrimage centre, and it attracts many tourists from all over the India and the world. It catches the attention of the inter Block and inter district migrants towards Mandapam Block leading to a higher population growth rate. According to the State Planning Commission, Government of Tamil Nadu's Human Development Report – 2017, 22.52 percent % families are in below poverty line (BPL). The % of BPL families are low in this Block and less than that of District

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

> The average literacy rate of this Block is 85.09 % which is much higher than the national average (72.98%)

BPL status. People of the Block are dependent on the coastal ecosystem, allied activities such as fishing, aquaculture, salt pan are high along the coastal GPs. Fishing is a major livelihood of this Block, giving huge profits for the Block and district. Coconut is the dominant crop under irrigated conditions followed by Paddy, groundnut, fruits like mango, guava, sapota etc. Fish processing factories are functioning in this Block. Prawn, squids, cuttle fish, crabs and fish are processed and exported to foreign countries. Many small entrepreneurs are involved in fish drying and dried fish is used in poultry and cattle feed manufacturing. The Regional centre of the Central Marine Fisheries Research Institute is situated here. A marine Aquarium has been established by the Central Marine Fisheries Research Institute at Maraikayarpattinam near Mandapam. It has many varieties of Marine fishes and animals on display. The Forest Department of Tamil Nadu runs the services of some glass-bottomed boats for tourists to see the beautiful coral reefs and other sea life.

> 22.52 percent % families are in below poverty line (BPL)

Hydrologically, lower Vaigai sub basin of Vaigai basin covers the Block (Figure 1.2).

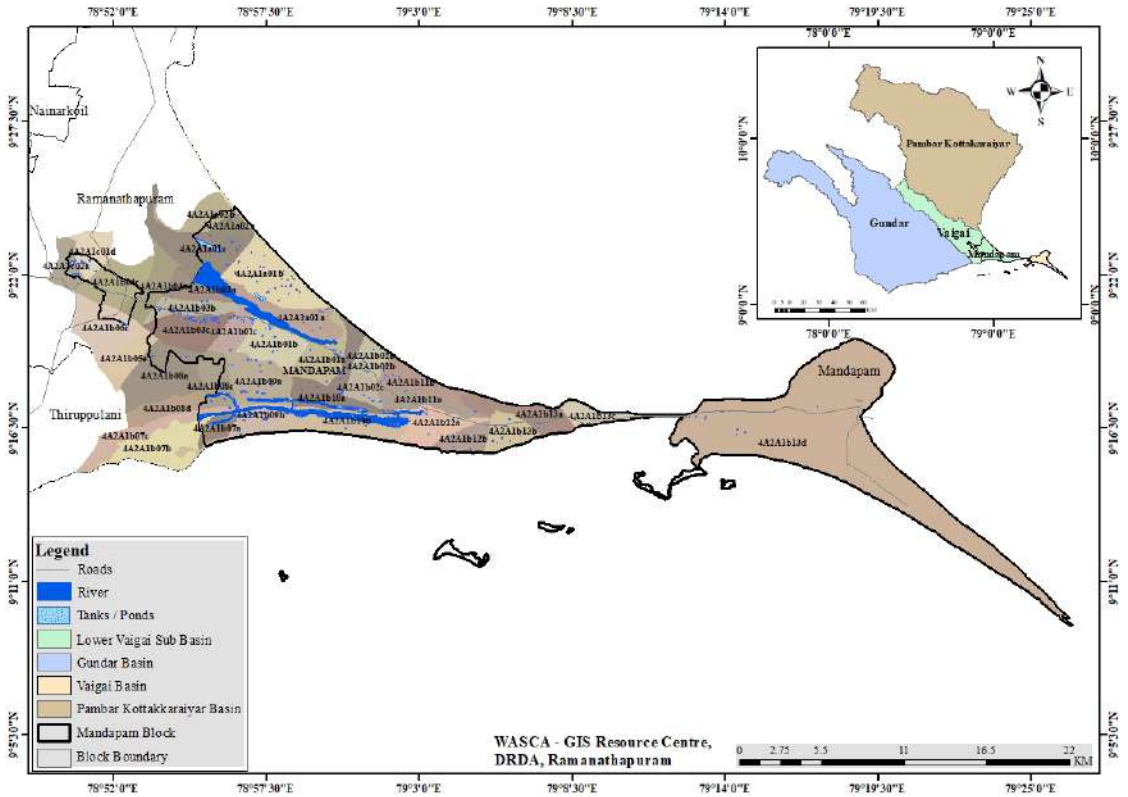


Figure 1.2. Watersheds – Mandapam Block

It has 1 macro-watershed and 38 micro-watershed. The Block has a very flat terrain. Situated in 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. While, this Block has least water bodies in the district. Unlike other Blocks in Ramanathapuram district, this Block has very few tanks including one PWD tank. Figure 1.3 shows the spatial distribution of water bodies in this Block. Two firkas namely Mandapam and Perunkulam cover the Block, and both firkas are safe in ground water development (CGWB's ground water assessment report 2017).

GROUND WATER LEVEL OF THIS BLOCK

SAFE - <70%	Mandapam, Perunkulam

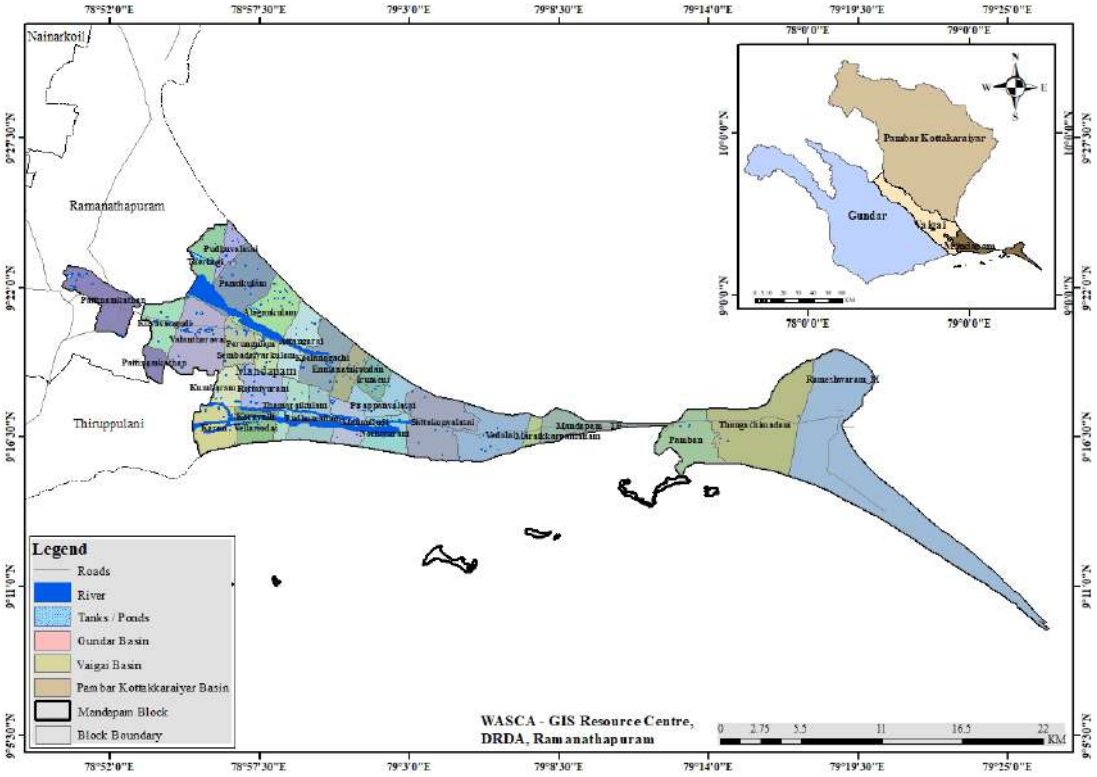
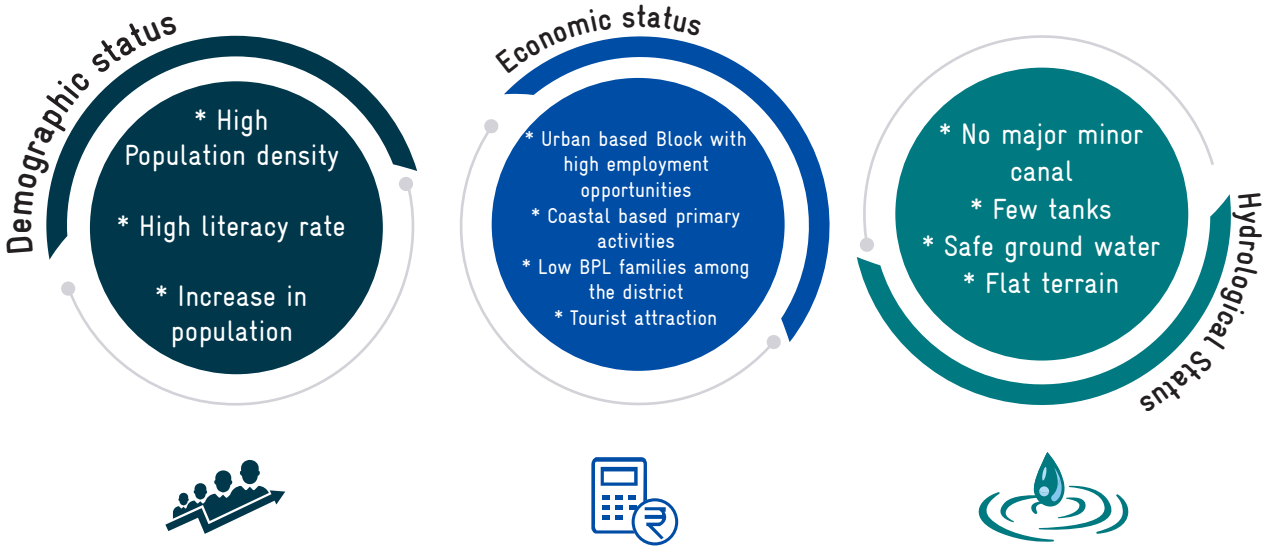


Figure 1.3. Spatial distribution of waterbodies



விண்இன்று பொய்ப்பின் விரிநீர் வியனுலகத்து
உள்நின்று உடற்றும் பசி

குறள் - 13

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

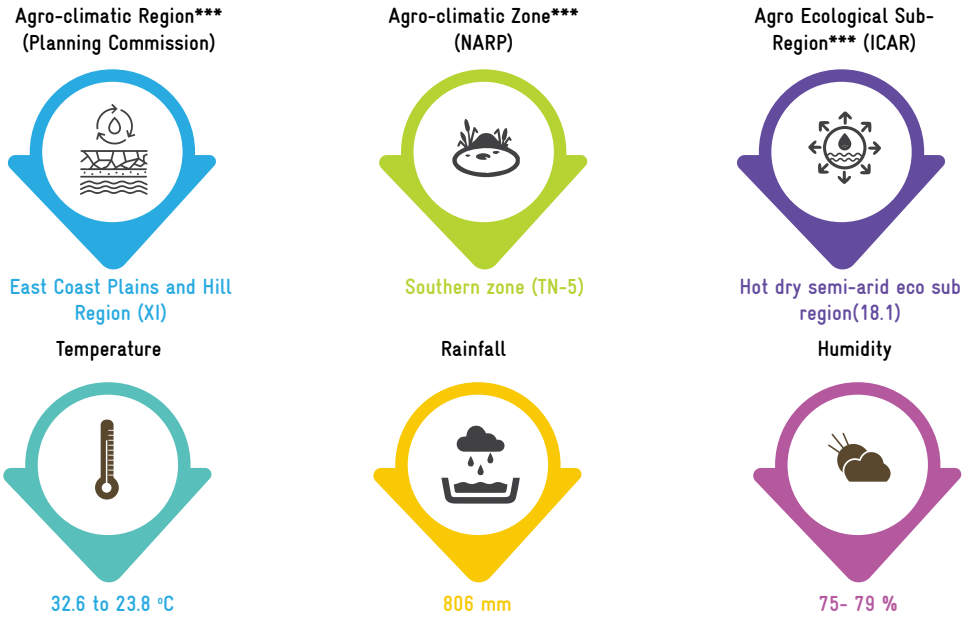
Thirukkural - 13

CHAPTER 2

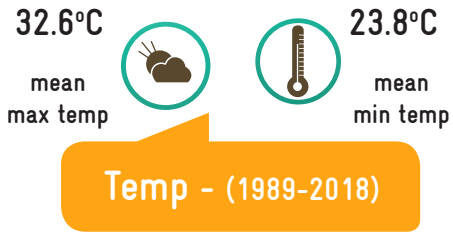
2 CLIMATE AND WATER SECURITY

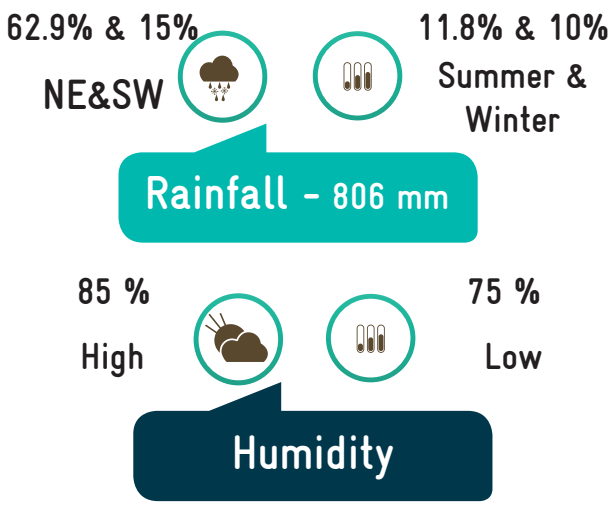
Water has always been a contentious subject in this region. This semi-arid region is classified as southern agro-climatic zone of State and East coast plains and Hills region according to the agro climatic regional classification of planning commission. The general climate description of this region 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 the 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), and during winter and summer. NEM contributes 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% (82.2) of the annual rainfall (WRIS, GoI)

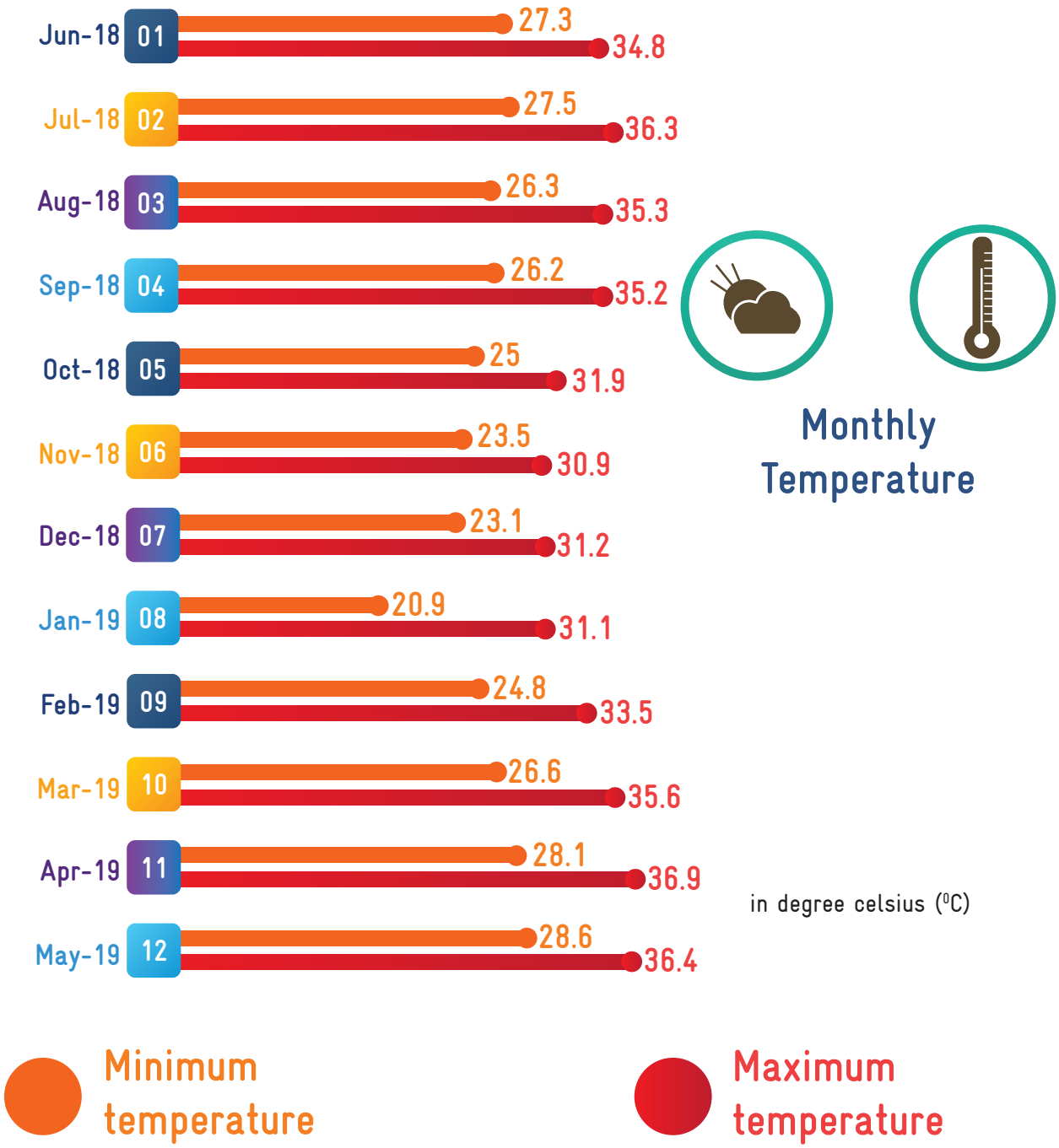


Figure 2.1. Monthly average maximum and minimum temperature

(Figure 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 of 10 days followed by 9 days in SWM and 4 days in winter months. The onset of NEM rainfall starts in the first week of October and ceases during the fourth week of December. In general, the humidity percentage ranges between 75% to 79%. The highest relative humidity percentage of 85% is recorded during the month of November and the lowest relative humidity percentage of 75% is recorded during the month of May in this southern zone.

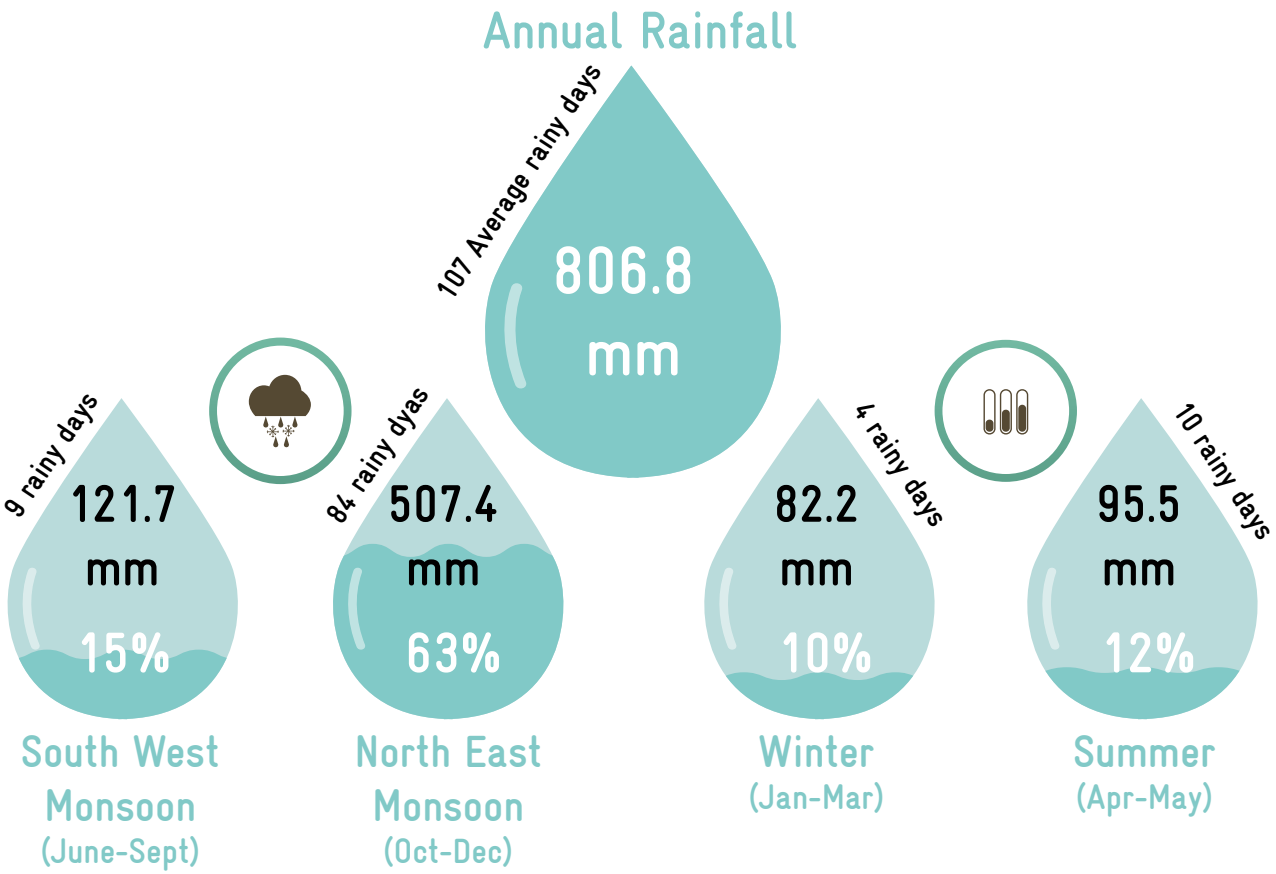


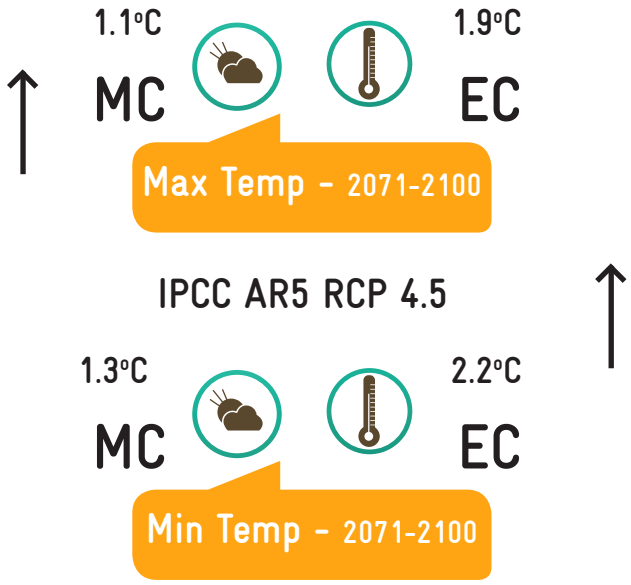
Figure 2.2. Season wise distribution to annual rainfall

In recent decades, the world is 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^{0}C and 0.4^{0}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, the 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 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
* Storm surges up to 6m
* Soil erosion
* Flood inundation
* Sea level rise

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 results 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 hazards due to cyclone forms in the Bay of Bengal. The 1964 Rameswaram cyclone was regarded as one of the most powerful storms to ever strike India on record and the worst to hit the District. In recent years, some of the recent 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 to cyclones (Cyclone warning in India, IMD, and March 2021). Being a coastal Block, it is often affected by cyclones.

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 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 indicate that there would be 4.51 cm (low range)/ 7.21cm (medium range) increase 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). In Ramanathapuram district, about 180 coastal habitations are identified for coastal vulnerability based on their distance from sea shore, soil erosion, and saltwater intrusion (Ramanathapuram District Disaster Management Plan 2021-2022). Out of this 180 habitations, 37 habitations of 21 GP are in Mandapam Block and are considered in this study for the vulnerability assessment.

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 the 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	

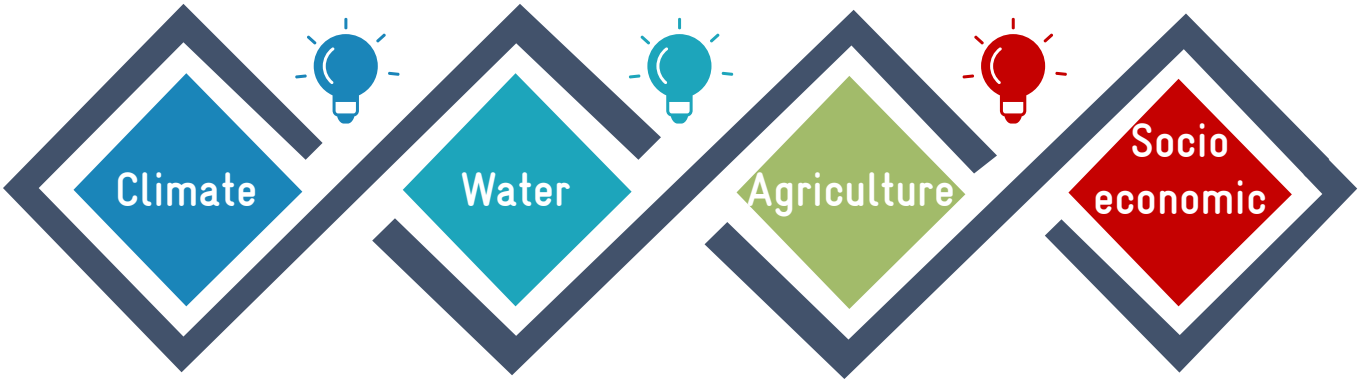
Agriculture	Rainfed area (%)	A1	Goal 15
	Cropping intensity (%)	A2	Goal 2
	Soil moisture (Kg/m^2)	A3	Goal 15
	Evapo-transpiration (Kg/m^2)	A4	
Socio-economic	Rural proportion (%)	S1	Goal 2
	Multidimensional poverty index	S2	Goal 1
	Source of drinking water within premises in rural (%)	S3	Goal 6
	Marginal 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 GRAM PANCHAYAT PLANNING IN MAHATMA GANDHI NREGS

WASCA, GIZ has evolved a GP based CWRM planning approach for facilitating convergent planning under Mahatma Gandhi NREGA as per the recommendations of 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 Annual Master Circular issued by MoRD during 2021-22 and 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.

Special focus is given to vulnerable households and communities and are considered while preparing estimates for anticipated demand, list of works on individual lands, 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, particularly the '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.

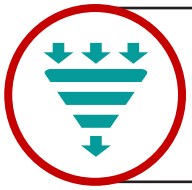
262 Total Kinds of works in Schedule-I of Mahatma Gandhi NREGA

182 Kinds of works relate to NRM alone

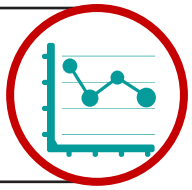
164 Kinds of works related to Agriculture & allied works

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. 164 of the total works 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 the 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.

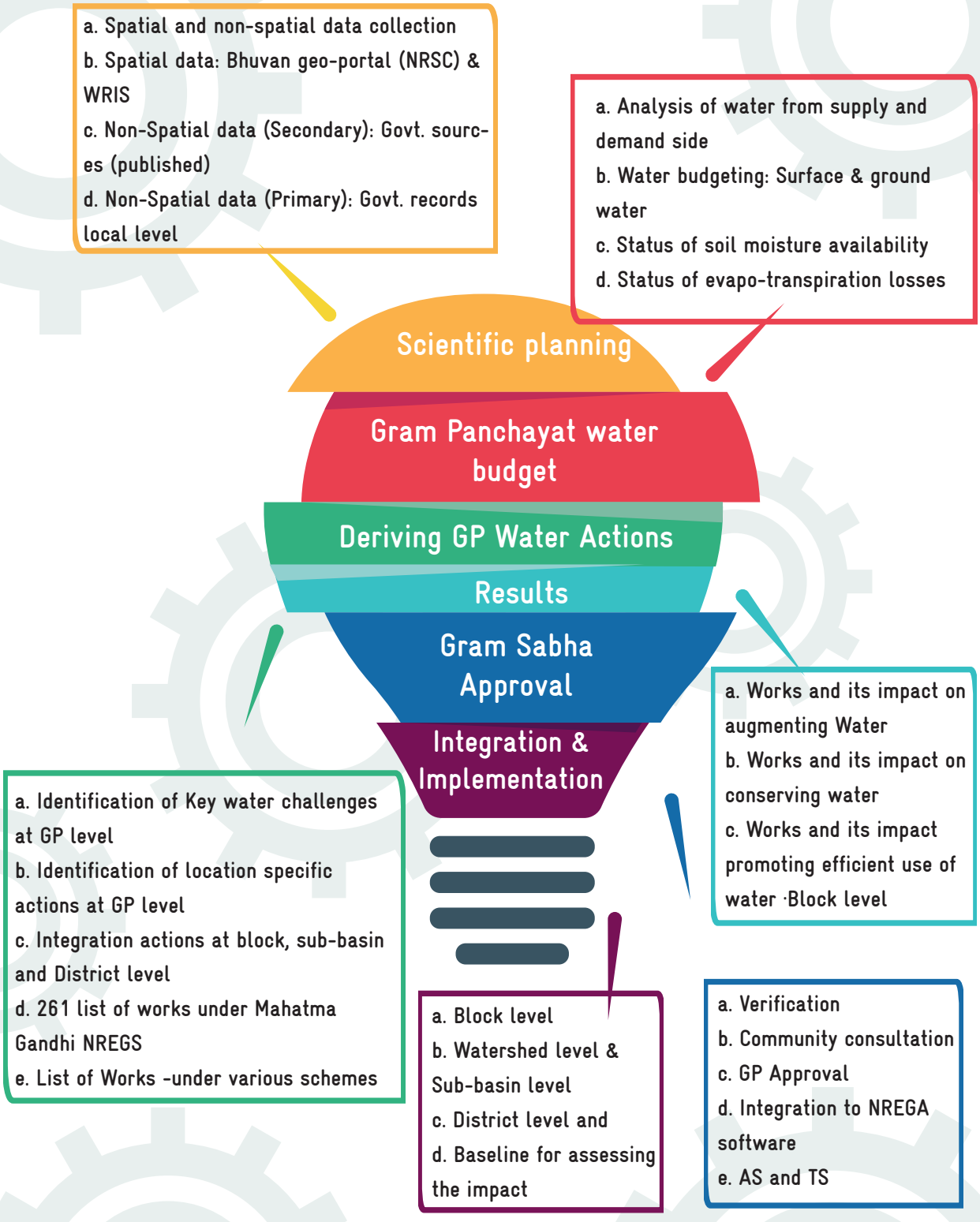


3.1 COMPOSITE WATER RESOURCE MANAGEMENT APPROACH

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

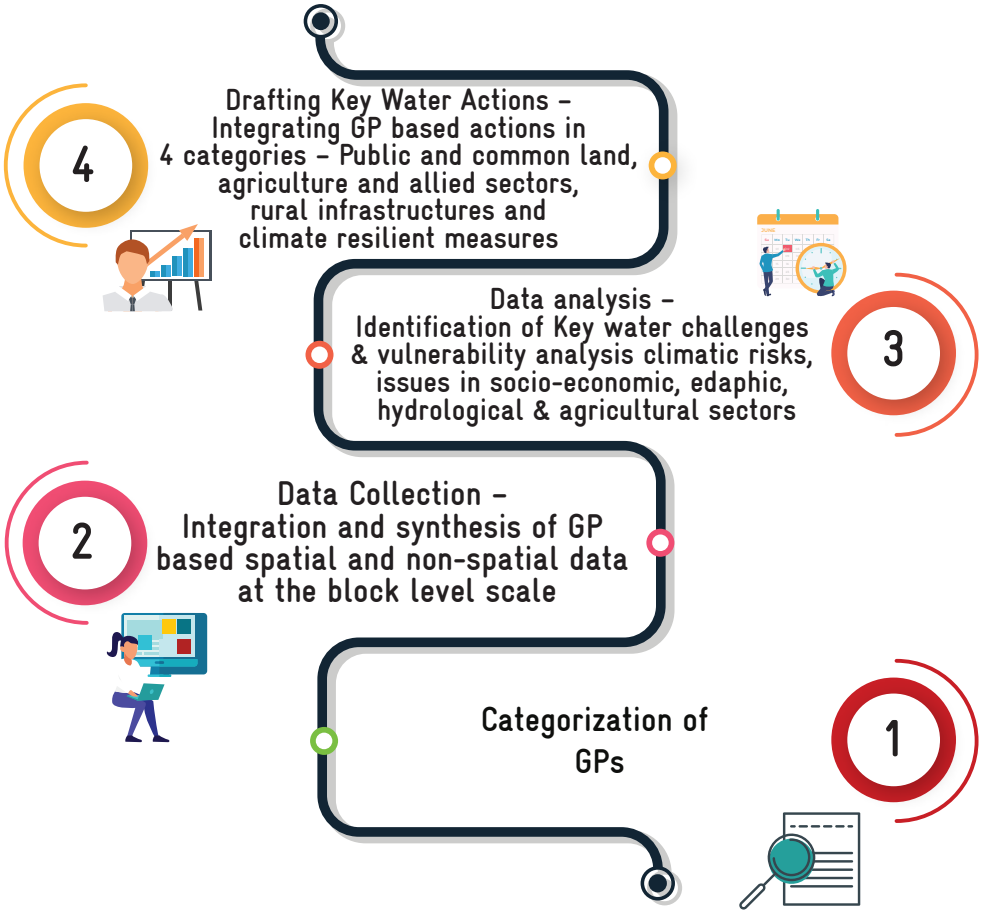
BOX 1. MAJOR COMPONENTS INVOLVE IN CWRM PLANNING WORKOUTS



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

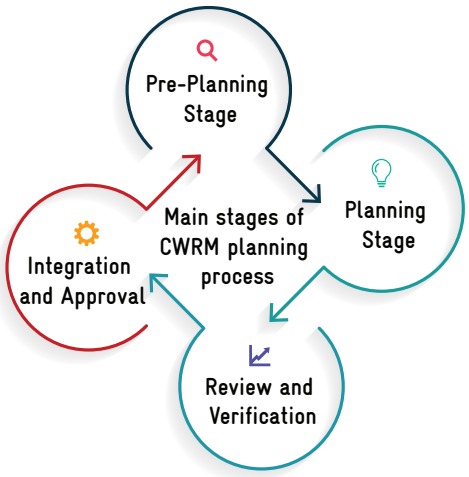
PLANNING STAGE

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 level, keeping data availability and administrative boundaries for GIS planning, the GP's of the Block 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 Mandapam Block is tabulated in Table 4.

TABLE 4. CATEGORIZATION OF MANDAPAM BLOCK GPs

NUMBER OF GP	GP TYPE	NAME OF THE PANCHAYAT
8	GP and revenue village data and boundary match (Type-I)	Attangarai, Pudumadam, Keelanagachi, Enmanamkondan, Sattakkonvalasai, Kusavankudi, Valantaravai, Kumbaram
20	Having more than one GPs in one Revenue Village (Type-II)	Alagangulam, Panikulam, Pirappanvalasai, Irumeni, Karan, Vallarioodai, Rettaiyurani, Koravalli, Tamaraikulam, Marakayarpattinam, Vadalai, Nochiyurani, Manakudi, Pamban, Thangachimadam, Perungulam, Sambadaiyarkulam, Terbhogi, Puduvalasai, Pattinamkathan

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 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 Annexures 3.1 to 3.3. The methods, 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

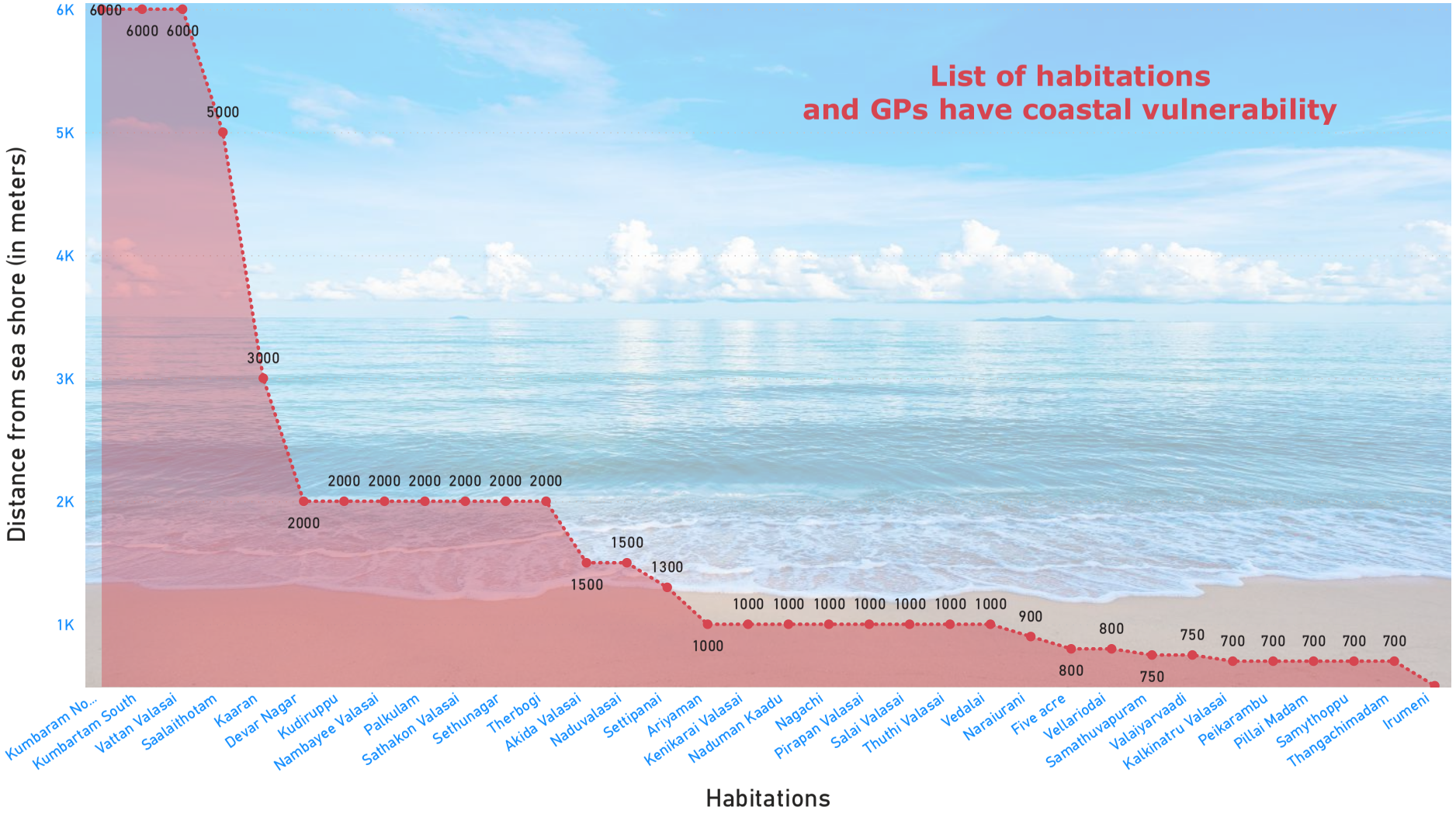
All the CWRM parameters are intended at Block level. On the other hand, all the climate change observations and projections are at District or regional level. Current data at the Block level is not available at present. Hence, previous hydro-meteorological disasters are considered to denote the Block's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

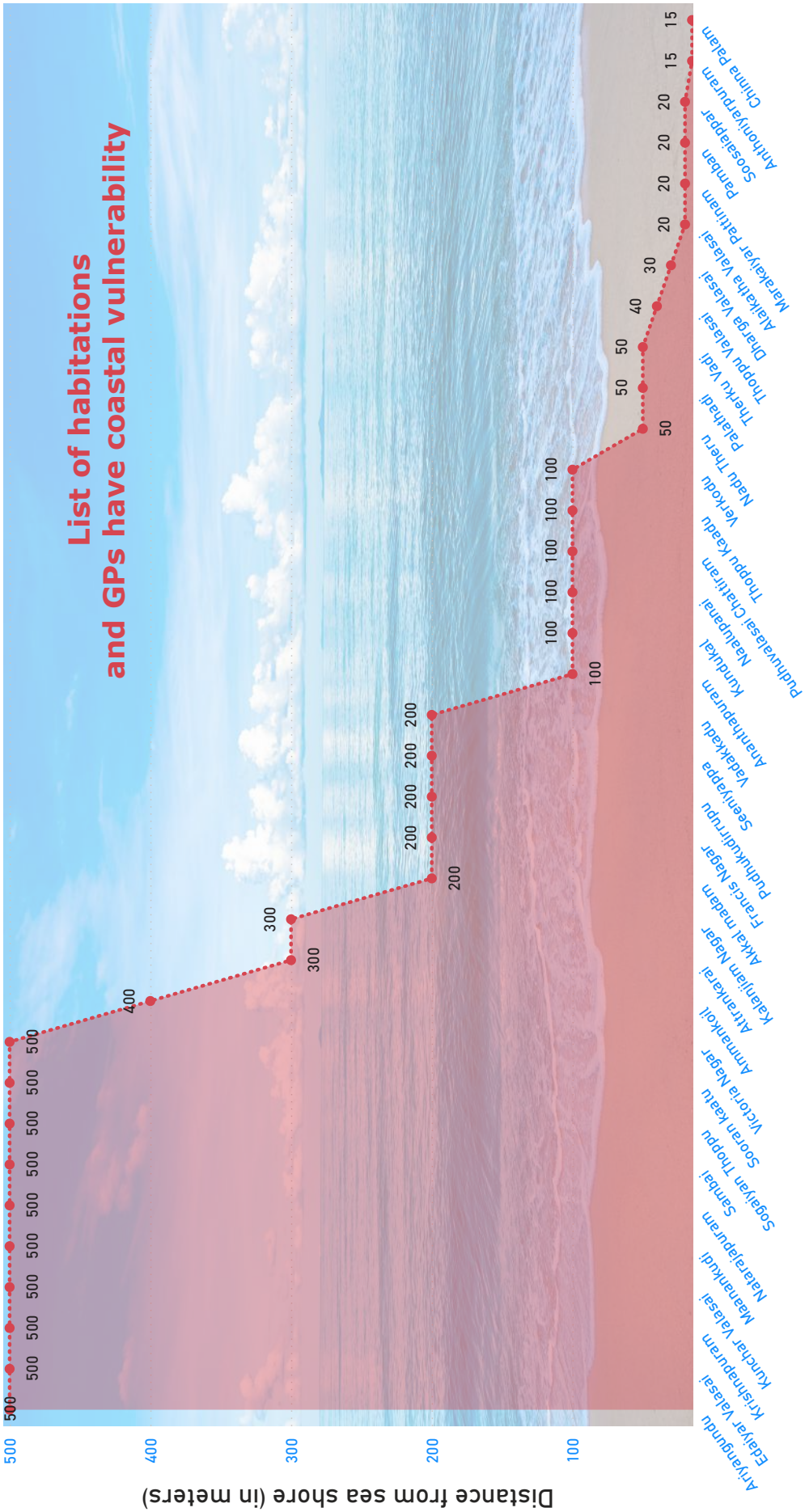
TABLE 5. CLIMATE RISKS AND VULNERABLE GP's

LIST OF HABITATIONS AND GPs HAVE COASTAL VULNERABILITY

GP name	Habitations
Alagankulam	Ammankoil, Samythoppu, Settipanai, Devar Nagar, Ananthapuram
Attrankarai	Attrankarai, Kalanjiam Nagar
Enmanamkondan	Dharga Valasai, Thuthi Valasai
Irumeni	Alaikatha Valasai, Irumeni, Salai Valasai
Kaaran	Kaaran, Five acre, Saalaithotam, Sethunagar
Keelanagachi	Thoppu Valasai, Kenikarai Valasai, Naduvalasai, Nambayee Valasai, Akida Valasai, Kalkinatru Valasai
Kumbaram	Kumbaram North, Kumbartam South
Maanankudi	Maanankudi, Sooran kaatu,
Marakayarpattinam	Marakaiyar Pattinam

Nagachi	Nagachi
Pamban	Pamban, Chinna Palam, Nadu Theru, Therku Vadi, Kundukal, Francis Nagar, Akkal madam
Panaikulam	Pudhukudirrupu, Sogaiyan Thoppu, Krishnapuram
Pirapan Valasai	Pirapan Valasai
Pudhuvalasai	Pudhuvalasai Chattiram
Pudumadam	Naraiurani
Sathakon Valasai	Sathakon Valasai, Ariyaman, Seeniyappa
Sembadayarkulam	Vattan Valasai
Thangachimadam	Thangachimadam, Peikarambu, Kudiruppu, Palathadi, Anthoniyarpuram, Soosaiappar, Thoppu Kaadu, Naalupanai, Verkodu, Vadakkadu, Ariyangundu, Sambai, Natarajapuram, Palkulam
Therbogi	Therbogi
Vedalai	Kunchar Valasai, Edaiyar Valasai, Victoria Nagar, Pillai Madam, Vedalai, Valaiyarvaadi, Naduman Kaadu, Samathuvapuram
Vellariodai	Vellariodai


List of habitations
and GPs have coastal vulnerability
Distance from sea shore (in meters)
6K
5K
4K
3K
2K
1K
6000 6000 6000 5000 3000 2000 2000 2000 2000 2000 2000 1500 1500 1300 1000 1000 1000 1000 1000 1000 1000 900 800 800 750 750 700 700 700 700 700
Kumbaram No...
Kumbartam South
Vattan Valasai
Saalaithotam
Kaaran
Devar Nagar
Kudiruppu
Nambayee Valasai
Palkulam
Sathakon Valasai
Sethunagar
Therbogi
Akida Valasai
Naduvalasai
Settipanai
Ariyaman
Kenikarai Valasai
Naduman Kaadu
Nagachi
Pirapan Valasai
Salai Valasai
Thuthi Valasai
Vedalai
Naraiurani
Five acre
Vellariodai
Samathuvapuram
Valaiyarvaadi
Kalkinatru Valasai
Peikarambu
Pillai Madam
Samythoppu
Thangachimadam
Irumeni
Habitations


List of habitations
and GPs have coastal vulnerability
Distance from sea shore (in meters)
500
400
300
200
100
Habitations
Ariyangundu
Edaiyar Valasai
Krishnapuram
Kuuchar Valasai
Maanamkudi
Nataraajapuram
Sembai
Sogaiyan Thoppu
Sooran Kaadu
Victoria Nagar
Ammankoil
Attrankarai
Kalanjiam Nagar
Akkal madam
Francis Nagar
Pudhukudiruppu
Seeniyappa
Vadakkadu
Anantharapuram
Kundukkal
Neaulpanai
Thoppu Kaadu
Verkadu
Nadu Theru
Palathadi
Therku Vadi
Thoppu Valasai
Dharga Valasai
Alaikatha Valasai
Marakalyar Pattinam
Pambam
Soosaiappar
Anthonyarpuram
Chinna Palam
Pudhuvalasai Chattiram

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 the 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 analyzed at the 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 analyse 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. Mandapam Block is engrossed with costal origin landform units (Figure 3.1). Costal landforms are further classified based on the landform age and its characteristics including biodiversity existence such as older deltaic plain, young coastal plain and coral reef. 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 in identifying suitable sites for NRM activates under CWRM plan preparation.

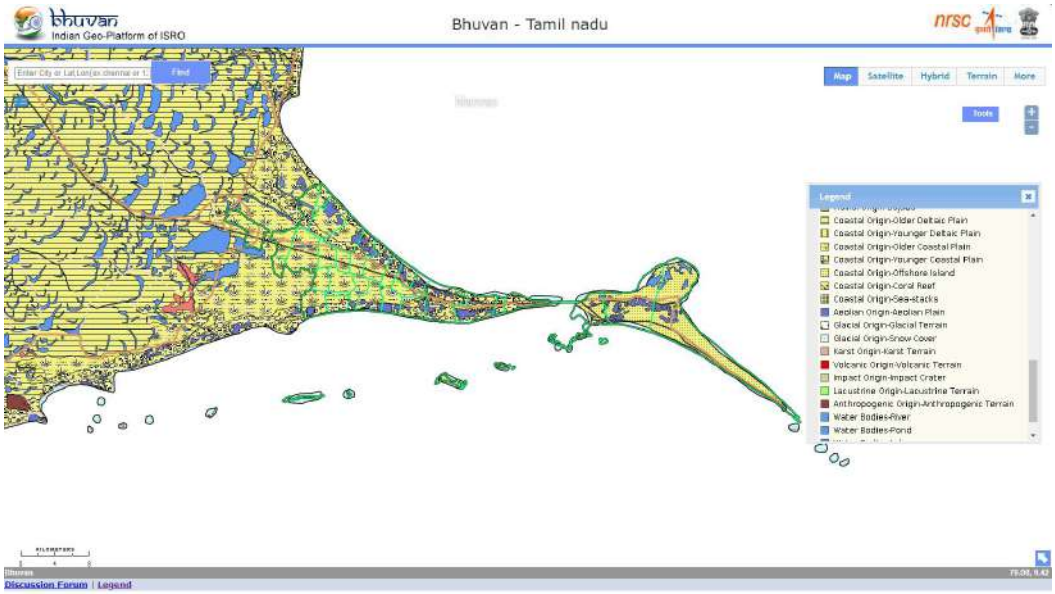
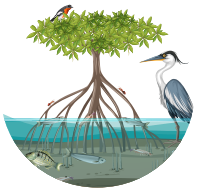


Figure 3.1. Geomorphology map

Origin	Area coverage in %	Gram Panchayat
Coastal Origin - Older Coastal Plain		
	68%	Pattinamkathah, Kuyavankudi, Valantaravai, Perungulam, Sembidaiyarkulam, Kumbaram, Rettaiyurani, Koravalli - 100%, Tamaraikulam - 70%, Terbhogi, Panaikulam, Alagankulam, Pirappanvalasai - 60%, Pudumadam - 50%, Puduvalasai, Keelanagachi, Enmanamkondan, Manankudi, Karan - 50%, Attangarai - 40%, Vellariodai - 25%, Irumeni - 15%
Coastal Origin - Younger Coastal Plain		
	57%	Sattakkonvalasai, Vedalai, Maraikkarpattinam - 100%, Nochiyurani - 90%, Irumeni - 85%, Vellariodai - 60%, Attangarai, Keelanagachi, Pirappanvalasai - 50%, Alagankulam, Enmana-mkondan, Manankudi, Karan - 45%, Pudumadam - 40%, Panaikulam - 30%, Puduvalasai, Tamaraikulam - 30%, Terbhogi - 25%
Coastal Origin - Offshore Island		
	100%	Pamban, Thangachimadam

3.5.1.2 Lineament: The lineament is also a lithological unit which reveals the hidden architecture of rock basement, representation of an underlying geological structure such as a fault, 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.

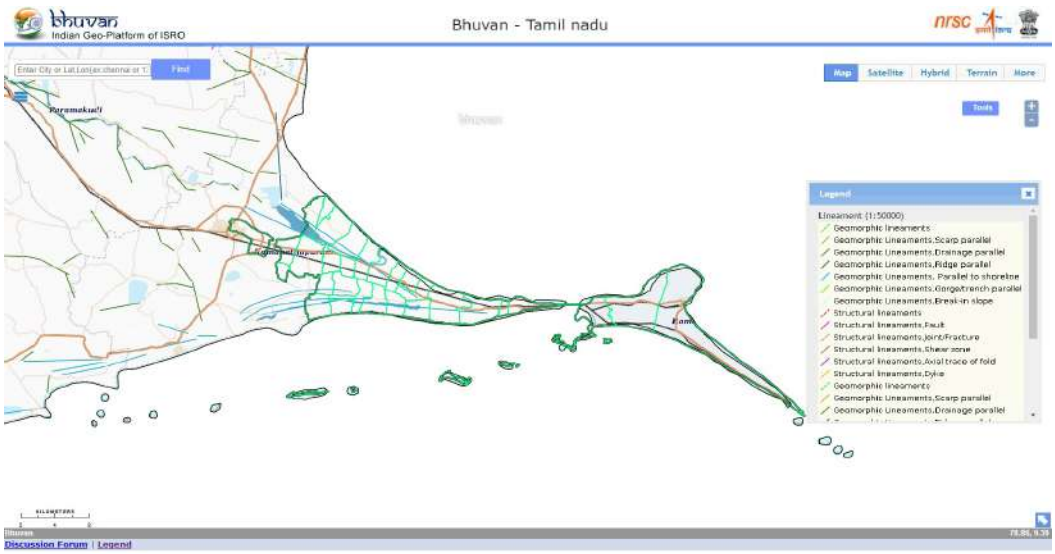


Figure 3.2. Lineament map

Lineament type	Gram Panchayat
Geomorphic lineaments, Parallel to shoreline	Terbhogi, Panaikulam, Alagankulam, Attangarai, Keelanagachi, Enmanamkondan, Pirappanvalasai, Sattakkonvalasai, Nochiyurani, Manankudi, Pudumadam, Tamaraikulam, Vellariodai, Karan, Kumbaram, Rettaiyurani, Vedalai

3.5.1.3 Terrain: The terrain map gives information related to elevation from above sea level. A terrain of same range is noticed in 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.

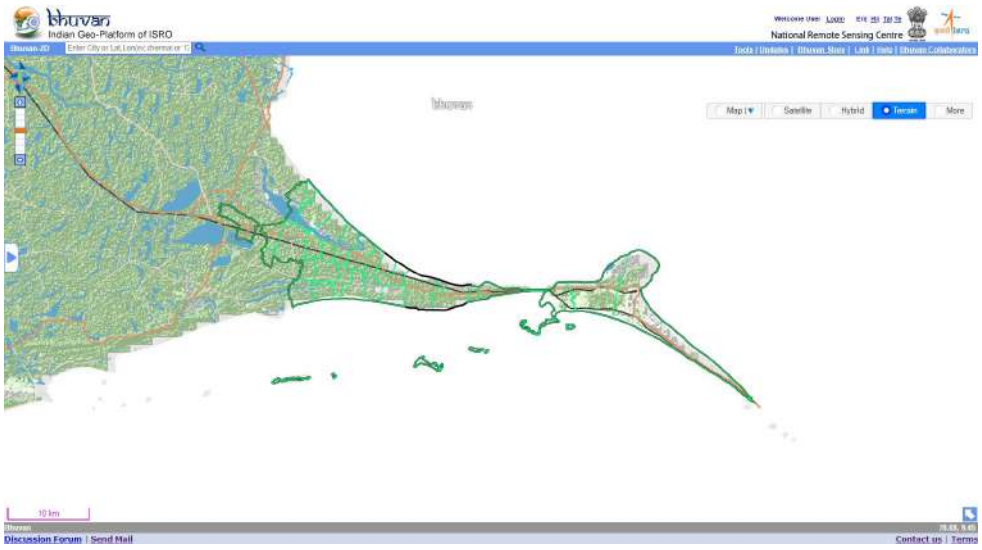


Figure 3.3. Terrain map

3.5.1.4 DEM: The DEM is the 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. 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).

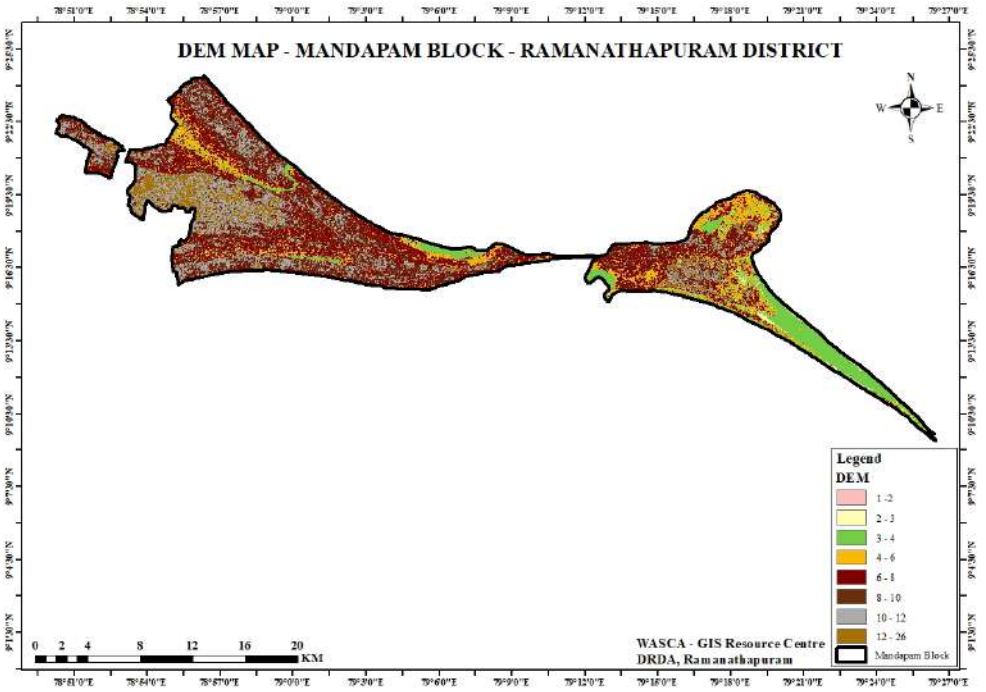


Figure 3.4. DEM map

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 slope ranges from 0 to 1 % is 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 and also used in analysing / proposing soil conservation measures such as check dam, bunding land development, farm ponds etc.

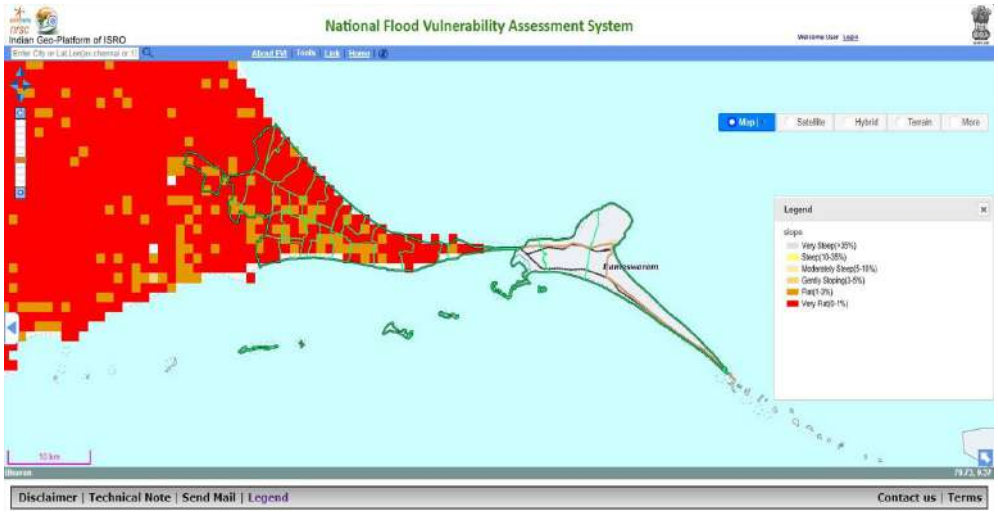


Figure 3.5. Slope map

Slope range	Area in %	Gram Panchayat
Very Flat (0-1%)	74%	Maraikkarpattinam, Vedalai, Puduvalasai, Terbhogi - 100%, Alagankulam, Panaikulam - 95%, Pirappanvalasai, Irumeni, Keelanagachi, Kuyavankudi, Valantaravai - 90%, Tamaraikulam, Enmanamkondan, Perungulam - 85%, Sattakkonvalasai, Karan, Pattinamkathah - 80%, Kumbaram, Rettaiyurani - 60%, Koravalli, Attangarai, Sembidaiyarkulam - 50%, Vellariodai - 40%, Pudumadam - 30%, Nochiyurani, Manankudi - 20%
Flat (1-3%)	32%	Nochiyurani, Manankudi - 80%, Pudumadam - 70%, Vellariodai - 60%, Koravalli, Attangarai, Sembidaiyarkulam - 50%, Kumbaram, Rettaiyurani - 40%, Sattakkonvalasai, Karan, Pattinamkathah - 20%, Tamaraikulam, Enmanamkondan, Perungulam - 15%, Pirappanvalasai, Irumeni, Keelanagachi, Kuyavankudi, Valantaravai - 10%, Alagankulam, Panaikulam - 5%

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. It is noticed that very less dense drainage network and a lower order stream is flowing towards South from North in the middle part of the Block (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.

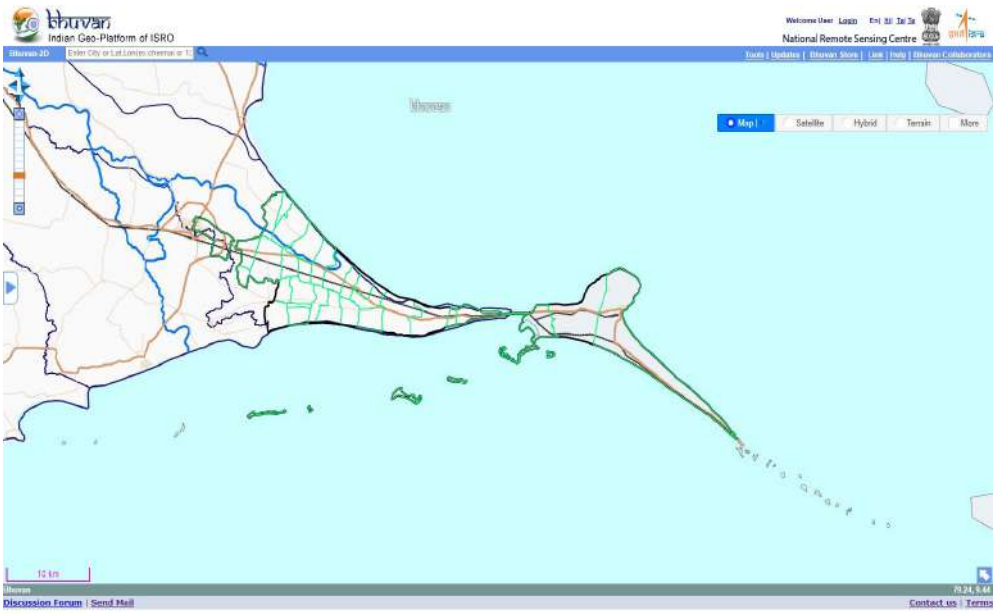


Figure 3.6. Drainage network and density

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. Mandapam 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 and also aids in strengthening the durability of land, soil and water conservation structures downstream.

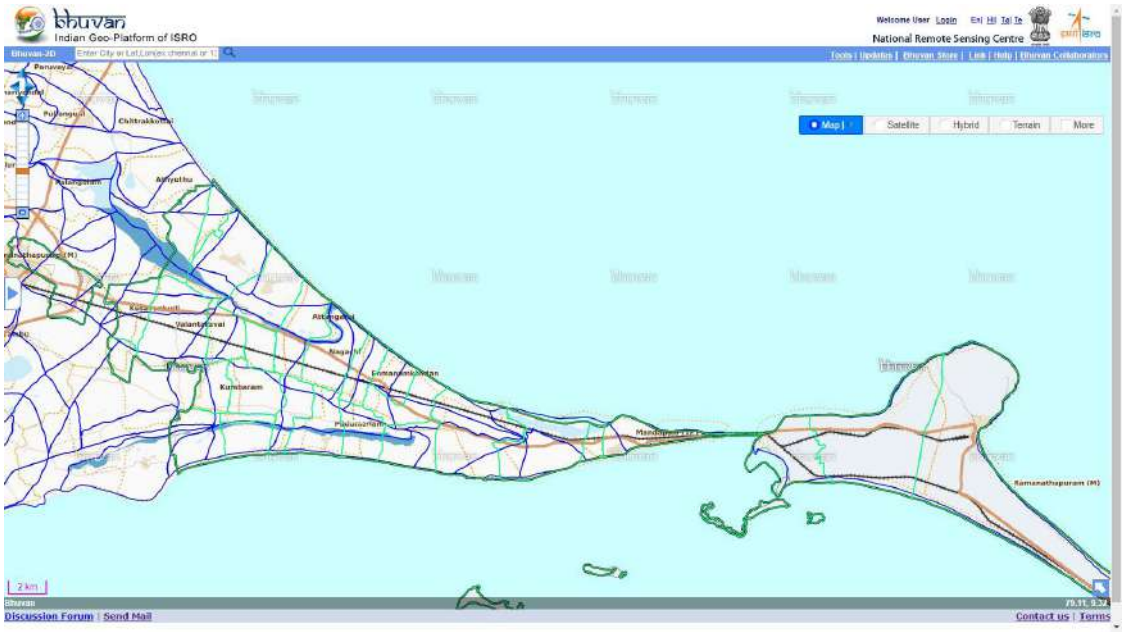


Figure 3.7. Watershed map

3.5.1.8 Ground water perspectives: Ground water is one of the important natural resources in a semi-arid region like Mandapam 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 (Figure 3.8). The GPs wise detail of GW prosperity is shown in the illustration below. This specific information will play a crucial role in identifying sites for recharge structures in order to address water scarcity issues in the Block.

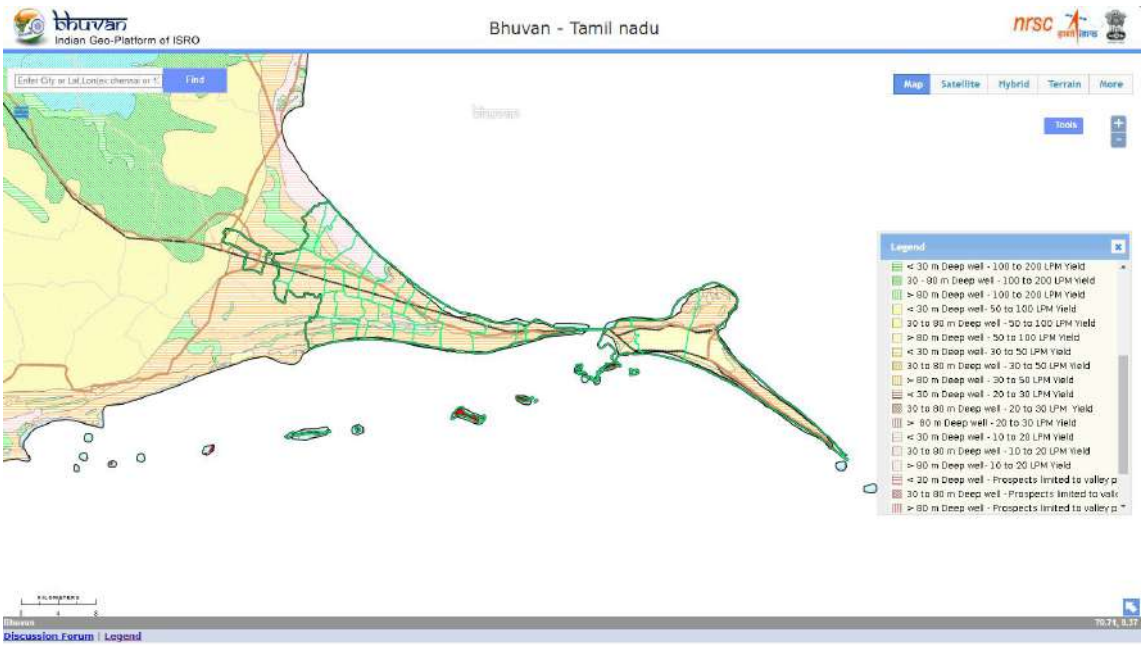


Figure 3.8. Ground water perspective map

Groundwater Prospects	Area in %	Gram Panchayat
<30m Deep well, 100 to 200 LPM Yield	16%	Terbhogi, Koravalli - 40%, Pudumadam - 25%, Tamaraikulam, Manankudi - 20%, Attangarai, Vellariodai, Nochiyurani - 10%, Panaikulam, Alagankulam, Valantaravai, Karan - 5%
<30m Deep well, 50 to 100 LPM Yield	55%	Thangachimadam - 60%, Pamban - 50%
<30 m Deep well, 10 to 20 LPM Yield	41%	Alagankulam - 70%, Puduvalasai - 60%, Panaikulam - 55%, Attangarai - 50%, Terbhogi, Manankudi - 20%, Pudumadam - 10%
< 30m Deep well 30 to 50 LPM Yield	72%	Maraikkarpattinam, Vedalai, Sattakkonvalasa, Pirappanvalasai, Irumeni, Enmanamkondan, Keelanagachi, Sembidaiyarkulam, Perungulam, Kumbaram, Rettaiyurani - 100%, Kuyavankudi - 90%, Valantaravai, Karan, Tamaraikulam - 80%, Pattinamkathah, Vellariodai - 75%, Pudumadam, Nochiyuran - 60%, Koravalli - 55%, Attangarai - 50%, Pamban - 45%, Thangachimadam - 40%, Panaikulam - 35%, Alagankulam, Manankudi - 30%, Puduvalasai - 20%, Terbhogi - 15%

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

Sl. No.	Canal Network	Extent
	Canal Network (m)	
1	Length of Main Canal (m)	43,555
2	Length of Minor Canal (m)	23,134
3	Length of Distributaries (m)	15,067
4	Water Courses (Field Channels) (m)	10,234
	Traditional Water bodies (No.)	
5	Number of Tanks (PWD & Union) (No.)	12
6	Number of Ooranis (No.)	371
	Irrigation Facilities (ha)	
7	Tank Irrigation	3,435
8	Canal Irrigation	550
9	Open & Tube Well Irrigation	546
	Catchment Area wise Available Runoff (ha.m)	
10	Good Catchment Area	1,454
11	Average Catchment Area	453
12	Bad Catchment Area	1,582
	Watershed and Drainage Networks	
13	Length of Natural Drainage Lines (m)	3,533
14	Number of Natural Drainage Lines (No.)	3
15	Number of Micro-watersheds (No.)	125
	Water Demand	
16	For Humans (ha.m)	488
17	For Livestock (ha.m)	36
18	For Agriculture (ha.m)	5,935
19	GW utilization for Drinking (%)	97.93
20	GW utilization for Livestock (%)	64.11
21	GW utilization for Agriculture. (%)	17.82
22	SW utilization for Drinking (%)	2.07
23	SW utilization for Livestock (%)	35.89
24	SW Utilization for Agriculture (%)	82.18

3.5.2.1 Existing Water Structures

The Block has structured traditional water storage units such as tanks and Ooranis. It is noticed that the Ooranis are more (371) than tanks (12) (Figure 3.9).

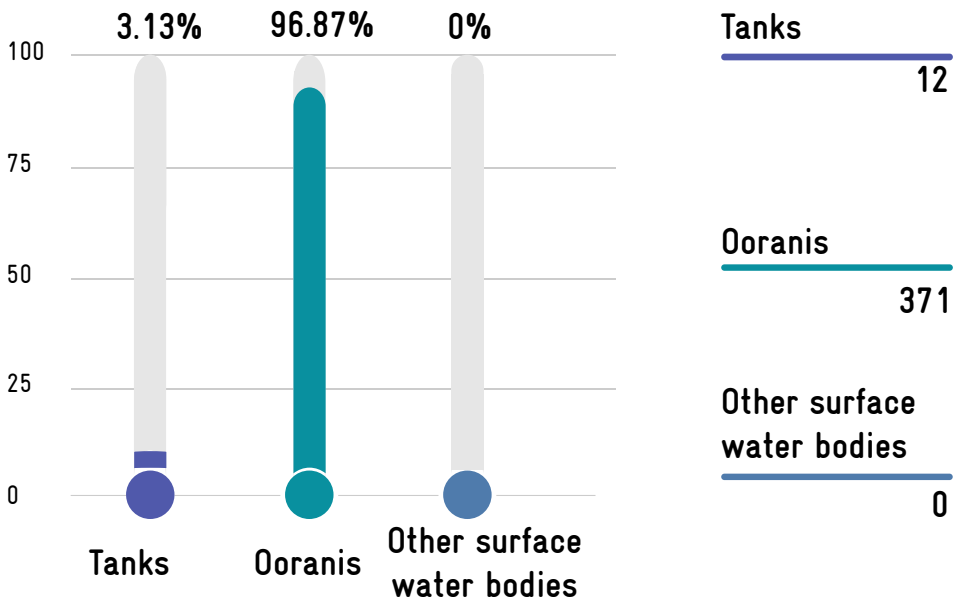


Figure 3.9. Traditional Waterbodies

3.5.2.2 Sources of Irrigation

The total area under irrigation in the Block is 4,531 ha, of which 75.8 % (3,435 ha) is irrigated through tanks, followed by 12.1 % (546 ha) through open/tube well and the remaining 12.1 % (550 ha) area is through canals-based irrigation (Figure 3.10).

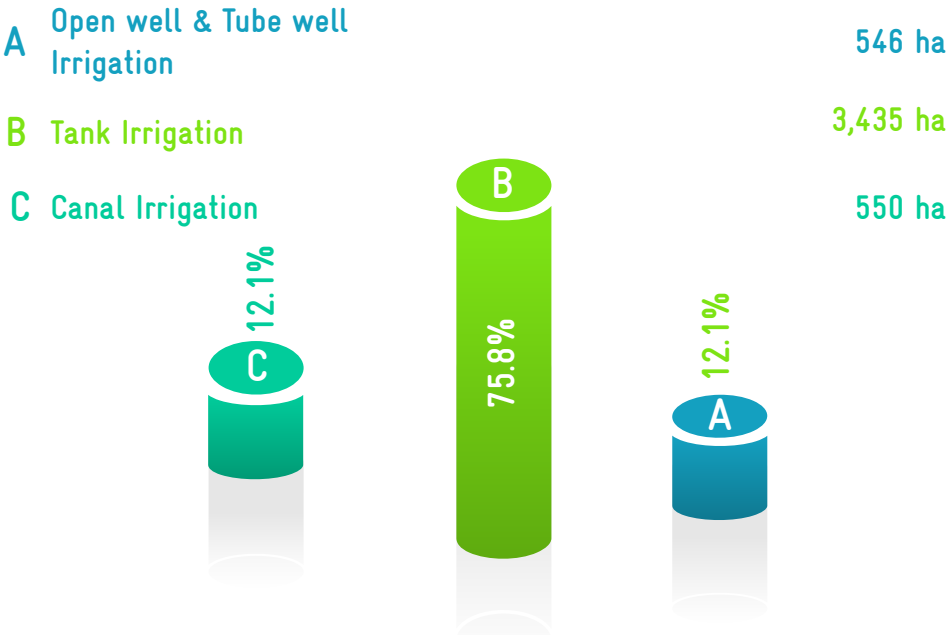


Figure 3.10. Irrigation sources

3.5.2.3 Available Run off

The total available runoff in the catchment area is 3,488 ha.m out of which 41.7 % is from good catchment area followed by 45.4 % from bad catchment area and the remaining 13 % is from average catchment area. As the area has worse catchment area, the runoff generated is more (Figure 3.11).

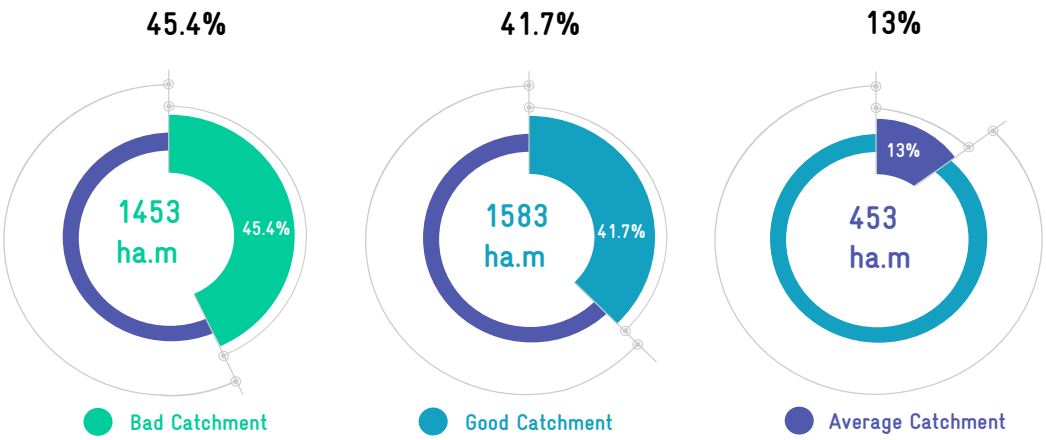
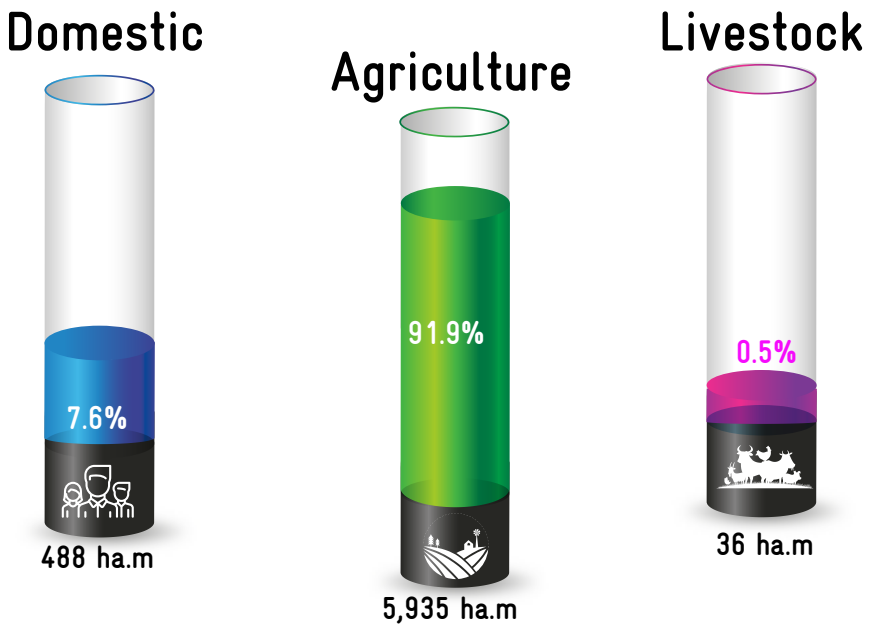


Figure 3.11. Runoff from catchments

3.5.2.4 Water Demand

The total demand for water including domestic, agriculture and livestock purpose is 6,459 ha.m. The highest demand is from the agriculture sector of 5,935 ha.m (91.9 %) followed by domestic use demand of 488 ha.m (7.6 %) and rest is from livestock.



Out of the total water demand, 97.93 % for domestic purpose usage is met through ground water while the remaining 2.07 % from surface water resources. Utilization of 82.18 % for agriculture is from surface water while 17.82 % is from Ground water. Utilization of 64.11 % of water demand for livestock is met by ground water and 35.89% from Surface water (Figure 3.12).

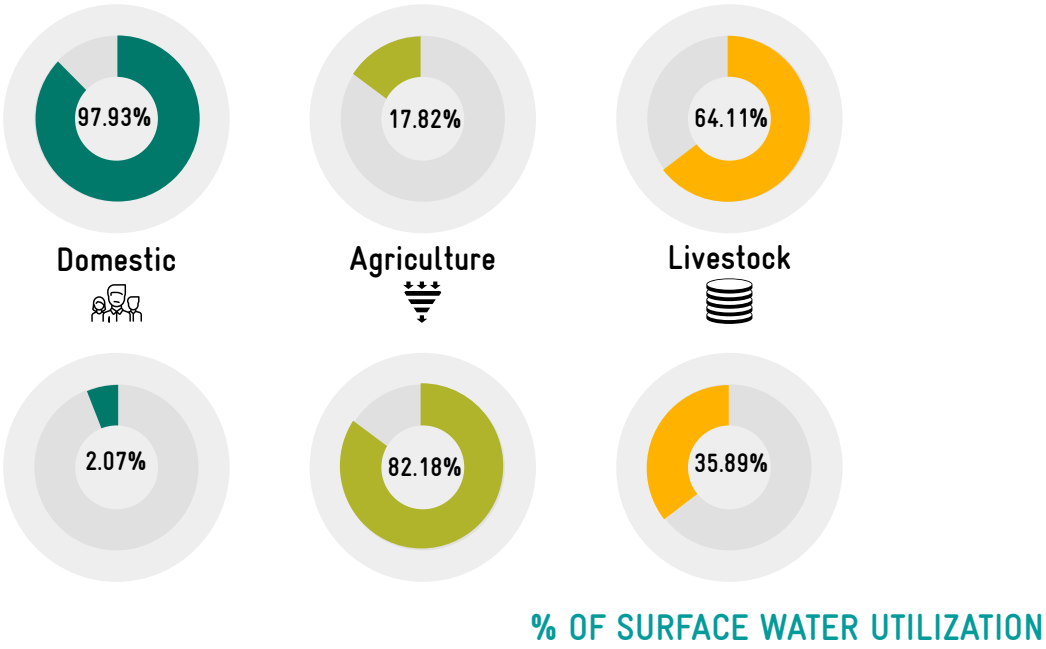


Figure 3.12. Sector-wise water utilization

3.5.3 ANALYSIS OF PHYSICOCHEMICAL PARAMETERS

Physicochemical parameters were assessed to understand their influence on nature of water through Water Quality Index (WQI), Seawater Mixture Index (SMI) and Salinity. To understand WQI and SMI, 28 water samples were collected across the Block area, out of which 18 samples were of open well water and remaining samples were from ground water (Figure 3.13).

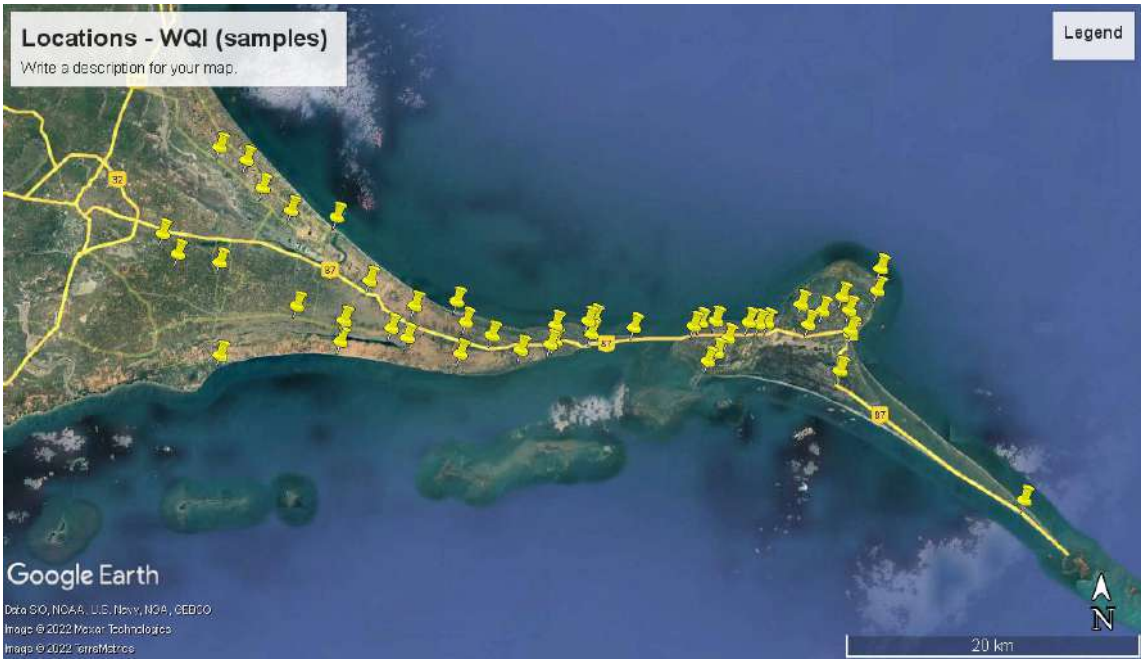


Figure 3.13. Location of water samples

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, HCO3, Cl, SO4, NO3, Ca, Mg, Na and K to determine the water quality. The results showed that the average content of ions was as follows: Cl > TA > TH > HCO3 > Na > Ca > Mg > CO3 > S04 > K > NO3. The predominant hydro-chemical parameters are Chloride (C) and total hardness (TH) while Potassium (K) is very less. The excellent water quality /suitable water for domestic purpose is found in seven spots (blue colour in Figure 3.10) over the Block area while very poor-quality water/ unsuitable water for domestic purpose with index value >300 is found in two spots. Buffer area of very poor sites falls under poor quality water of index zone ranging from 200 to 300. However most of the area falls under good water quality zone of index value range good to medium (50-100) (Figure 3.14). These zones act as inputs in identifying suitable sites to propose appropriate treatment measures. Location wise water quality during pre and post monsoons are attached in Annexure 3.8 and 3.9.

Physicochemical parameters	Cl	TA	TH	HCO_3	Na	Ca	Mg	CO_3	$S0_4$	K	NO3
Average in mg/l	530.93	314.58	309.81	220.52	207.88	135.33	97.82	68.54	55.45	17.05	16.95

(TH = Total hardness, TA = Titratable acidity, Ca =calcium, Na= Sodium, Cl= Chloride, HCO3=Bicarbonate, Mg= Magnesium, SO4= Sulphate, NO3= Nitrate, K= Potassium, CO3= Carbonate)

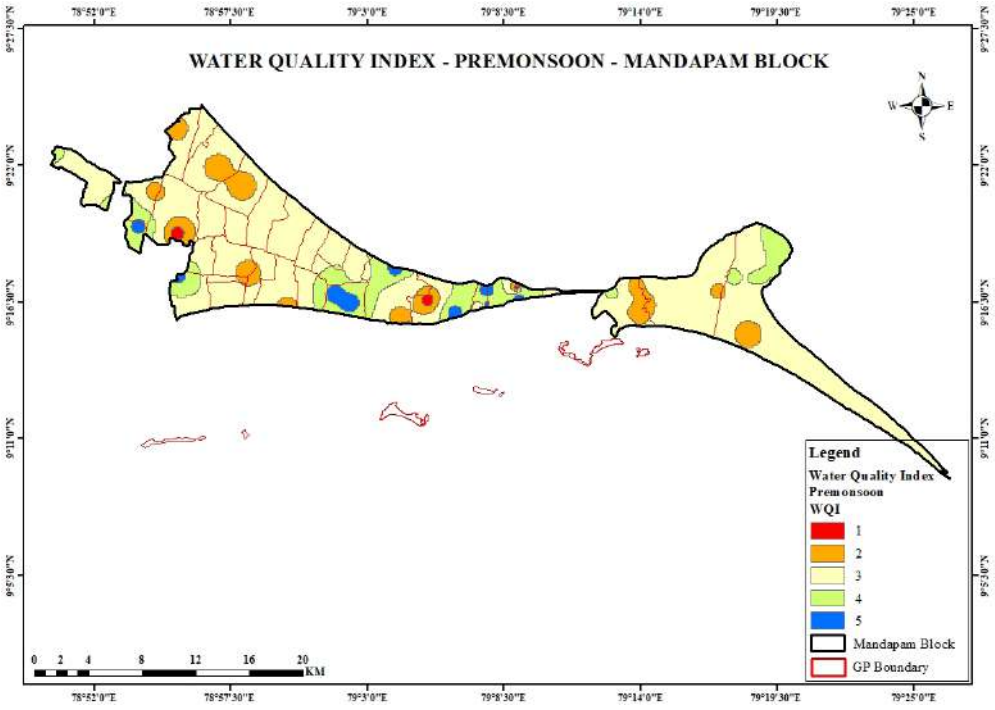


Figure 3.14. Water Quality Index

3.5.3.2 Seawater Mixing Index

SWI parameter is calculated based on mixing of major ionic constituents (Na, Cl, Mg, and SO4) 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 > S04. The predominant hydro-chemical parameter is Sodium followed by calcium while sulphate is less. Geographically three spots were found with high SWI while two zones 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).

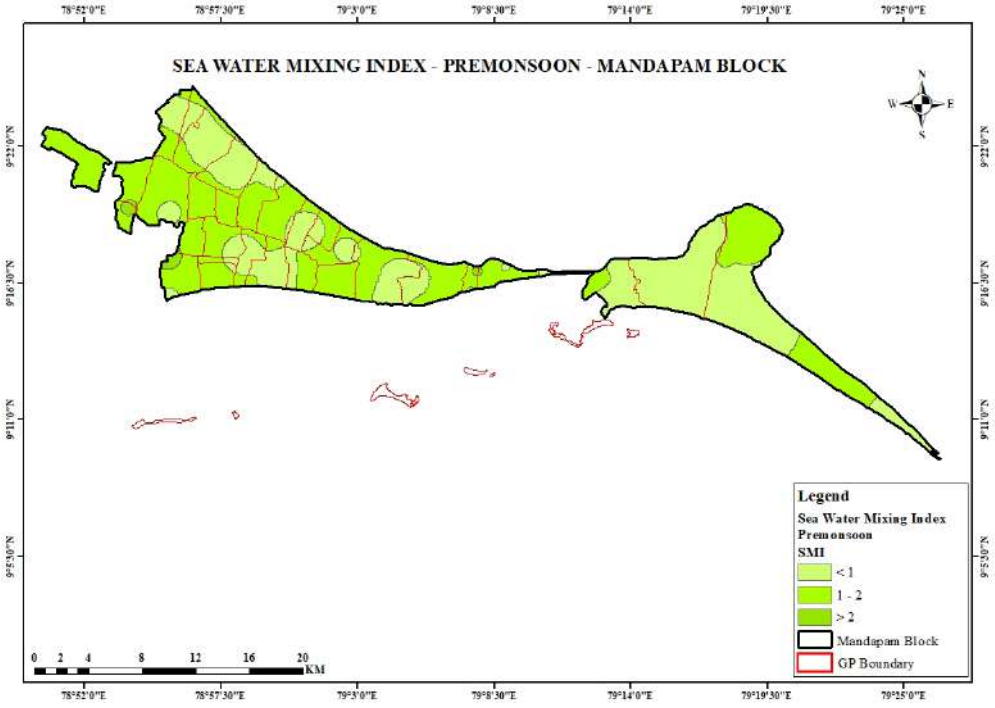


Figure 3.15. Seawater Mixing Index

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).

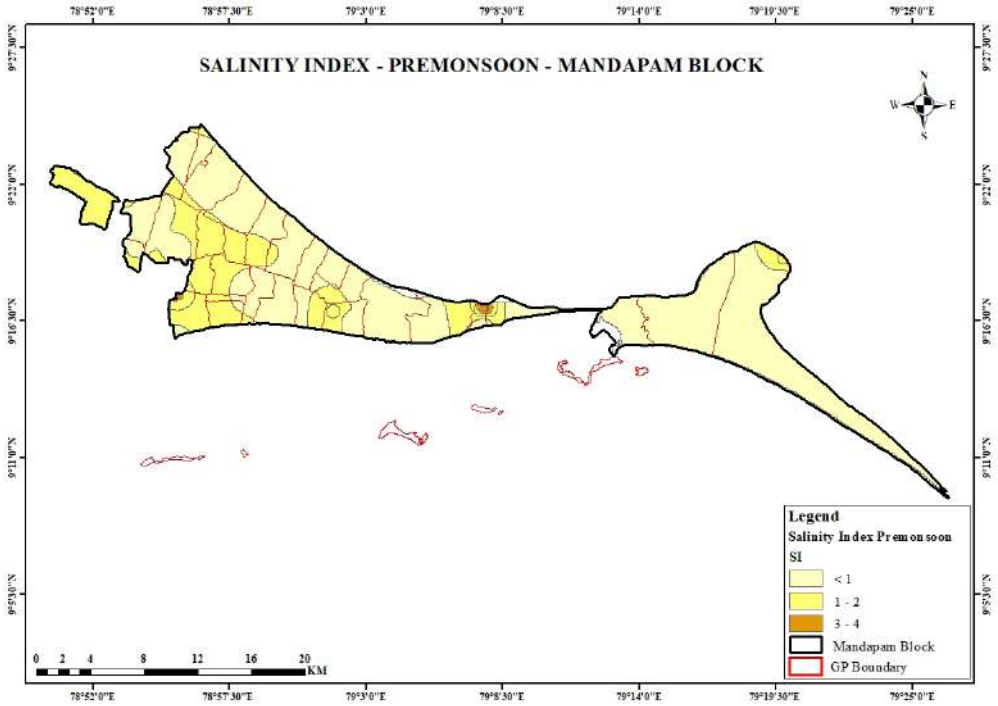


Figure 3.16. Salinity Index

3.6 CWRM PLANNING ANALYSIS-AGRICULTURE

Agriculture is the primary livelihood of the households in Mandapam 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 Mandapam 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 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.

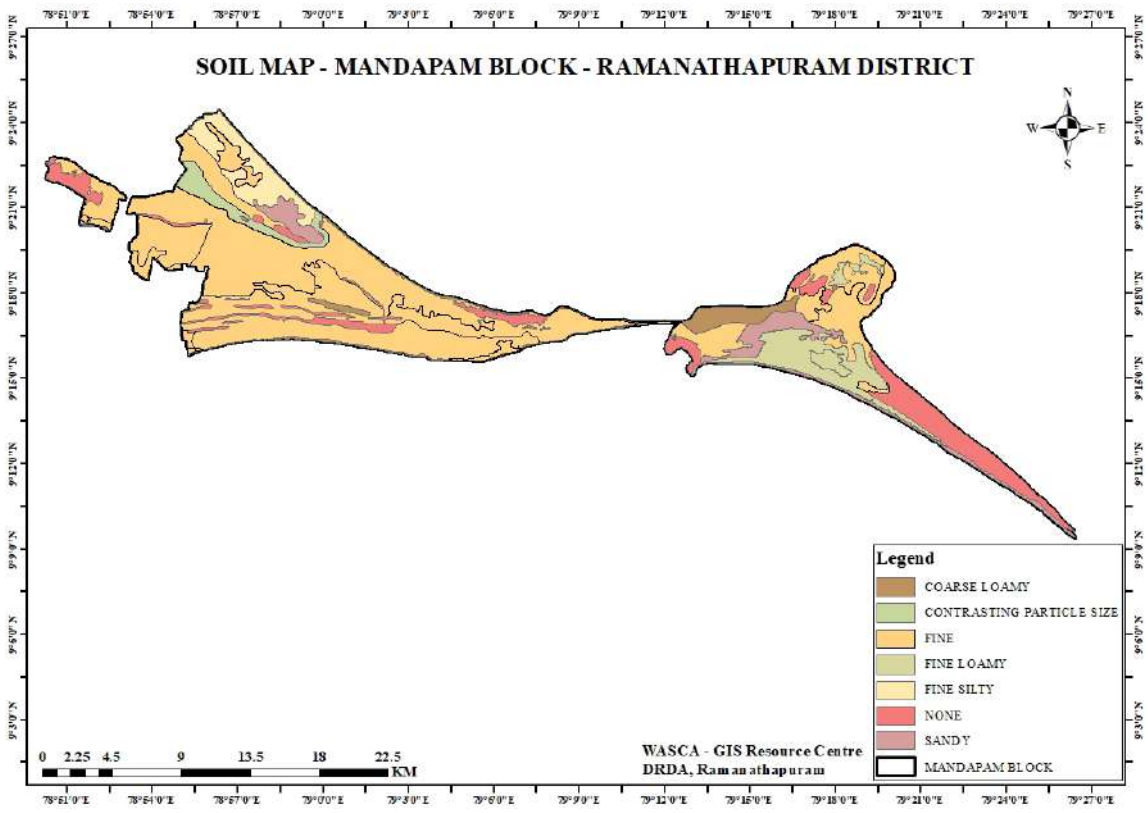


Figure 3.17. Soil texture

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 of soil erosion is found in the western region of the Block (Figure 3.18) and the illustration below gives area wise soil erosion details of the GPs. Data of Soil eroded sites will help in preparing plans, to suggest soil conservation and watershed management activities.

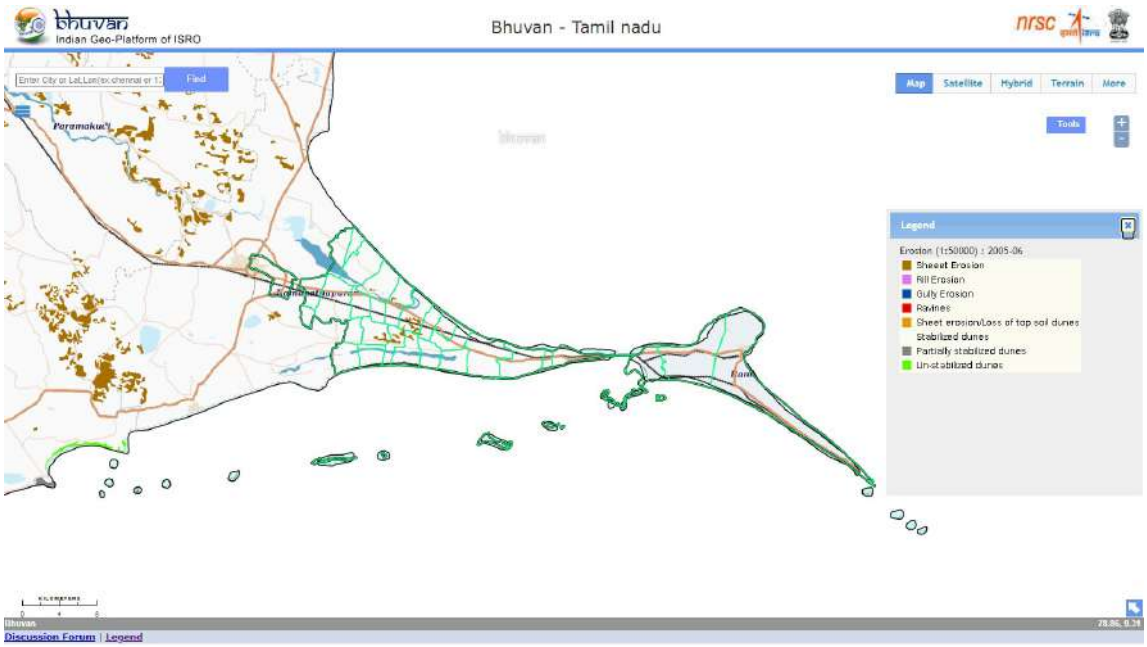


Figure 3.18. Soil erosion map

Erosion type	Area in %	Gram Panchayat
Sheet Erosion		
	19%	Tamaraikulam - 35%, Keelanagachi - 30%, Pudumadam - 20%, Rettaiyurani - 15%, Attangarai - 10%, Alagankulam - 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. Mandapam Block is majorly covered by agricultural crop land, fallow land followed by forest area and barren lands (Figure 3.19). The GP wise LULC is tabulated in table. LULC map helps the decision makers and planners to focus on the fallow land development activities.

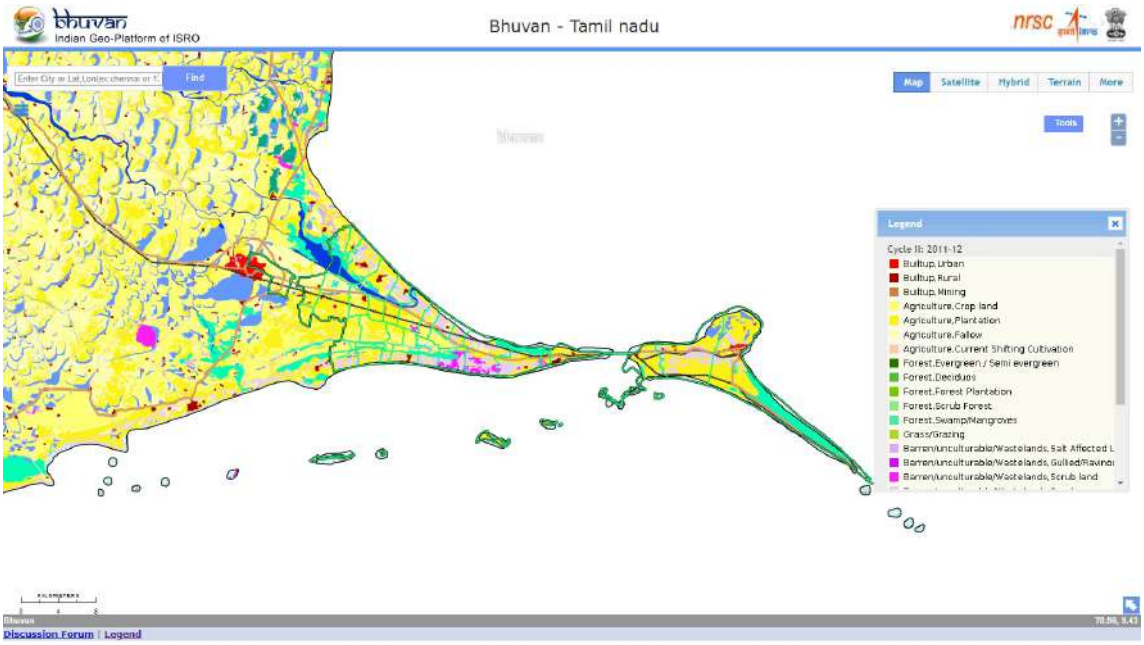


Figure 3.19. Land Use Land Cover map

Land Use	Area coverage in %	Gram Panchayat
Barren Lands/Scrub Lands	28%	Nochiyurani - 50%, Sattakkonvalasai - 43%, Keelanagachi, Vedalai - 10%
Barren /Salt affected Lands	28%	Manankudi, Nochiyurani - 60%, Irumeni - 50%, Pudumadam, Keelanagachi - 40%, Vedalai, Pirappanvalasai, Attangarai, Panaikulam - 30%, Karan, Thangachimadam, Enmanamkondan - 20%, Alagankulam - 15%, Vellariodai, Tamaraikulam, Pamban, Puduvalasai, Terbhogi - 10%
Agriculture, Fallow lands	35%	Koravalli, Kumbaram - 80%, Perungulam - 75%, Enmanankondan - 60%, Pattinamkathan, Pirappanvalasai, Pudumadam - 50%, Kusavankudi - 45%, Attrangarai, Irumeni, Karan, Rettaiyurani - 40%, Alagankulam, Keelanagachi, Panaikulam, Puduvalasai, Thamaraikulam, Valantharavai, Vellariodai - 30%, Vedalai - 25%, Pamban, Thangachimadam - 20%, Maraikayarpattinam - 15%, Manangudi, Nochiyurani, Sathakonvalasai, Sembadaiyarkulam, Therbogi - 10%
Agriculture, Plantation	28%	Sembidaiyarkulam - 80%, Rettaiyurani - 65%, Valantaravai - 60%, Thangachimadam - 55%, Pattinamkathah - 45%, Koravalli - 40%, Attangarai, Alagankulam, Pamban, Pudumadam - 35%, Perungulam, Tamaraikulam, Manankudi, Vedalai, Terbhogi - 30%, Panaikulam - 25%, Kumbaram, Tamaraikulam, Sattakkonvalasai, Nochiyurani - 20%, Kuyavankudi, Karan - 15%, Vellariodai, Attangarai - 10%, Vellariodai, Sattakkonvalasai, Keelanagachi, Valantaravai, Pamban - 5%

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. Salt affected and sandy area type of wastelands are noticed in Mandapam Block (Figure 3.20). GP wise details are 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.

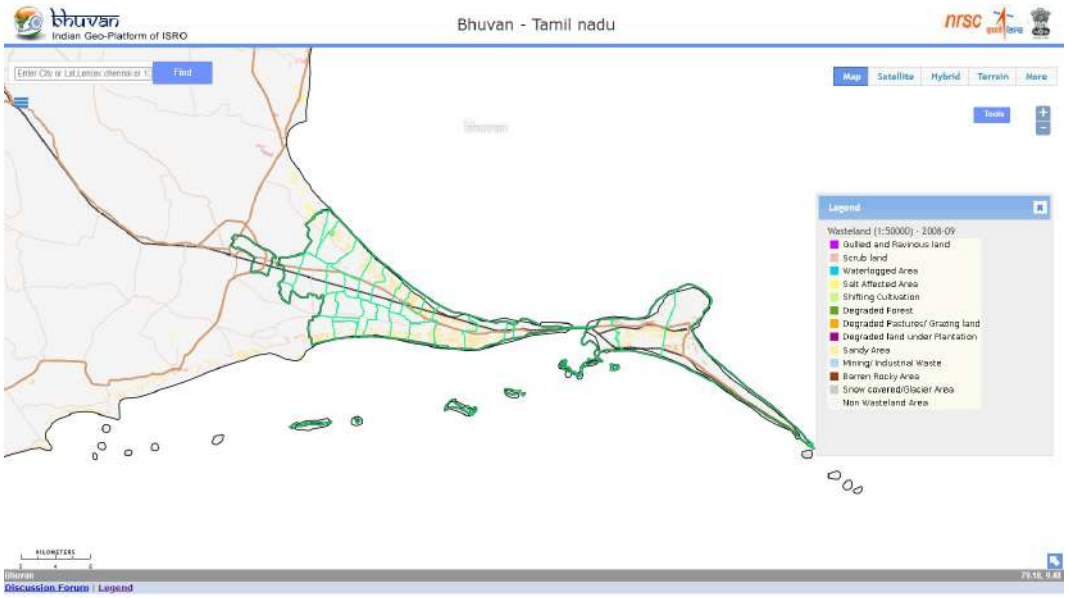
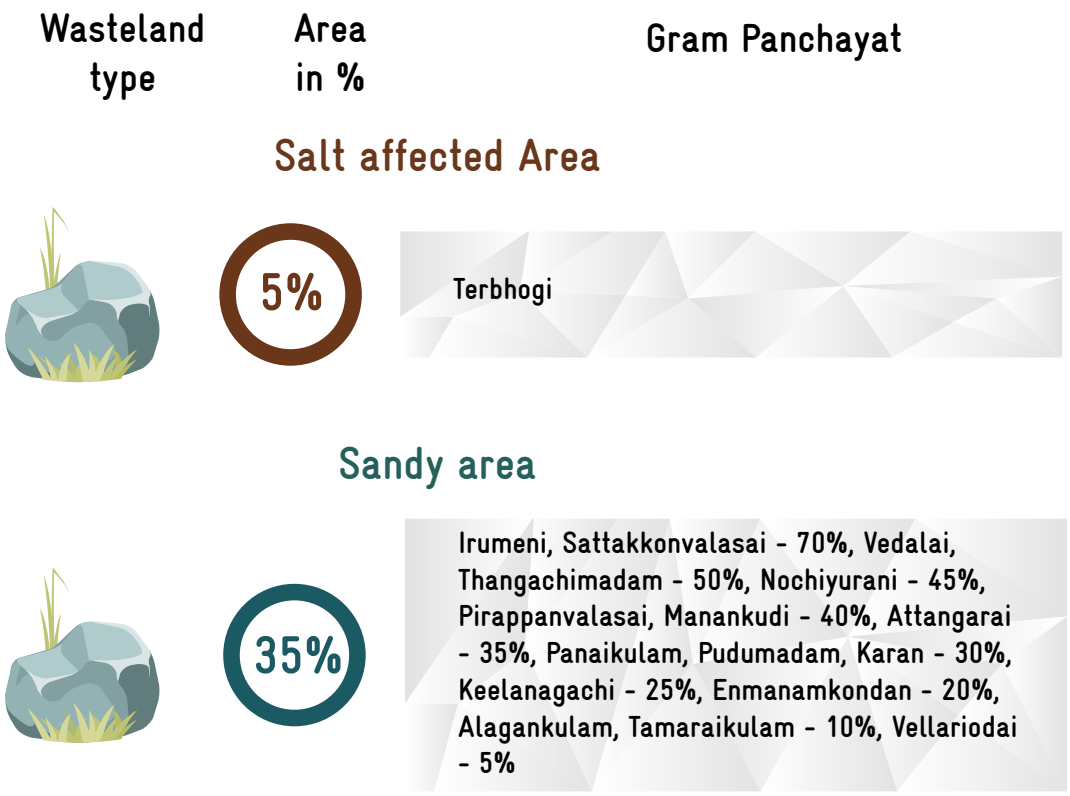


Figure 3.20. Wasteland map



3.6.1.5 Salt affected area: Due to the Block's proximity to coastal region, one fourth of the Block area is sodic and same was also found in the results of salinity analysis of water samples (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.

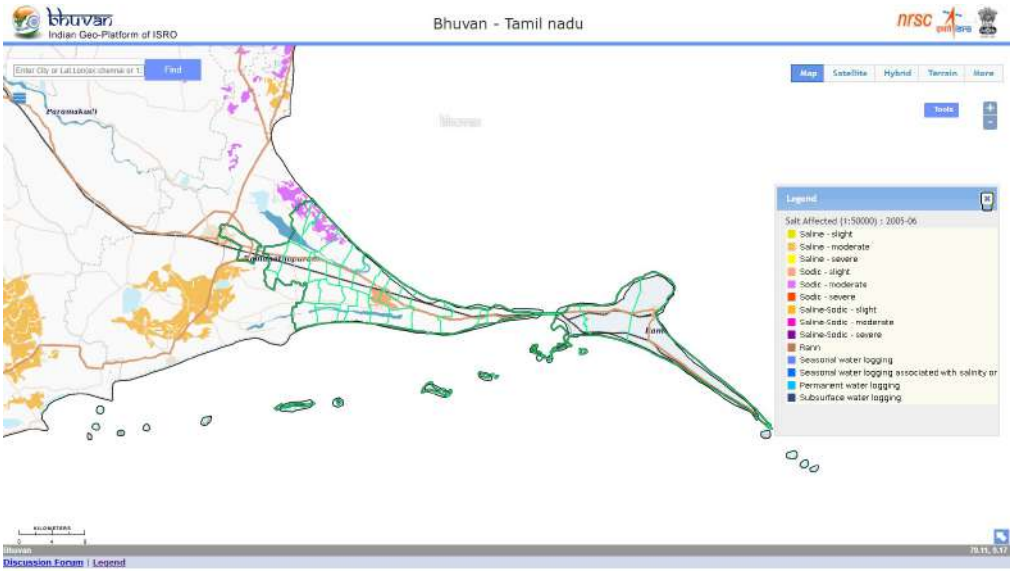


Figure 3.21. Salt affected area

Thematic unit	Area in %	Gram Panchayat
Sodic – Moderate		
	10%	Terbhogi
Sodic-Slight		
	5%	Pirappanvalasai - 55%, Puduvalasai, Panaikulam - 45%, Irumeni - 30%, Alagankulam - 25%, Enmanamkondan - 20%, Manankudi - 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

Sl. No.	Key parameter	Extent
	Area under Land Resources (ha.)	
1	Non-Agricultural Uses	6,548
2	Land Under Miscellaneous Tree Crops etc.	2,011
3	Cultivable Waste Land	647
4	Fallows Land other than Current Fallows	56
5	Current Fallow land	4,244
6	Unirrigated Land	7,501
7	Area Irrigated by Source	2,123
	Land under Catchment Area (ha)	
8	Good Catchment	6,554
9	Average Catchment	2,658
10	Bad Catchment	13,925
	Crop Details	
11	Irrigated Area (ha)	3,461
12	Rainfed area (ha)	4,262
13	Paddy Cultivation (ha)	3,470
14	Crop Water Requirement - Irrigated condition (ha.m)	2,212
15	Crop Water Requirement - Rainfed condition (ha.m)	3,724
	Soil Resources: Status of Available Nitrogen (%)	
16	Very Low	6
17	Low	20
18	Medium	2
	Status of Organic Carbon (%)	
19	Very Low	5
20	Low	10
21	Medium	4
22	High	7
23	Very High	3
	Status of Soil Micro Nutrients (%)	
24	Sufficient	20
25	Deficient	8
	Status of Physical condition of the soil (%)	
26	Acidic Sulphate	5.3
27	Highly Acidic	12.7
28	Moderately Acidic	32.1
29	Slightly Acidic	7.5

30	Moderately Alkaline	39
	Soil Texture (%)	
31	% of Fine Soil	23
32	% of Coarse loamy	1
33	Soil Water Permeability (Low, Moderate, high)	Moderate
	Soil moisture and ET	
34	Volumetric Soil Moisture (%)	5
35	Estimated Soil Moisture (ha.m)	2,820
36	ET Losses (ha.m)	6,074
	Means of Water Extraction (%)	
37	Gravity	40.7
38	Lifting	59.3
	Irrigation Methods (%)	
39	Wild Flooding	74.5
40	Control Flooding	21.9
	Livestock (No.)	
41	Cattle Population	6,027
42	Sheep Population	16,281
43	Goat Population	15,482
44	Poultry	20,304

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 23,137 ha, the highest of 32.42 % land is Unirrigated land, followed by 28.3 % Non-agricultural uses, while less than five percent of land is cultivable wasteland, fallow land other than current fallows and barren and uncultivable land (Figure 3.22).

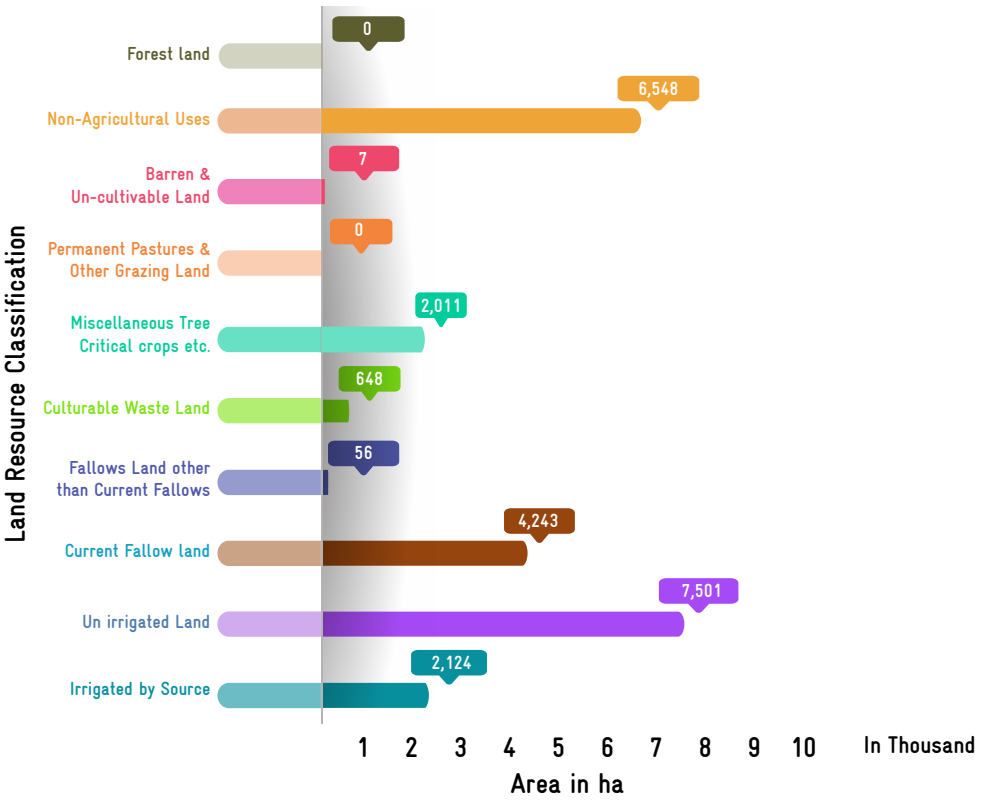


Figure 3.22. Land utilization

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 total catchment area of 23,137.16 ha, of the Block, the highest of 60.18 % is from bad catchment area followed by 28.33 % from good catchment area and remaining is from 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). It is noticed that the good and average catchment area are with similar extension, with effective and better plans of treatment measures, there is a high possibility of converting the average catchment area to good catchment area.

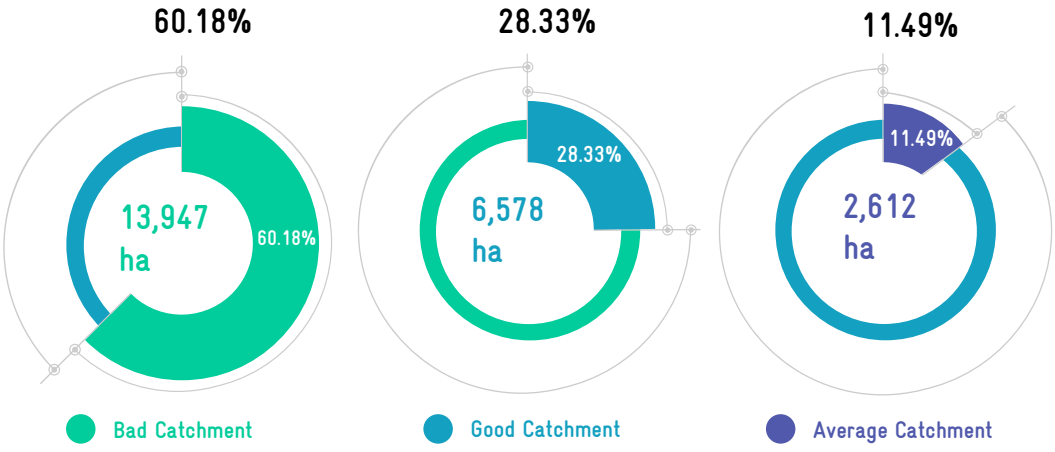


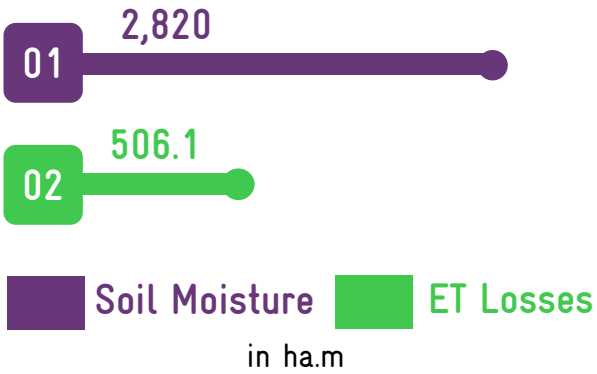
Figure 3.23. Catchment area

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 2,820 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 6,074 ha.m during 2018-19, with a monthly average of 506.1 ha.m.



3.6.2.5 Macro-nutrients
Nitrogen

The macro soil nutrients such as nitrogen and organic carbon falls under very low to medium category in all the soil samples tested. The available nitrogen is very low in 6 % of the samples tested while it was 20 % under low category and remaining is medium Nitrogen (Figure 3.24). According to soil resource map, this Block is identified as one of the nitrogen deficient Blocks (Ramanathapuram District profile 2020).

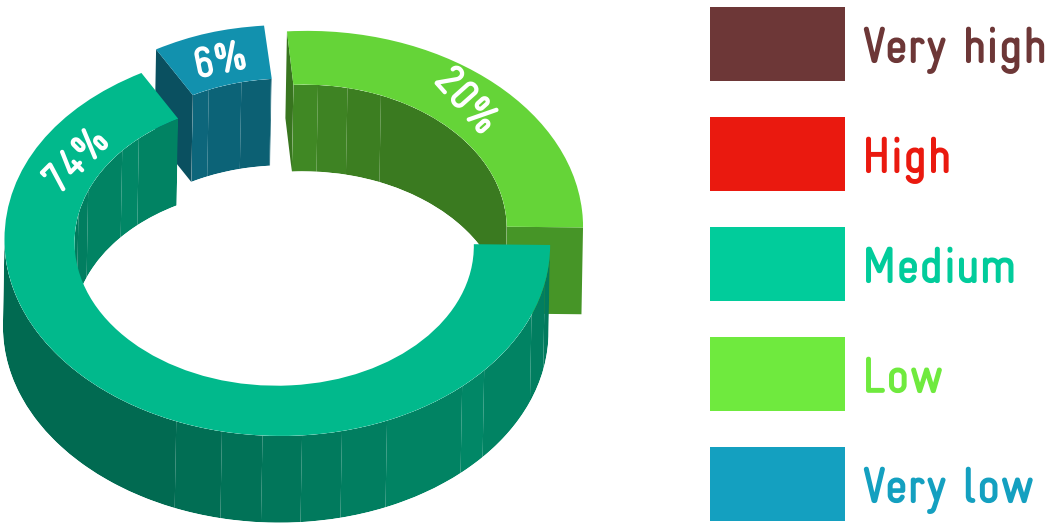


Figure 3.24. Status of available Nitrogen

Organic Carbon

Soil organic carbon ranges between very low and very high in the tested soil samples. Nearly 10 % of the soil samples tested fall under low category followed by 7 % which falls under high category while 5 % falls under very low organic carbon (Figure 3.25). This indicates that the soil fertility is moderately poor.

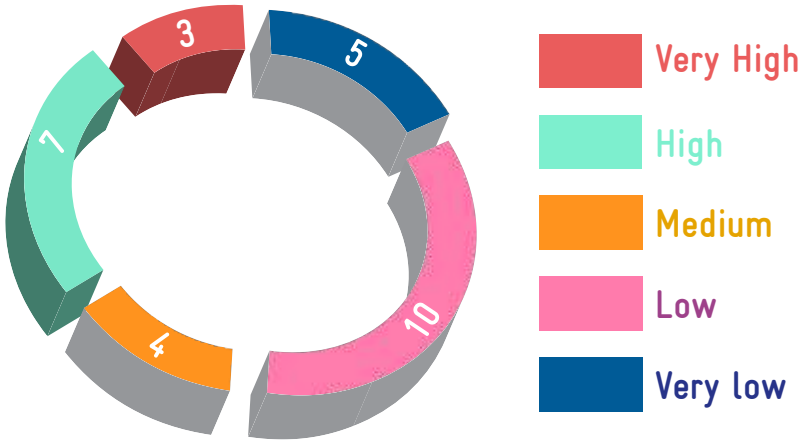


Figure 3.25. Status of soil Organic Carbon

3.6.2.6 Status of the soil micro-nutrients

This Block is one of the Nitrogen, zinc and ferrous deficient Blocks of Ramanathapuram District. The micro-nutrient status of the soil with specific reference to Manganese, Boron and Zinc, Ferrous, Copper, and Sulphate are deficient in 28 % and 72 % sufficient in the soils tested (Figure 3.26).

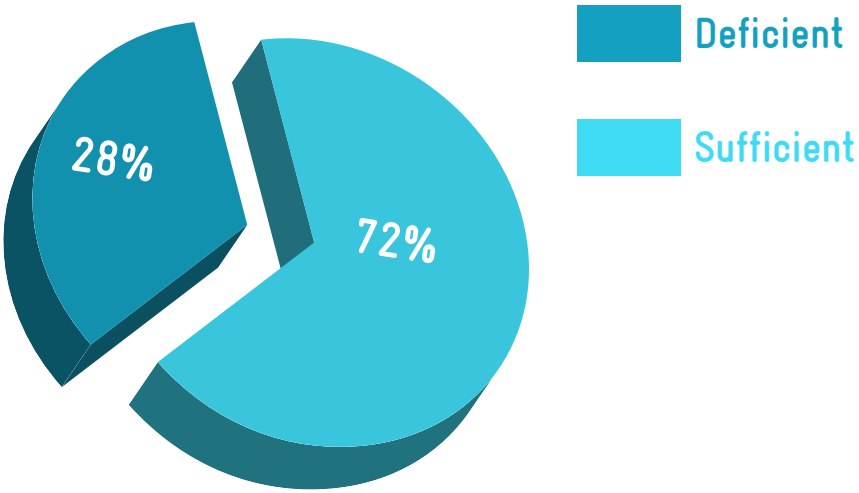


Figure 3.26. Status of soil micro-nutrients

3.6.2.7 Physical parameters – pH status

With reference to the physical parameters, 39 % of the soil is moderately alkaline in nature followed by 32.1 % which is moderately acidic and rest is slightly acidic (Figure 3.27).

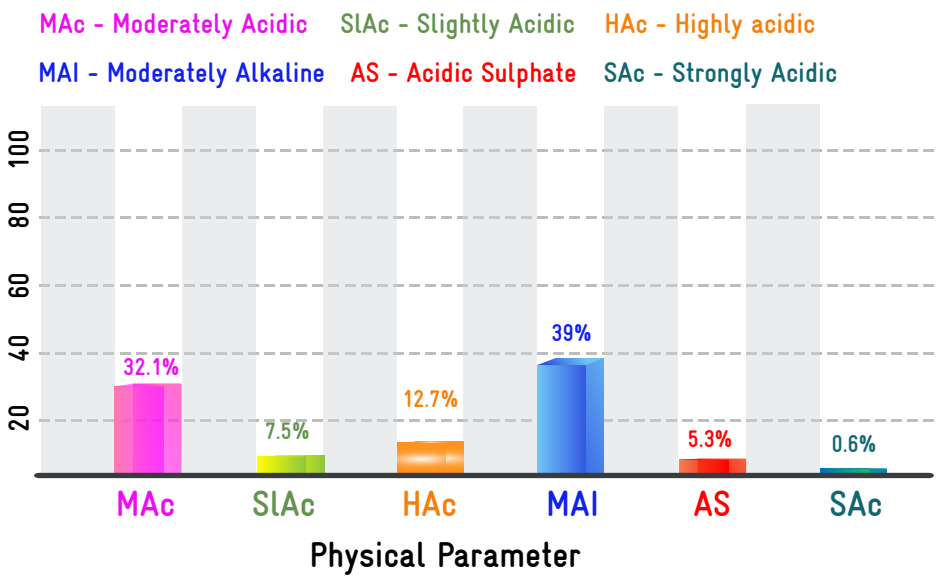


Figure 3.27. Status of pH of soil

3.6.2.8 Cropping pattern and the irrigation

A total of 4,758.5 ha area is used for crop cultivation in which 52.12 % area is rain fed cultivation and the rest is the irrigation based cultivation. Coconut is a major crop with about 2,062.5 ha (43.34 %) followed by paddy. Sugar cane, red gram, ragi, dry chilli, brinjal, water melon, ladies finger, gourds, flower crops, banana, guava, medicinal plants, lemon, mango, tomato are cultivated in less than one percent of the area.

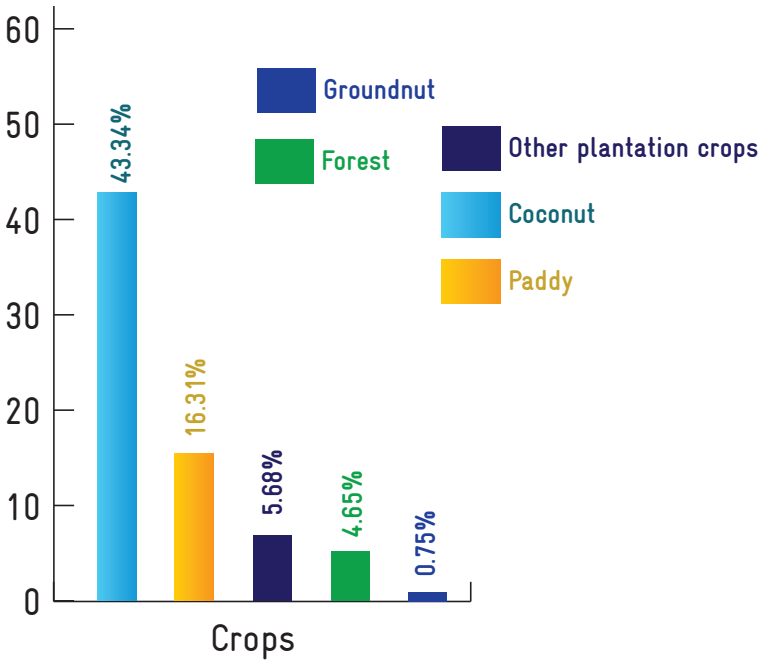


Figure 3.28. Crop pattern (including rain-fed and irrigation area)

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, 74.5 % of the irrigation is done by wild flooding and rest of irrigation is done by control flooding (Figure 3.29).

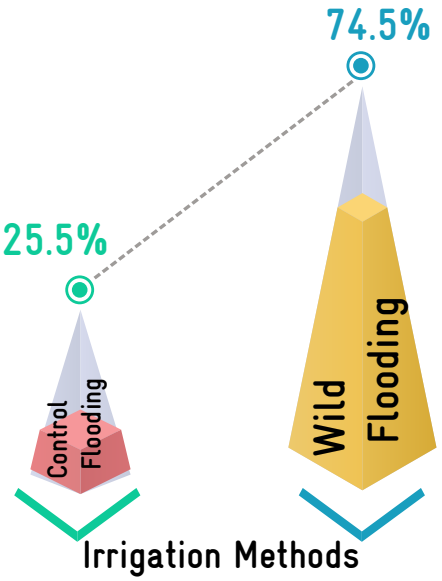


Figure 3.29. Irrigation methods

3.6.2.10 Means of water extraction

Water is extracted in two ways, one by gravity and another 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, 40.7 % of the water extraction is through gravity and rest comes under lifting means of water extraction (Figure 3.30).

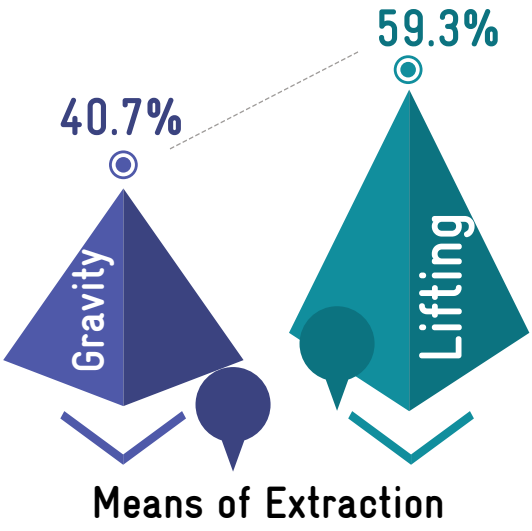


Figure 3.30. Means of water extraction

3.6.2.11 Livestock details

This Block has considerable proportion of livestock resources of about 58,094. Of which poultry population is high 35 % (20,304) followed by small ruminant's sheep of 28 % (16,281), while cattle population is about 10 % (6,027) (Figure 3.31). The total water requirement for livestock is 35.6 ha.m. Of the total water demand 64.1 % is met through ground water and remaining is from surface water resources.

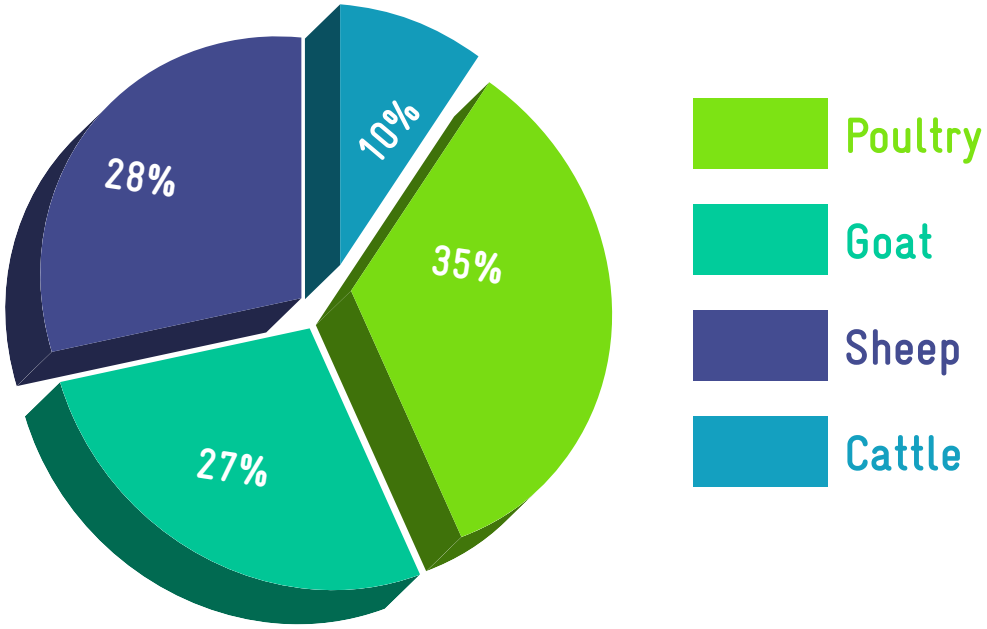


Figure 3.31. Livestock details

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 Mandapam Block. GP wise demographic and socio economic status is attached in Annexure 3.11.

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

Sl.No.	Parameter	Total
1	Geographical Area (ha)	23,858
2	Male Population (No.)	1,19,073
3	Female Population (No.)	1,17,735
4	Total Population (No.)	2,36,808
5	SC Population (No.)	7,350
6	ST Population (No.)	405
7	Vulnerable Population (No.)	7,755
8	Households (HH's) (No.)	52,635
9	Only one room HH's (SECC) (No.)	8,437
10	Female Headed HH's (SECC) (No.)	2,426
11	Vulnerable Households (SECC) (No.)	6,635.6
12	% of Vulnerable Households (%)	13.1

13	Registered MGNREGA Job cards (Persons)	21,351
14	Active person working in MGNREGA job Cards (Persons)	15,316
15	Drinking Water Sources (No.)	9,260
16	HH's have tap water connection for drinking water (No.)	38,824
17	HH's dependent on other sources for drinking water (No.)	14,150
18	Annual Greywater Generation (ha.m)	325.2

3.7.1 Population:

The total population of this Block is 2.36 Lakhs* in which the female proportion is slightly lower than male 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 22 % of the total population are under vulnerable population of SC (Figure 3.32).

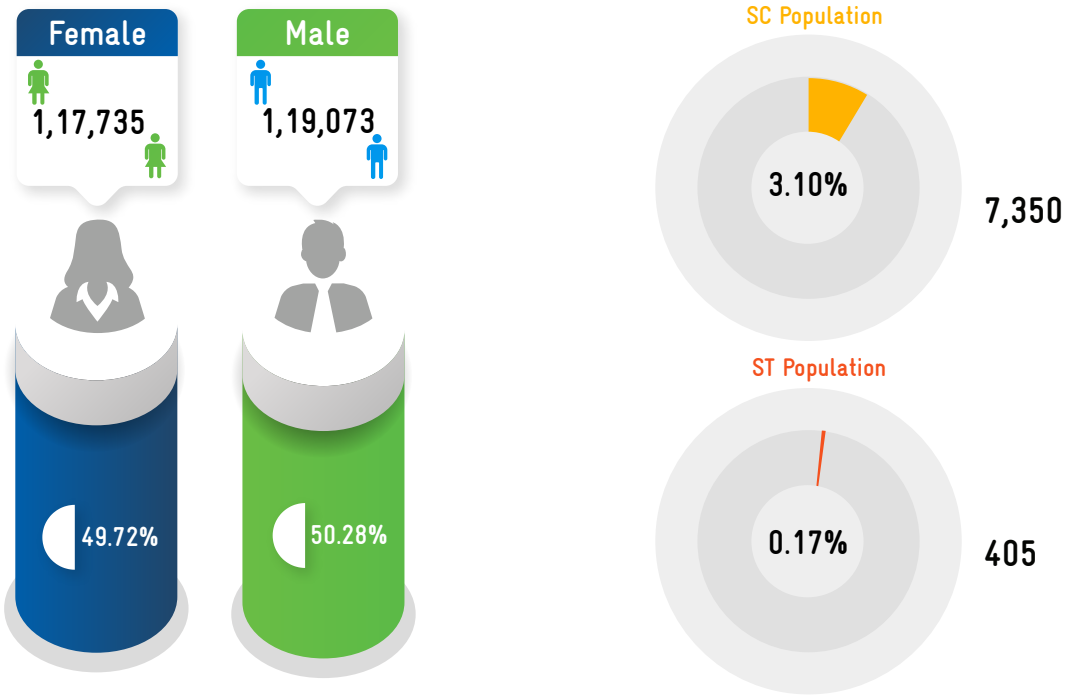


Figure 3.32. Population details

**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 52,635 households in which 16 % households have only one room, 5 % households are headed by women and 13 % are vulnerable households (Figure 3.33).

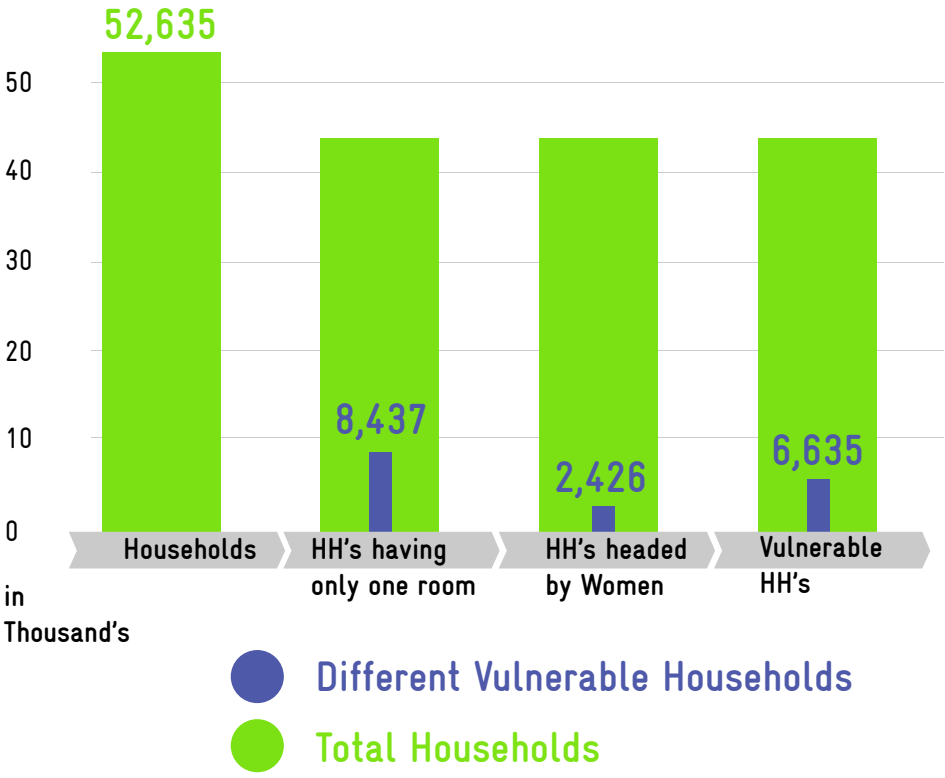


Figure 3.33. Details of households

3.7.3 Status of Mahatma Gandhi NREGA - job card status

In the Block, of the total population of 2.36 Lakhs, 21,351 are registered for job cards in Mahatma Gandhi NREGA scheme in which 72 % of the job cards are in active category (Figure 3.34).

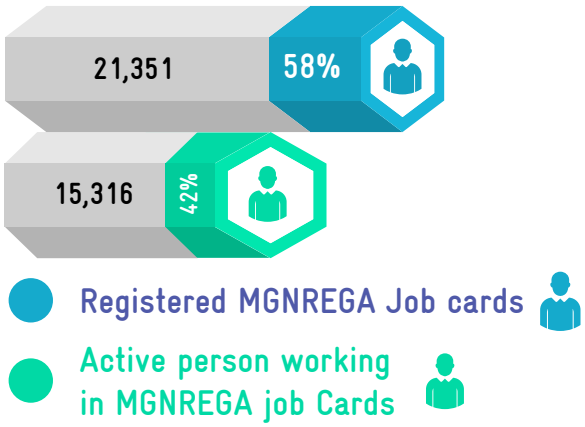


Figure 3.34. Status of MGNREGA job cards

3.7.4 Drinking Water Sources

Nearly 38,824 households have tap water connection and 14,150 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

38,824
Households

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

14,150
Households

3.7.5 Annual Greywater Generation

The grey water generation estimated across this Block is 325.2 ha.m which is available for reuse or recycle.

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

Morphology

Pattinamkathah, Sattakkonvalasai, Terbhogi

Wasteland

Alagankulam, Terbhogi, Nochiyurani

Soil erosion

Tamaraikulam, Keelanagachi, Pudumadam

Physicochemical parameters

Kadaloor, Odaikaal, Solandur, Pullamadai

Upland/Slope

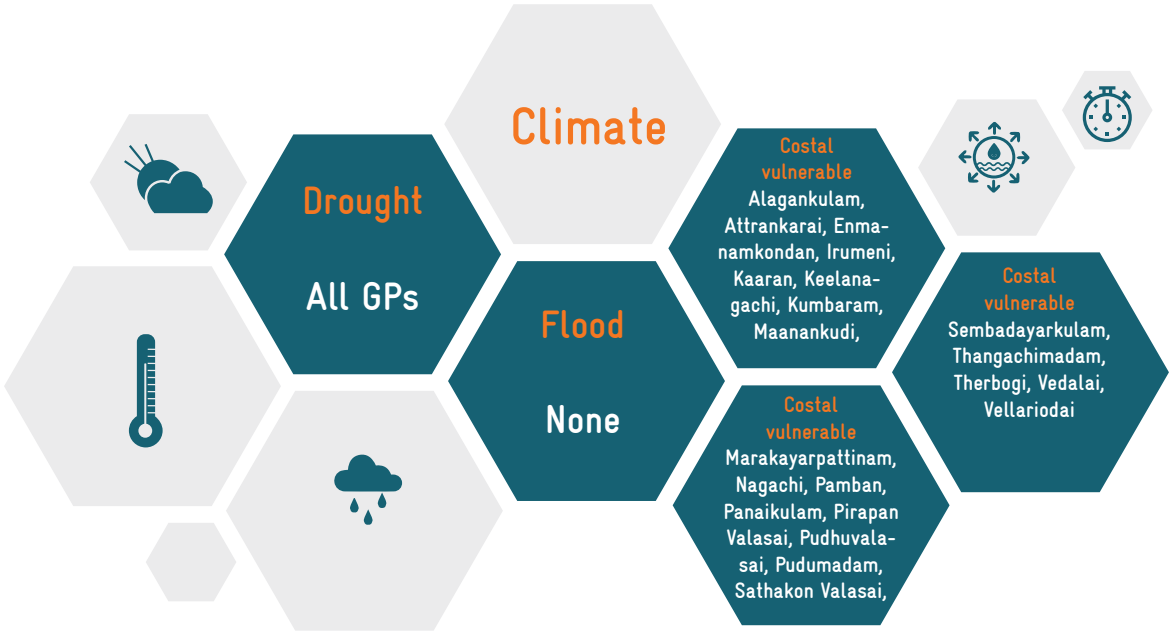
Nochiyurani, Manankudi, Pudumadam

Ground water prosperity

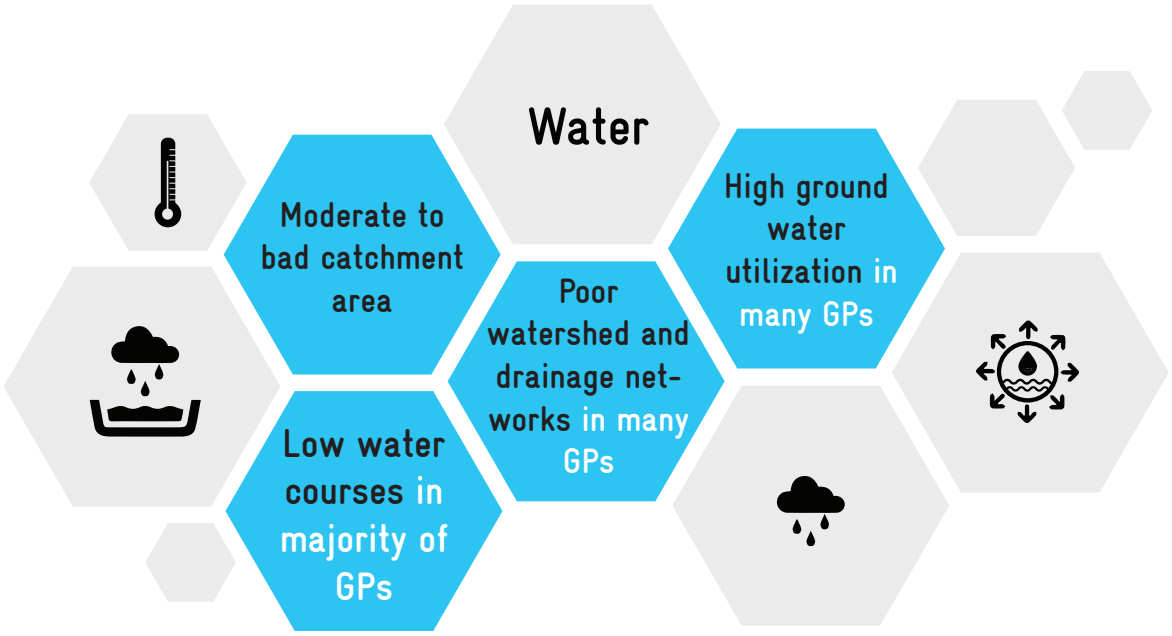
Pattinamkathah, Sattakkonvalasai, Terbhogi

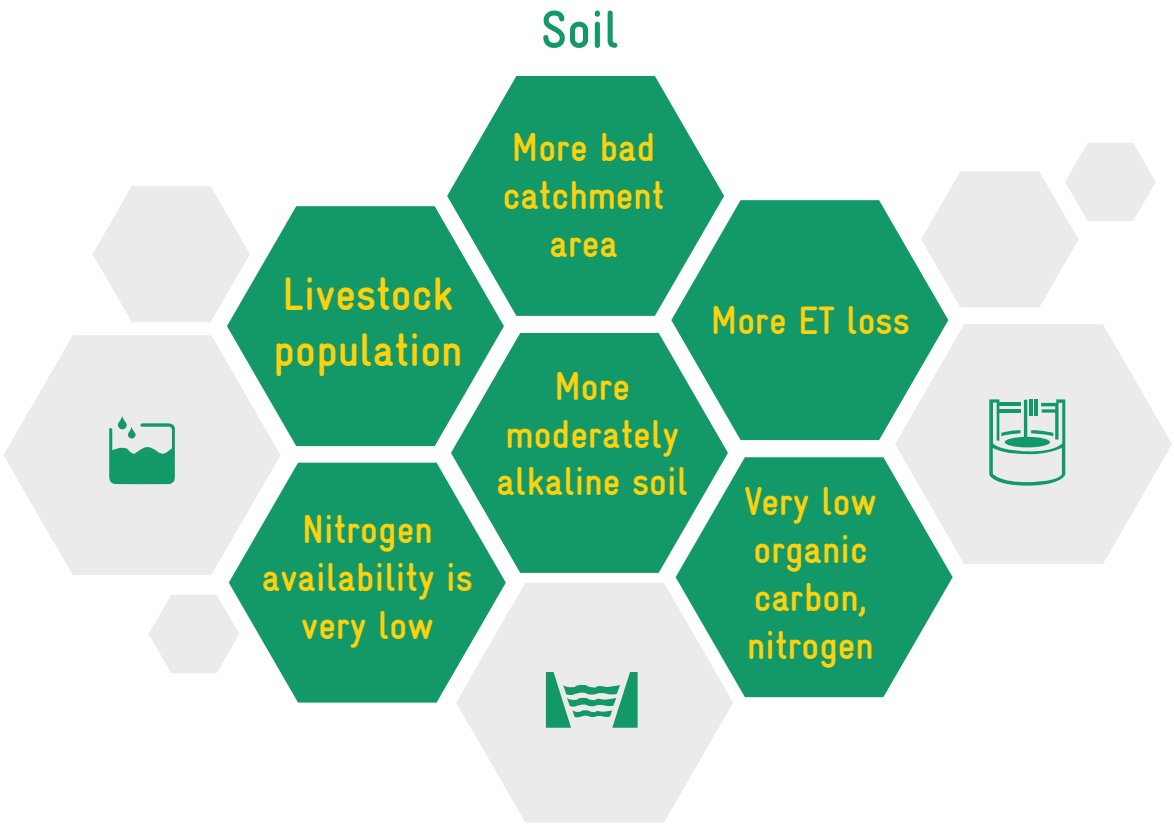
Salt affected area

Valantharavai, Vedalai, Thangachimadam, Pamban



Socio economic


Water
Moderate to bad catchment area
Poor watershed and drainage net-works in many GPs
High ground water utilization in many GPs
Low water courses in majority of GPs


Soil
More bad catchment area
Livestock population
More ET loss
More moderately alkaline soil
Nitrogen availability is very low
Very low organic carbon, nitrogen

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).

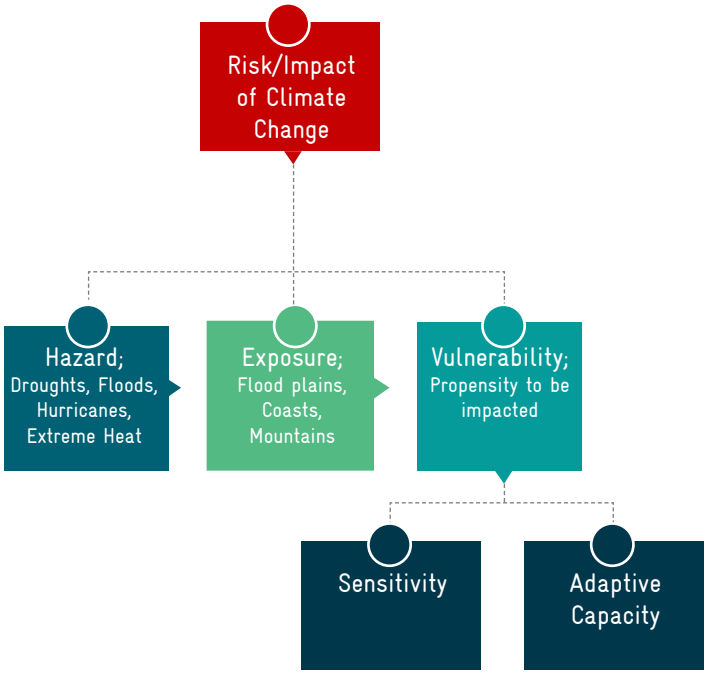


Figure 4.1. Vulnerability of the system as defined by IPCC

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 Socio-demographic (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.

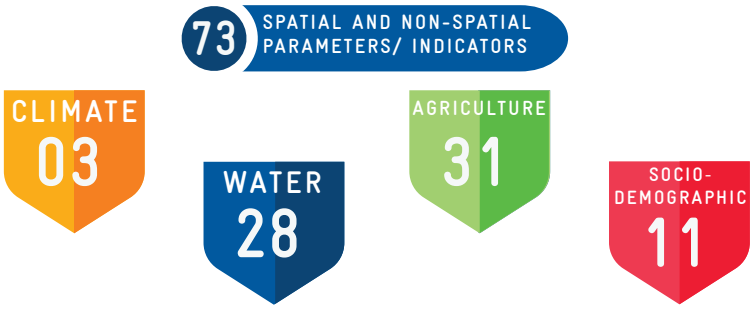


TABLE 9. CWRM PARAMETERS/INDICATORS SELECTED FOR BLOCK LEVEL VULNERABILITY

	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, and 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. Pattinamkathan GP has very high rural water security vulnerability to climate risks followed by Koravalli, Enmanamkondan, Marakayarpattinam, GPs with high vulnerability. Rettaiyurani, Puduvalasai, Sambadaiyarkulam. Keelanagachi, Vadalai, Terbhogi, and Manakudi GPs have very low vulnerability.

Upto	Category	Color range
0.548	Very High	
0.521	High	
0.495	Medium	
0.469	Low	
0.442	Very low	

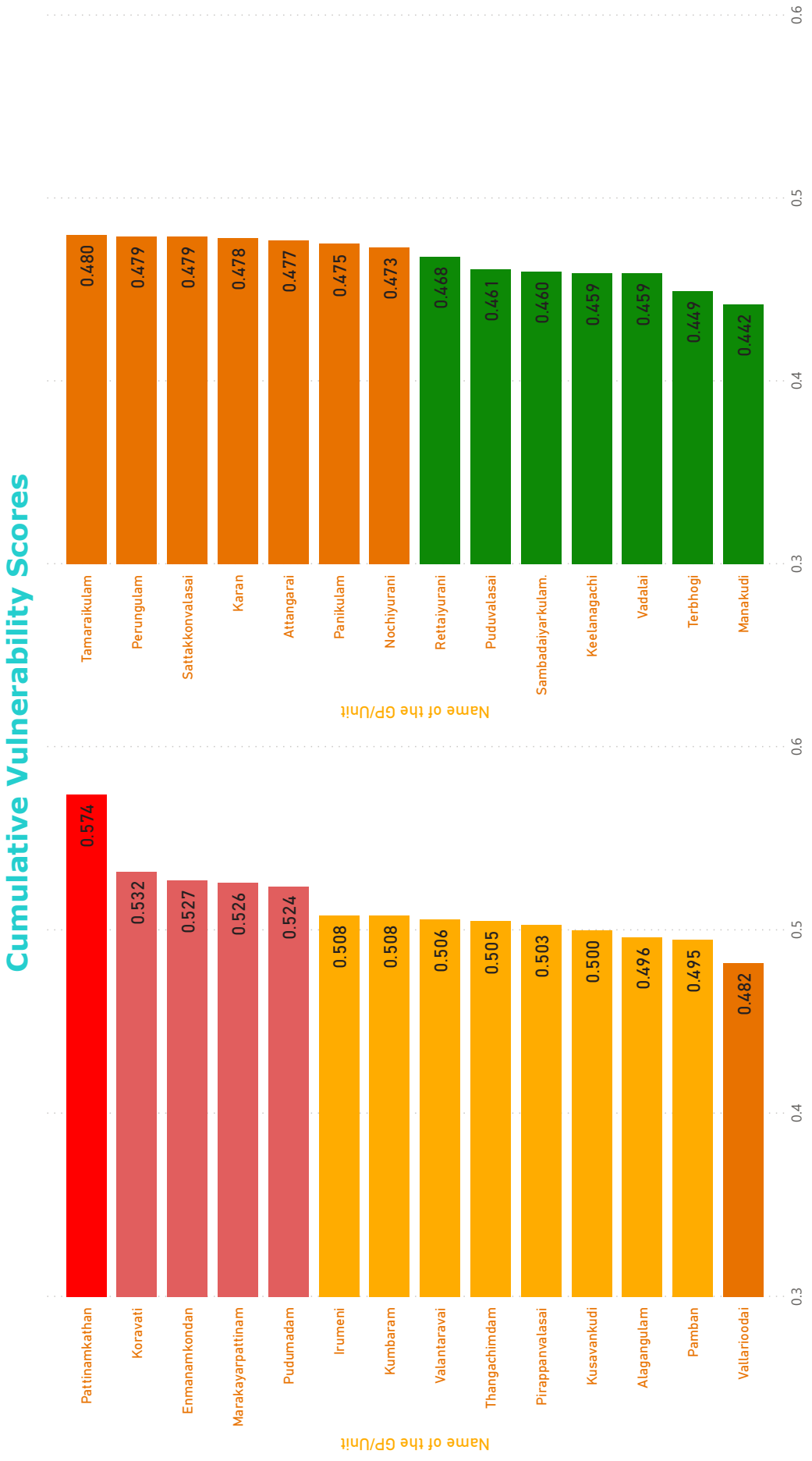


Figure 4.2. Final cumulative vulnerability scores

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 the last decades.

ALL GPs

Coastal vulnerability hot spots

GPs Alagankulam, Attrankarai, Enmanamkondan, Irumeni, Kaaran, Keelanagachi, Kumbaram, Maananku di, Marakayarpattinam, Nagachi, Pamban, Panaikulam, Pirapan Valasai, Pudhuvalasai, Pudumadam, Sathakon Valasai, Sembadayarkulam, Thangachimadam, Therbogi, Vedalai and Vellariodai are hot spots for costal vulnerability.

ALAGANKULAM, ATTRANKARAI, ENMANAMKONDAN, IRUMENI, KAARAN, KEELANAGACHI, KUMBARAM, MAANANKUDI, MARAKAYARPATTINAM, NAGACHI, PAMBAN, PANAIKULAM, PIRAPAN VALASAI, PUDHUVALASAI, PUDUMADAM, SATHAKON VALASAI, SEMBADAYARKULAM, THANGACHIMADAM, THERBOGI, VEDALAI, VELLARIODAI

Water resource vulnerability

The water resources vulnerability index shows that Marakayarpattinam, Pattinamkathan, Thangachimadam GPs have high vulnerability.

MARAKAYARPATTINAM, PATTINAMKATHAN, THANGACHIMADAM

Agriculture resources vulnerability

In agriculture and allied sectors, Pattinamkathan, Pudumadam, Enmanamkondan, Koravalli, Kumbaram GPs have high vulnerability

PATTINAMKATHAN, PUDUMADAM, ENMANAMKONDAN, KORAVALLI, KUMBARAM

Socio-economic vulnerability

Valantaravai, Alagangulam, Koravalli, Panikulam GPs have high socio economic vulnerability

VALANTARAVAI, ALAGANGULAM, KORAVALLI, PANIKULAM

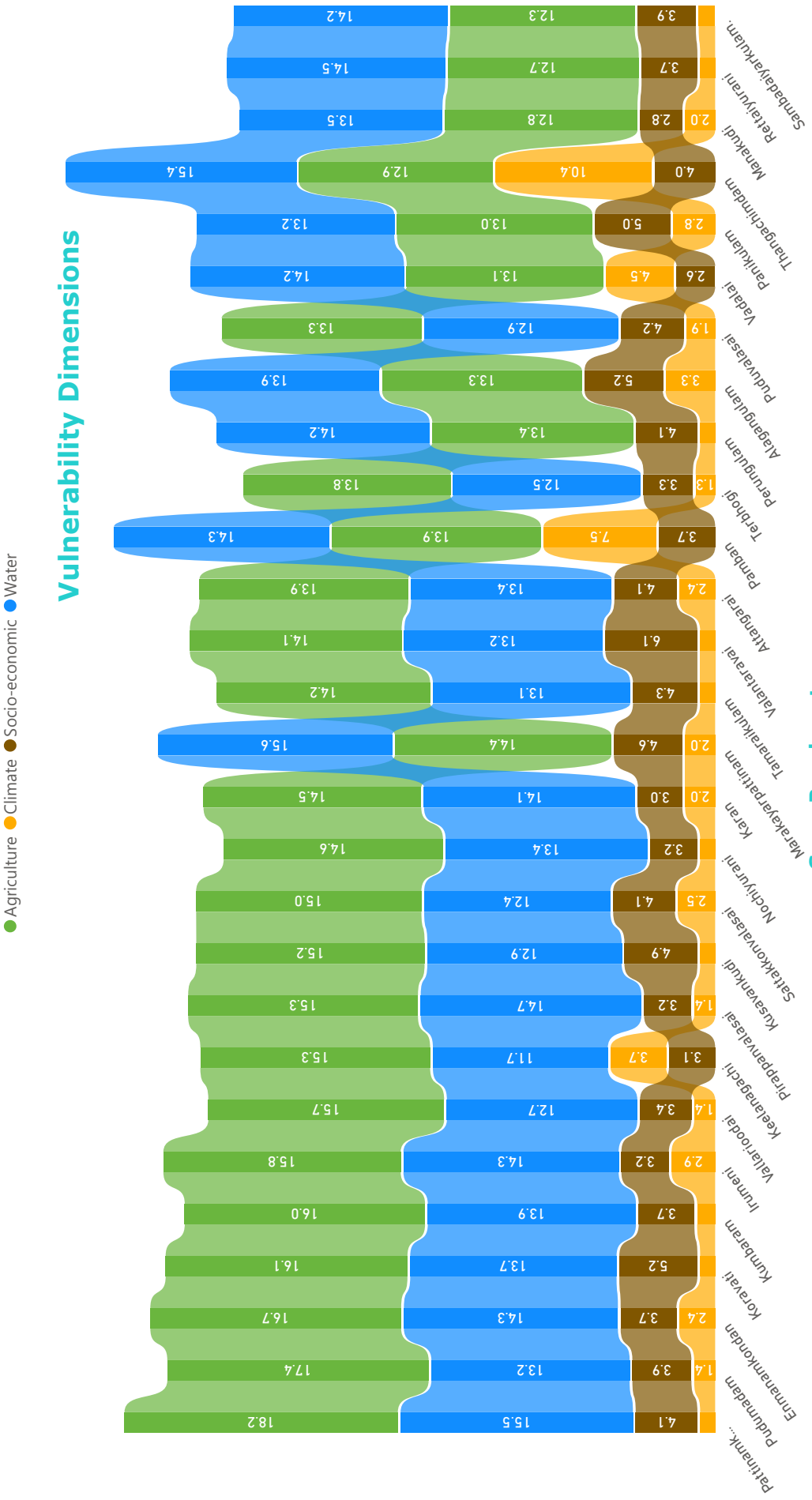
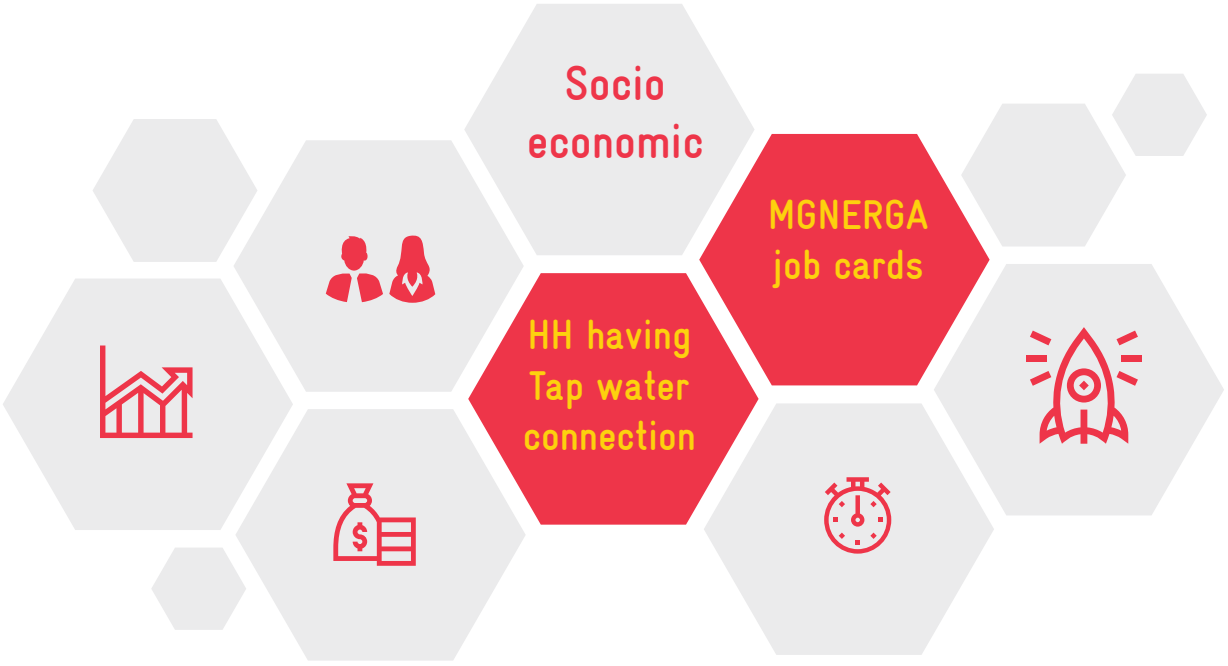
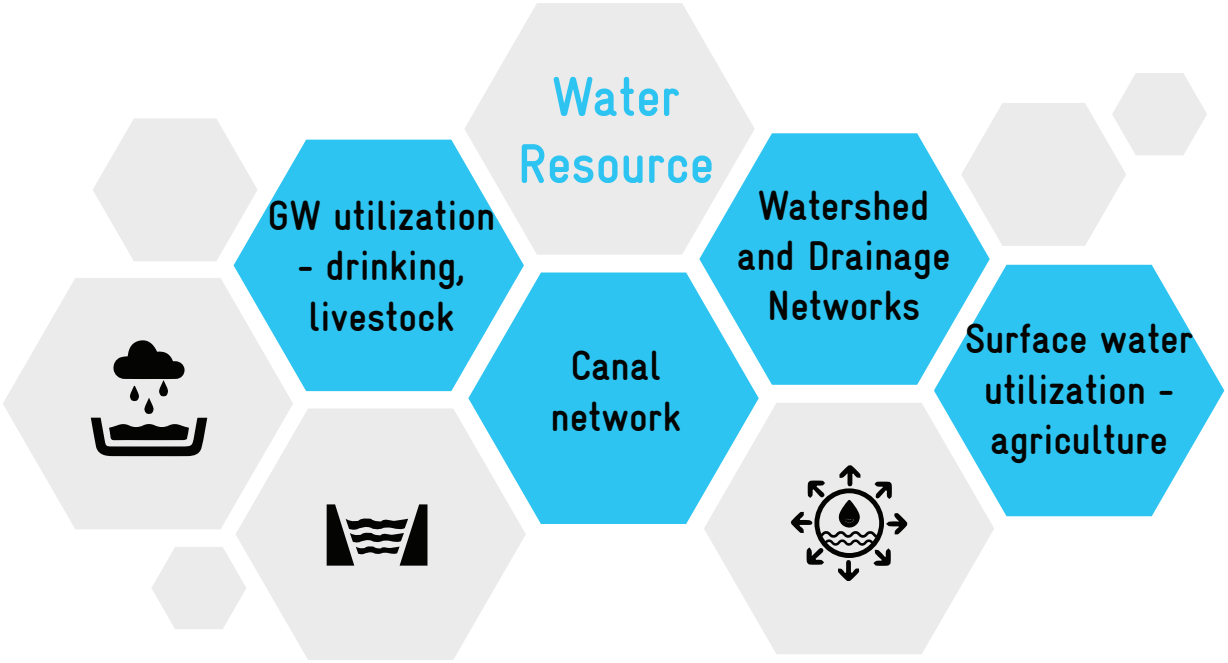
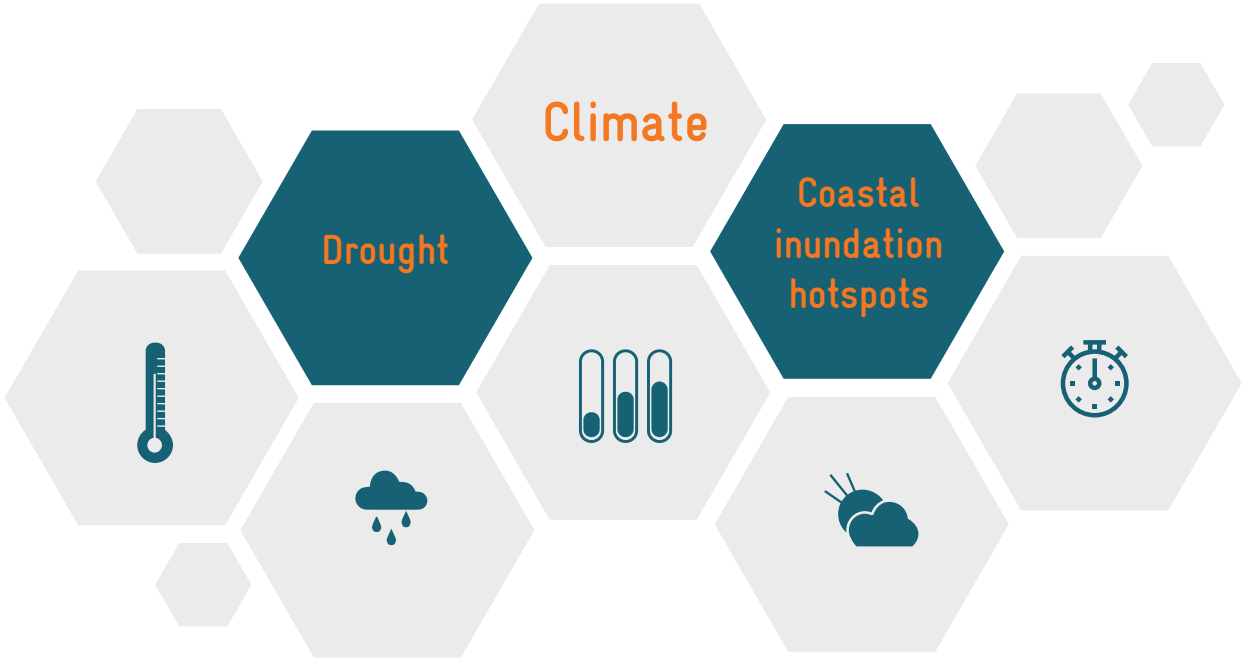


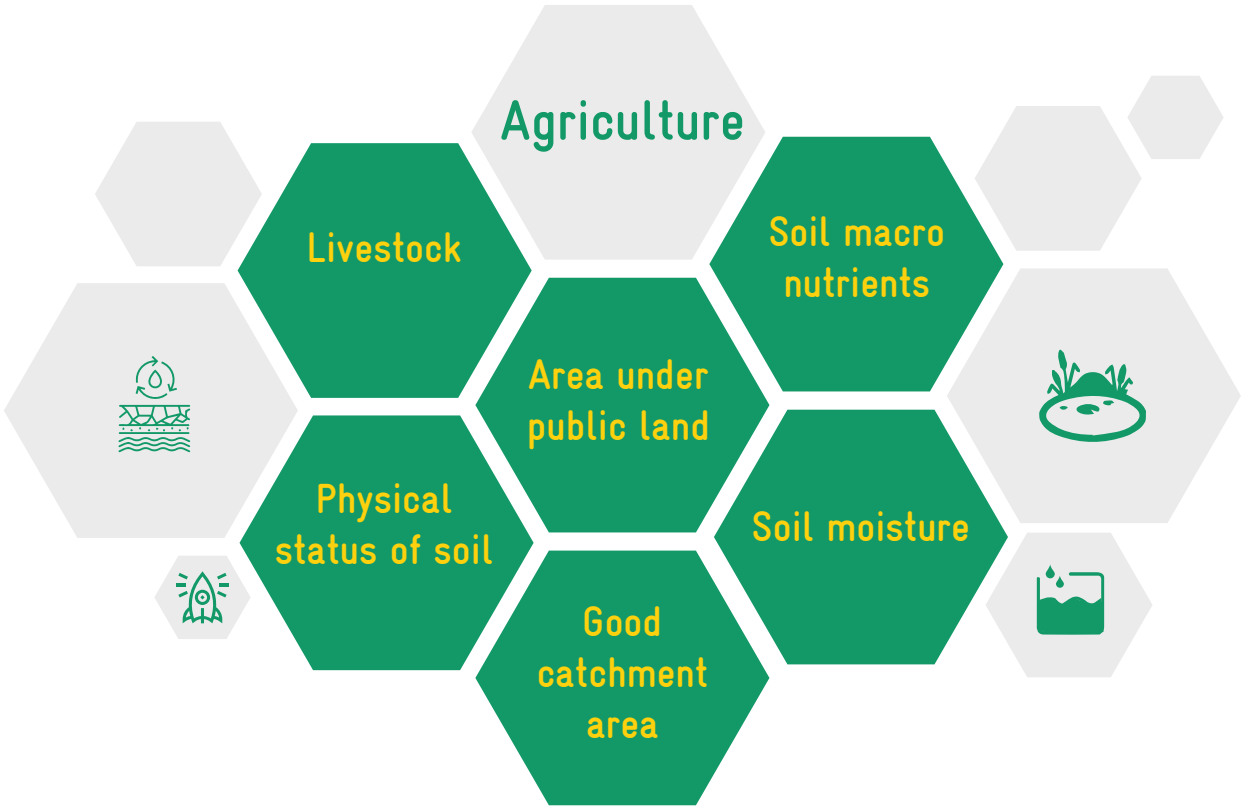
Figure 4.3. GP wise vulnerability dimensions

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).

5.1 THE PROPOSED AREA UNDER WASCA TREATMENT

Out of 23,137 ha available land in Mandapam Block, 5,106.2 ha (31 %) area is proposed for treatment under WASCA TN– CWRM planning. A major portion of Key Water Actions is proposed in 1,709.8 ha of land under miscellaneous tree crops (33.48 % of total area), followed by 1,276.2 ha of unirrigated land (24.99 % of total area) while least of 0.04 % area of fallow land other than current fallow 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)
Land Under Miscellaneous Tree Crops etc.	2,011.5	1,709.8
Unirrigated Land	7,500.9	1,276.2
Non-Agricultural Uses	6,548.1	692.7
Cultivable Waste Land	646.7	549.7
Current Fallow land	4,244.2	447.6
Irrigated by Source	2,123	422.9
Fallows Land other than Current Fallows	56.4	1.9

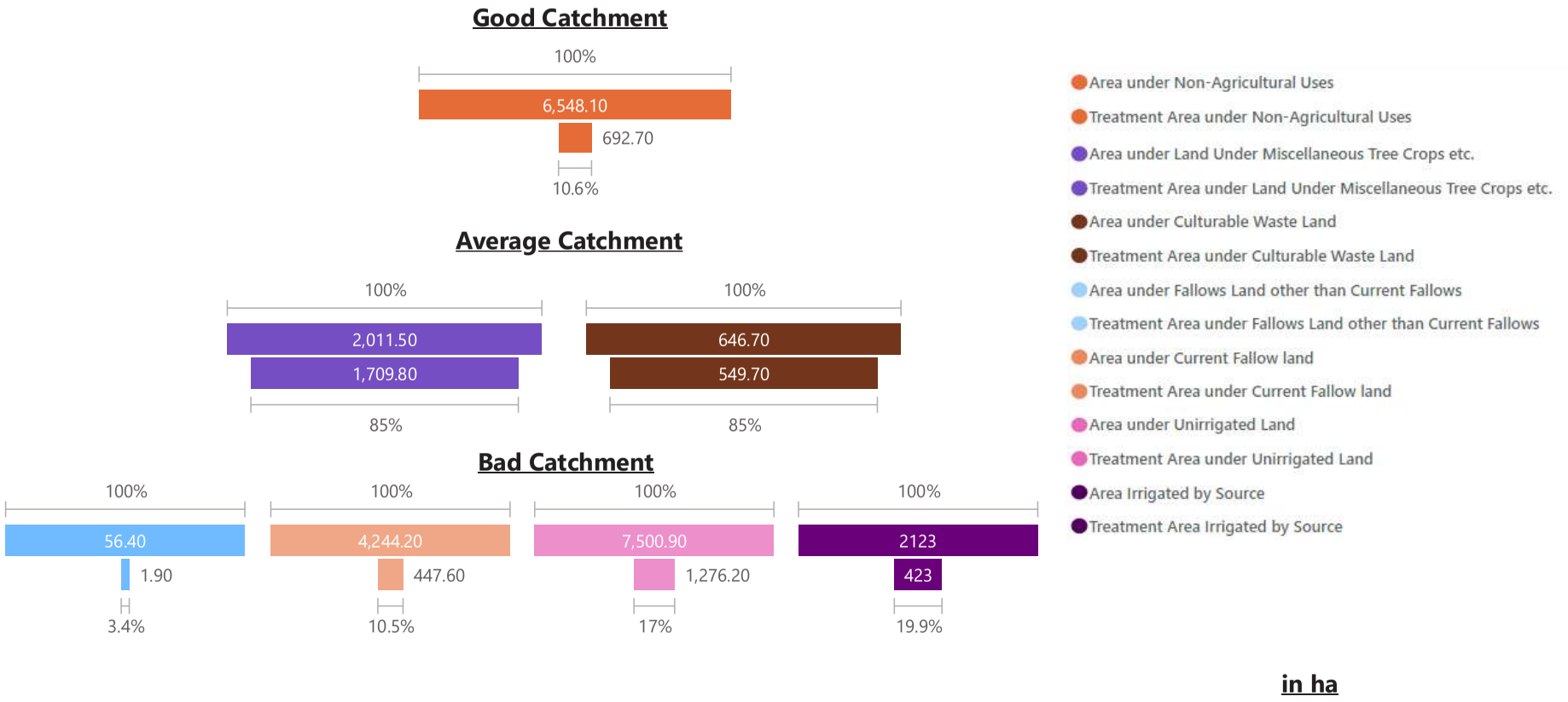


Figure 5.1. WASCA treatment area in percentage

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 1,087 ha.m which is 31.17 % of the total runoff. Of the expected runoff conservation, the highest of 35.5 % average catchment area was considered for treatment followed by 34.1 % of good and rest from bad catchment (Figure 5.2).

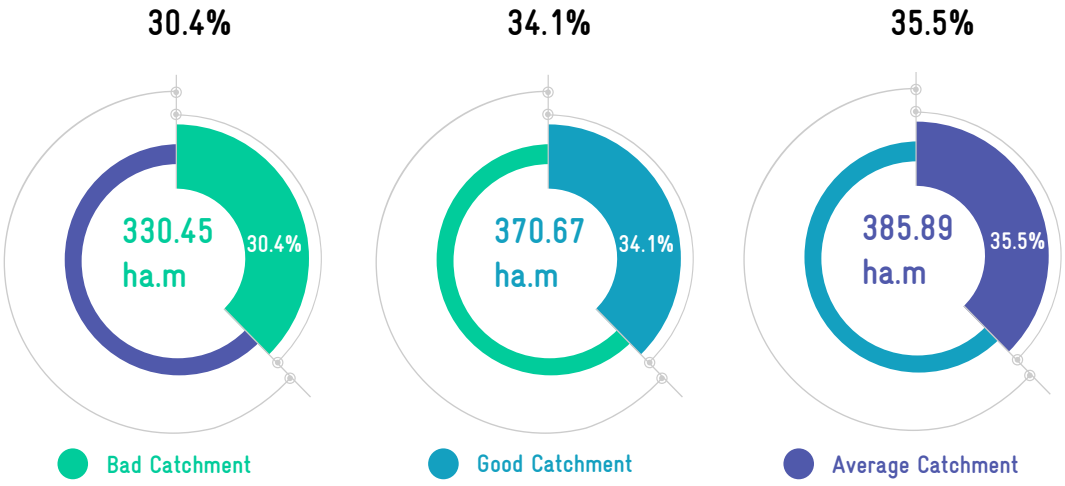


Figure 5.2. Expected conservation after WASCA treatment

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 approach. GP wise works are annexed in annexed in Annexure 5.3.

Work (unit)	Abbreviation (unit)	No.	Extent (area in ha or length in m)
Azolla units - Individual (Number of units)	Az	151	1,486
Cattle Shelters (Number of units)	CS	151	1,486
Cattle Trough(Number of units)	CT	151	1,486
Fodder development - Community & Individual	FD	151	1,486
Goat Sheep Shelters (Number of units)	GSS	1,968	19,360
Poultry Shed (Number of units)	PS	508	5,077
Silvi-pasture Development (ha)	SPD	-	-
Soak Pits (Community) (Number of units)	SPC	1,118	1,11,725
Soak Pits (Individual) (Number of units)	SPI	11,173	1,11,725
Artificial Recharge Structure(Number of units)	ARS	214	536

Construction of Farm Ponds - Individual (Number of units)	FP	690	2,149
Restoration of water bodies:PWD and UnionTanks(Number)	RPWDT	12	
Restoration of water bodies: Ooranis(Number)	Roo	371	
Restoration of water bodies:Ponds(Number)	RP	-	
Roof Rain Water Harvesting (Number of units)	RRWH	56	
Water Course - Irrigation Channels - Desilting (Mtrs)	WCICD	578	
Afforestation in Public/common lands(ha)	Aff	5,58,430	698
Avenue plantation(km)	AVP	35,247	1,40,984
Block Plantation (Community)(ha)	BP	18,07,592	2,260
Canal Bund Plantation(ha)	CBP	583	2,334
Contour Continuous Bunds (CCB) for Afforestation area(Mtrs)	CCBF	1,39,608	698
Drainage Line Treatment (Mtrs)	DLT	9,889	39,558
Dry land Horticulture/Agro-forestry - Individual (ha)	DLHAI	430	1,074
Irrigation Channel Plantation (Mtrs)	ICP	145	578
Linear Plantation(km)	LP	11,681	46,725
Micro Irrigation(ha)	MI	167	423
Nursery Development (Number of units)	ND	5,58,625	1,11,725
Composting(Number of units)	Co	690	2,149
Farm Bunding with Boundary Trenches - Individual (ha)	FBBTI	860	2,149
Land development - Individual (ha)	LDI	345	863
NADEP Vermi compost (Number of units)	NADEP	151	1,486


Proposed works are included the drought proofing, livelihood, land development and WCWH, measures
Land development works over 6,646 ha area
More than 31.21 Lakhs plants planting
1,900 sites for WCWH
15,000 livelihood works

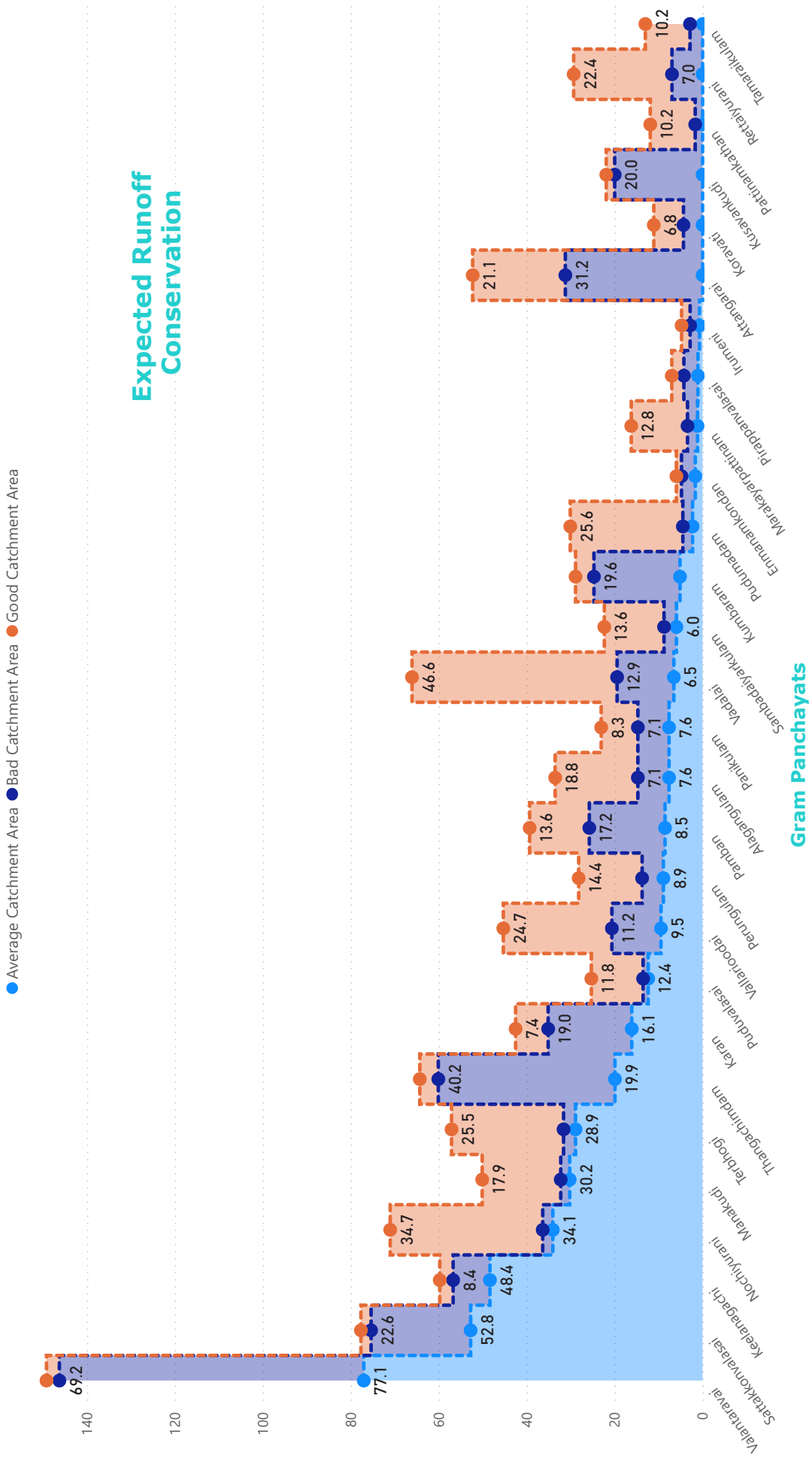


Figure 5.3. Expected GP wise runoff conservation after WASCA treatment

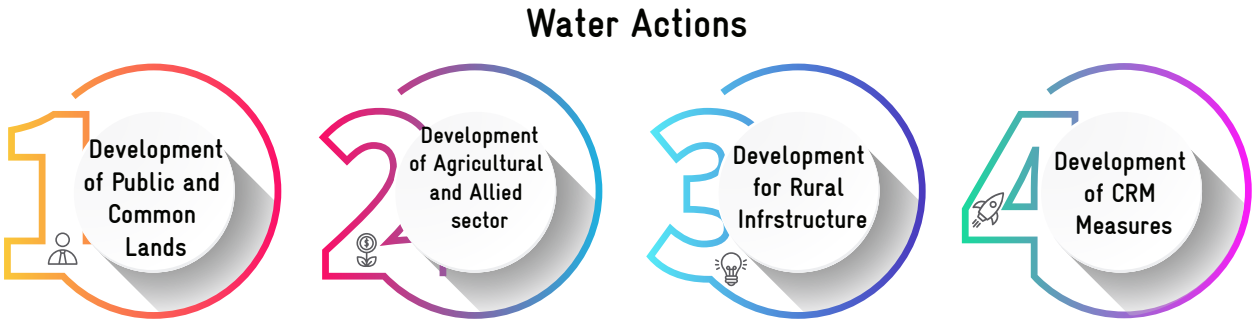
MAHATMA GANDHI NREGS Annual circular 2020-21 (Clause 6.3)

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



5.2 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)	2,792	10	0.025	63.80	27,922
COMPOSTING (NUMBER OF UNITS)	690	15	0.17	117.30	10,350
AFFORESTATION IN PUBLIC/ COMMON LANDS (ha)	698	3,344	8.6	6,002.80	23,34,112
BLOCK PLANTATION (COMMUNITY) (ha)	2,260	4,320	11.1	25,086	97,63,200
SILVI-PASTURE DEVELOPMENT (ha)	-	6,664	17.1	-	-
LINEAR PLANTATION (km)	47	703	1.8	84.11	32,848
CANAL BUND PLANTATION (ha)	35	2,930	7.5	260.18	1,01,642
IRRIGATION CHANNEL PLANTATION (m)	1,650	6	0.015	24.75	9,900
AVENUE PLANTATION(km)	141	703	1.8	253.77	99,112
NURSERY DEVELOPMENT (NUMBER OF UNITS)	2,793	2,344	15	41,896.88	65,47,085
RESTOTARATION OF WATER BODIES: PWD AND UNION TANKS (NUMBER)	13	800	5	65	10,400
RESTORATION OF WATER BODIES: OORANIS (NUMBER)	353	200	2	706	70,600
RESTORATION OF WATER BODIES: PONDS (NUMBER)	1	200	1	1	200
ARTIFICIAL RECHARGE STRUCTURE (NUMBER OF UNITS)	637	391	2.5	1,592.50	2,49,067
WATER COURSE - IRRIGATION CHANNELS - DESILTING (M)	1,650	3	0.0075	12.38	4,950
DRAINAGE LINE TREATMENT (m)	989	5	0.03	29.67	4,945

COASTAL WATERSHED WORKS					
NURSERY DEVELOPMENT - COASTAL PLANTATION (NUMBER OF UNITS)	1	7,813	20	15.43	6027
MANGROVE PLANTATIONS (ha)	-	6,250	16	-	-
RIVERSIDE PLANTATION (ha)	4	703	1.8	7.05	2052
COASTLINE SHELTER BELT PLANTATION (ha)	-	2,930	7.5	-	-
BUND PLANTATION WET LANDS (km)	10,853	2,930	0.1875	2,034.90	3,17,98,704
WETLAND PLANTATION (INNER) (ha)	-	2,930	7.5	0.16	63
COASTAL WETLAND - BUND STRENGTHENING (km)	11,060	977	0.0625	691.23	1,08,05,229
WETLAND INLET IMPROVEMENT WORKS (NUMBER OF UNITS)	23	3,906	10	230	89,838
CHECK DAM FOR CONTROLLING SEA WATER INTRUSION (NUMBER OF UNITS)	12	234	1.5	18	2,808
CONSTRUCTION OF FISH DRYING YARD (NUMBER OF UNITS)	32	331	2.12	67.84	10,592
AGRO FORESTRY IN INDIVIDUAL LANDS (ha)	434	2,930	7.5	3,255	12,71,620

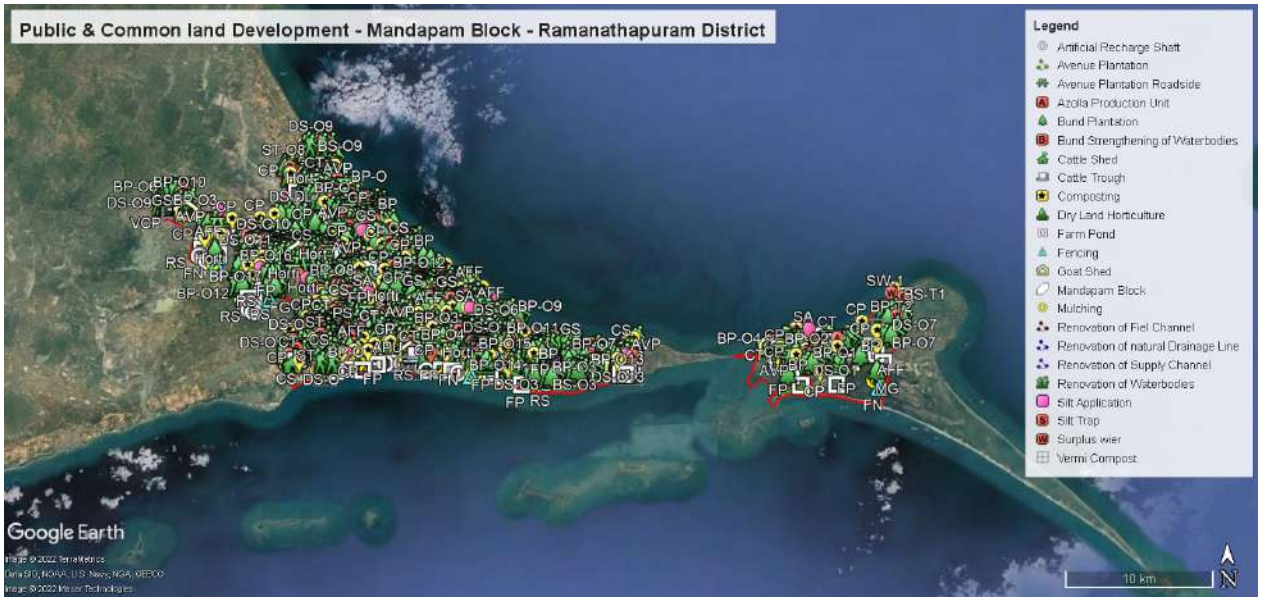


Figure 5.4. Proposed development activities in Public and Common land

5.3 DEVELOPMENT OF AGRICULTURE AND ALLIED SECTOR

Based on the assessment, the works which enhance the agriculture and allied sectors particularly for irrigation, soil and live stocks 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)	2,149	586	1.5	3,223.50	12,59,314
MICRO IRRIGATION (ha)	167	-	1	167	-
CONSTRUCTION OF FARM PONDS - INDIVIDUAL (NUMBER OF UNITS)	690	781	2	1,380	5,38,890
LAND DEVELOPMENT - INDIVIDUAL (ha)	863	3,906	10	8,630	33,70,878
DRY LAND HORTICULTURE/AGRO-FORESTRY - INDIVIDUAL (ha)	1,074	3,321	8.5	9,129	35,66,754
AZOLLA UNITS - INDIVIDUAL (NUMBER OF UNITS)	151	23	0.15	22.65	3,473
NADEP VERMI-COMPOST (NUMBER OF UNITS)	151	27	0.18	27.18	4,077
FODDER DEVELOPMENT - COMMUNITY & INDIVIDUAL	151	2,344	1.48	223.48	3,53,944
CATTLE SHELTERS (NUMBER OF UNITS)	151	331	2.12	320.12	49,981
GOAT SHEEP SHELTERS (NUMBER OF UNITS)	1,968	355	2.27	4,467.36	6,98,640
CATTLE TROUGH (NUMBER OF UNITS)	151	6	0.05	7.55	906
POULTRY SHED (NUMBER OF UNITS)	508	10	0.09	45.72	5,080

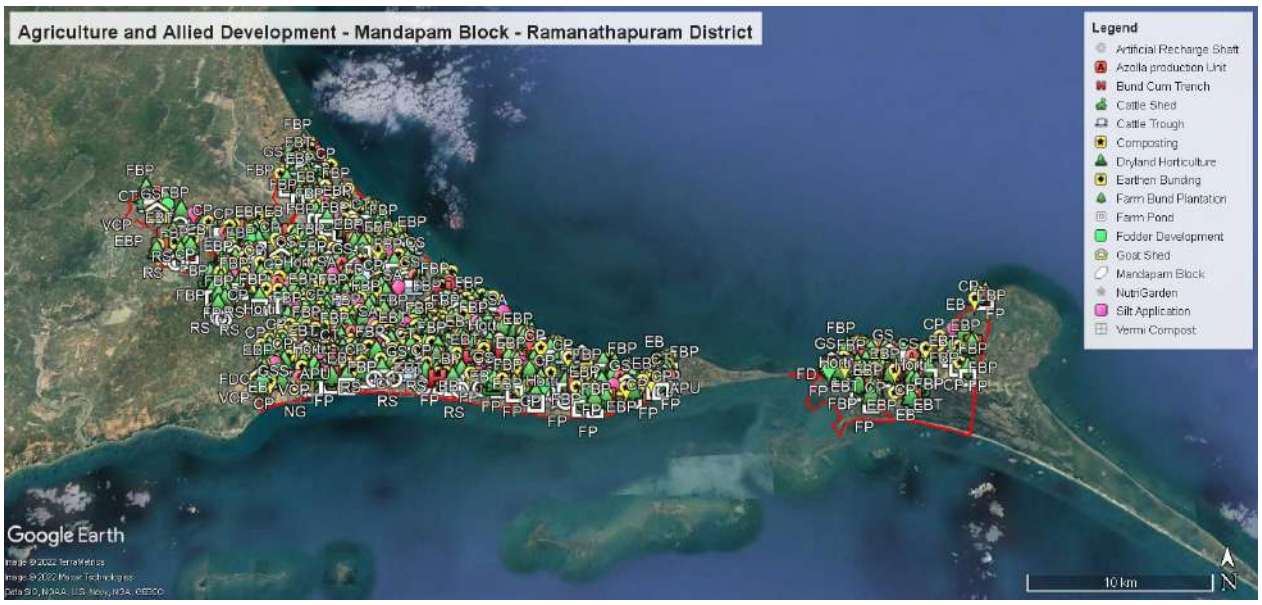


Figure 5.5. Proposed development activities in Agriculture and allied Sectors

5.4 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)	1,118	20	0.13	145.34	22,360
SOAK PITS (INDIVIDUAL) (NUMBER OF UNITS)	11,173	16	0.1	1,117.30	1,78,768
ROOF RAIN WATER HARVESTING (NUMBER OF UNITS)	56	625	4	224	35,000
TANKA - COMMUNITY LEVEL (NUMBER OF UNITS)	-	300	30	-	-

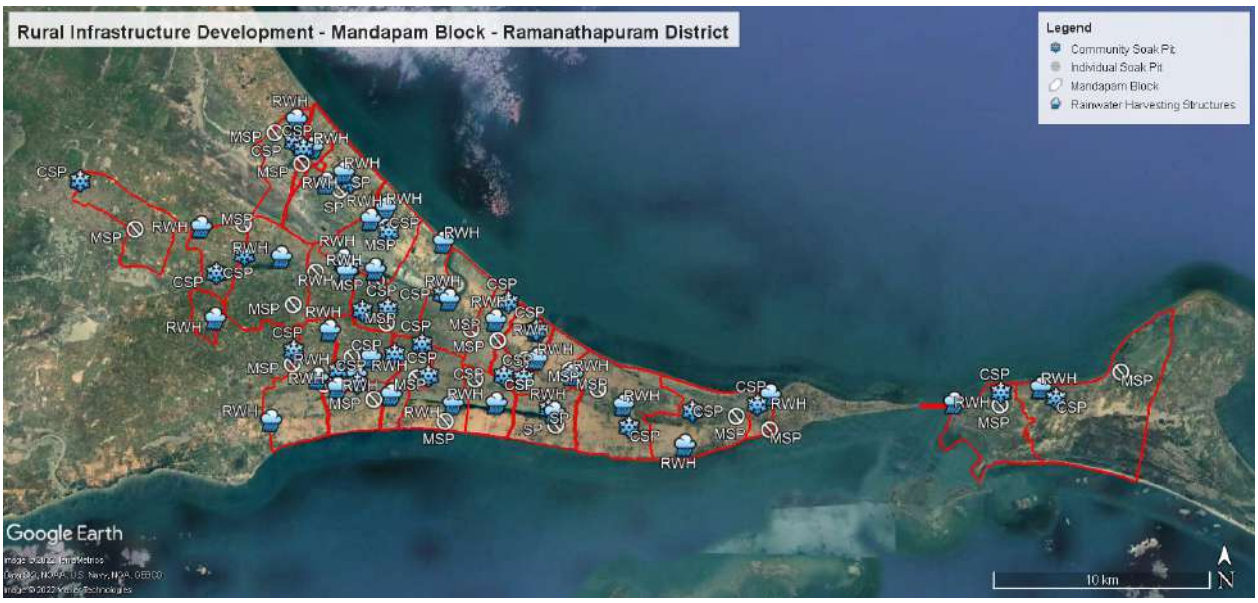


Figure 5.6. Proposed Rural Infrastructure activities

5.5 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), Bamboo plantation (Table 16), horticulture park (Table 17), mega forest plantation (Table 18), Block level nursery (Table 19), GP level nursery (Table 20), mini forestry (Table 21), tanka (Table 22) and fallow land development (Table 23) were proposed in this Block in saturation mode. Among the activities Village level nursery works are more in number (28) followed by tanka (14) while Bamboo plantation, Block level nursery, fallow land development and Horticulture park are less as one.

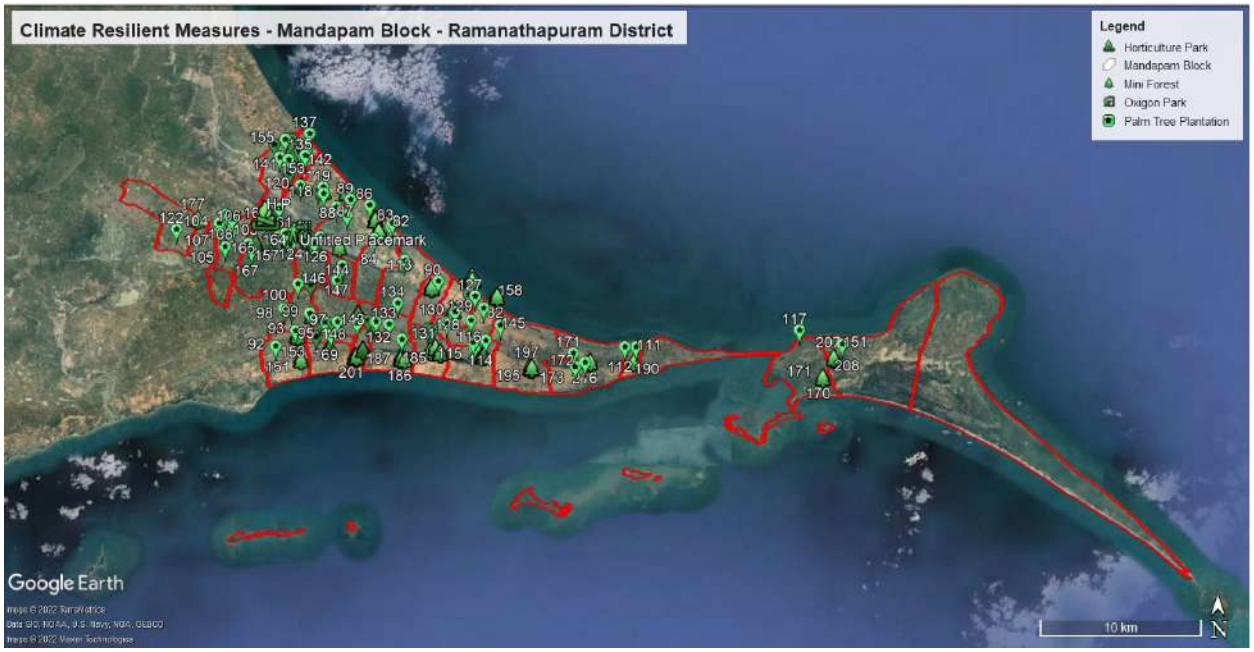


Figure 5.7. Proposed climate resilient measures

TABLE 14. GP WISE PROPOSED CRM

GP	Agriculture and allied activities	Public and common land	Rural infrastructure
Alagankulam	Fallow land development	GP Level Nursery	
	Mega Forest		
	Mini Forest		
Attrangarai	Mega Forest	GP Level Nursery	
Enmanankondan		GP Level Nursery	
Irumeni		GP Level Nursery	
Karan	Mega Forest	GP Level Nursery	Tanka
Keelanagachi	Mega Forest	GP Level Nursery	
Koravalli		GP Level Nursery	Tanka
Kumbaram		GP Level Nursery	Tanka
Kusavankudi		GP Level Nursery	
Kuyavankudi			Tanka
Manangudi	Mega Forest	GP Level Nursery	
Mandapam		Farm pond	
Maraikayarpattinam		GP Level Nursery	
Maraikkarpattinam			Tanka
Nagachi		Block Level Nursery	
Nochiyurani		GP Level Nursery	Tanka
Pamban		GP Level Nursery	
Panaikulam		GP Level Nursery	
Pattinamkathan		GP Level Nursery	Tanka
Perungulam		GP Level Nursery	Tanka
Pirappanvalasai		GP Level Nursery	Tanka
Pudhumadam	Mega Forest		
Pudumadam		GP Level Nursery	
Puduvalasai		GP Level Nursery	
Rettaiyurani		GP Level Nursery	Tanka
Sathakonvalasai	Mega Forest	GP Level Nursery	
Sattakkonvalasai			Tanka
Sembadaiyarkulam		GP Level Nursery	
Thamaraikulam	Mega Forest	GP Level Nursery	
Thangachimadam		GP Level Nursery	
Therbogi		GP Level Nursery	
Valantaravai			Tanka
Valantharavai	Mega Forest	Bamboo Plantation	
		Horticulture Park	
		GP Level Nursery	
Vedalai		GP Level Nursery	Tanka
Vellariodai		GP Level Nursery	Tanka

TABLE 15. DETAILS OF PROPOSED FARM PONDS ACTIVITY UNDER CRM

Community Farm Ponds Completed	Individual Farm Ponds Completed	Individual Farm Ponds Ongoing	Total Number of Plants
77	3	3	5,000

TABLE 16. DETAILS OF PROPOSED BAMBOO PLANTATION ACTIVITIES UNDER CRM

GP	Area of Plantation (in ha)	Total No. of Plants	Classification of Land
Valantharavai	4.856	4,000	**Fallow Land**

TABLE 17. DETAILS OF PROPOSED HORTICULTURE PARK ACTIVITIES UNDER CRM

GP	Area in ha	No. of Plants (1 ha – 10,000 saplings)	Land type
Valantharavai	2.00	500	**Govt. Purampok-ku land**

TABLE 18. DETAILS OF PROPOSED MEGA FOREST ACTIVITY UNDER CRM

GP	Area in ha	No. of Plants (1 ha – 10,000 saplings)	Land type
Attrangarai	0.5 ha in each GP	5,000 in each GP	**Govt. Purampok-ku land**
Alagankulam			
Manangudi			
Keelanagachi			
Pudhumadam			
Sathakonvalasai			
Thamaraikulam			
Valantharavai			
Karan			
Manangudi			
Total	**5.0**	**50,000**	

TABLE 19. DETAILS OF PROPOSED BLOCK LEVEL NURSERY ACTIVITY UNDER CRM

GP	Area of Plantation (in ha)	Total No. of Plants	Classification of Land
Nagachi	1.5	5,000	**Govt. Purampok-ku land**

TABLE 20. DETAILS OF PROPOSED GP LEVEL NURSERY ACTIVITY UNDER CRM

Sl. No.	GP	Total No. of Plants
1	Alagankulam	1,000 plants in each GP
2	Attrangarai	
3	Enmanankondan	
4	Irumeni	
5	Karan	
6	Keelanagachi	
7	Koravalli	
8	Kumbaram	
9	Kusavankudi	
10	Manangudi	
11	Maraikayarpattinam	
12	Nochiyurani	
13	Pamban	
14	Panaikulam	
15	Pattinamkathan	
16	Perungulam	
17	Pirappanvalasai	
18	Pudumadam	
19	Puduvalasai	
20	Rettaiyurani	
21	Sathakonvalasai	
22	Sembadaiyarkulam	
23	Thamaraikulam	
24	Thangachimadam	
25	Therbogi	
26	Valantharavai	
27	Vedalai	
28	Vellariodai	

TABLE 21. DETAILS OF PROPOSED MINI FOREST ACTIVITY UNDER CRM

GP	Area in ha	No. of Plants (1 ha – 10,000 saplings)	Land type
Alagankulam	0.5	5,000	Govt Purampok-ku land
Attrangarai	0.15	1,500	
Enmanangkondan	0.1	1,000	
Irumeni	0.15	1,500	
Karan	0.25	2,500	
Keelanagachi	0.05	500	
Koravalli	0.05	500	
Kumbaram	0.05	500	

Kuyavankudi	0.25	2,500	Govt Purampok-ku land
Manangudi	0.3	3,000	
Maraikkayarpattinam	0.05	500	
Nochiyurani	0.2	2,000	
Pamban	0.1	1,000	
Panaikulam	0.15	1,500	
Pattanamkathan	0.05	500	
Perungulam	0.2	2,000	
Pirappanvalasai	0.15	1,500	
Pudhumadam	0.3	3,000	
Puduvalasai	0.1	1,000	
Rettaiyurani	0.1	1,000	
Sathakonvalasai	0.2	2,000	
Sembadaiyarkulam	0.15	1,500	
Thamaraikulam	0.3	3,000	
Thangachimadam	0.1	1,000	
Therbogi	0.05	500	
Valantharavai	0.1	1,000	
Vedhalai	0.15	1,500	
Vellariodai	0.1	1,000	
Total	**4.4**	**44,000**	

TABLE 22. DETAILS OF PROPOSED TANKA ACTIVITY UNDER CRM

Sl. No.	GP
1	Karan
2	Koravalli
3	Kumbaram
4	Kuyavankudi
5	Maraikkarpattinam
6	Nochiyurani
7	Pattinamkathah
8	Perungulam
9	Pirappanvalasai
10	Rettaiyurani
11	Sattakkonvalasai
12	Valantaravai
13	Vedalai
14	Vellariodai

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

GP
Alagankulam

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	5,106.2 ha (22 %) of the total area treated under WASCA
2	Percentage reduction of run off	1,087.4 ha.m i.e., 31.17 % of the total runoff harvested due to WASCA interventions
3	No. of waterbodies restored	383 waterbodies (tanks/pond and ooranis) restored
4	Area under afforestation	698 ha area under afforestation
5	Length of drainage line treated	39.5 km length of drainage line treated
6	Canal Bund Plantation	More than 6 thousands plants through 35 works
7	Nursery development	2,793 units

5,106.2 ha
AREA TREATED

1,087.4 ha.m
TOTAL RUNOFF HARVESTED

383
WATER BODIES RESTORED

698 ha
AREA AFFORESTATION

39.5 km
DRAINAGE LINE TREATED

6,000
PLANTS

2,793 UNITS
NURSERY DEVELOPMENT

COASTAL WATERSHED WORKS

	INDICATOR		OUTCOMES/ IMPACT
1	Check dam	1	12 check dams for controlling sea water intrusion
2	Fish drying yard	2	32
3	Agroforestry	3	434 ha
4	Wetland inlet improvement work	3	23

12 CHECK DAMS

434 ha AGROFORESTRY

23 WETLAND INLET WORK

32 FISH DRYING YARD

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	1	690 farm ponds established which target the harvest of 12,14,400 cu.m of water which has the potential to irrigate 241.5 ha area in both kharif and rabi seasons
2	Improvement in soil health	2	151 NADEP vermicomposting units for soil health improvement
3	Dry land development with agro-forestry	3	1,074 ha under dry land horticulture
4	Households established fodder plots	4	151 vulnerable households established fodder plots
5	Sheds for livestock's (cattle, goat, poultry)	5	2,778

690 FARM PONDS

151 COMPOST UNITS

151 FODDER PLOTS

1,074 ha DRY LAND HORTICULTURE

2,778 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	1	11,173 individual and 1,118 community level soak pits established for recycle of grey water benefiting 52,635 HHs
2	Roof rain water harvesting measures	2	56 common roof rainwater harvesting and storage structures with a target to harvest and store 0.1 ha.m of rainwater for use
3	Nutri-garden	3	52,635 HHs established nutri-gardens in homesteads and planted 2,63,175 saplings

1,118 COMMON &
11,173 INDIVIDUAL
SOAK PITS

56
COMMON ROOF
RAINWATER HARVESTING

52,635
NUTRI-GARDENS

2,63,175
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	9 models are identified via., Farm ponds, bamboo plantation, horticulture park, village level nursery, Block level nursery, fallow land development, mini forest, mega forest, and tankas 77 community and 3 individual farm ponds are completed in the GP Bamboo plantation in 4.85 ha area with 4,000 plants GP level nursery in 28 GPs with 28,000 plants in each GP Block level nursery in 1.5 ha area with 5,000 plants Horticulture park in 2 ha. Mega forest in 5 ha area with 50,000 plants Mini forest in 4.4 ha with 44,000 plants Fallow land Development in 1GP Tankas in 14 GPs

77 COMMUNITY & **3** INDIVIDUAL FARM PONDS

4.85 ha BAMBOO PLANTATION

28 GP LEVEL NURSERY

1.5 ha BLOCK LEVEL NURSERY

20 ha HORTICULTURE PARK

5 ha MEGA FOREST

4.4 ha MINI FOREST

14 TANKAS

Estimated person days

The total estimated person days required for the above proposed activities are 7,33,42,030 as specified below Figure 6.1.

Estimated Cost

The total estimated cost budgeted for the above proposed activities is Rs. 1,11,652 Lakhs as specified below in Figure 6.2.

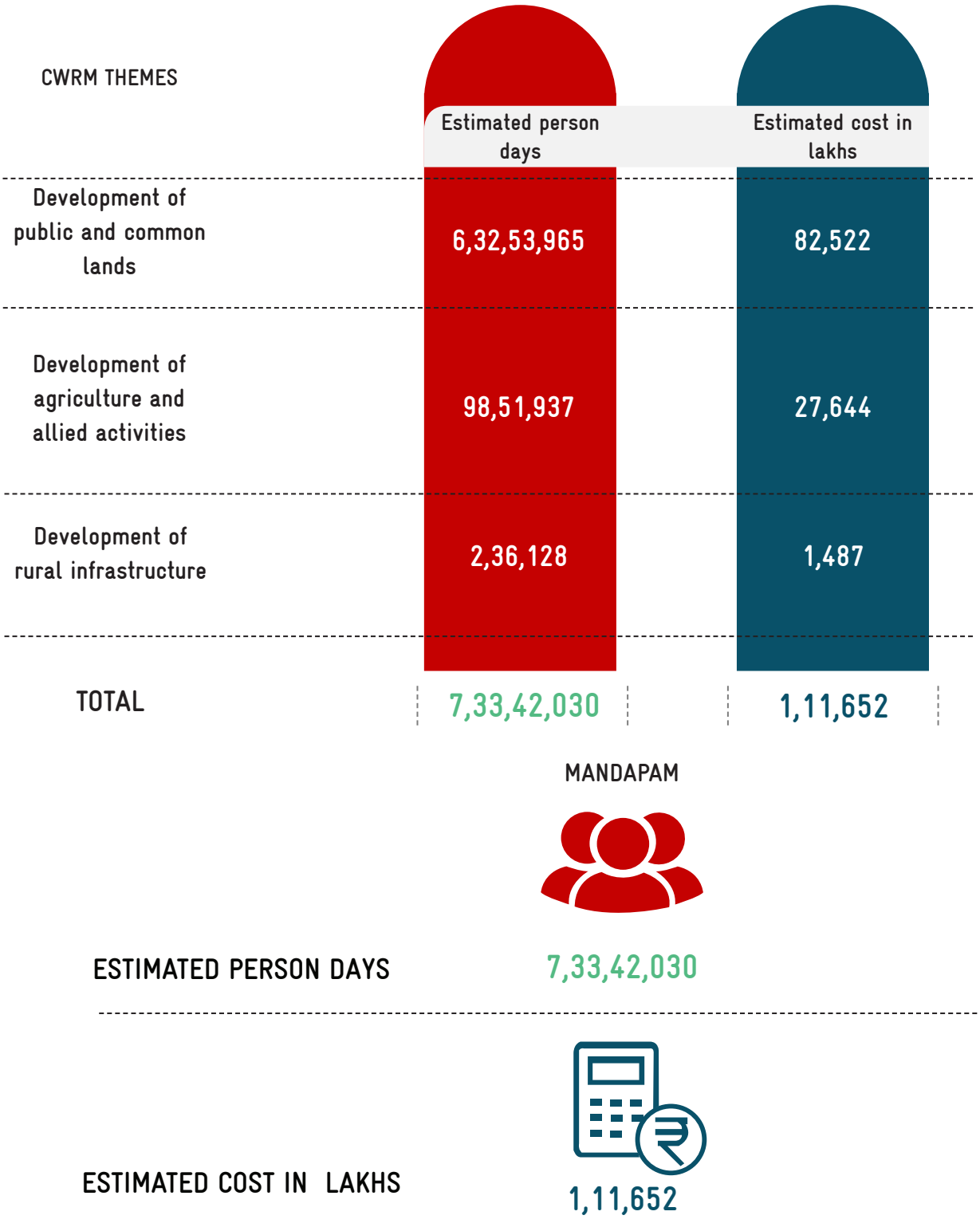


Figure 6.1 & 6.2. Estimated person days & cost for all water actions

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.

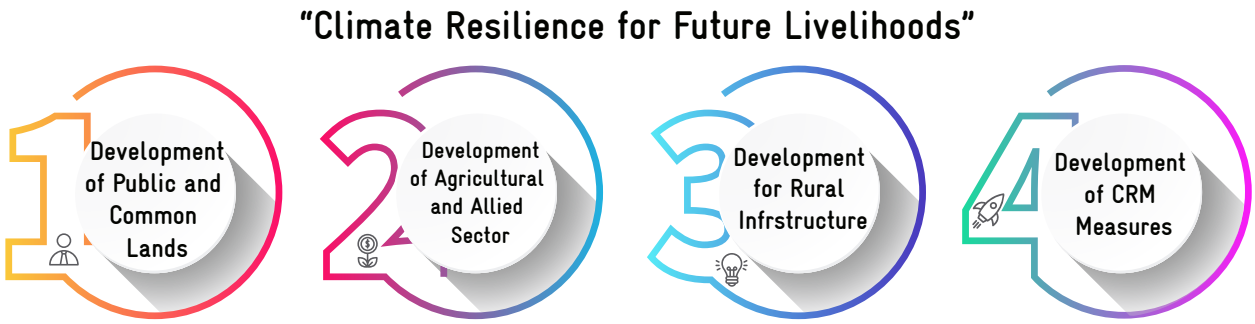
Internationally, the recent process on NDC Enhancement (2020) significantly acknowledge the climate change vulnerability on national sectors including agriculture, energy, and urban areas, especially through impacts on water resources. The role that water and water-related activities play in national 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 24)

TABLE 24. 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 25 to 27.

TABLE 25. 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)	2,792	W3	SDG 1,2, 6,13&15
Composting (No. of units)	690	W1	SDG1& 6
Afforestation in Public/common lands (ha)	698	C1,C2,C3, W3,	SDG 1, 2,6,13&15
Block Plantation (Community) (ha)	2,260	C1,C2,C3,W3,S2	SDG 1,2, 6 &13, 15
Silvi-pasture Development (ha)	0	C1,C2,C3,W3	SGG 12 &15
Linear Plantation (km)	47	C1,C2,C3,W3,S2	SDG 1,2,6,12&13, 15
Canal Bund Plantation (ha)	35	C1,C2,C3,W3,S2	SDG 1, 6&13, 15
Irrigation Channel Plantation (m)	1,650	W4,W5,S2	SDG 1,2& 6, 15
Avenue plantation (km)	141	C1,C2,C3,W3,S2	SDG 1, 6&13

Nursery Development (No. of units)	2,793	C1,S2,S4	SDG 1,2 &6
Restoration of waterbodies :PWD and Tanks (No.)	13	S2, S1	SDG 6, 1, 13
Restoration of water bodies : Ooranis (No.)	353	S2, S1	SDG 6, 1, 13
Restoration of waterbodies :Ponds (No.)	1	S2, S1	SDG 6,1, 13
Artificial Recharge Structure (No. of units)	637	W3	SDG 1, 2, & 6
Water Course - Irrigation Channels - Desilting (m)	1,650	C1,C2,C3,W3,S2	SDG 1, 6&13
Drainage Line Treatment (m)	989	W1,W3,W4	SDG1 & 6
Coastal watersheds works			
Nursery development -Coastal plantation(No.)	-	C1,S2,S4	SDG 1, 6, 13,
Mangrove plantations(ha)	-	C1,C2,C3,W3,S2	SDG 1, 6, 13, 14, 15
Riverside plantation(ha)	-	W3,S2	SDG 1, 6, 13, 14, 15
Coastline Shelter belt Plantation (ha)	-	W3,S2	SDG 1, 6, 13, 14, 15
Bund Plantation wet lands (km)	-	W3,S2	SDG 1, 6, 13, 14, 15
Wetland plantation (inner)(ha)	-	W3,S2	SDG 1, 6, 13, 14, 15
Coastal wetland - Bund strengthening (km)	-	W3,S2	SDG 1, 6, 13, 14, 15
Wetland Inlet improvement works(No.)	-	W3,S2	SDG 1, 6, 13, 14, 15
Check dam for controlling sea water intrusion (No.)	-	W5	SDG 1, 6, 13, 14, 15
Construction of Fish Drying Yard (No.)	-	S2	SDG 1, 2, 4, 12
Agro Forestry in Individual lands (ha)	-	S2	SDG 1, 2, 6, 13

TABLE 26. 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)	2,149	A1,A3,W1,W3	SDG 1,2&6
Micro Irrigation(ha)	167	A1,A3,A5,W5	SDG 1, 2&6
Construction of Farm Ponds - Individual (No. of units)	690	A1,A3,W5,W1, W3	SDG 2& 6
Land development - Individual (ha)	863	W1,W5,A1,A3,S2,S4	SDG 2, 6&
Dry land Horticulture/Agro-forestry - Individual (ha)	1,074	A1,A3,A4,W1,S4,S2,C1	SDG 1& 2,15
Azolla units - Individual (No. of units)	151	A3,A4,S4	SDG 1& 2
NADEP Vermi compost (No. of units)	151	A3, W1, S4	SDG 1& 2,6
Fodder development - Community & Individual	151	A3, S4	SDG 1& 2, 15
Cattle shelters (No. of units)	151	S4	SDG 1& 2

Goat/sheep shelters (No. of units)	1,968	S4	SDG 1& 2
Cattle trough(No. of units)	151	W5,S4	SDG 1& 2
Poultry Shed (No. of units)	508	S2,S4	SDG 1& 2

TABLE 27. 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)	1,118	W3,S2	SDG 1& 6
Soak Pits (Individual) (No. of units)	11,173	W3,S2	SDG 1& 6
Roof Rain Water harvesting (No. of units)	56	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

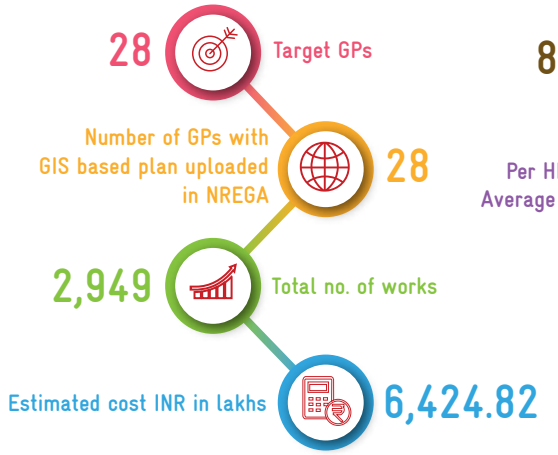
7 IMPLEMENTATION OF GP PLANS

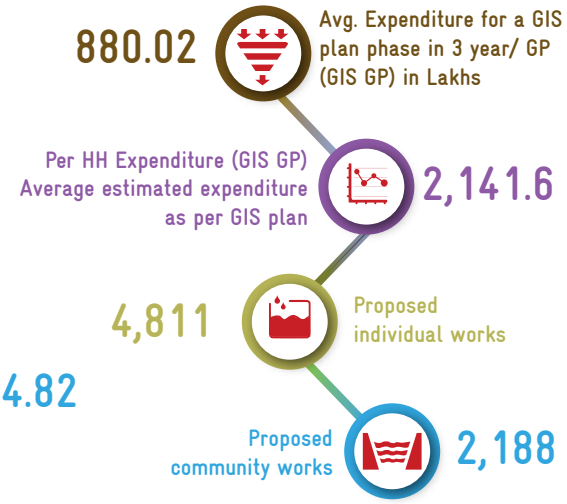
Execution of GP plans includes integrating all verified, approved works in MORD's web enabled application NREGA Soft (https://nrega.nic.in) for mainstreaming WASCA. The target GPs are identified first, the status of GIS based plans and total works along with its expenditure and category wise estimation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

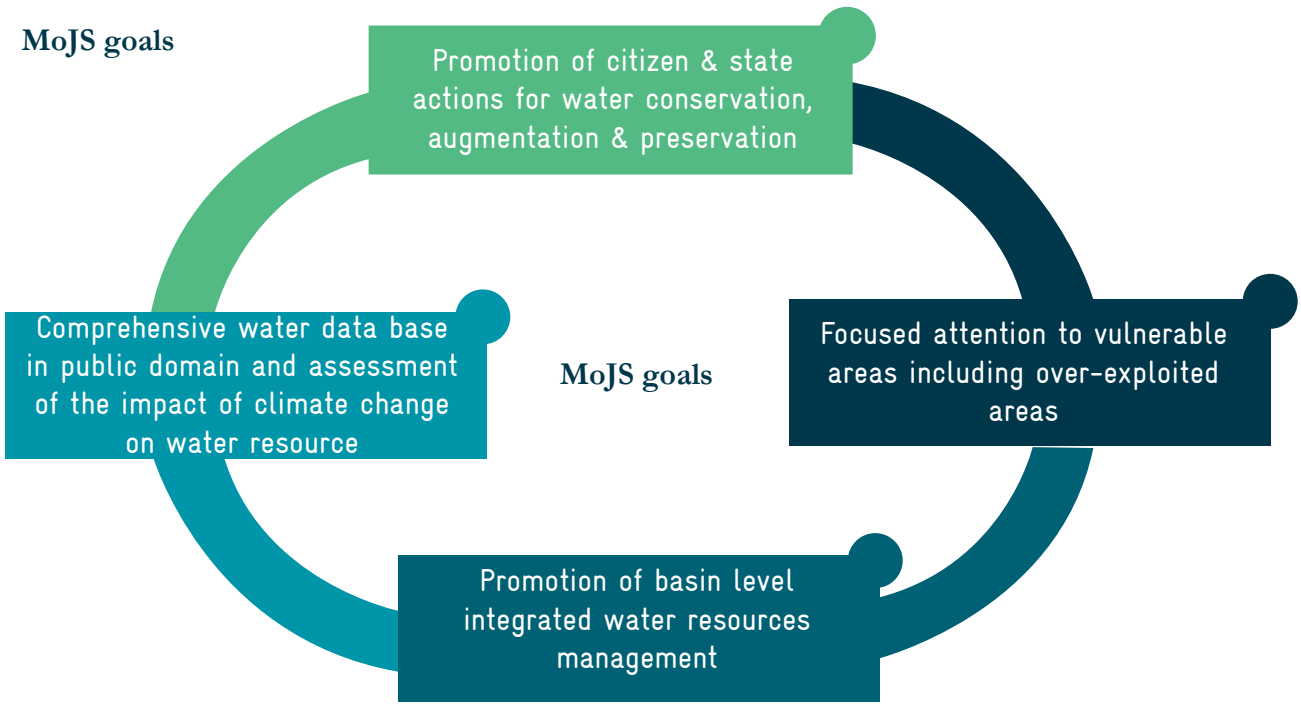
7.1 INTEGRATION INTO NREGA SOFT

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 Mandapam Block is listed in Table 28 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 28. GIS-BASED PLAN IMPLEMENTATION- KEY PARAMETERS PERFORMANCE IN MANDAPAM BLOCK







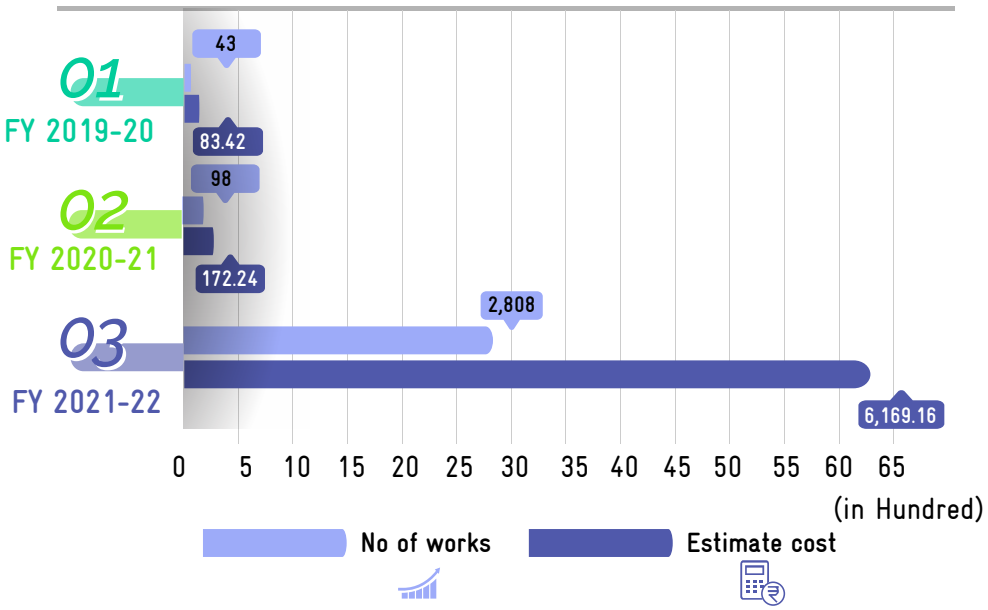


Figure 7.1. Work progress in last three years

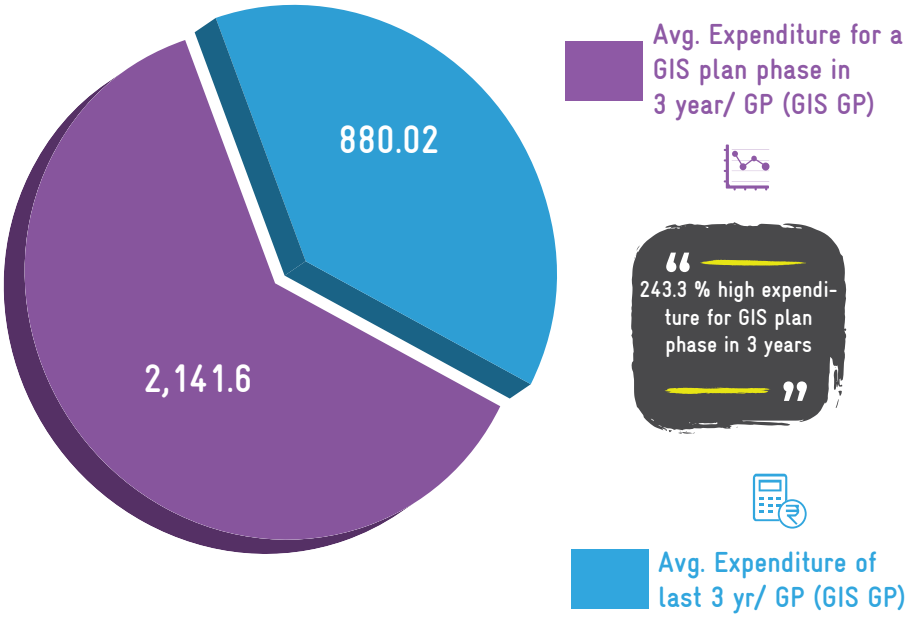
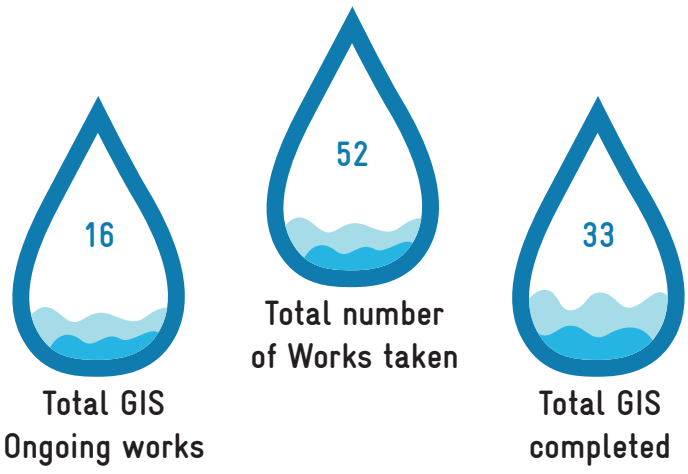


Figure 7.2. Average Expenditure for GIS plan in last 3 years



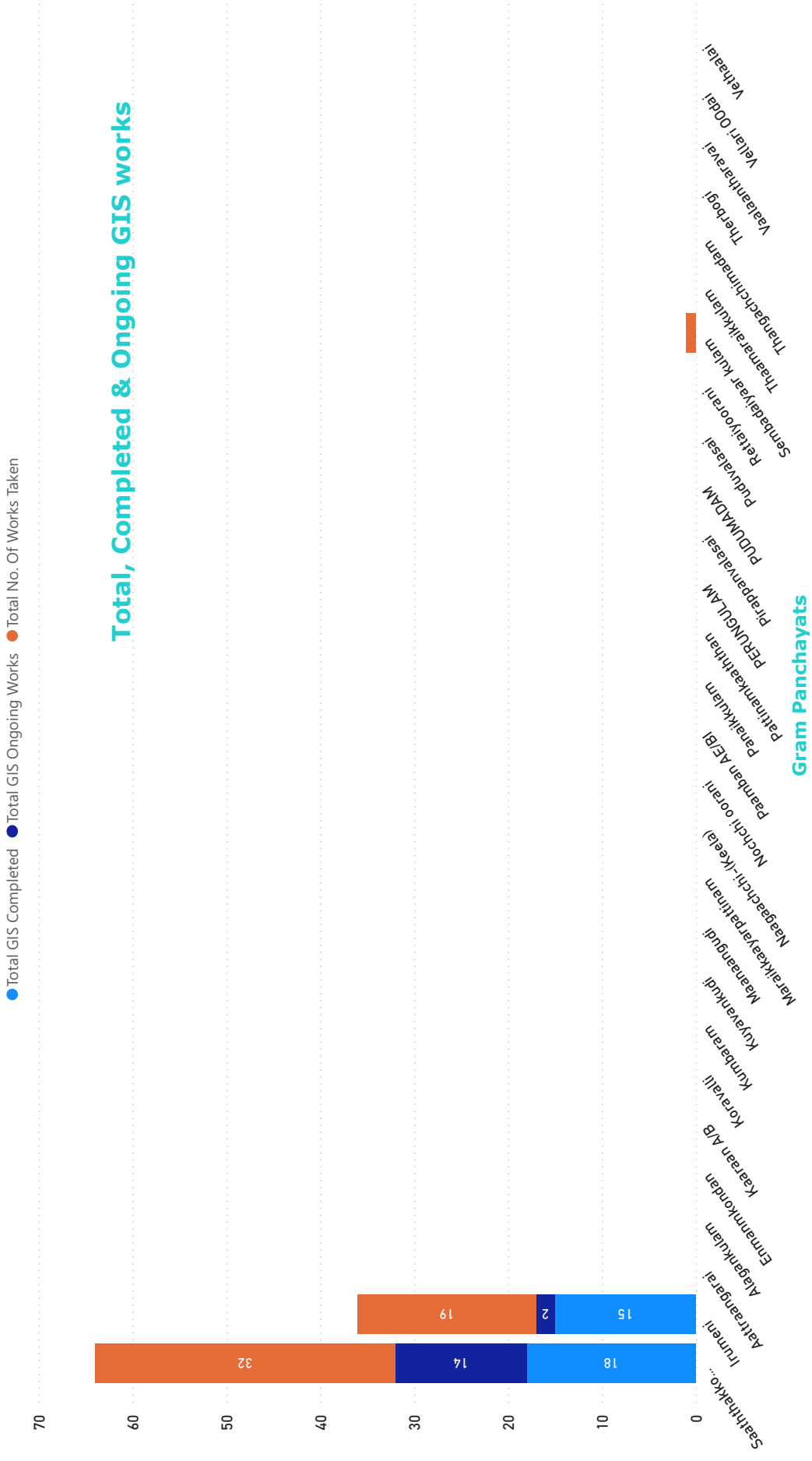
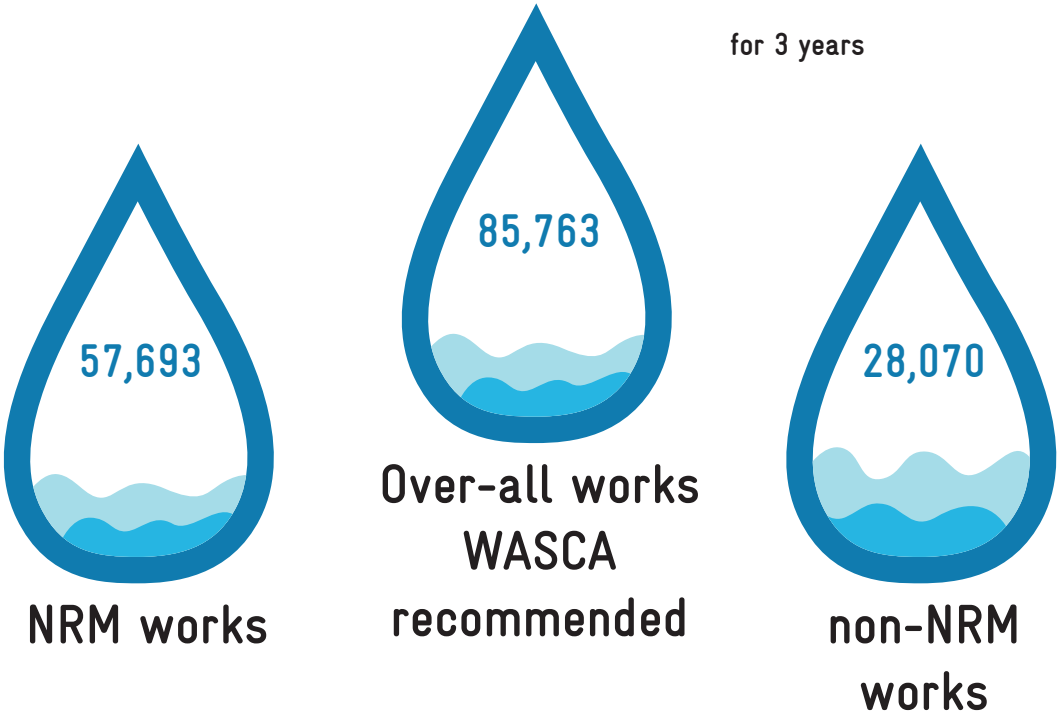


Figure 7.3. GP wise total, completed and ongoing GIS works

7.2 WASCA RECOMMENDED NRM AND NON-NRM WORKS

WASCA recommended 85,763 works for a period of 3 years, out of which 57,693 are NRM works and 28,070 are non NRM works (Figure 7.4). A total of 2,136 works has been uploaded so far for the financial year 2021-22 as on 21/02/2021.



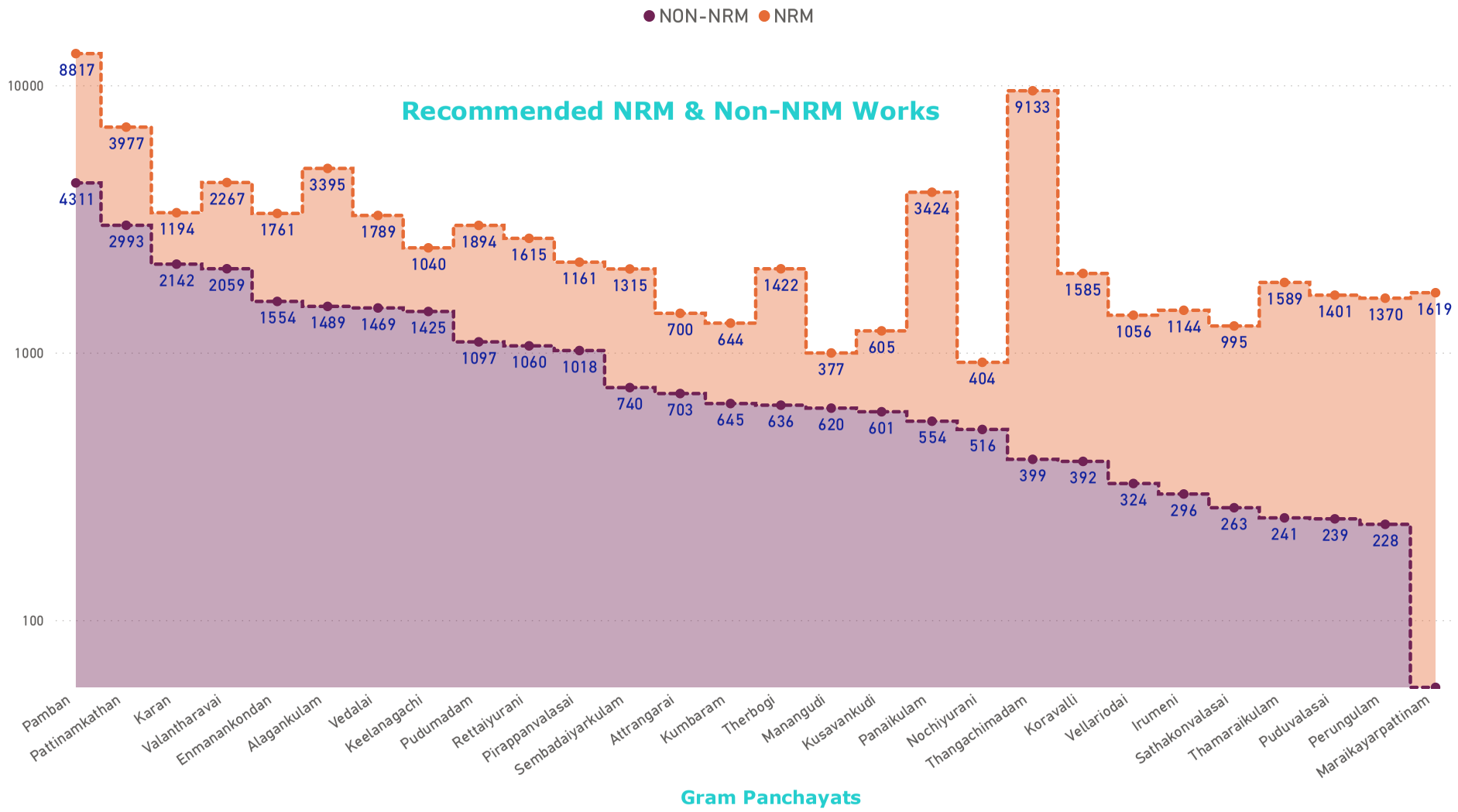


Figure 7.4. GP wise recommended NRM and Non-NRM works

7.3 ONGOING WORKS

The ongoing works in Mandapam Block includes Water Conservation and Water Harvesting, Works on Individual Lands (Category IV), Rural Connectivity, and Drought Proofing. A total of 138 works are ongoing in the Block, in which individual beneficiary works (47.8 %) are more followed by WCWH works (26 %) while micro irrigation works are less in number (0.7 %) (Figure 7.5), GP and work category wise ongoing works are tabulated in Annexure 7.2.

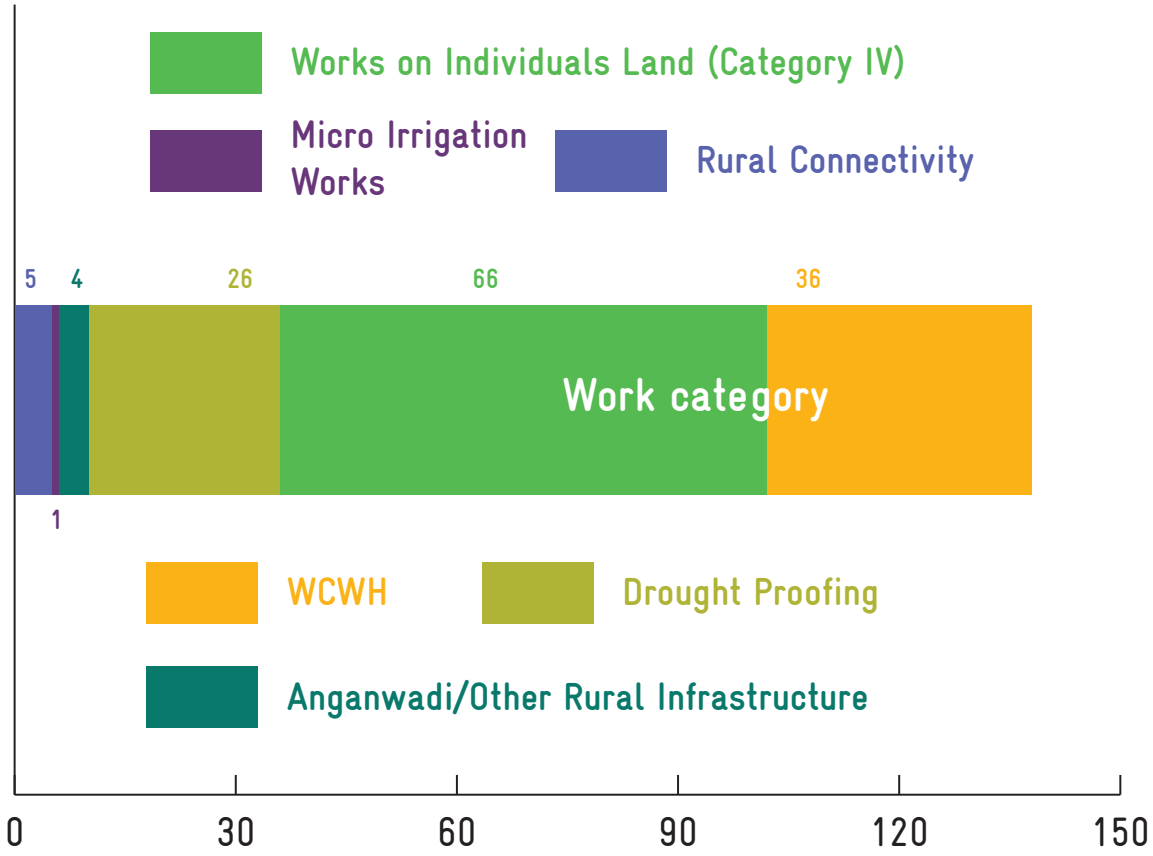


Figure 7.5. Category-wise ongoing works in Mandapam Block

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 Mandapam Block is Rs. 1,647.88 Lakhs and nearly 68% of the expenditure utilized for water conservation and Rain water harvesting (Figure 7.6).

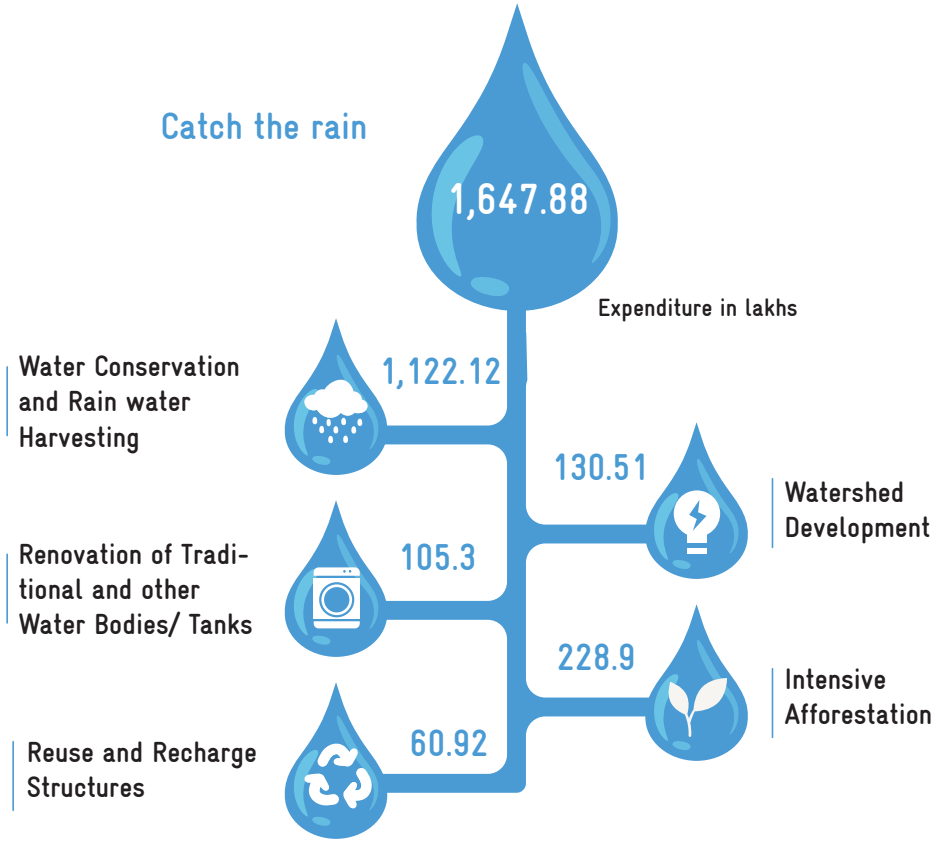
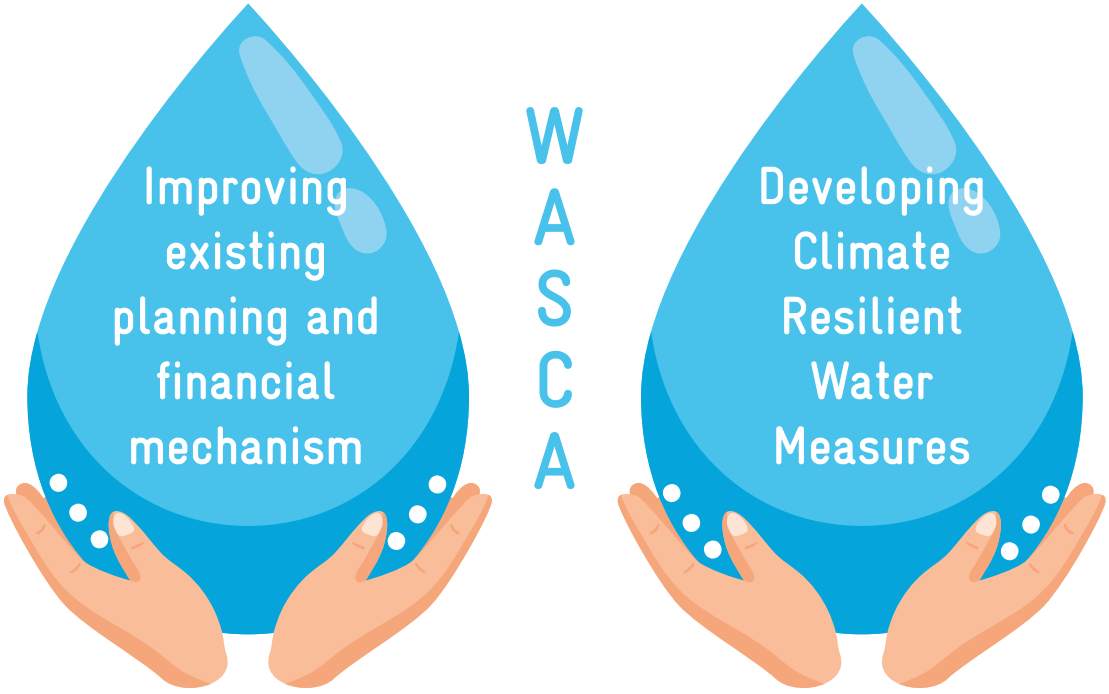


Figure 7.6. Expenditure for Catch the Rain campaign in Mandapam Block



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 of projects efficiently.

8.1 MACRO-WATERSHEDS OF MANDAPAM BLOCK

Mandapam Block comes under Lower Vaigai sub-basin of Vaigai basin. Vaigai River flows through the Block. Lower Vaigai macro- watershed covers the Block with 38 micro-watersheds covering an area of 29,872.63 ha (Figure 8.1) and (Table 29). In Mandapam Block all 28 GPs, fall under Lower Vaigai watershed. (Tables 30). The micro-watershed related works are identified using Basin, Sub-basin, and micro-watershed with GP administrative boundaries through CWRM approach.

TABLE 29. GENERAL DESCRIPTION OF MACRO-WATERSHEDS COVERING MANDAPAM BLOCK

Macro-watershed	Area in ha	No. of micro-watersheds
Lower Vaigai	29,872.63	38

TABLE 30. NO. OF GPs COVERED UNDER WATERSHEDS IN MANDAPAM BLOCK

Name of watershed	No. of GPs
Lower Vaigai	28

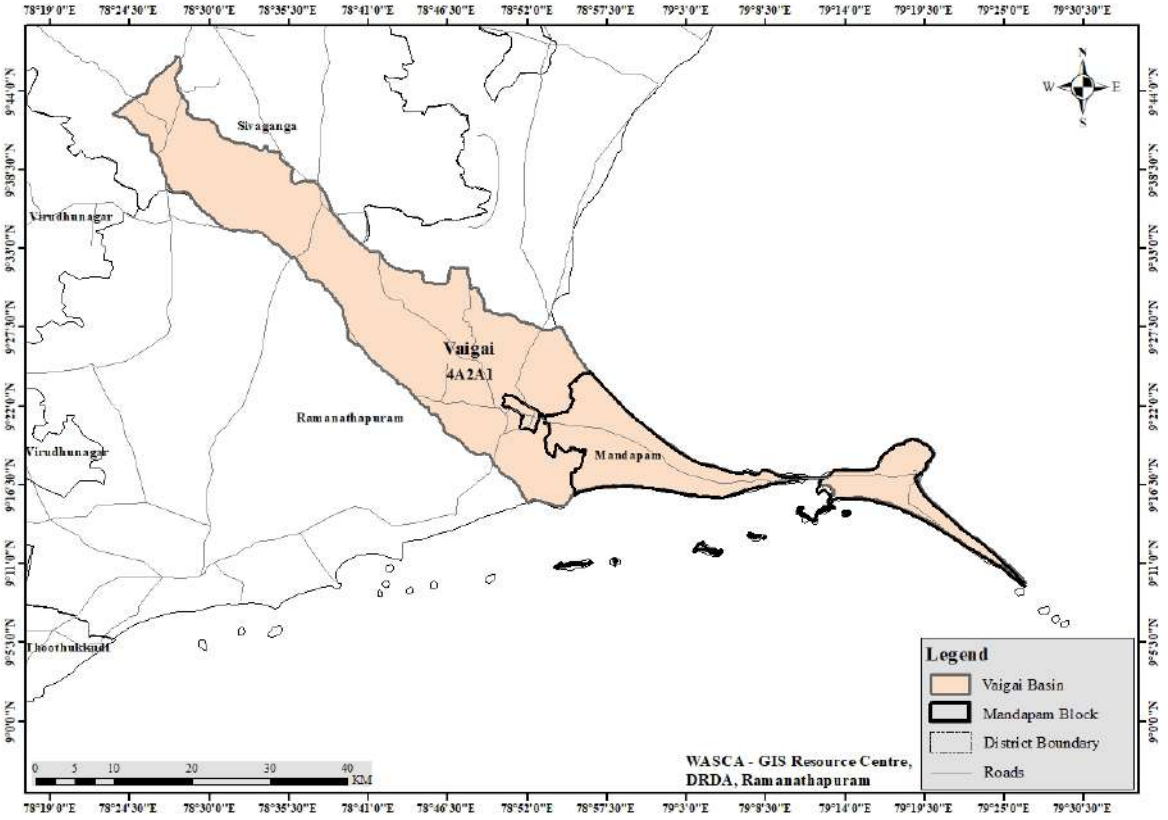


Figure 8.1. Macro-watershed map - Mandapam Block

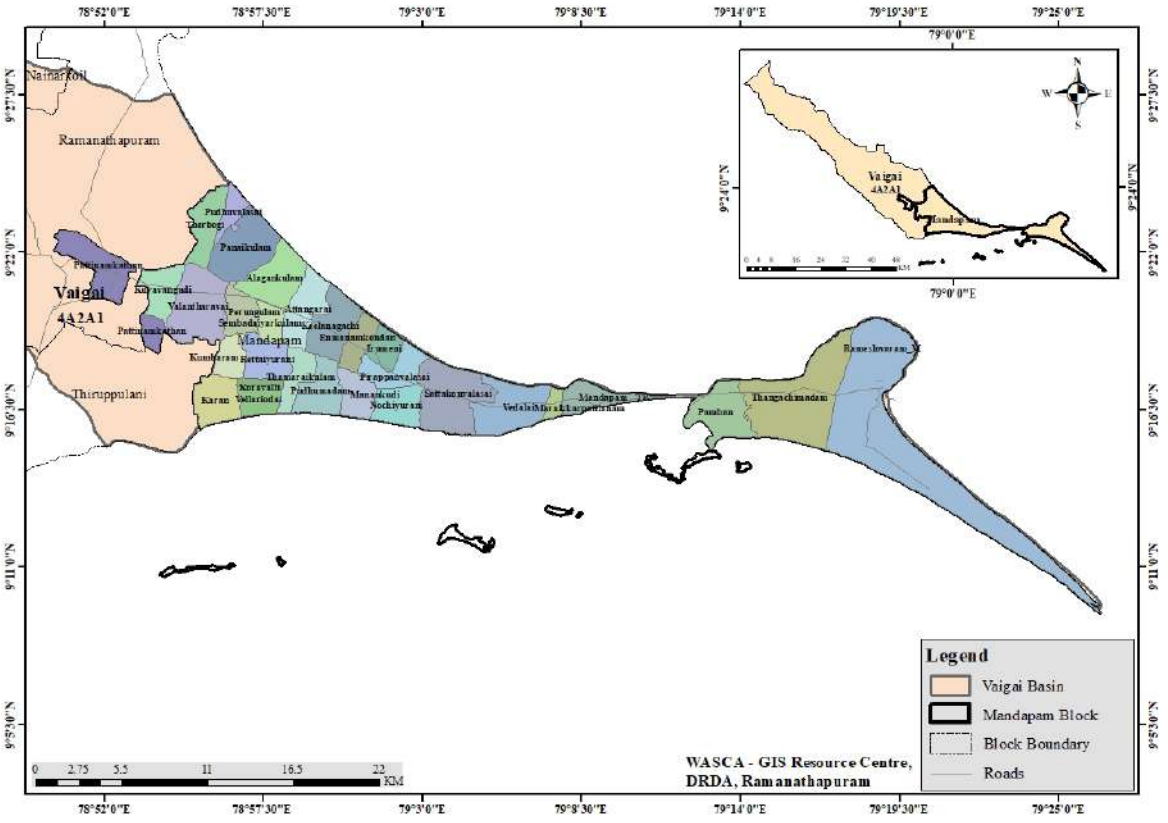


Figure 8.2. Macro-watershed with GPs

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 Mandapam Block are listed in Tables 31 to 33.

TABLE 31. MICRO-WATERSHED IN MANDAPAM BLOCK FALLING UNDER LOWER VAIGAI MACRO- WATERSHED

Sl.No	Micro-watershed Code	Micro-watershed Area in ha	Ridge Type
1	4A2A1a01b	1656.160938	Lower
2	4A2A1a01c	849.4735548	
3	4A2A1a02b	98.63998986	
4	4A2A1a02a	257.8528235	
5	4A2A1c01d	183.0936781	
6	4A2A1c02a	99.14885046	
7	4A2A1b04a	165.109905	
8	4A2A1b04c	481.0903867	
9	4A2A1b03a	351.2346748	
10	4A2A1a01a	1206.101731	
11	4A2A1b06c	155.9443291	
12	4A2A1b03b	521.7777701	
13	4A2A1b01c	475.0367212	
14	4A2A1b01a	829.3468373	
15	4A2A1b02a	446.0997392	
16	4A2A1b03c	930.9093714	
17	4A2A1b01b	981.93756	
18	4A2A1b05e	31.94027526	
19	4A2A1b02b	435.1092131	
20	4A2A1b13d	9537.377291	
21	4A2A1b08a	350.2681487	
22	4A2A1b08c	409.1125492	
23	4A2A1b09a	1162.254561	
24	4A2A1b11b	721.3070789	
25	4A2A1b02c	376.3207024	
26	4A2A1b10a	763.3753192	
27	4A2A1b11a	663.6312968	
28	4A2A1b08d	3.381992281	
29	4A2A1b13a	833.5599365	
30	4A2A1b13c	449.4564709	
31	4A2A1b09b	626.7658778	
32	4A2A1b12a	855.6220404	
33	4A2A1b10b	1453.604187	
34	4A2A1b07c	80.09297265	
35	4A2A1b13b	601.5217705	
36	4A2A1b07a	300.1142233	
37	4A2A1b07b	66.45353274	
38	4A2A1b12b	462.3986801	

TABLE 32. LIST OF GPs WITH TYPE OF RIDGE FALLING UNDER LOWER VAIGAI MACRO-WATERSHED IN MANDAPAM BLOCK

Sl.No	Name of the GP	Ridge Type
1	Alagankulam	Lower
2	Attrangarai	
3	Enmanankondan	
4	Irumeni	
5	Karan	
6	Keelanagachi	
7	Koravalli	
8	Kumbaram	
9	Kusavankudi	
10	Manangudi	
11	Maraikayarpattinam	
12	Nochiyurani	
13	Pamban	
14	Panaikulam	
15	Pattinamkathan	
16	Perungulam	
17	Pirappanvalasai	
18	Pudumadam	
19	Puduvalasai	
20	Rettaiyurani	
21	Sathakonvalasai	
22	Sembadaiyarkulam	
23	Thamaraikulam	
24	Thangachimadam	
25	Therbogi	
26	Valantharavai	
27	Vedalai	
28	Vellariodai	

TABLE 33. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPE OF RIDGE FALLING UNDER LOWER VAIGAI MACRO- WATERSHED IN MANDAPAM BLOCK

Sl.No	Proposed Work	Ridge Type	Extent
1	Contour Continuous Bunds (CCB) for Afforestation area (m)	Lower	6,980.3
2	Afforestation in Public/common lands (ha)		698.03
3	Drainage Line Treatment (m)		39,558
4	Block Plantation (Community) (ha)		2,259.51
5	Avenue plantation (km)		140.99
6	Composting (No.)		690
7	Canal Bund Plantation (km)		23.34
8	Restoration of water bodies: Tanks and Ooranis (No.)		301
9	Artificial Recharge Structure (No.)		214
10	Farm Bunding with Boundary Trenches - Individual (ha)		214.87

11	Construction of Farm Ponds – Individual (No.)	Lower	690
12	Land development – Individual (ha)		862.86
13	Azolla units – Individual (No.)		151
14	NADEP Vermi compost (No.)		347
15	Fodder development - Community & Individual (No.)		151
16	Cattle Shelters (No.)		151
17	Goat Sheep Shelters (No.)		1,968
18	Cattle Trough (No.)		151
19	Soak Pits (Community) (No.)		1,118
20	Soak Pits (Individual) (No.)		11,173
21	Roof Rain Water Harvesting (No.)		56
22	Agro Forestry (ha)		434.39
23	Nutri Garden (No.)		28
24	Silt application (No.)		345
25	Mini Forest (No.)		2
26	Fish Drying Yard (No.)		32
27	Bird Watching Tower (No.)		21
28	Fish Processing Unit (No.)		36
29	Sand Dune Development (No.)		40
30	Wetland Bund Strengthening (km)		110.93
31	Wetland Bund Plantation (No.)		12.43
32	Wetland Inlet (No.)		23

8.2 MODEL MICRO-WATERSHED: DHARGA VALASAI

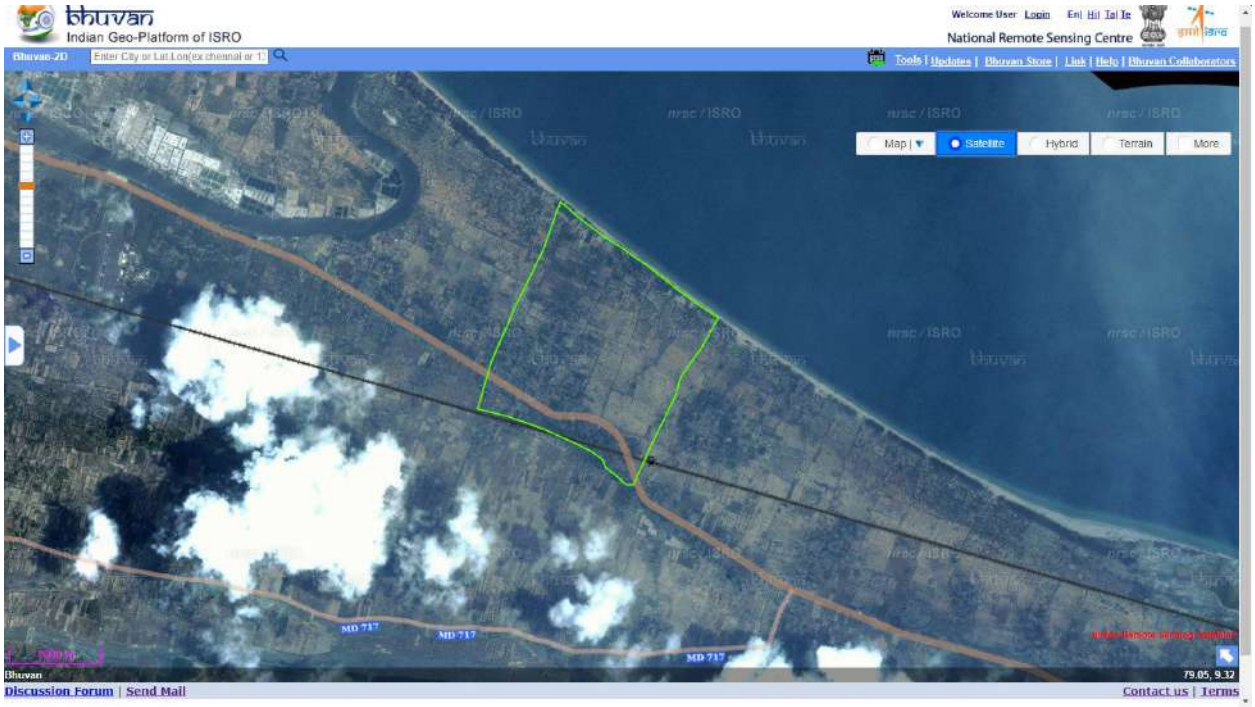


Figure 8.3. Dharga Valasai micro-watershed over satellite image

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 components. The ultimate goal is to achieve and maintain a balance between resources development to increase the welfare of the population.

SATHANOOR MICRO-WATERSHED

Dharga Valasai micro-watershed falls under Irumeni and Enmanamkondaan GP, Mandapam Block in Ramanathapuram District. Micro-watershed over satellite image is shown in Figure 8.3. This micro-watershed is the part of Lower Vaigai (4) Macro-watershed in Lower Vaigai sub-basin. The general information, geology, hydrogeology, natural drainage line, catchment area, ground water status, water budget of are Dharga Valasai 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 34 to 46 & Figure 8.4). The key CWRM parameters for the GPs falling in this micro-watershed is Annexed 8.

TABLE 34. GENERAL INFORMATION OF THE MICRO-WATERSHED

Description	Name/ Number/ Quantity/ Status
Name of the Micro-watershed	Dharga Valasai micro-watershed
Micro-watershed Number	4A2A1b02b
Name of the Basin	Vaigai Basin
Name of the sub basin	Lower-Vaigai (4) Sub Basin
Name of the Macro-watershed	Vaigai
Number of GPs covered under the Micro-watershed	2
Name of the GPs	1. Irumeni
	2. Enmanamkondaan
Latitude of Micro-watershed (From To)	9°9'14.715"N to 9°25'0.244"N
Longitude of Micro-watershed (From To)	79°20'8.164"E to 78°55'46.559"E
Total area of the Micro-watershed in ha	438
% of Micro-watershed area in Irumeni GP	48
% of Micro-watershed area in Enmanamkondan GP	52
Area of Micro-watershed falling in Irumeni GP (ha)	212
Area of Micro-watershed falling in Enmanamkondan GP (ha)	226
Length of the Coastal Line on Irumeni GP (m)	1,927
Length of the Coastal Line on Enmanamkondan GP (m)	1,260
Total Population of Irumeni GP	4,406
Total Population of Enmanamkondan GP	7,184
Annual Average Rainfall (mm)	821
Annual maximum Temperature (°C)	32.6
Annual Minimum Temperature (°C)	23.8
Evapo-Transpiration Losses of Irumeni GP (ha.m)	8.69
Evapo-Transpiration Losses of Enmanamkondan GP (ha.m)	7.63
Volumetric soil moisture availability (%)	17
Climate Risk	Drought and heat waves
CVI Index Value for Irumeni (Based on WASCA Climate study)	0.508 (High water Vulnerability)
CVI Index Value for Enmanamkondan (Based on WASCA Climate study)	0.527 (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 Irumeni GP	Safe
Status of Ground water in Enmanamkondaan GP	Safe

TABLE 35. HYDROGEOLOGY OTHER CHARACTERISTICS IN MICRO-WATERSHED

Type of Geomorphology	Coastal Origin - Younger Coastal Plain
Geomorphology occurrence in %	100
Principle Aquifer	Alluvium
Salt Affected Area passing through the micro- watershed	None
Type of lineaments passing through the micro- watershed	Geomorphic Lineaments, Parallel to shoreline
Barren & waste lands	157.4 ha (Lower Ridge)

TABLE 36. EXISTING WATER HARVESTING STRUCTURES IN IRUMENI AND ENMANAMKONDAN GP

Sl.No.	Name of Structure	Irumeni GP		Enmanamkondan GP	
		Existing Structures		Existing Structures	
		No.	Area in ha	No.	Area in ha
1	Oorani	10	1.13	13	2.8
2	Tank	0	0	1	1.5
	Total	**10**	**1.13**	**10**	**4.3**

TABLE 37. CATCHMENT AREA OF MICRO-WATERSHED (STRANGE METHODOLOGY - CGWB)

Catchment Area in ha	Irumeni GP	Enmanamkondan GP
Good catchment area	12.5	19.2
Average catchment area	0.8	1.9
Bad catchment area	41.7	43.5

TABLE 38. GROUND WATER STATUS OF MICRO-WATERSHED

Firka Assessment Unit for Sathanoor and Veeranam GP in ha.m	
Name of the Firka (Assessment Unit) falling under micro-watershed	Mandapam
Recharge from other sources during monsoon season (ha.m)	347.18
Recharge from other sources during non-monsoon season (ha.m)	331.65

TABLE 39. SALINITY AND SEA WATER INTRUSION IN THE MICRO-WATERSHED

Pre monsoon Water Quality Index	Poor Quality
Post monsoon Water Quality Index	Medium and Good Quality
Pre monsoon Sea Water Mixing Index	1-2
Post monsoon Sea Water Mixing Index	1-2

TABLE 40. WATER BUDGET OF GP'S FALLING IN MICRO-WATERSHED-IRUMENI & ENMANAMKONDAN GPs

Water Budget in ha.m	Irumeni GP	Enmanamkondan GP
Water for domestic	12.06	19.67
Water for agriculture	199.6	160
Water for livestock's	1.34	2.25
Village wise water required	213	181.9
Available run-off from rain water (derived from Strange method)	55	64.7
Harvested Runoff from Water Harvesting Activities	6.6	4.1
Potential Harvesting from proposed Interventions	4.8	6
Total Water harvested	11.4	10.0
Water demand and Supply Difference	-201.6	-171.9
Water demand supply gap status	Deficient	Deficient
Per capita Water Availability in cum	124.83	90.06
International Standard per capita water Availability (cum)	1,700	1,700
Water Availability Gap (cum)	-1,575.17	-1,609.94
Water security status	Water Stress	Water Stress

TABLE 41. GP WISE PROPOSED MICRO-WATERSHED WORKS – IRUMENI & ENMANAMKONDAN GPs

Proposed Work	Irumeni GP	Enmanamkondan GP
Proposed works in Upper Ridge	No works in Upper Ridge	No works in Upper Ridge
Proposed works in Middle Ridge	No works in Middle Ridge	No works in middle Ridge
Proposed works in Lower Ridge	86	73
Total works	86	73

TABLE 42. RIDGE WISE TREATMENT AREA ESTIMATED COST AND PERSON DAYS REQUIRED - IRUMENI & ENMANAMKONDAN GPs

Ridge Type	Sathanoor GP	Veeranam GP
Lower Ridge		
Estimated cost for Lower Ridge area (INR in Lakhs)	75.64 Lakhs	163.52 Lakhs
Total area in ha of Lower ridge	212 ha	226 ha
Estimated Person days generated for Treatment of Lower Ridge	**17,721**	**38,887**
Treatment cost of Lower Ridge Lakhs/ha	**0.357 Lakh/ha**	**0.724 Lakh/ha**

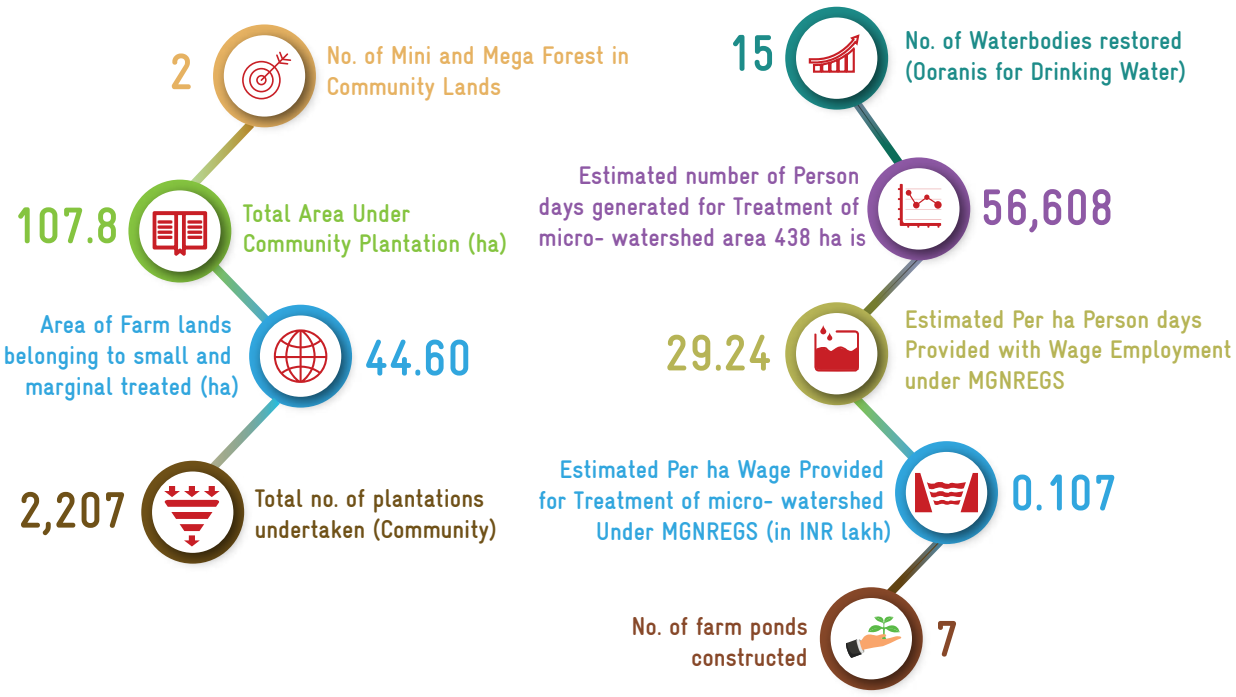
Irumeni GP	Treatment cost (INR in lakhs)	Estimated person days
Upper Ridge	NA	NA
Middle Ridge	NA	NA
Lower Ridge	0.357 lakh/ha	17,721
	0.357 lakh/ha	17,721

Enmanamkondan GP	Treatment cost (INR in lakhs)	Estimated person days
Upper Ridge	NA	NA
Middle Ridge	NA	NA
Lower Ridge	0.724 lakh/ha	38,887
	0.724 lakh/ha	38,887

TABLE 43. NATURE AND NO. OF WORKS IN MICRO-WATERSHED

Description	Number
Total No. of works in Micro-watershed area (Arable, Non arable & DLT)	71
Total No. of works in Micro-watershed including livelihood Activities	27
Total No. of works in Micro-watershed including Rural Greywater Management Activities	34

TABLE 44. KEY OUTCOMES OF INTERVENTION



Expenditure for FY 2020-21 (in INR lakh)

Irumeni GP	74.19 lakh
Enmanamkondan GP	41.13 lakh

TABLE 45. ESTIMATES OF MICRO-WATERSHED IN IRUMENI 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	4	4	28	10,256
Oorani bund Plantation (No.)			144	4	0.66	225
Avenue plantation (km)			1.26	1	14.49	514
Roof Rain Water Harvesting in GP Building (No.)			2	2	0.6	30
Sub total				**11**	**43.75**	**11,025**
Works in Individual Farmer lands (Agriculture and Allied Activities)						
Farm Bunding with Boundary Trenches - Individual (ha & No.)	Lower	Not commenced	7.3	5		
			7	5	10.5	2,930
Construction of Farm Ponds - Individual (No.)			5	5	9	3,100
Composting (No.)			5	5	0.45	155
Fodder development - Individual (No.)			1	1	0.2	10
Sub total				**21**	**20.15**	**6,195**
Total				**32**	**63.902**	**17,220**
Livelihood enhancement activities for Individual Farmers (Coastal Area)						
Fish Drying Yard (No.)	Lower	Not commenced	1	1	3.5	119
Azolla Production Unit (No.)			2	2	0.3	28
Cattle Shelters (No.)			2	2	3.2	66
Poultry Shed (No.)			2	2	0.4	44
Goat Sheep Shelters (No.)			2	2	2.3	60
Cattle Trough (No.)			3	3	0.6	99
Sub total				**12**	**10.3**	**416**
Rural Greywater and Roof Rainwater Management						
Soak Pits (Individual) (No.)	Lower	Not commenced	7	7	0.756	42
Soak Pits (Community) (No.)			5	5	0.65	40
Nutri Garden (No.)			3	3	0.03	3
Sub total				**15**	**1.436**	**85**
Total				**59**	**75.64**	**17,721**

TOTAL ESTIMATES OF MICRO-WATERSHED IN IRUMENI GP

	No. of works as per KML	Estimate cost in INR (Lakhs)	Person days
			
Irumeni GP	59	75.64	17,721

TABLE 46. ESTIMATES OF MICRO-WATERSHED IN ENMANAMKONDAN 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						
Mini Forest (No.)	Lower	Completed	1,000	2	4.6	3,160
Restoration of Traditional water bodies: (Oorani & Tank) (No.)		Not commenced	11	11	77	28,204
Oorani bund Plantation (No.)			725	11	33.35	1185
Avenue plantation (km)			0.89	1	0.92	321
Roof Rain Water Harvesting in GP Building (No.)			2	2	0.6	30
Sub total				**27**	**116.47**	**32,900**
Works in Individual Farmer lands (Agriculture and Allied Activities)						
Farm Bunding with Boundary Trenches - Individual (ha &No.)	Lower	Not commenced	7.3			
			7	7	10.95	4,102
Construction of Farm Ponds - Individual (No.)			2	2	3.6	1,240
Composting (No.)			3	3	0.27	93
Sub total				**12**	**14.82**	**5,435**
Total				**39**	**131.29**	**38,335**
Livelihood enhancement activities for Individual Farmers (Coastal Area)						
Fish Drying Yard (No.)	Lower	Not commenced	1	1	3.5	119
Azolla Production Unit (No.)			3	3	0.45	42
Cattle Shelters (No.)			3	3	4.8	99
Poultry Shed (No.)			3	3	6	90
Goat Sheep Shelters (No.)			3	3	3.45	66
Cattle Trough (No.)			2	2	0.4	22
Sub total				**15**	**18.6**	**438**

Rural Greywater and Rooftop Rainwater Management						
Soak Pits (Individual) (No.)	Lower	Not commenced	12	12	12.96	72
Soak Pits (Community) (No.)			5	5	0.65	40
Nutri Garden (No.)			2	2	0.02	2
Sub total				**19**	**13.63**	**114**
Total				**73**	**163.52**	**38,887**

TOTAL ESTIMATES OF MICRO-WATERSHED IN ENMANAMKONDAN GP

	No. of works as per KML	Estimate cost in INR (Lakhs)	Person days
Enmanamkondan GP	73	163.52	38,887

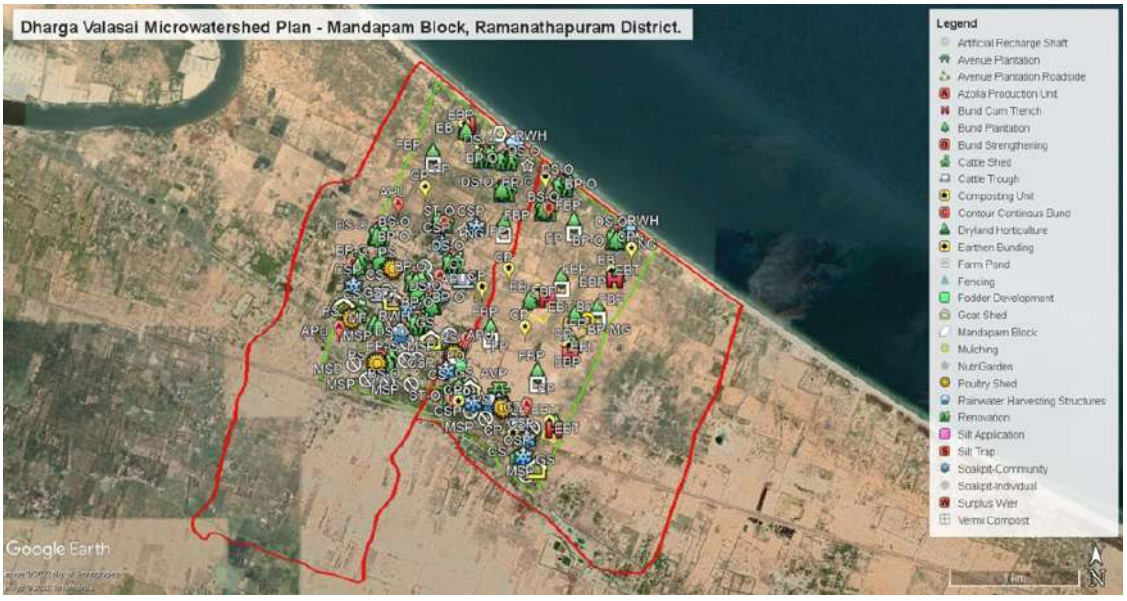


Figure 8.4. Proposed activities in Dharga Valasai micro-watershed

8.3 MODEL GP – KORAVALLI

BACKGROUND OF GRAM PANCHAYAT - KORAVALLI

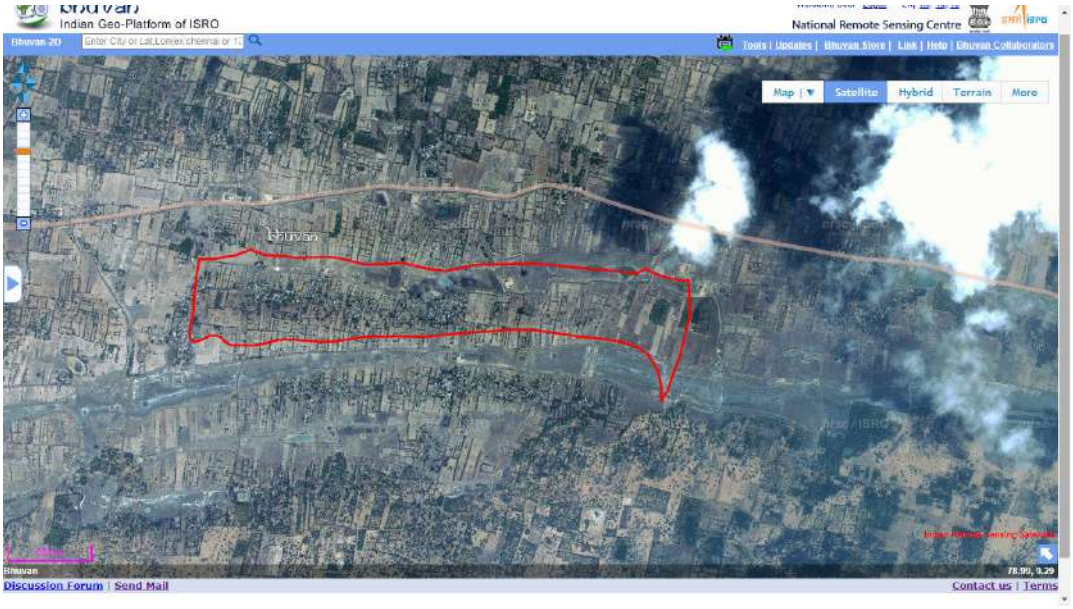
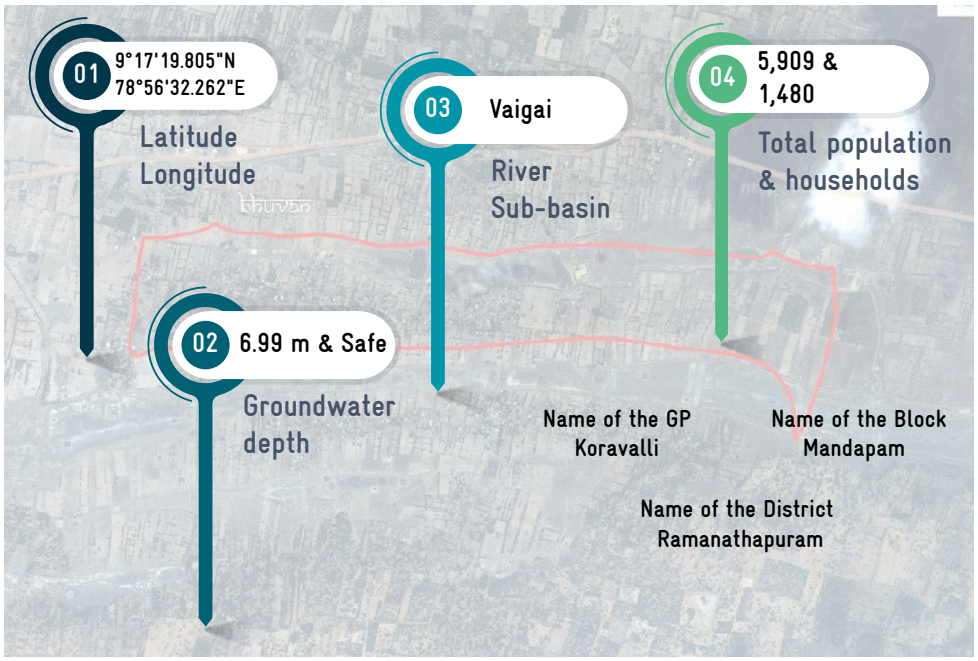


Figure 8.5. Koravalli GP over satellite image

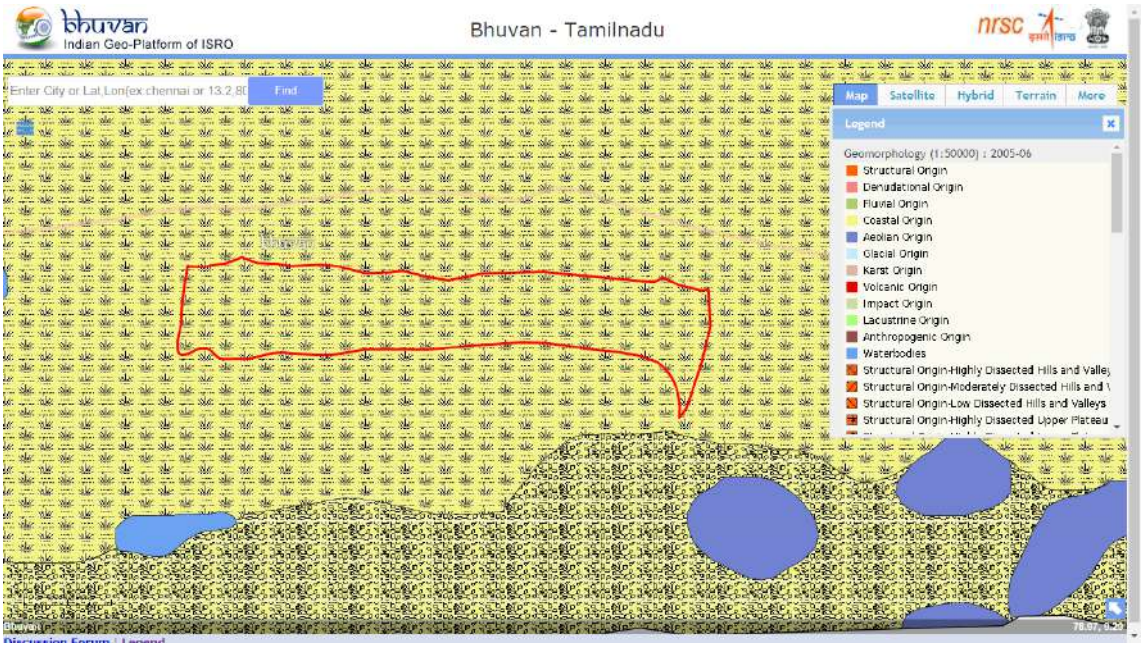
Koravalli GP is located in Mandapam Block of Ramanathapuram District, Tamil Nadu (Figure 8.5). The total geographic area of this GP is about 138 ha. As per the Population Census 2011, the total population of the GP is 5,909 out of which 2,966 are males, 4851 are females. The total number of HH in the village is 1,480 and SC, ST population comprises 5.06% of the total GP population (Table 47).

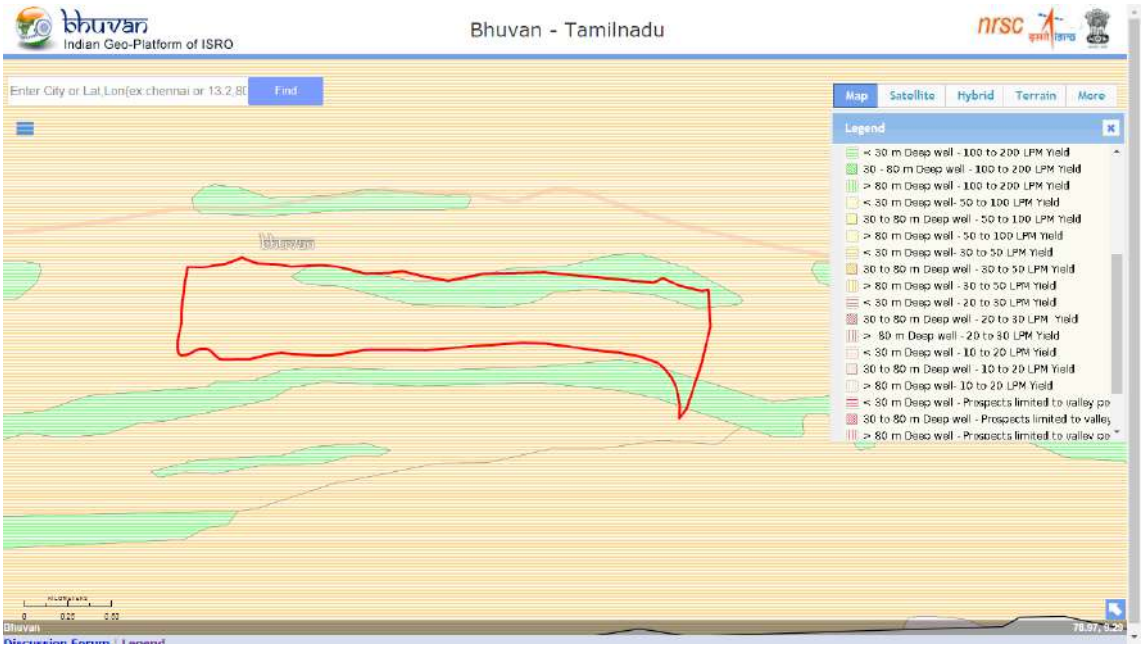
TABLE 47. GENERAL DESCRIPTION OF KORAVALLI GP, MANDAPAM BLOCK



8.3.1 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 implemented towards conservation of resources. Various thematic datasets for Koravalli GP is shown in Figure 8.6 (A,B,C,D,E). Koravalli GP is engrossed with younger coastal plain landform unit (A). It is observed that the groundwater prosperity is available in less than 30 m deep well with yield between 30 to 50 LPM and also the GW prosperity is 30-80 m deep well and 100 to 200 LPM yield (B). GP area falls under two micro-watershed units (C). Most of the land is used for crop cultivation while forest land is noticed in and around the GP (D). No wasteland is observed in the GP (E).





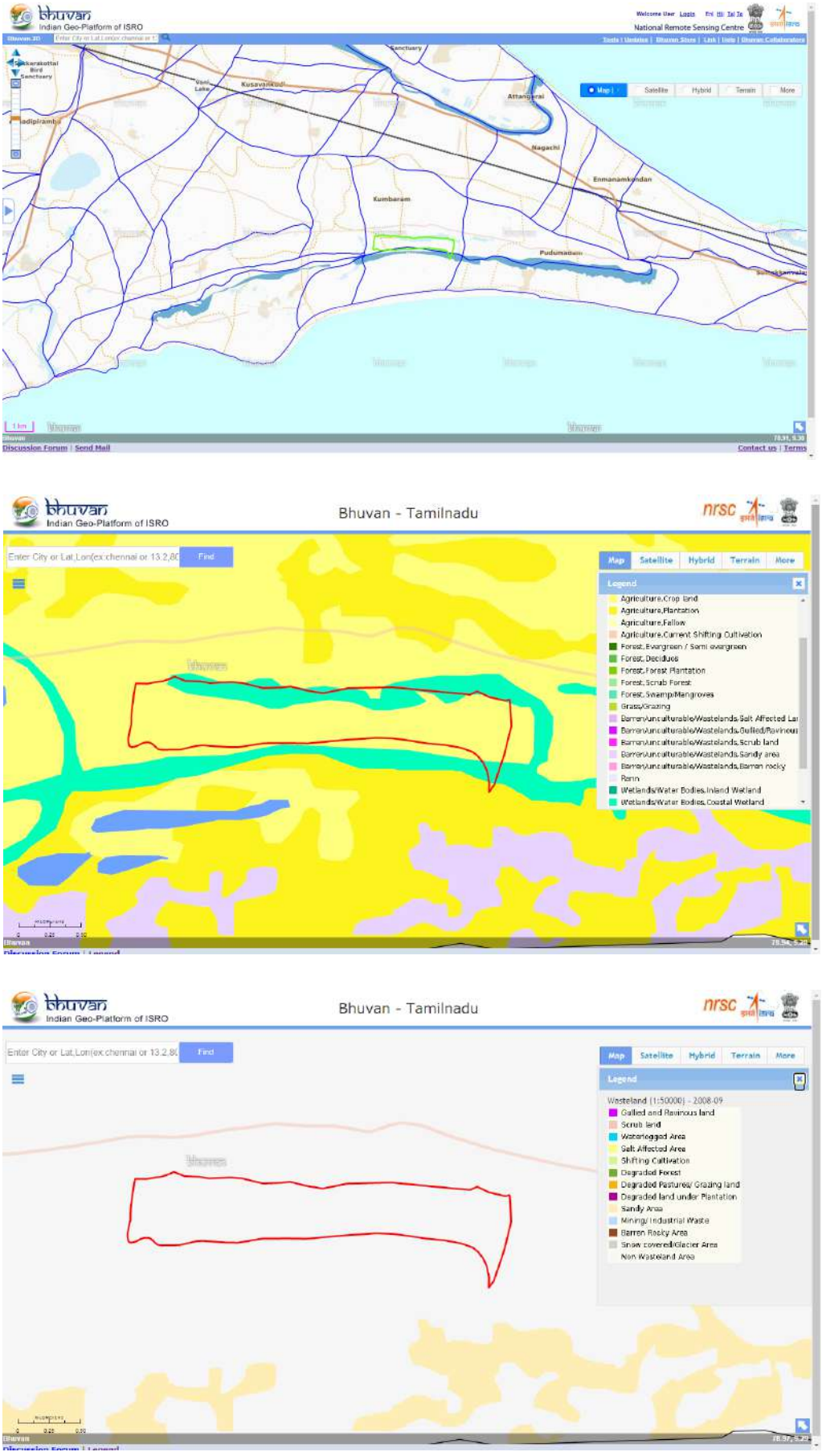


Figure 8.6. Spatial thematic maps of Koravalli GP. A. Geomorphology, B. GW prosperity, C. Watershed, D. LULC, E. Wasteland

8.3.2 CWRM PLANNING- NON-SPATIAL DATA

The non-spatial data covers four important themes – socio economic, climate, water and agriculture with 116 parameters (Table 48). 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 48. NON-SPATIAL DATA- KORAVALLI GP

Key CWRM Parameter	Details
Climate Vulnerability Area (CVA) 1: Socio-Economic	
Geographical Area	138
Male Population	2,966
Female Population	2,943
Total Population	5,909
SC Population	199
ST Population	100
Vulnerable population	299
Households (HH's)	1,480
Only one room HH's	307
Female Headed HH's	99
Vulnerable Households	245
% of Vulnerable Households	17
Registered MGNREGA Job cards	340
The active person working in job Cards	261
Drinking Water Sources	205
HH's have tap water connection for drinking water	270
HH's dependent on other sources for drinking water	170
Annual Greywater Generation (ha.m)	10.78
Climate Vulnerability Area (CVA) 3: Water Resources	
Canal Network (m)	
Length of Main Canal	3,000
Water Courses (Field Channels)	1,000
No. of Ooranis	12
Irrigation Facilities (ha)	
Area under Tank Irrigation	81
Area under Open & Tube Well Irrigation	30

Catchment Area wise Available Runoff (ha.m)	
Good Catchment Area	28
Bad Catchment Area	24.9
Watershed and Drainage Networks	
No. of Micro-watersheds	2
Water Demand (ha.m)	
Water Demand For Humans	16
Water Demand For Agriculture	623
% G.W Utilization for Drinking	100
% G.W Utilization for Livestock	78
% G.W Utilization for Agriculture.	27
% SW Utilization for Livestock	22
% SW Utilization for Agriculture	73
Climate Vulnerability Area 4: Agriculture	
Area Under Land Resources (ha)	
Area under Non-Agricultural Uses	6,126.25
Area under Current Fallow land	30.82
Area under Unirrigated Land	106.99
Area Irrigated by Source	81.53
Catchment Area (ha)	
Land under Good Catchment	126.25
Land under Bad Catchment	219.34
Crop Details (ha)	
Irrigated Area	323.39
Rainfed area	485.59
Area under Paddy Cultivation	439.56
Crop Water Requirement - Irrigated condition (ha.m)	161.82
Crop Water Requirement - Rainfed condition (ha.m)	461.12
Soil Resources: Status of Available Nitrogen (%)	
Very Low	7
Low	83
Medium	10
Status of Organic Carbon (%)	
Medium	1
High	99
Status of Soil Micro Nutrients (%)	
Sufficient	96
Deficient	4

Status of Physical condition of the soil (%)	
Highly Acidic	4
Moderately Acidic	92
Slighly Acidic	3
Moderately Alkaline	1
Soil Texture	
% of Fine Soil	78
Soil Water Permeability	Moderate to Low (5-20 mm/hr)
Soil moisture and ET	
Volumetric Soil Moisture (%)	17
Estimated Soil Moisture (ha.m)	37.29
ET Losses (ha.m)	98.41
Means of Water Extraction (%)	
Gravity	60
Lifting	40
Irrigation Methods (%)	
Wild Flooding	73
Control Flooding	27
Livestock (No)	
Cattle Population	100
Sheep Population	3
Goat Population	238
Poultry	301
Livestock Water Requirement (ha.m)	0.47

8.3.3 KEY WATER CHALLENGES

Socio-Economic

1. Female population is almost equal to male population
2. 5% percent of the population belongs to the SC category and according to SECC data,
3. 17% of the households are vulnerable, 99 HH are female headed
4. 5% Households have only one room.
5. 10.78 ha.m grey water from 1,480 households living in the coast needs attention

Water

1. No major, minor canals, distributaries in this GP
2. 12 Ooranis in the GP
3. Drinking water depends 100% of ground-water
4. 73% of surface water utilized for agriculture
5. More water for agriculture (623 ha.m)
6. 52.9 ha.m of water is an available runoff in which 52.93% of the runoff is from the good catchment, 47% of the conservation is from the bad catchment

Agriculture and Allied Sector

1. 96.54 % is under Common and public land
2. More bad catchment area (63.46%)
3. Rain fed area (60%)
4. Low soil Nitrogen and High carbon
5. 92 % moderately acidic
6. 78% fine soil
7. 73% Wild flooding
8. Area under paddy cultivation 439.56 ha

8.3.4 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 0.86% of the total land area is taken for WASCA activities like plantation, conservation works. The total proposed area for treatment is 55.05 ha out of which 67.73% of the proposed work in under individual lands (Figure 8.7). Through the proposed conservation activities, 11.1 ha.m run off would be harvested in which, about 80 % of the runoff is from the bad catchment, 60.8% of the run off is from the good catchment and 39.18 % of conservation is from the bad catchment area (Figure 8.8).

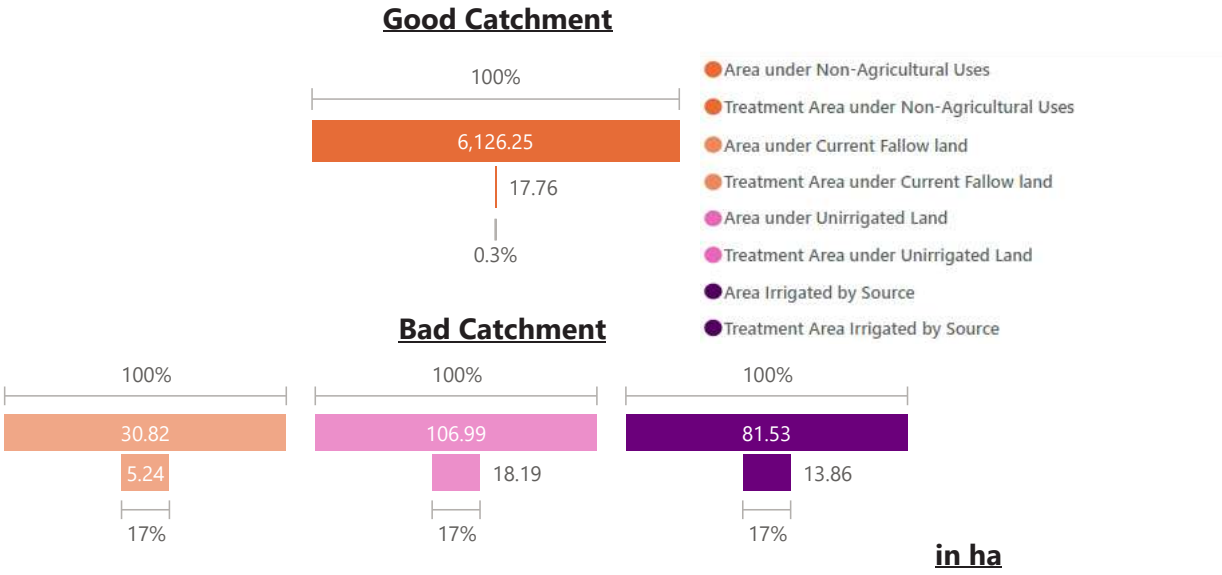


Figure 8.7. Proposed land resource treatment area in Koravalli GP

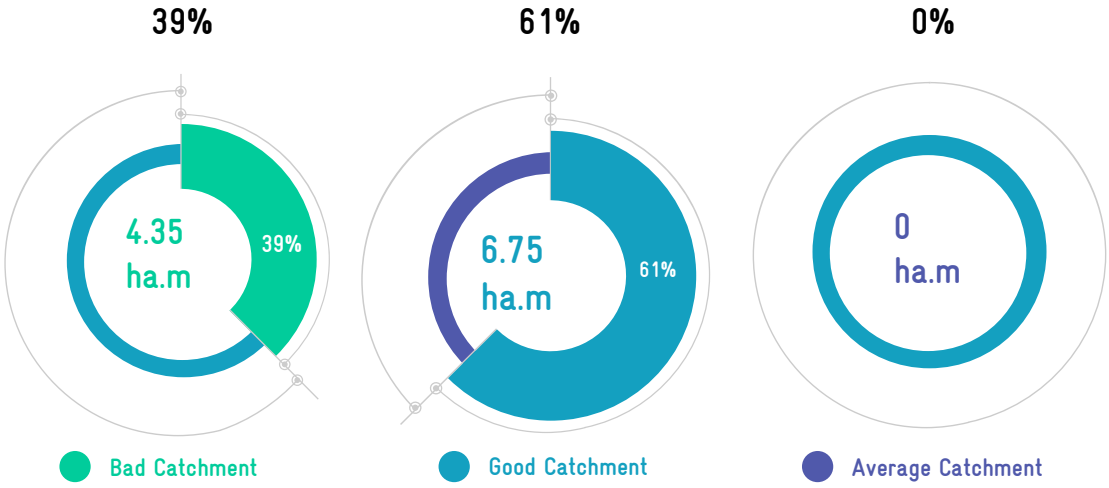


Figure 8.8. Expected run off conservation after treatment in Koravalli GP

Table 49 shows the detailed perspective plan and estimates of the work, budget, and person-days for three years from 2021-2022 to 2023-2024 in the Koravalli GP. Since it is a vulnerable village, attention was given to include appropriate works to improve the common and public land development.

TABLE 49. PERSPECTIVE PLAN OF KORAVALLI 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	Lower ridge	17.76	152.74	59,389.44
Contour Continuous Bunds (CCB) for Afforestation area		71.04	1.78	710.4
Composting		9	1.53	135
Drainage Line Treatment (m)		0	0	0
Avenue plantation (km)		3	5.41	2,114
Block Plantation (Community)		0	0	0
Deepening of water bodies		12	24	2,400
Artificial Recharge Structure (No. of units)		12	30	4,692
Subtotal Water Action – I		**125**	**215**	**69,441**
CWRM Water Action 2: Agricultural and allied Sector development				
CWRM Water Action 2: Works in Lower Ridge				
Farm Bunding	Lower ridge	37	55.94	21,852
Micro Irrigation		6	6	0
Construction of farm ponds		9	18	7,029
Land development		12	117.1	45,739
Cattle Shelters		3	6.36	993
Goat Sheep Shelters		24	54.48	8,520
Fodder development for cattle		3	4.44	7,032
Azolla units		3	0.45	69
Cattle Trough		3	0.15	18
Poultry shed		8	0.72	80
Dry land Horticulture/Agro-forestry		19	161.5	63,099
Vermi Compost		3	0.54	81
Subtotal Water Action – II		**130**	**426**	**1,54,512**

CWRM Water Action 3: Rural Water Management				
CWRM Water Action 3: Works in Lower Ridge				
Soak pits (Community)	Lower ridge	15	1.95	300
Soak pits (Individual)		150	15	2,400
Roof rain Water Harvesting		2	8	1,250
Community Tanka (Rajasthan Model)		1	30	300
Subtotal Water Action – III		**168**	**54.95**	**4,250**
Total		**423**	**696**	**2,28,203**

Water actions

Regarding CWRM themes, of the total number of projects identified, 29.5 percent works are in public and common land, 30.7 percent in agriculture and allied sector while it is 39.7 percent under rural infrastructure. (Table 50).

TABLE 50. 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	125	215	69,441
Agriculture and Allied sector development	130	426	1,54,512
Rural water management	168	54.95	4,250
TOTAL	423	696	2,28,203

8.3.5 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 51). It is expected that the impacts will potentially reduce the vulnerability and improved the resilience of the system to the projected climatic change events and ensured water security.

TABLE 51. 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	13 water bodies restored
2	Area under afforestation	2	17.76 ha area under afforestation
3	Quantum of water harvested/recharge	3	11.1 ha.m surface runoff is harvested due to WASCA interventions
4	The proportion of land treated under WASCA	4	16 percent of the total area treated under WASCA (55.05 ha)
5	Drainage Line Treatment	5	Nil

13
TRADITIONAL WATER BODIES RESTORED

17.76 ha
AFFORESTATION

11.1 ha.m
RUNOFF HARVESTED

16 %
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	9 Farm ponds established
2	No structures were established for on-farm (in-situ) water harvesting in drylands	2	9 compost units for soil health improve-ment
3	Improvement in soil health	3	37.29 ha Farm bunding with trenches
4	Changes in the irrigation practices	4	19 ha under dryland horticulture
5	Dryland development with agro-forestry	5	3 vulnerable households established fodder plots
6	Households established fodder plots		

9
FARM PONDS

9
VERMI COMPOST

37.29 ha
FARM BUNDING

19 ha
DRYLAND HORTICULTURE

3
FODDER PLOTS

WASCA CWRM ACTION PLAN

DEVELOPMENT OF RURAL INFRASTRUCTURE

INDICATOR	
1	Number of villages having complete solid and liquid waste management systems
2	Greywater drains
3	Roof rainwater harvesting measures
4	Nutri gardens

OUTCOMES/ IMPACT	
1	15 common and 150 individual soak pits were established for recycling greywater benefiting 1502 households
2	2 common roof rainwater harvesting and storage

15 COMMUNITY &
150 INDIVIDUAL SOAK PITS

2
COMMON ROOF RAINWATER HARVESTING

Table 52 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 52. PROPOSAL FOR THE MGNREGS, KORAVALLI GP, MANDAPAM BLOCK

	No of works	No of person days
Perspective plan	423	2,28,203
Annual plan	169	91,281

8.3.6 PROPOSED ACTIVITY MAP

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

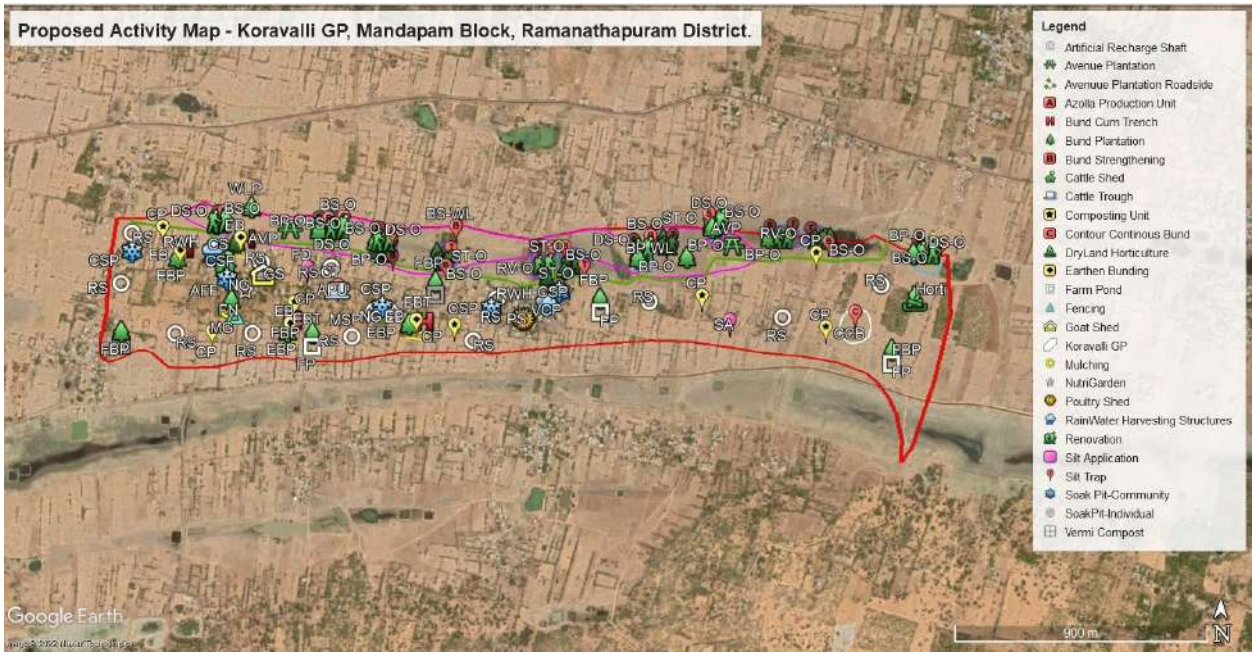
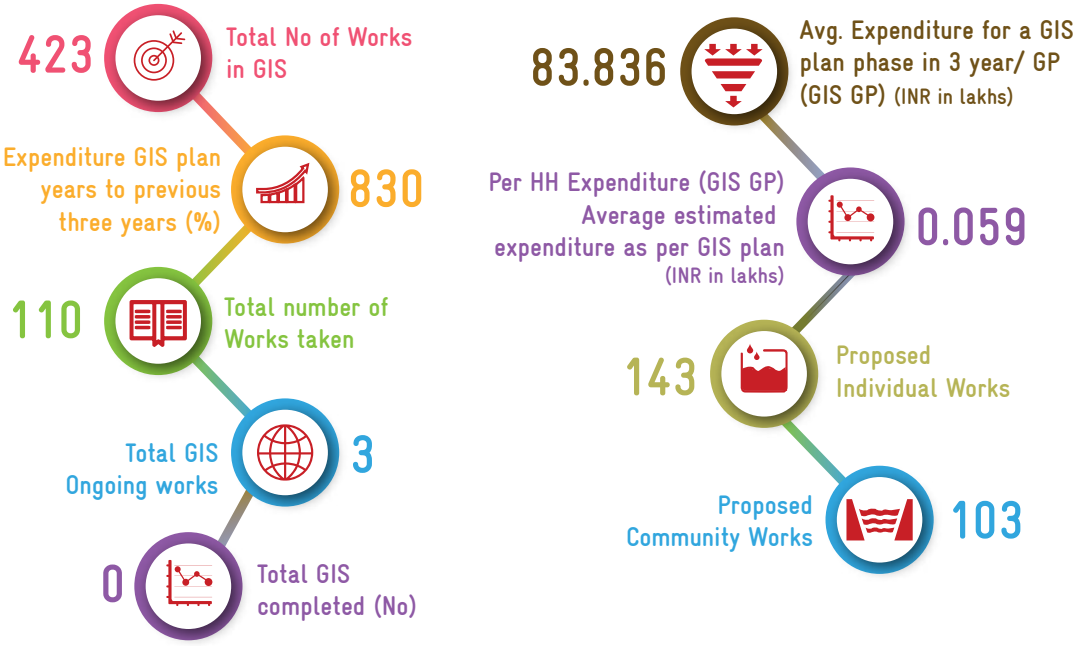


Figure 8.9. Proposed action plan of Koravalli GP

8.3.7 GIS PLAN IMPLEMENTATION AND KEY PARAMETERS

The GIS plan implementation and performance of Mandapam Block is represented in Table 53.

TABLE 53. 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

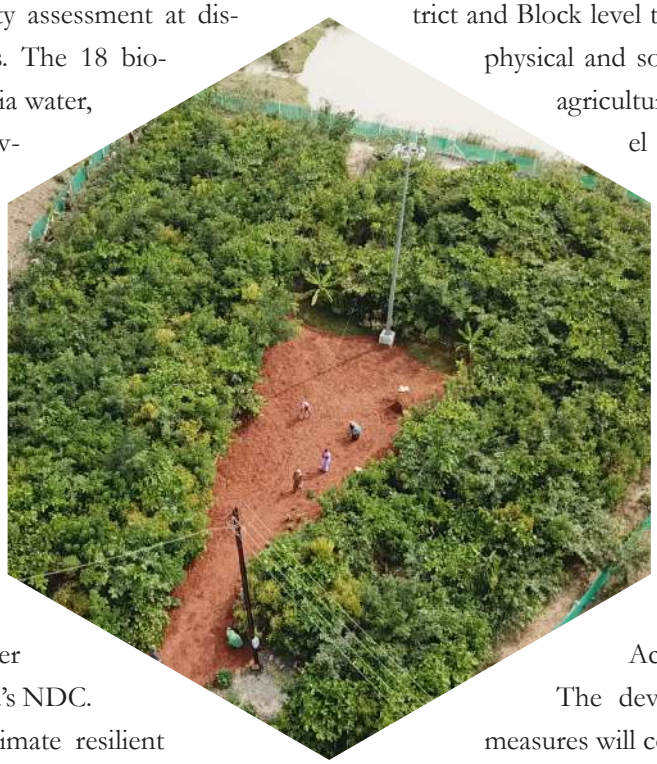
Thirukkural - 20

CHAPTER 9

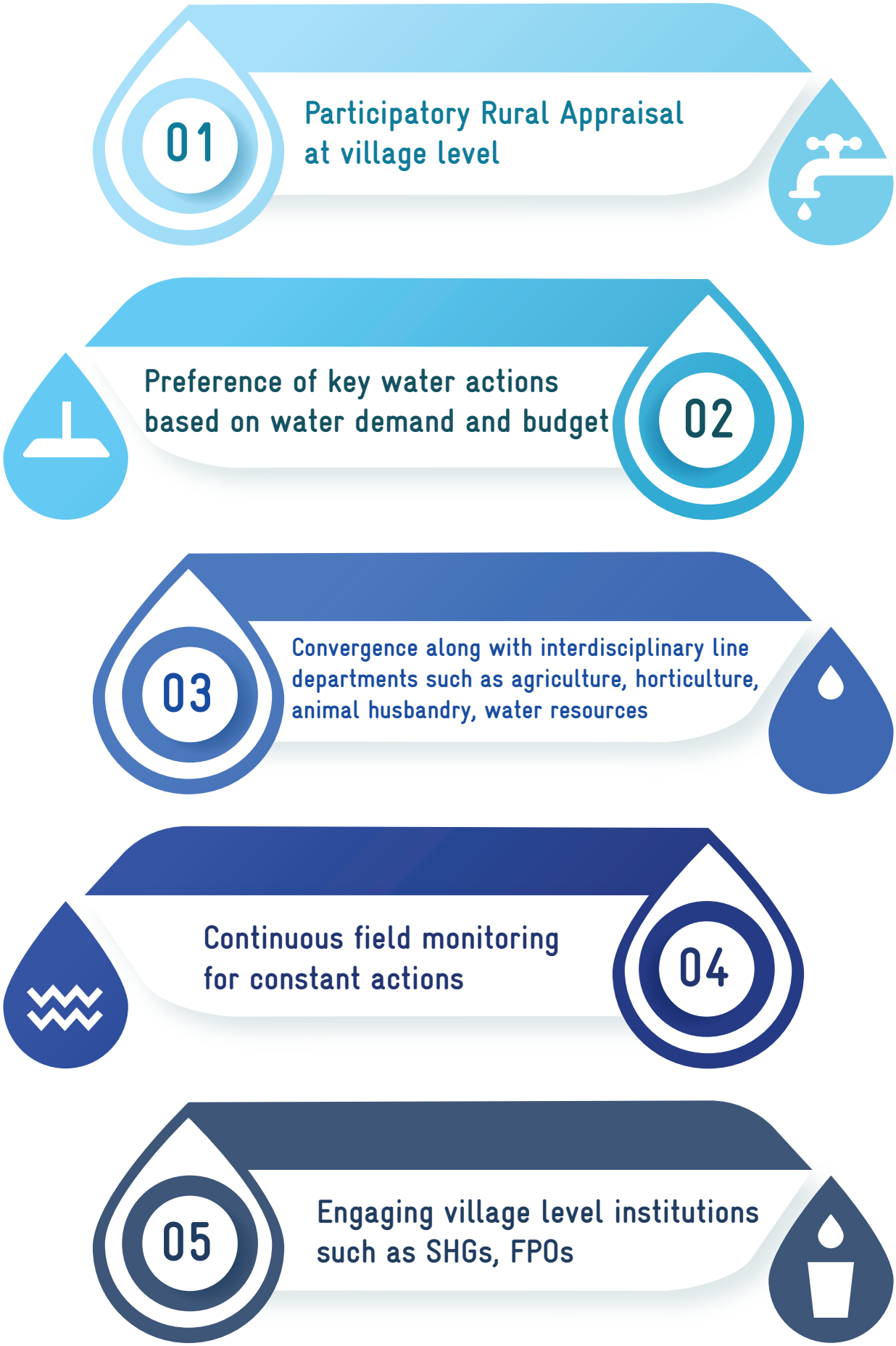
CONCLUSION

"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.)	Other Surface Water Bodies (No.)
Attangarai	-	-	-	500	2	12	-
Pudumadam	-	-	-	500	-	16	-
Keelanagachi	-	-	-	-	-	16	-
Enmanamkondan	-	-	-	-	1	13	-
Sattakkonvalasai	-	-	-	-	-	16	-
Kusavankudi	-	-	-	-	4	10	-
Valantaravai	-	-	-	-	-	28	-
Kumbaram	-	-	-	-	-	9	-
Alagangulam	7,000	-	-	3,500	1	19	-
Panikulam	-	-	-	-	-	14	-
Pirappanvalasai	-	-	-	-	-	12	-
Irumeni	-	-	-	-	-	10	-
Karan	5,400	-	-	1,500	-	21	-
Vallarioodai	2,773	1,781	-	1,000	1	8	-
Rettaiyurani	-	-	-	-	-	15	-
Koravati	3,000	-	-	1,000	-	12	-
Tamaraikulam	1,000	-	-	500	-	14	-
Marakayarpattinam	-	-	-	500	-	20	-
Vadalai	1,500	-	-	500	-	15	-
Nochiyurani	2,800	-	-	500	-	23	-
Manakudi	-	-	-	500	2	4	-
Pamban	-	-	-	500	-	4	-
Thangachimdam	-	-	-	500	-	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.)	Other Surface Water Bodies (No.)
Perungulam	-	-	-	-	-	8	-
Sambadaiyarkulam	-	-	-	-	-	13	-
Terbhogi	1,000	1,500	-	5,000	1	11	-
Puduvalasai	-	-	-	-	-	9	-
Pattinamkathan	-	-	-	-	-	12	-

Gram Panchayat	Irrigation Facilities (ha)			Catchment Area wise Available Runoff (ha.m)			Watershed and Drainage Networks		
	Tank Irrigation	Canal 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.)
Attangarai	125.30	-	-	70.50	10.00	49.80	-	-	4
Pudumadam	107.08	-	-	86.10	2.60	43.10	-	-	4
Keelanagachi	-	-	145.13	51.00	55.40	45.30	1,196.30	1	4
Enmanamkondan	207.83	-	-	19.20	1.90	43.50	-	-	3
Sattakkonvalasai	-	-	176.35	57.40	60.50	81.70	1,597.98	1	6
Kusavankudi	-	-	-	23.80	-	87.50	-	-	6
Valantaravai	296.06	-	-	83.40	88.30	82.30	-	-	7
Kumbaram	-	-	-	32.10	5.90	32.20	-	-	3
Alagangulam	-	258.00	-	74.50	8.70	86.40	-	-	5
Panikulam	-	258.00	-	74.50	8.70	86.40	738.28	1	7
Pirappanvalasai	150.00	-	-	18.80	1.20	62.60	-	-	5
Irumeni	167.00	-	-	12.50	0.80	41.70	-	-	5
Karan	97.52	-	25.34	52.80	18.50	48.80	-	-	8
Vallarioodai	61.44	-	36.00	31.00	10.80	28.60	-	-	3
Rettaiyurani	50.00	-	-	44.80	-	39.90	-	-	3
Koravati	81.00	-	30.00	28.00	-	24.90	-	-	2
Tamaraikulam	-	24.30	-	39.20	-	34.90	-	-	6
Marakayarpattinam	106.60	-	-	34.20	1.30	20.20	-	-	2
Vadalai	604.08	-	-	194.10	7.50	114.20	-	-	6
Nochiyurani	-	10.11	-	48.10	39.10	28.00	-	-	5
Manakudi	-	-	33.06	42.60	34.60	24.80	-	-	4
Pamban	278.07	-	-	44.80	9.80	93.20	-	-	1
Thangachimdam	648.83	-	-	104.60	22.80	217.50	-	-	1
Perungulam	216.02	-	12.14	51.20	10.20	33.60	-	-	6
Sambadaiyarkulam	144.02	-	-	34.10	6.80	22.40	-	-	2

Gram Panchayat	Irrigation Facilities (ha)			Catchment Area wise Available Runoff (ha.m)			Watershed and Drainage Networks		
	Tank Irrigation	Canal 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.)
Terbhogi	63.49	-	39.74	46.90	33.10	37.80	-	-	5
Puduvalasai	10.11	-	-	20.10	14.20	16.20	-	-	4
Pattinamkathan	20.11	-	48.50	33.40	-	54.50	-	-	8

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 (%)
Attangarai	6.98	0.47	219.64	90	47	-	10	53	100
Pudumadam	23.98	0.87	171.08	99	86	-	1	14	100
Keelanagachi	10.07	1.02	176.60	100	58	100	-	42	-
Enmanamkondan	19.67	2.25	159.95	100	41	-	-	59	100
Sattakkonvalasai	7.18	0.66	353.36	100	33	100	-	67	-
Kusavankudi	4.82	1.01	214.61	100	77	-	-	23	100
Valantaravai	20.53	1.78	389.76	100	81	-	-	19	100
Kumbaram	5.79	0.52	233.53	100	75	-	-	25	100
Alagangulam	42.36	2.96	70.87	100	68	-	-	32	100
Panikulam	42.36	1.01	70.87	100	30	-	-	70	100
Pirappanvalasai	12.06	2.00	199.56	91	24	-	9	76	100
Irumeni	12.06	1.34	199.56	97	24	-	3	76	100
Karan	9.36	0.70	245.94	98	80	21	2	20	79
Vallarioodai	9.36	0.41	245.94	98	80	37	2	20	63
Rettaiyurani	16.18	0.75	622.94	98	78	-	2	22	100
Koravati	16.18	0.47	622.94	100	78	27	-	22	73
Tamaraikulam	16.18	0.65	621.39	98	78	-	2	22	100
Marakayarpattinam	20.67	0.39	92.10	100	80	-	-	20	100
Vadalai	20.67	2.20	92.10	100	80	-	-	20	100
Nochiyurani	6.69	0.61	141.50	100	70	-	-	30	100
Manakudi	6.69	0.54	141.50	100	70	100	-	30	-
Pamban	23.33	1.61	87.25	100	74	-	-	26	100
Thangachimdam	23.33	3.76	87.25	100	74	-	-	26	100
Perungulam	14.65	0.93	3.62	94	77	5	6	23	95
Sambadaiyarkulam	14.65	0.61	3.62	91	77	-	9	23	100
Terbhogi	17.00	2.62	167.25	91	39	38	9	61	62

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 (%)
Puduvalasai	17.00	1.12	167.25	97	39	-	3	61	100
Pattinamkathan	48.18	2.31	133.49	100	77	71	-	23	29

ANNEXURE 3.8

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

Gram Panchayat	Location	Latitude	Longitude	Well type	pH	Salinity	EC (µS/cm)	TDS (ppm)	TA (mg/l)
Alagankulam	Alagankulam	E 78° 57' 58.761"	N 9° 21' 10.923"	Open well	7.38	-	878	532	375
Attangarai	Attangarai	E 78° 59' 40.048"	N 9° 20' 56.287"	Open well	6.83	-	1,795	1,096	297
Enmankondaan	Uchipuli	E 79° 0' 54.065"	N 9° 18' 36.486"	Open well	7	-	902	551	308
Kuyavankudi	Kusavankudi	E 78° 53' 11.994"	N 9° 20' 19.734"	Open well	7.78	-	3,430	2,015	452
Mandapam	Madapam	E 79° 9' 0.853"	N 9° 17' 8.633"	Open well	6.79	-	645	402	292
Mandapam	Mandapam (Near Sea Park)	E 79° 10' 41.887"	N 9° 16' 53.594"	Open well	6.78	-	1,104	698	290
Mandapam	Mandapam Camp	E 79° 9' 13.843"	N 9° 17' 12.856"	Open well	6.63	-	9,680	6,010	276
Mandapam	Mandapam South	E 79° 9' 6.205"	N 9° 16' 40.577"	Open well	6.96	-	10,880	5,440	305
Marakayarpattinam	Marakayarpattinam	E 79° 7' 46.027"	N 9° 16' 23.862"	Open well	6.38	-	9,060	4,620	255
Marakayarpattinam	Marakayarpattinam shore	E 79° 7' 36.232"	N 9° 16' 16.99"	Open well	7.09	-	587	325	315
Marakayarpattinam	Meenavarkuddiruppu	E 79° 7' 47.482"	N 9° 16' 59.484"	Open well	6.3	4	12,880	7,400	246
Nochiyurani	Nochiyurani	E 79° 2' 17.758"	N 9° 16' 31.49"	Bore well	7.82	-	7,275	4,650	458
Nochiyurani	Nochiyurani Near	E 79° 1' 42.11"	N 9° 16' 52.248"	Open well	8.05	2.00	11,600	6,410	476
Pamban	Akkalmadam North	E 79° 13' 44.205"	N 9° 17' 8.71"	Open well	6.99	-	1,186	679	307
Pamban	Kunthukal	E 79° 13' 26.484"	N 9° 15' 39.877"	Open well	7.43	-	3,055	1,709	393
Pamban	Kunthukal farm	E 79° 13' 46.476"	N 9° 15' 58.346"	Bore well	7.54	-	607	363	407
Pamban	Pamban North	E 79° 13' 10.307"	N 9° 17' 4.833"	Open well	7.23	-	1,925	1,162	336
Pamban	Pamban South	E 79° 12' 54.615"	N 9° 16' 57.233"	Open well	6.78	-	3,978	2,486	290
Panaikulam	Panaikulam	E 78° 56' 54.856"	N 9° 21' 59.729"	Open well	7.14	-	988	593	323
Pattinamkathan	Pattinamkattan	E 78° 53' 46.388"	N 9° 19' 35.342"	Open well	7.63	-	16,450	9,940	427
Pirappanvalasai	Pirappanvalasai	E 79° 2' 34.404"	N 9° 17' 42.043"	Open well	6.82	-	1,380	789	294
Pudhumadam	Indhiranagar	E 78° 55' 20.491"	N 9° 15' 52.441"	Open well	7.5	-	1,048	671	400
Pudhumadam	Pudhumadam	E 78° 59' 48.901"	N 9° 16' 22.919"	Open well	7.25	-	691	412	344
Pudhuvalasai	Pudhuvalasai	E 78° 56' 19.639"	N 9° 23' 1.335"	Open well	7.16	-	1,726	963	329
Pudumadam	Puduadam North	E 78° 59' 56.727"	N 9° 17' 9.185"	Open well	6.83	-	1,628	1,003	264

Gram Panchayat	Location	Latitude	Longitude	Well type	pH	Salinity	EC (µS/cm)	TDS (ppm)	TA (mg/l)
Rameshwaram	Dhanushkodi	E 79° 25' 11.068"	N 9° 10' 34.46"	Open well	7.07	-	1,704	953	314
Rameshwaram	Erakadu	E 79° 17' 41.974"	N 9° 17' 30.062"	Open well	6.82	-	3,409	2,108	294
Rameshwaram	Natarajapuram	E 79° 18' 20.513"	N 9° 15' 18.85"	Open well	6.85	-	1,327	804	298
Rameshwaram	Olaikudda	E 79° 19' 44.161"	N 9° 18' 14.603"	Open well	7	-	3,192	1,995	308
Rameshwaram	Olaikudda Light House	E 79° 19' 51.124"	N 9° 19' 2.996"	Open well	6.65	2.00	3,088	1,968	276
Rameshwaram	Ramarpatham	E 79° 18' 25.666"	N 9° 18' 1.319"	Open well	6.82	-	2,655	1,705	295
Rameshwaram	Rameswaram	E 79° 18' 41.159"	N 9° 17' 31.855"	Open well	6.82	-	2,933	1,864	295
Rameshwaram	Rameswaram South	E 79° 18' 44.536"	N 9° 16' 37.477"	Open well	6.61	-	2,507	1,455	274
Rameshwaram	Rameswarm	E 79° 18' 44.413"	N 9° 16' 47.632"	Bore well	7.69	-	1,531	963	437
Rettaiyurani	Rettaiyurani	E 78° 58' 11.764"	N 9° 17' 41.181"	Open well	6.73	-	1,512	898	284
Sattakonvalasai	Ariyaman Beach	E 79° 4' 7.615"	N 9° 17' 51.133"	Open well	6.95	-	5,840	3,720	304
Sattakonvalasai	Seeniappadhurga	E 79° 4' 15.593"	N 9° 15' 56.491"	Open well	7.25	-	819	510	344
Sattakonvalasai	TM Kuddiruppu	E 79° 4' 27.721"	N 9° 17' 5.953"	Bore well	6.86	-	877	538	300
Thangachimadam	Ariyakundu	E 79° 16' 54.152"	N 9° 17' 44.038"	Open well	7.42	-	2,354	1,480	391
Thangachimadam	Ayyanthoppu	E 79° 14' 11.418"	N 9° 16' 30.205"	Open well	7.04	-	764	465	312
Thangachimadam	Semmamadam	E 79° 17' 10.446"	N 9° 17' 0.511"	Open well	6.85	-	1,327	824	298
Thangachimadam	Thangachi madam	E 79° 15' 38.047"	N 9° 17' 3.843"	Open well	7.32	-	1,302	826	359
Thangachimadam	Thangachi madam North	E 79° 14' 57.035"	N 9° 17' 5.154"	Open well	7.62	-	1,280	781	424
Thangachimadam	Thangachimadam south	E 79° 15' 19.388"	N 9° 17' 1.554"	Open well	7.61	-	1,414	825	418
Therbhogi	Terbhogi	E 78° 55' 20.096"	N 9° 23' 29.328"	Open well	7.46	-	1,612	963	319
Valantharavai	Pandiyanagar (Valuthur)	E 78° 55' 19.841"	N 9° 19' 16.41"	Open well	6.83	-	520	302	296
Vedalai	Kunjarvalasai	E 79° 5' 25.685"	N 9° 16' 36.48"	Open well	7.07	-	589	314	314
Vedalai	Vedalai	E 79° 6' 30.391"	N 9° 16' 5.315"	Open well	6.7	-	2,540	1,470	280

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
Alagankulam	95	244	105	48	27	156	2	38	204	14	68.70	0.21
Attangarai	76	193	280	200	22	231	2	27	590	19	130.40	0.35
Enmankondaan	59	230	420	80	179	107	18	17	546	15	125.20	0.31
Kuyavankudi	106	314	409	187	105	607	5	16	1,044	7	232.10	0.63
Mandapam	98	155	77	35	20	89	9	31	114	11	49.70	0.14
Mandapam	101	163	474	217	121	235	8	26	463	6	129.80	0.32
Mandapam	84	154	1,154	528	295	1,380	11	22	2,160	2	561.30	1.35
Mandapam	69	198	1,297	593	332	652	34	53	2,556	42	546.90	1.33
Marakayarpattinam	63	166	1,080	494	277	686	37	35	2,856	28	516.00	1.41
Marakayarpattinam	66	235	200	120	67	100	6	11	224	9	72.10	0.15
Marakayarpattinam	57	160	1,535	702	393	856	34	14	3,637	24	714.10	1.74
Nochiyurani	116	305	2,684	1,120	623	436	12	97	2,381	56	611.20	1.35
Nochiyurani	95	359	180	40	45	486	11	24	821	8	330.70	0.52
Pamban	69	200	230	200	22	65	13	27	432	10	93.80	0.24
Pamban	111	255	364	166	93	287	18	38	724	11	177.00	0.45
Pamban	99	274	72	33	19	123	7	14	179	10	54.60	0.14
Pamban	96	218	229	105	59	352	10	29	452	4	129.10	0.35
Pamban	94	175	474	217	121	563	19	129	1,182	54	275.70	0.90
Panaikulam	94	210	250	120	22	121	6	51	186	17	73.70	0.21
Pattinamkathan	85	306	1,961	896	502	908	15	37	3,871	26	861.50	1.91
Pirappanvalasai	69	191	450	120	112	146	7	33	456	15	118.10	0.30
Pudhumadam	96	262	372	184	75	189	12	13	358	3	105.70	0.23
Pudhumadam	84	224	281	134	48	186	6	12	450	9	93.10	0.26
Pudhuvalasai	69	244	310	80	179	75	11	37	472	20	133.70	0.31
Pudumadam	78	132	268	102	58	268	5	46	483	8	120.60	0.37
Rameshwaram	56	241	400	40	67	204	34	34	428	21	112.10	0.30
Rameshwaram	35	241	480	400	22	668	26	24	863	10	228.60	0.58
Rameshwaram	58	224	158	72	41	173	14	27	316	20	92.40	0.23

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
Rameshwaram	84	200	320	80	202	493	11	33	842	1	221.10	0.58
Rameshwaram	89	165	384	92	189	603	2	28	1,027	1	236.60	0.67
Rameshwaram	48	222	340	84	160	363	19	22	817	1	191.80	0.50
Rameshwaram	69	192	305	79	188	451	13	35	820	1	209.20	0.56
Rameshwaram	85	156	450	40	134	218	25	45	597	16	154.00	0.41
Rameshwaram	121	284	183	83	47	201	1	44	367	9	108.90	0.30
Rettaiyurani	96	155	186	78	34	99	2	38	356	14	90.50	0.25
Sattakonvalasai	89	198	696	318	178	426	2	51	1,463	24	336.70	0.82
Sattakonvalasai	66	254	240	80	134	55	1	6	380	10	96.90	0.20
Sattakonvalasai	95	195	400	120	112	111	5	11	456	8	104.70	0.25
Thangachimadam	107	254	281	128	72	286	9	16	675	3	154.50	0.39
Thangachimadam	96	188	91	42	23	124	10	52	169	21	62.90	0.21
Thangachimadam	58	224	158	72	41	242	3	51	401	5	100.50	0.33
Thangachimadam	69	263	318	166	55	56	13	53	520	4	108.80	0.33
Thangachimadam	92	291	321	185	43	47	10	19	467	5	101.00	0.24
Thangachimadam	97	284	169	77	43	183	21	34	433	16	103.60	0.29
Therbhogi	71	211	244	126	46	111	1	19	295	14	96.40	0.19
Valantharavai	94	186	122	32	53	36	4	28	85	9	47.10	0.11
Vedalai	88	187	70	32	18	111	11	14	176	6	50.30	0.13
Vedalai	68	182	303	138	78	363	12	6	772	13	168.80	0.43

ANNEXURE 3.9

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

Gram Panchayat	Location	Latitude	Longitude	Well type	pH	Salinity	EC (µS/cm)	TDS (ppm)	TA (mg/l)
Alagankulam	Alagankulam	E 78° 57' 58.761"	N 9° 21' 10.923"	Open well	7.04	-	895	555	261
Attangarai	Attangarai	E 78° 59' 40.048"	N 9° 20' 56.287"	Open well	7.14	-	531	329	148
Enmankondaan	Uchipuli	E 79° 0' 54.065"	N 9° 18' 36.486"	Open well	6.85	-	1,380	856	238
Kuyavankudi	Kusavankudi	E 78° 53' 11.994"	N 9° 20' 19.734"	Open well	7.01	-	314	195	82
Mandapam	Madapam	E 79° 9' 0.853"	N 9° 17' 8.633"	Open well	6.93	-	784	486	173
Mandapam	Mandapam (Near Sea Park)	E 79° 10' 41.887"	N 9° 16' 53.594"	Open well	6.98	-	926	574	210
Mandapam	Mandapam Camp	E 79° 9' 13.843"	N 9° 17' 12.856"	Open well	6.91	-	3,518	2,181	297
Mandapam	Mandapam South	E 79° 9' 6.205"	N 9° 16' 40.577"	Open well	6.82	-	1,731	1,073	382
Marakayarpattinam	Marakayarpattinam	E 79° 7' 46.027"	N 9° 16' 23.862"	Open well	6.63	1	12,100	7,502	782
Marakayarpattinam	Marakayarpattinam shore	E 79° 7' 36.232"	N 9° 16' 16.99"	Open well	6.98	-	590	366	127
Marakayarpattinam	Meenavarkuddiruppu	E 79° 7' 47.482"	N 9° 16' 59.484"	Open well	6.41	4	13,500	8,370	893
Nochiyurani	Nochiyurani	E 79° 2' 17.758"	N 9° 16' 31.49"	Bore well	6.70	-	916	568	197
Nochiyurani	Nochiyurani Near	E 79° 1' 42.11"	N 9° 16' 52.248"	Open well	7.26	-	322	200	97
Pamban	Akkalmadam North	E 79° 13' 44.205"	N 9° 17' 8.71"	Open well	7.09	-	902	559	184
Pamban	Kunthukal	E 79° 13' 26.484"	N 9° 15' 39.877"	Open well	6.84	-	1,902	1,179	277
Pamban	Kunthukal farm	E 79° 13' 46.476"	N 9° 15' 58.346"	Bore well	6.83	-	3,246	2,013	342
Pamban	Pamban North	E 79° 13' 10.307"	N 9° 17' 4.833"	Open well	7.34	-	1,134	703	262
Pamban	Pamban South	E 79° 12' 54.615"	N 9° 16' 57.233"	Open well	6.97	-	3,245	2,012	768
Panaikulam	Panaikulam	E 78° 56' 54.856"	N 9° 21' 59.729"	Open well	7.24	-	509	316	146
Pattinamkathan	Pattinamkattan	E 78° 53' 46.388"	N 9° 19' 35.342"	Open well	7.35	-	2,011	1,247	533
Pirappanvalasai	Pirappanvalasai	E 79° 2' 34.404"	N 9° 17' 42.043"	Open well	6.74	-	791	490	184
Pudhumadam	Indhiranagar	E 78° 55' 20.491"	N 9° 15' 52.441"	Open well	7.32	-	946	587	249
Pudhumadam	Pudhumadam	E 78° 59' 48.901"	N 9° 16' 22.919"	Open well	6.98	-	1,061	658	274
Pudhuvalasai	Pudhuvalasai	E 78° 56' 19.639"	N 9° 23' 1.335"	Open well	6.91	-	887	550	175
Pudumadam	Puduadam North	E 78° 59' 56.727"	N 9° 17' 9.185"	Open well	7.00	4	9,990	6,194	1,015

Gram Panchayat	Location	Latitude	Longitude	Well type	pH	Salinity	EC (µS/cm)	TDS (ppm)	TA (mg/l)
Rameshwaram	Dhanushkodi	E 79° 25' 11.068"	N 9° 10' 34.46"	Open well	7.09	-	1,376	853	173
Rameshwaram	Erakadu	E 79° 17' 41.974"	N 9° 17' 30.062"	Open well	6.96	-	2,564	1,590	352
Rameshwaram	Natarajapuram	E 79° 18' 20.513"	N 9° 15' 18.85"	Open well	7.05	-	1,354	839	317
Rameshwaram	Olaikudda	E 79° 19' 44.161"	N 9° 18' 14.603"	Open well	6.86	-	1,645	1,020	356
Rameshwaram	Olaikudda Light House	E 79° 19' 51.124"	N 9° 19' 2.996"	Open well	7.04	-	2,430	1,507	337
Rameshwaram	Ramarpatham	E 79° 18' 25.666"	N 9° 18' 1.319"	Open well	7.07	-	1,732	1,074	345
Rameshwaram	Rameswaram	E 79° 18' 41.159"	N 9° 17' 31.855"	Open well	7.13	-	1,932	1,198	331
Rameshwaram	Rameswaram South	E 79° 18' 44.536"	N 9° 16' 37.477"	Open well	7.04	-	2,254	1,397	351
Rameshwaram	Rameswarm	E 79° 18' 44.413"	N 9° 16' 47.632"	Bore well	7.52	-	1,231	763	272
Rettaiyurani	Rettaiyurani	E 78° 58' 11.764"	N 9° 17' 41.181"	Open well	7.35	-	953	591	233
Sattakonvalasai	Ariyaman Beach	E 79° 4' 7.615"	N 9° 17' 51.133"	Open well	6.75	2	8,760	5,431	578
Sattakonvalasai	Seeniappadhurga	E 79° 4' 15.593"	N 9° 15' 56.491"	Open well	6.93	-	769	476	186
Sattakonvalasai	TM Kuddiruppu	E 79° 4' 27.721"	N 9° 17' 5.953"	Bore well	7.24	-	778	482	195
Thangachimadam	Ariyakundu	E 79° 16' 54.152"	N 9° 17' 44.038"	Open well	7.27	-	1,426	884	282
Thangachimadam	Ayyanthoppu	E 79° 14' 11.418"	N 9° 16' 30.205"	Open well	7.17	-	590	366	153
Thangachimadam	Semmamadam	E 79° 17' 10.446"	N 9° 17' 0.511"	Open well	6.73	-	1,164	722	241
Thangachimadam	Thangachi madam	E 79° 15' 38.047"	N 9° 17' 3.843"	Open well	7.58	-	646	401	174
Thangachimadam	Thangachi madam North	E 79° 14' 57.035"	N 9° 17' 5.154"	Open well	7.45	-	896	556	229
Thangachimadam	Thangachimadam south	E 79° 15' 19.388"	N 9° 17' 1.554"	Open well	6.90	-	1,276	791	195
Therbhogi	Terbhogi	E 78° 55' 20.096"	N 9° 23' 29.328"	Open well	6.70	-	2,182	1,353	291
Valantharavai	Pandiyanagar (Valuthur)	E 78° 55' 19.841"	N 9° 19' 16.41"	Open well	7.64	-	324	201	87
Vedalai	Kunjarvalasai	E 79° 5' 25.685"	N 9° 16' 36.48"	Open well	7.09	-	356	221	96
Vedalai	Vedalai	E 79° 6' 30.391"	N 9° 16' 5.315"	Open well	6.67	-	3,067	1,902	237

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
Alagankulam	56	176	81	38	31	43	6	37	88	6	52.10	0.24
Attangarai	16	116	37	19	9	29	3	24	31	9	33.30	0.27
Enmankondaan	47	173	118	57	43	64	14	87	136	10	74.70	0.26
Kuyavankudi	6	73	39	18	11	16	4	16	33	8	27.70	0.65
Mandapam	11	162	78	25	37	34	7	52	70	4	48.40	0.18
Mandapam	36	158	71	31	26	48	12	42	114	10	54.50	0.34
Mandapam	70	214	267	138	116	187	62	86	291	26	167.70	1.65
Mandapam	25	342	141	58	69	86	13	101	187	11	93.50	0.86
Marakayarpattinam	173	604	878	397	467	589	97	226	1,868	110	605.50	1.90
Marakayarpattinam	8	96	53	26	17	31	4	16	86	6	39.40	0.16
Marakayarpattinam	194	689	763	386	359	567	114	214	1,359	127	578.10	1.79
Nochiyurani	40	137	68	26	29	43	4	33	97	15	52.80	0.53
Nochiyurani	17	69	39	16	12	16	3	7	31	4	26.70	0.52
Pamban	24	146	89	36	42	48	6	81	83	14	58.60	0.18
Pamban	86	182	148	59	73	96	18	128	182	11	100.10	0.51
Pamban	47	278	277	136	124	156	38	136	316	21	162.90	0.42
Pamban	26	223	99	48	32	42	8	49	96	6	59.80	0.46
Pamban	49	296	336	176	143	156	73	144	346	34	178.50	0.89
Panaikulam	18	122	45	16	15	32	5	18	46	10	35.30	0.16
Pattinamkathan	98	416	154	62	76	92	21	106	167	27	105.50	1.11
Pirappanvalasai	41	143	73	23	38	36	8	33	86	13	50.60	0.23
Pudhumadam	42	193	79	37	29	72	10	43	111	15	59.10	0.29
Pudhumadam	46	212	91	32	44	56	8	53	116	13	63.00	0.30
Pudhuvalasai	32	121	51	18	25	28	18	32	52	1.36	44.70	0.13
Pudumadam	223	765	700	386	296	479	108	209	981	63	446.50	0.99
Rameshwaram	12	149	143	75	54	93	36	91	218	26	91.70	0.40
Rameshwaram	126	212	195	86	92	128	24	113	243	19	128.20	0.92
Rameshwaram	29	273	113	59	41	68	13	66	136	7.36	72.80	0.31

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
Rameshwaram	96	246	141	51	73	79	11	85	153	15	89.30	0.66
Rameshwaram	106	216	166	66	84	126	23	107	204	24	120.00	0.82
Rameshwaram	87	246	134	72	46	82	19	83	149	21	89.00	0.52
Rameshwaram	28	288	155	73	68	105	21	121	148	26	102.80	0.65
Rameshwaram	88	243	159	83	61	126	21	149	327	28	123.80	0.53
Rameshwaram	18	247	106	43	51	65	8	65	125	7	74.50	0.33
Rettaiyurani	34	180	98	32	49	47	13	48	119	15	62.60	0.21
Sattakonvalasai	126	436	646	283	343	435	86	226	1,317	78	444.20	1.34
Sattakonvalasai	32	128	65	31	22	29	6	17	89	11	45.90	0.12
Sattakonvalasai	39	149	63	22	31	37	8	46	73	7	48.00	0.19
Thangachimadam	69	198	121	67	39	72	16	73	135	11	76.50	0.43
Thangachimadam	18	126	52	22	16	46	3	41	69	5	40.00	0.20
Thangachimadam	86	143	104	56	34	48	15	76	108	9	64.40	0.37
Thangachimadam	21	137	64	22	33	27	10	25	66	13	45.60	0.12
Thangachimadam	23	182	95	45	36	32	9	68	89	18	58.30	0.16
Thangachimadam	18	166	121	46	57	63	4	81	124	8	72.50	0.33
Therbhogi	61	213	152	78	63	95	21	93	196	11.88	104.60	0.30
Valantharavai	18	65	37	16	9	11	4	13	25	5	26.50	0.06
Vedalai	18	71	23	13	6	21	4	10	33	4	26.20	0.14
Vedalai	36	186	239	102	124	148	32	86	285	23	150.90	0.61

ANNEXURE 3.10

GP WISE STATUS OF AGRICULTURE RESOURCE

Gram Panchayat	Land Resources (ha)							
	Non-Agricultural Uses	Area under Barren & Un-cultivable Land	Land Under Miscellaneous Tree Critica-lops etc.	Cultivable Waste Land	Fallows Land other than Current Fallows	Current Fallow land	Unirrigated Land	Area Irrigated by Source
Attangarai	318.00	-	58.40	-	-	-	156.18	282.28
Pudumadam	387.97	-	15.35	-	-	-	272.65	107.08
Keelanagachi	230.00	-	325.35	-	-	-	253.66	145.13
Enmanamkondan	86.72	-	-	11.16	-	207.83	175.44	-
Sattakkonvalasai	258.92	-	354.90	-	-	1.00	541.75	176.35
Kusavankudi	107.49	-	-	0.26	-	398.88	371.09	-
Valantaravai	376.11	-	518.37	-	-	-	428.13	296.06
Kumbaram	144.75	-	34.60	-	-	8.67	148.80	125.56
Alagangulam	335.63	-	-	51.32	-	529.03	224.68	6.59
Panikulam	335.63	-	-	51.32	-	529.03	224.68	6.59
Pirappanvalasai	84.65	-	-	7.06	-	251.11	299.56	-
Irumeni	56.43	-	-	4.70	-	167.40	199.70	-
Karan	238.21	-	108.39	-	-	1.47	366.28	61.44
Vallarioodai	139.90	-	63.65	-	-	0.86	215.11	36.08
Rettaiyurani	202.00	-	-	-	-	49.30	171.19	130.44
Koravati	126.25	-	-	-	-	30.82	106.99	81.53
Tamaraikulam	176.75	-	-	-	-	43.14	149.79	114.14
Marakayarpattinam	153.42	0.94	-	7.76	-	106.60	70.86	-
Vadalai	869.40	5.32	-	43.99	-	604.08	401.55	-
Nochiyurani	216.77	-	229.17	-	-	-	208.79	37.29
Manakudi	192.23	-	203.30	-	-	-	185.46	33.07
Pamban	202.03	-	-	57.46	-	278.07	542.40	-

Gram Panchayat	Land Resources (ha)							
	Non-Agricultural Uses	Area under Barren & Un-cultivable Land	Land Under Miscellaneous Tree Criticalops etc.	Cultivable Waste Land	Fallows Land other than Current Fallows	Current Fallow land	Unirrigated Land	Area Irrigated by Source
Thangachimdam	471.39	-	-	134.07	-	648.83	1,265.62	-
Perungulam	230.76	-	60.00	-	1.24	36.90	41.50	216.02
Sambadaiyarkulam	153.84	-	40.00	-	0.82	24.60	27.67	144.02
Terbhogi	211.48	-	-	194.42	-	-	260.62	72.26
Puduvalasai	90.63	-	-	83.22	-	-	111.69	30.97
Pattinamkathan	150.78	-	-	-	54.31	326.60	79.10	20.11

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)
Attangarai	318.00	58.40	438.46	290.17	145.18	-	148.49	71.15
Pudumadam	387.97	15.35	379.73	152.84	91.54	54.60	121.05	50.03
Keelanagachi	230.00	325.35	398.79	111.81	171.89	70.12	56.67	119.93
Enmanamkondan	86.72	11.16	383.27	78.34	98.52	111.10	71.25	88.70
Sattakkonvalasai	258.92	354.90	719.10	193.01	537.34	-	100.60	252.76
Kusavankudi	107.49	0.26	769.97	247.98	113.30	66.67	125.42	89.20
Valantaravai	376.11	518.37	724.19	403.99	200.23	160.62	209.10	180.66
Kumbaram	144.75	34.60	283.03	143.19	163.45	160.60	71.50	162.03
Alagangulam	335.63	51.32	760.30	60.10	17.50	36.80	53.37	17.50
Panikulam	335.63	51.32	760.30	60.10	17.50	36.80	53.37	17.50
Pirappanvalasai	84.65	7.06	550.67	123.18	20.25	137.37	179.31	20.25
Irumeni	56.43	4.70	367.10	123.18	20.25	137.37	179.31	20.25
Karan	238.21	108.39	429.19	-	247.76	244.96	-	245.94
Vallarioodai	139.90	63.65	252.05	-	247.76	244.96	-	245.94
Rettaiyurani	202.00	-	350.93	323.39	485.59	439.56	161.82	461.12
Koravati	126.25	-	219.34	323.39	485.59	439.56	161.82	461.12
Tamaraikulam	176.75	-	307.07	333.50	473.40	439.00	167.80	453.59
Marakayarpattinam	154.36	7.76	177.46	183.20	-	-	92.10	-
Vadalai	874.72	43.99	1,005.63	183.20	-	-	92.10	-
Nochiyurani	216.77	229.17	246.08	1.22	142.83	139.30	0.66	140.84
Manakudi	192.23	203.30	218.53	1.22	142.83	139.30	0.66	140.84
Pamban	202.03	57.46	820.47	0.52	64.37	-	0.30	86.95
Thangachimdam	471.39	134.07	1,914.45	0.52	64.37	-	0.30	86.95
Perungulam	230.76	60.00	295.66	6.04	-	-	3.62	-
Sambadaiyarkulam	153.84	40.00	197.11	6.04	-	-	3.62	-

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)
Terbhogi	211.48	194.42	332.88	41.26	109.33	146.20	57.92	109.33
Puduvalasai	90.63	83.22	142.66	41.26	109.33	146.20	57.92	109.33
Pattinamkathan	150.78	-	480.12	28.79	91.89	118.49	41.60	91.89

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
Attangarai	-	99.16	0.84	-	-	0.84	9.24	89.08	-	0.84	68.00	32.00
Pudumadam	1.43	98.57	-	-	-	18.57	81.43	-	-	-	55.00	45.00
Keelanagachi	95.52	4.48	-	-	-	42.54	55.22	2.24	-	-	66.00	34.00
Enmanamkondan	34.38	65.63	-	-	-	3.13	53.13	43.75	-	-	56.00	44.00
Sattakkonvalasai	-	100.00	-	-	-	16.79	83.21	-	-	-	70.00	30.00
Kusavankudi	6.93	93.07	-	-	-	-	8.00	92.00	-	-	82.00	18.00
Valantaravai	-	100.00	-	-	-	24.70	75.30	-	-	-	58.00	42.00
Kumbaram	-	100.00	-	-	-	20.25	77.22	2.53	-	-	90.00	10.00
Alagangulam	35.96	21.35	41.57	-	1.12	31.46	-	-	44.94	23.60	70.00	30.00
Panikulam	35.96	21.35	41.57	-	1.12	31.46	-	-	44.94	23.60	70.00	30.00
Pirappanvalasai	30.00	60.59	9.41	-	-	1.17	-	16.37	68.42	14.04	53.00	47.00
Irumeni	30.00	60.59	9.41	-	-	1.17	-	16.37	68.42	14.04	53.00	47.00
Karan	-	100.00	-	-	-	39.86	54.05	6.08	-	-	83.00	17.00
Vallarioodai	-	100.00	-	-	-	39.86	54.05	6.08	-	-	83.00	17.00
Rettaiyurani	7.00	83.00	10.00	-	-	-	-	0.67	99.00	0.33	96.00	4.00
Koravati	7.00	83.00	10.00	-	-	-	-	0.67	99.00	0.33	96.00	4.00
Tamaraikulam	7.00	83.00	10.00	-	-	-	-	0.67	99.00	0.33	96.00	4.00
Marakayarpattinam	75.81	24.19	-	-	-	19.35	25.81	-	-	54.84	79.00	21.00
Vadalai	75.81	24.19	-	-	-	19.35	25.81	-	-	54.84	79.00	21.00
Nochiyurani	19.40	80.60	-	-	-	8.96	83.58	4.48	2.99	-	62.00	38.00
Manakudi	18.18	81.82	-	-	-	-	-	-	-	100.00	63.00	37.00
Pamban	12.50	38.54	25.26	3.91	19.79	38.54	25.78	22.14	13.54	-	63.00	37.00
Thangachimdam	12.50	38.54	25.26	3.91	19.79	38.54	25.78	22.14	13.54	-	63.00	37.00
Perungulam	14.29	85.71	-	-	-	-	-	57.14	28.57	14.29	66.00	34.00
Sambadaiyarkulam	-	87.50	12.50	-	-	-	-	4.17	79.17	16.67	69.00	31.00

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
Terbhogi	1.52	96.97	1.52	-	-	3.03	93.94	-	-	3.03	71.00	29.00
Puduvalasai	1.52	96.97	1.52	-	-	3.03	93.94	-	-	3.03	71.00	29.00
Pattinamkathan	75.00	25.00	-	-	-	50.00	50.00	-	-	-	71.00	29.00

Gram Panchayat	Status of Physical condition of the soil (%)								Soil Texture (%)			
	Mod-erately Acidic	Strongly Acidic	Highly Acidic	Mod-erately Acidic	Slighly Acidic	Neutral	Mod-erately Alkaline	Strongly Alkaline	Clay soil	Fine Soil	Coarse loamy	Soil Water Perme-ability (Low, Mod-erate, high)
Attangarai	-	-	-	96.69	1.65	-	1.65	-	-	55.00	0.49	Moderate
Pudumadam	-	-	84.29	11.43	-	-	4.29	-	-	82.00	5.04	Moderate
Keelanagachi	-	-	19.74	2.63	-	-	77.63	-	-	81.54	0.11	Moderate
Enmanamkondan	46.88	-	-	34.38	15.63	-	3.13	-	-	99.00	-	Moderate
Sattakkonvalasai	-	-	0.76	-	-	-	99.24	-	-	96.00	1.68	Moderate
Kusavankudi	-	-	-	33.66	56.44	-	9.90	-	-	96.00	-	Moderate
Valantaravai	-	-	44.58	0.60	8.43	-	45.18	1.20	-	90.00	-	Moderate
Kumbaram	-	-	15.19	84.81	-	-	-	-	-	97.00	-	Moderate
Alagangulam	-	-	-	40.91	6.82	-	52.27	-	-	58.00	0.65	Moderate
Panikulam	-	-	-	40.91	6.82	-	52.27	-	-	83.00	0.68	Moderate
Pirappanvalasai	-	1.75	69.01	29.24	-	-	-	-	-	95.00	3.87	Moderate
Irumeni	-	1.75	69.01	29.24	-	-	-	-	-	95.00	2.29	Moderate
Karan	-	-	0.68	22.30	74.32	-	2.70	-	-	84.00	0.62	Moderate
Vallarioodai	-	-	0.23	7.67	25.58	-	0.93	-	-	90.00	1.67	Moderate
Rettaiyurani	-	-	3.67	91.67	3.33	-	1.33	-	-	99.00	-	Moderate
Koravati	-	-	3.67	91.67	3.33	-	1.33	-	-	78.00	-	Moderate
Tamaraikulam	-	-	3.67	91.67	3.33	-	1.33	-	-	92.00	0.91	Moderate
Marakayarpattinam	-	-	-	-	-	4.84	93.55	1.61	-	71.00	3.80	Moderate
Vadalai	-	-	-	-	-	4.84	93.55	1.61	-	79.00	2.49	Moderate
Nochiyurani	-	-	-	-	1.49	-	98.51	-	-	77.00	3.18	Moderate
Manakudi	-	-	-	-	-	-	100.00	-	-	63.00	18.08	Moderate
Pamban	50.38	-	11.25	17.14	0.77	-	20.20	0.26	-	47.00	25.70	Moderate

Gram Panchayat	Status of Physical condition of the soil (%)								Soil Texture (%)			
	Mod-erately Acidic	Strongly Acidic	Highly Acidic	Mod-erately Acidic	Slighly Acidic	Neutral	Mod-erately Alkaline	Strongly Alkaline	Clay soil	Fine Soil	Coarse loamy	Soil Water Perme-ability (Low, Mod-erate, high)
Thangachimdam	50.38	-	11.25	17.14	0.77	-	20.20	0.26	-	52.00	15.09	Moderate
Perungulam	-	14.29	14.29	-	-	-	71.43	-	-	100.00	-	Moderate
Sambadaiyarkulam	-	-	4.17	79.17	-	-	16.67	-	-	100.00	-	Moderate
Terbhogi	-	-	-	-	-	-	100.00	-	-	70.00	-	Moderate
Puduvalasai	-	-	-	-	-	-	100.00	-	-	98.00	1.78	Moderate
Pattinamkathan	-	-	-	75.00	-	-	25.00	-	-	69.00	-	Moderate

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
Attangarai	17	84.47	259.36	60	40	100	-	60.00	251.00	404.00	462.00
Pudumadam	17	67.16	206.23	60	40	100	-	205.00	-	209.00	171.00
Keelanagachi	17	123.10	378.00	-	100	-	100	161.00	-	1,059.00	983.00
Enmanamkondan	17	67.05	91.58	9	91	100	-	252.00	2,066.00	1,415.00	1,351.00
Sattakkonvalasai	17	182.58	560.11	-	100	-	100	59.00	16.00	1,181.00	432.00
Kusavankudi	17	130.94	193.71	-	100	-	-	211.00	60.00	560.00	418.00
Valantaravai	17	211.24	648.62	60	40	100	-	394.00	50.00	835.00	601.00
Kumbaram	17	54.00	161.28	-	100	100	-	107.00	-	308.00	321.00
Alagangulam	17	137.98	120.72	0	100	100	-	548.00	1,169.00	1,298.00	2,415.00
Panikulam	17	137.98	120.72	8	92	100	-	84.00	1,049.00	786.00	328.00
Pirappanvalasai	17	94.81	156.37	77	23	100	-	130.00	3,038.00	1,079.00	1,280.00
Irumeni	17	63.21	104.24	58	42	100	-	87.00	2,026.00	720.00	854.00
Karan	17	91.39	279.85	74	26	79	21	154.00	-	329.00	349.00
Vallarioodai	17	53.67	164.35	67	33	63	37	90.00	-	194.00	205.00
Rettaiyurani	17	59.66	157.45	88	12	100	-	160.00	5.00	381.00	481.00
Koravati	17	37.29	98.41	60	40	73	27	100.00	3.00	238.00	301.00
Tamaraikulam	17	52.20	137.77	2	98	60	40	140.00	5.00	334.00	421.00
Marakayarpattinam	17	31.65	36.99	-	100	100	-	86.00	21.00	183.00	162.00
Vadalai	17	179.34	209.61	7	93	100	-	485.00	119.00	1,037.00	921.00
Nochiyurani	17	80.79	248.08	10	90	25	75	117.00	2.00	471.00	168.00
Manakudi	17	71.71	220.20	-	100	-	100	104.00	1.00	417.00	149.00
Pamban	17	149.25	283.13	100	-	100	-	325.00	104.00	-	1,493.00
Thangachimdam	17	348.25	660.65	100	-	100	-	759.00	243.00	-	3,485.00
Perungulam	17	60.46	165.75	67	33	95	5	194.00	42.00	431.00	431.00
Sambadaiyarkulam	17	40.31	110.50	79	21	100	-	129.00	28.00	287.00	154.00

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
Terbhogi	17	89.64	173.76	55	45	62	38	279.00	3,788.00	482.00	685.00
Puduvalasai	17	38.40	74.47	67	33	100	-	120.00	1,623.00	207.00	293.00
Pattinamkathan	17	81.62	51.79	32	68	29	71	487.00	572.00	637.00	990.00

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.)	Vulnerable popupation (No.)	Households (HH's) (No.)	Only one room HH's (SECC) (No.)	Female Headed HH's (SECC) (No.)
Attangarai	815	1,289	1,260	2,549	54	54	552	135	35
Pudumadam	783	4,454	4,306	8,760	85	85	1,988	106	104
Keelanagachi	954	1,853	1,825	3,678	26	26	961	228	40
Enmanamkondan	481	3,625	3,559	7,184	338	339	1,686	135	53
Sattakkonvalasai	1,333	1,295	1,328	2,623	51	51	636	228	40
Kusavankudi	878	871	891	1,762	758	758	425	45	54
Valantaravai	1,619	3,704	3,794	7,498	1,362	1,362	437	222	56
Kumbaram	462	1,082	1,032	2,114	-	-	541	141	74
Alagangulam	1,333	7,485	7,988	15,473	508	511	2,857	288	130
Panikulam	1,333	7,485	7,988	15,473	508	511	2,857	288	130
Pirappanvalasai	700	2,248	2,158	4,406	32	53	1,988	106	104
Irumeni	439	2,248	2,158	4,406	32	53	1,988	106	104
Karan	810	1,731	1,689	3,420	16	18	936	105	57
Vallarioodai	480	1,731	1,689	3,420	16	18	936	105	57
Rettaiyurani	734	2,966	2,943	5,909	199	299	1,480	307	99
Koravati	138	2,966	2,943	5,909	199	299	1,480	307	99
Tamaraikulam	551	2,966	2,943	5,909	199	299	1,480	307	99
Marakayarpattinam	185	3,857	3,676	7,551	83	104	1,490	222	49
Vadalai	1,251	3,857	3,676	7,551	83	104	1,490	222	49
Nochiyurani	695	1,223	1,220	2,443	58	58	595	66	27
Manakudi	606	1,223	1,220	2,443	58	58	595	66	27
Pamban	1,118	19,163	18,656	8,522	503	506	8,175	2,006	248
Thangachimdam	2,834	19,163	18,656	8,522	503	506	8,175	2,006	248

Gram Panchayat	Geographical Area (ha)	Male Population (No.)	Female Population (No.)	Total Population (No.)	SC Population (No.)	Vulnerable popupation (No.)	Households (HH's) (No.)	Only one room HH's (SECC) (No.)	Female Headed HH's (SECC) (No.)
Perungulam	566	2,658	2,695	5,353	27	27	1,189	199	107
Sambadaiyarkulam	382	2,658	2,695	5,353	27	27	1,189	199	107
Terbhogi	764	3,144	3,065	6,209	145	145	1,309	97	66
Puduvalasai	340	3,144	3,065	6,209	145	145	1,309	97	66
Pattinamkathan	1,274	8,984	8,617	17,601	1,335	1,339	3,891	98	97

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)
Attangarai	105	19	660	467	80	490	970	5
Pudumadam	105	5	1,297	774	1,079	1,418	1,518	16
Keelanagachi	172	18	1,148	804	257	432	172	7
Enmanamkondan	110	7	576	419	232	580	410	13
Sattakkonvalasai	172	27	710	554	134	320	310	5
Kusavankudi	48	11	539	376	76	250	325	3
Valantaravai	172	39	1,664	1,263	916	1,590	765	14
Kumbaram	121	22	591	448	324	467	243	4
Alagangulam	241	8	728	543	507	1,752	1,393	28
Panikulam	241	8	725	486	398	3,300	100	28
Pirappanvalasai	105	5	457	313	77	947	485	8
Irumeni	105	5	923	519	209	1,001	270	8
Karan	91	10	709	564	223	750	650	6
Vallarioodai	91	10	302	243	223	750	650	6
Rettaiyurani	245	17	910	793	456	1,331	750	11
Koravati	245	17	340	261	205	270	170	11
Tamaraikulam	245	17	706	544	404	1,280	942	11
Marakayarpattinam	170	11	189	135	178	210	220	14
Vadalai	170	11	949	706	266	3,547	61	14
Nochiyurani	54	9	408	297	88	175	109	4
Manakudi	54	9	565	476	328	474	476	4
Pamban	1,479	18	1,472	1,055	627	4,250	-	16
Thangachimdam	1,479	18	1,506	851	273	5,116	96	16
Perungulam	171	14	619	475	138	1,210	170	10
Sambadaiyarkulam	171	14	491	444	114	1,210	220	10
Terbhogi	88	7	673	578	107	807	1,057	11

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)
Puduvalasai	88	7	375	219	267	1,007	418	11
Pattinamkathan	98	3	1,119	709	1,074	3,890	1,200	32

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	Land Under Miscellaneous Tree Critica-lops etc.	Cultivable Waste Land	Fallows Land other than Current Fallows	Current Fallow land	Unirrigated Land	Treatment Area Irrigated by Source
Attangarai	51.49	-	49.64	-	-	-	29.67	53.63
Pudumadam	97.55	-	13.05	-	-	-	13.63	5.35
Keelanagachi	8.04	-	276.55	-	-	-	45.66	26.12
Enmanamkondan	1.48	-	-	9.49	-	14.55	12.28	-
Sattakkonvalasai	4.41	-	301.67	-	-	0.27	146.27	47.61
Kusavankudi	1.83	-	-	0.22	-	43.88	40.82	-
Valantaravai	10.36	-	440.61	-	-	-	166.97	115.46
Kumbaram	13.93	-	29.41	-	-	1.91	32.74	27.62
Alagangulam	26.43	-	-	43.62	-	42.32	17.97	0.53
Panikulam	26.43	-	-	43.62	-	42.32	17.97	0.53
Pirappanvalasai	1.44	-	-	6.00	-	12.56	14.98	-
Irumeni	0.96	-	-	4.00	-	8.37	9.99	-
Karan	4.05	-	92.13	-	-	0.56	139.18	23.35
Vallarioodai	12.75	-	54.11	-	-	0.33	81.74	13.71
Rettaiyurani	28.42	-	-	-	-	8.38	29.10	22.17
Koravati	17.76	-	-	-	-	5.24	18.19	13.86
Tamaraikulam	24.87	-	-	-	-	3.45	11.98	9.13
Marakayarpattinam	32.87	0.80	-	6.60	-	11.73	7.79	-
Vadalai	186.29	4.52	-	37.39	-	66.45	44.17	-
Nochiyurani	20.89	-	194.79	-	-	-	16.70	2.98
Manakudi	18.49	-	172.81	-	-	-	14.84	2.65
Pamban	3.44	-	-	48.84	-	50.05	97.63	-
Thangachimdam	8.02	-	-	113.96	-	116.79	227.81	-
Perungulam	38.00	-	51.00	-	0.17	5.17	5.81	30.24
Sambadaiyarkulam	25.33	-	34.00	-	0.12	3.44	3.87	20.16

Gram Panchayat	Non-Agricultural Uses	Barren & Un-cultivable 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
Terbhogi	15.52	-	-	165.26	-	-	18.24	5.06
Puduvalasai	6.66	-	-	70.74	-	-	7.82	2.17
Pattinamkathan	5.00	-	-	-	1.63	9.80	2.37	0.60

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
Attangarai	21.08	-	31.21
Pudumadam	25.60	2.28	2.21
Keelanagachi	3.04	48.36	8.37
Enmanamkondan	1.17	1.66	3.13
Sattakkonvalasai	2.31	52.75	22.64
Kusavankudi	1.92	-	19.99
Valantaravai	2.93	77.05	69.23
Kumbaram	4.18	5.14	19.57
Alagangulam	18.81	7.63	7.09
Panikulam	8.34	7.63	7.09
Pirappanvalasai	2.75	1.05	3.21
Irumeni	1.94	0.70	2.14
Karan	7.40	16.11	19.01
Vallarioodai	24.69	9.46	11.17
Rettaiyurani	22.36	-	6.96
Koravati	6.75	-	4.35
Tamaraikulam	10.16	-	2.86
Marakayarpattinam	12.79	1.15	2.28
Vadalai	46.64	6.54	12.90
Nochiyurani	34.68	34.06	2.30
Manakudi	17.86	30.22	2.04
Pamban	13.57	8.54	17.22
Thangachimdam	4.21	19.93	40.17
Perungulam	14.43	8.92	4.83
Sambadaiyarkulam	13.58	5.95	2.82
Terbhogi	25.47	28.90	2.72
Puduvalasai	11.77	12.37	1.16
Pattinamkathan	10.22	-	1.68

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.
Alagangulam	21,148	26	-	1,271	5,083	14	34,898	44	-	-	14
Attangarai	41,188	51	-	761	3,042	2	39,712	50	-	-	2
Enmanamkondan	1,181	1	-	337	1,349	6	7,589	9	408	1,633	6
Irumeni	768	1	-	1,044	4,174	2	3,199	4	-	-	2
Karan	3,243	4	-	1,854	7,414	4	73,702	92	-	-	4
Keelanagachi	6,429	8	58	1,919	7,674	4	2,21,238	277	-	-	4
Koravali	14,210	18	12	752	3,007	3	-	-	-	-	3
Kumbaram	11,141	14	-	-	-	3	23,528	29	-	-	3
Kusavankudi	1,464	2	-	1,096	4,385	5	177	0	-	-	5
Manakudi	14,795	18	13	1,101	4,404	3	1,38,244	173	-	-	3
Marakayarpattinam	26,939	34	-	722	2,889	2	5,277	7	-	-	2
Nochiyurani	16,712	21	-	1,271	5,083	3	1,55,836	195	-	-	3
Pamban	2,751	3	-	2,740	10,961	8	39,073	49	-	-	8
Panikulam	21,148	26	-	1,644	6,577	2	34,898	44	-	-	2
Pattinamkathan	4,002	5	19	1,952	7,807	12	-	-	-	-	12
Perungulam	30,400	38	40	2,224	8,896	5	40,800	51	-	-	5
pirappanvalasai	1,153	1	-	1,310	5,241	3	4,798	6	-	-	3
Pudumadam	78,040	98	-	935	3,741	5	10,438	13	-	-	5
Puduvalasai	5,328	7	-	1,485	5,940	3	56,591	71	-	-	3
Rettaiyurani	22,736	28	-	1,796	7,185	4	-	-	-	-	4
Sambadaiyarkulam	20,267	25	1	1,382	5,527	3	27,200	34	-	-	3
Sattakkonvalasai	3,525	4	71	1,096	4,385	1	2,41,332	302	-	-	1
Tamaraikulam	19,894	25	-	1,018	4,072	4	-	-	-	-	4
Terbhogi	12,418	16	-	1,271	5,082	7	1,32,204	165	175	701	7
Thangachimdam	6,418	8	-	1,567	6,269	19	91,168	114	-	-	19

Gram Panchayat	Aff		ARS	AVP		Az	BP		CBP		CS
	No.	Area	No.	No.	Length	No.	No.	Area	No.	Length	No.
Valantaravai	8,285	10	-	-	-	10	3,52,492	441	-	-	10
Vallarioodai	10,197	13	-	1,460	5,841	2	43,285	54	-	-	2
Vedalai	1,52,650	191	-	1,239	4,956	12	29,913	37	-	-	12

Gram Panchayat	CT	Co		FP	CCBF		DLT		DLHAI		FBBTI	
	No.	No.	Area	No.	No.	Area	Plants	Length	No.	Area	No.	Area
Alagangulam	14	24	61	24	5,287	26	-	-	12	30	24	61
Attangarai	2	12	83	12	10,297	51	433	1,731	17	42	33	83
Enmanamkondan	6	11	27	11	295	1	172	687	5	13	11	27
Irumeni	2	7	18	7	192	1	471	1,885	4	9	7	18
Karan	4	56	163	56	811	4	709	2,837	33	82	65	163
Keelanagachi	4	18	72	18	1,607	8	1,051	4,205	14	36	29	72
Koravali	3	9	37	9	3,552	18	-	-	7	19	15	37
Kumbaram	3	14	62	14	2,785	14	-	-	12	31	25	62
Kusavankudi	5	34	85	34	366	2	-	-	17	42	34	85
Manakudi	3	6	17	6	3,699	18	-	-	3	9	7	17
Marakayarpattinam	2	8	20	8	6,735	34	207	827	4	10	8	20
Nochiyurani	3	7	20	7	4,178	21	-	-	4	10	8	20
Pamban	8	59	148	59	688	3	-	-	30	74	59	148
Panikulam	2	24	61	24	5,287	26	658	2,633	12	30	24	61
Pattinamkathan	12	6	14	6	1,001	5	-	-	3	7	6	14
Perungulam	5	4	41	4	7,600	38	-	-	8	21	17	41
pirappanvalasai	3	11	28	11	288	1	515	2,061	6	14	11	28
Pudumadam	5	5	19	5	19,510	98	1,281	5,124	4	9	8	19
Puduvalasai	3	3	10	3	1,332	7	-	-	2	5	4	10
Rettaiyurani	4	15	60	15	5,684	28	-	-	12	30	24	60
Sambadaiyarkulam	3	3	28	3	5,067	25	-	-	6	14	11	28
Sattakkonvalasai	1	59	194	59	881	4	1,875	7,498	39	97	78	194
Tamaraikulam	4	6	25	6	4,973	25	269	1,077	5	12	10	25
Terbhogi	7	7	23	7	3,105	16	348	1,393	5	12	9	23
Thangachimdam	19	138	345	138	1,605	8	-	-	69	172	138	345
Valantaravai	10	67	282	67	2,071	10	-	-	56	141	113	282
Vallarioodai	2	33	96	33	2,549	13	709	2,835	19	48	38	96
Vedalai	12	44	111	44	38,163	191	1,191	4,765	22	55	44	111

Gram Panchayat	FD	GSS	ICP		LDI		LP		MI		NADEP
	No.	No.	Plants	Length	No.	Area	Plants	Length	No.	Area	No.
Alagangulam	14	159	-	-	12	30	888	3,550	-	1	14
Attangarai	2	47	-	-	6	15	444	1,774	21	54	2
Enmanamkondan	6	194	112	446	5	13	15	58	-	-	6
Irumeni	2	123	-	-	4	9	438	1,752	-	-	2
Karan	4	33	-	-	28	70	941	3,764	9	23	4
Keelanagachi	4	106	-	-	9	23	226	905	10	26	4
Koravali	3	24	-	-	5	12	497	1,987	6	14	3
Kumbaram	3	31	-	-	7	17	-	-	11	28	3
Kusavankudi	5	58	-	-	17	42	-	-	-	-	5
Manakudi	3	42	33	132	3	7	933	3,731	1	3	3
Marakayarpattinam	2	19	-	-	4	10	656	2,624	-	-	2
Nochiyurani	3	47	-	-	3	8	922	3,687	1	3	3
Pamban	8	3	-	-	30	74	679	2,717	-	-	8
Panikulam	2	105	-	-	12	30	772	3,087	-	1	2
Pattinamkathan	12	78	-	-	3	7	61	244	-	1	12
Perungulam	5	44	-	-	2	6	102	407	12	30	5
pirappanvalasai	3	184	-	-	6	14	169	675	-	-	3
Pudumadam	5	30	-	-	3	7	1,165	4,659	2	5	5
Puduvalasai	3	61	-	-	2	4	304	1,215	1	2	3
Rettaiyurani	4	38	-	-	7	19	32	128	9	22	4
Sambadaiyarkulam	3	29	-	-	1	4	-	-	8	20	3
Sattakkonvalasai	1	119	-	-	29	73	19	77	19	48	1
Tamaraikulam	4	34	-	-	3	8	358	1,430	4	9	4
Terbhogi	7	143	-	-	4	9	998	3,991	2	5	7
Thangachimdam	19	6	-	-	69	172	5	20	-	-	19
Valantaravai	10	85	-	-	33	83	-	-	46	115	10
Vallarioodai	2	19	-	-	16	41	745	2,979	5	14	2
Vedalai	12	107	-	-	22	55	316	1,264	-	-	12

Gram Panchayat	ND		PS	RPWDT	Roo	RP	RRWH	SPD		SPC	SPI
	Plants	HH	No.	No.	No.	No.	No.	No.	Area	No.	No.
Alagangulam	16,295	3,259	60	1	19		2			33	326
Attangarai	2,925	585	12	2	12	-	2	-	-	6	59
Enmanamkondan	8,420	1,684	34	1	13	-	2	-	-	17	168
Irumeni	5,355	1,071	21		10		2			11	107
Karan	4,360	872	9		21		2			9	87
Keelanagachi	4,235	847	25	-	16	-	2	-	-	8	85
Koravali	7,510	1,502	8		12		2			15	150
Kumbaram	2,710	542	8	-	9	-	2	-	-	5	54
Kusavankudi	2,180	436	10	4	10	-	2	-	-	4	44
Manakudi	1,490	298	4	2	4		2			3	30
Marakayarpattinam	7,785	1,557	4		20		2			16	156
Nochiyurani	1,490	298	4		23		2			3	30
Pamban	1,89,095	37,819	37		4		2			378	3,782
Panikulam	16,295	3,259	8		14		2			33	326
Pattinamkathan	19,500	3,900	25	-	12	-	2	-	-	39	390
Perungulam	6,285	1,257	11		8		2			13	126
pirappanvalasai	5,355	1,071	32		12		2			11	107
Pudumadam	9,170	1,834	4	-	16	-	2	-	-	18	183
Puduvalasai	6,705	1,341	7		9		2			13	134
Rettaiyurani	7,510	1,502	12		15		2			15	150
Sambadaiyarkulam	6,285	1,257	4		13		2			13	126
Sattakkonvalasai	3,005	601	11	-	16	-	2	-	-	6	60
Tamaraikulam	7,510	1,502	11		14		2			15	150
Terbhogi	6,705	1,341	17		11		2			13	134
Thangachimdam	1,89,095	37,819	87		22		2			378	3,782
Valantaravai	9,210	1,842	15	-	28	-	2	-	-	18	184
Vallarioodai	4,360	872	5	1	8		2			9	87
Vedalai	7,785	1,557	23				2			16	156

ANNEXURE 7.1

GP WISE WASCA RECOMMENDATION AND WORKS UPLOADED

S. No	GP	WASCA Recommendation for 3 Years	WASCA Uploaded for FY-2021-22 as on 21-02-2021
1	Alagankulam	4,884	7
2	Attrangarai	1,403	-
3	Enmanankondan	3,315	193
4	Irumeni	1,440	186
5	Karan	3,336	1
6	Keelanagachi	2,465	-
7	Koravalli	1,977	88
8	Kumbaram	1,289	290
9	Kusavankudi	1,206	82
10	Manangudi	997	-
11	Maraikayarpattinam	1,675	45
12	Nochiyurani	920	-
13	Pamban	13,128	-
14	Panaikulam	3,978	131
15	Pattinamkathan	6,970	-
16	Perungulam	1,598	77
17	Pirappanvalasai	2,179	174
18	Pudumadam	2,991	-
19	Puduvalasai	1,640	52
20	Rettaiyurani	2,675	-
21	Sathakonvalasai	1,258	14
22	Sembadaiyarkulam	2,055	230
23	Thamaraikulam	1,830	-
24	Thangachimadam	9,532	171
25	Therbogi	2,058	-
26	Valantharavai	4,326	252
27	Vedalai	3,258	-
28	Vellariodai	1,380	143

ANNEXURE 7.2

GP WISE ONGOING WORKS IN MANDAPAM BLOCK

GP	Work Category	No of ongoin works
Aattraangarai	Drought Proofing	1
	Rural Connectivity	1
	Water Conservation and Water Harvesting	1
Alagankulam	Anganwadi/Other Rural Infrastructure	1
	Drought Proofing	2
	Rural Connectivity	1
Enmanmkondan	Drought Proofing	1
	Rural Connectivity	1
	Water Conservation and Water Harvesting	1
Irumeni	Drought Proofing	1
	Water Conservation and Water Harvesting	1
Kaaraan	Drought Proofing	1
	Water Conservation and Water Harvesting	4
	Works on Individuals Land (Category IV)	1
Koravalli	Drought Proofing	1
	Water Conservation and Water Harvesting	1
Kumbaram	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	3
Kuyavankudi	Drought Proofing	1
	Water Conservation and Water Harvesting	1
Maanaangudi	Drought Proofing	1
	Rural Connectivity	1
	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	3
Maraikkaayarpattinam	Drought Proofing	1
Naagaachchi-(Keela)	Anganwadi/Other Rural Infrastructure	1
	Drought Proofing	1
	Water Conservation and Water Harvesting	1
Nochchi oorani	Drought Proofing	1
	Water Conservation and Water Harvesting	1
Paamban	Micro Irrigation Works	1
	Rural Connectivity	1
	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	3
Panaikkulam	Drought Proofing	2
Pattinamkaaththan	Water Conservation and Water Harvesting	2
Perungulam	Drought Proofing	2
	Water Conservation and Water Harvesting	1
Pirappanvalasai	Anganwadi/Other Rural Infrastructure	1
	Drought Proofing	1
	Works on Individuals Land (Category IV)	3

GP	Work Category	No of ongoin works
Pudumadam	Drought Proofing	3
	Rural Connectivity	1
	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	14
Puduvalasai	Drought Proofing	2
	Micro Irrigation Works	1
	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	3
Rettaiyoorani	Drought Proofing	1
	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	5
Saaththakkonvalasai	Drought Proofing	1
	Rural Connectivity	1
	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	6
Sembadaiyaar kulam	Water Conservation and Water Harvesting	2
Thaamaraikkulam	Drought Proofing	1
	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	3
Thangachchimadam	Anganwadi/Other Rural Infrastructure	1
	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	2
Therbogi	Micro Irrigation Works	1
	Rural Connectivity	1
	Water Conservation and Water Harvesting	2
Vaalaantharavai	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	1
Vellari Oodai	Drought Proofing	1
	Water Conservation and Water Harvesting	1
Vethaalai	Drought Proofing	1
	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	9

ANNEXURE 8

CWRM KEY INDICATORS FOR GPs IN DHARGA VALASAI MICRO-WATERSHED

CWRM Parameter	Enmanamkondan	Irumeni
Soil Resources: Status of Available Nitrogen (%)		
Very Low	34.38	30.00
Low	65.63	60.59
Medium	-	9.41
Status of Organic Carbon (%)		
Very Low	3.13	1.17
Low	53.13	-
Medium	43.75	16.37
High	-	68.42
Very High	-	14.04
Status of Soil Micro Nutrients (%)		
Sufficient	56	53
Deficient	44	47
Status of Physical condition of the soil (%)		
Moderately Acidic	46.88	-
Strongly Acidic	-	1.75
Highly Acidic	-	69.01
Moderately Acidic	34.38	29.24
Slighly Acidic	15.63	-
Moderately Alkaline	3.13	-
Soil Texture (%)		
Fine Soil	99	95
Coarse loamy	-	2.29
Soil Water Permeability (Low, Moderate, high)	Moderate	Moderate
Soil moisture and ET		
Volumetric Soil Moisture (%)	17	17
Estimated Soil Moisture (ha.m)	67.05	63.21
ET Losses (ha.m)	91.58	104.24
Means of Water Extraction (%)		
Gravity	9	58
Lifting	91	42
Irrigation Methods (%)		
Wild Flooding	100	100
Livestock (No.)		
Cattle Population	252.00	87.00
Sheep Population	2066.00	2026.00
Goat Population	1415.00	720.00
Poultry	1351.00	854.00
Land Resources (ha)		
Non-Agricultural Uses	86.72	56.43
Cultivable Waste Land	11.16	4.70
Current Fallow land	207.83	167.40
Unirrigated Land	175.44	199.70

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