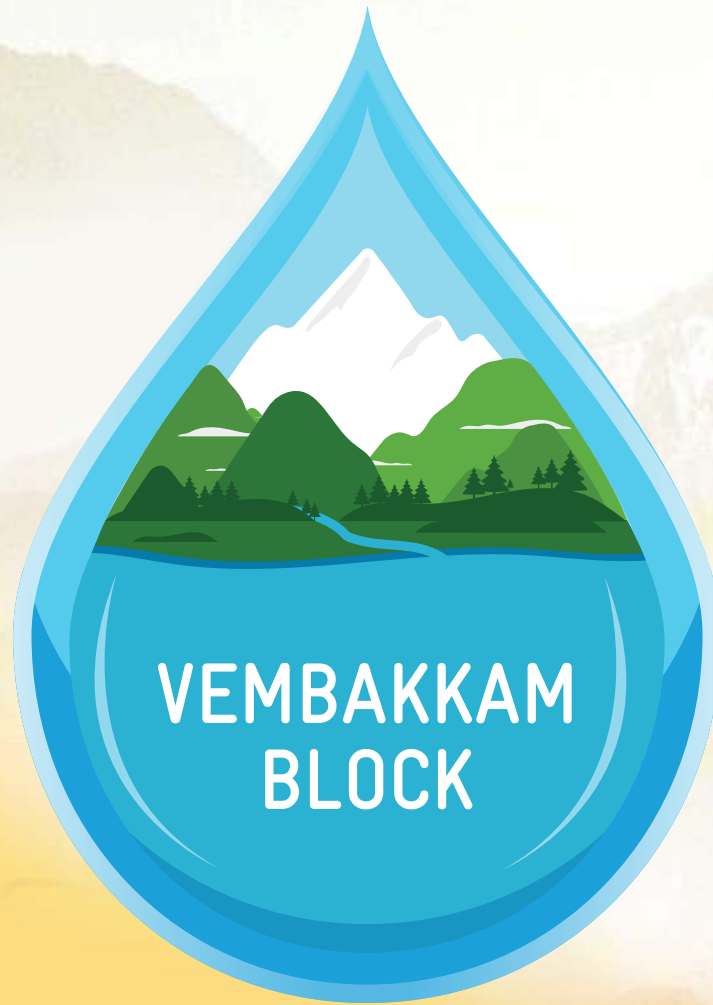


Ministry of Rural Development Ministry of Jal Shakti

WATER SECURITY AND CLIMATE ADAPTATION IN RURAL INDIA



Block Level Composite Water Resources Management Plan under Mahatma Gandhi NREGS

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

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Panagal Building, 4th and 5th floor, Jeenias 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. B Murugesh I.A.S

District Collector, Tiruvannamalai, Govt of Tamil Nadu

Email: collrtvm@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, Mr. Nandeesh P, Mr. Karunamoorthi M, Mr. Samu Jebaraj V, Mr. Arun Siddharth R, Ms. Yogalakshmi R, Mr. Kumaragurubaran R

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. M. Prathap I.A.S - Additional Collector, Thiru. Ramakrishnan P - EE, Thiru. Harikrishnan K - AE

Design and Layout:

Mr. Manikandan T

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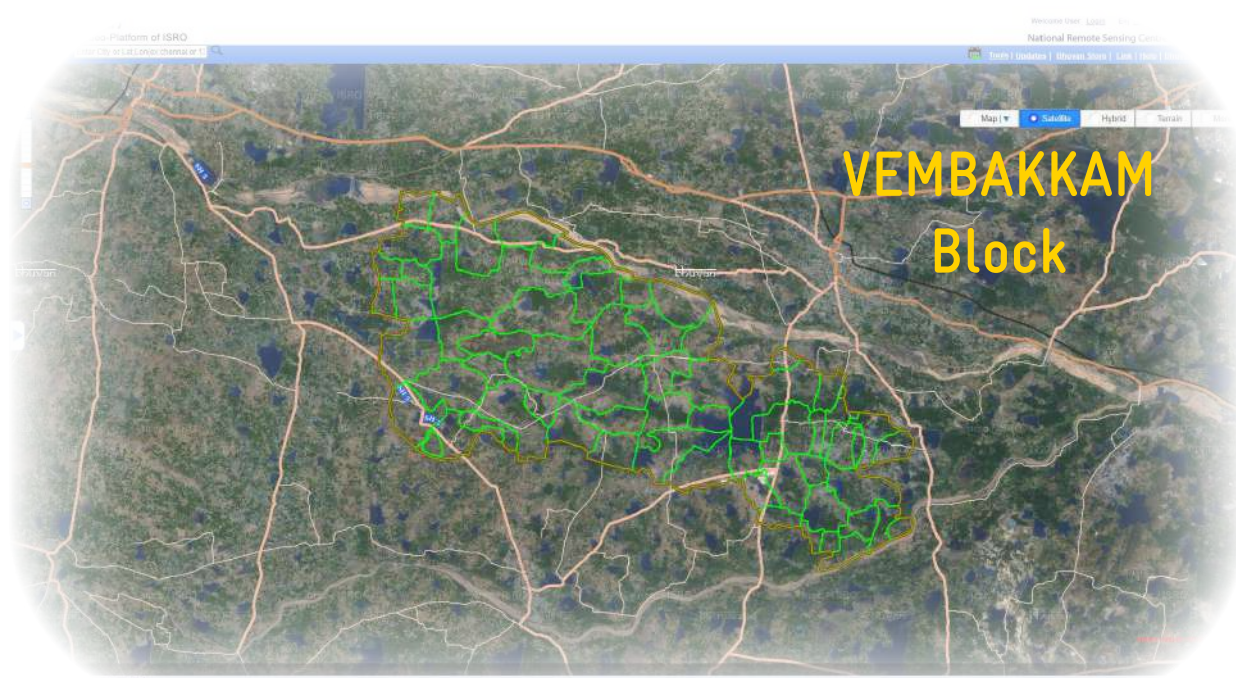
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New Delhi, India, Jan 2022

WATER SECURITY AND CLIMATE ADAPTATION IN RURAL INDIA



Block Level Composite Water Resources Management Plan under Mahatma Gandhi NREGS

**District Rural Development Agency, Tiruvannamalai &
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 convergence model.

There will be a reorientation with livelihood promotion goals in addition to Natural Resource Management with GIS based plan-vention will be maximised

In this context, implementation of Climate Adaptation (WASCA) 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) framework 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 Panchayat. Out of the shelf

“
**Close to 10 lakh
NRM and Non- NRM
works are identified,
verified, approved by
Gram Panchayat**
”

of priorities under MGNREGS and poverty alleviation as Resource Management, asset development. The approach to ment will be on a saturation ning. The impact of each inter-through convergence.

tation of Water Security and CA) a technical cooperation

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.

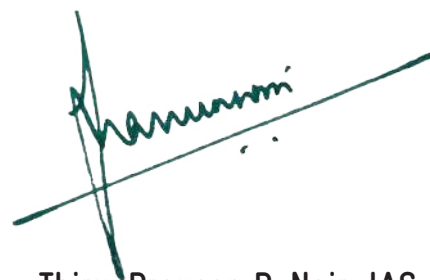
1.	Development of Public and Common lands
2.	Development of Agriculture and allied activities
3.	Development of Rural Infrastructure Management
4.	Development of Climate Resilience Measures

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 plan-
ning, 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 a 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 Mission, Ministry of Jal supported by National Water Shakti.

The state government of Tamil Nadu, with core support from Director Thiru. Praveen Nair I.A.S., Department of Rural Development of Rural Development-related departments, under District Collector, Thiru. B. Murugesh, I.A.S., has embarked on this strategic leadership of the report uses strong scientific data and analysis using GIS and statistical data to develop a medium-term picture of water and climate 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.

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

A handwritten signature in black ink that reads "Rajeev Ahal". The signature is written in a cursive style with a long horizontal stroke underneath the name.

Rajeev Ahal
Director,
NRM & Agroecology, GIZ India

FOREWORD



Thiru. B. Muruges, IAS
District Collector,
Tiruvannamalai



Tiruvannamalai is the second largest district in Tamil Nadu. The topography of Tiruvannamalai is almost plain sloping from west to east. Tiruvannamalai experiences hot and dry weather condition throughout the year. It is dry land region where farmers cultivate a single crop groundnut and some part of the district cultivate paddy coinciding north east monsoon. Groundwater plays an important role in the food production of the district. Ground water level and water quality ground water discharge and recharge are critical aspects of climate change. 85 % cultivation area of the district is met through groundwater.

All eighteen Blocks in the district are categorized as over exploited or critical as per latest state reports on groundwater status. Mahatma Gandhi NREGA is key scheme in the district, providing unskilled wage employment, asset creation for district has implemented in cam-farm pond construction.

To enhance scientific works with technical support of GIZ project, the Composite Water (CWRM) approach is used for various parameters including spatial and technique to provide solution water (Ground water, Surface Moisture).

Through GIS based planning in 860 GPs, works identified under CWRM are verified, approved at Gram Sabha. These works would potentially reduce 38% surface runoff to be harvested or recharged by various interventions through ridge to valley watershed approach.

Hence, the developed CWRM plan at GP level would help to improve the status of Water, Socio Economic, Climate, and Agricultural parameters in the district. The developed GP level plan by using CWRM is an integrated approach covering NRM (Natural Resource Management) and non NRM works.

The Innovative approach of climate Resilient measures (CRM) is helping the district to mitigate the cli-

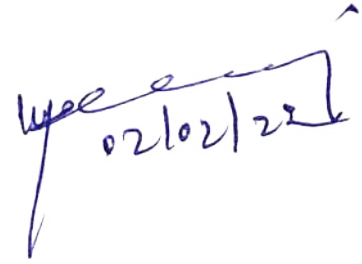
“
**GIS based
planning in 860 GPs,
works identified under
CWRM are verified,
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”

identification in MGNREGS, under WASCA bilateral water Resource Management analyzing various parameters temporal changes and also solution for improving the four water, Rain water and Soil

860 GPs, works identified

mate hazard. The micro level systematic planning at GP level really brings a change in the climate aspects in the district. Water is the key factor for all development works, increasing the ground and surface water capacity would boost the economy and enhance climatic condition throughout the district.

Hence, all the GPs plans are analyzed, synthesized with mapping of SDG goals, INDC contributions to climate change in form of Block level report. The Block level reports really help rural development department and other convergence departments to do the systematic planning by using the data and technique. Wishes the contributors who have involved in bringing out this report for district development.



Thiru. B. Muruges, IAS
District Collector,
Tiruvannamalai

MESSAGES



Thriu. M .Prathap, IAS
Additional Collector (Development) /
Project Director, DRDA



The present climate change crisis is inextricably linked to water. It induces extreme weather events, reduces the predictability of water availability, decreases water quality and threatens sustainable development, biodiversity and enjoyment of the human rights to safe drinking water and sanitation. Building resilience towards Water Security and Climate Adaptation is inevitable for an integrated water resource management which WASCA is targeting. WASCA pilot study started in the district during January 2019 with developing inclusive Composite Water Resources Management (CWRM) plans for all GPs in this district. It also supported in building the ca-based planning adopting. The dis-support of WASCA Resourcecenter the CWRM plans for all the GPs. the supply and demand prepared suitable key actions are identified and common land, agriculture infrastructure at GP level through hydrological, agricultural and so- These GP plans are verified at the GP officials of DRDA and are con-levels for prioritizing the actions outcome of the WASCA project on completion will form a major chunk of DRDA of districts water security particularly the works related to cascade tank development, fallowland development, roof rain water harvesting, watershed works for treating drainage lines, improving dry lands with farm trench cum bund, farm ponds, pasture development, Block plantation with soil conservation. This demonstration project on water security and climate adaptation and its convergence approach at Panchayat level could be scaled-up and replicated. Subsequently, the Block level reports are envisioned to water resources planners and other stakeholders works on challenges of adapting to climate change with a portfolio of potential actions to reduce vulnerability. I assure this booklet of good practice example will guide the best adaptation practices towards climate resilience. I wish the entire team, stakeholders, experts, technical people involved in generating this good learning practice.

“
Block level reports are envisioned to water resources planners and other stakeholders works on challenges of adapting to climate change
”

capacity of the Engineers in GIS district officials with the technical in the district has completed The CWRM plans assessed both a water budget at GP level. The for the development of public and allied activities and rural scientific process including cio economic perspectives. ground level by the Block and solidated at Block and district and planning. The expected

M. Prathap

Thriu. M .Prathap, IAS
Additional Collector (Development) /
Project Director, DRDA

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.

Through District level GIS partners MSSRF build canonical officers of Rural Depletion of 1,289 GP plans. In Nationally approved Commitment (CWRMP) framework Bhuvan NRSC ISRO GIS

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

resource centres, GIZ with the capacity of Block, GP level development Department in preparation of GP level plans, composite Water Resources Management is adopted along with platform.

Total 3,00,000 works identified in NREGA Soft. The 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.

tified through CWRM are up-works focused on treatment of

The Block level report provides the details of the parameters used for preparing plans, analysis of the situation, works for overcoming 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
Chief 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 (Socio-economic, agriculture, etc.) and identified the most for project implementation. vannamalai in Northern Tamil South coastal aspirational WASCA project Composite Water Resource Management (CWRM) Plan is used.

The CWRM plans assessed both water using data pertaining parameters, catchment agriculture and prepared a water identified a set of key water 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.

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

18 Vulnerability parameters water and climate parameters vulnerable two districts The two districts are Tirunadu and Ramanathapuram district. For implementing Water Resource Management

the supply and demand for to land resources, climate as, soil, surface runoff, agriculture budget. Besides, it has actions for the development

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



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ABBREVIATIONS AND ACRONYMS

A - D	D - H	I - M
% Percentage	DLSC District Level Steering Committee	ha.m Hectare Meter
°C Degree Celsius	DLT Drainage Line Treatment	HH Households
AR Assessment Report	DRD&PR Department of Rural Development & Panchayat Raj	ICAR Indian Council for Agriculture Research
CCB Contour Continuous Bunds	ET Evapo-transpiration	IMD Indian Meteorological Department
CCCDM Centre for Climate Change and Disaster Management	FPO Farmer Producer Organization	INR Indian Rupees
CRM Climate Resilient Measures	FY Financial Year	IPCC Intergovernmental Panel on Climate Change
CuM Cubic Meter	GIS Geographical Information System	IWRM Integrated Water Resources Management
CVI Climate Vulnerability Index	GIZ Deutsche Gesellschaft für Internationale	Kharif crop Sown in Monsoon and harvested close to Autumn
CWRM Composite Water Resource Management	Govt. Government	Km Kilometer
CWRMP Composite Water Resource Management Plan	GP Gram Panchayat	KML Keyhole Markup Language
DEM Digital Elevation Model	GW Ground Water	LULC Land use and land cover
	ha Hectare	





M - N

Max
Maximum

MCM
Million Cubic Meter

MC
Mid Century

MCM
Million Cubic Meter

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 - S

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

S - U

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

UN

United Nations

SW

Surface Water

TN

Tamil Nadu

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



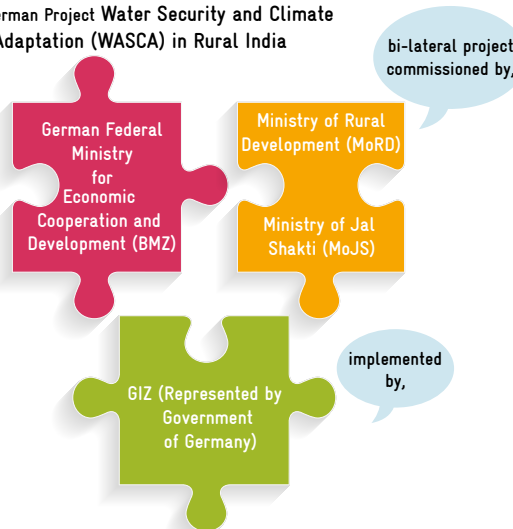
“Aims to improve water resource management with respect to water security and climate adaptation”



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.

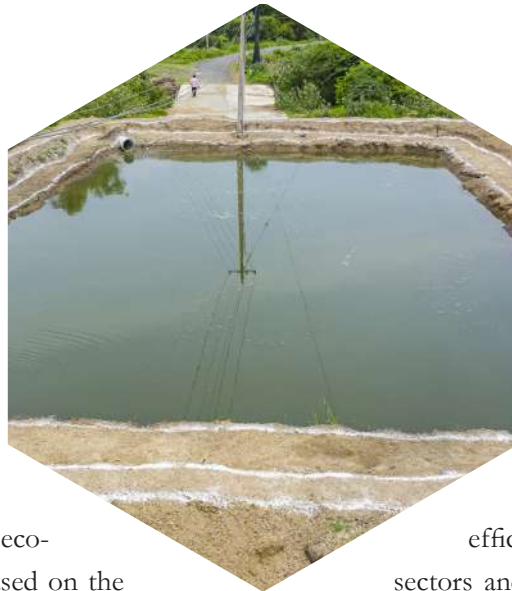
The Indo-German Project “Water Security and Climate Adaptation in Rural India” (WASCA), is a bi-lateral project commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ) in partnership with the Ministry of Rural Development (MoRD) and Ministry of Jal Shakti (MoJS) and 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, New Delhi.

Indo-German Project Water Security and Climate Adaptation (WASCA) in Rural India



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 Contributions (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 the 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 was structured with nine 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

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

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

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

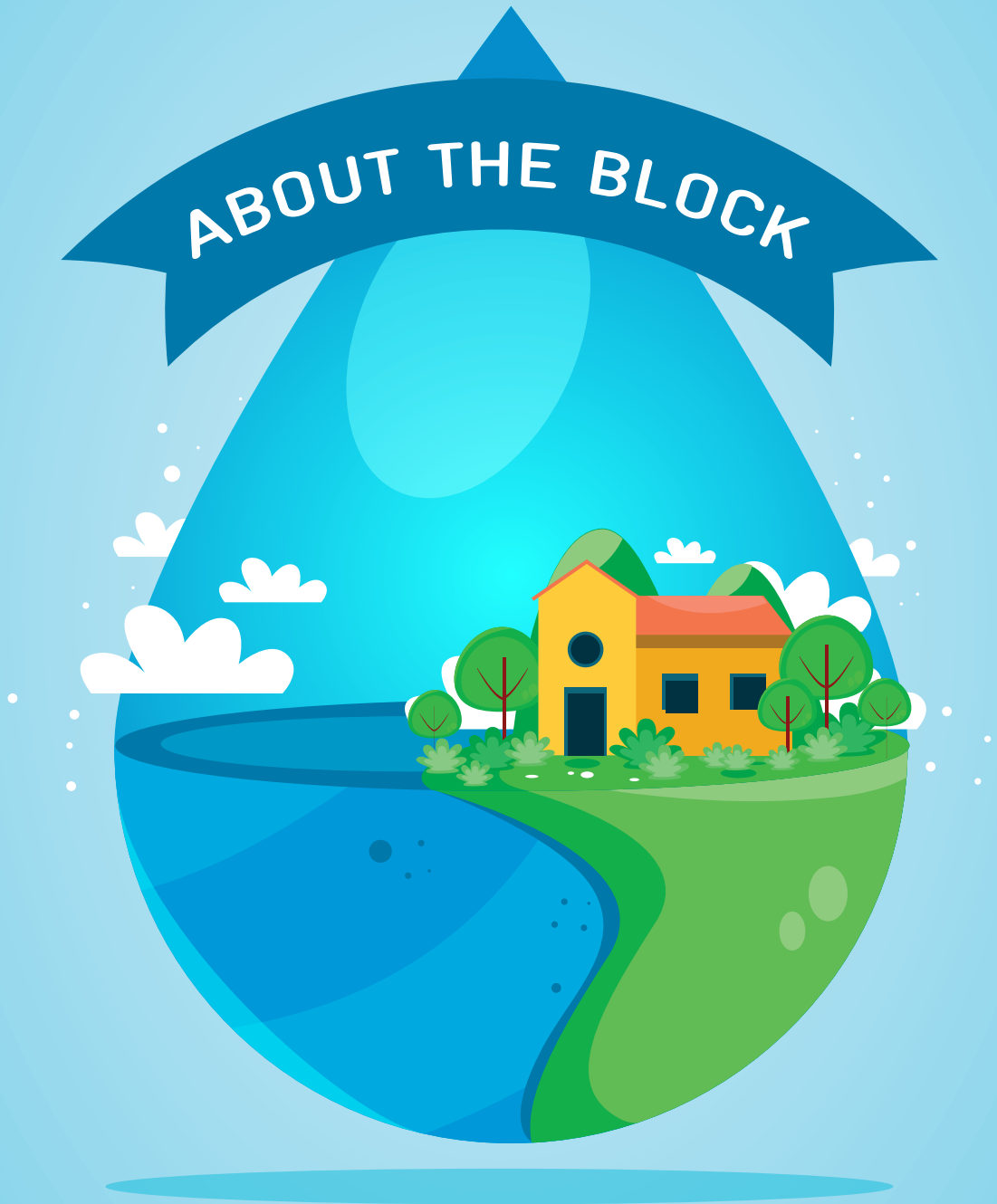
குறள் - 12

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

Thirukkural - 12

CHAPTER 1

ABOUT THE BLOCK



1 | ABOUT THE BLOCK

Vembakkam Block of Tiruvannamalai district lies between 12°41'15.857"N to 12°51'2.562"N latitude and 79°32'52.237"E to 79°35'46.391"E longitude and is surrounded by Anakkavur and Cheyyar Blocks (Figure 1.1). The total geographical area of this Block is 32,392 ha (323.9 Sq. Km). Administratively, this Block comes under Vembakkam taluk, with 64 Gram panchayats and 231 habitations in it.

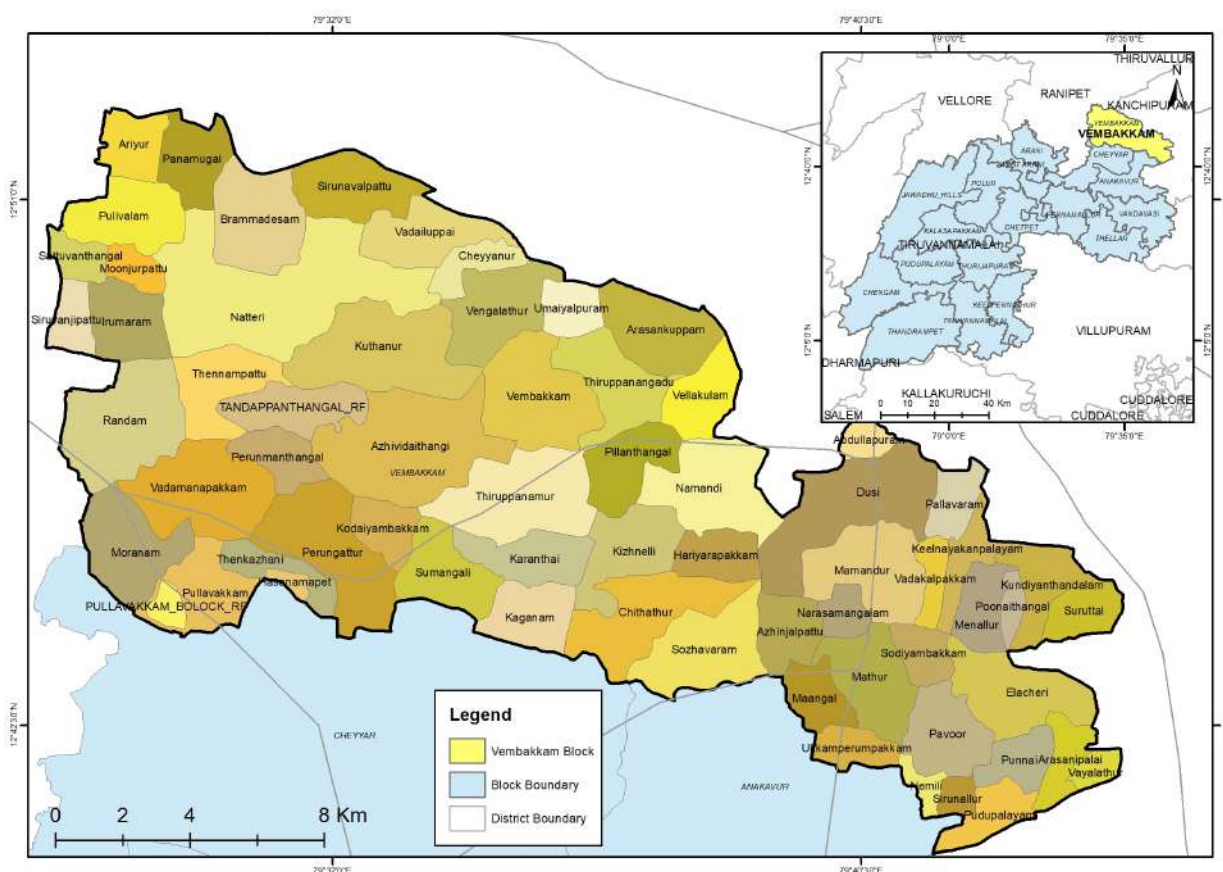


Figure 1.1. Vembakkam Block and its environ

According to Census 2011, the population of Vembakkam Block is 1,27,752. The population density of the Block is 386 per Sq. Km which is lower than the district population density (473 per Sq. Km) and much lower than the State's density (555 per Sq.Km). There is a 6.77 % increase in the population observed since 2001 in this rural Block. The percentage of male population is slightly higher than (50.10 %) female population (49.89%). The proportion of sex ratio is 987 females per 1000 males, which is lower compared to the District average sex-ratio (996 females per 1,000 males). However, the literacy rate of female population is lower

(43.60%) than male literacy (56.40%). At 74.98 % the literacy rate of the Block is slightly higher than the national average (72.98%). Scheduled Castes and Scheduled Tribes accounted for 25.57% of the total population (Thiruvannamalai District profile 2020).

Economically, Vembakkam has poor revenue and it is 3rd low revenue earning Blocks of the Tiruvannamalai District. The primary source of income for most of the Block's inhabitants is agriculture and allied activities. Paddy tops as the predominant crop, with 77.40 % of the irrigated area cultivated with it. The other major crops grown in the Block

“
 The proportion of sex ratio is 987 females per 1000 males, which is lower compared to the District average sex-ratio (996 females per 1,000 males)
 ”

“
 At 74.98 % the literacy rate of the Block is slightly higher than the national average (72.98%)
 ”

area are groundnut and other pulses. Under rainfed crops other pulses is the predominant crop with 73.7% area cultivated, followed by mango, red gram and coconut cultivation. Significant cultivated areas of Mango, dry chilli, coconut, mango and other fruits and vegetables can also be seen. A small patch of sericulture (37acres) is seen in the Block and 244 families are engaged in handlooms. livestock count of 1,79,879 was recorded during 2019-20. The cattle count is 62,397 and the Block has 22 milk societies with 9,049 litres of milk being produced per day.

“
 Paddy tops as the predominant crop, with 77.40 % of the irrigated area cultivated with it
 ”

Hydrologically, Vembakkam Block comes under Cheyyar and Vegavati sub-basins of Palar basin. Palar River flows through the Block. Cheyyar, R B Palar and L B Palar macro-watersheds cover the Block with 84 micro-watersheds (Figure 1.2).

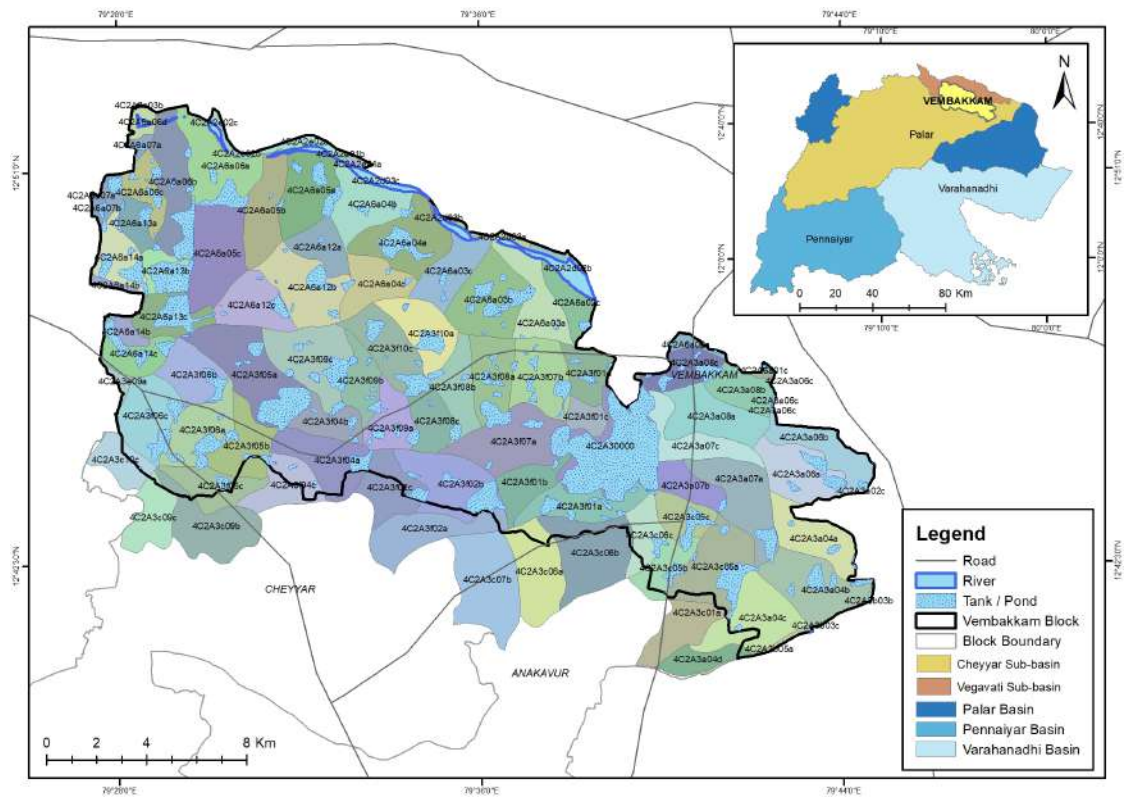


Figure 1.2. Watersheds- Vembakkam Block

There are 147 tanks in the Block with the largest tank being the Alividaithangi Big Tank with an area of 214.11 ha. Other important tanks are Valathottam Tank (163.97 ha) and Vadamanapakkam Big Tank (105.26 ha). Figure 1.3 depicts the spatial distribution of water bodies in the Block. The ground water levels in Vembakkam Block is in an over exploited and semi critical state of depletion stage of ground water development. Dusi, Nateri, Perungattur and Vembakkam firkas cover the Block. Nateri, Perungattur and Vembakkam firkas are in a semi critical stage, while Dusi is over exploited.

GROUND WATER LEVEL OF THIS BLOCK

OVER EXPLOITED- > 100%	Nateri, Perungattur, Vembakkam
SEMI CRITICAL->70%&<90%	Dusi

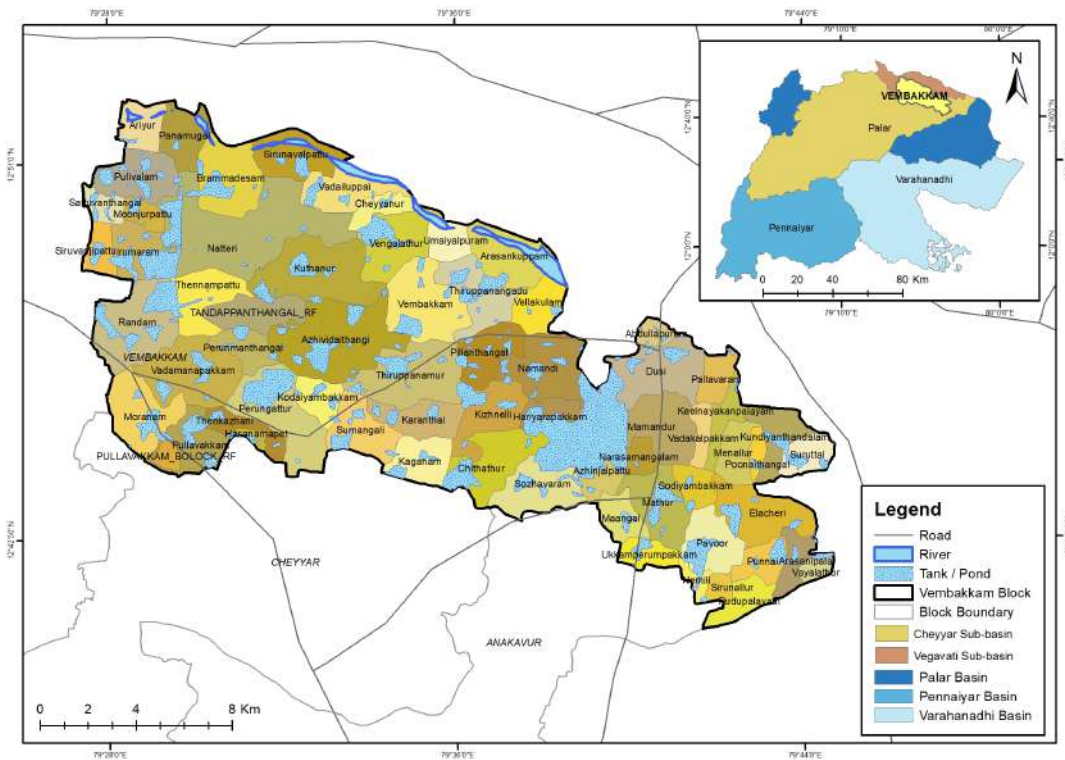
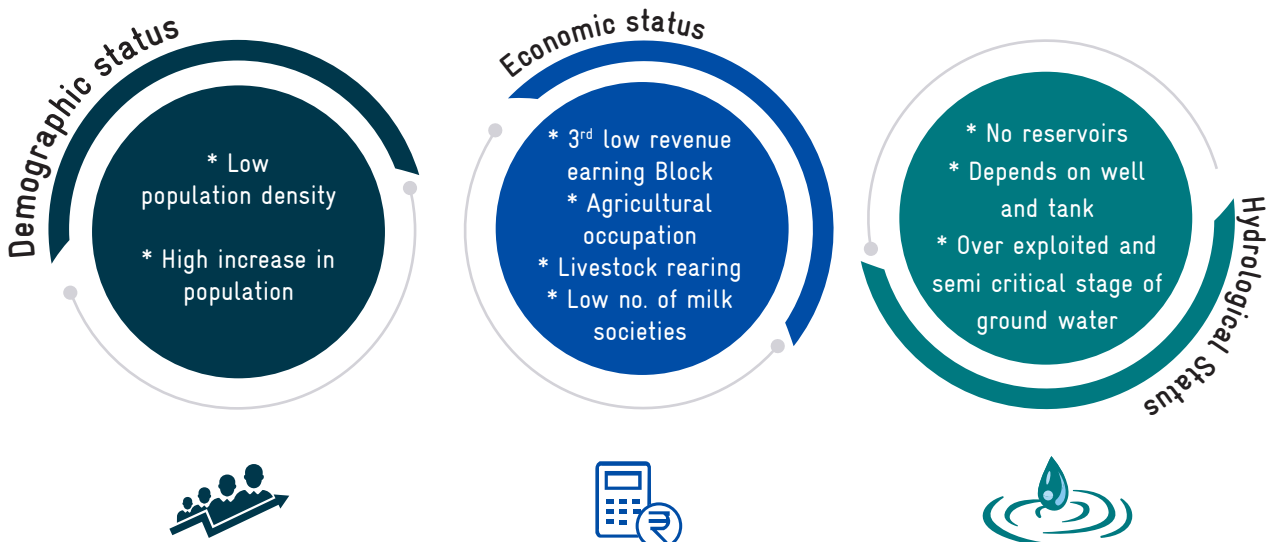


Figure 1.3. Spatial distribution of waterbodies



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

CLIMATE AND WATER SECURITY



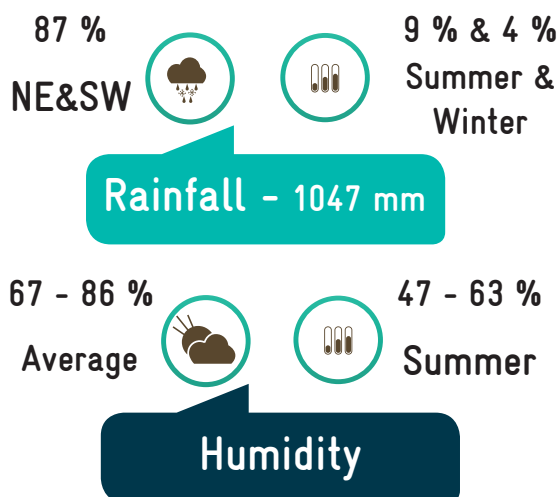
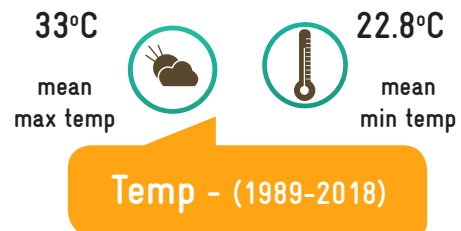
2 | CLIMATE AND WATER SECURITY

This region has typical tropical climate, located in the North Eastern agro-climatic zone of State and Southern Plateau 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).

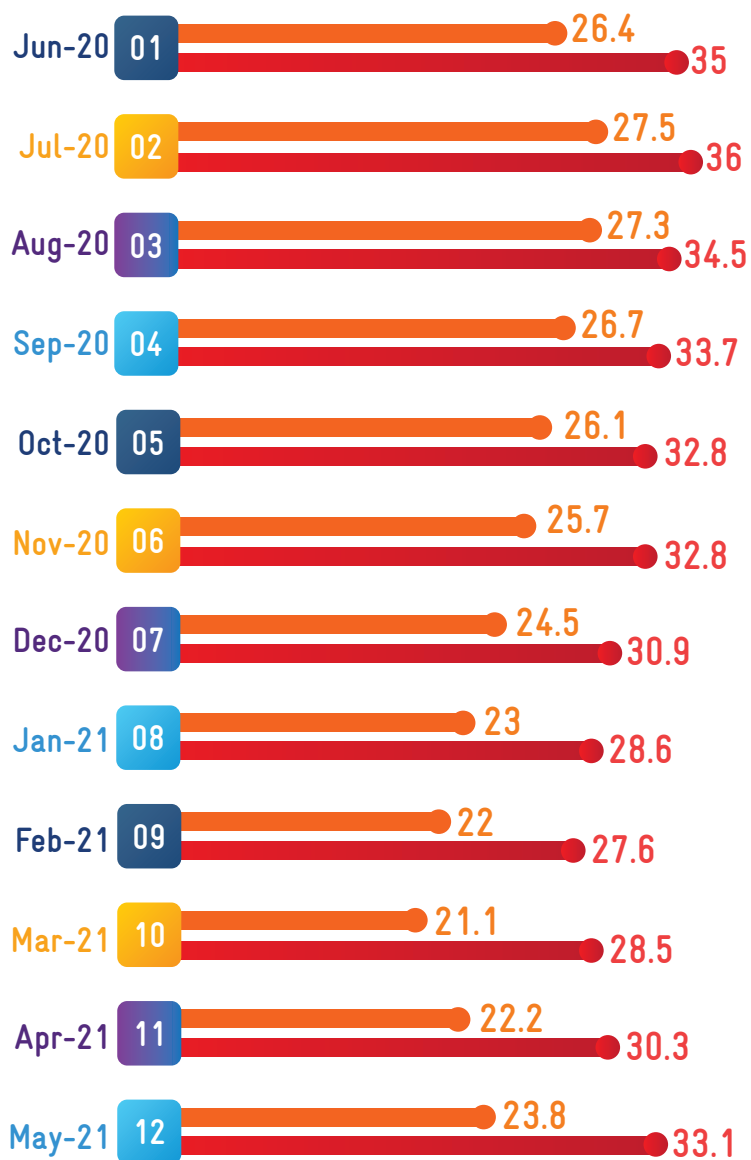
TABLE 1. GENERAL CLIMATE DESCRIPTION



In general, this semi arid region has dry and hot weather. The mean maximum temperature is 33°C and mean minimum temperature is 22.8°C during last 30 years (1989-2018) (IMD). In summer months the maximum temperature goes up to 45°C for few days. The average monthly temperature characteristic during 2020 is shown in Figure 2.1



Normally this region receives major rainfall from North-East Monsoon (NEM) (October to December) and South-West Monsoons (SWM) (June to September). Past records show the annual average rainfall of this region is 1,047 mm (WRIS, GoI). Both North-East and South-West Monsoons contribute nearly 87 % of the annual rainfall in which SWM is slightly stronger. While summer (March to May) rainfall accounts for 9 % of the total rainfall and winter (January, February) season has low contribution (4%) to the annual rainfall (Figure 2.2). The average relative humidity is 67- 86 % and during summer it ranges between 47-63 %.



Monthly Temperature

in degree celsius (°C)

Minimum temperature

Maximum temperature

Figure 2.1. Average monthly temperature

The average annual rainfall days are 172 days in which 72 days are from NEM and 82 days are from SWM months. Onset of SWM rainfall starts in the 1st week of June and cessation would be in the 1st week of October. Onset of NEM

rainfall starts in the 2nd week of October and cessation would be in the 4th week of December. Though the number of rainy days is slightly lesser than SWM, the intensity is more in NEM.

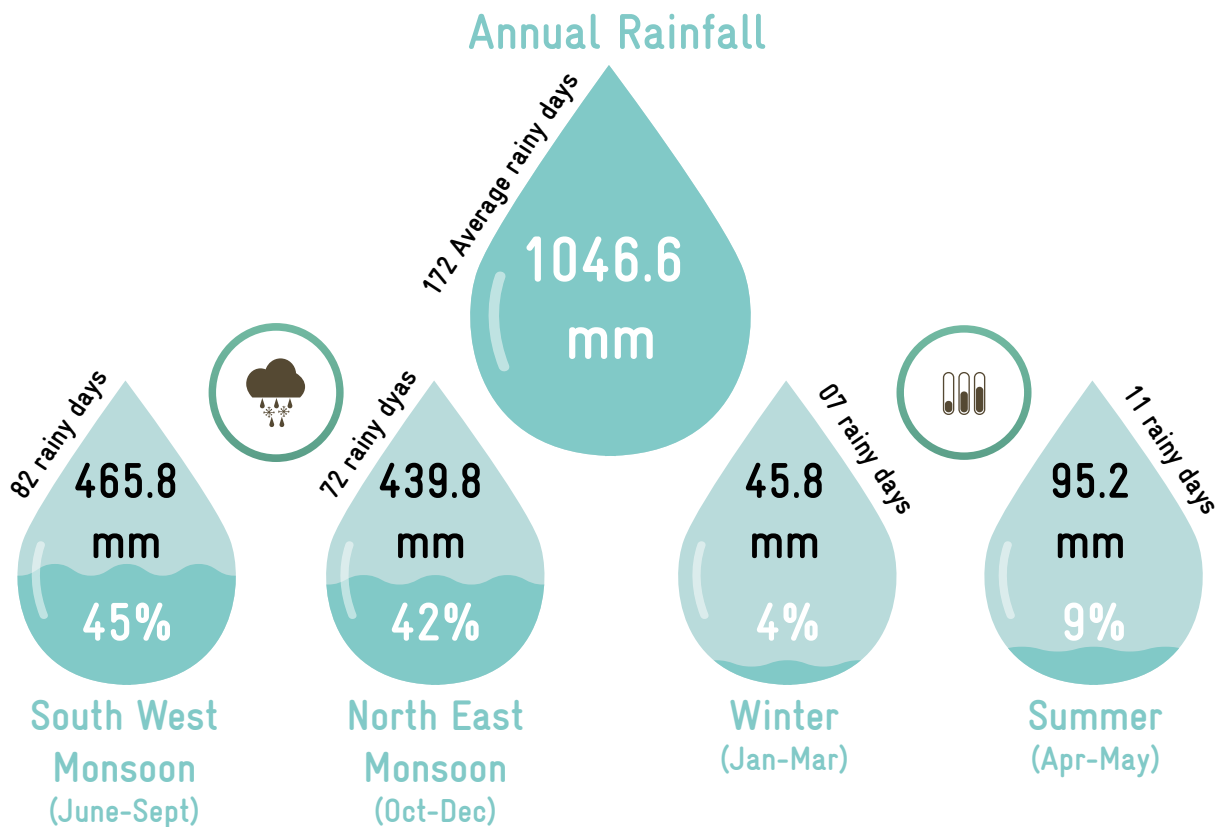


Figure 2.2. Season-wise distribution of annual rainfall

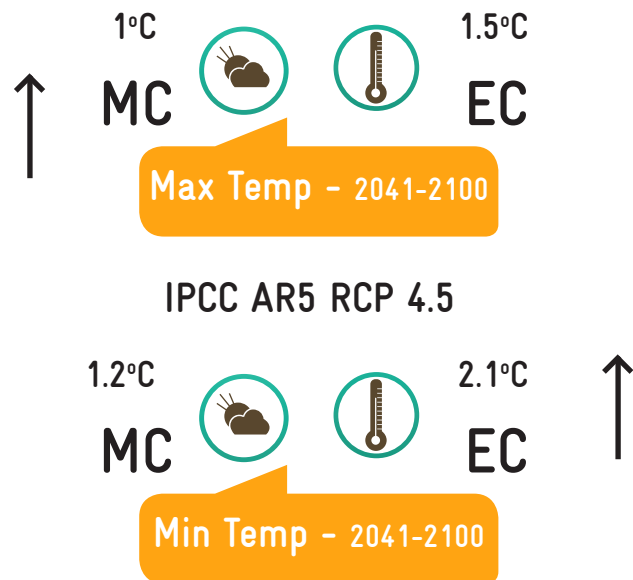
In recent decades, the world is witnessing significant changes in its climate. These changes include increase in average temperature, variations in the rainfall intensity and its frequency. This region is also no exception, and an increase in maximum and minimum temperature of 1.20C and 0.50C was observed during 1951 to 2015 (IMD). The rainfall variability is also well observed. During 1951 to 2015, there were 15 excess rainfall years (above normal rainfall) and 15 deficient rainfall years (below normal rainfall) recorded. The consecutive excess and deficient rainfall lead to rainfall variability and its extremities. Since this region is heavily dependent

on monsoon rains, it is prone to droughts when the monsoons fail. As rainfall is the major source for determining water storage, existing water resources such as rivers, dams and major and minor tanks fail along with deficient rainfall years.

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

Recent IPCC Assessment Report 6 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 indicate that there would be 1°C increase in maximum temperature in mid-century (MC) period (2041-2070) and 1.5 °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 1.2 °C and 2.1 °C during MC and EC periods. Average annual rainfall for IPCC AR5 RCP4.5 scenarios is projected to increase about 13 % towards MC and increase by about 21% towards EC period.



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



- * surface and ground water availability
- * river flow
- * water quality
- * soil moisture
- * evapo-transpiration



- * 1.2°C increase in maximum temperature during 1951-2015
- * 0.5°C increase in minimum temperature during 1951-2015
- * 1°C increase in max temp during 2041-2070 (RCP4.5)
- * 1.5°C increase in max temp during 2071-2100 (RCP 4.5)



As a result, these impacts pose severe risks 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 river basins more vulnerable. This district experienced climate hazards in the past such as floods, drought and heat waves.

- * Flood
- * Drought
- * Heat waves

This region experiences heavy rain and flood during deep depressions/cyclones forms in the Bay of Bengal. In recent decades, all parts were severely affected during 2005, 2010, 2015 heavy rainfall events and Thane (2011) and Vardah (2016) cyclones. State Disaster Management Authority, Government of Tamil Nadu identified 75 locations of Thiruvannamalai District as flood vulnerability spots. In Vembakkam Block, 7 GPs are moderately vulnerable to floods.

Flood

Drought

Low rainfall coupled with the erratic behavior of the monsoon in the state makes Tamil Nadu the most vulnerable to drought. Thiruvannamalai District comes under drought vulnerable area as less than 40 % of normal rainfall was received and has experienced frequent droughts in the past, particularly in the years 2003 and 2009. The District also experienced severe drought during the year 2016- 2017. All parts of the District are affected by drought and its consequences are large areas of crop losses and drinking water scarcity. In Vembakkam Block, all GP's are prone to drought.

A heatwave is a period of abnormal high temperatures, more than the normal maximum temperature that occurs during the (hot weather) summer season. Heatwaves typically occur between March and June. The extreme temperatures and resultant atmospheric conditions adversely affect people living in these regions as they cause physiological stress, sometimes resulting in death. Normally, all parts of this District witnesses heat waves. All GPs in Vembakkam Block are prone to heatwaves.

Heat Wave

2.2 | WASCA CLIMATE VULNERABILITY INDICATORS

During 2019, WASCA TN conducted a preliminary State level scoping study on the State's rural water security through the climate lens and identified climate and water security hotspots/potential geographical areas for project demonstration through scientific criteria jointly with 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 ground reality and accurate observations, WASCA TN study proposed 18 indicators to reflect the State's rural water security through four interconnected CWRM areas viz., climate extremities, water resources, agriculture and socio-economic to assess climate-water vulnerability at the District level (Table 2).

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

CWRM Area	Indicators of Rural water security vulnerability	Indicators label	Linked SDG
Climate	Changes in max temperature (°C)	C1	Goal 13
	Changes in min temperature (°C)	C2	
	Changes in rainfall (%)	C3	
	Excess rainfall years	C4	
	Deficient rainfall years	C5	
Water	Ground water extraction (%)	W1	Goal 6
	Ground water Recharge (m3)	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/m2)	A3	Goal 15
	Evapotranspiration (Kg/m2)	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 from these 18 bio-physical and socio-economic indicators was 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, Ramanathapuram and Tiruvannamalai Districts were selected by the State Level Steering

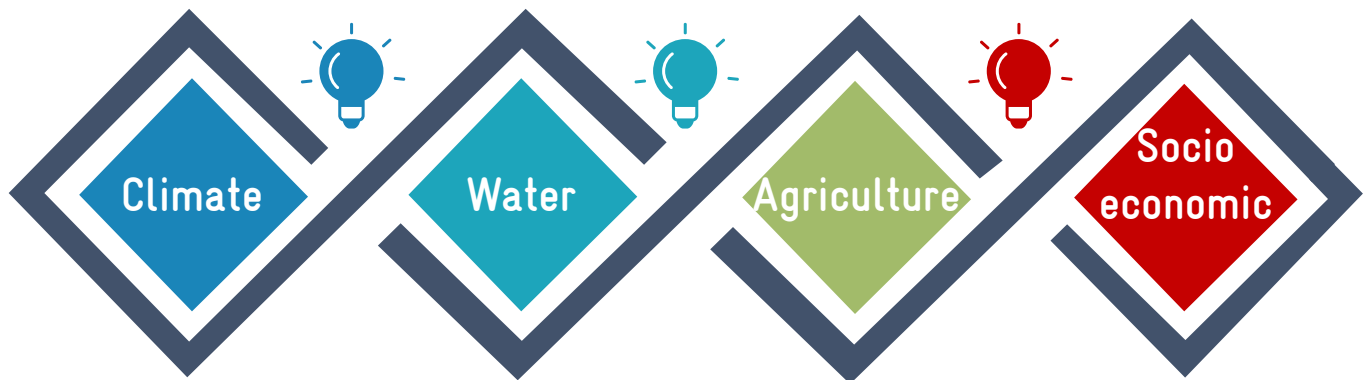
Committee headed by the Secretary RD&PR in November 2019 for implementing the WASCA. Subsequently, all the key water actions, CWRM planning and implementation works are envisaged for the above Districts through these influencing indicators collectively under four CWRM areas viz. climate, water, agriculture and socio-economic.

2.3 | COMPRESSIVE 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 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 technical partners of WASCA project Viz., MS Swaminathan Research Foundation (MSSRF), Prime Meridian and key sectoral

experts. Based on 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 are thus identified under four areas via climate, water, agriculture and socio-economic for advancements towards actions. Data for the major parameters identified at Block level (Table 3) are collected both from primary and secondary sources to be analyzed statistically and geospatially.

TABLE 3. MAJOR PARAMETERS IDENTIFIED FOR BLOCK LEVEL VULNERABILITY ASSESSMENT



Changes in temperature, rainfall and its extremities

Watershed, Micro-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

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 MGNEGRA 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

CONVERGENCE OF WASCA AND MAHATMA GANDHI NREGA



CONVERGENCE OF WASCA AND
MAHATMA GANDHI NREGA

3 | CONVERGENCE OF WASCA AND MAHATMA GANDHI NREGA

GIZ has evolved a GP based CWRM planning approach for facilitating convergent planning under MGNREGA for Water Security and Climate Adaption. This is as per the recommendations of National Level Workshop organized in February 2020, by MoRD, MoJS, GIZ, along with State Rural Development Department of WASCA. While developing the Farmework, inputs from all relevant stakeholders were considered including communities, public institutions, civil society, research organizations, and private agencies. The basis on which GIS based planning was developed for all GPs is the Annual Master Circular issued during 2021-22 and the Annual Planning Circular issued in September 2020 by MoRD.



District under MGNREGS, 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, and Water Resource Department and the Agriculture Department. The technical inputs relating to Excavation, Renovation & Modernization (ERM) of waterbodies may also be sought from the regional office of Central Ground Water Commission (CWC). The GPs will keep in perspective the Macro and Micro-watersheds of 500-100 ha comprising of 1-10 GPs, while deliberating and finalizing prioritization of shelf of projects.

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 & Allied Activities and Livelihood related works on individual lands leading to sustainable livelihoods as well as provisioning of livestock shelters for individual households. The NRM related works under MGNREGS will be taken up in convergence with other programmes such as 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 at farm level. PMKSY aims to achieve a high degree of effective water availability and use for Indian farms, especially in water scarce regions. IWMP, Mission Water Conservation, Har Khetko Pani and Per Drop More Crop are the four pillars of PMKSY. Technical inputs for planning is to be drawn from the technical resources available in the

Special focus is given to vulnerable households and communities while preparing estimates for anticipated demand, list of works on individual land, and list of other works that provide direct individual benefits. The Convergent Planning Exercise will 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 playing a significant role in improving the livelihood conditions of the vulnerable people. 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

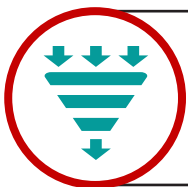


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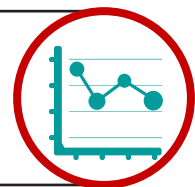
Water related works out of NRM

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 are related to NRM alone. Among NRM works, 85 activities focus on water conservation and harvesting while 164 works are related to Agriculture and Allied works. As MGNREGA activities benefit both the community and individuals, this should typically change 'relief works mode' to an integrated NRM perspective. Planned and systematic development of land and harnessing of rain-water 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 in the watersheds using web-GIS platform (Bhuvan Geoportal). The GIS (Geographical Information System) 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 Annual Master Circular provides the key steps for GIS based planning.



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



3.1 | COMPOSITE WATER RESOURCE MANAGEMENT APPROACH

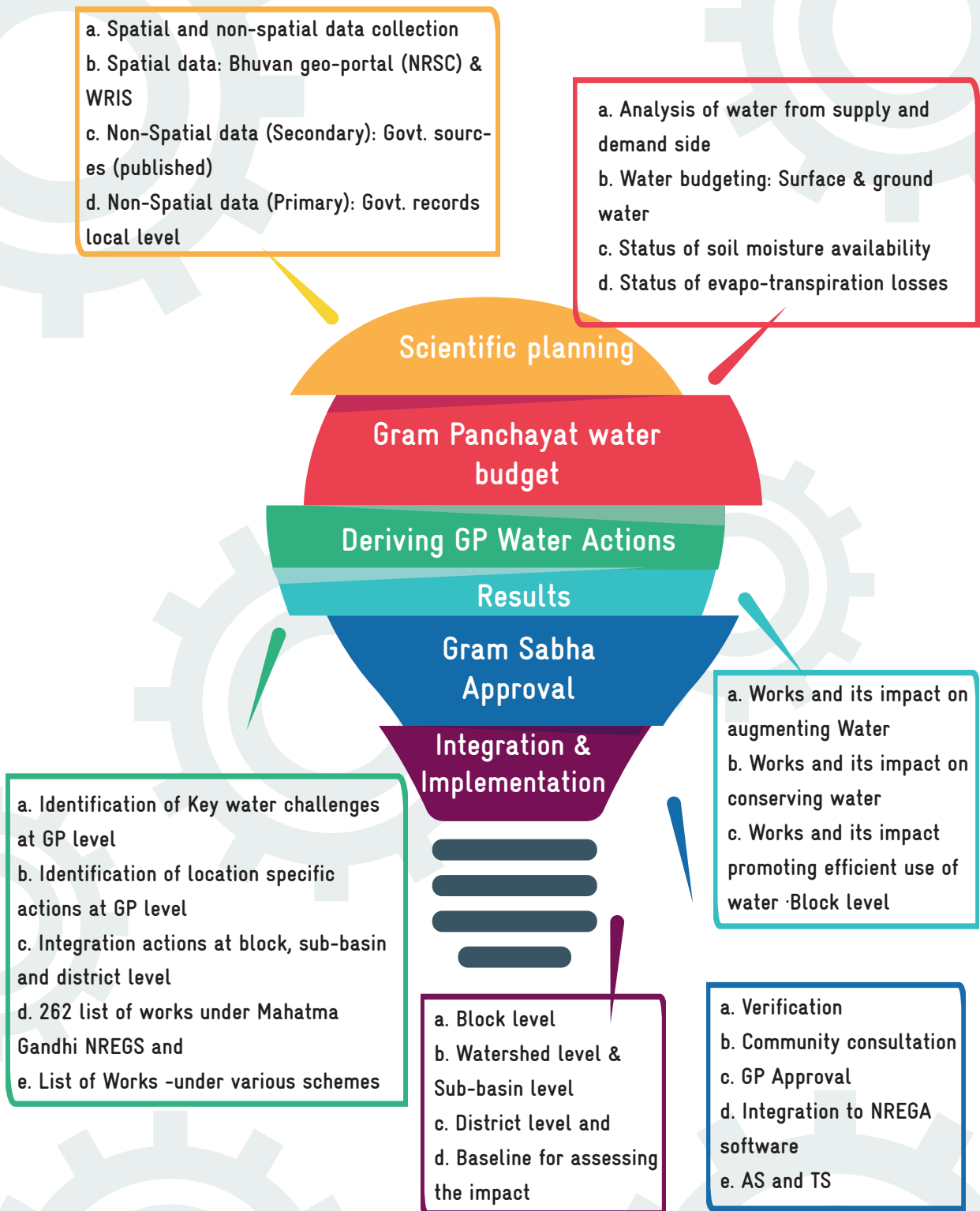
CWRM approach for WASCA uses simple scientific tools that can help Block or GP level officer to organize, analyze and prepare a developmental draft plan for participatory discussion at GP level. This approach involves analyzing key water challenges using both non-spatial and geo-spatial data in GIS, coupled with extensive ground truth verification. The non-spatial data includes the 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 GP as the lowest unit for 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. The next step is to assess land use, watersheds, drainage networks and surface runoff,

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 helps in preparing the water budget integrating ground water, surface water through runoff from rainfall, evapo-transpiration and soil moisture which further helps to identify potential areas of action to augment the water resources in public /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. This shelf of projects is again mapped with the schemes available 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 are some of the key aspects that needs attention for a tangible outcome in both NRM 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 into 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 the National, State, and District Level Steering Committees headed by the Additional Chief Secretary RD&PR and the District Collector respectively in the project area of Tamil Nadu government as a comprehensive and climate adapted planning approach for water security under the Mahatma Gandhi NRGES and National Water Mission.

BOX 2. MAIN 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 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

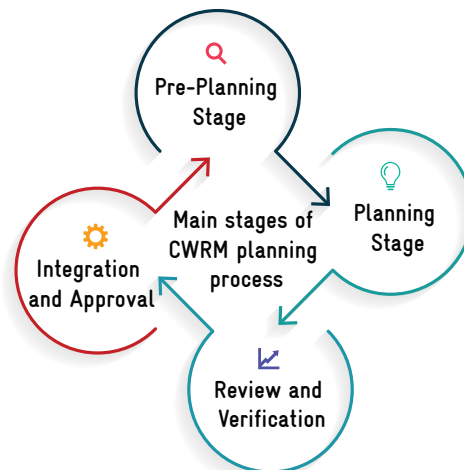
1. DEVELOPING PLANS AT LOWEST ADMINISTRATIVE LEVEL: GP LEVEL PLANS

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 NATURAL RESOURCES

4. INTEGRATING GP PLANS TO DEVELOP WASCA DISTRICTS CWRM PLANS



INTEGRATION AND APPROVAL

1. Preparation of Integrated plans (Block, Watershed)
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 NREGS
4. Integrating verified, approved works into NREGA soft (MORD NIC Portal) for mainstreaming WASCA
5. Regular review on progress at each levels

3.2 | CATEGORIZATION OF GPS

The CWRM uses both spatial and non-spatial data for developing GP level plans. Most of the non-spatial data are available at the revenue village level. To synchronize planning at GP, keeping data availability and administrative 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 Type I, II, III, IV and V. The description and basis on which GPs are categorized is given in Annexure 1. The details of categorization of GPs of Vembakkam Block is tabulated in Table 4.

TABLE 4. CATEGORIZATION OF VEMBAKKAM BLOCK GPS

NUMBER OF GP	GP TYPE	NAME OF THE PANCHAYAT
38	GP and revenue village data and boundary match (Type-I)	Sirunallur, Umaiyalpuram, Pillanthangal, Sodiyambakkam, Punnai, Karanthai, Kundiyanthandalam, Kuthanur, Maman-dur, Ukkamperumbakkam, Sumangali, Nemili, Mangal, Ma-thur, Pallavaram, Panamugai, Perungattur, Natteri, Surut-tal, Pavor, Thenkalani, Thennampattu, Thirupanangadu, Vadailuppai, Vadamanapakkam, Vayalathur, Vengalathur, Vembakkam
23	One GP is falling under more than Type 1 one Revenue Village (Type -III)	Alinjalpattu, Arasanipalai, Arasankuppam, Chithathur, Cholavaram, Hasanampettai, Kilnayakanpalayam, Kizhnelli, Kodayambakkam, Moranam, Namandi, Perunmanthangal, Poonathangal, Pudupalayam, Pulivalam, Pullavakkam, Sattuvanhangal, Mennalur, Randam, Sirunavelpet, Thirup-panamur, Vadakalpakkam, Velliakulam
18	GPs having more than one GP, one Revenue Villages data, boundary (Type -IV)	Siruvanjpattu, Irumaram
1	Newly formed GP after 2011 census publication (Type-V)	Dusi

3.3 | DATA COLLECTION

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 pro-







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 Land Use and Land Cover (LULC), waste lands, salt and erosion affected lands, drainage lines, ground water potential, lineament, geomorphology, and slope will contribute significantly in the prepara-

tion of appropriate and suitable science-based plans for 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:

tion of appropriate and suitable science-based plans for 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 analysis to understand the hydrological and administrative boundaries, know the vulnerable and good micro-watersheds, its location, distribution of different land use within the micro-watersheds 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 the 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.

Data from a total of 99 parameters were collected, out of which 13 parameters are primary source data and were collected at GP administrative units by GPs officers. 65 parameters are secondary source data collected from Govt. sources and authentic websites and the remaining 21 requisite parameters

for water budgeting and grey water were calculated using standards/suitable methods or formulas. CWRM parameters and its data sources is attached in the Annexure 3.1 to 3.3. The methods, and formulas used for water budgeting is attached in Annexure 3.4 and for grey water generation in Annexure 3.5.

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 and currently, data at Block level is not available. Hence, previous hydro-meteorolog-

ical disasters are considered to denote the Block's change in climate (temperature, rainfall) extremities and its risks, which was recorded by State Disaster Management Agency, 2020 (Table 5).

TABLE 5. CLIMATE RISKS AND VULNERABLE GP's

Flood	Drought	Heat Wave
Mathur, Mangal, Dusi, Cholavaram, Chithathur, Kanagampalayam, Namandi	All villages	All villages

3.5 | CWRM PLANNING ANALYSIS - WATER

For effective planning, the available traditional water storage and conveyance structures along with its supply and demand status for different sectors at Block level are necessary. Both spatial and non-spatial data including details and status on watershed and drainage network, canal network, irrigation fa-

cilities, 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 use are collected from authorized open sources and analyzed at the Block level as follows:

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. To understand, interpret and analyze the spatial parameters of the Block, available Bhuvan source thematic spatial maps/website views were referred to.

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 has further expanded with landform maps, which were widely used in various fields of hydrology, pedology, geoscience, urban and regional planning etc. Vembakkam Block is majorly engrossed with denudation origin pediment and pediplain complex and (Figure 3.1). Pediment is the low relined or plain with gentle slope area close to the foot of the mountains with or without debris whereas pediplain is relatively flat rock surface formed by joining of several pediments. Fundamental information of landform by its units will act as critical input in the identification of suitable sites for NRM activities while preparing CWRM plans.

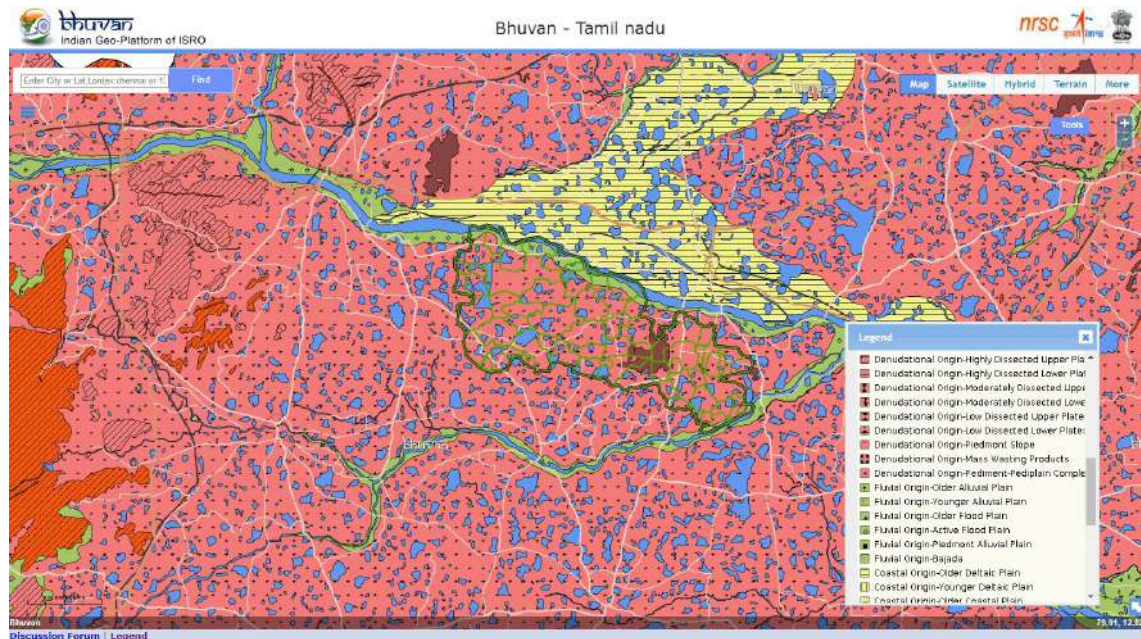
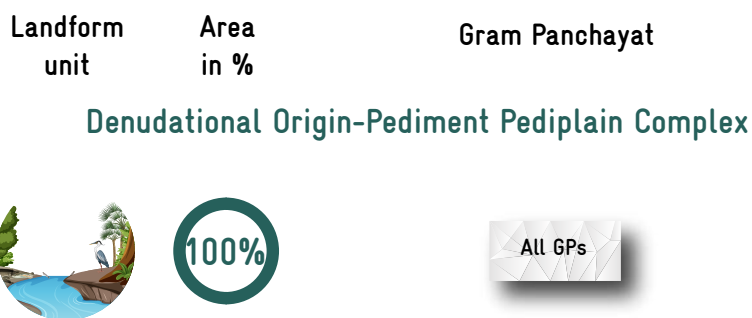


Figure 3.1. Geomorphology map



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 is represented with linear feature where two different landform converges or diverges. Lineament plays a significant role in identification of ground water and oil exploration sources. This site allows water to percolate at a high rate. GP wise lineament type in the Block is illustrated in the table below. These observations are widely used to locate points of high-water flow especially in groundwater exploration.

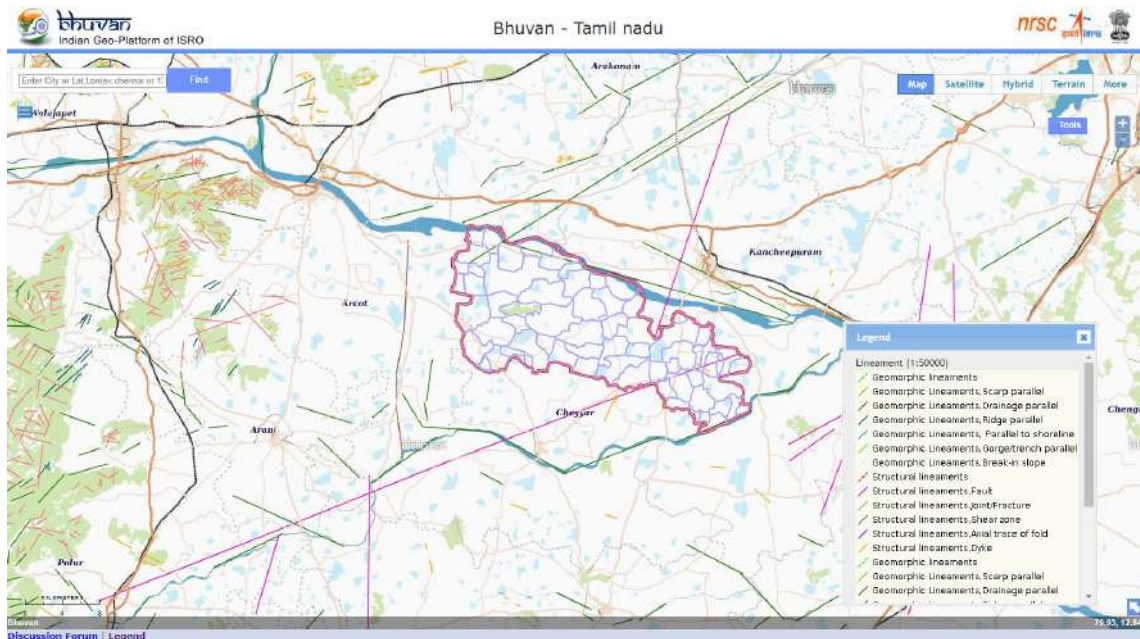


Figure 3.2. Lineament map

Lineament type
Gram Panchayat
Structural lineaments, Faults



Kilnaickenpalayam, Kundiyanthandalam,
 Mathur, Poonaihangal, Sodiyaibakkam,
 Vadakalpakkam

Geomorphic lineaments, Ridge parallel



Vadailuppai, Sirunavelpet,
 Brahmadesam, Panamugai,
 Pulivalam

3.5.1.3 Terrain: The terrain map is a product of Digital Elevation Model (DEM), which gives information related to elevation from above sea level used to represent the relief features. Block area belonging to the lower elevation range (grey color) (Figure 3.3). This map will be useful in identification of sites suitable for proposing activities related to water and soil conservation.

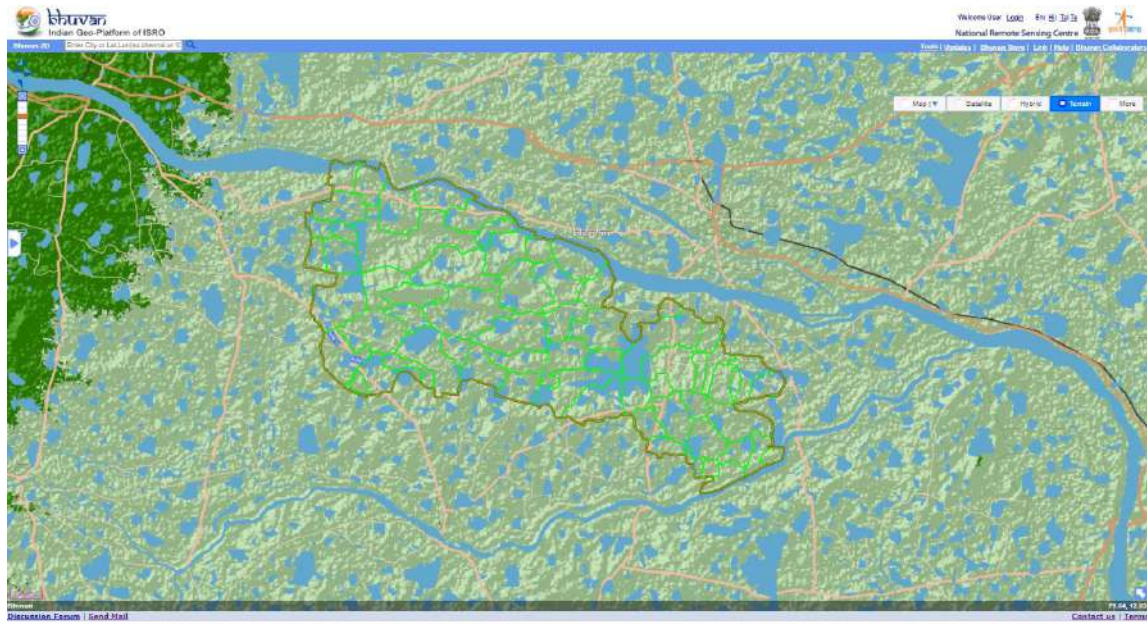


Figure 3.3. Terrain map

3.5.1.4 Contour map: The contour is the most important element in the cartographic representation of the terrain and determines relief forms such as valleys and hills, and the steepness or gentleness of slopes, geometrically. A contour map is illustrated with contour lines which shows the elevation of that earth surface from above sea level. The constant vertical distance between two consecutive contours, i.e. their height difference, is called contour interval. Density of the contour lines are related to the existence of upland or mountain/ hilly areas which can be noticed in the North West and Western part in the Vembakkam Block. The contour map plays a vital role in delineation of watershed & its units, used in planning and identifying the recharge structures, farm ponds and construction of grey water drain network etc., (Figure 3.4).

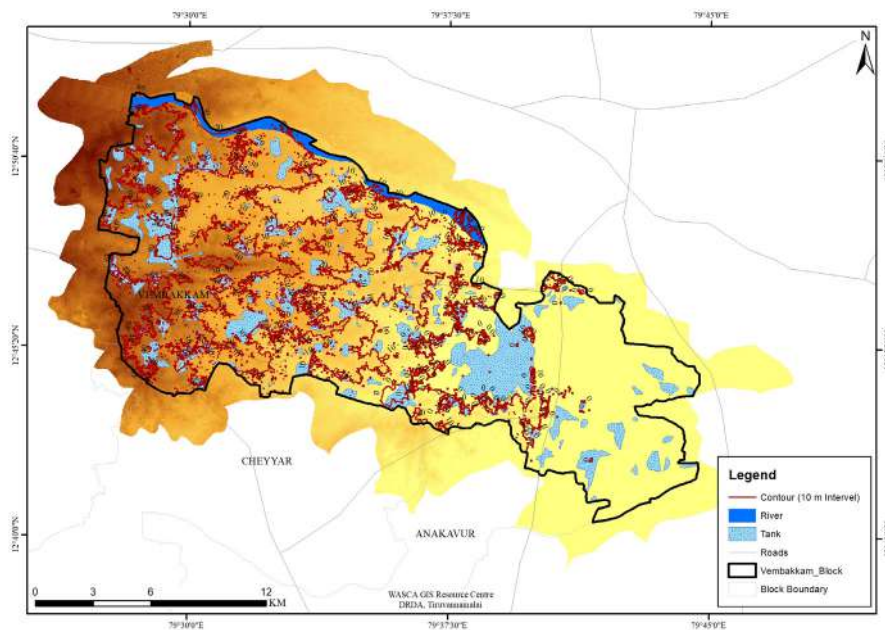


Figure 3.4. Contour map

3.5.1.5 Slope: The average slope of a terrain feature is calculated from contour lines on a topo map or DEM. Slope is typically expressed in percentage or 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 to flat slope ranges were noticed in the Block (Figure 3.5). GP wise details are shown in the below illustration. Slope information plays a significant role in identification of soil eroded sites, depth profiles, also used in analyzing / proposing the soil conservation measures such as check dam, farm ponds etc.

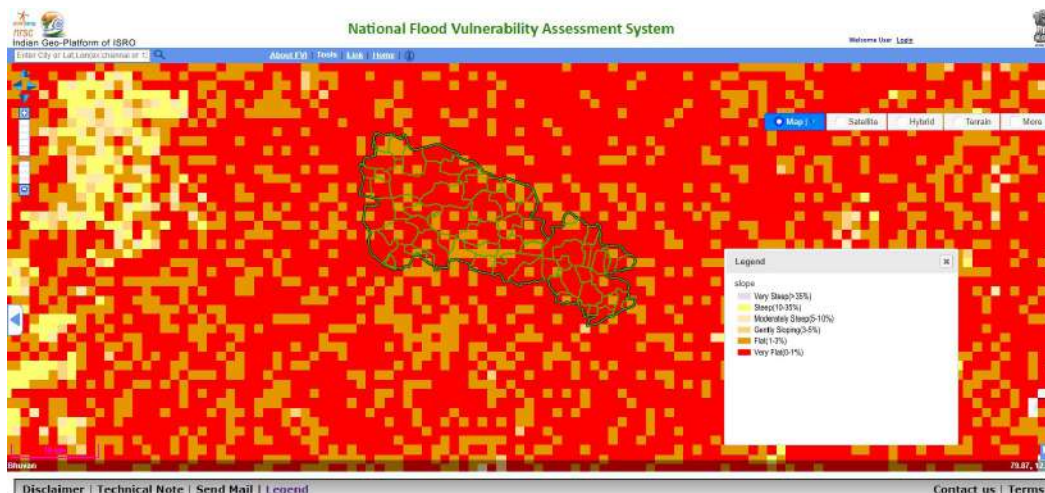


Figure 3.5. Slope map

Slope range	Area in %	Gram Panchayat
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Very flat (0-1%)



Kilnaickenpalayam, Kuthanur, Mamandur , Mathur, Menallur, Narasamangalam, Pallavaram, Pavor, Poonaihangal, Pudupalayam, Pulivalam, Sirunallur, Sodiymbakkam, Vadakalpakkam - 100%, Thiruppanamur - 99%, Alinjalpattu, Chithathur, Irumaram, Moranam, Natteri, Perumanthangal, Randam, Sattuvanthangal, Siruvanji pattu, Vadai-luppai, Vembakkam, Vengalathur - 95%, Dusi - 90%

Flat (1-3%)



Panamugai, Sumangali - 95%, Karandai, Thiruppanamur - 50%, Arasankuppam - 40%, Alividithangi, Ariyur, Dusi - 10%

3.5.1.6 Drainage Network : Drainage network pattern of a region is particularly dependent on the lithological characteristics, regional slope, structural control, climate condition etc. Dendritic or tree pattern drainage system was observed in Vembakkam Block. Block area is drained with low dense drainage network (Figure 3.6). The dendritic pattern is characterized by irregular branching of tributary streams in all directions. Drainage network is referred in identifying the suitable sites for soil and water conservation measurements such as dams, ponds, bunding, restoration of gullied region etc.

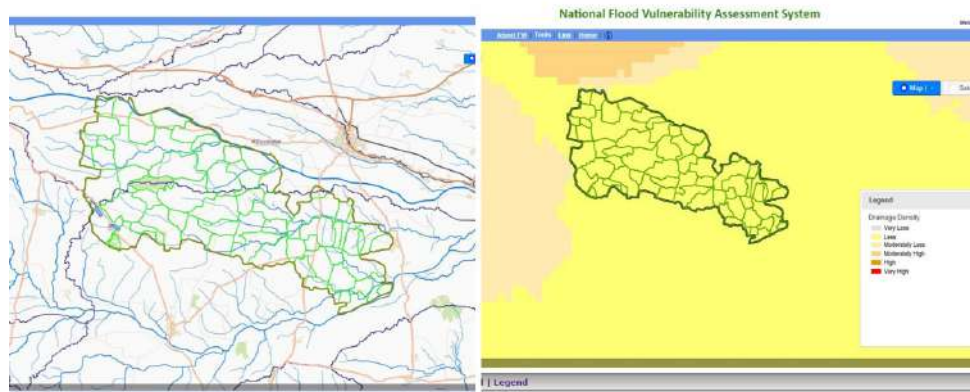


Figure 3.6. Drainage network and density

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. Vembakkam Block watershed map is illustrated in Figure 3.7. Watershed is used for the interventions based on Ridge to Valley (R2V) concept and sequencing the plan accordingly. R2V approach intends to conserve each drop of rain water from ridge to a reasonable extent and it ensures the better surface water flow management also aids in strengthening the durability of land, soil and water conservation structures downstream.

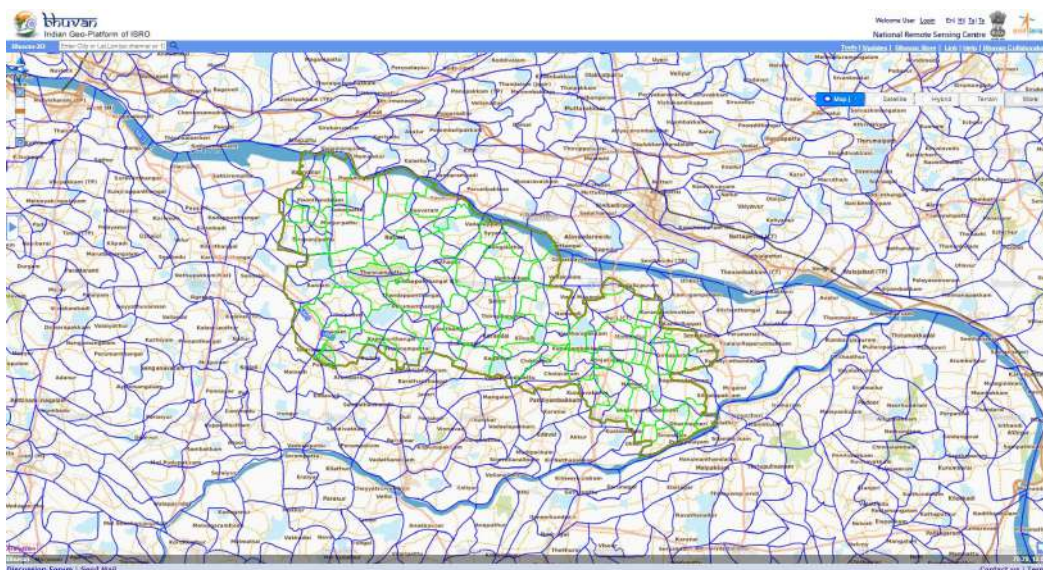


Figure 3.7. Watershed map

3.5.1.8 Ground water perspectives: Ground water (GW) is one of the important natural resources in semi-arid region like Vembakkam 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. Most of GPs area is witnessed the enrich yield of 50-100 LPM in above 80 m deep well (Figure 3.8). The GPs wise detail of GW prosperity is shown in the illustration below. This specific information is will play crucial role in identifying sites for recharge structures in order to address water scarcity issues in the Block.

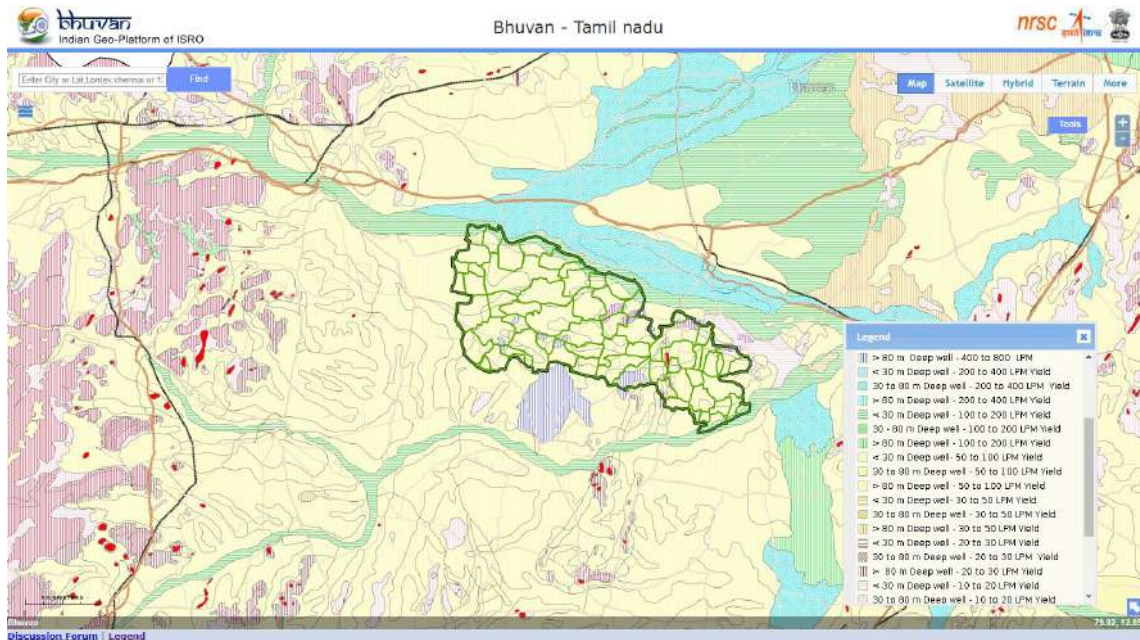
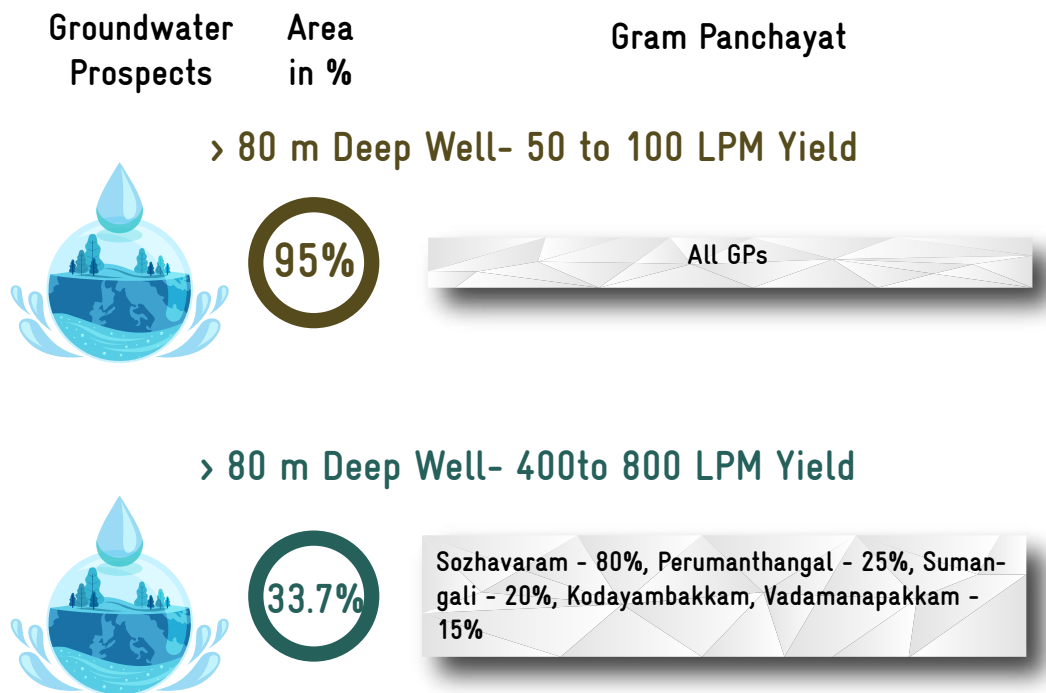


Figure 3.8. Ground water perspective map



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). Detailed GP wise current water resources state and its supply and demand side are shown in Annexure 3.6.

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

S No	Key CWRM Parameter	Total
	Canal Network (in m)	
1	Length of Minor Canal	1,41,710
2	Water Courses (Field Channels)	1,21,870
	Traditional Waterbodies (in no.)	
3	Number of Tanks (PWD & Union)	139
4	Number of Ooranis	353
5	Other Surface Water Bodies	58
	Area under Irrigation facilities (ha.)	
6	Area under Tank Irrigation	2,532.23
7	Area under Open & Tube Well Irrigation	3,661.71
	Catchment Area wise Available Runoff (in ha.m)	
8	Good Catchment Area	3,199.32
9	Average Catchment Area	295.77
10	Bad Catchment Area	4,295.71
	Watershed and Drainage Networks	
11	Length of Natural Drainage Lines (m)	2,29,162.87
12	Number of Natural Drainage Lines (No.)	271
13	Number of Micro Watersheds (No.)	281
	Water Demand in ha.m	
14	For Humans (ha.m)	347.73
15	For Livestock (ha.m)	226.63
16	For Agriculture (ha.m)	9,959.36
17	GW Utilization for Drinking (%)	71.81
18	GW Utilization for Livestock (%)	70.75
19	GW Utilization for Agriculture. (%)	96.49
20	SW Utilization for Drinking (%)	28.19
21	SW Utilization for Livestock (%)	29.25
22	SW Utilization for Agriculture (%)	3.51

3.5.2.1 Existing Water Structures

The Block has structured traditional water storage units as tanks, Ooranis and other surface waterbodies which are the life line for their lives and livelihoods. The Block has 139 tanks, 353 Ooranis and 58 other surface waterbodies (Figure 3.9).

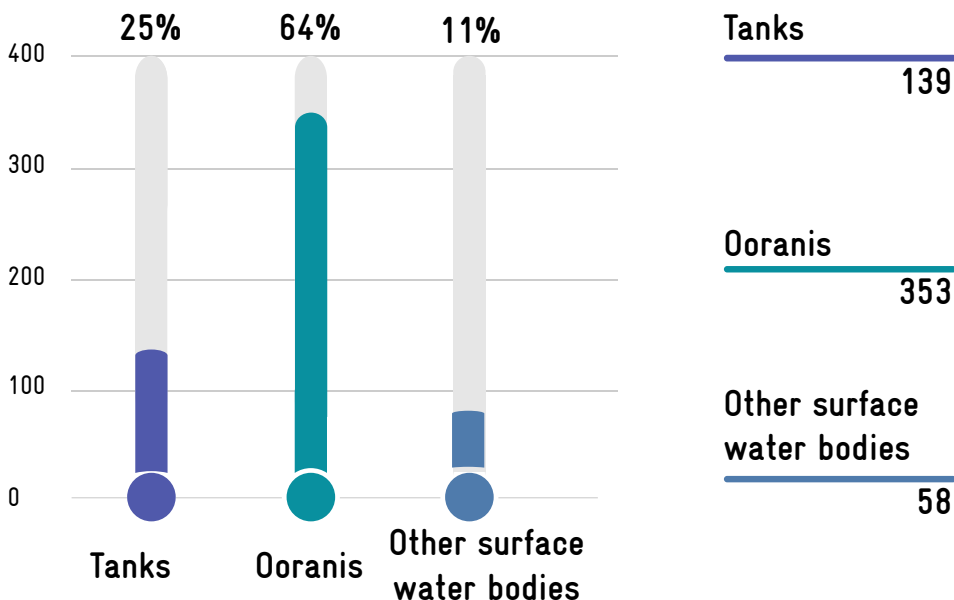


Figure 3.9. Traditional waterbodies

3.5.2.2 Sources of Irrigation

The total area under irrigation in the Block is 6,194 ha, of which 59.12 % (3,661.71 ha) is irrigated through open & tube well remaining is from tank-based irrigation (Figure 3.10).

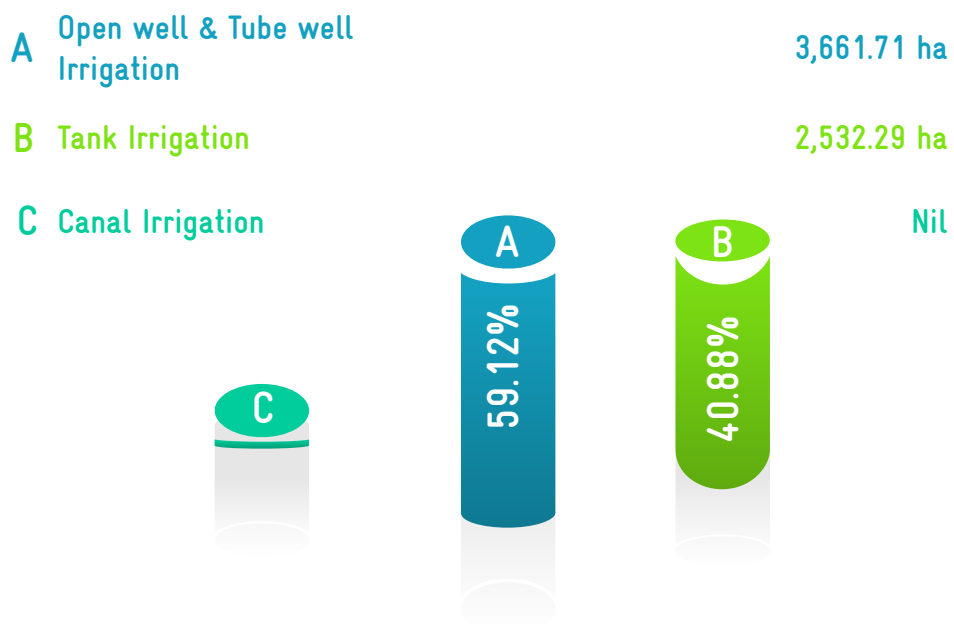


Figure 3.10. Irrigation source

3.5.2.3 Available Run off

The available runoff in catchment area is 7,791 ha m, out of which 41.07 % (3,199 ha m) comes from good catchment area, 3.8 % (296 ha.m) comes from average catchment area and 55.14 % (4,296 ha.m) comes from bad catchment area (Figure 3.11).

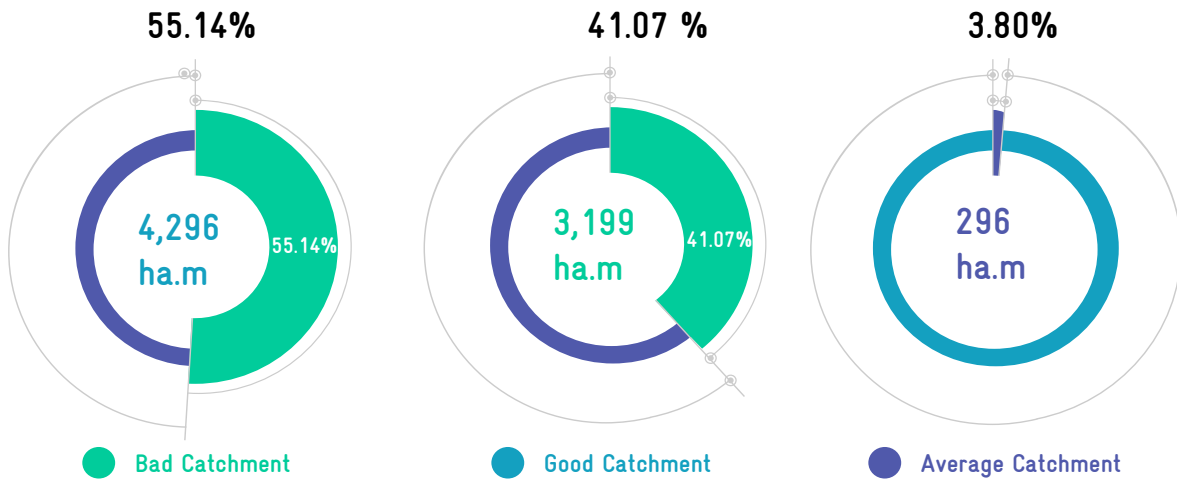
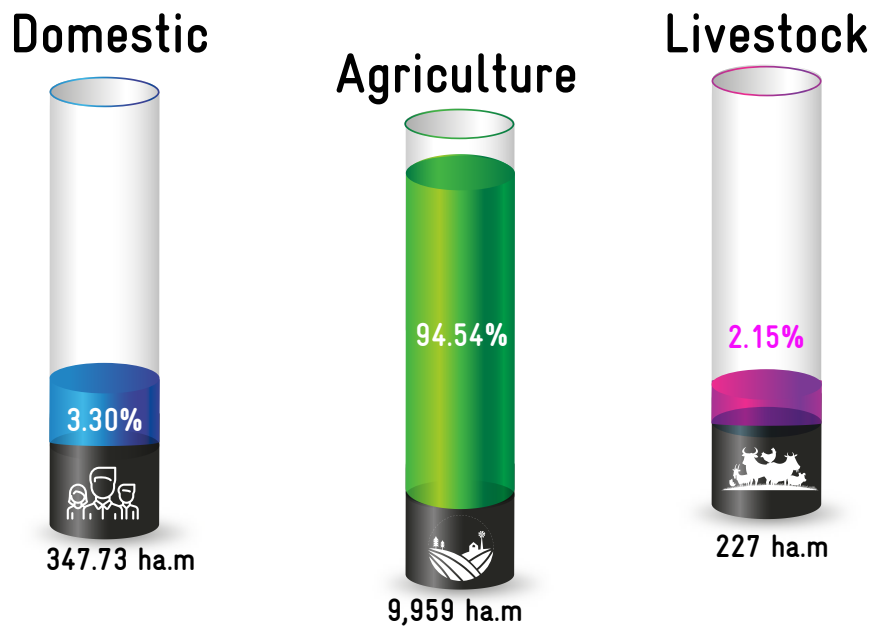


Figure 3.11. Runoff from catchments

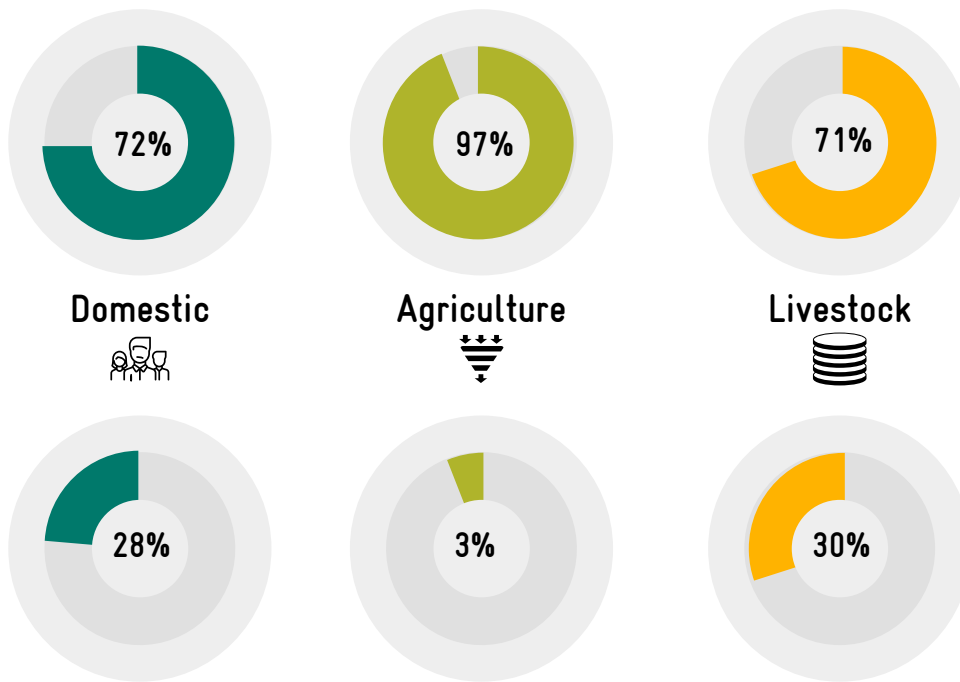
3.5.2.4 Water Demand

The total demand for water including domestic, agriculture and livestock purpose is 10,534 ha m. In which 348 ha.m for domestic, 227 ha.m for livestock and 9,959 ha.m for agriculture sector. In the Block, utilization of ground water is more than surface water.



About 96.5 % agriculture purpose, 70.8 % livestock and 71.8 % domestic purpose are met through groundwater (Figure 3.12).

% OF GROUND WATER UTILIZATION



% OF SURFACE WATER UTILIZATION

Figure 3.12. Sector wise water utilization

3.6 | CWRM PLANNING ANALYSIS- AGRICULTURE

Agriculture is the primary livelihood for the households in Vembakkam 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

To understand Vembakkam Block’s problems, Bhuvan based spatial data of LULC, waste land, salt

affected land, soil erosion and soil texture was referred to, for drafting scientific key water actions.

3.6.1.1 Soil texture: The Block has diverse soil types and predominant in vertisol and alfisol, with reference to soil texture the proportion of fine loamy texture type soil is dominant in the Block (Figure 3.13).

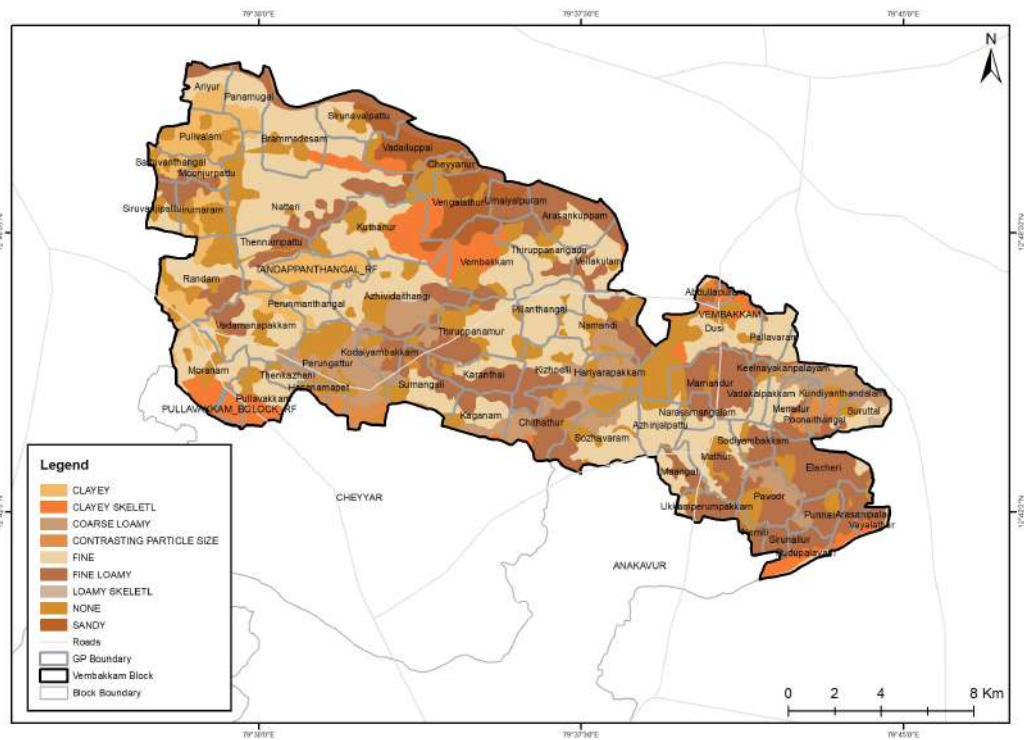


Figure 3.13. Soil texture map

3.6.1.4 Soil erosion: Soil erosion is a natural process of displacement of upper layer of soil caused by dynamic erosion agents that is, water, air, plants and humans. Sheet erosion is witnessed in the Block (Figure 3.14). GP wise details of soil sheet erosion area is illustrated in the table below. The soil eroded units will act as a direct input while preparing plans for soil conservation and watershed management activities.

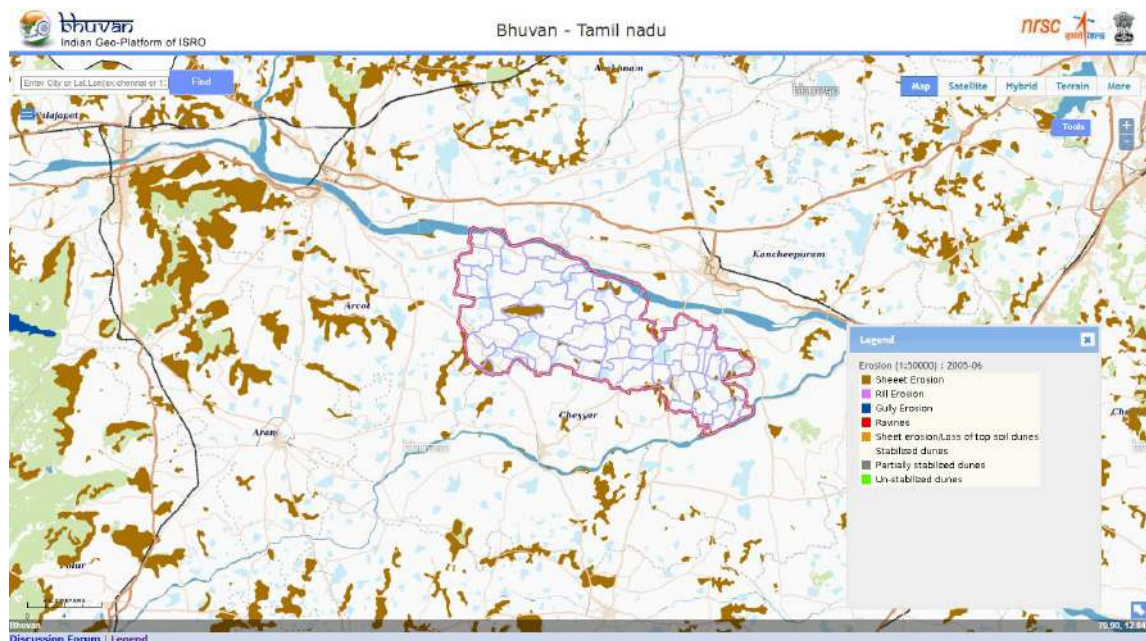
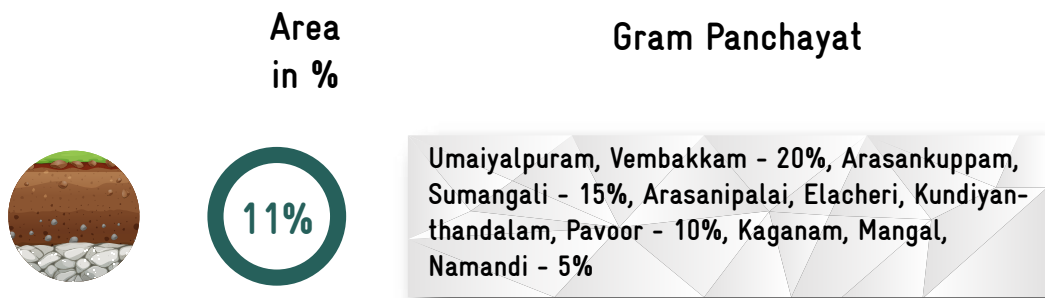


Figure 3.14. Soil erosion map



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 increasingly important which, in turn, underlines many environment-development policies. Polur Block is majorly covered by the agricultural crop and fallow lands classes of wasteland (Figure 3.15). The detailed LULC of Polur Block at GP level is listed below (Table 7). LULC map helps the decision makers and planners to focus on the fallow land development activities.

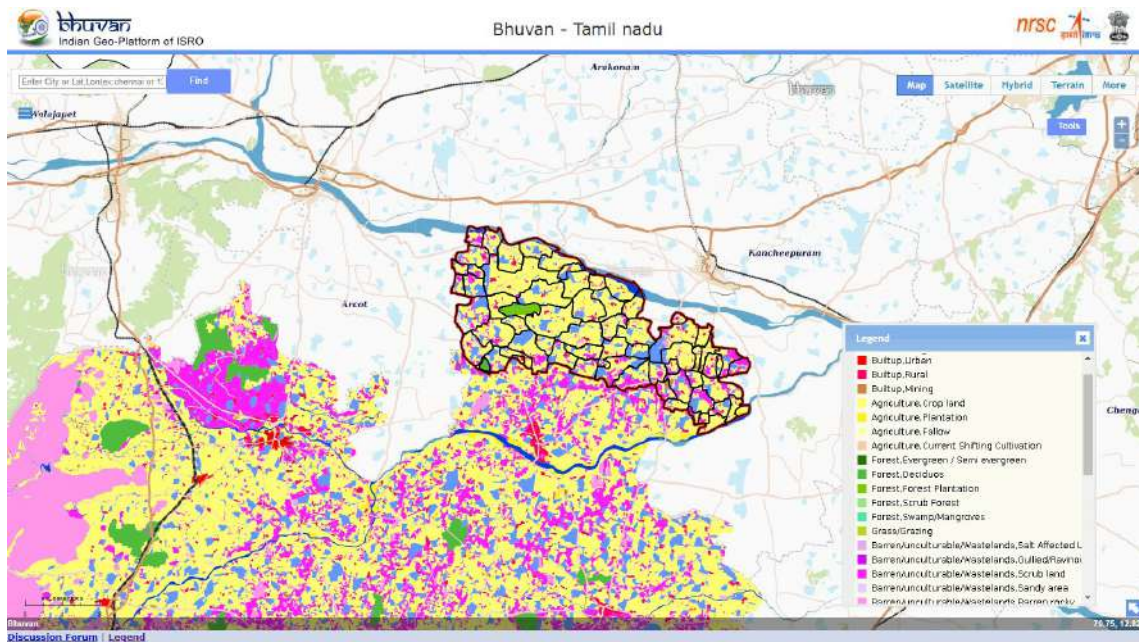
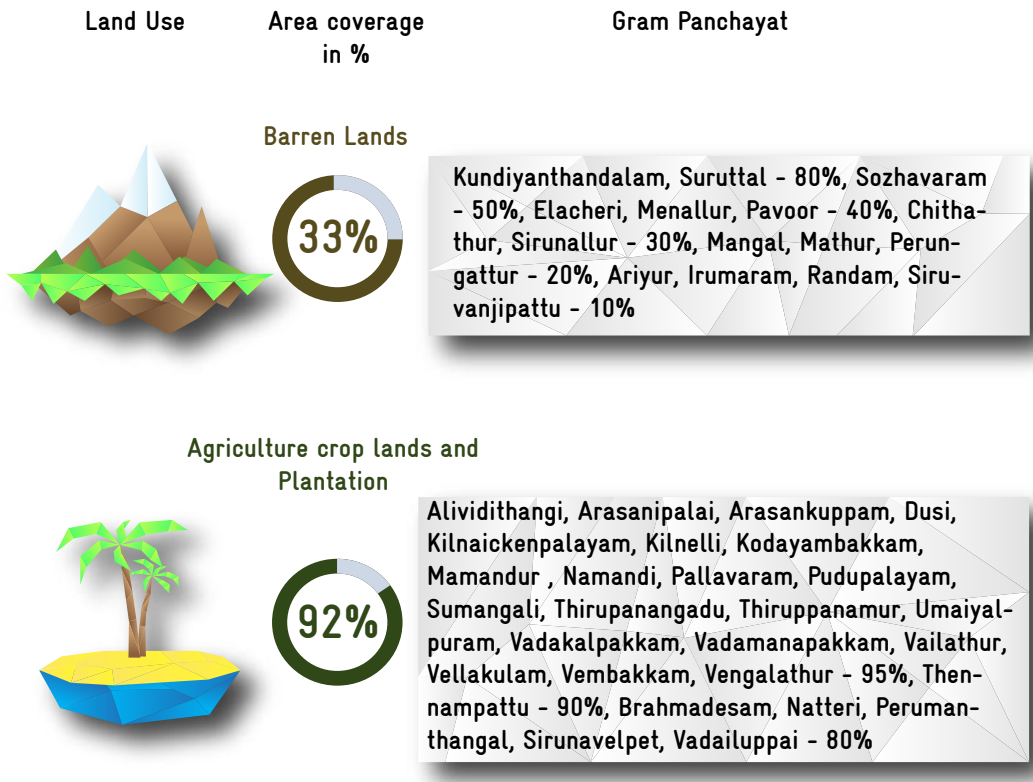


Figure 3.15. Land use land cover map



3.6.1.4 Waste land: A parcel of land which is not suitable for any agricultural activity and mostly covered with dense or open scrub is called as wasteland. Data on wastelands acts as a direct input in the preparation of plans for land development activities or greenery. Wasteland type of barren rocky area land is noticed in the Block (Figure 3.16).

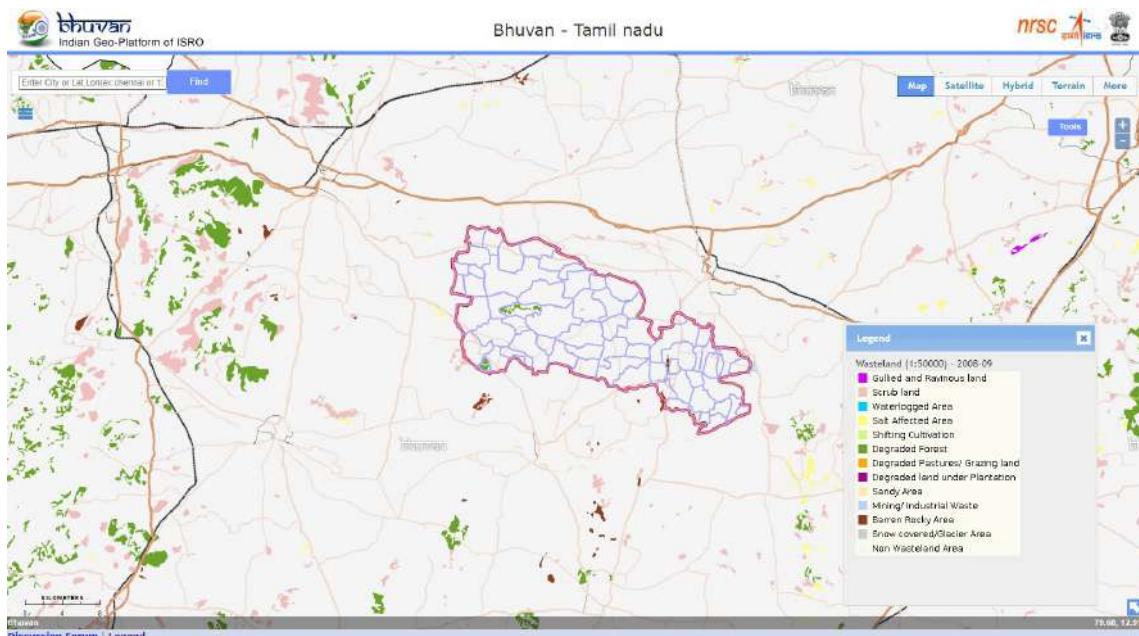


Figure 3.16. Wasteland map

Wasteland
type

Area
in %

Gram Panchayat

Barren rocky area



7.5%

Narasamangalam - 10%,
Mamandur - 5%

3.6.1.5 Salt affected area: No salt affected area is witnessed in the Block (Figure 3.17).

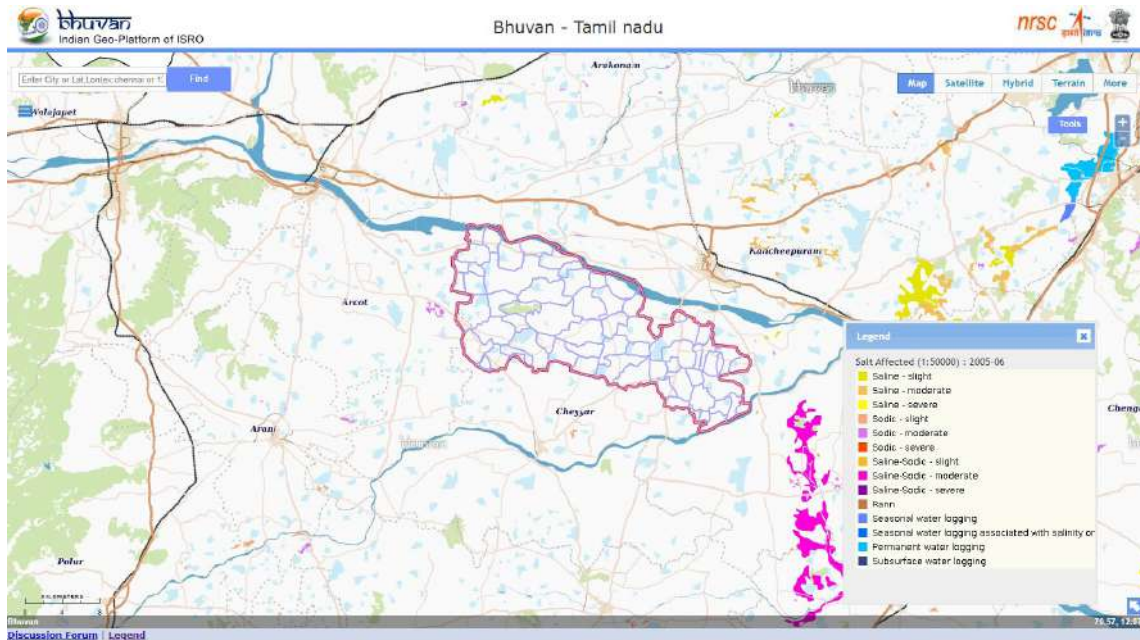


Figure 3.17. Salt affected area

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 Government sources (Table 7). The key CWRM parameters of agriculture area for all GPs are tabulated in Annexure 3.7.

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

S No	Key CWRM Parameter	Total
	Land Resources (ha)	
1	Non-Agricultural Uses	7,995.26
2	Area under Barren & Un-cultivable Land	536.68
3	Area under Permanent Pastures and Other Grazing Land	340.07
4	Land Under Miscellaneous Tree Crops etc.	203.20
5	Cultivable Waste Land	509.17
6	Fallows Land other than Current Fallows	2,686.97
7	Current Fallow land	12,573.77
8	Unirrigated Land	2,070.22
9	Area Irrigated by Source	5,639.01
	Land under Catchment Area (ha)	
10	Good Catchment	8,531.94
11	Average Catchment	1,052.44
12	Bad Catchment	22,969.97
	Crop details	
13	Irrigated Area (ha)	6,981.09
14	Rainfed area (ha)	392.49
15	Paddy Cultivation (ha)	6,147.23
16	Crop Water Requirement - Irrigated condition (ha-m)	9,797.35
17	Crop Water Requirement - Rainfed condition (ha-m)	162.03
	Soil Resources: status of available Nitrogen (%)	
18	Very Low	29.90
19	Low	67.24
20	Medium	2.15
21	High	0.72
23	Very high	0
	Status of Organic Carbon (%)	
22	Very Low	39.09
23	Low	59.90
24	Medium	0.57
25	High	0.31
26	Very High	0.13
	Status of Soil micro-nutrients (%)	
27	Sufficient	64.83
28	Deficient	35.17
	Status of physical condition of the soil (%)	
29	Moderately Acidic	0.09
30	Strongly Acidic	0.07
31	Highly Acidic	0.05
32	Moderately Acidic	5.54
33	Slightly Acidic	7.95
34	Neutral	1.85
35	Moderately Alkaline	82.89

Soil Texture (%)		
36	Clay soil	12.01
37	Fine Soil	58.56
38	Coarse loamy	11.01
39	Soil Water Permeability (Low, Moderate, high)	Moderate
Soil moisture and ET		
40	Volumetric Soil Moisture (%)	23
41	Estimated Soil Moisture (ha.m)	5648.5896
42	ET Losses (ha.m)	6495.3314
Means of water extraction (%)		
43	Gravity	14.55
44	Lifting	83.88
Irrigation methods (%)		
45	Wild Flooding	37.13
46	Control Flooding	55.06
Livestock (No.)		
47	Cattle Population	42,056
48	Sheep Population	35,599
49	Goat Population	17,576

3.6.2.1 Land Use

The standard land use classification helps to understand the distribution and extent of different categories of land use. 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 32,554 ha, 38.62 % of land is current fallow land, followed by 24.56 % area land is under non-agriculture uses and 17.32 % area is irrigated by sources while less than a percent of land is under miscellaneous tree crops (Figure 3.18).

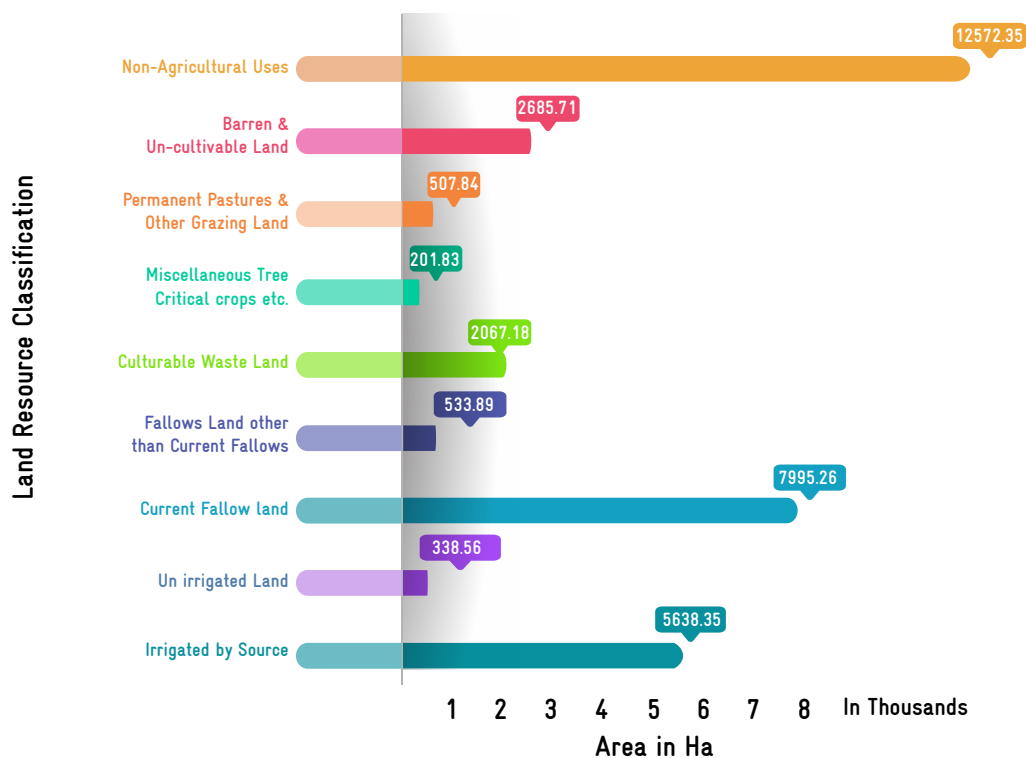


Figure 3.18. Land utilization

3.6.2.2 Catchment Area

The land use types in each of the GPs are categorized into three different types of runoff: Good, Average and Bad Catchment area. Out of total catchment area (32,554 ha), the highest of 70.56 % area is from bad catchment area followed by 26.21 % from good catchment area and the rest is from average catchment area (Figure 3.19). The run-off generated through bad catchment is higher than the good catchment. This information helps to prioritize and propose treatment activities.

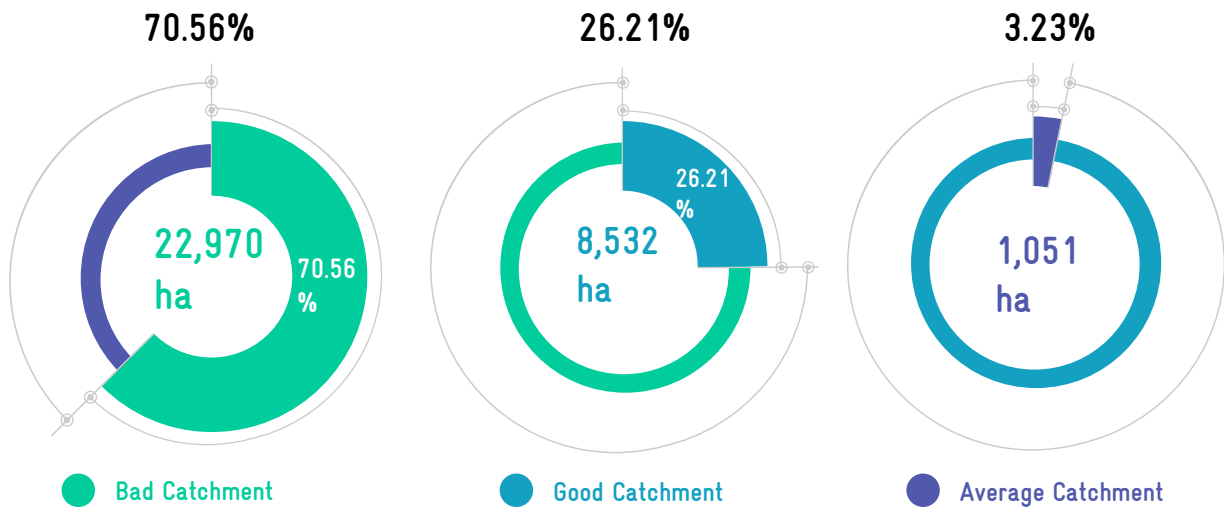


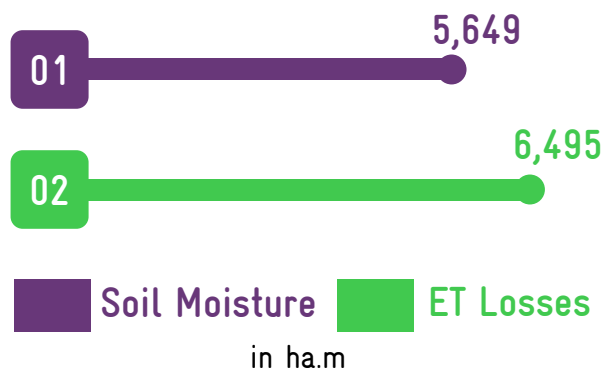
Figure 3.19. Catchment Area

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 (23%), is taken for estimating the amount of water stored as soil moisture which accounts to 5,649 ha.m.

3.6.2.4 ET losses

The loss of water through ET is important in water budgeting. The annual total ET loss during 2018-19 was 804 mm with monthly average of 67.08 mm. The average percentage of water loss through ET in the Block is 23% and the total annual losses due to ET alone is 6,495 ha.m.



3.6.2.5 Macro soil nutrients

Nitrogen Status

The macro soil nutrients such as nitrogen falls under very low to high category in the total number of soil samples tested. The available nitrogen is very low in 29.9 % of the samples tested while it was 67.24 % under low category, 2.15 % under medium and minute of 1 % samples with witnessed with high nitrogen content (Figure 3.20). According to soil resource map, this Block is identified as one of the nitrogen deficient Blocks (Tiruvannamalai District profile 2020).

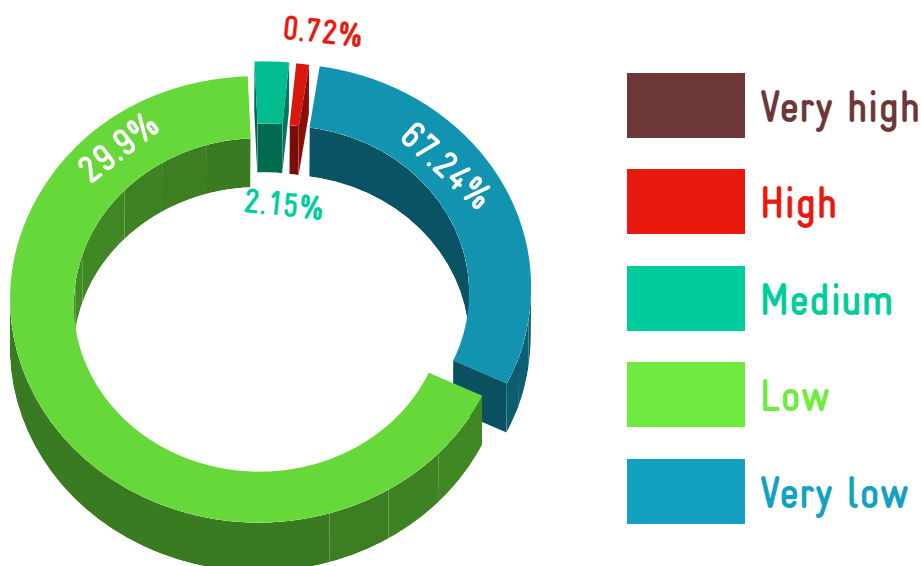


Figure 3.20. Status of available Nitrogen

Organic Carbon Status

Status of soil organic carbon content in tested samples varies from very low to very high. The highest of samples witnessed a low percentage (59.9 %) of organic carbon content followed by 39.09 % of low while 0.13 % samples witnessed the very high organic carbon (Figure 3.21). This indicates that the soil fertility is very poor and further intensive practices will make the soil more vulnerable to degradation over a period of time.

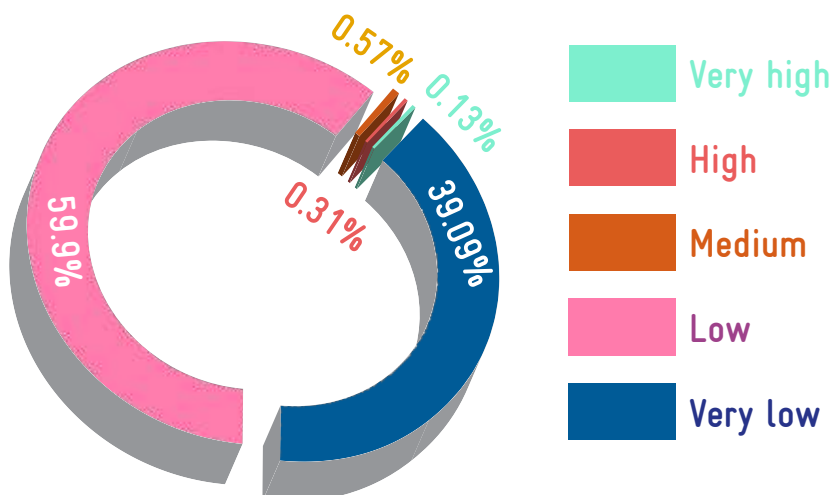


Figure 3.21. Status of soil Organic Carbon

3.6.2.6 Status of the soil micro nutrients

This Block is one of the zinc deficient Blocks of Tiruvannamalai District. Of the soils tested, the micro nutrient status of the soil with specific reference to Manganese, Boron and Zinc, Ferrous, Copper, and Sulphate are deficient in 35.17 % and 64.83 % sufficient (Figure 3.22).

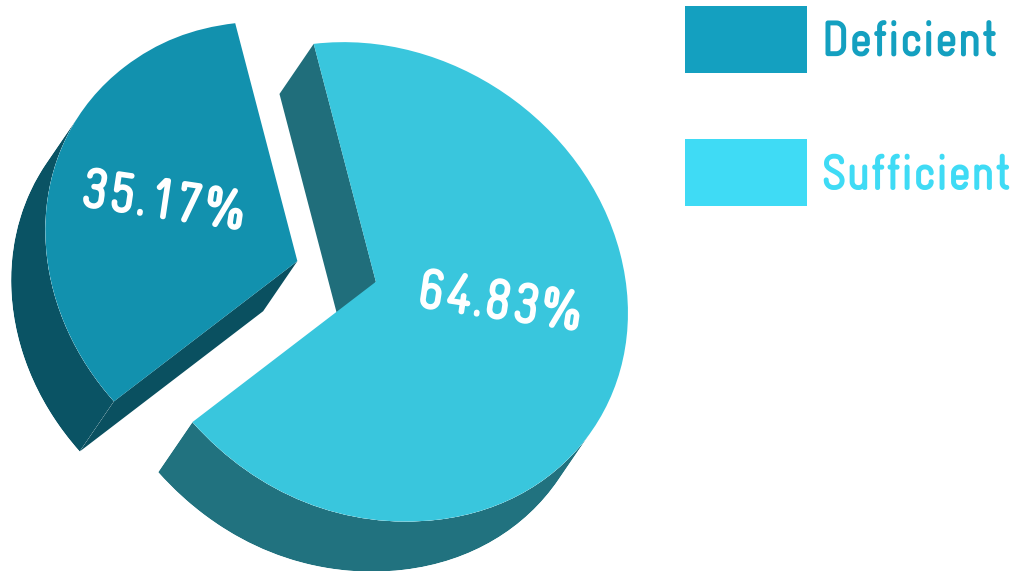


Figure 3.22. Status of soil micro-nutrients

3.6.2.7 Physical parameters – pH status

With reference to the physical parameters, 82.89 % of the soil is moderately alkaline in nature, rest is acidic variations, except 1.85 % is neutral in nature (Figure 3.23).

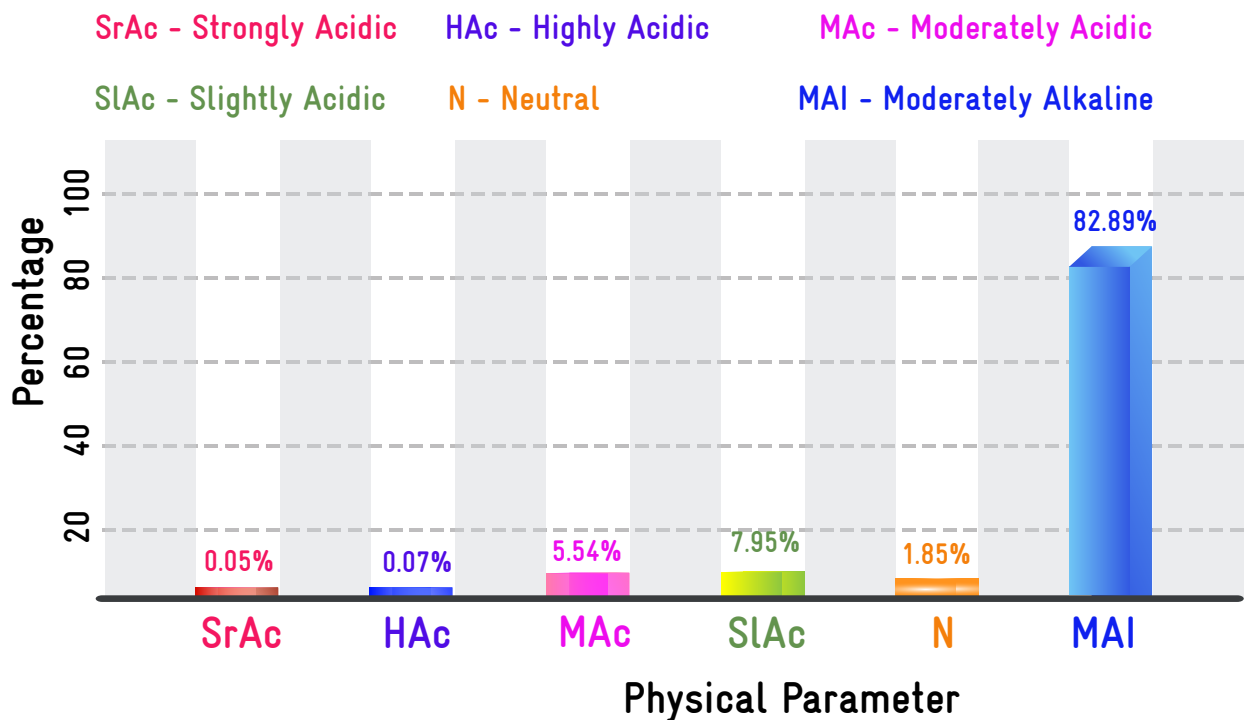


Figure 3.23. Status of pH of soil

3.6.2.8 Cropping pattern and the irrigation

The total of 8,890 ha of land is used for crop cultivation, of which 94.85 % area is under irrigation practices and remaining is under rain-fed cultivation. Overall, Paddy crop land shares the highest cultivation area of 73.42 % followed by ground nut if 14.45 % while other pulses, horticulture crops shares less than a percent of total cultivated area (Figure 3.24).

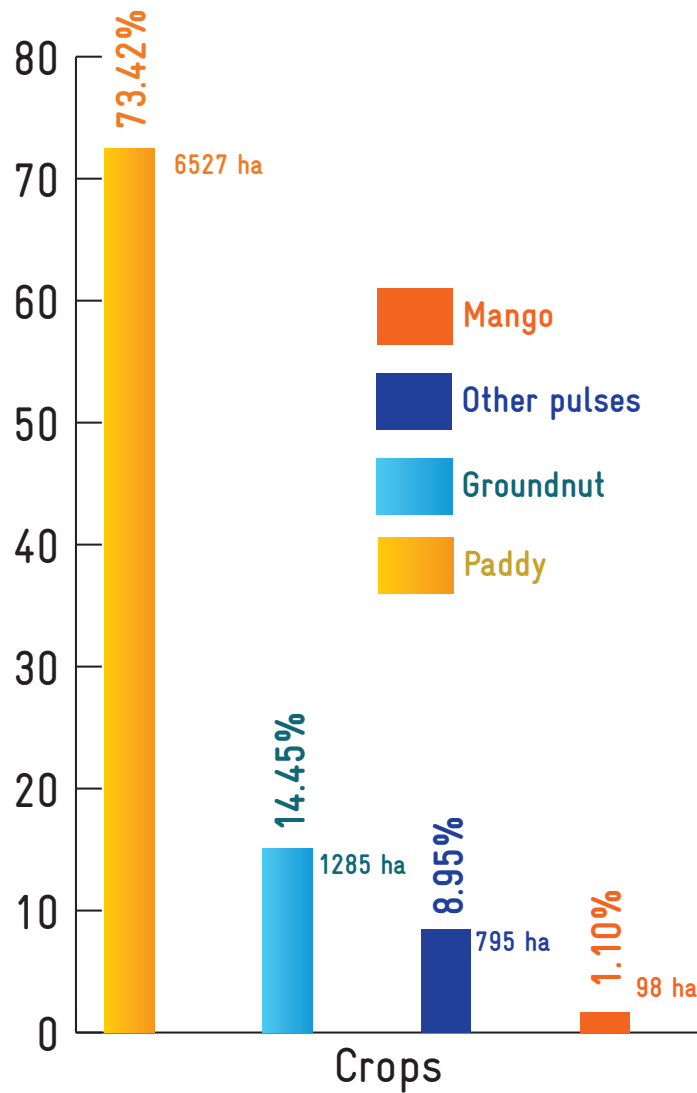


Figure 3.24. Cropping patterns

3.6.2.9 Irrigation Methods

In case of surface water resources, wild flooding is the primary method of irrigation. But in case of ground water resources, the predominant type of irrigation is controlled flooding. In the Block, 55.06 % of the irrigation is done by control flooding and rest is of wild flooding irrigation (Figure 3.25).

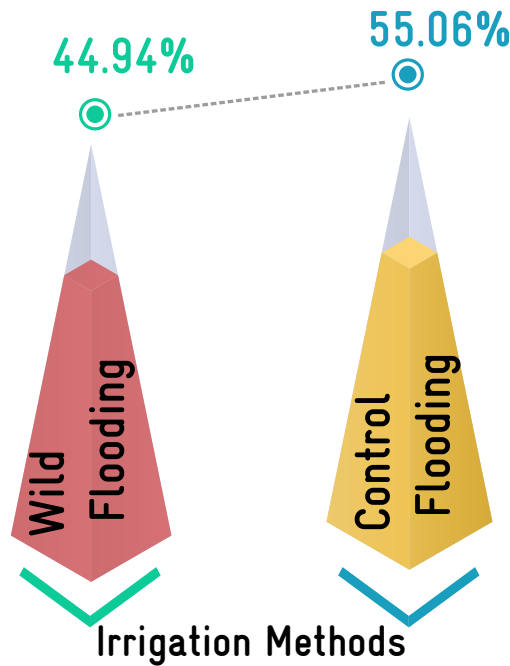


Figure 3.25. Irrigation methods

3.6.2.10 Means of Water Extraction

In the Block, water is extracted in two ways: gravity and lifting from the sources. The 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 District, since the dependence on ground water sources is more, 83.88 % of the water extraction is through lifting means of extraction and only 14.55 % is through gravity means of water extraction (Figure 3.26).

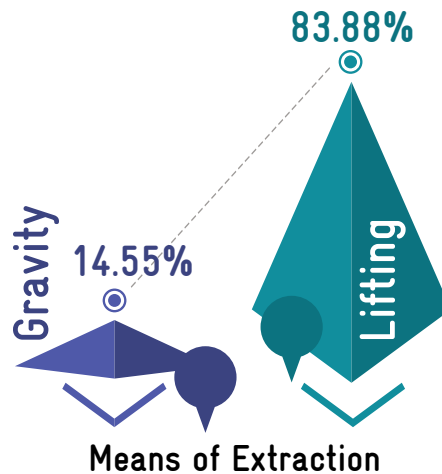


Figure 3.26. Means of water extraction

3.6.2.11 Livestock Details

The Block has a total livestock population of 95,231 which includes, cattle, sheep and goats. The small ruminants such as sheep and goat constitute 37.38 % and 18.46 % respectively of the total livestock. Cattle population is higher in this Block at 44.16 % (Figure 3.27). The total water requirement for livestock is 227 ha.m. Of the total water demand, 70.8 % is met through ground water and remaining 29.2 % is from surface water resources.

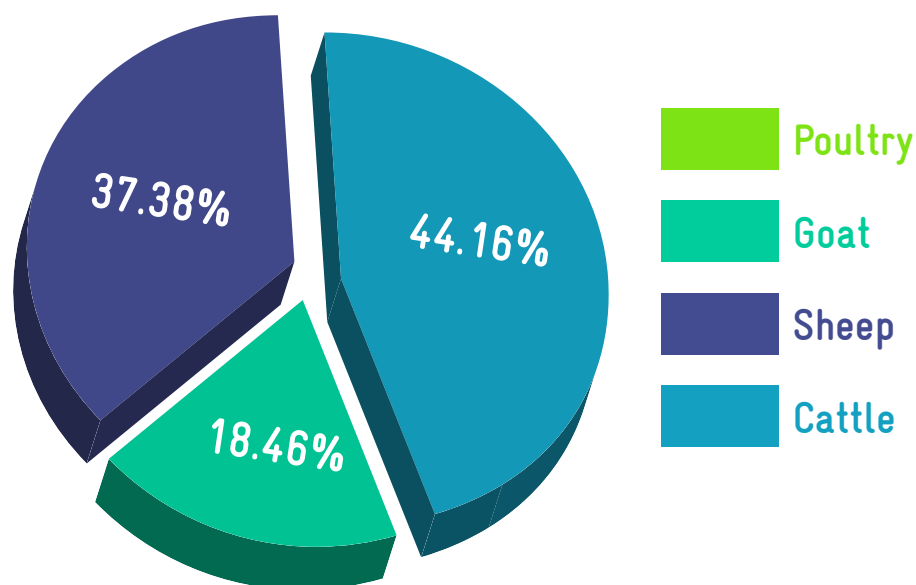


Figure 3.27. Livestock details

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

number of MGNREGA job holders is also analyzed. Table 8 lists demographic and socio-economic status of Vembakkam Block. GP wise demographic and socio-economic status are attached in Annexure 3.8.

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

S No	Key CWRM Parameter	Total
1	Geographical Area (ha)	32,897
2	Male Population (No.)	63,981
3	Female Population (No.)	63,051
4	Total Population (No.)	1,27,032
5	SC Population (No.)	32,673
6	ST Population (No.)	1,333
7	Vulnerable population (No.)	34,006
8	Households (HH's) (No.)	29,864
9	Only one room HH's (SECC) (No.)	3,882
10	Female Headed HH's (SECC) (No.)	1,858
11	Vulnerable Households (SECC) (No.)	3,279
12	% of Vulnerable Households (%)	10
13	Registered MGNREGA Job cards (Persons)	42,225
14	Active person working in MGNREGA job Cards (Persons)	32,373
15	Drinking Water Sources (No.)	17,645
16	Ground Water - Drinking source (No.)	288
17	Surface water - Drinking source (No.)	59
18	Sum of drinking water sources (No.)	347
19	HH's have tap water connection for drinking water (No.)	1,360
20	HH's dependent on other sources for drinking water (No.)	19,549
21	Annual Greywater Generation (ha - m)	232

3.7.1 Population

The total population of the Block is 1.27 Lakhs*, of which the proportion of male are slightly higher than female (Figure 3.28). 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 27 % of the total population constitute vulnerable population.

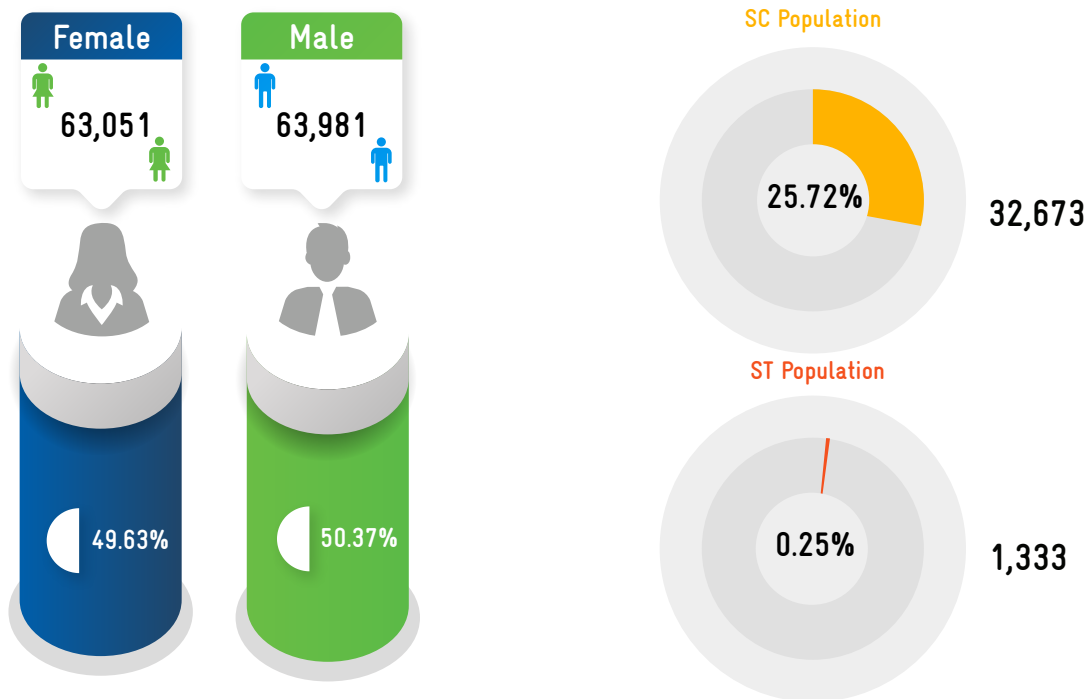


Figure 3.28. Population details

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

3.7.2 Households

There are a total of 29,864 households in which 13 % households have only one room, 6.22 % households are headed by women and 11.47 % are vulnerable households (Figure.3.29)

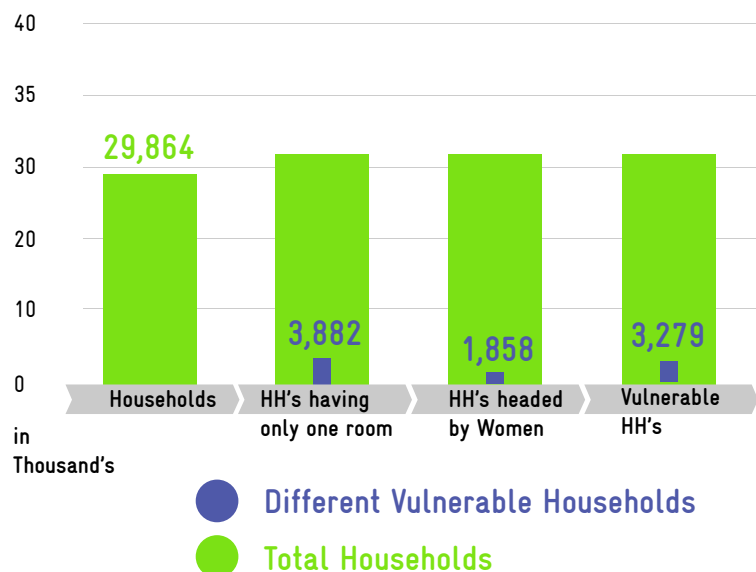


Figure 3.29. Details of households

3.7.3 Status of Mahatma Gandhi NREGA job card status

In the Block, of the total population of 1.27 Lakhs, 33.2 % are registered for job cards in Mahatma Gandhi NREGA scheme, in which 77% of the job cards are in active category (Figure 3.30).

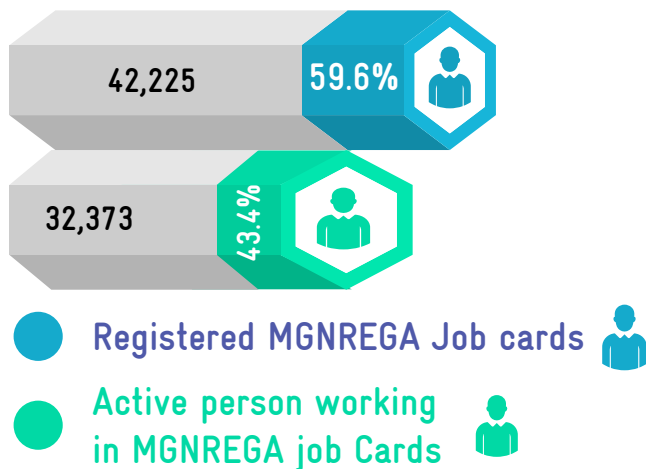


Figure 3.30. Status of MGNREGA job cards

3.7.4 Drinking Water Sources

Only 1,360 households have tap water connection and the rest of the population is dependent on other ground water sources, which include RTRWHS / Tanka (Roof Rain water harvesting systems, hand pump, open wells, bore wells, tank/ pond/ oorani, springs and river/ streams.



3.7.5 Annual Greywater Generation

The grey water generation estimated across this Block is 243 ha.m which is available for reuse or recycle.

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



Kundiyanthandalam,
Poonaihangal, Vadailuppai



Ground water prosperity

Mamandur, Narasaman-
galam, Kodayambakkam



Vembakkam,
Umaiyalpuram



Wasteland

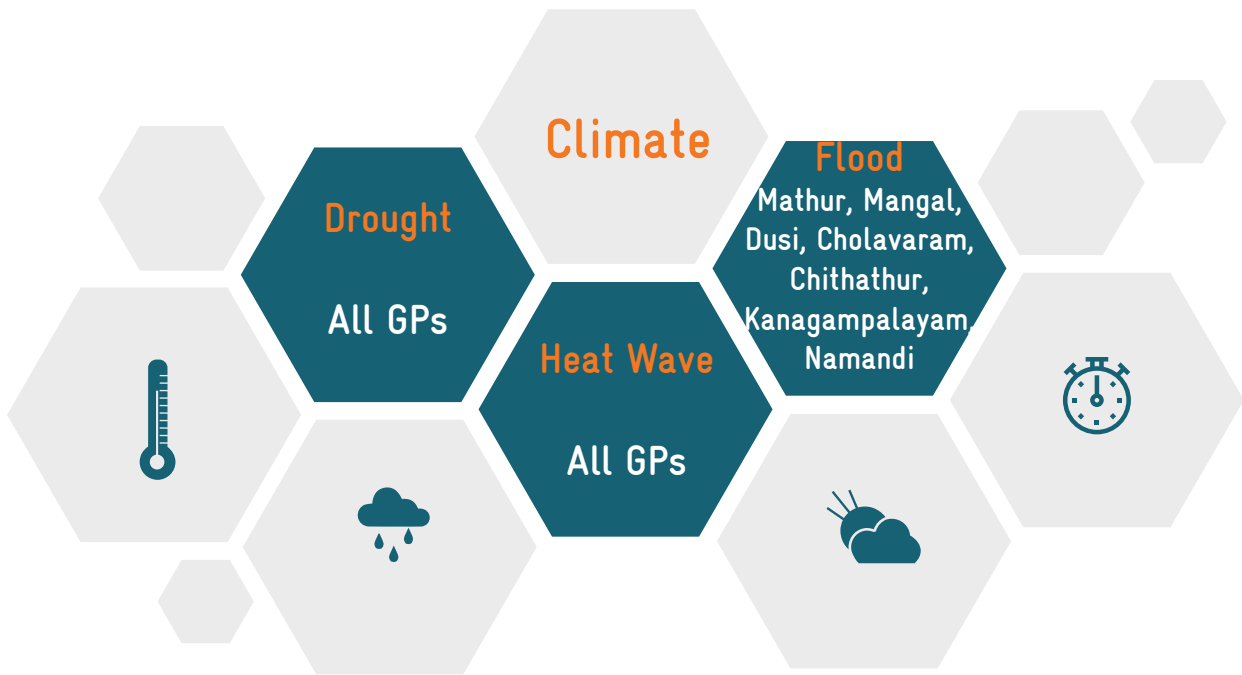
Suruttal, Kundiyanthanda-
lam, Narasamangalam



Sumangali Panamugai

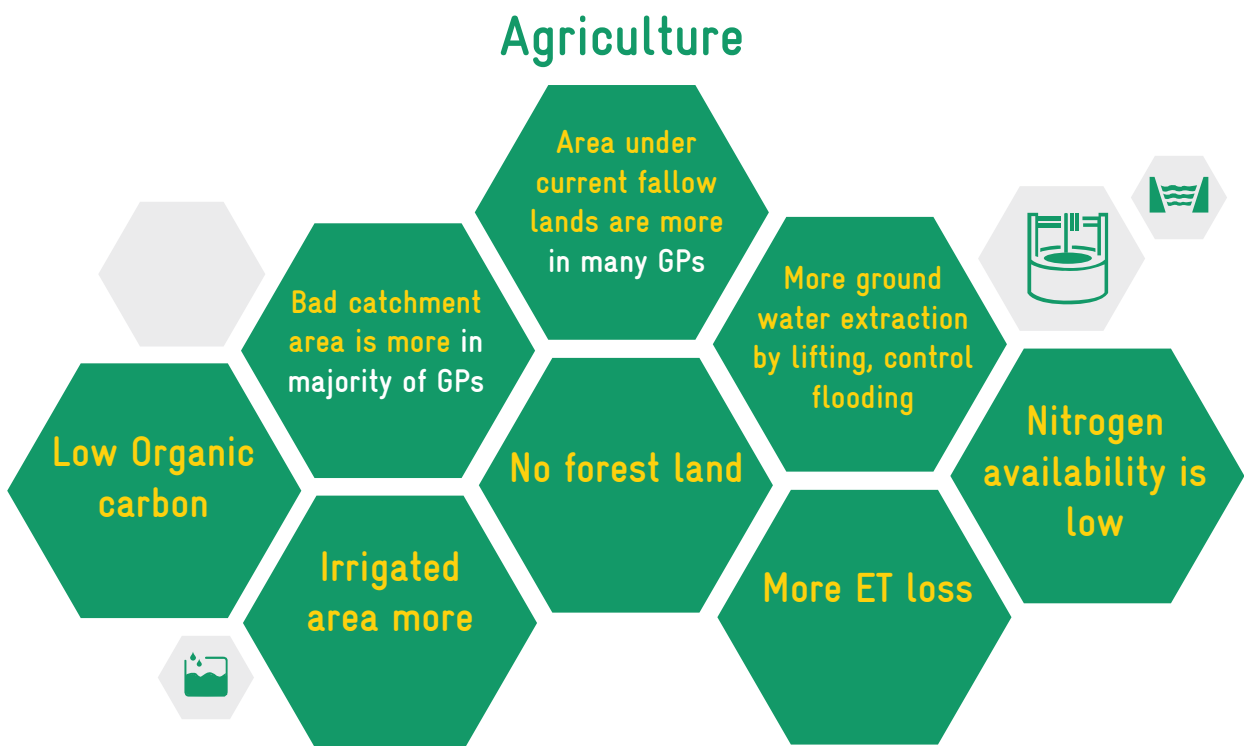
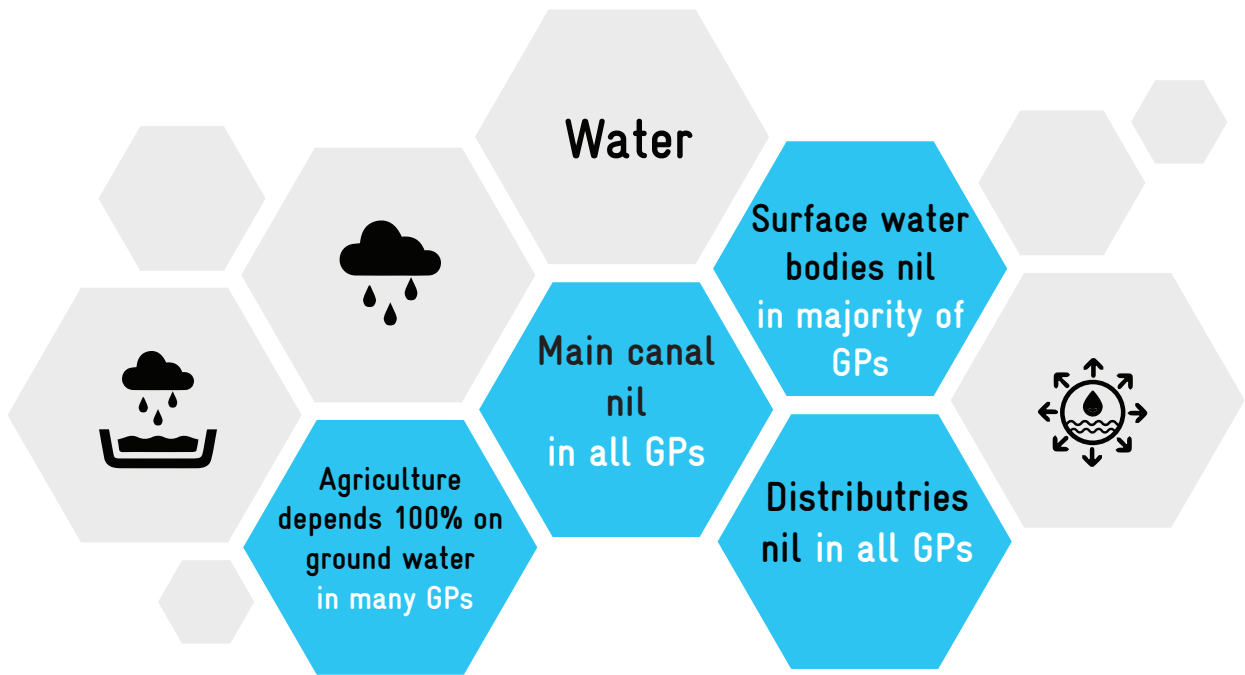
Each spatial thematic information indicates the scope for treatment activities in the relevant GPs for land or water-based measures





Socio economic





கெடுப்பதூஉம் கெட்டார்க்குச் சார்வாய்மற் றாங்கே
எடுப்பதூஉம் எல்லாம் மழை

குறள் - 15

Destruction it may sometimes pour
But only rain can life restore

Thirukkural - 15

CHAPTER 4

VULNERABILITY RANKING OF GP



4 | VULNERABILITY RANKING OF GPs

The vulnerability assessment has been carried out using IPCC methodology. 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).

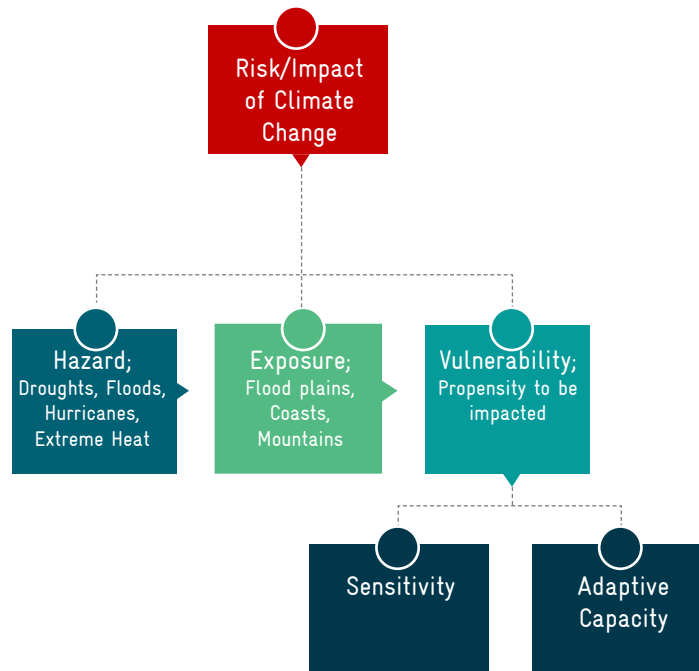


Figure 4.1. Vulnerability of the system as defined by IPCC

Generally, vulnerability assessments are made to identify.

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

The CWRM parameters which have been explored through rigorous study were considered here to address the key water challenges at GP level. About 70 spatial and non-spatial parameters/ indicators under 4 dimensions via climate (3), water (25), 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 the CWRM parameters/indicators, its rationale to vulnerability, source of data and its linkage with WASCA TN’s 18 primary indicators.

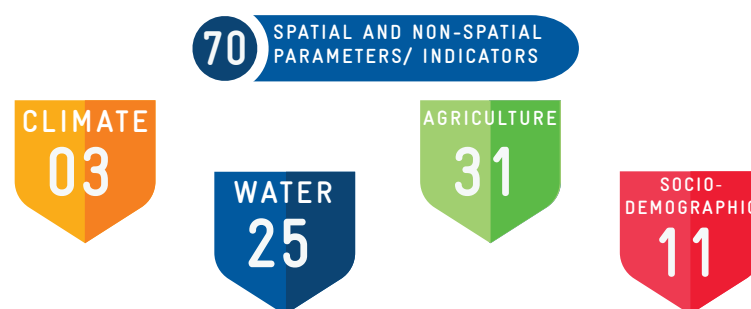


TABLE 9. CWRM PARAMETERS SELECTED FOR BLOCK LEVEL VULNERABILITY

	Key CWRM Parameter	Vulnerability relationship
Climate	Drought	Climate risk/Sensitivity
	Flood locations	
	Heat Wave	
Water	Canal Network (in m)	Adaptive capacity
	Length of main canal	
	Length of minor canal	
	Length of distributaries	
	Water courses (Field channels)	
	Traditional water bodies (in No.)	Adaptive capacity
	No. of Tanks	
	No. of Ooranis	
	Other surface waterbodies	Sensitivity
	Irrigation Facilities (in ha)	
	Area under Tank irrigation	
	Area under canal irrigation	
	Area under open & tube well irrigation	
	Catchment Area wise Available Runoff (ha-m)	Sensitivity
	Good catchment area	
	Average catchment area	
	Bad catchment area	Adaptive capacity
	Watershed and Drainage Networks	
	Length of natural drainage lines (m)	
	No. of natural drainage lines	
	No. of micro-watersheds	
	Water demand (ha-m)	Sensitivity
	For Humans	
	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		
Agriculture	Area under land resources (in ha)	Adaptive capacity
	Forest land	
	Non-Agricultural Uses	
	Barren & Un-cultivable Land	
	Permanent pastures and Other grazing land	
	Land under miscellaneous tree crops etc.	
	Cultivable wasteland	Sensitivity
	Fallow land other than current fallows	
	Current fallow land	
	Unirrigated land	
	Area irrigated by source	

Agriculture	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		
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 level. The vulnerability assessment methodology is given in Annexure 4. The normalized indicators are aggregated and categorized to different vulnerability level. GP Vembakkam has a high CVI value of 0.599 followed by Netteri, Moranam, Karanthai, Mamandur, Vadailuppai, Mennalur and Thennampattu GPs. These GPs have very high rural water security vulnerability. Sirunavelpet, Hasanampettai, Sodiyaambakkam, Vayalathur, Kundiyanthandalam. Naman-di, Cheyyanur, Kodayambakkam, Nemili, Arasankuppam and Alinjalpattu have low vulnerability. Figure 4.2 depicts GP wise vulnerability category and its scores

Range up to	Category	Color code
0.574	Very high	Red
0.550	High	Light Red
0.525	Medium	Yellow
0.501	Low	Orange
0.477	Very low	Green



Cumulative Vulnerability Scores

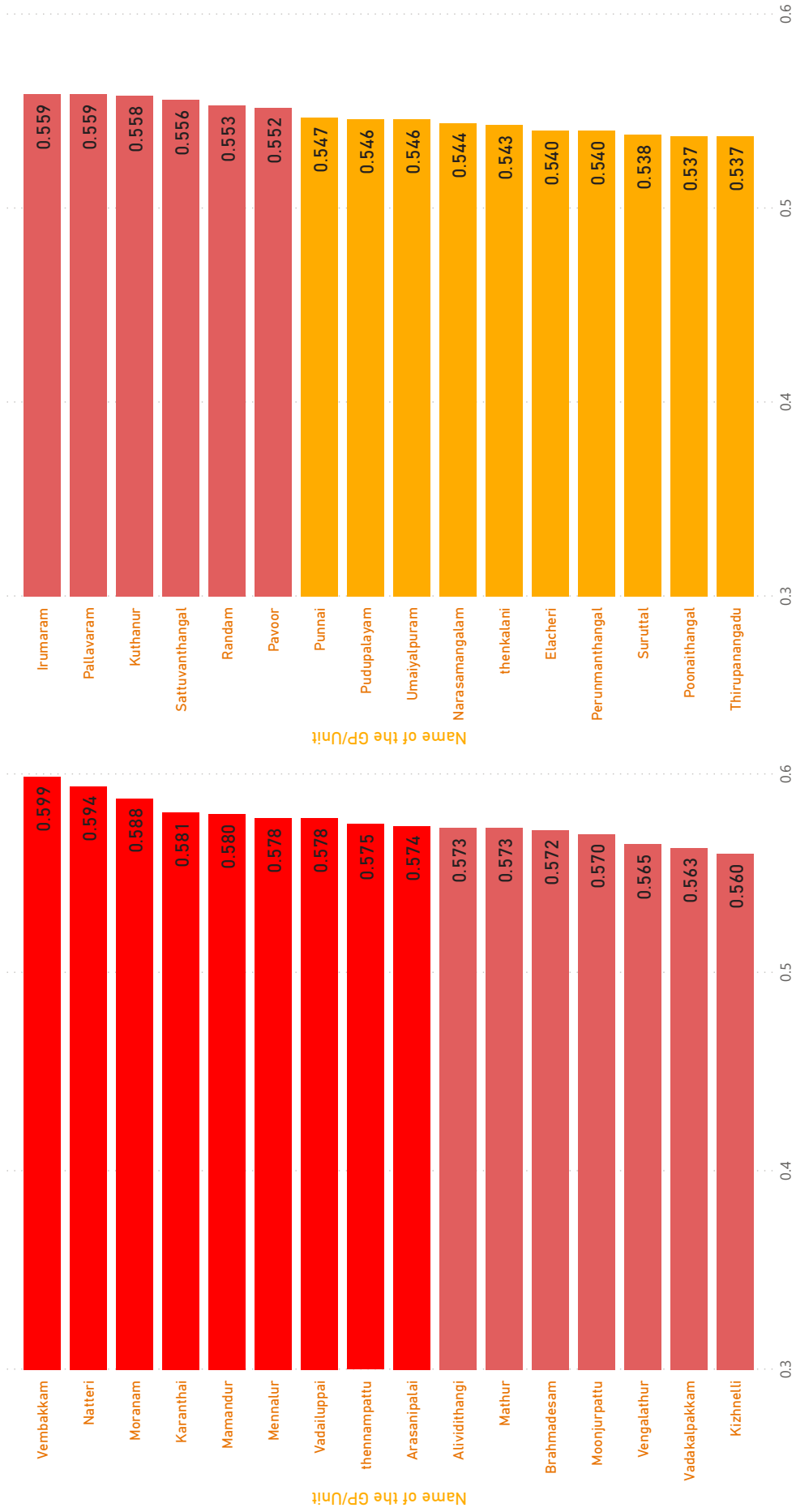


Figure 4.2. Final cumulative vulnerability scores

Cumulative Vulnerability Scores

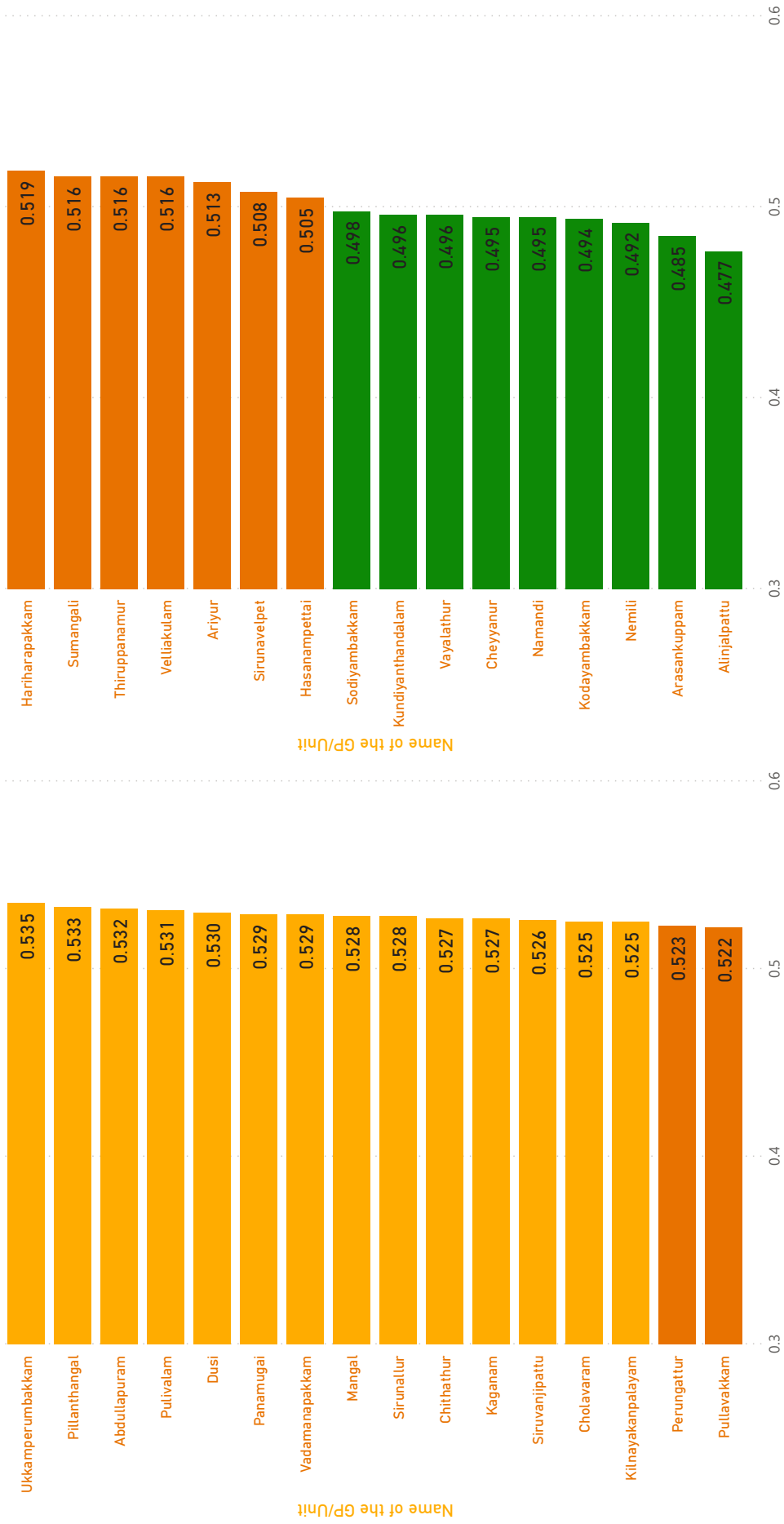


Figure 4.2. Final cumulative vulnerability scores

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 GP wise vulnerability dimensions

Climate risks vulnerability

In the last decade all GPs of the Block are affected by climate risks such as droughts and heatwaves. Mathur, Mangal, Dusi, Cholavaram, Chithathur, Kanagampalayam, Namandi GPs are vulnerable to floods.

MATHUR, MANGAL, DUSI, CHOLAVARAM, CHITHATHUR, KANAGAMPALAYAM, NAMANDI

Water resource vulnerability

The water resources vulnerability index shows that Poonathangal GP is highly vulnerable followed by Natteri, Brahmadesam while Vadamanapakkam GP is least vulnerable.

POONAITHANGAL, NATTERI, BRAHMADESAM, VADAMANAPAKKAM

Agriculture resources vulnerability

In agriculture and allied sectors, Pulivalam GP is highly vulnerable followed by Irumaram, Moonjurpattu, while Arasankuppam GP is least vulnerable.

PULIVALAM, IRUMARAM, MOONJURPATTU, ARASANKUPPAM

Socio-economic vulnerability

Vadailuppai GP has very high vulnerability followed by Brahmadesam while Pulivalam GP is least vulnerable.

VADAILUPPAI, BRAHMADESAM, PULIVALAM

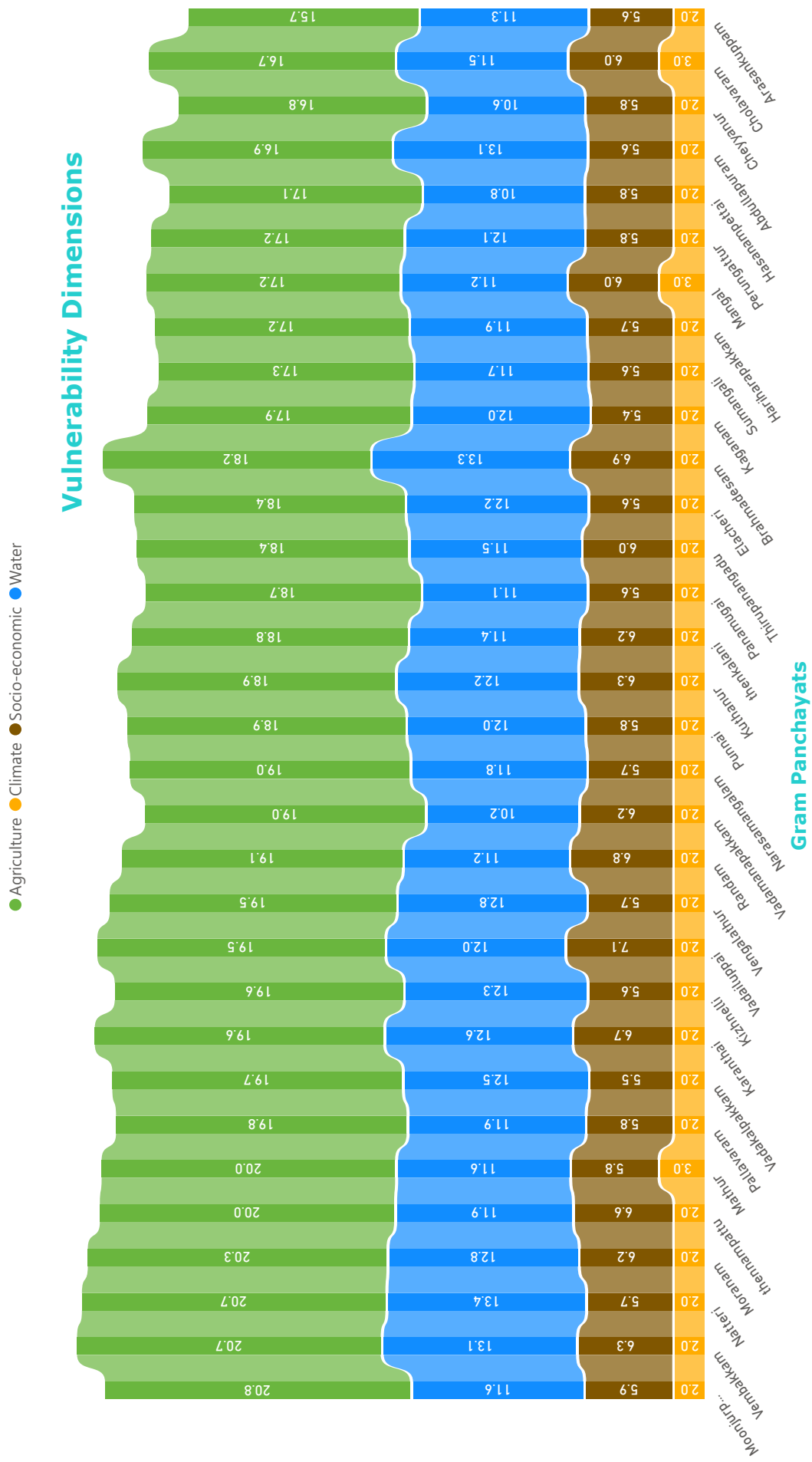


Figure 4.3. GP wise vulnerability dimensions

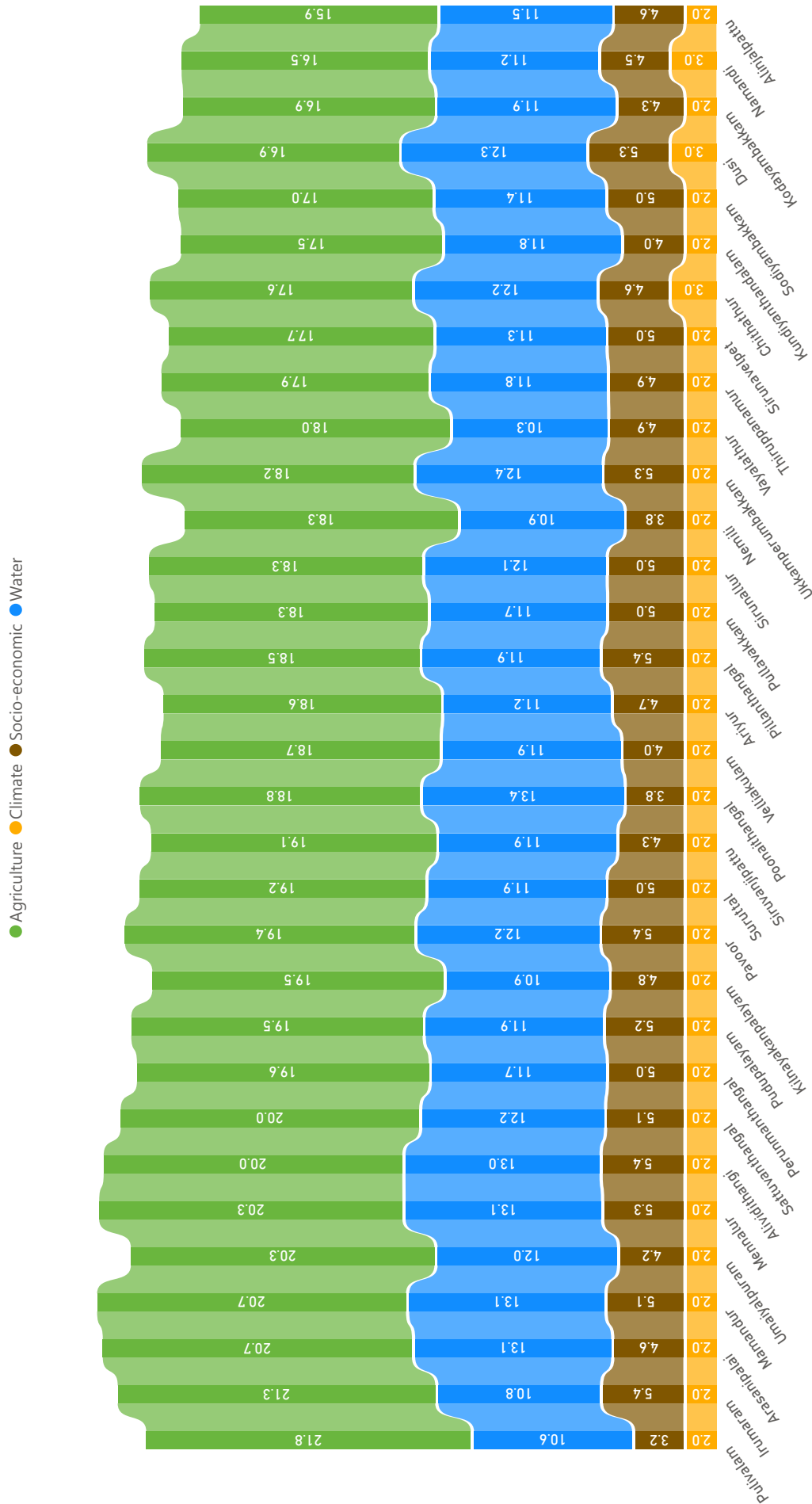
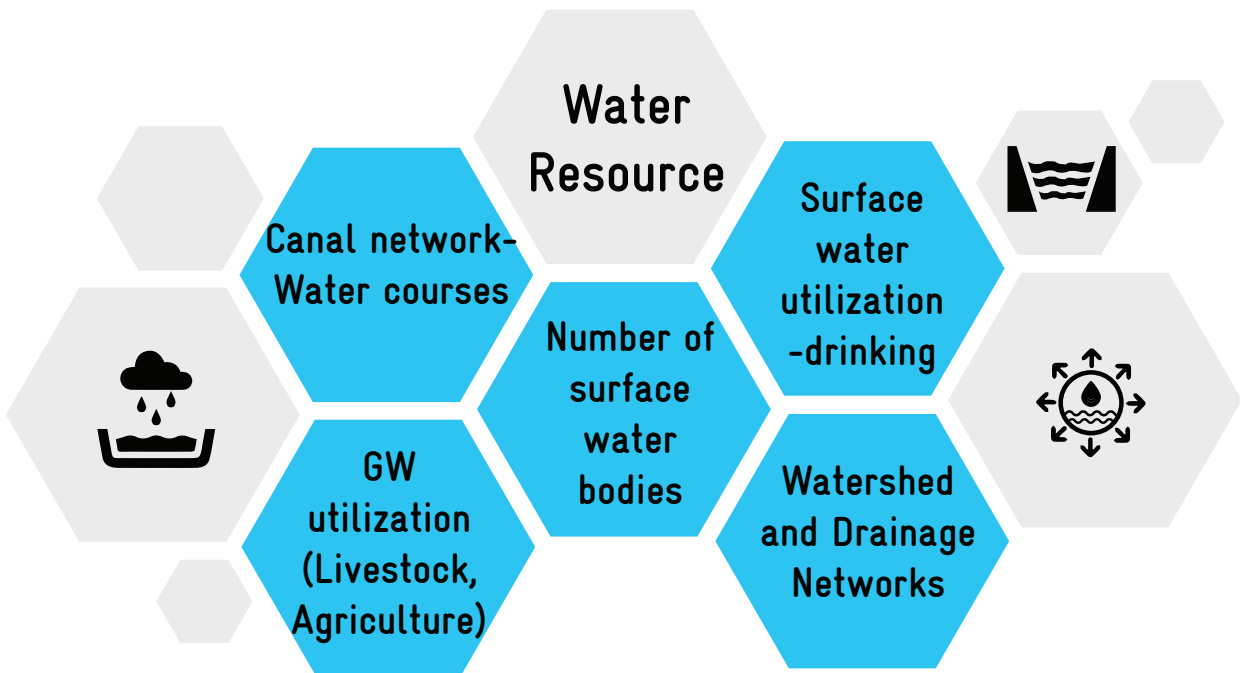
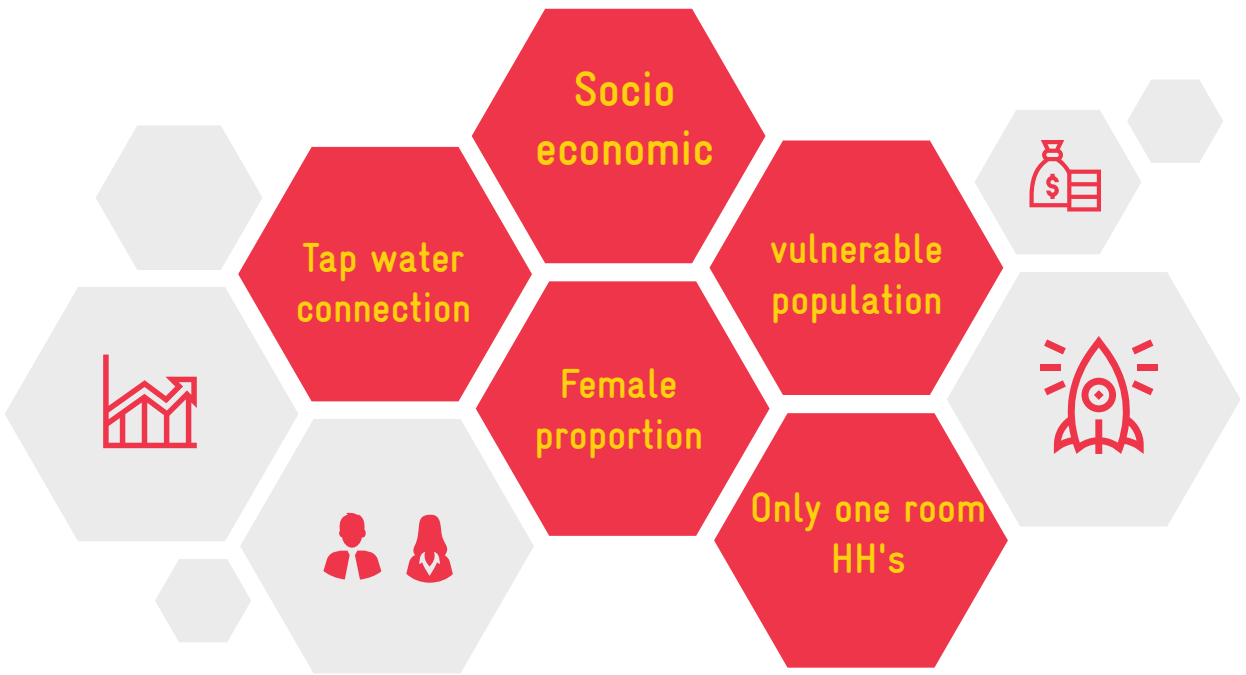
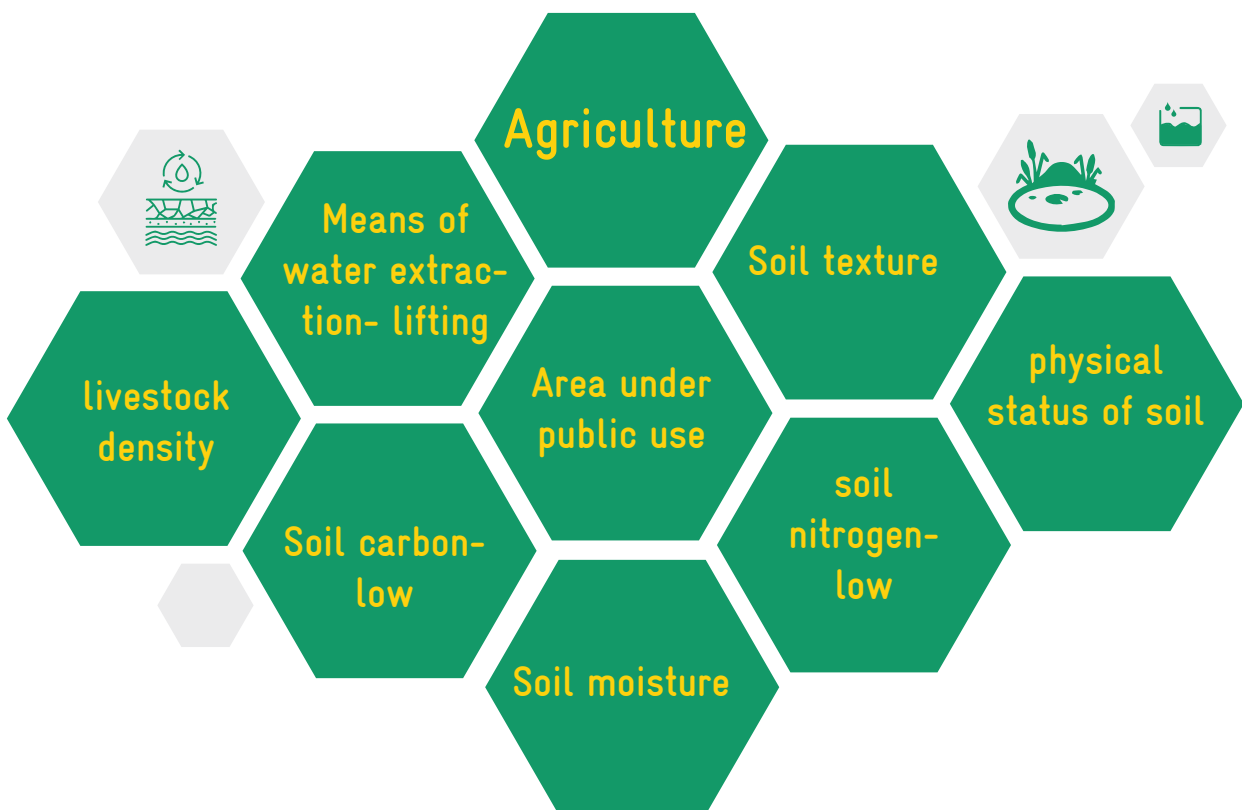
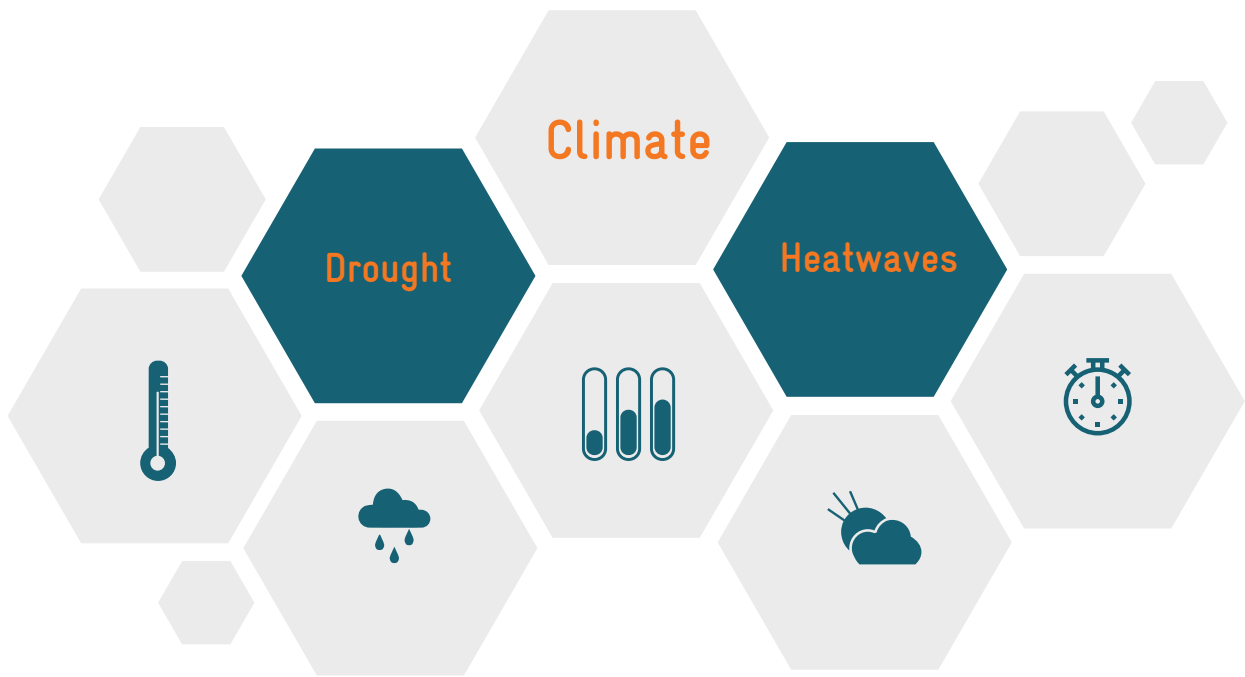


Figure 4.3. GP wise vulnerability dimensions

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.

விசம்பின் 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



KEY WATER ACTIONS UNDER MGNREGS CONVERGENCE

PROPOSED KEY WATER ACTIONS
UNDER MAHATMA GANDHI
NREGS CONVERGENCE

5 | PROPOSED KEY WATER ACTIONS UNDER MAHATMA GANDHI NREGS CONVERGENCE

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 enables 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). This chapter discusses the proposed treatment actions under WASCA, CWRM and CRM.

5.1 | THE PROPOSED AREA UNDER WASCA TREATMENT

Out of 32,554 ha available land in Vembakkam Block, 5,720 ha (17.6 %) area is proposed for treatment under WASCA TN– CWRM planning. A large portion of key water actions area proposed is in Non-Agricultural Uses land. The detailed land wise proposal for WASCA treatments is given in Table 10. GP wise proposed area for treatment is also attached in Annexure 5.1.

TABLE 10. PROPOSED AREA FOR WASCA TREATMENT

Land Use	Total available land (ha)	WASCA proposed Treatment Area (ha)
Area Irrigated by Source	5,639.0	636.5
Barren & Un-cultivable Land	536.7	402.5
Cultivable Waste Land	509.2	382.0
Current Fallow land	12,573.8	1,345.9
Fallows Land other than Current Fallows	2,687.0	332.2
Land Under Miscellaneous Tree Crops etc.	203.2	152.5
Non-Agricultural Uses	7,995.3	1,974.7
Permanent Pastures and Other Grazing Land	340.1	255.1
Unirrigated Land	2,070.2	238.3
Total	32,554.3	5,719.7

The highest of 34.53 % of non-agriculture land is considered and proposed for water treatment under WASCA followed by current fallow land of 23.53 % while least land under miscellaneous tree crops area is considered (Figure 5.1).

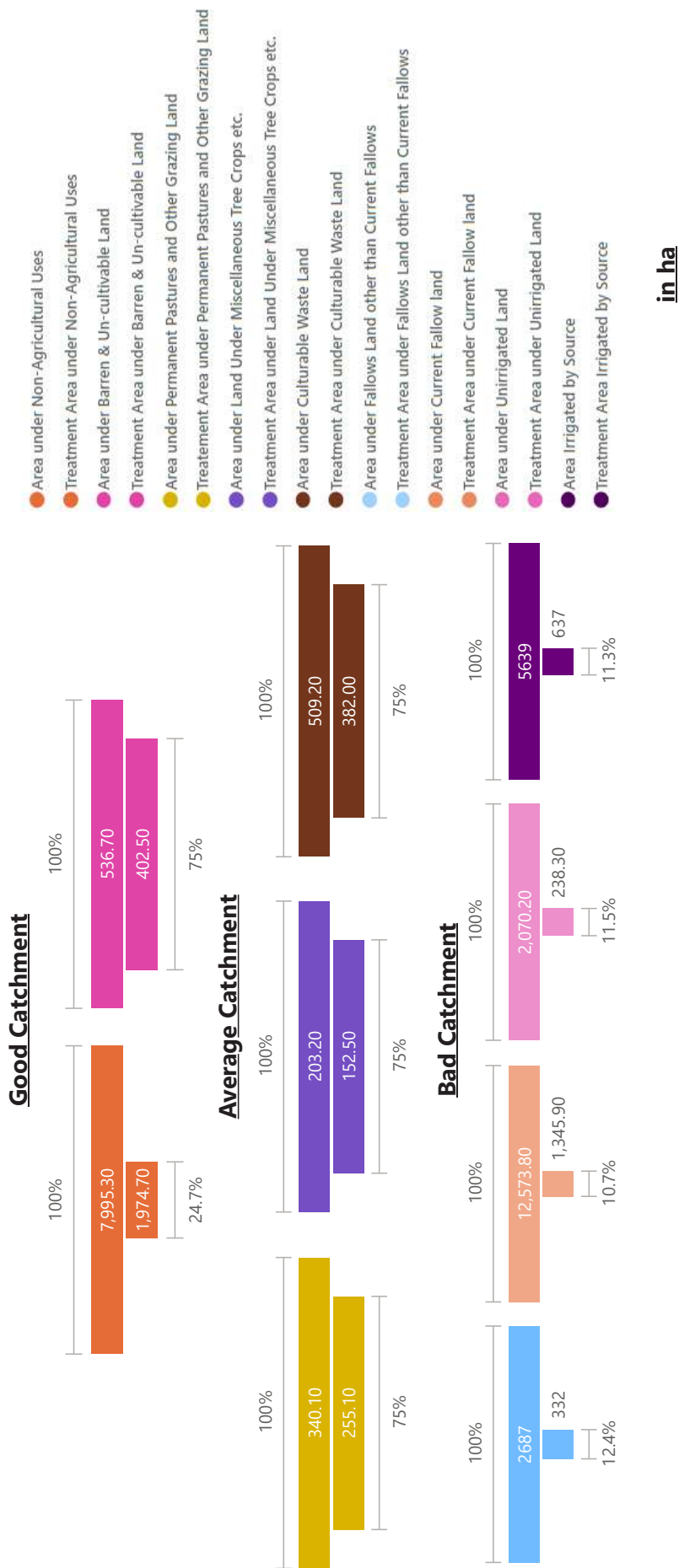


Figure 5.1. W/ASCA treatment area in %

Expected Runoff Conservation after WASCA treatment

The productive developmental activities are designated as key water actions in WASCA proposed area. With the above proposed treatment area, the expected runoff harvested due to WASCA intervention would be around 2,060 ha.m which is 26.44 % of the total runoff. Of which the expected runoff conservation of 64.86 % comes from good catchment area followed by 24.02 % from bad catchment area and rest is from average catchment area (Figure 5.2). The graphical representation of GP wise expected runoff conservation after completion of WASCA treatment is shown in Figure 5.3 and tabulated in Annexure 5.2.

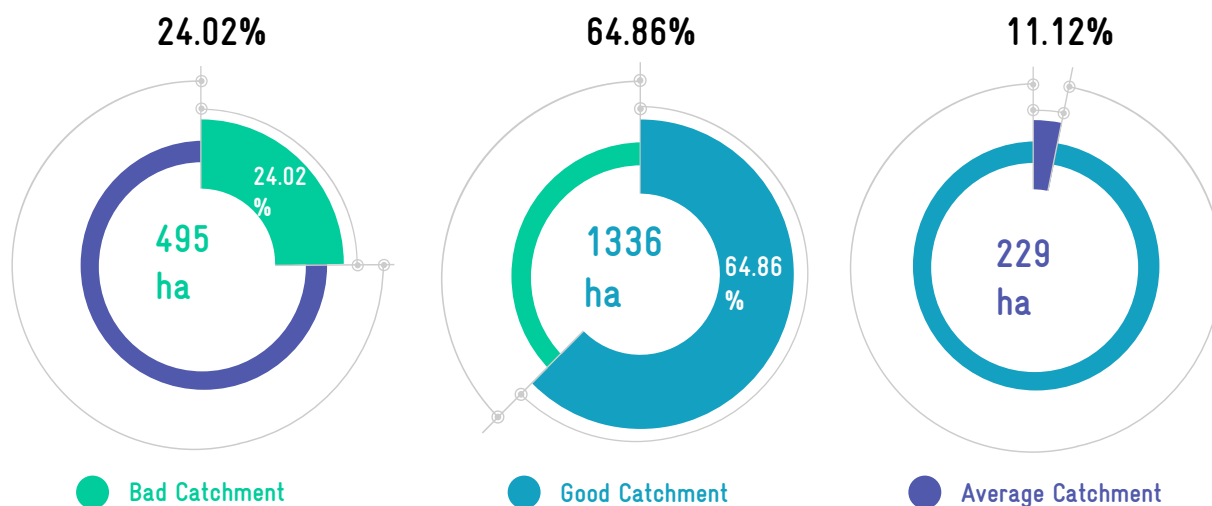


Figure 5.2. Expected conservation after WASCA treatment

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. The summary statistics of all proposed works are given below. The detailed list of works for all GP are attached in Annexure 5.3.

Work (unit)	Abbreviation (unit)	No.	Extent (area in ha or length in m)
Artificial Recharge Structure(Number of units)	ARS	60	2,925
Construction of Farm Ponds - Individual (Number of units)	FP	1,145	
Construction of new open wells & Recharge Shafts (Number of units)	COWRS	1,262	
Restoration of water bodies:a.PWD and Tanks(Number)	RPWDT	139	
Restoration of water bodies:c. Ponds(Num-ber)	RP	353	
Roof Rain Water Harvesting (Number of units)	RRWH	128	
Water Course - Irrigation Channels - Desilt-ing (Mtrs)	WCICD		70,470
Restoration of water bodies:b. Ooranis(Num-ber)	Roo	58	

Azolla units - Individual (Number of units)	Az	3,158	
Cattle Shelters (Number of units)	CS	3,109	
Cattle Trough(Number of units)	CT	3,109	
Fodder development - Community & Individual	FD	5,754	
Goat Sheep Shelters (Number of units)	GSS	417	
Silvi-pasture Development(Ha)	SPD	210780	260.71
Soak Pits (Community) (Number of units)	SPC	259	
Soak Pits (Individual) (Number of units)	SPI	452	
Afforestation in Public/common lands(Ha)	Aff	1019525	1272.37
Avenue plantation(Km)	AVP	51,453	207,765
Block Plantation (Community)(Ha)	BP	744,064	628
Canal Bund Plantation(Ha)	CBP	21,901	69,183
Contour Continuous Bunds (CCB) for Afforestation area(Mtrs)	CCBF	532,306	3,897
Drainage Line Treatment (DLT)(Mtrs)	DLT	5,633	28,164
Dry land Horticulture/ Agro-forestry - Individual (Ha)	DLHAI	208,651	1,023
Irrigation Channel Plantation (Mtrs)	ICP	14,094	70,470
Linear Plantation(Km)	LP	32,384	140,809
Micro Irrigation(Ha)	MI	-	-
Nursery Development(Number of units)	ND	119,698	23,940
Composting (Number of units)	Co	627	-
Farm Bunding with Boundary Trenches - Individual (Ha)	FBBTI	475	1,240
Land development - Individual (Ha)	LDI	479	1,197
NADEP Vermi compost (Number of units)	NADEP	3,092	

Proposed works are included the drought proofing, livelihood, land development and WCWH, measures



Land development works over 2,400 ha area



More than 3.7 Lakhs plants planting



3,000 sites for WCWH



2.2 Lakhs livelihood works

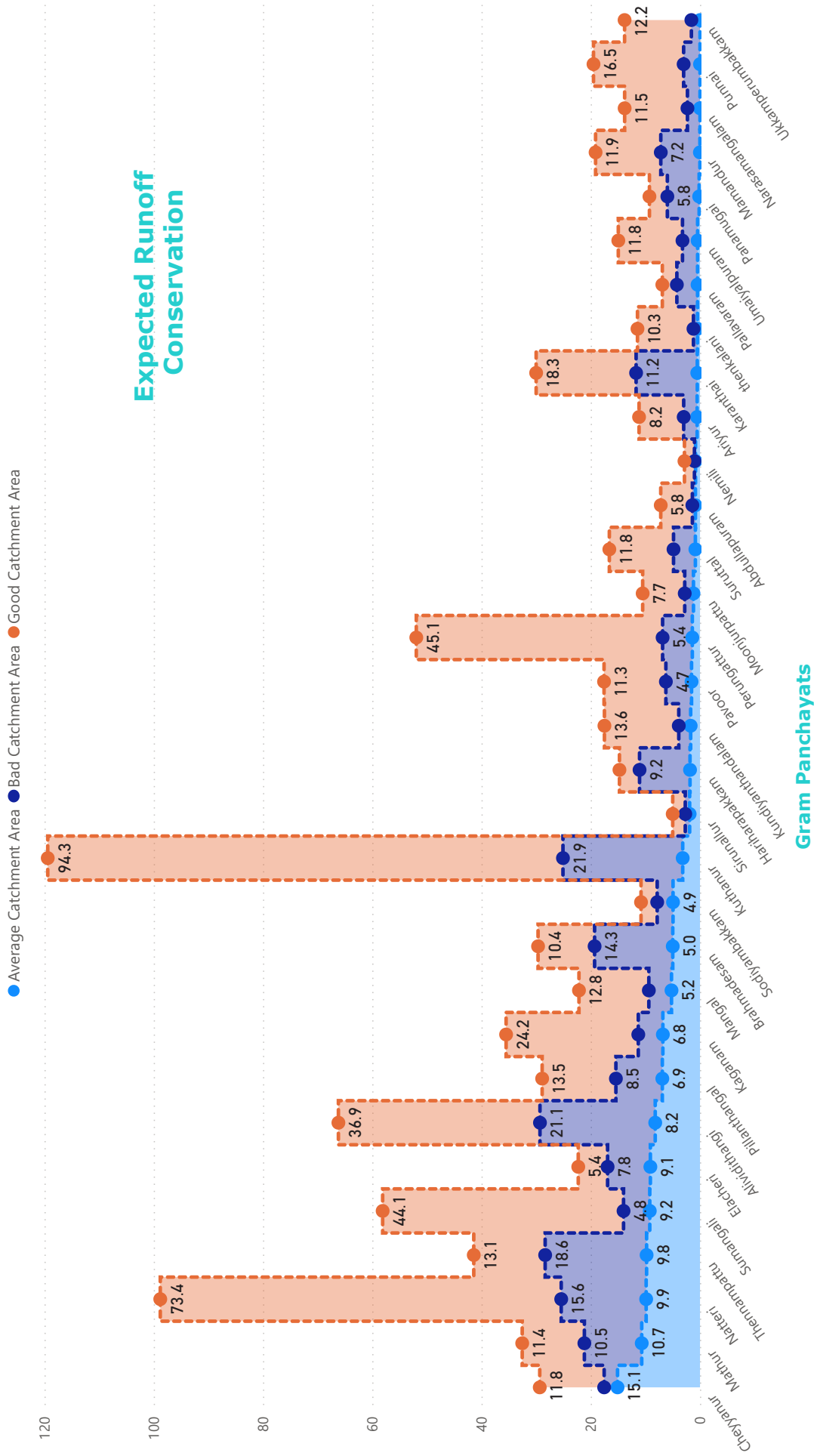


Figure 5.3. Expected GP wise runoff conservation after W/ASCA treatment

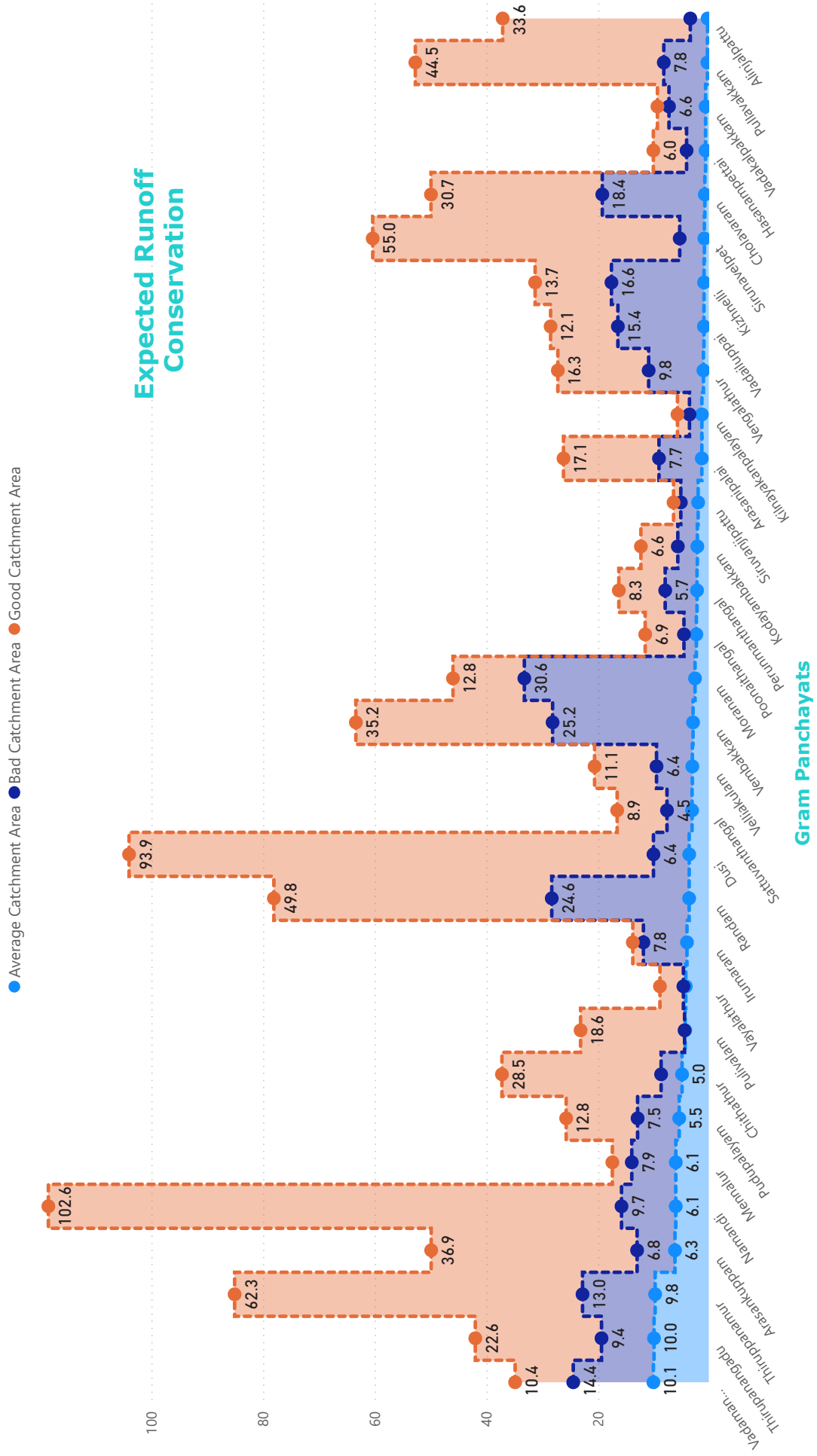


Figure 5.3. Expected GP wise runoff conservation after W/ASCA treatment

Mahatma Gandhi NREGS Annual circular 2020-21 (Clause 6.3)

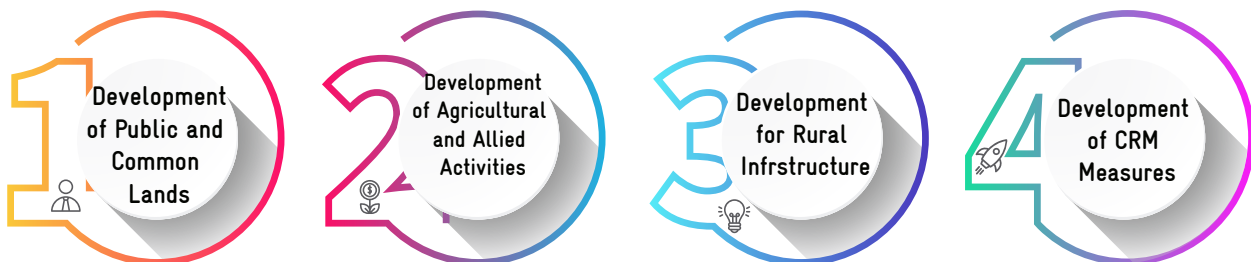
Planning and design of works under Mahatma Gandhi NREGS should take into account, impacts of climate change in order to ensure resilience of vulnerable rural communities and make the benefits sustainable in the long run. Specifically, the following things should be ensured:

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

Water Actions








5.2 | DEVELOPMENT OF PUBLIC & COMMON LANDS

The effective water augmentation measures are proposed in public and common lands via massive land development, tree plantation, restoration of waterbodies etc., which are listed in Table 11 and selected suitable sites can be visualized in 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 CONTINUOUS BUNDS (CCB) FOR AFFORESTATION AREA(M)	10,632	10	0.025	265.80	1,06,319
COMPOSTING(NUMBER OF UNITS)	850	15	0.17	144.50	12,750
AFFORESTATION IN PUBLIC/ COMMON LANDS(HA)	1300	3,344	8.6	11,180	43,47,200
BLOCK PLANTATION (COMMUNITY)(HA)	604	4,320	11.1	6,704.40	26,09,280
SILVI-PASTURE DEVELOPMENT(HA)	254	6,664	17.1	4,343.40	16,92,656
LINEAR PLANTATION(KM)	0	703	1.8	0.37	144
CANAL BUND PLANTATION(HA)	492	2,930	7.5	3,690	9,86,430
IRRIGATION CHANNEL PLANTATION (M)	64	6	0.015	0.97	386
AVENUE PLANTATION(KM)	0	703	1.8	0.50	193
NURSERY DEVELOPMENT (NUMBER OF UNITS)	57	2,344	15	849.90	1,32,811
RESTOTARATION OF WATER BODIES: A) PWD AND TANKS (NUMBER)	147	800	5	735	1,17,600
RESTORATION OF WATER BODIES: B.OORANIS (NUMBER)	0	200	2	0	0
RESTORATION OF WATER BODIES: C) PONDS (NUMBER)	335	200	1	670	67,000
ARTIFICIAL RECHARGE STRUCTURE (NUMBER OF UNITS)	1,110	391	2.5	1,711	4,34,010
WATER COURSE - IRRIGATION CHANNELS - DESILTING (MTRS)	64	3	0.0075	0.48	193
DRAINAGE LINE TREATMENT (M)	438	5	0.03	13.13	2,189

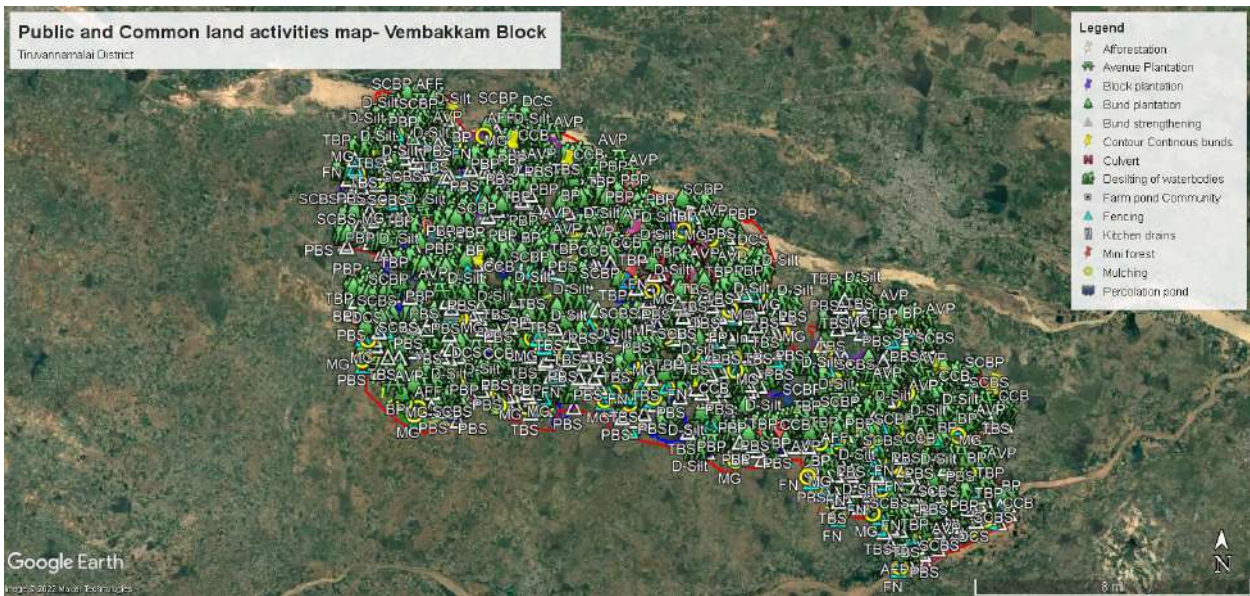


Figure 5.4. Proposed development activities in public and common land








5.3 | DEVELOPMENT OF AGRICULTURE AND ALLIED SECTORS

Based on the assessment, the works which enhance the agriculture and allied sectors, particularly for irrigation, soil and livestock are proposed in the lands under individual ownership (Table 12) and selected sites can be visualized in 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)	1,072	586	1.5	1,608	6,28,192
MICRO IRRIGATION (ha)	0	0	1	0	0
CONSTRUCTION OF FARM PONDS - INDIVIDUAL (NUMBER OF UNITS)	111	781	2	222	86,691
LAND DEVELOPMENT - INDIVIDUAL (ha)	974	3,906	10	9,740	38,04,444
DRY LAND HORTICULTURE/AGRO-FORESTRY - INDIVIDUAL (ha)	980	3,321	8.5	8,330	32,54,580
AZOLLA UNITS - INDIVIDUAL (NUMBER OF UNITS)	2,797	23	0.15	420	64,331
NADEP VERMI-COMPOST (NUMBER OF UNITS)	2,753	27	0.18	496	74,331
FODDER DEVELOPMENT - COMMUNITY & INDIVIDUAL	2,596	2,344	1.48	3,842	60,85,024
CATTLE SHELTERS (NUMBER OF UNITS)	2,758	331	2.12	5,847	9,12,898
GOAT/SHEEP SHELTERS (NUMBER OF UNITS)	2,771	355	2.27	6,290	9,83,705
CATTLE TROUGH (NUMBER OF UNITS)	2,758	6	0.05	138	36,548
POULTRY SHED (NUMBER OF UNITS)	2,665	10	0.09	240	26,650
CONSTRUCTION OF NEW OPEN WELLS & RECHARGE SHAFTS (NUMBER OF UNITS)	1,425	926	5	8,767	11,68,612

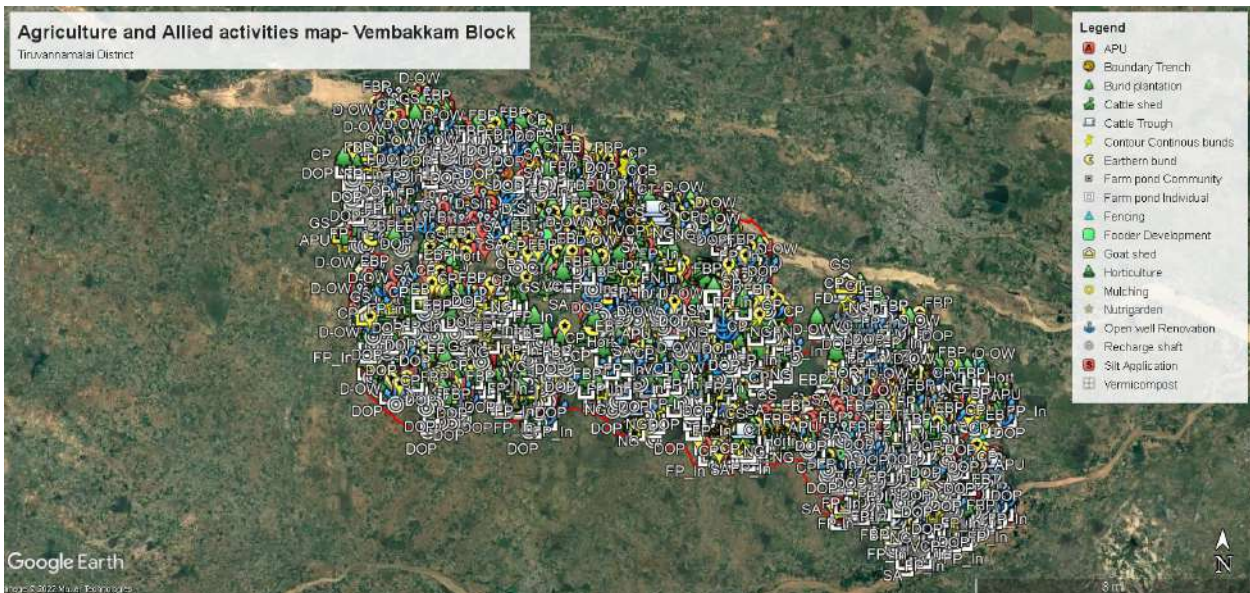







Figure 5.5. Proposed development activities in Agriculture and allied Sectors

5.4 | DEVELOPMENT OF RURAL INFRASTRUCTURE

The prominent works on constructing structures for water harvest 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)	232	92	0.13	11.96	1,840
SOAK PITS (INDIVIDUAL) (NUMBER OF UNITS)	2,325	1326	0.1	132.60	21,216
ROOF RAIN WATER HARVESTING (NUMBER OF UNITS)	105	128	4	512	80,000

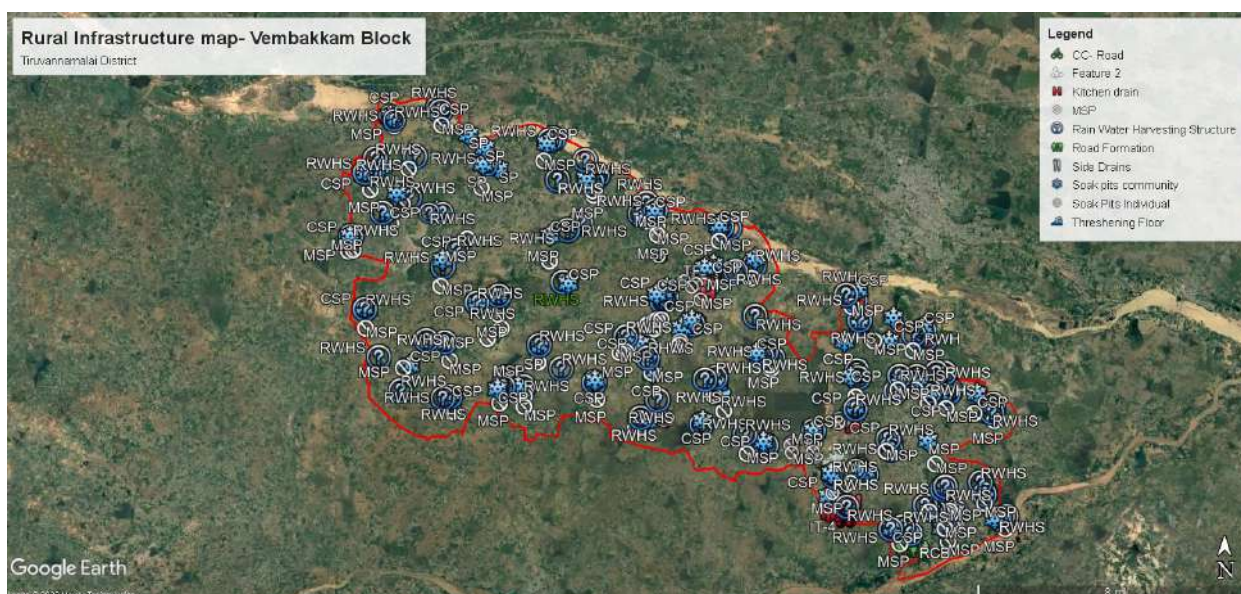


Figure 5.6. Proposed rural infrastructure activities

5.5 | PROPOSED CLIMATE RESILIENCE MEASURES

Climate resilient measures are proposed to cope up with the system with future climate risks such as droughts, heatwaves and floods. As Thiruvannamalai District is one of the drought prone areas and frequently exposed to severe droughts, more measures are proposed to manage droughts and its subsequent impacts. As Vembakkam Block

is also affected by droughts and heat waves, climate resilient measures are proposed to cover-up maximum of GPs (Figure 5.7 & Table 14). CRM such as silvi-pasture (Table 15), bamboo plantation (Table 16), farm pond (Table 17), and fallow land development (Table 18) were proposed.

TABLE 14. GP WISE PROPOSED CRM

Name of the GPs	Public and common land	Agriculture
Abdullapuram		Farm pond
Arasanipalai		Farm pond
Arasankuppam		Farm pond
Azhinjalpattu		Farm pond
Azhividaithangi		Farm pond
Brammadesam		Farm pond
Chithathur		Farm pond
Hariyarpakkam		Farm pond
Irumaram		Farm pond
Kaganam		Farm pond
Kuthanur		Farm pond
Mathur		Farm pond
Moranam		Farm pond
Mamandur	Fallow and development	
Namandi		Farm pond
Narasamangalam	Fallow and development	Farm pond
Natteri	Bamboo Plantation	Farm pond

Pallavaram	Silvi-pasture Development	Farm pond
Panamugai		Farm pond
Perumanthangal		Farm pond
Perungattur		Farm pond
Pillanthangal		Farm pond
Pudupalayam		Farm pond
Pulivalam		Farm pond
Pullavakkam		Farm pond
Punnai		Farm pond
Randham		Farm pond
Sattuvanhangal		Farm pond
Sirunallur	Fallow and development	Farm pond
Sirunavalpattu		Farm pond
Sozhavaram		Farm pond
Sumangali		Farm pond
Thennampattu		Farm pond
Thiruppanangadu		Farm pond
Thenkazhani	Fallow and development	
Umaiyalpuram		Farm pond
Vadailuppai		Farm pond
Vadakalpakkam		Farm pond
Vadamanapakkam		Farm pond
Vayalathur		Farm pond
Vellakulam		Farm pond
Vembakkam		Farm pond
Vengalathur		Farm pond

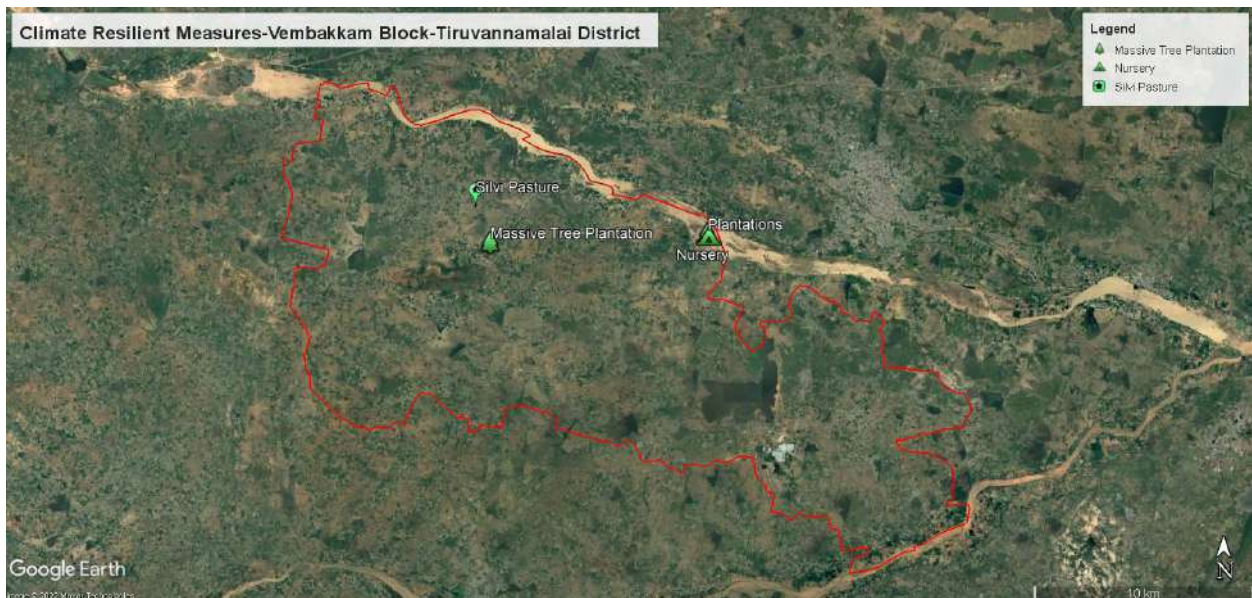


Figure 5.7. Proposed climate resilient measures

TABLE 15. DETAILS OF PROPOSED SILVI-PASTURE ACTIVITY UNDER CRM

GP	Area for Plantation	No. of Plants
Pallavaram	2	1,600

TABLE 16. DETAILS OF PROPOSED BAMBOO PLANTATION ACTIVITY UNDER CRM

GP	Area of plantation (in ha)	No. of Plants	Classification of Land
Natteri	1.11	2,775	Others

TABLE 17. DETAILS OF PROPOSED FARM POND ACTIVITY UNDER CRM

GP	Habitation	No. of farm ponds
Abdullapuram	Abdullapuram	1
Arasanipalai	Chithalapakkam	1
Arasankuppam	Mettu Colony	2
Azhinjalpattu	Azhinjalpattu	1
	Azhinjalpattu	1
Azhividaithangi	Azhividaithangi	2
Brammadesam	Brammadesam	1
Chithathur	Chithathur	2
Hariyarpakkam	Hariyarpakkam	1
Irumaram	Irumaram	1
Kaganam	Kaganam	1
Kuthanur	Kuthanur	2
Mathur	Mathur	3
Moranam	Moranam	2
Namandi	Namandi	1
Narasamangalam	Narasamangalam	1
Natteri	Natteri	2
Pallavaram	Pallavaram	1
Panamugai	Panamugai	1
Perumanthangal	Perumanthangal	2
Perungattur	Perungattur	2
Pillanthangal	Pillanthangal	1
Pudupalayam	Pudupalayam	1
Pulivalam	Pulivalam	2
	Pulivalam	2
Pullavakkam	Pullavakkam	1
Punnai	Punnai ADC	1
Randham	Randham	2
Sattuvanthangal	Sattuvanthangal	1
Sirunallur	Sirunallur	1
Sirunavalpattu	Sirunavalpattu	1
Sozhavaram	Sozhavaram	1

Sumangali	Sumangali	2
Thennampattu	Thennampattu	1
Thiruppanangadu	Thiruppanangadu	1
Umaiypuram	Umaiypuram	2
Vadailuppai	Vadailuppai	2
Vadakalpakkam	Vadakalpakkam	1
Vadamanapakkam	Vadamanapakkam	1
Vayalathur	Vayalathur	1
Vellakulam	Vellakulam	3
Vembakkam	Vembakkam	2
Vengalathur	Vengalathur	2
Total		63

TABLE 18. DETAILS OF FALLOW LAND DEVELOPMENT UNDER CRM

GP	Fallow land (ha.)
Narasamangalam	0.07
Mamandur	0.08
Sirunallur	0.09
Thenkazhani	0.10
Total	0.33

நெடுங்கடலும் தன்நீர்மை குன்றும் தடிந்தெழிலி
தான்நல்கா தாகி விடின

குறள் - 17

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

Thirukkural - 17

CHAPTER 6

PROJECTED OUT COMES OF PLANNING



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

were 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	1	5,720 ha (17.6 % of the total) area considered for treated under WASCA
2	Percentage reduction of run off	2	2,060 ha.m (26.44% of the total available runoff) runoff harvested due to WASCA interventions
3	No. of waterbodies restored	3	482 waterbodies restored
4	Area under afforestation	4	1,300 ha area under afforestation
5	Area under Silvi-pasture development	5	254 ha under Silvi-pasture plantation
6	Length of drainage line treated	6	4,377 m length of drainage line treated

5,720 ha
AREA TREATED

2,060 ha.m
TOTAL RUNOFF
HARVESTED

482
WATER BODIES
RESTORED

1,300 ha
AREA
AFFORESTATION

254 ha
SILVI-PASTURE
PLANTATION

4,377 m
DRAINAGE LINE TREATED

6.2 | OUTCOMES OF DEVELOPMENT OF AGRICULTURE AND ALLIED SECTORS

OUTCOMES OF DEVELOPMENT OF AGRICULTURE AND ALLIED SECTORS

INDICATOR

1	No. of structures established for on-farm (in-situ) water harvesting in dry lands Assessment of sources of water for live-stock and agriculture demand
2	Improvement in soil health
3	Changes in the irrigation practices
4	Dry land development with Agro-forestry
5	Households established fodder plots

OUTCOMES/ IMPACT

1	111 farm ponds established which target the harvest of 1,95,360 cu m of water which has the potential to irrigate 40 ha area in both kharif and rabi seasons
2	2,753 NADEP compost units for soil health improvement
3	390 ha Farm bunding with trenches
4	980 No. of works
5	3,279 vulnerable households established fodder plots

111
FARM PONDS

2,753
COMPOST UNITS

390 ha
FARM BUNDING

980
DRY LAND
HORTICULTURE

3,279
FODDER PLOTS

6.3 | OUTCOMES OF RURAL INFRASTRUCTURE DEVELOPMENT

OUTCOMES OF RURAL INFRASTRUCTURE DEVELOPMENT

INDICATOR

1	No. of villages having liquid waste management systems
2	Roof rain water harvesting measures
3	Nutri-garden

OUTCOMES/ IMPACT

1	92 common and 1,326 individual soak pits established for recycle of grey water benefiting 29,864 households
2	128 common roof rainwater harvesting and storage structures with a target to harvest and store 0.16 ha.m of rainwater for use
3	29,864 Households established nutri-gardens in homesteads and planted 1,49,320 saplings

92 COMMON & 1,326
INDIVIDUAL SOAK PITS

128
COMMON ROOF
RAINWATER HARVESTING

29,864
NUTRI-GARDENS

1,49,320
SAPLINGS

6.4 | OUTCOMES OF CLIMATE RESILIENCE MEASURES

OUTCOMES OF CLIMATE RESILIENCE MEASURES

INDICATOR

1 Climate resilient measures are identified for climate risks

OUTCOMES/ IMPACT

1 4 models are identified via., silvi-pasture, bamboo plantation, farm pond, fallow land development
 63 farm ponds in 41 GPs
 2 ha under silvi-pasture with 1,600 plants
 Bamboo plantation in 1.11 ha with 2,775 plants
 0.33 ha Fallow land development

63
FARM PONDS

2 ha
SILVI PASTURE

0.33 ha
FALLOW LAND
DEVELOPMENT

1.11 ha
BAMBOO PLANTATION

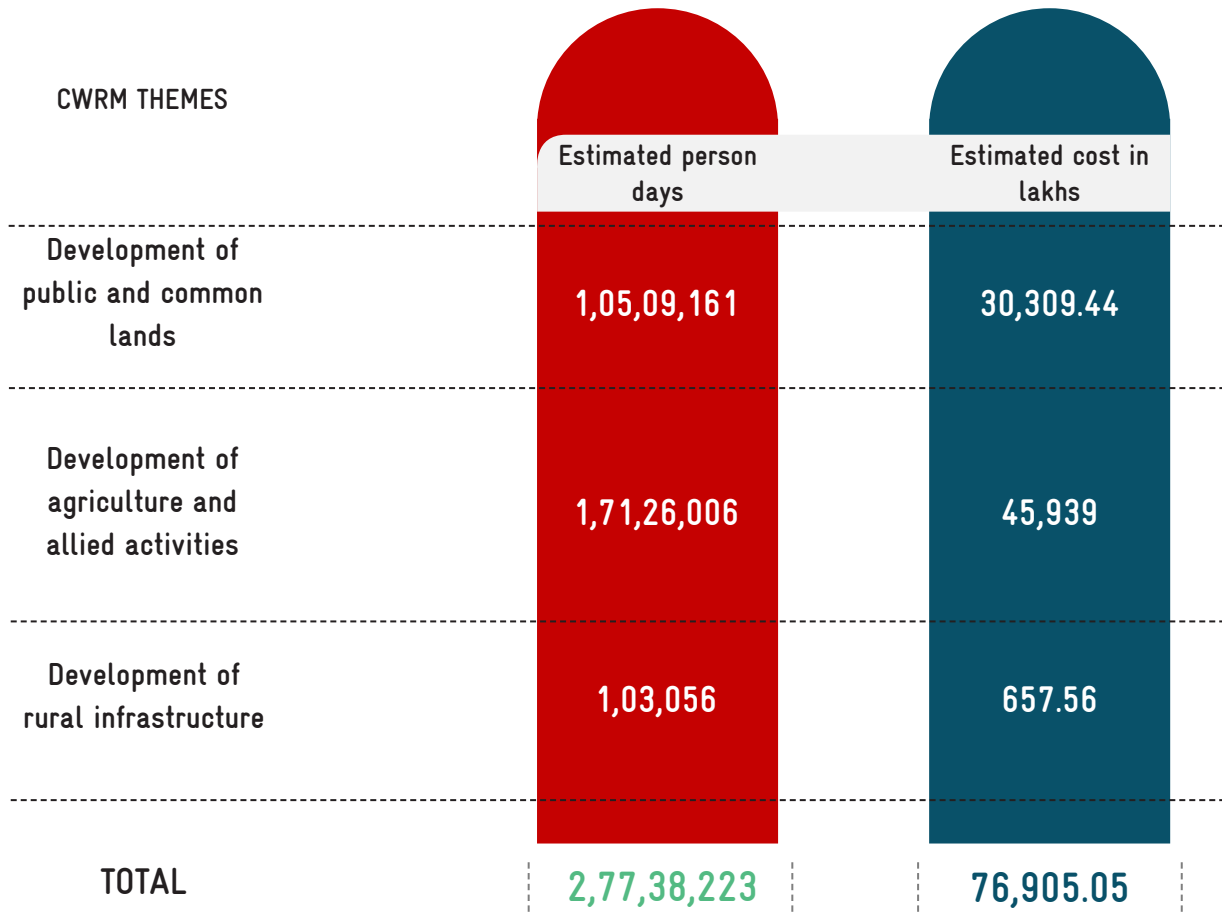


Estimated person days

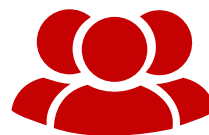
The total estimated person days required for the above propose activities are 2,77,38,223 as specified below Figure 6.1.

Estimated Cost

The total estimated cost budgeted for the above proposed activities is Rs 76,905 Lakhs as specified below Figure 6.2.



VEMBAKKAM



ESTIMATED PERSON DAYS

2,77,38,223



ESTIMATED COST IN LAKHS

76,905.05

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 (SDG) 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'S 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 degrees 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.



India's NDC

India's NDC emphasis Sustainable Development, Climate Justice, and Lifestyles

Activities

Activities includes Adaptation, Mitigation, requirement for Finance, Technology transfer, Capacity Building



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

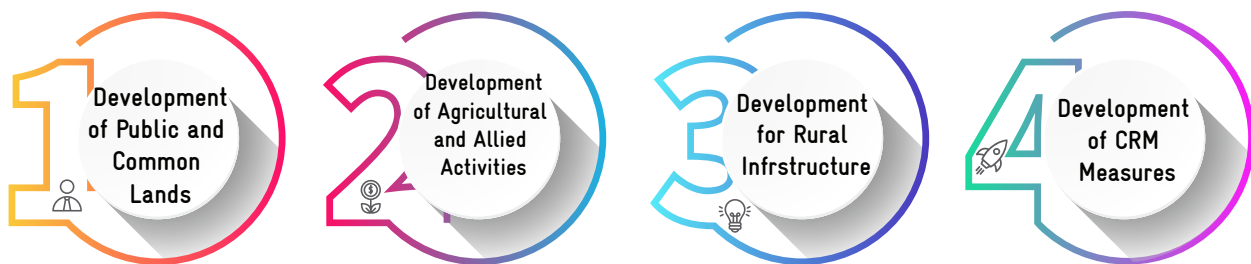


- 1 Supporting creation of an additional carbon sink of 2.5–3 billion tonnes through additional forest and tree cover
- 2 Enhancing investments in development programs for climate change adaptation in vulnerable sectors
- 3 Implementing programs to achieve the sustainable natural resource management 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.

“Climate Resilience for Future Livelihoods”



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 performed in District and Block level vulnerability assessment of WASCA TN also used in SDG India 2020-21 report (Table 19).

TABLE 19. 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 District level vulnerability assessment along with its linked SDGs are already tabulated in (Table 20). The detailed proposed water actions in CWRM assessed based on the vulnerability dimensions are linked with climate vulnerability index, SDGs are tabulated in Table 20 to 22.

TABLE 20. WATER ACTIONS ON DEVELOPMENT OF PUBLIC & COMMON LANDS & ITS LINKED SDG

Name of the work	No. of CWRM works	CVI Impacting (WASCA TN)	Linked SDG Goal
Contour Continuous Bunds (CCB) for Afforestation area (m)	10,632	W3	SDG 1,2, 6,13&15
Composting (No. of units)	850	W1	SDG1& 6
Afforestation in Public/common lands (ha)	1,300	C1,C2,C3, W3,	SDG 1, 2,6,13&15
Block Plantation (Community) (ha)	604	C1,C2,C3,W3,S2	SDG 1,2, 6 &13, 15
Silvi-pasture Development (ha)	254	C1,C2,C3,W3	SGG 12 &15
Linear Plantation (Km)	0	C1,C2,C3,W3,S2	SDG 1,2,6,12&13, 15
Canal Bund Plantation (ha)	492	C1,C2,C3,W3,S2	SDG 1, 6&13, 15
Irrigation Channel Plantation (m)	64	W4,W5,S2	SDG 1,2& 6, 15
Avenue plantation (Km)	0	C1,C2,C3,W3,S2	SDG 1, 6&13
Nursery Development (No. of units)	57	C1,S2,S4	SDG 1,2 &6

Restoration of waterbodies: PWD and Union tanks (count)	147	S2, S1	SDG 6, 1, 13
Restoration of waterbodies: Ponds (count)	335	S2, S1	SDG 6,1, 13
Artificial Recharge Structure (No. of units)	1,110	W3	SDG 1, 2, & 6
Water Course - Irrigation Channels - Desilting (m)	64	C1,C2,C3,W3,S2	SDG 1, 6&13
Drainage Line Treatment (m)	438	W1,W3,W4	SDG1 & 6

TABLE 21. WATER ACTIONS ON DEVELOPMENT OF AGRICULTURAL AND ALLIED SECTOR & IT'S LINKED SDG

Name of the Work	Number of CWRM works	CVI	SDG
Farm Bunding with Boundary Trenches - Individual (ha)	1,072	A1,A3,W1,W3	SDG 1,2&6
Micro Irrigation (ha)	-	A1,A3,A5,W5	SDG 1, 2&6
Construction of Farm Ponds - Individual (No. of units)	111	A1,A3,W5,W1, W3	SDG 2& 6
Land development - Individual (ha)	974	W1,W5,A1,A3,S2,S4	SDG 2, 6&
15	458	A1,A3,A4,W1,S4,S2,C1	SDG 1& 2,15
Dry land Horticulture/Agro-forestry - Individual (ha)	980	A1,A3,A4,W1,S4,S2,C1	SDG 1& 2,15
Azolla units - Individual (No. of units)	2,797	A3,A4,S4	SDG 1& 2
NADEP Vermi compost (No. of units)	2,753	A3, W1, S4	SDG 1& 2,6
Fodder development - Community & Individual	2,596	A3, S4	SDG 1& 2, 15
Cattle Shelters (No. of units)	2,758	S4	SDG 1& 2
Goat Sheep Shelters (No. of units)	2,771	S4	SDG 1& 2
Cattle Trough (No. of units)	2,758	W5,S4	SDG 1& 2
Poultry Shed (No. of units)	2,665	S2,S4	SDG 1& 2
Construction of new open wells & Recharge Shafts (No. of units)	1,425	S3,W5,W1	SDG 1,2 & 6

TABLE 22. WATER ACTIONS ON RURAL WATER MANAGEMENT & ITS LINKED SDG

Name of the work	No. of CWRM works	CVI	Linking SDG
Soak Pits (Community) (No. of units)	92	W3,S2	SDG 1& 6
Soak Pits (Individual) (No. of units)	1,326	W3,S2	SDG 1& 6
Roof Rain Water Harvesting (No. of units)	128	W3,S1,S3	SDG 1& 6

சிறப்பொடு பூசனை செல்லாது வானம்
வறக்குமேல் வானோர்க்கும் ஈண்டு

குறள் - 18

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

Thirukkural - 18

CHAPTER 7

IMPLEMENTATION OF GP PLANS



7 | IMPLEMENTATION OF GP PLANS

Execution of GP plans includes integrating all verified, approved works in MORD’s web enabled application NREGA Soft (<https://nrega.nic.in>) for mainstreaming WASCA. The target GPs are identified first, the status of GIS based plans and

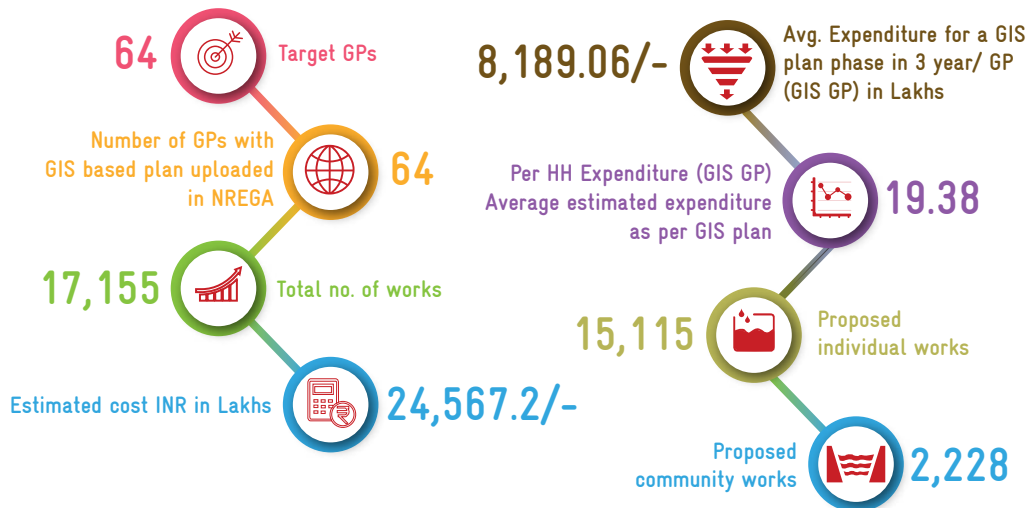
total works along with its expenditure and category wise estimation cost of works as per GIS Plan, GIS based planning cumulative report are uploaded as given below

7.1 | INTEGRATION INTO NREGA SOFT

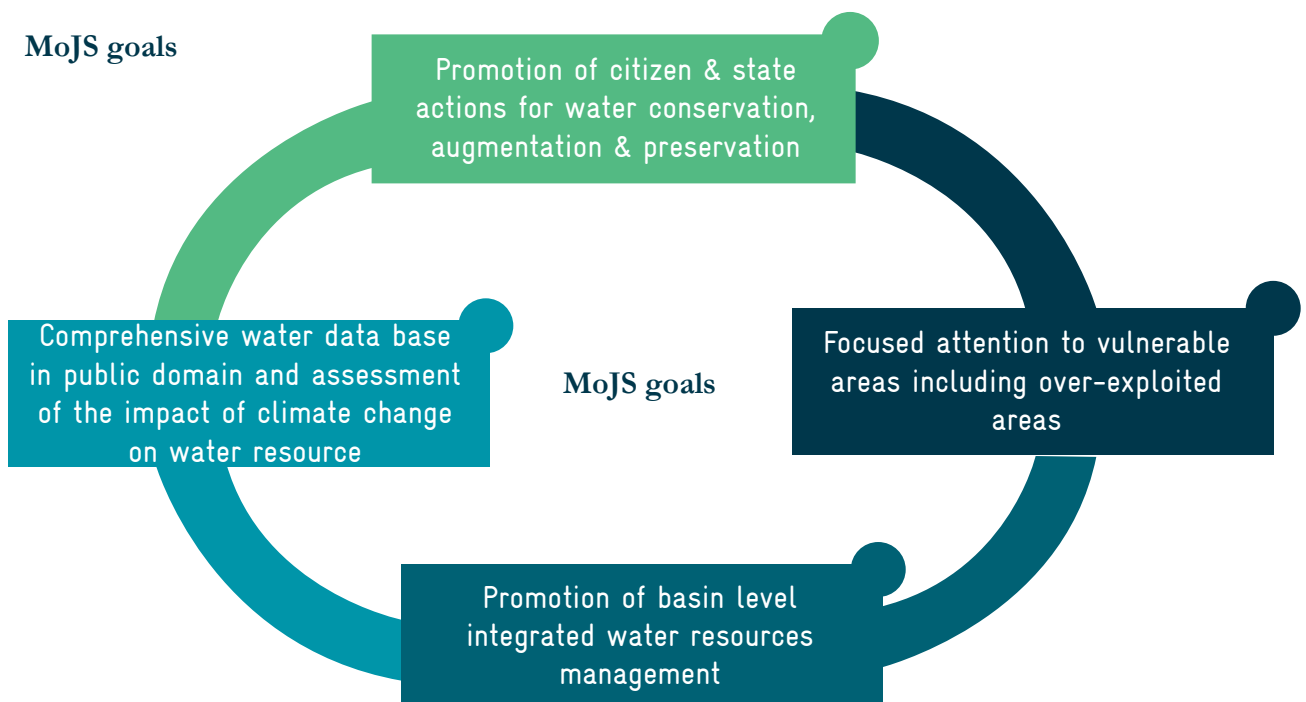
WASCA is progressing towards digitizing and integrating GP level GIS based plans, both NRM and Non NRM into Mahatma Gandhi NREGS portal. The performance and implementation of GP plans of Vembakkam Block is listed in Table 23 and work

progress, expenditure during the past 3 financial years is 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 23. GIS-BASED PLAN IMPLEMENTATION-KEY PARAMETERS PERFORMANCE IN VEMBAKKAM BLOCK



MoJS goals



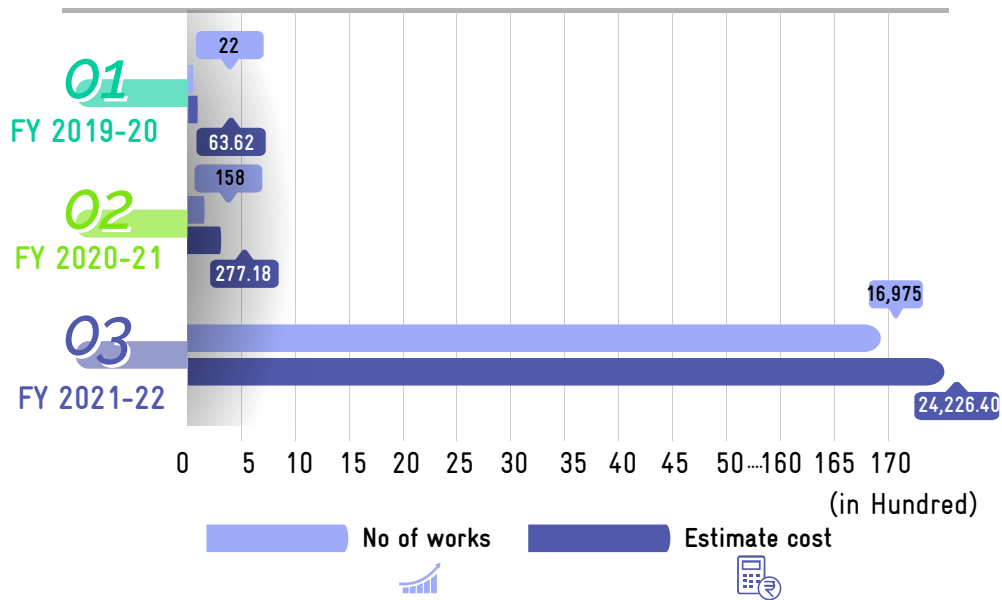


Figure 7.1. Work progress in last 3 years

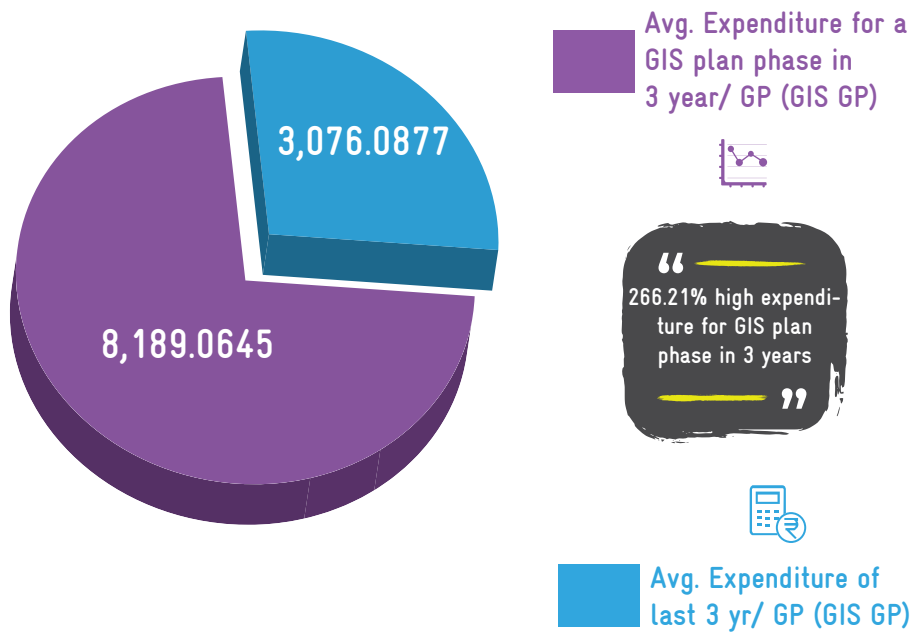
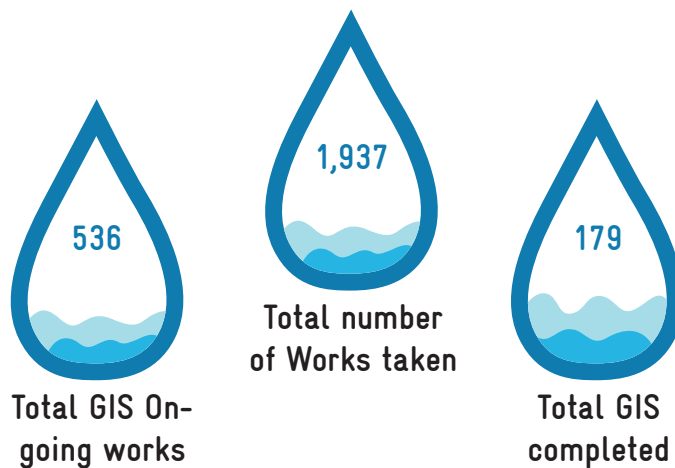


Figure 7.2. Average Expenditure for GIS plan in last three years



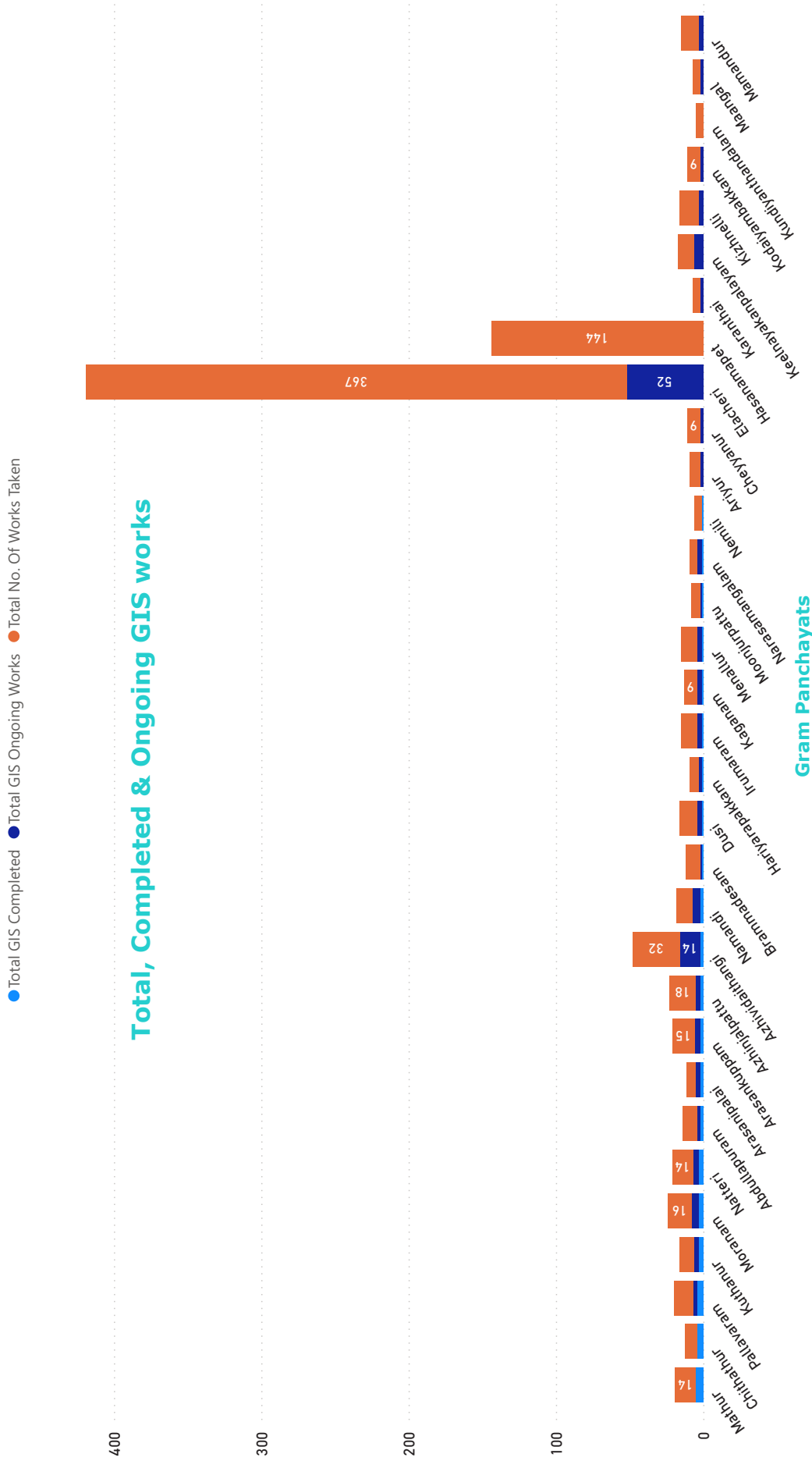


Figure 7.3. GP wise total, completed and ongoing GIS works (2021-22)

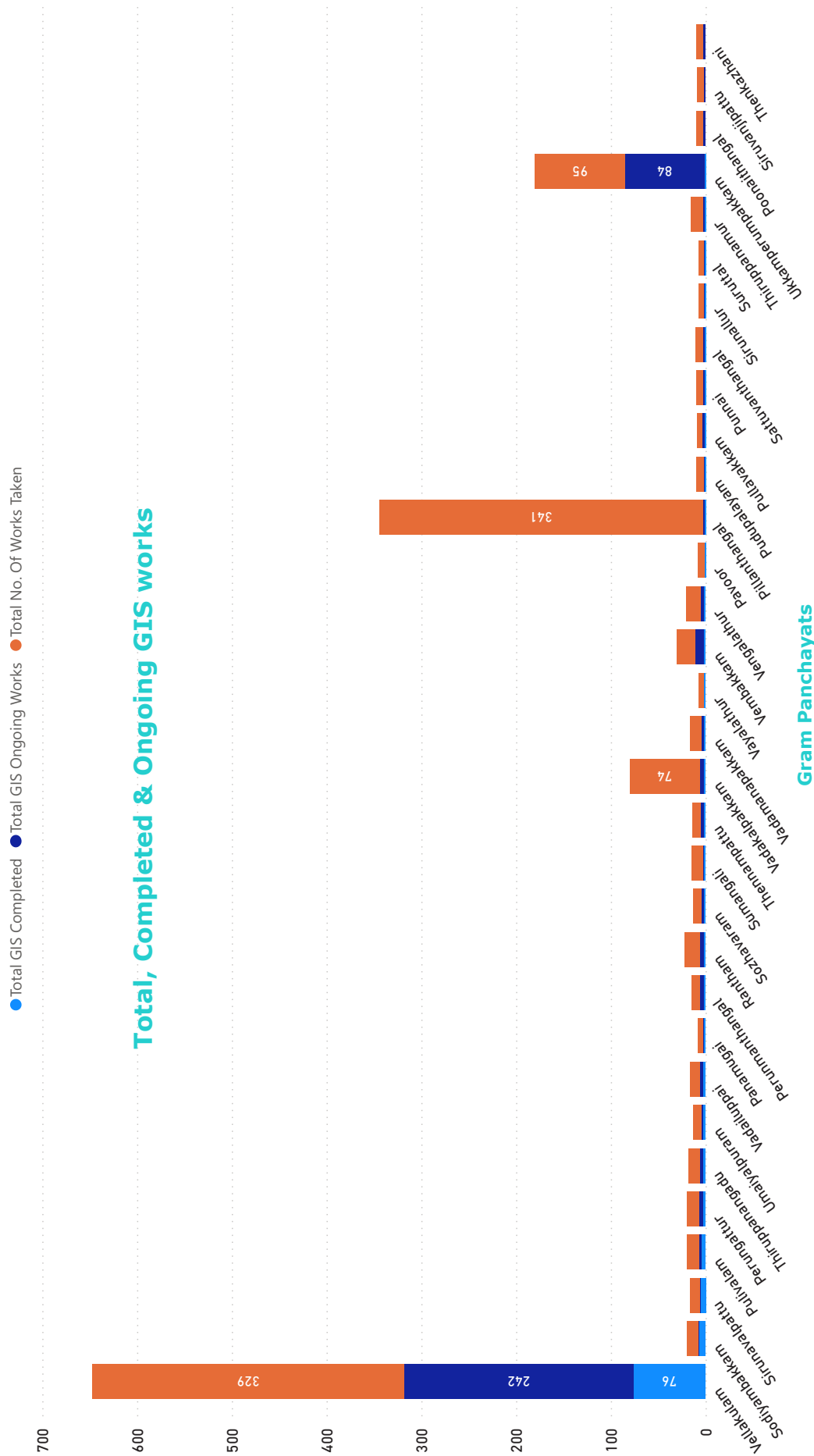
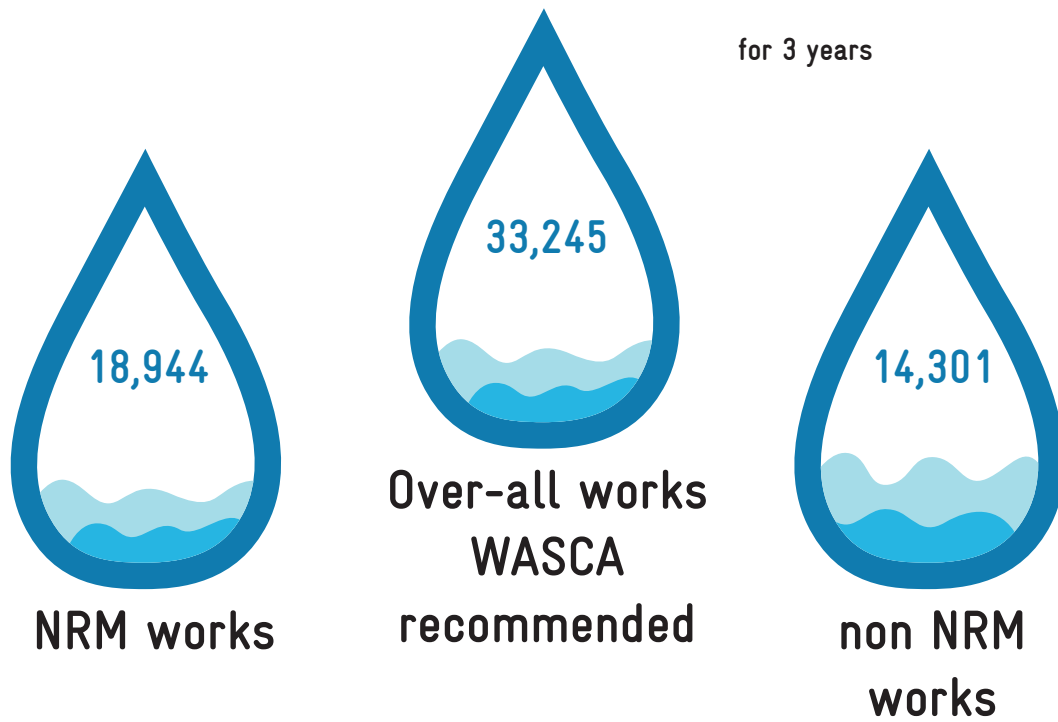


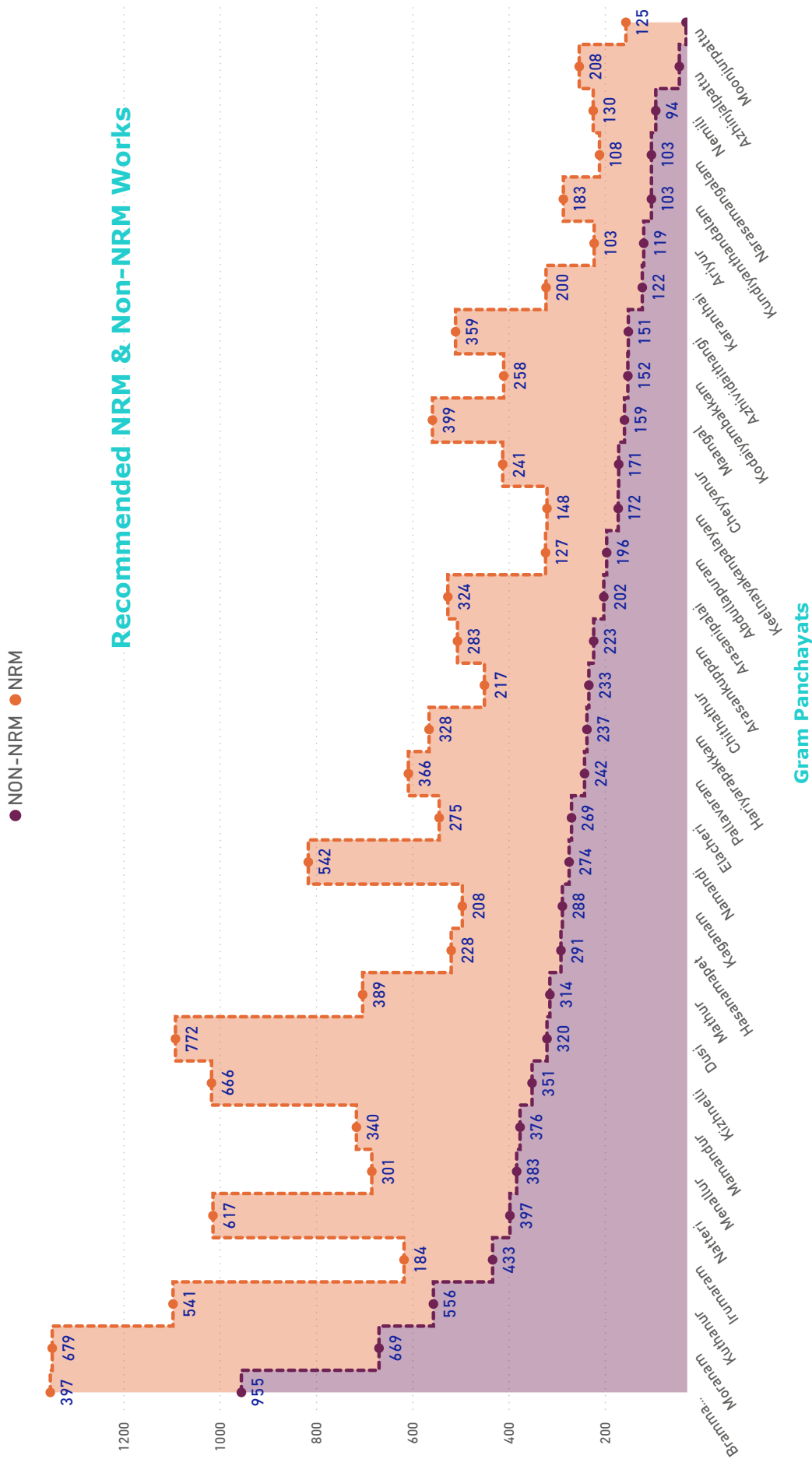
Figure 7.3. GP wise total, completed and ongoing GIS works (2021-22)

7.2 | NRM AND NON-NRM WORKS

WASCA recommended 33,245 works for a period of 3 years, out of which 18,944 are NRM works and 14,301 are Non-NRM works (Figure 7.4). A total

of 16,390 works has been uploaded so far for the financial year 2021-22 as on 04/02/2011.





Gram Panchayats

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

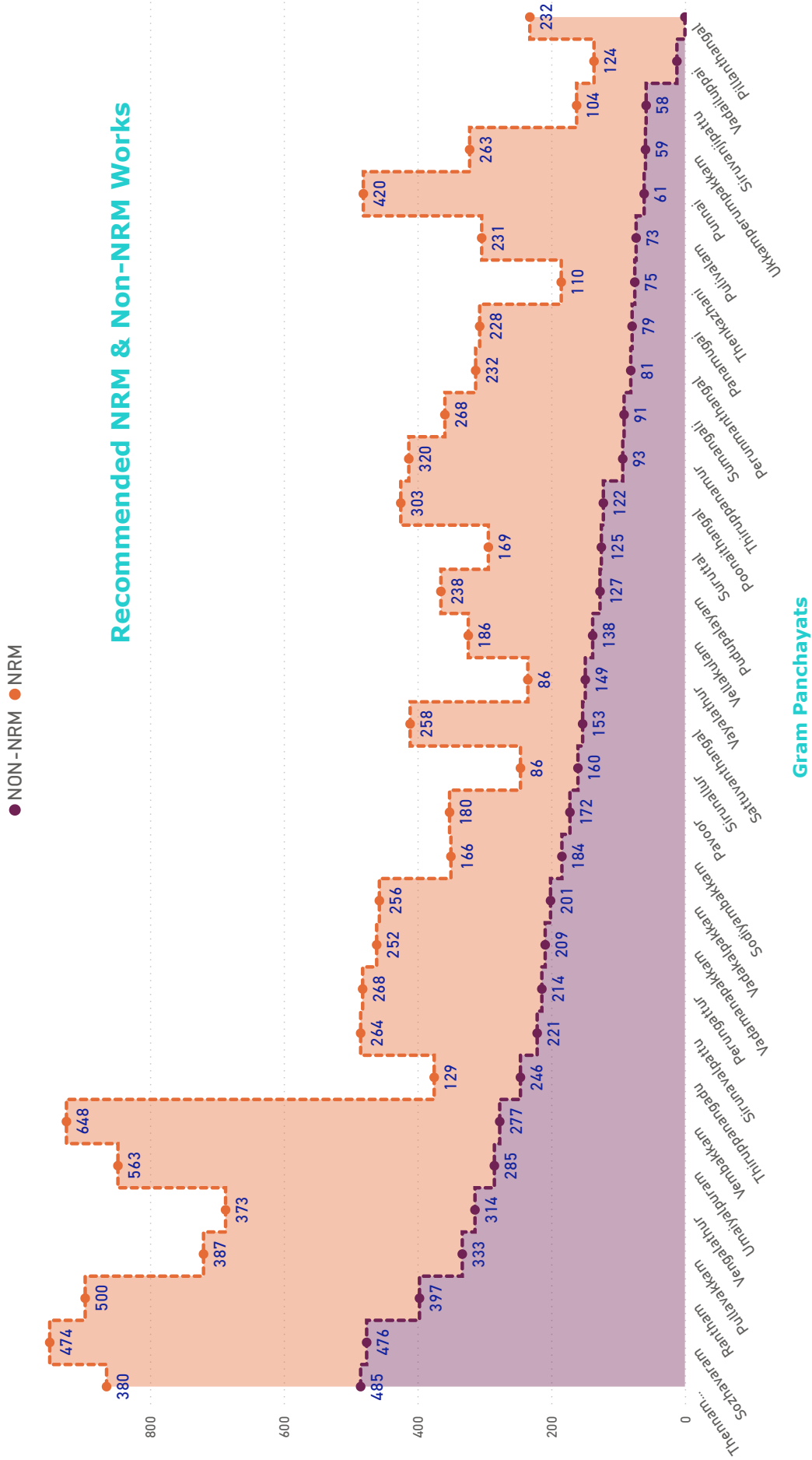


Figure 7.4. GP wise recommended NRM and Non-NRM works

7.3 | ONGOING WORKS

The ongoing works in Vembakkam Block includes Anganwadi/Other Rural Infrastructure, Drought Proofing, Rural Sanitation, Water Conservation and Water Harvesting (WCWH), and Works on Individuals Land (Category IV). A total of 231 works are ongoing in the Block, in which individual beneficiary oriented works are more (64 %) followed WCWH (28 %) while drought proofing, rural sanitation works are less in number (Figure 7.5). GP and work category wise ongoing works are tabulated in Annexure 7.2.

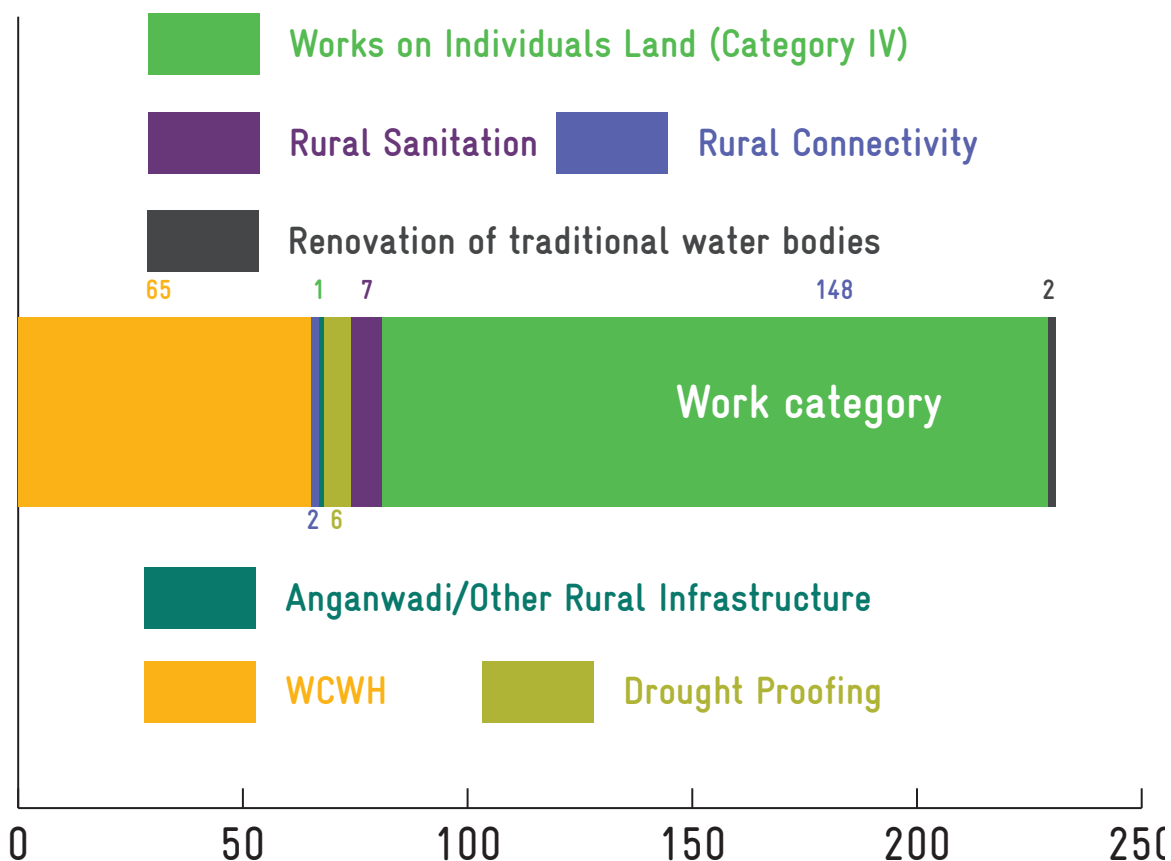


Figure 7.5. Category wise Ongoing works in Vembakkam Block (2021-22)

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 Vembakkam Block is Rs. 3,310.29 Lakhs, of it nearly 54 % of the expenditure utilized for renovation of traditional and other water bodies; 31% is for water conservation and rain water harvesting (Figure 7.6).

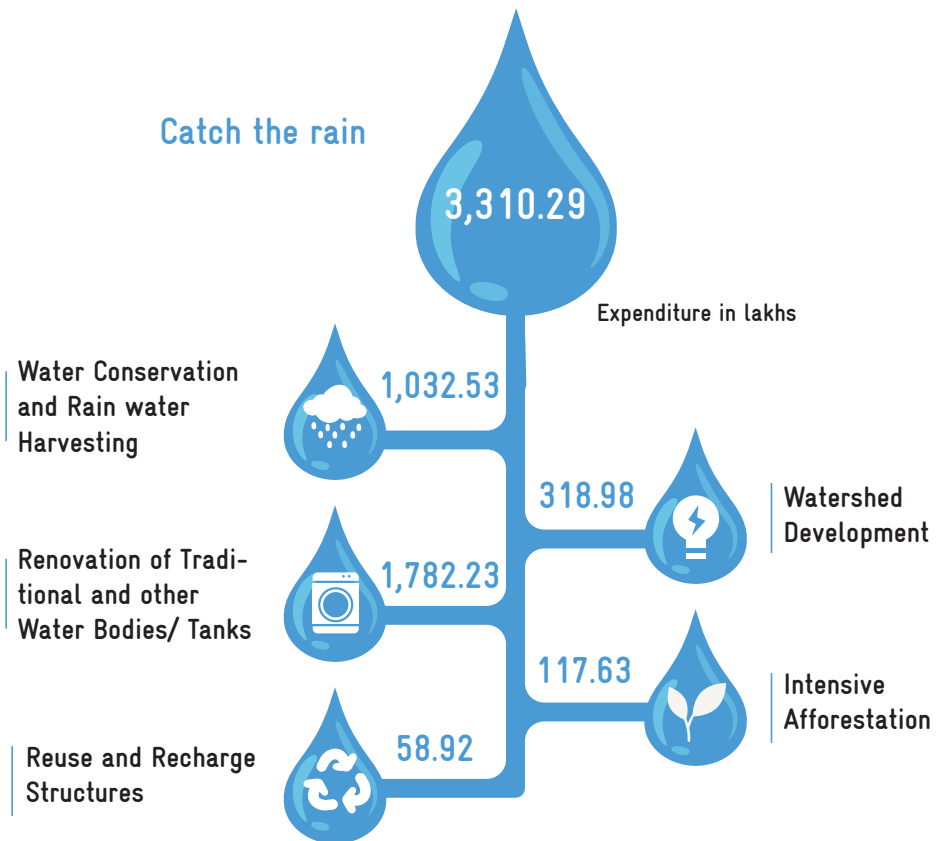
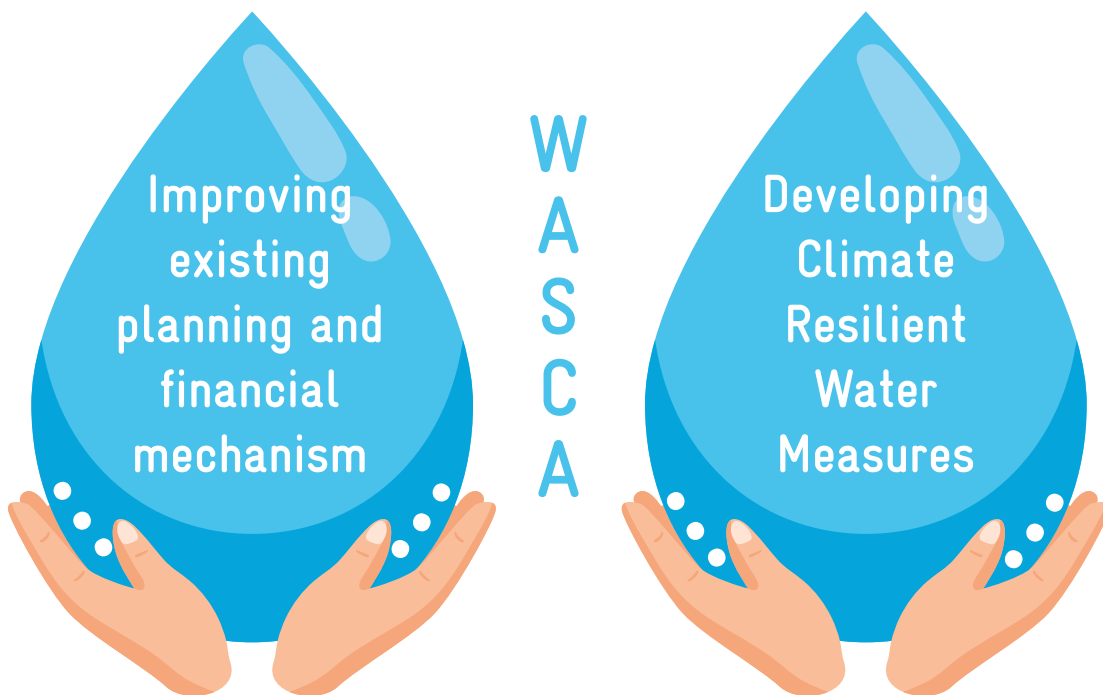


Figure 7.6. Catch the Rain campaign in Vembakkam Block



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

CASE STUDY



8 | CASE STUDY

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

8.1 | MACRO-WATERSHEDS OF VEMBAKKAM BLOCK

Vembakkam Block comes under Cheyyar and Vegavati sub-basins of Palar basin. Cheyyar, RB Palar and LB Palar macro-watersheds cover the Block. Cheyyar watershed (4C2A3) has 49 micro-watersheds covering an area of 27969.48 ha. RB Palar watershed (4C2A6) has 26 micro-watersheds covering an area of 14494.82 ha. LB Palar watershed (4C1D2) has 9 micro-watersheds covering an area of 6045.83 ha. (Table 24 & Figure 8.1). Out of 64 GPs in the Block, 42 GPs fall under Cheyyar (4C2A3) watershed, 7 GPs fall under RB Palar (4C2A6) watershed. 6 GPs have watershed boundaries passing through Cheyyar and RB Palar. One GP has watershed boundaries passing through Cheyyar, RB Palar and LB Palar. 8 GPs have watershed boundaries passing through RB Palar and LB Palar. (Table 25 & Figure 8.2). The micro-watershed-based works are identified using Basin, Sub-basin, and micro-watershed with GP administrative boundaries through Composite Water Resources Management plan approach.

TABLE 24. GENERAL DESCRIPTION OF MACRO-WATERSHEDS COVERING VEMBAKKAM BLOCK

Macro-watershed	Area in ha	No. of micro-watersheds
Cheyyar	27,969.48	49
R B Palar	14,494.82	26
L B Palar	6,045.83	9

TABLE 25. NO. OF GPs COVERED UNDER WATERSHEDS IN VEMBAKKAM BLOCK

Name of watershed	No. of GPs
Cheyyar	42
RB Palar	7
Cheyyar & RB Palar	6
Cheyyar, RB Palar & LB Palar	1
RB Palar & LB Palar	8

Understanding the Block area with respect to its nature of terrain aids in treating the area with appropriate measures at the right place which also ensures efficient management of the watershed (micro or macro). Ridge-based Block area is mapped (zoning) by referring to the spatial thematic datasets and showcased with macro-watershed (Table 26 & Figure 8.3) and GPs boundaries (Table 27 & Figure 8.4). Based on ridge range types such as high, middle, lower and inter variations of the Block area is distinguished into 4 kinds of ridge zones.

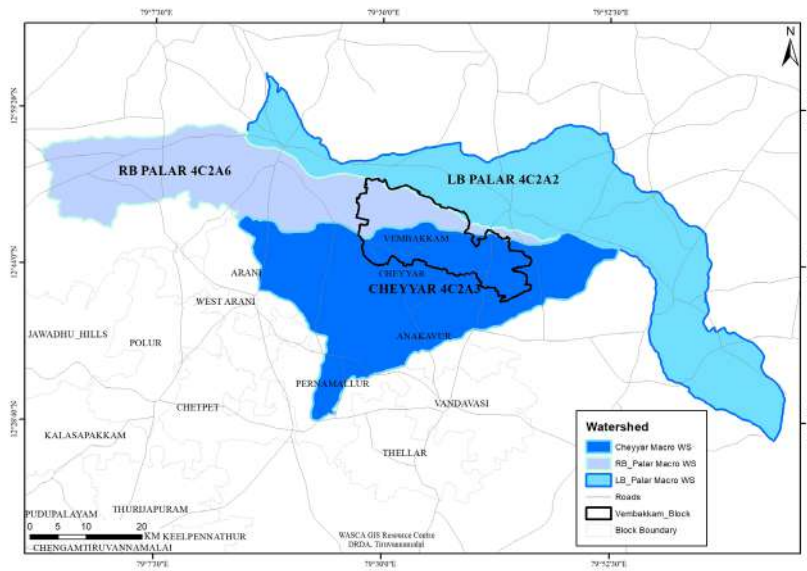


Figure 8.1. Macro-watershed Map of Vembakkam Block

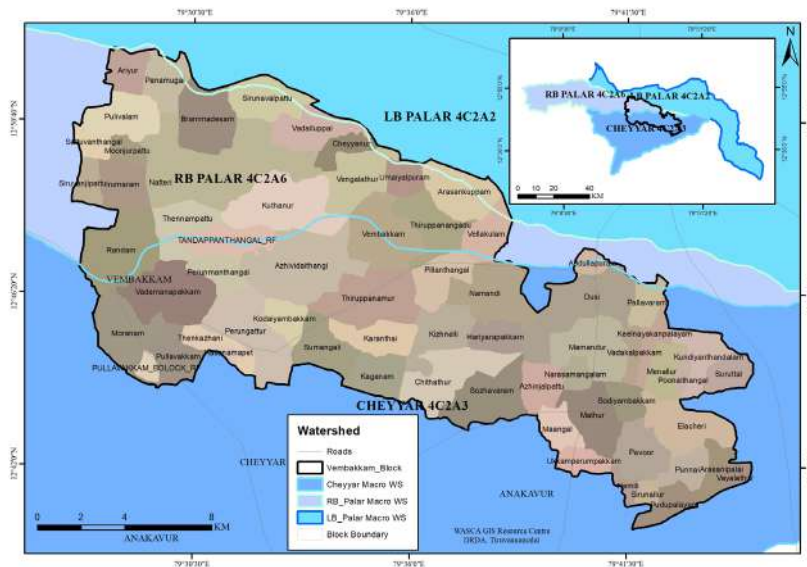


Figure 8.2. Macro-watershed with GPs map

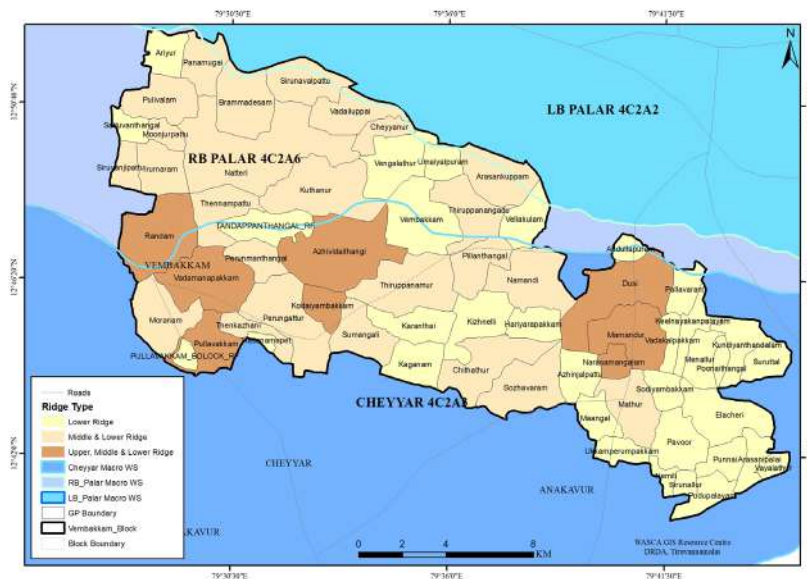


Figure 8.3. Macro-watershed Ridge Map

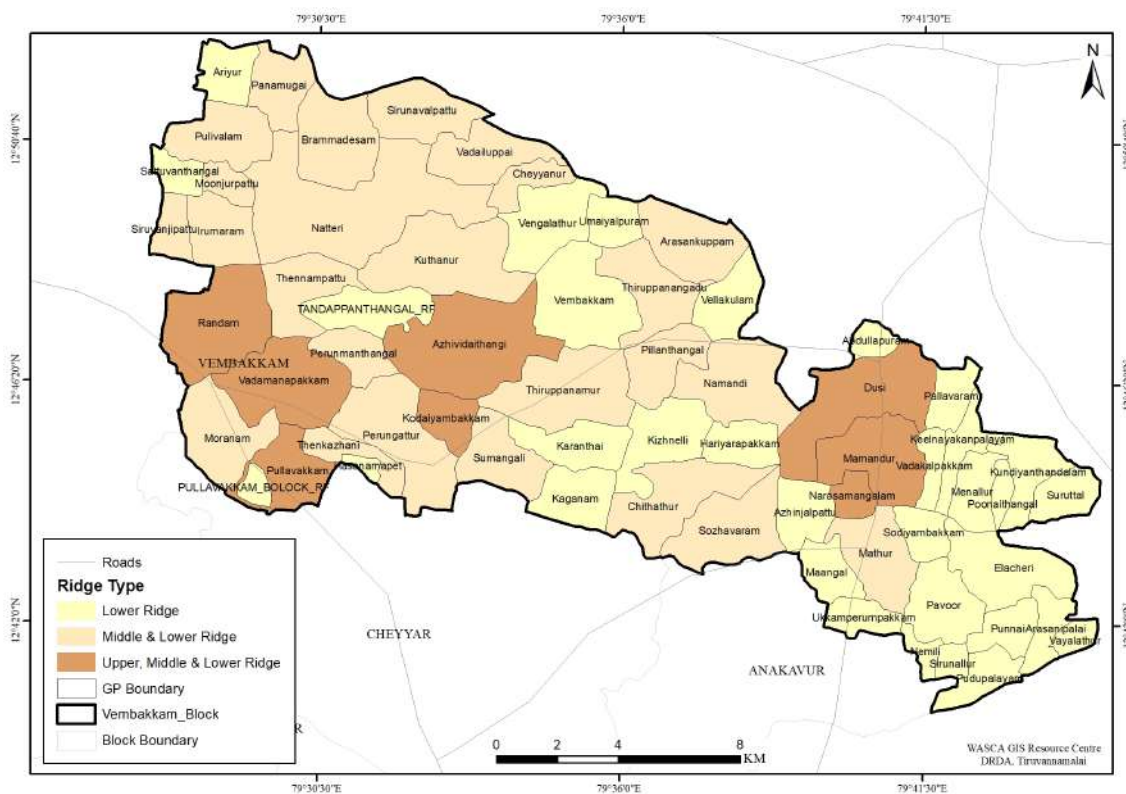


Figure 8.4. GP level Ridge Map

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, GPs proposed works in all macro watersheds in Vembakkam Block are listed in Tables 28 to 38.

TABLE 26. MICRO-WATERSHED IN VEMBAKKAM BLOCK FALLING UNDER CHEYYAR MACRO-WATERSHED

Sl.No	Micro watershed Code	Micro watershed Area in ha	Ridge Type
1	4C2A3f09b	366.09	Upper, Middle & Lower
2	4C2A30000	1206.53	
3	4C2A3f06c	628.5	
4	4C2A3f04b	360.07	
5	4C2A3a07c	485.3	
6	4C2A3a07b	315.04	
7	4C2A3f10c	604.85	
8	4C2A3f09c	781.09	
9	4C2A3f05a	966.98	
10	4C2A3f08b	435.15	
11	4C2A3f08a	535.38	
12	4C2A3f06b	462.05	
13	4C2A3f07b	625.91	
14	4C2A3f01d	470.52	
15	4C2A3f09a	403.17	
16	4C2A3f06a	598.98	
17	4C2A3f05b	513.36	

18	4C2A3f07a	842.9	Middle & Lower
19	4C2A3f04a	627.95	
20	4C2A3f02b	776.89	
21	4C2A3f02c	502.38	
22	4C2A3f04c	455.02	
23	4C2A3f01b	363.9	
24	4C2A3f01a	531	
25	4C2A3c05c	339.83	
26	4C2A3c06c	321.83	
27	4C2A3c06a	684.31	
28	4C2A3f10a	522.59	
29	4C2A3e09a	904.67	
30	4C2A3a08c	446.89	
31	4C2A3a08b	368.1	
32	4C2A3f08c	371.8	
33	4C2A3a08a	630.99	
34	4C2A3f01c	177.53	
35	4C2A3a06b	689.38	
36	4C2A3c10c	339.37	
37	4C2A3a06a	659.43	
38	4C2A3a07a	742.81	
39	4C2A3f05c	432.85	
40	4C2A3c09b	715.49	
41	4C2A3a04a	981.19	
42	4C2A3c05a	778.8	
43	4C2A3c06b	848.15	
44	4C2A3c05b	326.54	
45	4C2A3a04b	761.36	
46	4C2A3a04c	766.35	
47	4C2A3b03c	354.14	
48	4C2A3b05a	686.15	
49	4C2A3a04d	259.9	
			Lower

TABLE 27. LIST OF GPS WITH TYPE OF RIDGE FALLING UNDER CHEYYAR MACRO-WATERSHED IN VEMBAKKAM BLOCK

Sl.No	GP	Ridge type
1	Mamandur	Upper, Middle & Lower
2	Narasamangalam	
3	Vadamanapakkam	
4	Kodaiyambakkam	
5	Pullavakkam	
6	Azhividaithangi	
7	Dusi	
8	Mathur	Middle & Lower
9	Sozhavaram	
10	Thiruppanamur	

11	Perunmanthangal	Middle & Lower	
12	Sumangali		
13	Perungattur		
14	Pillanthangal		
15	Namandi		
16	Chithathur		
17	Moranam		
18	Thenkazhani		
19	Kaganam		Lower
20	Pavoor		
21	Poonaihangal		
22	Sirunallur		
23	Menallur		
24	Pallavaram		
25	Pudupalayam		
26	Sodiyambakkam		
27	Vadakalpakkam		
28	Arasanipalai		
29	Vayalathur		
30	Punnai		
31	Azhinjalpattu		
32	Ukkamperumpakkam		
33	Hariyarpakkam		
34	Maangal		
35	Karanthai		
36	Hasanamapet		
37	Kundiyanthandalam		
38	Nemili		
39	Elacheri		
40	Kizhnelli		
41	Keelnayakanpalayam		
42	Suruttal		

TABLE 28. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPE OF RIDGE FALLING UNDER CHEYYAR MACRO-WATERSHED IN VEMBAKKAM BLOCK

Sl. No.	Proposed work	Ridge type	Extent
1	Afforestation in Public/common lands (ha)	Upper	657.09
2	Drainage Line Treatment (m)		21,998.47
3	CC Check dams (No.)	Middle	21
4	Block Plantation (Community) (ha)		459.59
5	Avenue plantation (m)		1,56,425
6	Agro Forestry (ha)		2.06
7	Composting (No.)	Lower	339
8	Canal Bund Plantation (m)		8,904
9	Restoration of water bodies: Tanks and Ooranis (No.)		284

10	Artificial Recharge Structure (No.)	Lower	654
11	Farm Bunding with Boundary Trenches - Individual (ha)		818.34
12	Construction of Farm Ponds - Individual (No.)		667
13	Land development - Individual (ha)		649.34
14	Azolla units - Individual (No.)		1,860
15	NADEP Vermi compost (No.)		1,440
16	Cattle Shelters (No.)		1,837
17	Goat Sheep Shelters (No.)		1,996
18	Cattle Trough (No.)		1,837
19	Construction of new open wells & Recharge Shafts (No.)		654
20	Soak Pits (Community) (No.)		267
21	Soak Pits (Individual) (No.)		2,245
22	Roof Rain Water Harvesting (No.)		84
23	Nutri Garden (No.)		67,820
24	Silt application (No.)		176

TABLE 29. MICRO WATERSHED IN VEMBAKKAM BLOCK FALLING UNDER RB PALAR MACRO-WATERSHED

Sl.No	Micro watershed Code	Micro watershed Area in ha	Ridge Type
1	4C2A6a13c	445.86	Upper, Middle,& Lower
2	4C2A6a06b	716.25	Middle & Lower
3	4C2A6a06a	723.99	
4	4C2A6a07a	674.55	
5	4C2A6a06c	318.75	
6	4C2A6a05a	649.17	
7	4C2A6a05b	555.89	
8	4C2A6a04b	585.12	
9	4C2A6a04a	729.51	
10	4C2A6a13a	212.73	
11	4C2A6a05c	832.63	
12	4C2A6a14a	436.05	
13	4C2A6a03c	479.4	
14	4C2A6a03a	545.88	
15	4C2A6a12b	717.23	
16	4C2A6a03b	764.03	
17	4C2A6a13b	279.88	
18	4C2A6a04c	459.01	
19	4C2A6a14b	425.01	
20	4C2A6a12c	513.69	
21	4C2A6a14c	824.55	
22	4C2A6a06d	898	Lower
23	4C2A6a12a	340.41	
24	4C2A6a02c	483.63	
25	4C2A6a02a	392.11	
26	4C2A6a01c	491.5	

TABLE 30. LIST OF GPS WITH TYPE OF RIDGE FALLING UNDER R B PALAR MACRO-WATERSHED IN VEMBAKKAM BLOCK

Sl.No	Name of the GP	Ridge type
1	Siruvanjpattu	Middle & Lower
2	Moonjurpattu	
3	Irumaram	
4	Pulivalam	
5	Natteri	
6	Sattuvanthangal	Lower
7	Ariyur	

TABLE 31. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPE OF RIDGE FALLING UNDER R B PALAR MACRO-WATERSHED IN VEMBAKKAM BLOCK

Sl.No	Proposed Work	Ridge Type	Extent
1	Afforestation in Public/common lands (ha)	Upper	226.38
2	Drainage Line Treatment (m)		1015
3	CC Check dams (No.)	Middle	7
4	Block Plantation (Community) (ha)		58.24
5	Silvi-pasture Development (ha)		4.61
6	Avenue plantation		33,856
7	Mini Forest (ha)		0.5
8	Composting (No.)		48
9	Canal Bund Plantation (m)		3,609
10	Restoration of water bodies: Tanks and Ooranis (No.)	Lower	58
11	Artificial Recharge Structure (No.)		153
12	Farm Bunding with Boundary Trenches - Individual (ha)		41.59
13	Construction of Farm Ponds - Individual (No.)		114
14	Land development - Individual (ha)		52.59
15	Azolla units - Individual (No.)		155
16	NADEP Vermi compost (No.)		155
17	Cattle Shelters (No.)		155
18	Goat Sheep Shelters (No.)		356
19	Cattle Trough		155
20	Construction of new open wells & Recharge Shafts (No.)		153
21	Soak Pits (Community) (No.)		20
22	Soak Pits (Individual) (No.)		120
23	Roof Rain Water Harvesting (No.)		14
24	Nutri Garden (No.)		10,483
25	Silt application (No.)		30

TABLE 32. MICRO-WATERSHED IN VEMBAKKAM BLOCK FALLING UNDER L B PALAR MACRO-WATERSHED

Sl.No	Micro watershed Code	Micro watershed Area in ha	Ridge Type
1	4C2A2e02b	658.94	Middle & Lower
2	4C2A2e02c	504.09	
3	4C2A2e02a	796.83	
4	4C2A2e01a	467.02	Middle & Lower
5	4C2A2d03b	839.92	
6	4C2A2d03c	368.82	
7	4C2A2d03a	908.82	
8	4C2A2d02b	1195.64	
9	4C2A2e01b	305.74	

TABLE 33. LIST OF GPS WITH TYPE OF RIDGE FALLING UNDER RB PALAR & LB PALAR MACRO WATERSHED IN VEMBAKKAM BLOCK

Sl.No	Name of the GP	Ridge type
1	Panamugai	Middle & Lower
2	Brammadesam	
3	Cheyyanur	
4	Arasankuppam	
5	Sirunavalpattu	
6	Vadailuppai	
7	Umaiylpuram	Lower
8	Vengalathur	

TABLE 34. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPE OF RIDGE FALLING UNDER RB PALAR & LB PALAR MACRO-WATERSHED IN VEMBAKKAM BLOCK

Sl.No	Proposed Work	Ridge Type	Extent
1	Afforestation in Public/common lands (ha)	Upper	226.58
2	Drainage Line Treatment (m)		2556
3	CC Check dams (No.)	Middle	3
4	Block Plantation (Community) (ha)		36.29
5	Avenue plantation (m)		43,944
6	Composting (No.)	Lower	85
7	Canal Bund Plantation (m)		6,134
8	Restoration of water bodies: Tanks and Ooranis (No.)		48
9	Artificial Recharge Structure (No.)		222
10	Farm Bunding with Boundary Trenches - Individual (ha)		105.16
11	Construction of Farm Ponds - Individual (No.)		160
12	Land development - Individual (ha)		104.07
13	Azolla units - Individual (No.)		535
14	NADEP Vermi compost (No.)		535

15	Cattle Shelters (No.)	Lower	535
16	Goat Sheep Shelters (No.)		413
17	Cattle Trough (No.)		535
18	Construction of new open wells & Recharge Shafts (No.)		222
19	Soak Pits (Community) (No.)		42
20	Soak Pits (Individual) (No.)		540
21	Roof Rain Water Harvesting (No.)		16
22	Nutri Garden (No.)		19,725
23	Silt application (No.)		42

TABLE 35. LIST OF GPS WITH TYPE OF RIDGE FALLING UNDER CHEYYAR, RB PALAR & LB PALAR MACRO-WATERSHED IN VEMBAKKAM BLOCK

Sl.No	Name of the GP	Type of Ridge
1	Vellakulam	Lower Ridge

TABLE 36. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPE OF RIDGE FALLING UNDER CHEYYAR, RB PALAR & LB PALAR MACRO-WATERSHED IN VEMBAKKAM BLOCK

Sl.No	Proposed Work	Ridge Type	Extent
1	Afforestation in Public/common lands (ha)	Upper	4.78
2	CC Check dams (No.)	Middle	1
3	Block Plantation (Community) (ha)		9.79
4	Avenue plantation		4,043
5	Composting (No.)		11
6	Canal Bund Plantation (m)	Lower	500
7	Restoration of water bodies: Tanks and Ooranis (No.)		5
8	Artificial Recharge Structure (No.)		12
9	Farm Bunding with Boundary Trenches - Individual (ha)		13.6
10	Construction of Farm Ponds - Individual (No.)		15
11	Land development - Individual (ha)		13.6
12	Azolla units - Individual (No.)		30
13	NADEP Vermi compost (No.)		30
14	Cattle Shelters (No.)		30
15	Goat Sheep Shelters (No.)		16
16	Cattle Trough (No.)		30
17	Construction of new open wells & Recharge Shafts (No.)		12
18	Soak Pits (Community) (No.)		3
19	Soak Pits (Individual) (No.)		30
20	Roof Rain Water Harvesting (No.)		2
21	Nutri Garden (No.)		1,510
22	Silt application (No.)	5	

TABLE 37. LIST OF GPS WITH TYPE OF RIDGE FALLING UNDER CHEYYAR & RB PALAR MACRO-WATERSHED IN VEMBAKKAM BLOCK

Sl.No	Name of the GP	Ridge type
1	Randam	Upper, Middle & Lower
2	Thiruppanangadu	Middle & Lower
3	Thennampattu	
4	Kuthanur	
5	Vembakkam	Lower
6	Abdullapuram	

TABLE 38. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPE OF RIDGE FALLING UNDER CHEYYAR & RB PALAR MACRO-WATERSHED IN VEMBAKKAM BLOCK

Sl.No	Proposed Work	Ridge Type	Extent
1	Afforestation in Public/common lands (ha)	Upper	159.54
2	Drainage Line Treatment (m)	Middle	2,595
3	CC Check dams (No.)		5
4	Block Plantation (Community) (ha)		63.73
5	Avenue plantation (m)		39,999
6	Composting (No.)		144
7	Canal Bund Plantation (m)	Lower	2,748
8	Restoration of water bodies: Tanks and Ooranis (No.)		70
9	Artificial Recharge Structure (No.)		129
10	Farm Bunding with Boundary Trenches - Individual (ha)		136.07
11	Construction of Farm Ponds - Individual (No.)		189
12	Land development - Individual (ha)		177.76
13	Azolla units - Individual (No.)		578
14	NADEP Vermi compost (No.)		578
15	Cattle Shelters (No.)		552
16	Goat Sheep Shelters (No.)		407
17	Cattle Trough (No.)		552
18	Construction of new open wells & Recharge Shafts (No.)		129
19	Soak Pits (Community) (No.)		39
20	Soak Pits (Individual) (No.)		519
21	Roof Rain Water Harvesting (No.)		12
22	Nutri Garden (No.)		18,365
23	Silt application (No.)		72

8.2 | MODEL MICRO-WATERSHED- NATTERI

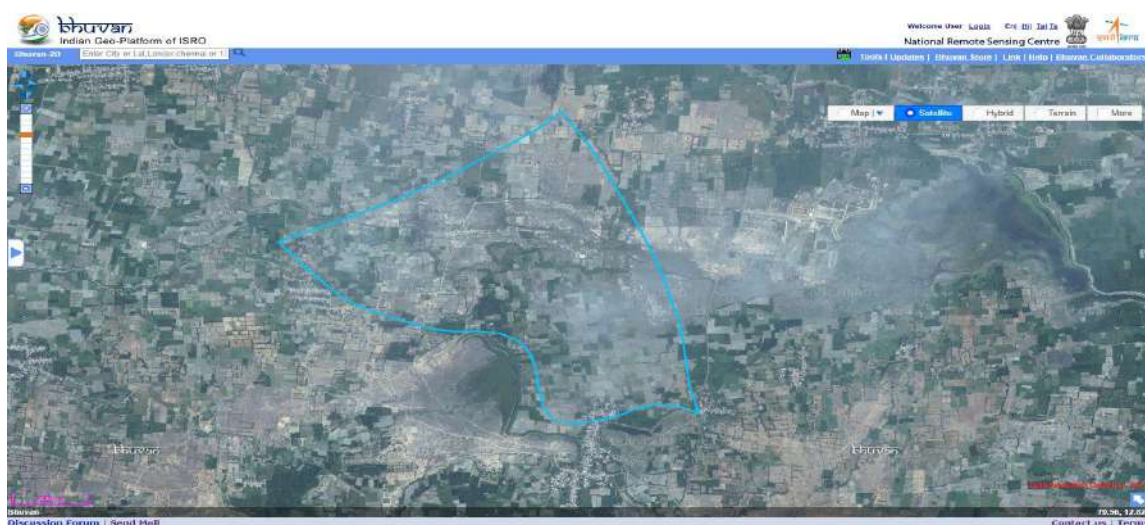


Figure 8.5. Satellite image of Natteri micro-watershed

The micro-watershed case study addresses the issues of water conservation and climate change through 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 de-

velopment programs. This includes coordination of various natural components like groundwater, surface water, geology, hydrogeology, catchment, land use, soil, population, salt affected water along with various water resource supply and demand component. The ultimate goal is to achieve and maintain a balance between resources development to increase the welfare of the population.

NATTERI MICRO-WATERSHED

Natteri micro-watershed falls under Natteri GP, Vembakkam Block in Thiruvannamalai District (Figure 8.5 and 8.6). This micro-watershed is a part of Kiliyar macro-watershed in Kiliyar sub-basin. The general information, geology, hydrogeology, natural drainage line, catchment area, groundwater status, water budget of Natterimicro-water-

shed is given below in separate sections followed by proposed works, ridge wise proposed treatment area, estimated cost and required person days and key outcomes (Tables 39 to 50). Figure 8.7 and 8.8 shows the spatial representation of proposed activities. The key CWRM parameters for the GPs falling in this micro-watershed is Annexed 8.

TABLE 39. GENERAL INFORMATION OF THE MICRO-WATERSHED

Description	Name/ Number/ Quantity/ Status
Name of the Micro-watershed	Natteri
Micro-watershed Number	4C2A6a12a
Name of the Basin	Palar Basin
Name of the subbasin	Vegavati Sub Basin
Name of the Macro-watershed	RB Palar
Number of GPs covered under the Micro-watershed	2

Name of the GPs	1. Natteri 2. Kuthanur
Latitude of Micro-watershed (From To)	12°48'43.39"N to 12°50'6.17"N
Longitude of Micro-watershed (From To)	79°31'39.02"E to 79°33'3.69"E
Total area of the Micro-watershed (in ha)	340
% of Micro-watershed area in Natteri GP	60
% of Micro-watershed area in Kuthanur GP	40
Area of Micro-watershed falling in Natteri GP	204
Area of Micro-watershed falling in Kuthanur GP	136
Total Population of Natteri GP	5,066
Total Population of Kuthanur GP	3,509
Annual Average Rainfall (mm)	1,047
Annual maximum Temperature (°C)	33
Annual Minimum Temperature (°C)	22.8
Evapo-Transpiration Losses of Natteri GP (ha.m)	36.24
Evapo-Transpiration Losses of Kuthanur GP (ha.m)	19.93
Volumetric soil moisture availability (%)	23
Climate Risk	Drought and heat waves
CVI Index Value for Natteri GP (Based on WASCA Climate study)	0.594
CVI Index Value for Kuthanur GP (Based on WASCA Climate study)	0.558
Agro-Climatic Zone	North eastern zone (TN-1)
Agro Ecological Sub-Region (ICAR)	Eastern Ghats
Status of Ground water in Natteri GP	Semi-Critical
Status of Ground water in Kuthanur GP	Semi-Critical

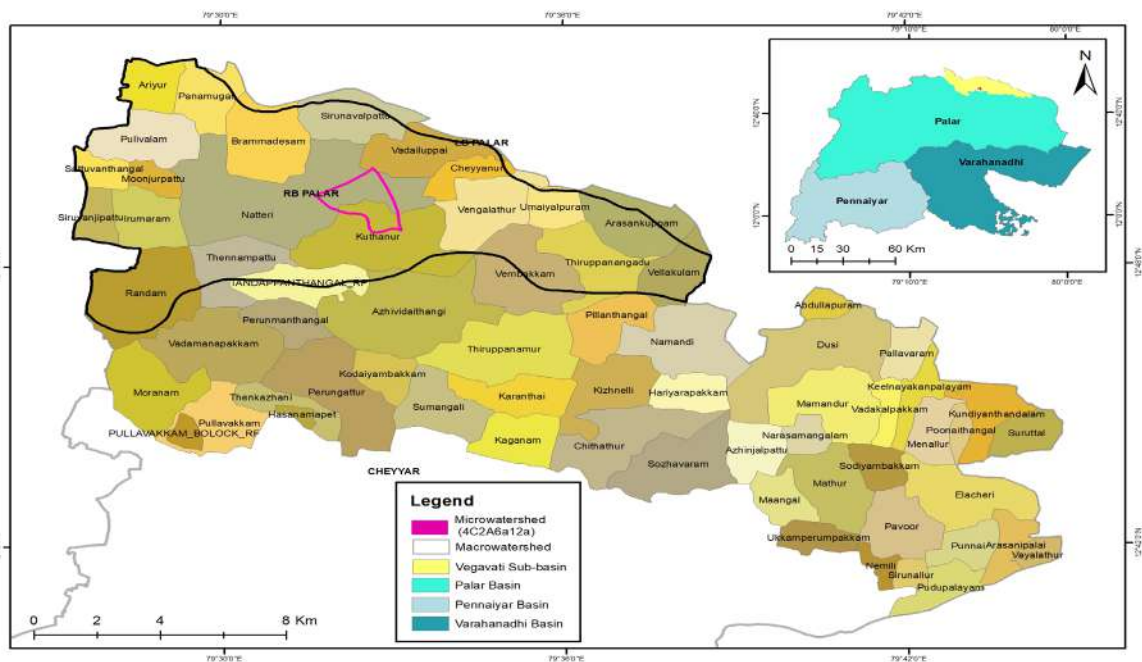


Figure 8.5. Satellite image of Natteri micro-watershed

TABLE 40. GEOLOGY, HYDROGEOLOGY OTHER CHARACTERISTICS IN MICRO-WATERSHED

Geology occurrence in % (Hard rock)	100
Geology Quality	Moderate
Depth of weathered zone and/or maximum depth of fractures in Hard Rock area (m)	30 to 60
Bottom of the unconfined aquifer in soft rock areas (m)	20 to 40

TABLE 41. NATURAL DRAINAGE LINES IN MICRO-WATERSHED

No. of 1st Order drains	1 Nos
No. of 2nd Order drains	1 Nos
Total length of natural drainage line (m)	3313
Drainage density (ha.m)	9.74

TABLE 42. MICRO-WATERSHED'S CATCHMENT AREA

Catchment Area Profile (Strange methodology- CGWB)		
Catchment Area in ha	Natteri GP	Kuthanur GP
Good catchment area	293.14	333.3
Average catchment area	44.7	14.35
Bad catchment area	1,588.75	799.53

TABLE 43. GROUND WATER STATUS OF MICRO-WATERSHED

Firka Assessment Unit (in ha.m)	Natteri GP	Kuthanur GP
Name of the Firka (Assesment Unit) falling under Micro-watershed	Natteri	Perungattur
Net Annual Ground Water Availability	1676.13 ha.m	1848.12 ha.m
Existing Gross Ground Water Draft for Irrigation	1143.80 ha.m	1220.40 ha.m
Existing Gross Ground Water Draft for domestic and industrial water supply	38.67 ha.m	76.20 ha.m
Existing Gross Ground Water Draft for All uses	1182.47 ha.m	1296.60 ha.m
Provision for domestic and industrial requirement supply to 2025	43.95 ha.m	86.61 ha.m
Net Ground Water Availability for future irrigation development	488.38 ha.m	541.11 ha.m

TABLE 44. GP WISE WATER BUDGET OF MICRO-WATERSHED- NATTERI GP AND KUTHANUR GP

Water Budget in ha.m	Natteri GP	Kuthanur GP
Water for Human	13.87	9.61
Water for Agriculture	1,079.9	287.5
Water for Animals	12.54	5.22
Village wise water required	1106.3	302.4
Available run-off from rain water (derived from strange method)	419.6	278.5
Harvested Runoff from Water Harvesting Activities	10.7	101
Potential Harvesting from proposed Interventions	98.8	119.4
Total Water harvested	109.5	220.3
Water demand and Supply Difference	-996.8	-82
Water Demand Supply Gap Status	Deficient	Deficient
Per capita Water Availability in cum	828.27	793.67
International Standard per capita water Availability in cum	1,700	1,700
Water Availability Gap in cum	-871.73	-906.33
Water security status	Water Stress	Water Stress

TABLE 45. GP WISE PROPOSED MICRO-WATERSHED WORKS - NATTERI GP & KUTHANUR GP

Ridge type	Natteri GP	Kuthanur GP
Upper	No works in Upper Ridge	No works in Upper Ridge
Middle	No works in Middle Ridge	No works in Middle Ridge
Lower	45	53
Total	45	53

TABLE 46. RIDGE WISE TREATMENT AREA, ESTIMATED COST AND PERSON DAYS REQUIRED - NATTERI GP & KUTHANUR GP

	Natteri GP	Kuthanur GP
Lower Ridge		
Estimated cost for Lower Ridge area (INR in Lakhs)	156.6	63.74
Total area in ha of Lower Ridge	204	136
Treatment cost of Lower Ridge (INR in Lakhs per ha)	0.77	0.47
Estimated Person days generated for Treatment of Lower Ridge	56,405	24,732

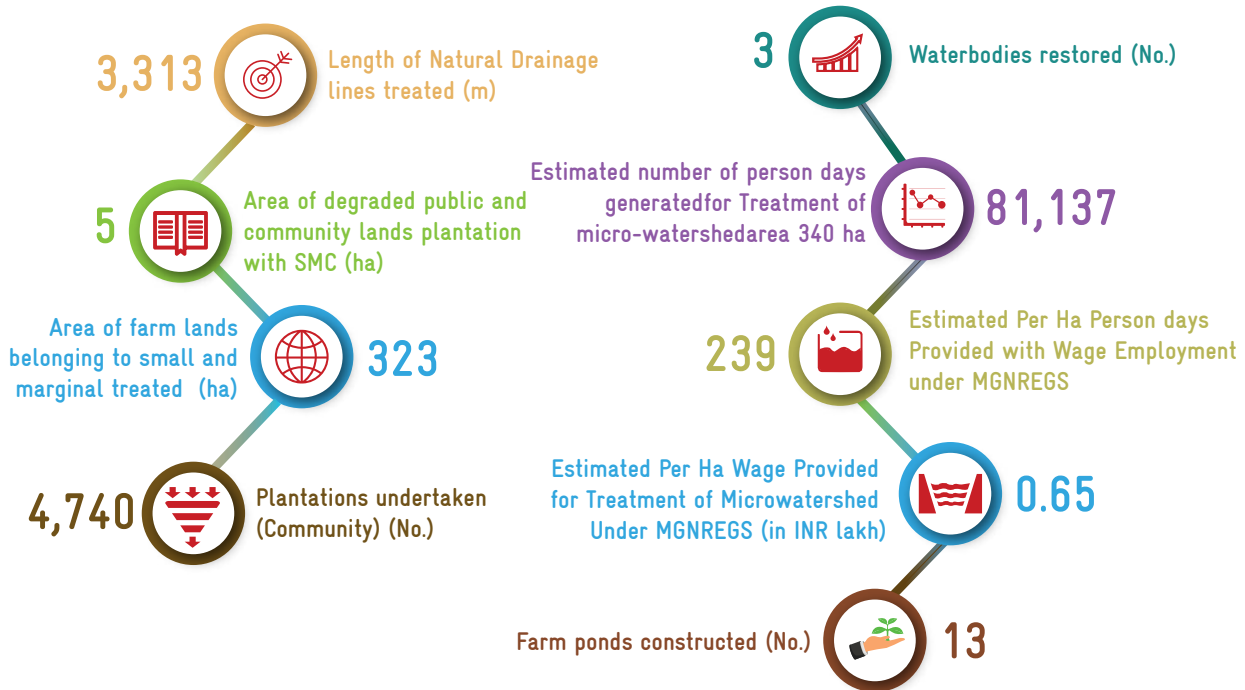
Natteri GP	Treatment cost (INR in lakhs)	Estimated person days
Upper Ridge	NA	NA
Middle Ridge	NA	NA
Lower Ridge	0.77 lakh/ha	56,405
0.77 lakh/ha		56,405

Kuthanur GP	Treatment cost (INR in lakhs)	Estimated person days
Upper Ridge	NA	NA
Middle Ridge	NA	NA
Lower Ridge	0.47 lakh/ha	24,732
0.47 lakh/ha		24,732

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

Description	Number
Total No. of works in Micro-watershed area (Arable, Non arable & DLT)	65
Total No. of works in Micro-watershed including livelihood Activities	13
Total No. of works in Micro-watershed including Rural Greywater Management Activities	20

TABLE 48. KEY OUTCOMES OF INTERVENTION



Expenditure for FY 2020-21 (in INR lakh)



Natteri GP	76.75 lakh
Kuthanur GP	56.56 lakh

TABLE 49. ESTIMATES OF MICRO-WATERSHED IN NATTERI 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						
Avenue plantation (Km)	Lower	Commenced	1.091	1	1.9638	126
Restoration of Traditional water bodies: (Pond)			2	2	2	1,149
Restoration of Traditional water bodies: (Union Tank) (No.)			1	1	43.2	160
Loose boulder check dam (No.)		Not commenced	3	3	2.5	703
Sunken Pit in 1st order drain (No.)			3	3	4.62	12,960
Gabion Check Dam (No.)			1	1	1.6	6,664
Tank bund Plantation (No.)			1	1	1.8	767
Block Plantation (ha)			3	1	33.3	90
Silvi Pasture (ha)			1	1	17.1	400
Compost Pit (No.)		6	6	1.02	16,000	
Sub total					20	109.1
Works in Individual Farmer lands (Agriculture and Allied Activities)						
Azolla Production units - Individual (No.)	Lower	Commenced	2	2	0.3	1,173
NADEP Vermi compost			1	1	0.18	
Artificial Recharge Structure for borewell farmers (No.)		Not commenced	3	3	7.5	1,758
Farm Bunding with Boundary Trenches - Individual (ha & No.)			7.5	3	4.5	4,686
			3			
Dryland Horticulture (ha & No.)			5	2	17	6,642
			2			
Silt application (No.)			2	2		46
Fodder development - Individual (No.)		1	1	1.48	27	
Construction of Farm Ponds - Individual (No.)		Ongoing	6	6	12	2,344
Sub total				20	42.96	16,676
Total				40	152.06	55,695
Livelihood enhancement activities for Individual Farmers (dryland)						
Cattle Shelters (No.)	Lower	Commenced	1	1	2.12	331
Goat Sheep Shelters (No.)	Lower	Not commenced	1	1	2.27	355
Cattle Trough (No.)			1	1	0.05	6
Sub total				3	4.44	692
Rural Greywater Management						
Soak Pits (Individual) (No.)	Lower	Ongoing	1	1	0.1	16
Nutri Garden (No.)		Not commenced	1	1	0.01	2
Sub total				2	0.11	18
Total				45	156.61	56,405

TOTAL ESTIMATES OF MICRO-WATERSHED IN NATTERI GP







	No. of works as per KML	Estimate cost in INR (Lakhs)	Person days
			
Natteri GP	45	156.61	56,405

TABLE 50. ESTIMATES OF MICRO-WATERSHED IN KUTHANUR GP

Proposed Work	Ridge Type	Status of Work	Extent	No. of works as per KML	Estimate cost (INR in Lakhs)	Person days
NRM works in Public and Community Lands						
Afforestation (No.)	Lower	Not commenced	1	1	8.6	3,344
Works in Individual Farmer lands (Agriculture and Allied Activities)						
Azolla Production units - Individual (No.)	Lower	Commenced	12	5	7.5	2,930
NADEP Vermi compost (No.)			5			
Artificial Recharge Structure for borewell farmers (No.)		Not commenced	15	5	42.5	16,605
Farm Bunding with Boundary Trenches - Individual (ha & No.)			5			
Fodder development - Individual (No.)			6	6	12	4,686
Construction of Farm Ponds - Individual (No.)			10	10	25	3,910
	Ongoing	5	5			
Sub total				24	33.09	17,951
Total				25	41.69	21,295
Livelihood enhancement activities for Individual Farmers (dryland)						
Cattle Shelters (No.)	Lower	Commenced	4	4	8.48	1,324
Goat Sheep Shelters (No.)			2	2	4.54	710
Cattle Trough (No.)	Lower	Not commenced	4	4	0.2	24
Sub total				10	13.22	2058
Rural Greywater and Roof top Rainwater Management						
Rainwater Harvesting Structure (No.)	Lower	Commenced	2	2	8	1250
Soak Pits (Individual) (No.)			8	8	0.8	128
Nutri Garden (No.)		Not commenced	8	8	0.03	1
Sub total				18	8.83	1,379
Total				53	63.74	24,732

TOTAL ESTIMATES OF MICRO-WATERSHED IN KUTHANUR GP

	No. of works as per KML	Estimate cost in INR (Lakhs)	Person days
			
Northamboondi GP	235	259.28	91,178

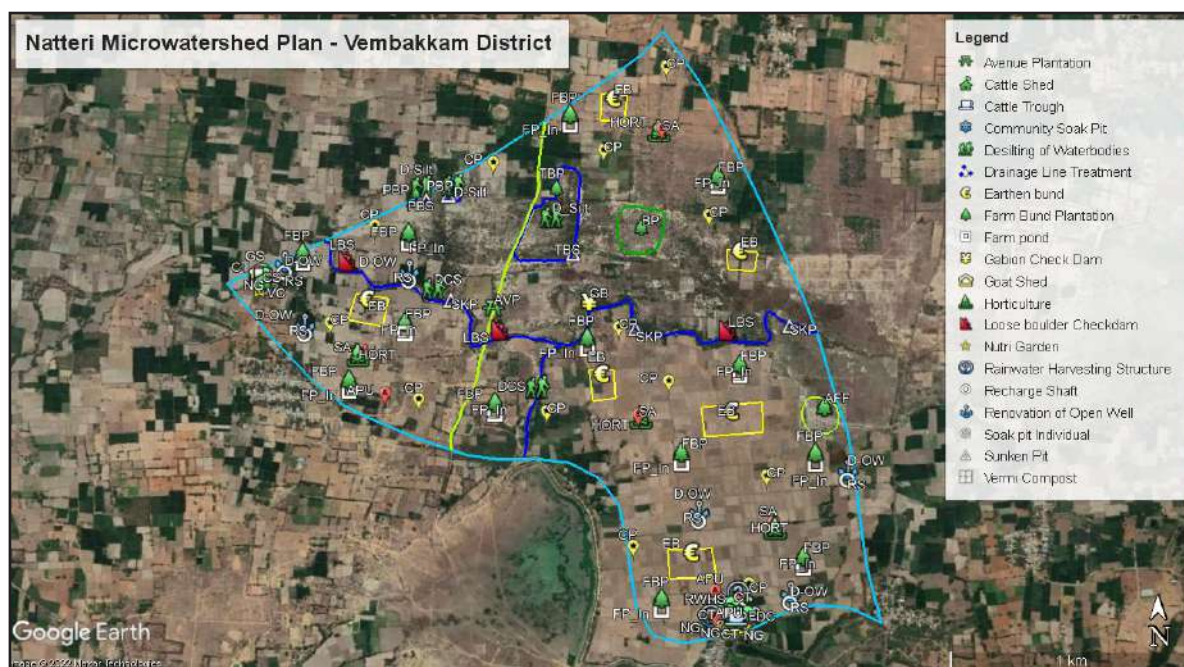
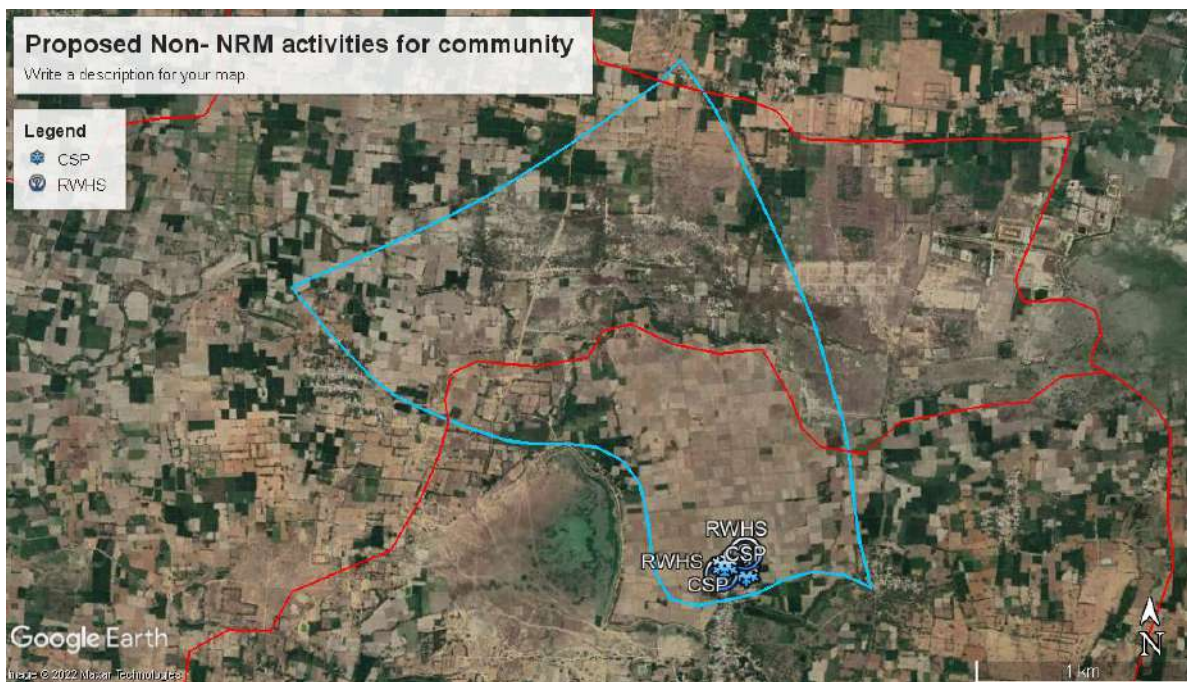
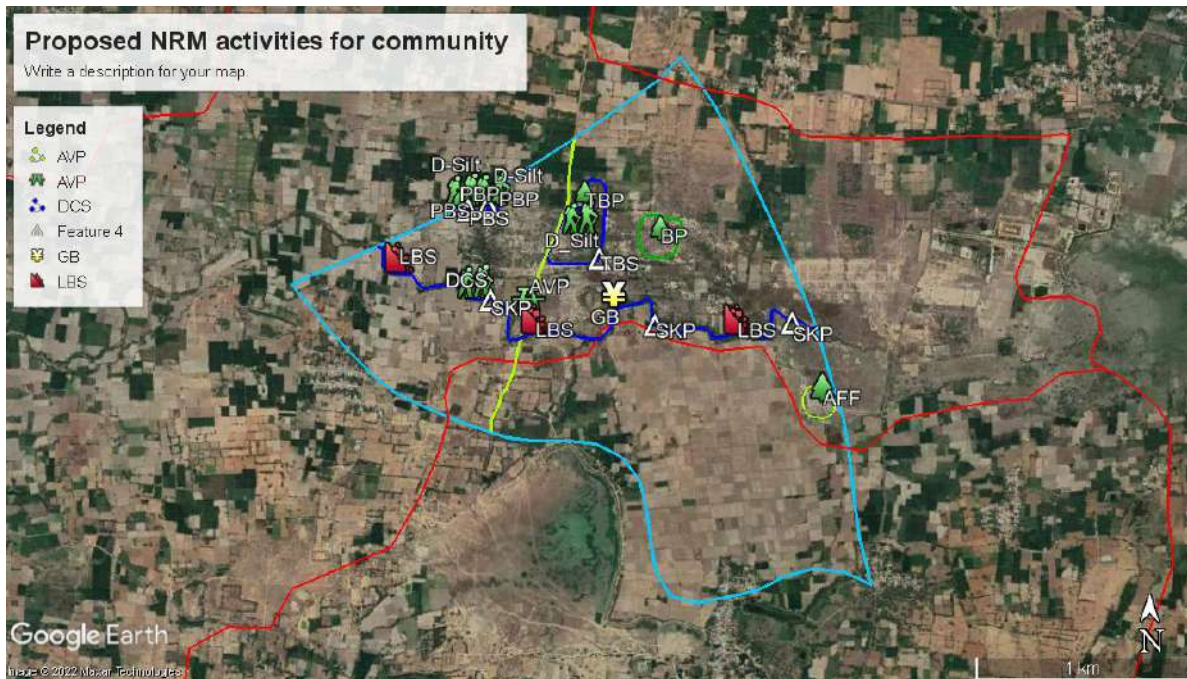


Figure 8.7. Proposed activities in Natteri micro-watershed



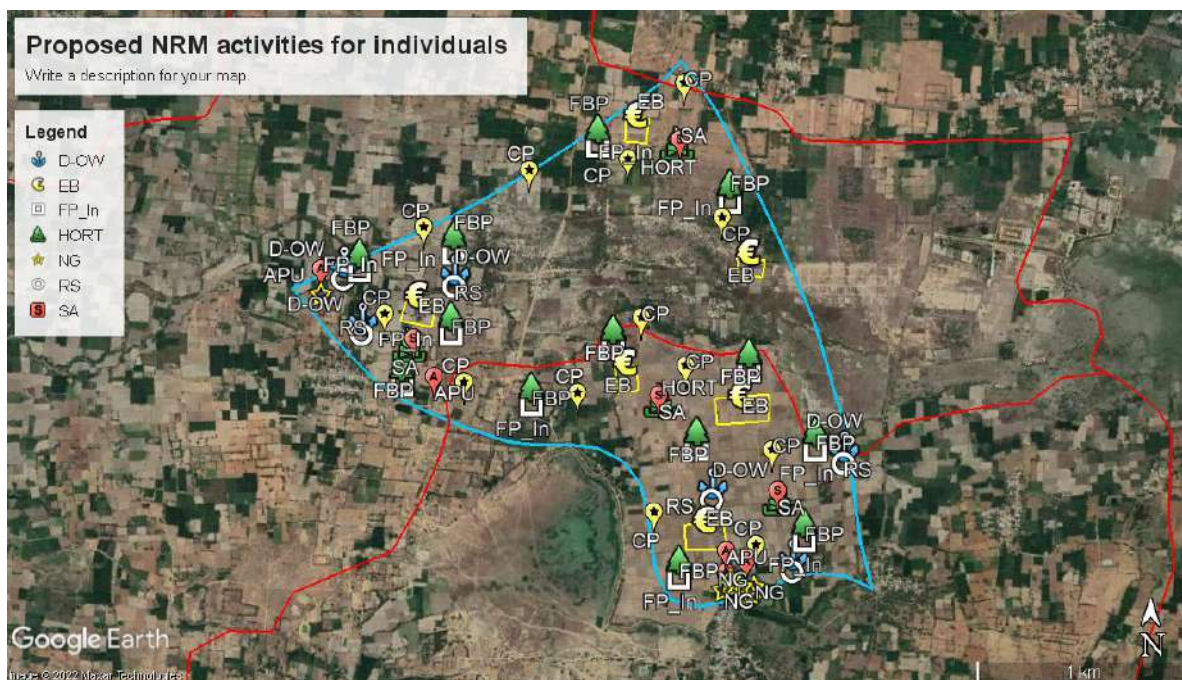


Figure 8.8 Proposed activities in Natteri micro-watershed A: NRM activities for community. B: Non-NRM activities for community. C: NRM activities for Individuals. D: Non-NRM activities for Individuals
 (APU: Azolla Production unit, AVP: Avenue Plantations, CP: Compost pit, CS: Cattle Shed, D-silt: Desilting, D-OW: Desilting open well, CT: Cattle through, EB: Farm Bunding with Boundary Trenches - Individual, FBP: Farm Bund Plantations, FDC: Fodder Development, FP_in: Farm Pond for Individuals, FN: Fencing, GS: Goat shed, Horti: Horticulture, LBS: Loose Boulder Structure, MSP: Soak pits for Individual, NG: Nutrition garden, RS: Artificial Recharge Structure, RWHS: Rain Water Harvesting Structure, SA: Silt Application, VCP: Vermi compost pit)

8.3 | MODEL GP- VELLAKULAM

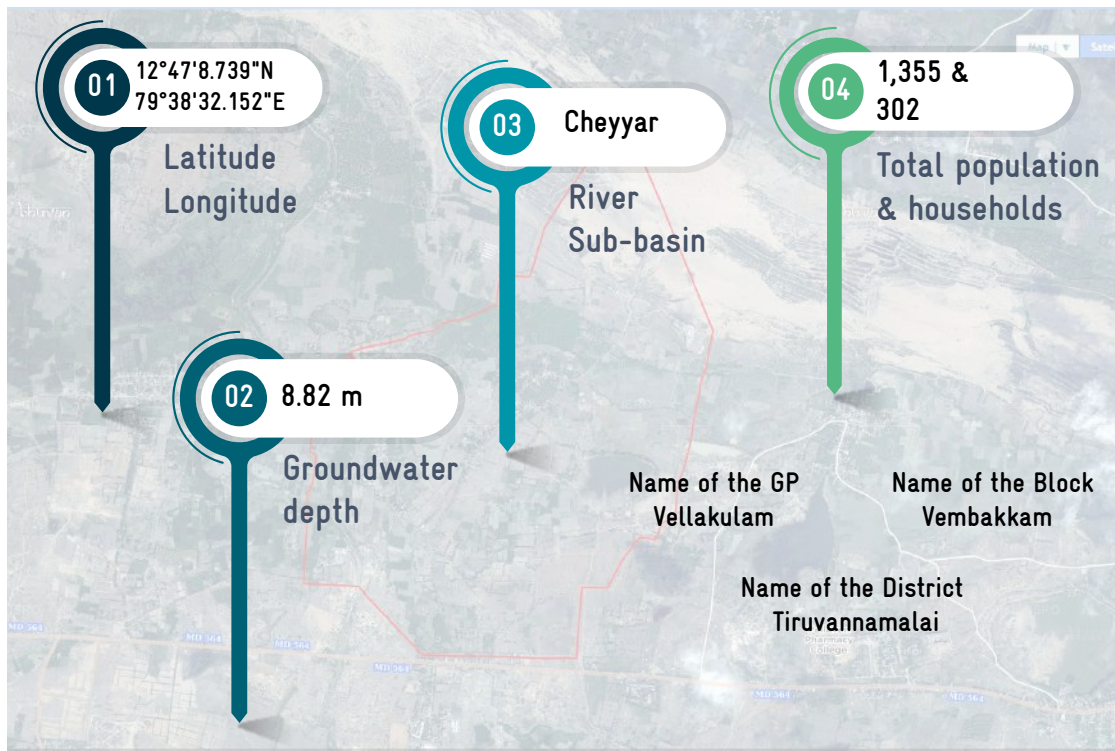
VELLAKULAM GP

8.3.1 | BACKGROUND OF GRAM PANCHAYAT - VELLAKULAM



Vellakulam GP is geographically situated between 12°47'8.739"N and 79°38'32.152"E located in Vembakkam Block of Tiruvannamalai District. (Table 51). The average annual temperature of GP is 27.9 °C, and receives annual average rainfall of 1,047 mm. The total geographical area of

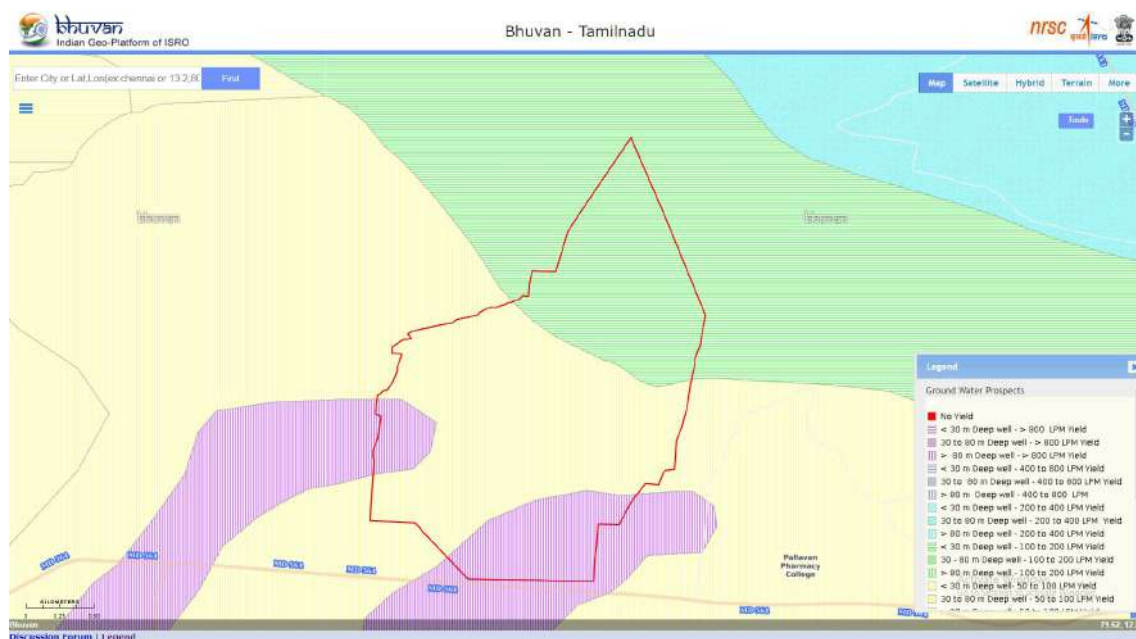
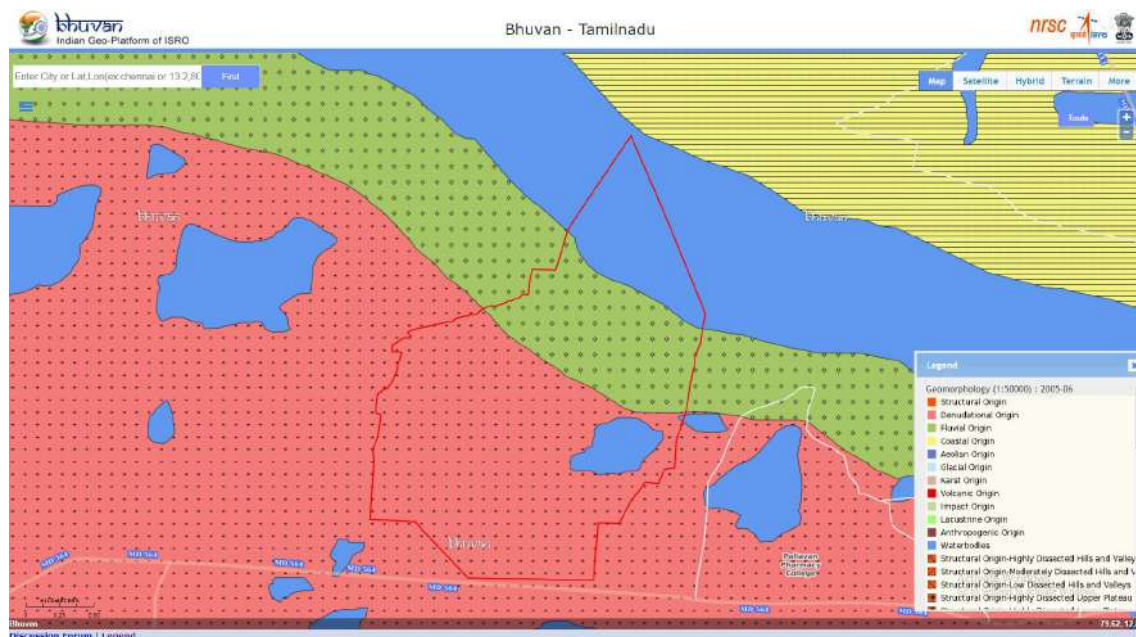
GP is 451 ha, As per Census 2011, the total population is 1,355 of which 665 are males and the female population is 690. The total number of households is 302. The Scheduled Caste constitute 31.8 % of the total population in Vellakulam GP.



The detailed spatial and non-spatial data considered in the process of preparation of climate resilient measures under CWRM for Vellakulam GP is illustrated as follows:

8.3.2 CWRM Planning - Spatial Data

CWRM adapted the geospatial technologies in its process of plan preparation towards climate-resilient infrastructure, Water Conservation and Water Harvesting (WCWH) 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 implement towards conservation of resources. Various thematic datasets for Vellakulam GP are displayed in Figure 8.9 (A, B, C, D, E) and discussed below.



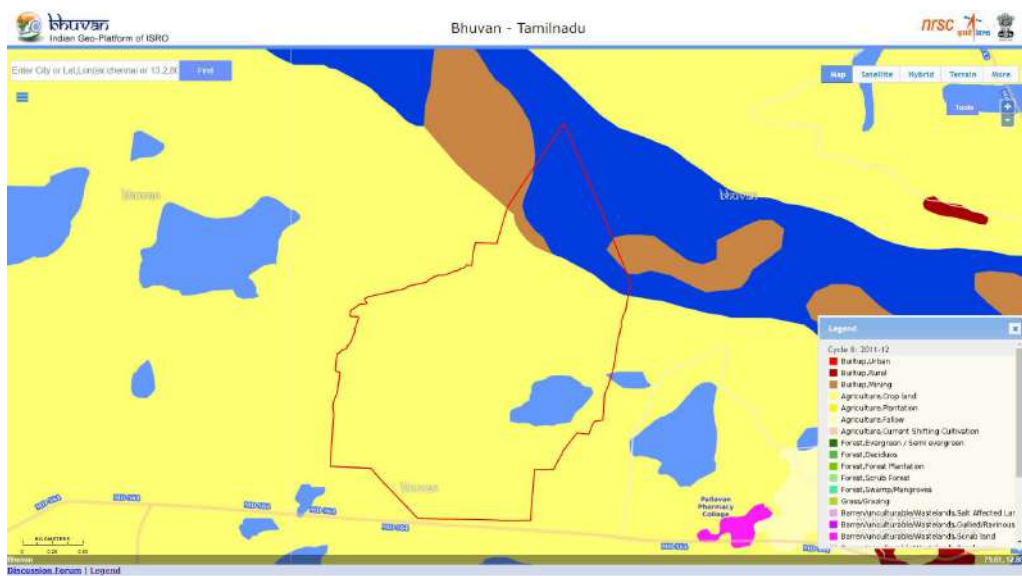
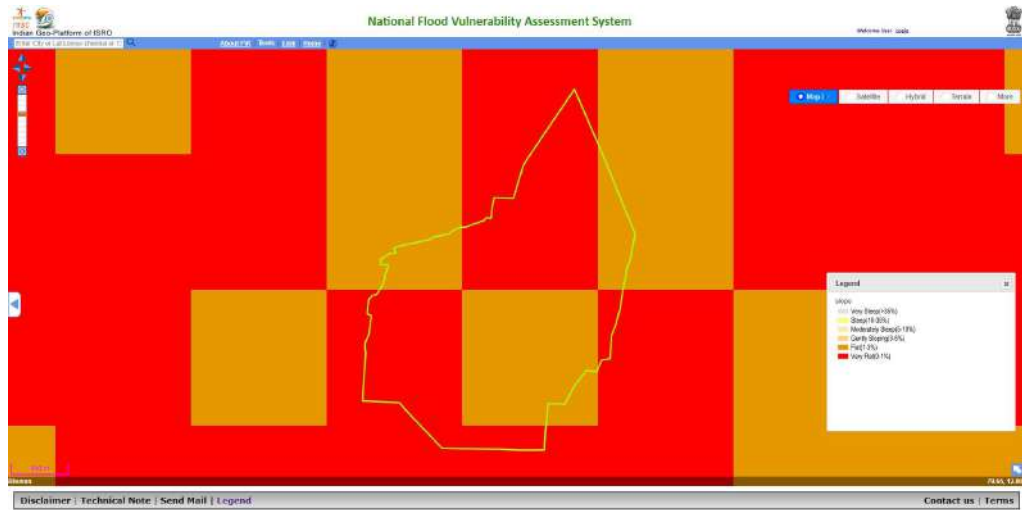
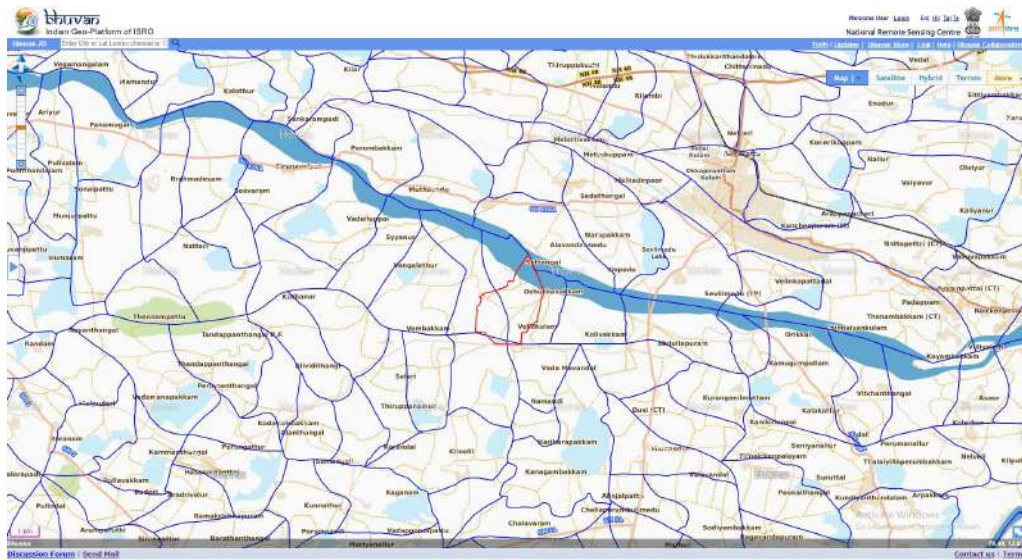


Figure 8.9 Spatial thematic maps of Vellakulam GP. A. Geomorphology, B. GW prosperity, C. Watershed, D. Slope, E. LULC

Vellakulam GP engrossed with denudation origin pediment complex (Figure 8.9 A). It is noticed central region of GP witnessed the groundwater prosperity of 50 to 100 LPM in less than 30 m deep well, 100-200 LPM between 30 to 80 m deep well in North-Eastern region and highest of more than 800 LPM yield in above 80 m deep well in South and South-West region (B). Very flat terrain (0-1 %) is dominant in the GP (D), Whereas GP area is falls under three micro-watershed units (C). Agriculture plantation is dominated in the GP (E).

8.3.3 | CWRM PLANNING- NON-SPATIAL DATA

The non-spatial data covers four important themes – socio economic, climate, water and agriculture with 116 parameters (Table 52). These non-spatial data is 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/ta-luk), agro-ecological (regional and sub-regional, climatic and agricultural zonation's) and hydrological (drainage points/watersheds/sub basin) units keeping GP as the lowest unit of planning and execution.

TABLE 51. NON SPATIAL DATA-MEPPATHURAI GP

Key CWRM Parameter	Details
Socio-Economic	
Geographical Area (ha)	451
Male Population	665
Female Population	690
Total Population	1,355
SC Population	431
ST Population	0
Vulnerable population	431
Households (HH's)	302
Only one room HH's (SECC)	38
Female-Headed HH's (SECC)	12
Vulnerable Households (SECC)	30
% of Vulnerable Households	10
Registered MGNREGA Job cards	430
Active person working in job Cards	324
Drinking-Water Sources	243
Groundwater sources - Drinking water	245
Surface water sources - Drinking water	4
Annual Grey water Generation (ha.m)	2.47
Water Resources	
Canal Network (m)	
Water Courses (Field Channels)	2,500
No. of Tanks (PWD & Union)	2

No.of Ooranis	3
Other Surface Water Bodies	1
Irrigation Facilities (ha)	
Area under Tank Irrigation	26.37
Area under Open & Tube Well Irrigation	29
Catchment Area wise Available Runoff (ha.m)	
Good Catchment Area	41.2
Average Catchment Area	4
Bad Catchment Area	61.2
Watershed and Drainage Networks	
Length of Natural Drainage Lines (m)	3,062
No. of Natural Drainage Lines	2
No. of Micro Watersheds	5
Water Demand (ha.m)	
Water Demand For Humans	3.71
Water Demand for Livestock	1.74
Water Demand For Agriculture	90.34
% G.W Utilization for Drinking	98
% G.W Utilization for Livestock	70
% G.W Utilization for Agriculture.	99
% SW Utilization for Drinking	2
% SW Utilization for Livestock	30
% SW Utilization for Agriculture	1
Agriculture Resources	
Land Resources (ha)	
Area under Non-Agricultural Uses	109.89
Area under Permanent Pastures and Other Grazing Land	1.2
Area under Cultivable Waste Land	13.05
Area under Fallows Land other than Current Fallows	10.33
Area under Current Fallow land	229.49
Area under Unirrigated Land	32.17
Area Irrigated by Source	55.18
Catchment Area (ha)	
Land under Good Catchment	109.89
Land under Average Catchment	14.25
Land under Bad Catchment	327.17
Crop Details	
Irrigated Area (ha)	63.73
Rainfed area (ha)	1.64
Area under Paddy Cultivation (ha)	56.34

Crop Water Requirement - The irrigated condition (ha.m)	89.52
Crop Water Requirement - Rainfed condition(ha.m)	0.82
Soil Resources: Status of Available Nitrogen (%)	
Low	100
Status of Organic Carbon (%)	
Very Low	25
Low	75
Status of Soil Micro Nutrients (%)	
Sufficient	60
Deficient	40
Status of Physical condition of the soil (%)	
Moderately Alkaline	100
Soil Texture (%)	
% of Clay Soil	2
% of Fine Soil	96
Soil Water Permeability	Moderate
Soil moisture and ET	
Volumetric Soil Moisture (%)	23
Estimated Soil Moisture (ha.m)	78.53
ET Losses (ha.m)	71.19
Means of Water Extraction (%)	
Gravity	15
Lifting	85
Irrigation Methods (%)	
Wild Flooding	48
Control Flooding	52
Livestock	
Cattle Population	331
Sheep Population	175
Goat Population	77

8.3.4 | KEY WATER CHALLENGES

Socio-Economic



1. According to SECC data, 10% of the households are vulnerable in the village
2. Female population more than male population
3. 38 one room households, and 12 female headed households.
4. Access to drinking water through tap water connections is less
5. Grey water generation is 2.47 ha.m; Handling of grey water from households needs attention

Water



1. Ground water status: semi-critical
2. 6 traditional waterbodies in the GP
3. Irrigation depends both on tank as well as open and tube well
4. 99% Agriculture and 70% livestock and 98% drinking water needs met through groundwater
5. 106.4 ha-m of water is available runoff
-Bad catchment area is more

Agriculture and Allied Sector



1. 27.5 % of the land covers the common area
2. 72.49 % of the land covers an individual land area
3. Main crop in the GP is paddy which is cultivated about 56.34 ha of land
4. Crop water requirement for irrigated condition is more
5. 85% of the water is given to paddy fields by lifting methods of irrigation
6. Soil Nitrogen is low and organic carbon is low to very low
7. 100% Moderately Alkaline soil
8. 96% fine soil is predominant in the GP
9. Slightly high ET loss at 71.19 ha.m

8.3.5 | PERSPECTIVE PLAN - WORKS PROPOSED: WATER ACTIONS

The appropriate and site-specific works are identified for the development of public and common land, agriculture and allied activities, rural infrastructure, and climate-resilient measures to reduce the vulnerability of the GP. About 26.89% of the total land area is taken for WASCA treatment activities like plantation and conservation works. The total proposed area for treatment is 121.39 ha with more

attention being given for current fallow lands followed by area under unirrigated land and land irrigated by source. (Figure 8.10). Through the proposed conservation activities, 26.46 ha.m run off would be harvested in which, about 78.34 % of the runoff is from the bad catchment, 9.7% of the run off is from the good catchment and 11.86% of conservation is from the average catchment area (Figure 8.11).

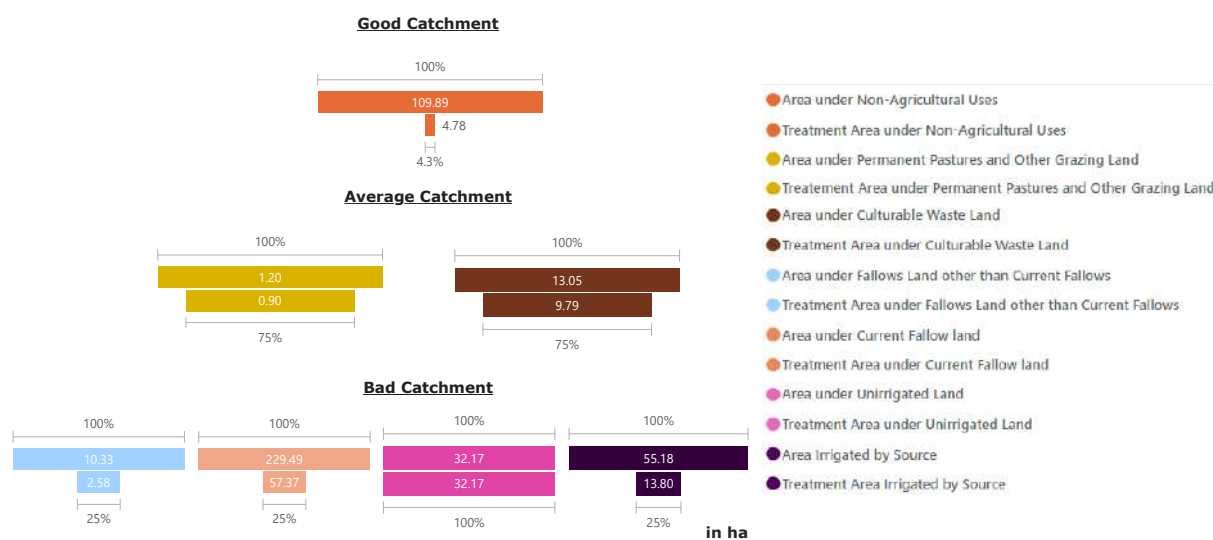


Figure 8.10. Proposed land resource treatment area in Vellakulam GP

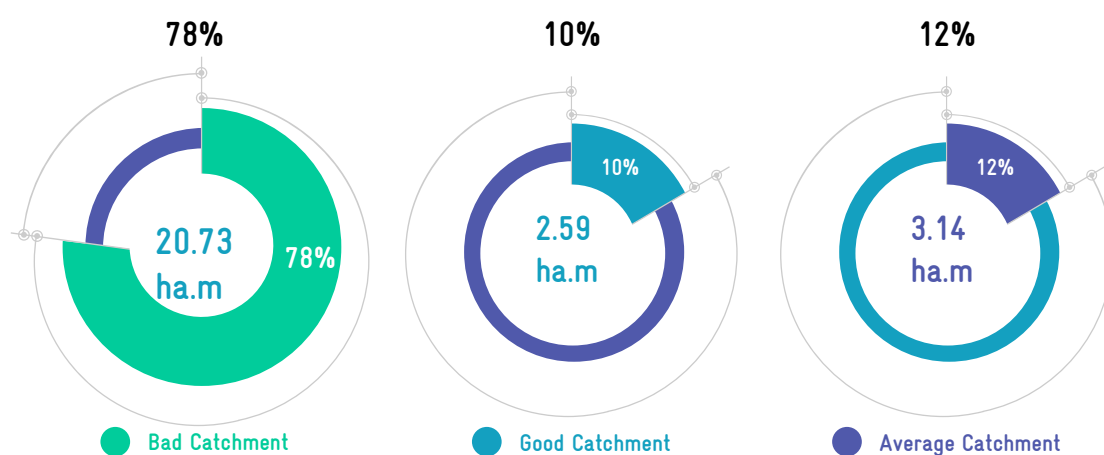


Figure 8.11. Expected run off conservation after treatment in Vellakulam GP

The detailed proposed activities along with salient parameters are showed in the Table 53 for 2021-2024. More attention towards common and public

land developments, agriculture and allied activities are given with appropriate works to improve the resilience of the GP.




TABLE 53. PERSPECTIVE PLAN OF VELLAKULAM 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 in (INR in Lakhs)	Estimated Person Days	
Composting (No. of units)	Lower	37	6.29	555	
Afforestation in Public/common lands (ha)	Upper	2	17.2	6,688	
Block Plantation (Community) (ha)	Middle	2	22.2	8,640	
Silvi-pasture Development (ha)		2	34.2	13,328	
Linear Plantation (Km)		3	5.4	2,109	
Canal Bund Plantation (Km)	Lower	2	15	5,860	
Avenue plantation (Km)	Middle	3	5.4	2,109	
Nursery Development (No.of units)	Lower	5	75.5	11,798	
Restoration of water bodies: a. PWD and Tanks (No.)		5	25	4,000	
Restoration of water bodies: b. Ooranis (No.)		5	5	1,000	
Artificial Recharge Structure (No.of units)		12	30	4,692	
Drainage Line Treatment (m)	Upper	1	0.03	5	
Sub Total Water Action -1		79	241	60,784	
CWRM Water Action 2: Agriculture and Allied Sector Development					
CWRM Water Action 2: Works in Lower Ridge					
Farm Bunding with Boundary Trenches - Individual (ha)	Lower	18	27	10,548	
Micro Irrigation (ha)		6	5.52	0	
Construction of Farm Ponds - Individual (No.of units)		18	36	14,058	
Land development - Individual (ha)		3	30	11,718	
Dry land Horticulture/Agro forestry - Individual (ha)		3	25.5	9,963	
Azolla units - Individual (No.of units)		30	4.5	690	
NADEP Vermi compost (No. of units)		30	5.4	810	
Fodder development - Community & Individual		30	44.4	70,320	
Cattle Shelters (No. of units)		30	63.6	9,930	
Goat Sheep Shelters (No. of units)		16	36.32	5,680	
Cattle Trough (No. of units)		30	1.5	180	
Construction of new open wells & Recharge Shafts (No. of units)		55	275	660	
Sub Total Water Action -2			269	555	1,34,557

CWRM Water Action 3: Rural Water Management				
CWRM Water Action 3: Works in Lower Ridge				
Soak Pits (Community) (No. of units)		3	0.39	60
Soak Pits (Individual) (No. of units)	Lower	30	3	480
Roof Rain Water Harvesting (No. of units)		2	8	1,250
Sub Total Water Action -3		35	11	1,790
District Total		383	807	1,97,131

Of the total number of projects identified under CWRM themes, 70.23 % works are in agriculture and allied sectors while 9.13 % works are in rural water management and 20.62 % works are in public and common land. Table 54 provides the estimates of the work budget, and personal days for three years from 2021-2024 in Vel-lakulam GP.

TABLE 54. 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	79	241	60,784
Agriculture and Allied sector development	269	555	1,34,557
Rural water management	35	11	1,790
TOTAL	383	807	1,97,131

8.3.6 | IMPACTS

The proposed water actions based on the above key water challenges cover a period of three years from 2021- 2022 to 2023-2024, At the end of the implementation period i.e. in the year 2024, the following

impacts are envisaged (Table 55). It is expected that the impacts will potentially reduce the vulnerability and improve the resilience of the system to the projected climatic change events and ensured water security.

TABLE 55. 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	Five traditional water bodies restored
2	Area under Afforestation	2	4.7 ha under afforestation
3	Percentage reduction in the annual surface runoff	3	26.84 ha.m surface runoff harvested and stored
4	The proportion of land treated under WASCA	4	27 % of the total geographical area of the village treated under WASCA in three years
5	Drainage Line Treatment	5	3 Km length of drainage lines treated

5
TRADITIONAL WATER
BODIES RESTORED

4.7 ha
AFFORESTATION

26.84 ha.m
SURFACE RUNOFF
HARVESTED

27%
AREA OF THE VILLAGE
TREATED

3 KM
DRAINAGE LINES
TREATED

WASCA CWRM ACTION PLAN

DEVELOPMENT OF AGRICULTURE AND ALLIED ACTIVITIES

INDICATOR		OUTCOMES/ IMPACT	
1.	No of structures were established for on-farm (in-situ) water harvesting in dry lands	1.	18 Farm ponds established
2.	Reducing area under fallow lands	2.	229.49 ha under fallow land restored for cultivation
3.	Improvement in soil health	3.	30 units of vermi compost established
4.	No of artificial recharge structures proposed	4.	12 artificial recharge structures were established to replenish groundwater flow

18
FARM PONDS

229.49 ha
FALLOW LAND RESTORED

30
VERMI COMPOST

12
ARTIFICIAL RECHARGE
STRUCTURES

WASCA CWRM ACTION PLAN
DEVELOPMENT OF RURAL INFRASTRUCTURE

INDICATOR

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

OUTCOMES/ IMPACT

1.	3 community level and 30 individual level soak pits were constructed for grey water management to maintain hygiene in the village
2.	Two units of roof rainwater harvesting and storing established
3.	302 households established Nutri-gardens in homesteads





3 COMMUNITY & **30**
INDIVIDUAL SOAK PITS

2
COMMON ROOF
RAINWATER HARVESTING

302
NUTRI-GARDENS

Table 56 provides both the perspective plan for three years' period and the annual plan for the one-year period from 2021-2022 on the shelf of projects/number of works and number of person-days.

TABLE 56. PROPOSALS FOR THE MGNREGS, VELLAKULAM GP

	No of works	No of person days
 Perspective plan	 383	 1,97,131
<hr style="border-top: 1px dashed #ccc;"/>		
 Annual plan	153	78,852

8.3.7 | PROPOSED ACTIVITY MAP

The proposed activity map for Vellakulam GP, Vembakkam Block shows a shelf of projects for all three year works from 2021-2024 (Figures 8.12 to 8.15).

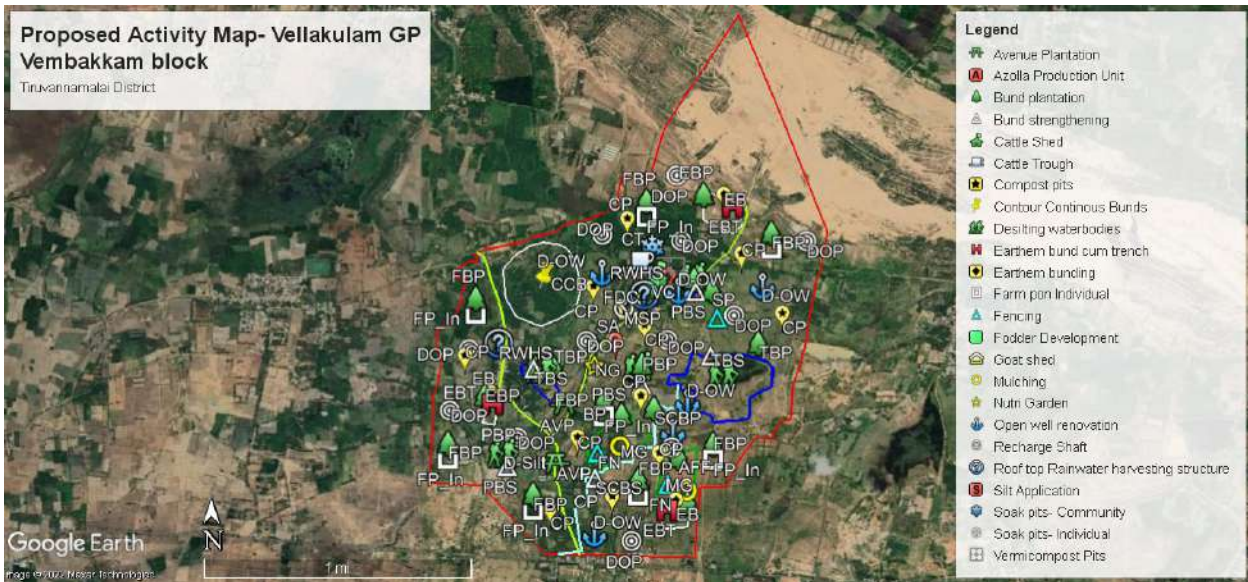


Figure 8.12. Proposed action plan of Vellakulam GP



Figure 8.13. Works on Upper Ridge of Vellakulam GP



Figure 8.14. Works on Middle Ridge of Vellakulam GP

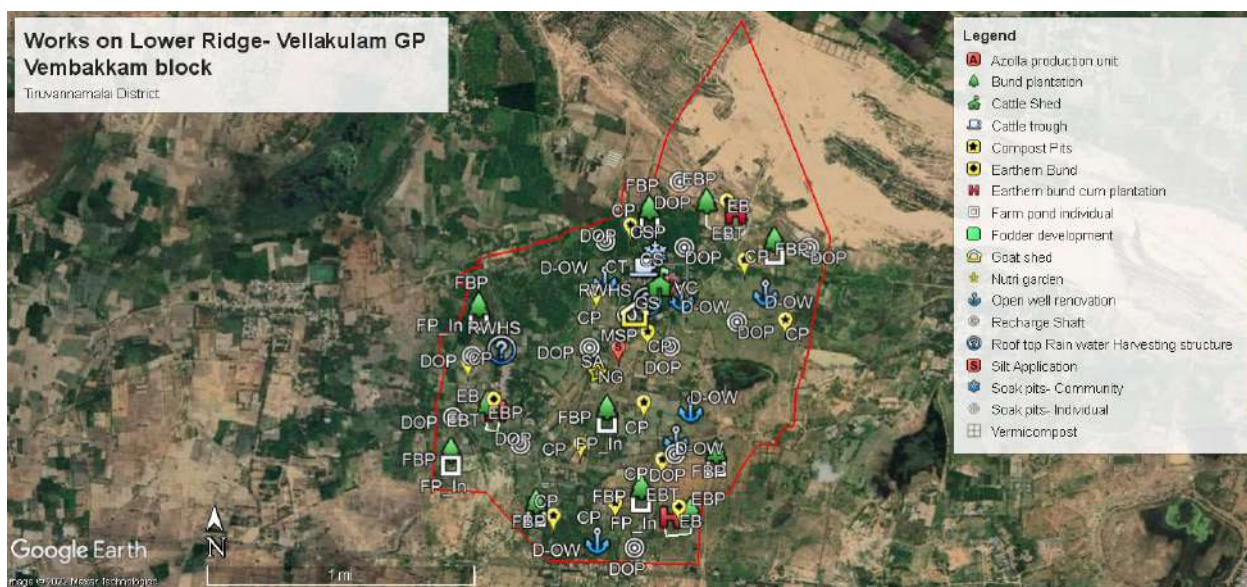
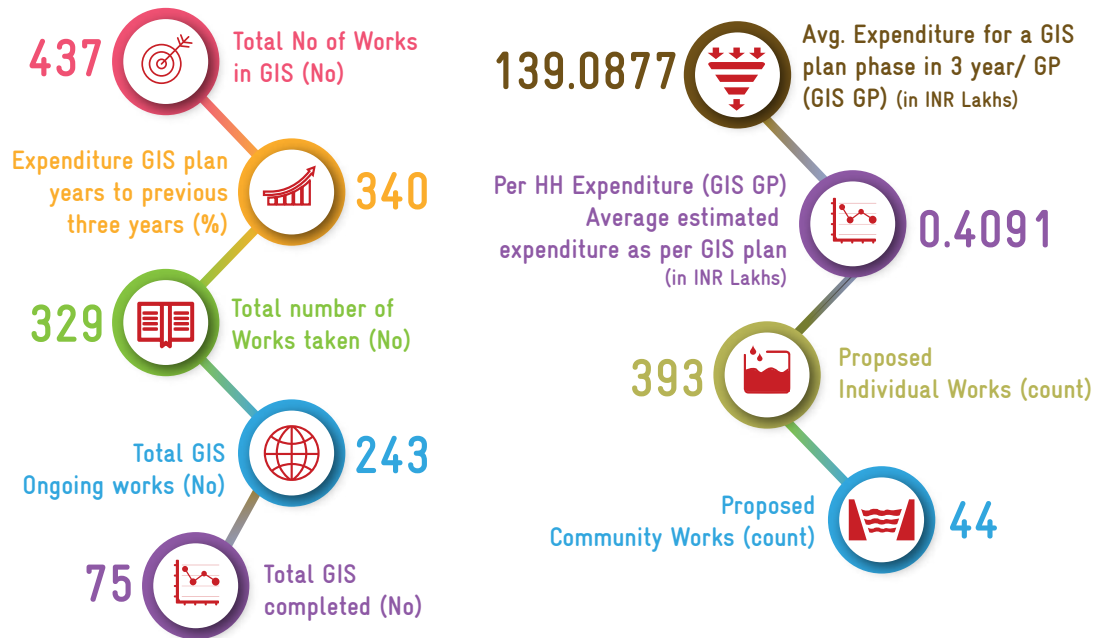


Figure 8.15. Works on Lower Ridge of Vellakulam GP

8.3.8 | GIS PLAN IMPLEMENTATION AND KEY PARAMETERS

The GIS plan implementation and performance of Vellakulam GP, Vembakkam Block is represented in Table 57.

TABLE 57. KEY PARAMETERS PERFORMANCE IN VELLAKULAM GP -VEMBAKKAM BLOCK



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 initiative 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 water demand is increasing at a fast rate due to rapid surge of population, industrial and economic growth. The evident changes in climate change 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 that has 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 biophysical and socio-economic indicators of four interrelated areas via water, agricultural and climate used at District level are further expanded to 110 parameters at Block level. The spatial and non-spatial CWRM parameters for four 4 above mentioned interrelated areas are used to represent adaptive capacity of the reflects rural water security of the Blocks are identifiable adaptation options intended under WASCA



and common land, agricultural infrastructure areas. All the indicators are accompanied with appropriate action are accompanied with appropriate 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 enables to adopt ecosystem approach in promoting nature based solutions. The productive impacts are visualized through 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



Convergence along with interdisciplinary line
departments such as agriculture, horticulture,
animal husbandry, water resources

03



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/dccb/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&flag=eng&state_name=TAMIL%20NADU&state_code=29&fin_year=2020-2021&source=national&Digest=3ics8+9Z9fEQ8y7j5E3qcQ 
Active person working in MGNREGA job Cards	
Water Resources	
Irrigation Facilities	Census-2011, MoHA, GOI https://censusindia.gov.in/2011census/dccb/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/dccb/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/dccb/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		
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	standard table	
Soil Water Permeability		
Soil moisture and ET	https://indianwris.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 3.1
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 3.2
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

GP WISE STATUS OF WATER RESOURCE AND ITS SUPPLY AND DEMAND

GP/Key CWRM Parameter	Canal Irrigation			Tradational Water bodies			
	Length of Main Canal (m)	Length of Minor Canal (m)	Length of Dis-tributaries (m)	Water Courses (Field Channels) (m)	Number of Tanks (PWD & Union) (No.)	Number of Ooranis (No.)	Other Surface Water Bodies (No.)
Abdullapuram	0	0	0	0	3	5	0
Alividithangi	0	1,860	0	7000	6	1	0
Ariyur	0	2,000	0	750	1	4	0
Brahmadesam	0	12,620	0	0	3	4	0
Elacheri	0	0	0	1980	2	4	0
Hariharapakkam	0	0	0	2050	2	4	0
Kaganam	0	0	0	1250	1	6	0
Moonjurpattu	0	0	0	3140	0	4	0
Narasamangalam	0	0	0	1500	1	1	0
Cheyyanur	0	0	0	2050	2	3	0
Sirunallur	0	0	0	700	0	3	0
Umaiyalpuram	0	0	0	2950	0	2	0
Pillanthangal	0	0	0	1100	7	1	0
Sodiyambakkam	0	2,430	0	0	2	7	0
Punnai	0	0	0	2090	1	3	0
Karanthai	0	0	0	700	0	4	0
Kundiyanthandalam	0	0	0	1630	1	4	0
Kuthanur	0	6,540	0	1000	6	7	0
Mamandur	0	7,820	0	0	1	3	0
Ukkamperumbakkam	0	0	0	5760	2	0	0
Sumangali	0	0	0	1250	0	10	0
Nemili	0	870	0	0	1	3	0
Mangal	0	2,560	0	0	2	6	0

GP/Key CWRM Parameter	Canal Irrigation			Traditional Water bodies				
	Length of Main Canal (m)	Length of Minor Canal (m)	Length of Dis-tributaries (m)	Water Courses (Field Channels) (m)	Number of Tanks (PWD & Union) (No.)	Number of Ooranis (No.)	Other Surface Water Bodies (No.)	
Mathur	0	1,840	0	0	3	7	0	
Pallavaram	0	0	0	5100	0	4	0	
Panamugai	0	8,680	0	0	2	6	0	
Perungattur	0	8,430	0	2400	3	11	0	
Natteri	0	50,400	0	0	3	15	0	
Suruttal	0	2,640	0	0	2	8	0	
Pavoor thenkalani	0	8,170	0	0	1	6	0	
Thennampattu	0	7,200	0	0	0	11	0	
Thirupanangadu	0	0	0	4500	2	10	0	
Vadailuppai	0	7,320	0	3000	2	4	0	
Vadamanapakkam	0	10,330	0	0	3	0	9	
Vayalathur	0	0	0	3180	0	0	2	
Vengalathur	0	0	0	3400	2	6	0	
Vembakkam	0	0	0	1640	2	11	0	
Alinjalpattu	0	0	0	2000	3	2	0	
Arasanipalai	0	0	0	1500	1	3	0	
Arasankuppam	0	0	0	2600	1	3	1	
Chithathur	0	0	0	3100	2	7	1	
Cholavaram	0	0	0	7000	6	5	4	
Hasanampettai	0	0	0	2000	0	5	1	
Kilnayakanpalayam	0	0	0	0	1	2	5	
Kizhnelli	0	0	0	3540	3	10	1	
Kodayambakkam	0	0	0	450	3	4	2	
Moranam	0	0	0	2300	2	8	0	
Namandi	0	0	0	1350	8	10	0	

GP/Key CWRM Parameter	Canal Irrigation			Traditional Water bodies			
	Length of Main Canal (m)	Length of Minor Canal (m)	Length of Dis-tributaries (m)	Water Courses (Field Channels) (m)	Number of Tanks (PWD & Union) (No.)	Number of Ooranis (No.)	Other Surface Water Bodies (No.)
Perunmanthangal	0	0	0	2400	3	11	0
Poonathangal	0	0	0	2000	1	3	1
Pudupalayam	0	0	0	1350	0	2	0
Pulivalam	0	0	0	1350	7	4	0
Pullavakkam	0	0	0	4950	3	9	0
Sattuvanthangal	0	0	0	1200	2	3	1
Mennalur	0	0	0	1500	0	7	0
Randam	0	0	0	1500	5	5	6
Sirunavelpet	0	0	0	3000	2	3	10
Thiruppanamur	0	0	0	2300	4	11	0
Vadakalpakkam	0	0	0	3200	0	4	6
Velliakulam	0	0	0	2500	2	3	1
Siruvanjiipattu	0	0	0	3500	1	1	3
Irumaram	0	0	0	2600	4	31	1
Dusi	0	0	0	2,560	4	4	3

GP/Key CWRM Parameter	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.)
Abdullapuram	6.72	0.00	9	10.50	1.10	17.80	0	0	1
Alividithangi	70.00	0.00	149	66.30	10.90	214.70	7769	6	7
Ariyur	20.00	0.00	13	41.70	0.70	39.20	6380	6	5
Brahmadesam	0.00	0.00	63	65.20	6.40	97.70	3619	2	5
Elacheri	25.50	0.00	61	10.10	11.60	68.00	5980	5	3
Hariharapakkam	4.83	0.00	2	30.10	2.30	45.60	370	3	4
Kaganam	25.50	0.00	31	47.20	9.00	55.00	1818	2	3
Moonjurpattu	25.00	0.00	24	14.52	1.62	23.93	387	2	3
Narasamangalam	14.10	0.00	6	18.80	0.00	24.00	1890	2	3
Cheyyanur	54.00	0.00	54	16.00	19.20	26.00	3701	7	3
Sirunallur	10.00	0.00	14	4.20	2.50	17.20	1168	2	1
Umaiyalpuram	28.35	0.00	10	17.80	0.60	38.60	2556	2	4
Pillanthangal	29.84	0.00	17	26.00	9.10	71.00	1647	2	2
Sodiyambakkam	0.00	0.00	34	20.20	6.30	34.60	2587	2	4
Punnai	0.00	0.00	40	33.70	0.00	26.90	1444	3	2
Karanthai	23.50	0.00	20	34.90	0.70	68.50	302	2	6
Kundiyanthandalam	14.05	0.00	18	20.90	2.20	52.10	5622	6	3
Kuthanur	0.00	0.00	129	125.00	4.00	149.50	5408	7	6
Mamandur	150.00	0.00	116	61.30	0.00	85.50	11799	11	4
Ukkamperumbakkam	0.00	0.00	121	24.20	0.00	39.10	1656	1	2
Sumangali	20.00	0.00	26	65.70	12.20	59.30	765	1	7
Nemili	0.00	0.00	11	3.20	1.00	19.30	610	3	3
Mangal	0.00	0.00	11	20.50	6.60	44.10	2466	5	4
Mathur	40.00	0.00	58	53.50	13.60	77.20	4802	5	5
Pallavaram	0.00	0.00	48	13.20	0.60	40.20	2401	4	2

GP/Key CWRM Parameter	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 MiCriticalo Watersheds (No.)
Panamugai	0.00	0.00	22	35.40	0	55.60	3990	4	4
Perungattur	92.06	0.00	34	148.20	1.80	103.90	1905	8	5
Natteri	300.00	0.00	128	109.90	12.60	297.10	14464	12	10
Suruttal	30.23	0.00	14	26.30	1.10	42.40	2843	5	2
Pavoor	82.68	0.00	37	62.70	2.00	74.80	1787	4	4
thenkalani	0.00	0.00	0	12.00	0.60	23.60	1416	2	4
Thennampattu	58.27	0.00	8	13.20	12.50	88.70	4258	5	5
Thirupanangadu	41.72	0.00	14	41.40	13.40	87.00	2595	7	5
Vadailuppai	0.00	0.00	185	65.90	1.35	70.08	7076	4	7
Vadamanapakkam	37.76	0.00	44	51.10	12.90	85.70	9503	9	5
Vayalathur	0.00	0.00	27	5.80	5.50	13.70	2720	2	1
Vengalathur	154.58	0.00	103	76.50	1.50	78.10	3643	4	5
Vembakkam	30.00	0.00	97	36.50	3.80	150.20	2642	5	6
Alinjalpattu	0.00	0.00	26	78.20	0.50	32.10	2300	4	5
Arasanipalai	30.00	0.00	118	29.30	1.80	66.60	2459	3	3
Arasankuppam	0.00	0.00	28	114.80	8.00	53.90	6453	3	5
Chithathur	78.13	0.00	17	115.40	6.30	89.60	2855	1	8
Cholavaram	0.00	0.00	41	121.00	1.10	87.70	330	1	5
Hasanampettai	0.00	0.00	79	24.70	1.00	23.20	3540	7	3
Kilnayakanpalayam	42.40	0.00	6	13.60	1.80	42.50	5349	6	6
Kizhnelli	70.50	0.00	28	54.90	1.30	83.30	2575	2	5
Kodayambakkam	7.02	0.00	18	32.60	2.80	33.40	137	1	4
Moranam	66.64	0.00	165	79.30	3.40	132.70	2457	7	7
Namandi	28.72	0.00	17	126.50	7.80	84.30	4645	4	5
Perunmanthangal	5.60	0.00	61	26.90	3.00	50.10	4209	7	2

GP/Key CWRM Parameter	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 MiCriticalo Watersheds (No.)
Poonaihangal	152.50	0.00	213	10.80	3.10	26.50	1475	3	2
Pudupalayam	11.65	0.00	56	20.70	7.00	50.80	5234	3	5
Pulivalam	84.51	0.00	110	25.90	5.60	53.50	11675	9	5
Pullavakkam	64.14	0.00	73	117.30	0.60	53.30	1756	3	5
Sattuvanthangal	35.00	0.00	62	48.00	4.10	47.60	863	3	4
Mennalur	100.00	0.00	127	9.80	7.80	75.30	4169	4	5
Randam	103.08	0.00	77	163.80	4.70	106.80	10491	11	8
Sirunavelpet	30.00	0.00	93	96.00	1.30	60.30	4062	7	6
Thiruppanamur	77.95	0.00	58	89.80	13.00	129.90	772	2	7
Vadakalpakkam	40.00	0.00	94	18.60	1.00	78.30	2676	6	3
Velliakulam	26.37	0.00	29	41.20	4.00	61.20	3062	2	5
Siruvanjiipattu	15.00	0.00	27	16.10	2.90	37.00	1015	2	2
Irumaram	74.33	0.00	42	43.00	5.50	63.30	555	2	7
Dusi	0	0	202	151.50	4.90	66.60	8066	6	4

GP/Key CWRM Parameter	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 (%)	
Abdullapuram	7.10	4.83	11	77	48	100	23	52	0	0
Alividthangi	12.30	5.99	302	2	87	68	98	13	32	32
Ariyur	2.45	4.60	72	79	84	100	21	16	0	0
Brahmadesam	15.73	13.26	254	85	90	99	15	10	1	1
Elacheri	5.69	8.31	44	92	63	99	8	37	1	1
Hariharapakkam	2.99	1.99	55	73	46	100	27	54	0	0
Kaganam	2.21	2.11	79	7	93	98	93	7	2	2
Moonjurpattu	1.58	1.14	90	80	87	100	20	13	0	0
Narasamangalam	4.66	1.46	116	80	92	100	20	8	0	0
Cheyyanur	3.23	2.70	130	81	76	100	19	24	0	0
Sirunallur	1.54	4.31	77	8	89	100	92	11	0	0
Umaiyalpuram	2.42	2.39	197	65	93	98	35	7	2	2
Pillanthangal	3.58	2.48	79	1	92	93	99	8	7	7
Sodiyambakkam	3.24	4.31	53	82	44	97	18	56	3	3
Punnai	1.94	1.58	133	4	55	97	96	45	3	3
Karanthai	2.41	2.00	97	80	89	97	20	11	3	3
Kundiyanthandalam	1.92	4.27	72	96	41	98	4	59	2	2
Kuthanur	9.61	5.22	288	84	83	100	16	17	0	0
Mamandur	11.74	6.24	535	94	64	99	6	36	1	1
Ukkamerumbakkam	3.40	4.00	81	0	0	96	100	100	4	4
Sumangali	4.46	1.96	8	0	0	73	100	100	27	27
Nemili	1.60	2.84	49	90	66	99	10	34	1	1
Mangal	2.10	3.34	48	95	38	97	5	62	3	3
Mathur	5.88	3.88	100	96	52	99	4	48	1	1
Pallavaram	4.77	2.92	81	94	66	98	6	34	2	2
Panamugai	2.65	1.86	88	92	87	100	8	13	0	0

GP/Key CWRM Parameter	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 (%)	
Perungattur	10.22	5.82	103	99	65	97	1	35	3	
Natteri	13.87	12.54	1080	93	92	99	7	8	1	
Suruttal	3.47	4.69	66	96	42	97	4	58	3	
Pavoor	3.75	3.36	128	94	64	94	6	36	6	
thenkalani	6.83	1.12	65	92	86	99	8	14	1	
Thennampattu	6.40	5.85	24	100	85	54	0	15	46	
Thirupanangadu	5.10	2.44	162	80	93	99	20	7	1	
Vadailuppai	6.47	3.50	527	100	83	100	0	17	0	
Vadamanapakam	7.27	3.14	135	86	84	89	14	16	11	
Vayalathur	1.38	2.17	38	100	67	92	0	33	8	
Vengalathur	6.34	2.24	335	89	64	100	11	36	0	
Vembakkam	8.70	2.94	225	95	54	99	5	46	1	
Alinjalpattu	3.93	1.30	126	63	93	100	37	7	0	
Arasanipalai	4.77	4.58	180	56	44	95	44	56	5	
Arasankuppam	4.50	1.64	55	88	70	100	12	30	0	
Chithathur	7.90	5.69	44	77	59	100	23	41	0	
Cholavaram	5.15	4.92	141	73	47	100	27	53	0	
Hasanampettai	6.10	0.13	59	91	69	99	9	31	1	
Kilnayakanpalayam	3.60	3.41	91	84	64	99	16	36	1	
Kizhnelli	6.05	2.14	240	63	99	100	37	1	0	
Kodayambakkam	3.79	3.42	24	63	97	95	37	3	5	
Moranam	8.06	3.59	165	73	94	90	27	6	10	
Namandi	8.87	1.85	225	68	50	99	32	50	1	
Perunmanthangal	6.50	1.62	207	43	92	100	57	8	0	
Poonathangal	1.78	3.14	111	89	35	99	11	65	1	
Pudupalayam	2.62	3.42	85	92	68	97	8	32	3	

GP/Key CWRM Parameter	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 (%)	
Pulivalam	4.00	3.87	140	75	85	97	25	15	3	
Pullavakkam	5.08	2.03	102	67	87	97	33	13	3	
Sattuvanhangal	3.87	1.20	186	76	91	100	24	9	0	
Mennalur	6.75	7.08	137	84	42	95	16	58	5	
Randam	8.67	4.06	361	55	87	99	45	13	1	
Sirunavelpet	6.19	3.49	414	89	83	100	11	17	0	
Thiruppanamur	7.61	1.36	70	80	94	100	20	6	0	
Vadakalpakkam	6.48	4.02	81	84	49	93	16	51	7	
Velliakulam	3.71	1.74	90	84	70	99	16	30	1	
Siruvanjiipattu	2.60	1.62	134	55	95	99	45	5	1	
Irumaram	2.88	2.14	114	60	88	100	40	12	0	
Dusi	15.27	3.37	348	3	72	100	97	28	0	

ANNEXURE 3.7

GP WISE STATUS OF AGRICULTURE RESOURCE

GP/Key CWRM Parameter	Land Resources (ha)										
	Area under Forest land	Non-Agricultural Uses	Area under Barren & Un-cultivable Land	Area under Permanent Pastures and Other Grazing Land	Land Under Miscellaneous Tree Criticalops etc.	Cultivable Waste Land	Fallows Land other than Current Fallows	Current Fallow land	Unirrigated Land	Area Irrigated by Source	
Abdullapuram	-	27.9	-	-	3.8	-	5.0	80.3	0.4	9.3	
Alividithangi	-	176.9	-	8.1	-	30.6	93.1	670.1	166.3	218.9	
Ariyur	-	111.2	-	-	-	2.4	20.0	132.6	23.5	33.4	
Brahmalesam	-	173.7	-	13.2	8.4	1.1	80.0	279.6	9.8	152.9	
Elacheri	-	27.0	-	-	-	41.2	91.7	175.2	10.6	86.3	
Hariharapakkam	-	79.7	0.6	4.2	-	4.1	183.9	39.3	13.5	7.2	
Kaganam	-	125.9	-	1.3	3.8	27.1	40.0	166.3	31.3	56.5	
Moonjurpattu	-	38.7	-	-	2.4	3.4	4.9	49.5	24.8	48.8	
Narasamangalam	-	25.8	24.2	-	-	0.1	0.5	105.2	2.8	20.0	
Cheyyanur	-	42.6	0.2	64.8	0.7	3.0	-	81.9	3.4	53.5	
Sirunallur	-	11.2	-	-	8.9	0.1	10.0	51.2	7.2	23.7	
Umaiyalpuram	-	47.4	-	-	-	2.1	21.7	146.0	0.9	38.0	
Pillanthangal	-	69.3	-	0.4	2.1	30.0	69.1	229.4	33.8	47.2	
Sodiyambakkam	-	53.9	-	9.1	0.9	12.5	1.1	114.3	25.2	44.2	
Punnai	-	89.8	-	-	-	-	4.0	81.9	18.1	40.0	
Karanthai	-	93.1	-	-	-	2.6	52.8	252.7	17.4	43.2	
Kundiyanthandalam	-	55.8	-	0.8	0.3	6.7	19.1	219.2	8.4	32.0	
Kuthanur	-	333.3	-	8.2	6.2	-	80.5	435.9	54.1	229.0	
Mamandur	-	153.2	10.2	-	-	0.1	6.0	170.7	14.3	266.0	
Ukkamperumbakkam	-	64.5	-	-	-	0.0	10.0	123.8	34.4	41.1	
Sumangali	-	175.2	-	35.2	7.0	1.2	50.0	178.1	42.9	46.3	
Nemili	-	8.6	-	3.7	-	0.1	29.5	29.2	23.4	20.9	

GP/Key CWRM Parameter	Land Resources (ha)										
	Area under Forest land	Non-Agricultural Uses	Area under Barren & Un-cultivable Land	Area under Permanent Pastures and Other Grazing Land	Land Under Miscellaneous Tree Criticalops etc.	Cultivable Waste Land	Fallows Land other than Current Fallows	Current Fallow land	Unirrigated Land	Area Irrigated by Source	
Mangal	-	48.7	5.9	2.1	2.5	19.1	-	179.3	25.0	31.3	
Mathur	-	126.6	16.1	20.1	10.2	18.1	-	171.9	142.5	98.2	
Pallavaram	-	35.3	-	-	1.7	0.3	10.7	143.4	12.6	48.3	
Panamugai	-	94.5	-	-	-	0.7	30.0	196.7	29.0	41.8	
Perungattur	-	395.2	-	4.1	0.4	1.9	40.0	467.6	14.5	33.9	
Natteri	-	293.1	-	-	31.9	12.9	90.0	989.7	80.8	428.3	
Suruttal	-	70.1	-	-	-	3.9	36.0	120.8	26.1	43.9	
Pavoor	-	167.2	0.1	0.7	5.3	1.1	140.2	90.2	50.4	119.3	
thenkalani	-	32.1	-	-	1.9	0.1	-	65.0	11.8	49.6	
Thennampattu	-	35.2	-	9.7	12.5	22.1	70.0	299.1	39.4	65.9	
Thirupanganadu	-	110.5	-	3.2	5.1	39.4	82.7	277.1	49.7	55.7	
Vadailuppai	-	175.4	0.3	-	-	4.8	24.3	96.5	19.1	234.9	
Vadamanapakkam	-	136.2	-	22.7	2.3	20.8	96.9	157.7	121.1	82.2	
Vayalathur	-	15.5	-	-	10.5	9.1	1.3	38.5	6.7	26.6	
Vengalathur	-	204.1	-	5.2	-	-	91.1	222.0	1.5	102.9	
Vembakkam	-	79.9	17.4	5.6	1.8	6.2	198.8	444.4	32.3	127.5	
Alinjalpattu	-	208.6	-	0.6	-	1.2	12.1	137.2	13.5	9.0	
Arasanipalai	-	78.2	-	-	4.7	1.8	13.1	127.4	67.5	148.0	
Arasankuppam	-	306.2	-	9.7	15.8	2.8	6.5	223.1	21.2	37.5	
Chithathur	-	307.3	0.4	13.0	-	9.6	49.4	310.6	24.2	95.0	
Cholavaram	-	319.6	3.2	-	0.4	3.7	52.0	304.0	29.4	83.5	
Hasanampettai	-	62.0	4.0	2.0	1.4	-	30.6	36.3	11.6	45.6	
Kilnayakanpalayam	-	36.2	-	3.7	1.9	0.9	30.4	138.7	9.5	48.6	
Kizhnelli	-	130.3	16.2	0.2	2.4	2.2	29.4	252.9	64.3	99.0	

GP/Key CWRM Parameter	Land Resources (ha)									
	Area under Forest land	Non-Agricultural Uses	Area under Barren & Un-cultivable Land	Area under Permanent Pastures and Other Grazing Land	Land Under Miscellaneous Tree Criticalops etc.	Cultivable Waste Land	Fallows Land other than Current Fallows	Current Fallow land	Unirrigated Land	Area Irrigated by Source
Kodayambakkam	-	86.8	-	5.9	3.1	1.1	1.1	141.7	11.3	24.7
Moranam	-	211.4	-	1.1	1.9	9.0	45.7	343.5	89.1	231.2
Namandi	-	118.8	218.6	6.8	5.0	15.9	5.0	392.2	8.1	45.4
Perunmanthangal	-	71.8	-	8.7	1.9	0.2	53.2	127.1	21.3	66.1
Poonaitthangal	-	28.9	-	7.3	-	3.6	19.5	78.8	3.0	40.3
Pudupalayam	-	54.0	1.3	-	24.9	-	50.9	133.8	19.6	67.4
Pulivalam	-	68.9	-	5.8	-	14.3	15.1	126.7	34.3	109.8
Pullavakkam	-	312.8	-	-	0.9	1.1	32.6	89.6	26.0	137.0
Sattuvanthangal	-	127.2	0.9	0.3	-	14.1	3.0	124.2	31.0	96.6
Mennalur	-	22.1	4.0	22.6	0.4	4.6	24.0	234.4	17.2	127.1
Randam	-	436.7	-	7.1	4.8	4.9	92.9	221.2	76.6	180.4
Sirunavelpet	-	249.6	6.3	1.4	0.4	2.7	18.6	125.6	55.4	122.9
Thiruppanamur	-	236.1	3.3	12.9	2.4	31.2	152.3	392.6	14.3	135.5
Vadakalpakkam	-	49.6	-	-	-	3.5	22.3	218.9	63.4	113.9
Velliakulam	-	109.9	-	1.2	-	13.1	10.3	229.5	32.2	55.2
Siruvanjiipattu	-	41.9	1.2	3.2	-	7.0	27.0	118.1	10.3	42.3
Irumaram	-	114.2	0.5	-	0.7	18.8	105.2	75.3	41.3	116.6
Dusi	-	202.0	202.0	4.3	-	13.2	-	98.1	45.8	212.1

GP/Key CWRM Parameter	Land under Catchment Area (ha)				Crop Details				
	Good Catchment	Average Catchment	Bad Catchment		Irrigated Area (ha)	Rainfed area (ha)	Paddy Cultivation (ha)	Crop Water Required - Irrigated condition (ha-m)	Crop Water Requirement - Rainfed condition (ha-m)
Abdullapuram	27.9	3.8	95.0	7.5	-	7.5	194.5	11.2	-
Alividthangi	176.9	38.7	1,148.4	206.5	12.0	194.5	297.2	297.2	4.4
Ariyur	111.2	2.4	209.4	48.9	-	46.0	72.0	72.0	-
Brahmadesam	173.7	22.6	522.2	170.9	2.9	151.6	252.6	252.6	1.6
Elacheri	27.0	41.2	363.7	38.1	1.7	25.2	43.2	43.2	0.6
Hariharapakkam	80.3	8.3	243.8	37.4	0.6	36.5	55.1	55.1	0.3
Kaganam	125.9	32.2	294.1	71.3	4.2	42.2	77.7	77.7	1.5
Moonjurpattu	38.7	5.8	128.0	62.3	0.5	59.0	89.8	89.8	0.2
Narasamangalam	50.0	0.1	128.6	79.9	-	75.9	115.8	115.8	-
Cheyyanur	42.7	68.5	138.9	96.9	0.2	77.4	129.6	129.6	0.1
Sirunallur	11.2	9.0	92.1	64.7	1.1	46.5	77.0	77.0	0.4
Umaiyalpuram	47.4	2.1	206.7	127.9	11.1	122.4	193.1	193.1	4.0
Pillanthangal	69.3	32.5	379.5	49.4	11.4	48.8	73.5	73.5	5.8
Sodiyambakkam	53.9	22.4	184.9	41.9	3.9	30.5	51.5	51.5	1.6
Punnai	89.8	-	143.9	115.4	9.9	69.0	129.1	129.1	3.6
Karanthai	93.1	2.6	366.1	74.5	9.2	58.5	94.2	94.2	3.2
Kundiyanthandalam	55.8	7.8	278.7	52.2	3.4	43.4	70.5	70.5	1.3
Kuthanur	333.3	14.4	799.5	194.4	2.8	186.9	286.5	286.5	1.0
Mamandur	163.4	0.1	457.0	386.3	21.4	338.7	527.6	527.6	7.7
Ukkamerumbakkam	64.5	0.0	209.3	84.3	8.2	29.3	78.0	78.0	3.2
Sumangali	175.2	43.4	317.3	6.8	6.3	2.8	6.1	6.1	2.2
Nemili	8.6	3.7	103.0	48.6	1.4	23.0	48.7	48.7	0.5
Mangal	54.7	23.7	235.6	35.2	3.8	29.3	46.3	46.3	1.3
Mathur	142.7	48.4	412.6	66.0	3.5	66.0	99.0	99.0	1.2
Pallavaram	35.3	2.0	215.0	53.6	4.9	50.1	79.5	79.5	1.7
Panamugai	94.5	0.7	297.4	58.9	-	58.9	88.3	88.3	-

GP/Key CWRM Parameter	Land under Catchment Area (ha)				Crop Details				
	Good Catchment	Average Catchment	Bad Catchment		Irrigated Area (ha)	Rainfed area (ha)	Paddy Cultivation (ha)	Crop Water Irrigated condition (ha-m)	Crop Water Requirement - Rainfed condition (ha-m)
Perungattur	395.2	6.4	555.9		66.3	5.6	63.0	100.2	2.8
Natteri	293.1	44.7	1,588.8		740.6	11.1	682.6	1,073.9	5.9
Suruttal	70.1	3.9	226.8		50.6	5.2	39.0	64.3	1.9
Pavoor	167.3	7.0	400.0		86.7	17.1	78.4	121.0	7.1
thenkalani	32.1	2.1	126.3		42.2	2.3	36.4	63.8	0.8
Thennampattu	35.2	44.3	474.4		23.7	24.1	-	13.0	11.0
Thirupanganadu	110.5	47.6	465.2		108.3	5.2	100.4	160.1	2.1
Vadailuppai	175.7	4.8	374.7		364.6	3.1	339.4	525.7	1.1
Vadamanapakkam	136.2	45.8	458.1		99.1	31.0	70.6	120.0	14.8
Vayalathur	15.5	19.5	73.1		31.8	8.4	18.5	34.9	2.9
Vengalathur	204.1	5.2	417.5		225.9	4.7	207.0	333.0	1.7
Vembakkam	97.3	13.7	803.0		150.1	4.7	137.3	223.5	1.8
Alinjalpattu	208.6	1.8	171.8		84.1	1.4	83.0	125.0	0.5
Arasanipalai	78.2	6.5	356.0		157.2	24.3	98.4	171.3	8.7
Arasankuppam	306.2	28.3	288.4		39.9	0.5	22.7	54.4	0.2
Chithathur	307.7	22.6	479.2		30.1	0.2	28.3	44.3	0.1
Cholavaram	322.8	4.1	468.9		92.5	-	77.4	141.2	-
Hasanampettai	66.0	3.5	124.1		36.8	1.2	30.4	58.5	0.4
Kilnayakanpalayam	36.2	6.5	227.2		65.8	3.0	58.0	90.3	1.0
Kizhneli	146.4	4.7	445.6		173.4	1.7	152.6	239.2	0.6
Kodayambakkam	86.8	10.1	178.9		15.8	3.3	15.0	22.9	1.2
Moranam	211.4	12.1	709.5		109.2	34.5	90.2	148.9	16.4
Namandi	337.4	27.7	450.6		148.7	4.4	147.9	222.3	2.4
Perunmanthangal	71.8	10.8	267.7		138.9	0.2	137.7	207.2	0.1
Poonathangal	28.9	11.0	141.6		71.5	3.6	67.8	109.8	1.3
Pudupalayam	55.3	24.9	271.7		65.3	6.7	51.6	83.0	2.4

GP/Key CWRM Parameter	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)	
Pulivalam	68.9	20.1	285.9		95.1	9.3	88.9	135.8	3.9	
Pullavakkam	312.8	2.0	285.1		68.3	5.5	64.9	99.3	2.7	
Sattuvanthangal	128.1	14.5	254.8		132.2	-	121.0	186.5	-	
Mennalur	26.0	27.7	402.7		93.7	17.7	78.9	130.5	6.7	
Randam	436.7	16.8	571.1		240.7	9.7	230.6	357.7	3.4	
Sirunavelpet	255.9	4.5	322.5		281.2	-	273.8	413.7	-	
Thiruppanamur	239.4	46.4	694.8		47.4	1.0	45.9	69.5	0.3	
Vadakalpakkam	49.6	3.5	418.5		52.0	11.7	49.4	75.1	6.1	
Velliakulam	109.9	14.3	327.2		63.7	1.6	56.3	89.5	0.8	
Siruvanji pattu	43.0	10.2	197.7		95.3	3.1	82.6	133.1	1.1	
Irumaram	114.7	19.5	338.4		80.6	0.9	70.3	113.8	0.3	
Dusi	404.0	17.5	356.0		232.0	0.5	231.5	348.2	0.2	

GP/Key CWRM Parameter	Soil Resources: Status of Available Nitrogen (%)				Status of Organic Carbon (%)						Status of Soil Micro Nutrients (%)	
	Very Low	Low	Medium	High	Very Low	Low	Medium	High	Very High	Sufficient	Deficient	
Abdullapuram	50.0	50.0	-	-	50.0	50.0	-	-	-	100.0	-	
Alividithangi	7.6	92.4	-	-	45.8	54.2	-	-	-	48.0	52.0	
Ariyur	15.6	84.4	-	-	40.6	59.4	-	-	-	63.0	37.0	
Brahmadesam	3.8	96.2	-	-	19.6	80.4	-	-	-	61.0	39.0	
Elacheri	-	100.0	-	-	17.6	82.4	-	-	-	59.0	41.0	
Hariharapakkam	-	100.0	-	-	15.4	84.6	-	-	-	83.0	17.0	
Kaganam	13.3	86.7	-	-	55.6	44.4	-	-	-	49.0	51.0	
Moonjurpattu	8.3	91.7	-	-	33.3	66.7	-	-	-	91.0	9.0	
Narasamangalam	3.8	96.2	-	-	42.3	57.7	-	-	-	60.0	40.0	
Cheyyanur	-	100.0	-	-	50.0	50.0	-	-	-	58.0	42.0	
Sirunallur	62.5	37.5	-	-	16.7	75.0	8.3	-	-	62.0	38.0	
Umaiyalpuram	-	100.0	-	-	27.3	72.7	-	-	-	64.0	36.0	
Pillanthangal	58.8	41.2	-	-	35.3	58.8	5.9	-	-	54.0	46.0	
Sodiyambakkam	35.7	64.3	-	-	39.3	35.7	14.3	10.7	-	45.0	55.0	
Punnai	4.0	96.0	-	-	40.0	60.0	-	-	-	50.0	50.0	
Karanthai	2.1	97.9	-	-	4.2	95.8	-	-	-	77.0	23.0	
Kundiyanthandalam	93.5	6.5	-	-	78.3	19.6	-	-	2.2	90.0	10.0	
Kuthanur	-	100.0	-	-	17.5	80.7	-	1.8	-	66.0	34.0	
Mamandur	1.4	65.2	33.3	-	2.9	97.1	-	-	-	45.0	55.0	
Ukkamperumbakkam	21.9	78.1	-	-	22.6	77.4	-	-	-	90.0	10.0	
Sumangali	63.6	36.4	-	-	83.6	16.4	-	-	-	85.0	15.0	
Nemili	-	-	54.2	45.8	62.5	37.5	-	-	-	59.0	41.0	
Mangal	16.7	83.3	-	-	72.2	22.2	-	5.6	-	68.0	32.0	
Mathur	27.5	72.5	-	-	32.5	67.5	-	-	-	42.0	58.0	
Pallavaram	83.7	16.3	-	-	34.9	65.1	-	-	-	63.0	37.0	
Panamugai	100.0	-	-	-	100.0	-	-	-	-	78.0	22.0	
Perungattur	-	100.0	-	-	-	100.0	-	-	-	68.0	32.0	

GP/Key CWRM Parameter	Soil Resources: Status of Available Nitrogen (%)				Status of Organic Carbon (%)					Status of Soil Micro Nutrients (%)	
	Very Low	Low	Medium	High	Very Low	Low	Medium	High	Very High	Sufficient	Deficient
Natteri	5.2	94.8	-	-	27.4	72.2	0.4	-	-	63.0	37.0
Suruttal	82.6	17.4	-	-	39.1	60.9	-	-	-	65.0	35.0
Pavoor	9.4	90.6	-	-	50.8	49.2	-	-	-	55.0	45.0
thenkalani	87.5	12.5	-	-	41.7	58.3	-	-	-	61.0	39.0
Thennampattu	2.5	97.5	-	-	27.2	72.8	-	-	-	63.0	37.0
Thirupanangadu	96.3	3.7	-	-	74.1	25.9	-	-	-	76.0	24.0
Vadailuppai	83.0	17.0	-	-	88.7	11.3	-	-	-	82.0	18.0
Vadamanapakkam	33.3	66.7	-	-	7.4	92.6	-	-	-	87.3	12.7
Vayalathur	13.0	87.0	-	-	39.1	60.9	-	-	-	57.0	43.0
Vengalathur	97.0	3.0	-	-	90.9	1.5	-	1.5	6.1	88.0	12.0
Vembakkam	-	100.0	-	-	25.0	75.0	-	-	-	51.0	49.0
Alinjalpattu	-	100.0	-	-	33.3	66.7	-	-	-	56.0	44.0
Arasanipalai	68.4	31.6	-	-	35.1	63.2	1.8	-	-	62.0	38.0
Arasankuppam	-	100.0	-	-	20.0	80.0	-	-	-	73.0	27.0
Chithathur	-	100.0	-	-	29.2	70.8	-	-	-	57.0	43.0
Cholavaram	63.2	36.8	-	-	21.1	78.9	-	-	-	60.0	40.0
Hasanampettai	88.9	11.1	-	-	44.4	55.6	-	-	-	65.0	35.0
Kilnayakanpalayam	4.2	95.8	-	-	30.4	69.6	-	-	-	53.0	47.0
Kizhnelli	4.9	95.1	-	-	36.1	63.9	-	-	-	61.0	39.0
Kodayambakkam	-	100.0	-	-	4.8	95.2	-	-	-	67.0	33.0
Moranam	-	100.0	-	-	8.1	91.9	-	-	-	72.0	28.0
Namandi	-	100.0	-	-	29.6	70.4	-	-	-	54.0	46.0
Perunmanthangal	9.1	90.9	-	-	63.6	36.4	-	-	-	61.0	39.0
Poonaitthangal	61.5	38.5	-	-	23.1	76.9	-	-	-	64.0	36.0
Pudupalayam	17.1	82.9	-	-	65.9	34.1	-	-	-	52.0	48.0
Pulivalam	40.9	59.1	-	-	81.8	18.2	-	-	-	61.0	39.0

GP/Key CWRM Parameter	Soil Resources: Status of Available Nitrogen (%)				Status of Organic Carbon (%)				Status of Soil Micro Nutrients (%)		
	Very Low	Low	Medium	High	Very Low	Low	Medium	High	Very High	Sufficient	Deficient
Pullavakkam	80.5	19.5	-	-	36.6	63.4	-	-	-	60.0	40.0
Sattuvanthangal	37.0	63.0	-	-	77.8	22.2	-	-	-	60.0	40.0
Mennalur	-	100.0	-	-	-	100.0	-	-	-	63.0	37.0
Randam	2.4	97.6	-	-	33.3	66.7	-	-	-	52.0	48.0
Sirunavelpet	-	100.0	-	-	14.0	86.0	-	-	-	67.0	33.0
Thiruppanamur	96.3	3.7	-	-	74.1	25.9	-	-	-	74.0	26.0
Vadakalpakkam	33.3	66.7	-	-	44.4	55.6	-	-	-	87.0	13.0
Velliakulam	-	100.0	-	-	25.0	75.0	-	-	-	60.0	40.0
Siruvanjiipattu	41.3	8.7	50.0	-	39.1	60.9	-	-	-	65.0	35.0
Irumaram	17.9	82.1	-	-	51.3	48.7	-	-	-	56.0	44.0
Dusi	62.9	37.1	-	-	28.6	65.7	5.7	-	-	61.0	39.0

GP /Key CWRM Parameter	Status of Physical condition of the soil (%)								Soil Texture (%)			
	Mod-erately Acidic	Strongly Acidic	Highly Acidic	Mod-erately Acidic	Slightly Acidic	Neutral	Mod-erately Alkaline	Strongly Alkaline	Clay soil	Fine Soil	Coarse loamy	Soil Water Per-meability (Low, Mod-erate, high)
Abdullapuram	-	-	-	50.0	-	-	50.0	-	35.6	50.0	-	Moderate
Alividithangi	-	-	-	-	-	-	100.0	-	5.7	55.0	22.0	Moderate
Ariyur	-	-	-	-	-	6.3	93.8	-	39.2	60.0	0.3	Moderate
Brahmadesam	-	-	-	-	-	1.9	98.1	-	4.0	80.0	0.4	Moderate
Elacheri	-	-	-	-	-	-	100.0	-	-	86.0	3.0	Moderate
Hariharapakkam	-	-	-	-	-	-	100.0	-	-	5.0	63.0	High
Kaganam	-	-	-	-	6.7	2.2	91.1	-	2.0	66.0	21.0	Moderate
Moonjurpattu	-	-	-	-	-	-	100.0	-	52.0	25.0	-	Low
Narasamangalam	-	-	-	-	-	-	100.0	-	-	92.5	-	Moderate
Cheyyanur	-	-	-	-	-	-	100.0	-	-	5.0	35.0	High
Sirunallur	-	-	-	-	8.3	8.3	83.3	-	-	100.0	-	Moderate
Umaiyalpuram	-	-	-	-	-	-	100.0	-	-	58.2	45.0	Moderate
Pillanthangal	-	-	-	-	17.7	-	82.4	-	-	95.7	-	Moderate
Sodiyambakkam	-	-	-	-	2.9	-	97.1	-	-	89.0	-	Moderate
Punnai	-	-	-	-	-	-	100.0	-	-	74.0	12.0	Moderate
Karanthai	-	-	-	-	-	-	100.0	-	-	70.0	-	Moderate
Kundiyanthandalam	-	-	-	59.4	37.5	-	3.1	-	-	23.0	48.0	High
Kuthanur	-	-	-	-	-	-	100.0	-	32.0	48.0	-	Moderate
Mamandur	-	-	-	-	2.9	-	97.1	-	-	83.0	-	Moderate
Ukkamperumbakkam	-	-	-	59.4	37.5	-	3.1	-	-	100.0	-	Moderate
Sumangali	-	-	-	-	-	-	100.0	-	-	75.0	6.0	Moderate
Nemili	-	-	-	-	16.7	20.8	62.5	-	-	71.0	-	Moderate
Mangal	-	-	-	-	-	-	100.0	-	-	98.0	-	Moderate

GP/Key CWRM Parameter	Status of Physical condition of the soil (%)								Soil Texture (%)			
	Mod-erately Acidic	Strongly Acidic	Highly Acidic	Mod-erately Acidic	Slightly Acidic	Neutral	Mod-erately Alkaline	Strongly Alkaline	Clay soil	Fine Soil	Coarse loamy	Soil Water Permeability (Low, Moderate, high)
Mathur	-	-	-	-	-	-	-	-	-	83.0	1.0	Moderate
Pallavaram	2.3	-	-	-	4.7	14.0	79.1	-	-	98.0	0.4	Moderate
Panamugai	-	-	-	-	-	-	100.0	-	28.3	68.0	4.0	Moderate
Perungattur	-	-	-	-	-	-	100.0	-	1.0	1.0	46.0	High
Natteri	0.8	-	-	-	0.8	-	98.4	-	8.0	79.0	1.0	Moderate
Suruttal	-	-	-	-	-	-	100.0	-	6.0	47.0	29.0	Moderate
Pavoor	-	-	-	-	-	3.0	97.0	-	-	46.0	31.0	Moderate
thenkalani	-	-	-	-	4.2	-	95.8	-	-	26.0	21.0	Moderate
Thennampattu	-	-	-	-	-	6.2	93.8	-	14.2	80.0	-	Moderate
Thirupanganadu	-	-	-	22.2	3.7	-	74.1	-	4.4	75.0	1.0	Moderate
Vadailuppai	-	-	-	35.9	7.6	-	56.6	-	13.2	17.0	-	Moderate
Vadamanapakkam	-	-	-	17.8	77.8	-	4.4	-	16.5	64.4	4.0	Moderate
Vayalathur	-	-	-	-	-	4.4	95.7	-	62.5	94.0	-	Moderate
Vengalathur	-	4.6	3.0	45.5	12.1	-	34.9	-	18.2	7.0	57.0	High
Vembakkam	-	-	-	-	-	-	100.0	-	31.0	36.0	-	Moderate
Alinjalpattu	-	-	-	41.7	58.3	-	-	-	-	87.0	-	Moderate
Arasanipalai	-	-	-	-	19.3	5.3	75.4	-	19.2	73.0	-	Moderate
Arasankuppam	-	-	-	-	-	-	100.0	-	-	96.0	-	Moderate
Chithathur	-	-	-	-	8.3	-	91.7	-	2.0	-	38.0	High
Cholavaram	-	-	-	-	31.6	-	68.4	-	12.9	33.3	53.8	Moderate
Hasanampettai	-	-	-	-	11.1	-	88.9	-	-	76.0	-	Moderate
Kilnayakanpalayam	-	-	-	4.2	29.2	4.2	62.5	-	-	62.0	33.0	Moderate
Kizhneli	-	-	-	-	3.3	-	96.7	-	-	75.0	12.0	Moderate

GP/Key CWRM Parameter	Status of Physical condition of the soil (%)								Soil Texture (%)			
	Mod-erately Acidic	Strongly Acidic	Highly Acidic	Mod-erately Acidic	Slightly Acidic	Neutral	Mod-erately Alkaline	Strongly Alkaline	Clay soil	Fine Soil	Coarse loamy	Soil Water Permeability (Low, Moderate, High)
Kodayambakkam	-	-	-	-	-	-	100.0	-	-	37.0	43.0	High
Moranam	-	-	-	-	-	-	100.0	-	35.0	50.0	-	Moderate
Namandi	-	-	-	-	3.7	-	96.3	-	0.4	54.0	21.0	Moderate
Perunmanthangal	-	-	-	-	-	-	100.0	-	24.2	67.0	-	Moderate
Poonaihangal	-	-	-	-	7.7	15.4	76.9	-	-	6.0	21.0	High
Pudupalayam	-	-	-	-	-	-	100.0	-	41.0	59.0	-	Moderate
Pulivalam	-	-	-	-	-	-	100.0	-	100.0	-	-	Low
Pullavakkam	-	-	-	-	7.3	12.2	80.5	-	43.5	37.0	-	Low
Sattuvanthangal	-	-	-	-	-	-	100.0	-	48.0	22.0	-	Low
Mennalur	-	-	-	-	-	-	100.0	-	-	66.0	16.0	Moderate
Randam	-	-	-	-	-	-	100.0	-	28.5	41.0	-	Moderate
Sirunavelpet	-	-	-	-	-	7.0	93.0	-	-	80.0	10.0	Moderate
Thiruppanamur	-	-	-	1.2	4.7	4.7	89.5	-	-	70.0	6.0	Moderate
Vadakalpakkam	-	-	-	17.8	77.8	-	4.4	-	-	100.0	-	Moderate
Velliakulam	-	-	-	-	-	-	100.0	-	2.0	96.0	-	Moderate
Siruvanjiipattu	-	-	-	-	-	-	100.0	-	2.2	70.0	-	Moderate
Irumaram	2.6	-	-	-	-	2.6	94.9	-	24.0	23.0	-	Low
Dusi	-	-	-	-	5.7	-	94.3	-	12.0	37.0	-	Moderate

GP/Key CWRM Parameter	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
Abdullapuram	23.0	22.7	7.1	44.6	55.4	41.9	58.1	631.0	1,384.0	358.0
Alividithangi	23.0	273.0	316.2	9.2	90.8	32.0	68.0	1,071.0	1,302.0	702.0
Ariyur	23.0	48.7	45.7	15.7	84.3	59.9	40.1	1,053.0	691.0	336.0
Brahmadesam	23.0	125.3	148.1	10.7	89.3	-	100.0	3,261.0	381.0	1,518.0
Elacheri	23.0	93.1	77.9	7.6	92.4	29.5	70.5	1,430.0	749.0	291.0
Hariharapakkam	23.0	58.1	20.0	68.3	31.7	67.6	32.4	253.0	397.0	107.0
Kaganam	23.0	75.0	74.7	7.5	92.5	45.2	54.8	401.0	250.0	150.0
Moonjarpattu	23.0	30.8	61.1	-	100.0	51.2	48.8	243.0	282.0	58.0
Narasamangalam	23.0	35.2	18.3	29.7	70.3	70.5	29.5	217.0	261.0	76.0
Cheyyanur	23.0	47.7	98.4	8.5	91.5	50.2	49.8	564.0	546.0	323.0
Sirunallur	23.0	23.3	32.0	-	100.0	42.3	57.7	485.0	974.0	288.0
Umaiyalpuram	23.0	48.0	31.3	-	100.0	74.6	25.4	412.0	250.0	200.0
Pillanthangal	23.0	94.8	43.6	50.2	49.8	63.2	36.8	354.0	375.0	150.0
Sodiyambakkam	23.0	47.7	63.8	12.8	87.2	-	100.0	516.0	1,078.0	316.0
Punnai	23.0	33.1	46.7	5.9	94.1	-	100.0	262.0	324.0	187.0
Karanthai	23.0	84.8	48.8	-	100.0	54.4	45.6	412.0	318.0	250.0
Kundiyanthandalam	23.0	65.9	33.4	12.2	87.8	43.9	56.1	480.0	969.0	281.0
Kuthanur	23.0	187.2	239.2	10.4	89.6	-	100.0	1,183.0	354.0	373.0
Mamandur	23.0	107.5	225.3	2.1	97.9	56.4	43.6	1,086.0	556.0	220.0
Ukkamperumbakkam	23.0	48.1	60.7	4.0	96.0	-	-	682.0	1,299.0	268.0
Sumangali	23.0	83.0	105.7	-	100.0	43.2	56.8	346.0	350.0	218.0
Nemili	23.0	24.6	38.6	18.6	81.4	-	100.0	511.0	690.0	384.0
Mangal	23.0	61.0	48.9	30.7	69.3	-	100.0	344.0	813.0	238.0
Mathur	23.0	109.7	217.8	11.4	88.6	40.7	59.3	551.0	944.0	258.0
Pallavaram	23.0	49.9	32.7	-	100.0	-	100.0	529.0	734.0	391.0

GP/Key CWRM Parameter	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
Panamugai	23.0	68.6	56.9	18.7	81.3	-	100.0	444.0	216.0	102.0
Perungattur	23.0	129.3	42.5	18.1	81.9	73.1	26.9	1,033.0	413.0	238.0
Natteri	23.0	375.7	434.9	5.5	94.5	70.0	30.0	3,168.0	302.0	1,335.0
Suruttal	23.0	53.0	56.3	26.8	73.2	68.9	31.1	536.0	1,366.0	270.0
Pavoor	23.0	93.6	141.2	6.4	93.6	69.3	30.7	590.0	1,251.0	279.0
thenkalani	23.0	29.5	50.9	100.0	-	-	-	263.0	64.0	-
Thennampattu	23.0	119.3	102.5	-	100.0	88.4	11.6	1,366.0	490.0	684.0
Thirupanangadu	23.0	118.0	91.3	26.3	73.7	74.9	25.1	325.0	208.0	254.0
Vadailuppai	23.0	87.4	204.2	2.6	97.4	-	100.0	800.0	100.0	105.0
Vadamanapakkam	23.0	115.9	183.6	14.4	85.6	45.9	54.1	725.0	90.0	63.0
Vayalathur	23.0	21.3	35.2	-	100.0	-	100.0	396.0	140.0	68.0
Vengalathur	23.0	97.2	57.2	4.6	95.4	60.0	40.0	395.0	450.0	200.0
Vembakkam	23.0	191.8	134.4	4.9	95.1	23.5	76.5	437.0	773.0	165.0
Alinjalpattu	23.0	39.9	18.5	22.5	77.5	-	-	224.0	172.0	60.0
Arasanipalai	23.0	83.4	177.0	2.1	97.9	20.3	79.7	553.0	1,037.0	323.0
Arasankuppam	23.0	72.9	67.8	8.3	91.7	-	100.0	315.0	190.0	252.0
Chithathur	23.0	115.5	106.3	22.8	77.2	82.2	17.8	921.0	1,346.0	344.0
Cholavaram	23.0	109.5	91.1	26.6	73.4	-	-	638.0	986.0	325.0
Hasanampettai	23.0	30.3	48.8	-	-	-	-	25.0	57.0	52.0
Kilnayakanpalayam	23.0	53.8	51.2	28.7	71.3	87.2	12.8	599.0	1,336.0	302.0
Kizhneli	23.0	107.3	133.3	20.8	79.2	71.2	28.8	579.0	16.0	36.0
Kodayambakkam	23.0	43.5	36.2	29.7	70.3	28.4	71.6	912.0	18.0	18.0
Moranam	23.0	166.0	260.0	2.9	97.1	28.8	71.2	923.0	375.0	234.0
Namandi	23.0	160.3	52.5	54.5	45.5	63.2	36.8	253.0	316.0	90.0
Perunmanthangal	23.0	64.1	51.2	11.0	89.0	8.5	91.5	374.0	70.0	291.0
Poonathangal	23.0	35.1	40.7	1.2	98.8	41.7	58.3	298.0	815.0	229.0

GP/Key CWRM Parameter	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
Pudupalayam	23.0	68.5	89.9	-	100.0	17.3	82.7	640.0	584.0	254.0
Pulivalam	23.0	70.4	120.5	13.7	86.3	43.5	56.5	903.0	747.0	301.0
Pullavakkam	23.0	66.0	131.7	9.3	90.7	46.8	53.2	486.0	76.0	616.0
Sattuvanthangal	23.0	62.1	66.8	7.5	92.5	36.2	63.8	298.0	153.0	113.0
Mennalur	23.0	99.9	134.5	-	100.0	44.0	56.0	821.0	1,880.0	386.0
Randam	23.0	135.2	216.2	13.9	86.1	57.1	42.9	968.0	828.0	343.0
Sirunavelpet	23.0	76.6	144.8	5.1	94.9	24.4	75.6	793.0	595.0	264.0
Thiruppanamur	23.0	171.3	132.7	14.8	85.2	57.5	42.5	349.0	203.0	2.0
Vadakalpakkam	23.0	97.1	142.6	-	100.0	29.9	70.1	541.0	491.0	249.0
Velliakulam	23.0	78.5	71.2	14.8	85.2	47.8	52.2	331.0	175.0	77.0
Siruvanjipattu	23.0	48.1	44.8	8.4	91.6	35.5	64.5	413.0	185.0	52.0
Irumaram	23.0	82.4	127.4	19.1	80.9	63.8	36.2	478.0	605.0	123.0
Dusi	23.0	132.3	210.7	4.7	95.3	-	100.0	666.0	209.0	536.0

ANNEXURE 3.8

GP WISE DEMOGRAPHIC AND SOCIO ECONOMIC STATUS

GP/Key CWRM Parameter	Geo-graphical Area (ha)	Male Population (No.)	Female Population (No.)	Total Population (No.)	SC Population (No.)	ST Population (No.)	Vulnerable population (No.)	Households (HH's) (No.)	Only one room HH's (SECC) (No.)	Female Headed HH's (SECC) (No.)	Vulnerable Households (SECC) (No.)
Abdullapuram	127	1312	1282	2594	463	0	463	553	20	17	19
Alividithangi	1364	2243	2251	4494	732	82	814	1107	124	71	108
Ariyur	323	445	451	896	208	11	219	197	10	16	12
Brahmadesam	719	2865	2882	5747	1216	32	1248	1339	238	87	193
Elacheri	432	1065	1015	2080	770	25	795	467	58	31	50
Hariharapakkam	332	565	529	1094	0	0	0	263	65	18	51
Kaganam	452	384	422	806	459	16	475	180	16	9	14
Moonjurpattu	172	294	283	577	401	0	401	148	4	15	7
Narasamangalam	179	856	847	1703	7	95	102	371	39	26	35
Cheyyanur	250	573	606	1179	396	0	396	288	29	17	25
Sirunallur	112	267	296	563	315	0	315	136	1	9	3
Umaiyalpuram	256	437	447	884	3	0	3	277	19	16	18
Pillanthangal	481	653	655	1308	253	16	269	323	51	13	40
Sodiyambakkam	261	599	586	1185	375	0	375	282	29	12	24
Punnai	234	338	369	707	264	14	278	193	24	17	22
Karanthai	462	451	430	881	596	12	608	231	48	21	40
Kundiyanthandalam	342	351	352	703	381	0	381	169	5	12	7
Kuthanur	1147	1780	1729	3509	563	31	594	850	150	60	123
Mamandur	620	2155	2132	4287	390	6	396	1015	94	50	81
Ukkamperumbakkam	274	597	646	1243	558	58	616	300	2	21	8
Sumangali	536	804	824	1628	324	24	348	417	33	32	33
Nemili	115	301	284	585	286	10	296	135	0	5	2
Mangal	314	377	390	767	407	19	426	178	36	12	29

GP/Key CWRM Parameter	Geographical Area (ha)	Male Population (No.)	Female Population (No.)	Total Population (No.)	SC Population (No.)	ST Population (No.)	Vulnerable population (No.)	Households (HH's) (No.)	Only one room HH's (SECC) (No.)	Female Headed HH's (SECC) (No.)	Vulnerable Households (SECC) (No.)
Mathur	604	1066	1081	2147	291	0	291	447	73	29	60
Pallavaram	252	865	878	1743	384	25	409	430	42	33	39
Panamugai	393	471	497	968	430	0	430	229	28	14	24
Perungattur	957	1839	1896	3735	941	13	954	875	43	40	42
Natteri	1927	2585	2481	5066	699	30	729	1159	62	57	61
Suruttal	301	659	607	1266	7	2	9	278	31	13	26
Pavoor	574	688	682	1370	1050	0	1050	315	23	12	20
thenkalani	160	1199	1295	2494	3	0	3	571	9	35	17
Thennampattu	554	1184	1155	2339	635	51	686	568	140	44	111
Thirupanangadu	623	870	993	1863	909	55	964	437	56	29	48
Vadailuppai	555	1178	1185	2363	621	32	653	606	157	57	127
Vadamanapakkam	640	1335	1322	2657	569	8	577	650	127	47	103
Vayalathur	108	257	248	505	313	7	320	117	2	7	4
Vengalathur	627	1159	1156	2315	685	0	685	550	87	21	67
Vembakkam	914	1573	1604	3177	644	13	657	692	137	40	108
Alinjalpattu	382	703	734	1437	291	0	291	338	36	23	32
Arasanipalai	441	879	865	1744	427	0	427	354	45	21	38
Arasankuppam	623	806	838	1644	1307	37	1344	377	58	18	46
Chithathur	809	1410	1475	2885	587	63	650	767	29	39	32
Cholavaram	796	958	923	1881	610	2	612	483	121	45	98
Hasanampettai	194	1130	1097	2227	0	23	23	525	90	28	71
Kilnayakanpalayam	270	644	671	1315	901	0	901	316	14	25	17
Kizhnelli	597	1101	1110	2211	265	0	265	573	139	46	111
Kodayambakkam	276	675	709	1384	0	24	24	349	41	24	36
Moranam	933	1505	1438	2943	1300	16	1316	712	202	50	156

GP/Key CWRM Parameter	Geo-graphical Area (ha)	Male Population (No.)	Female Population (No.)	Total Population (No.)	SC Population (No.)	ST Population (No.)	Vulnerable population (No.)	Households (HH's) (No.)	Only one room HH's (SECC) (No.)	Female Headed HH's (SECC) (No.)	Vulnerable Households (SECC) (No.)
Namandi	816	2157	1084	3241	770	34	804	763	99	43	82
Perunmanthangal	350	1190	1186	2376	607	5	612	556	80	32	66
Poonaitthangal	181	315	335	650	0	0	0	163	12	14	13
Pudupalayam	352	462	494	956	474	0	474	247	41	16	34
Pulivalam	375	741	722	1463	777	6	783	356	0	2	1
Pullavakkam	600	923	932	1855	0	5	5	447	78	34	65
Sattuvanthangal	397	719	695	1414	490	37	527	363	30	39	33
Mennalur	456	1219	1245	2464	650	7	657	609	70	39	61
Randam	1025	1578	1590	3168	1640	44	1684	713	206	46	158
Sirunavelpet	583	1140	1123	2263	304	37	341	545	36	48	40
Thiruppanamur	981	1385	1396	2781	1091	26	1117	302	38	12	30
Vadakalpakkam	472	1222	1146	2368	1246	156	1402	594	52	42	49
Velliakulam	451	665	690	1355	431	0	431	302	38	12	30
Siruvanjiipattu	251	460	491	951	68	0	68	108	9	7	8
Irumaram	473	543	508	1051	816	75	891	392	66	23	53
Dusi	1120	2811	2766	5577	73	49	122	1267	140	65	118

GP/Key CWRM Parameter	% of Vulnerable Households (%)	Registered MGN-REGA Job cards (Persons)	Active person working in MGN-REGA job Cards (Persons)	Drinking Water Sources (No.)	Ground Water - Drinking source (No.)	Surface water - Drinking source (No.)	sum of 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)
Abdullapuram	3.00	478	367	144	4	1	5	200	582	4.73
Alivithangi	9.77	1703	1528	743	4	0	4	0	1096	8.20
Ariyur	5.99	353	282	104	5	1	6	37	208	1.64
Brahmadesam	14.00	1416	1238	332	5	1	6	0	1369	10.49
Elacheri	11.00	868	662	238	4	1	5	9	473	3.80
Hariharapakkam	19.00	382	309	202	5	1	6	7	257	2.00
Kaganam	7.72	258	213	251	5	0	5	0	213	1.47
Moonjurpattu	4.93	236	149	116	4	0	4	5	193	1.05
Narasamangalam	9.46	533	436	292	4	0	4	9	486	3.10
Cheyyanur	9.00	455	270	272	5	1	6	0	289	2.15
Sirunallur	2.50	159	145	53	4	0	4	4	153	1.02
Umaiyalpuram	6.53	329	242	117	5	2	7	65	195	1.61
Pillanthangal	12.26	556	383	197	5	0	5	9	399	2.38
Sodiyambakkam	8.00	381	318	319	4	1	5	2	307	2.16
Punnai	11.35	237	187	113	4	0	4	0	176	1.29
Karanthai	17.27	342	217	56	5	1	6	20	210	1.60
Kundiyanthandalam	4.00	290	205	208	4	1	5	173	167	1.28
Kuthanur	14.00	1180	848	213	4	1	5	0	878	6.40
Mamandur	8.00	1361	1184	487	4	1	5	312	966	7.82
Ukkamperumbakkam	2.57	273	255	196	5	1	6	9	395	2.26
Sumangali	7.84	534	333	197	5	0	5	35	375	2.97
Nemili	1.00	221	166	101	4	1	5	62	100	1.07
Mangal	16.00	221	181	202	5	1	6	34	161	1.40
Mathur	13.00	560	451	710	5	1	6	80	523	3.92

GP/Key CWRM Parameter	% of Vulnerable Households (%)	Registered MGN-REGA Job cards (Persons)	Active person working in MGN-REGA job Cards (Persons)	Drinking Water Sources (No.)	Ground Water - Drinking source (No.)	Surface water - Drinking source (No.)	sum of 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)
Pallavaram	9.00	590	446	390	5	1	6	0	460	3.18
Panamugai	10.00	346	265	143	5	1	6	0	267	1.77
Perungattur	5.00	956	651	313	5	1	6	0	932	6.82
Natteri	5.00	1771	1274	349	4	1	5	0	1761	9.25
Suruttal	9.00	507	331	136	4	1	5	0	316	2.31
Pavoor	6.25	506	372	181	4	1	5	0	347	2.50
thenkalani	3.00	744	423	328	5	1	6	0	677	4.55
Thennampattu	20.00	741	630	235	4	0	4	0	659	4.27
Thirupanangadu	10.96	693	533	275	4	0	4	7	469	3.39
Vadailuppai	21.00	883	629	403	4	0	4	0	725	4.31
Vadamanapakkam	16.00	1135	855	223	5	1	6	0	812	4.85
Vayalathur	3.00	250	170	75	5	0	5	4	145	0.92
Vengalathur	12.00	923	635	494	5	1	6	7	553	4.22
Vembakkam	16.00	853	666	204	4	1	5	6	648	5.80
Alinjalpattu	9.50	547	434	481	5	2	7	0	0	2.62
Arasanipalai	11.00	697	545	427	3	2	5	0	0	3.18
Arasankuppam	12.00	556	425	143	5	1	6	0	0	3.00
Chithathur	4.00	842	627	344	4	2	6	0	0	5.27
Cholavaram	20.00	584	475	262	5	1	6	0	0	3.43
Hasanampettai	14.00	398	292	587	5	1	6	0	0	4.06
Kilnayakanpalayam	5.00	468	397	419	5	2	7	0	0	2.40
Kizhnelli	19.00	651	567	158	4	1	5	0	0	4.04
Kodayambakkam	10.00	530	448	28	4	1	5	0	0	2.53
Moranam	22.00	1086	860	295	5	1	6	0	0	5.37

GP/Key CWRM Parameter	% of Vulnerable Households (%)	Registered MGN-REGA Job cards (Persons)	Active person working in MGN-REGA job Cards (Persons)	Drinking Water Sources (No.)	Ground Water - Drinking source (No.)	Surface water - Drinking source (No.)	sum of 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)
Namandi	11.00	1018	756	236	4	1	5	0	0	5.91
Perunmanthangal	11.80	1068	790	353	5	1	6	0	0	4.34
Poonaitthangal	8.00	337	268	99	5	0	5	0	0	1.19
Pudupalayam	14.00	380	296	308	5	1	6	0	0	1.74
Pulivalam	0.20	626	519	208	5	1	6	0	0	2.67
Pullavakkam	14.00	608	491	419	5	1	6	0	0	3.38
Sattuvanthangal	9.00	463	362	198	5	1	6	0	0	2.58
Mennalur	10.00	665	511	591	5	1	6	0	0	4.50
Randam	22.00	863	637	520	3	1	4	0	0	5.80
Sirunavelpet	7.00	795	711	566	4	1	5	0	557	4.13
Thiruppanamur	10.00	1102	799	228	5	2	7	0	0	5.08
Vadakalpakkam	8.00	733	494	25	3	1	4	0	0	4.32
Velliakulam	10.00	430	324	349	5	1	6	264	50	2.47
Siruvanjiipattu	7.78	363	273	114	4	2	6	0	0	1.74
Irumaram	13.55	461	327	163	4	2	6	0	0	1.91
Dusi	9.27	1730	1296	512	5	1	6	0	0	10.18

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

$$x_{ij}^p = \frac{X_{ij} - \text{Min } i \{X_{ij}\}}{(\text{Max } i \{X_{ij}\} - \text{Min } i \{X_{ij}\})}$$

- for indicators with negative relationship with vulnerability

$$x_{ij}^n = \frac{\text{Max } i \{X_{ij}\} - X_{ij}}{\text{Max } i \{X_{ij}\} - \text{Min } i \{X_{ij}\}}$$

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_{ij}^p is the normalized value

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

ANNEXURE 5.1

GP WISE WASCA PROPOSED TREATMENT AREA

GP/Key CWRM Parameter	Land Resources - WASCA Treatment Proposed Area (ha)									
	Non-Agricultural Uses	Barren & Un-cultivable Land	Permanent Pastures and Other Grazing Land	Land Under Miscellaneous Tree Criticalops etc.	Cultivable Waste Land	Fallows Land other than Current Fallows	Current Fallow land	Unirrigated Land	Area Irrigated by Source	
Abdullapuram	0.6	-	-	2.9	-	0.2	2.4	0.0	0.3	
Alividithangi	88.5	-	6.1	-	23.0	9.1	65.4	16.2	21.9	
Ariyur	16.1	-	-	-	1.8	1.2	8.0	1.4	2.0	
Brahmalesam	7.3	-	9.9	6.3	0.8	11.2	39.1	1.4	21.4	
Elacheri	-	-	-	-	30.9	10.1	19.3	1.2	9.5	
Hariharapakkam	3.2	0.5	3.2	-	3.1	35.6	7.6	2.6	1.4	
Kaganam	63.0	-	1.0	2.8	20.3	3.1	12.8	2.4	5.7	
Moonjurpattu	19.4	-	-	1.8	2.5	0.2	2.4	1.2	4.9	
Narasamangalam	12.9	18.2	-	-	0.1	0.1	10.0	0.3	2.0	
Cheyyanur	21.3	0.1	48.6	0.5	2.2	-	7.4	0.3	4.8	
Sirunallur	5.6	-	-	6.7	0.1	0.3	1.3	0.2	2.4	
Umaiyalpuram	23.7	-	-	-	1.6	1.4	9.5	0.1	3.8	
Pillanthangal	34.7	-	0.3	1.6	22.5	8.5	28.1	4.1	4.7	
Sodiyambakkam	0.3	-	6.8	0.6	9.4	0.1	9.2	2.0	3.5	
Punnai	44.9	-	-	-	-	0.5	9.3	2.1	4.0	
Karanthai	46.6	-	-	-	2.0	9.1	43.6	3.0	4.3	
Kundiyanthandalam	27.9	-	0.6	0.2	5.0	0.8	8.8	0.3	1.3	
Kuthanur	30.2	-	6.2	4.6	-	11.3	61.0	7.6	32.1	
Mamandur	7.2	7.7	-	-	0.1	0.5	13.7	1.2	21.3	
Ukkamperumbakkam	32.3	-	-	-	0.0	0.3	3.2	0.9	4.1	
Sumangali	87.6	-	26.4	5.3	0.9	3.9	14.0	3.4	4.6	
Nemili	-	-	2.8	-	0.0	0.3	0.3	0.2	0.2	

GP/Key CWRM Parameter	Land Resources - WASCA Treatment Proposed Area (ha)									
	Non-Agricultural Uses	Barren & Un-cultivable Land	Permanent Pastures and Other Grazing Land	Land Under Miscellaneous Tree Criticalops etc.	Cultivable Waste Land	Fallow Land other than Current Fallows	Current Fallow land	Unirrigated Land	Area Irrigated by Source	
Mangal	24.4	4.5	1.6	1.8	14.3	-	16.1	2.3	2.8	
Mathur	1.2	12.1	15.1	7.6	13.6	-	22.4	18.5	12.8	
Pallavaram	-	-	-	1.3	0.2	1.0	12.9	1.1	4.4	
Panamugai	3.8	-	-	-	0.6	3.0	19.7	2.9	4.2	
Perungattur	84.1	-	3.1	0.3	1.4	2.0	23.4	0.7	1.7	
Natteri	146.6	-	-	23.9	9.6	4.5	49.5	4.0	21.4	
Suruttal	2.3	-	-	-	2.9	3.2	10.9	2.4	4.0	
Pavoor	15.2	0.1	0.5	4.0	0.8	8.4	5.4	3.0	7.2	
thenkalani	16.0	-	-	1.5	0.1	-	2.0	0.4	1.5	
Thennampattu	-	-	7.3	9.4	16.6	14.0	59.8	7.9	13.2	
Thirupanangadu	55.2	-	2.4	3.8	29.6	9.1	30.4	5.5	5.6	
Vadailuppai	20.3	0.2	-	-	3.6	5.1	20.3	4.0	49.3	
Vadamanapakkam	1.8	-	17.0	1.7	15.6	15.5	25.2	19.4	13.2	
Vayalathur	7.8	-	-	7.9	6.8	0.0	1.2	0.2	0.8	
Vengalathur	25.6	-	3.9	-	-	10.9	26.6	0.2	12.4	
Vembakkam	-	13.1	4.2	1.4	4.7	31.8	71.1	5.2	20.4	
Alinjalpattu	70.9	-	0.4	-	0.9	1.2	13.0	1.3	0.9	
Arasanipalai	39.1	-	-	3.5	1.4	1.4	14.0	7.4	16.3	
Arasankuppam	89.2	-	7.3	11.9	2.1	0.8	26.8	2.6	4.5	
Chithathur	55.2	0.3	9.7	-	7.2	2.0	12.4	1.0	3.8	
Cholavaram	64.4	2.4	-	0.3	2.8	10.4	60.8	5.9	16.7	
Hasanampettai	7.5	3.0	1.5	1.1	-	4.3	5.1	1.6	6.4	
Kilnayakanpalayam	-	-	2.8	1.4	0.7	1.5	6.9	0.5	2.4	
Kizhnelli	2.4	12.1	0.1	1.8	1.6	5.6	48.1	12.2	18.8	
Kodayambakkam	10.0	-	4.4	2.4	0.8	0.1	14.2	1.1	2.5	

GP/Key CWRM Parameter	Land Resources - WASCA Treatment Proposed Area (ha)									
	Non-Agricultural Uses	Barren & Un-cultivable Land	Permanent Pastures and Other Grazing Land	Land Under Miscellaneous Tree Criticalops etc.	Cultivable Waste Land	Fallows Land other than Current Fallows	Current Fallow land	Unirrigated Land	Area Irrigated by Source	
Moranam	5.6	-	0.9	1.4	6.8	10.1	75.6	19.6	50.9	
Namandi	59.4	163.9	5.1	3.8	12.0	0.6	43.1	0.9	5.0	
Perunmanthangal	19.7	-	6.6	1.4	0.1	6.3	15.0	2.5	6.6	
Poonathangal	14.4	-	5.5	-	2.7	1.6	6.3	0.2	3.2	
Pudupalayam	27.0	1.0	-	18.7	-	7.1	18.7	2.7	9.4	
Pulivalam	34.5	-	4.4	-	10.7	0.0	0.3	0.1	0.2	
Pullavakkam	100.5	-	-	0.7	0.9	4.6	12.5	3.6	19.2	
Sattuvanthangal	15.3	0.6	0.3	-	10.6	0.3	11.2	2.8	8.7	
Mennalur	-	3.0	17.0	0.3	3.5	2.4	23.4	1.7	12.7	
Randam	98.8	-	5.3	3.6	3.7	20.4	48.7	16.9	39.7	
Sirunavelpet	57.0	4.7	1.1	0.3	2.0	1.3	8.8	3.9	8.6	
Thiruppanamur	118.1	2.5	9.7	1.8	23.4	15.2	39.3	1.4	13.6	
Vadakalpakkam	-	-	-	-	2.6	1.8	17.5	5.1	9.1	
Velliakulam	4.8	-	0.9	-	9.8	1.0	23.0	3.2	5.5	
Siruvanjiipattu	0.7	0.9	2.4	-	5.3	2.1	9.2	0.8	4.2	
Irumaram	1.9	0.4	-	0.5	14.1	14.3	10.2	5.6	11.7	
Dusi	101.0	151.5	3.2	-	9.9	-	8.8	4.1	21.2	

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

GP/Key CWRM Parameter	Good Catchment Area	Average Catchment Area	Bad Catchment Area
Abdullapuram	5.79	0.84	0.56
Alividithangi	36.90	8.20	21.10
Ariyur	8.17	0.53	2.46
Brahmadesam	10.35	4.99	14.31
Elacheri	5.37	9.09	7.83
Hariharapakkam	3.68	1.83	9.24
Kaganam	24.20	6.80	4.50
Moonjurpattu	7.70	1.20	1.60
Narasamangalam	11.50	0.00	2.30
Cheyyanur	11.79	15.10	2.45
Sirunallur	2.30	1.90	0.80
Umaiypuram	11.75	0.44	2.77
Pillanthangal	13.50	6.90	8.50
Sodiyambakkam	2.96	4.94	2.90
Punnai	16.50	0.00	3.00
Karantnai	18.30	0.50	11.20
Kundiyanthandalam	13.61	1.71	2.18
Kuthanur	94.32	3.17	21.92
Mamandur	11.94	0.02	7.16
Ukkamperumbakkam	12.23	0.00	1.58
Sumangali	44.10	9.20	4.80
Nemili	1.83	0.82	0.20
Mangal	12.79	5.22	4.15
Mathur	11.38	10.67	10.50
Pallavaram	2.66	0.45	3.79
Panamugai	3.28	0.16	5.82
Perungattur	45.09	1.41	5.44
Natteri	73.40	9.86	15.55
Suruttal	11.75	0.85	4.00
Pavoor	11.32	1.55	4.70
thenkalani	10.25	0.46	0.74
Thennampattu	13.07	9.78	18.57
Thirupanangadu	22.60	10.00	9.40
Vadailuppai	12.05	1.06	15.41
Vadamanapakkam	10.41	10.11	14.35
Vayalathur	4.20	4.31	0.43
Vengalathur	16.26	1.15	9.81
Vembakkam	35.23	3.01	25.15
Alinjalpattu	33.60	0.40	3.10
Arasanipalai	17.10	1.44	7.67
Arasankuppam	36.87	6.25	6.78
Chithathur	28.50	4.98	3.75

GP/Key CWRM Parameter	Good Catchment Area	Average Catchment Area	Bad Catchment Area
Cholavaram	30.68	0.90	18.36
Hasanampettai	5.95	0.77	3.40
Kilnayakanpalayam	2.15	1.43	2.22
Kizhnelli	13.67	1.04	16.58
Kodayambakkam	6.61	2.24	3.50
Moranam	12.78	2.66	30.56
Namandi	102.63	6.11	9.71
Perunmanthangal	8.30	2.30	5.70
Poonathangal	6.94	2.42	2.22
Pudupalayam	12.79	5.49	7.45
Pulivalam	18.62	4.42	0.11
Pullavakkam	44.49	0.44	7.81
Sattuvanthangal	8.92	3.19	4.49
Mennalur	3.48	6.10	7.88
Randam	49.76	3.71	24.60
Sirunavelpet	54.97	0.98	4.42
Thiruppanamur	62.30	9.80	13.00
Vadakalpakkam	2.07	0.76	6.56
Velliakulam	11.09	3.14	6.41
Siruvanjiipattu	1.30	2.10	3.10
Irumaram	1.90	4.10	7.80
Dusi	93.90	3.70	6.40
Total	1,335.90	229.10	494.75

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 No.	AVP		Az No.	BP		CBP		CS No.
	No.	Area		No.	Length		No.	Area	No.	Area	
Abdullapuram	456	1	-	-	19	2,286	3	-	-	19	
Alinjalpattu	-	-	-	1,587	6,349	-	-	-	-	-	
Alividithangi	-	-	60	713	2,852	29	18,400	23	-	29	
Arasanipalai	31,264	39	-	1,197	4,787	38	3,906	5	-	38	
Arasankuppam	71,392	89	-	-	-	46	11,166	14	-	46	
Ariyur	12,837	16	-	894	3,574	12	1,440	2	400	12	
Brahmadesam	5,808	7	-	1,279	5,115	193	5,676	7	2,524	193	
Cheyyanur	17,028	21	-	1,461	5,844	25	2,268	3	410	25	
Chithathur	44,143	55	-	403	1,612	32	6,000	8	-	32	
Cholavaram	51,556	64	-	220	881	98	4,350	5	-	98	
Dusi	12,960	16	-	625	2,500	118	-	-	-	79	
Elacheri	-	-	-	1,070	4,280	50	24,720	31	-	50	
Hariharapakkam	2,531	3	-	1,165	4,658	51	2,820	4	-	51	
Hasanamapettai	5,960	7	-	1,893	7,571	71	3,270	4	-	71	
Irumaram	11,586	14	-	535	2,141	32	1,151	1	-	32	
Kaganam	16,000	20	-	1,661	6,644	27	45,000	3	-	40	
Karanthai	1,600	-	-	520	2,079	41	-	-	-	41	
Kilnayakanpalayam	-	-	-	488	1,953	17	1,686	2	-	17	
Kizhnelli	1,904	2	-	2,030	8,121	111	12,426	16	-	111	
Kodayambakkam	7,968	10	-	949	3,796	36	2,538	3	-	36	
Kundiyanthandalam	22,328	28	-	641	2,563	7	4,164	5	-	7	
Kuthanur	24,141	30	-	2,279	9,114	123	3,690	5	262	123	
Mamandur	5,746	7	-	1,241	4,963	81	6,168	8	313	81	
Mangal	19,492	24	-	1,191	4,764	29	16,494	21	325	29	
Mathur	978	1	-	1,712	6,848	60	26,610	33	-	60	

Gram Panchayat	Aff		ARS		AVP		AZ		BP		CBP		CS	
	No.	Area	No.	No.	No.	Length	No.	No.	No.	Area	No.	Area	No.	No.
Menallur	-	-	-	-	843	3,371	61	5,412	7	-	-	-	61	
Moonjurpattu	-	-	-	-	851	3,405	-	-	-	-	-	-	-	
Moranam	4,495	6	-	-	804	3,217	156	6,552	8	-	-	-	156	
Namandi	47,536	59	-	-	934	3,737	82	143,700	180	-	-	-	82	
Narasamangalam	14,400	18	-	-	853	3,413	25	-	-	-	-	-	22	
Natteri	117,256	147	-	-	1,312	5,249	61	26,820	34	10,080	10,080	-	61	
Nemili	-	-	-	-	-	-	2	30	0	35	174	-	2	
Pallavaram	-	-	-	-	-	-	39	1,218	2	-	-	-	39	
Panamugai	3,069	4	-	-	-	-	24	444	1	347	1,736	-	24	
Pavoor	12,187	15	-	-	-	-	20	3,858	5	327	1,634	-	20	
Perungattur	67,273	84	-	-	-	-	42	1,392	2	337	1,686	-	42	
Perunmanthangal	-	-	-	-	-	-	22	-	-	254	1,275	-	22	
Pillanthangal	18,400	23	-	-	1,046	4,184	26	30,000	2	-	-	-	35	
Poonathangal	11,540	14	-	-	686	2,743	13	2,184	3	-	-	-	13	
Pudupalayam	21,604	27	-	-	5,287	21,147	34	15,726	20	-	-	-	34	
Pulivalam	27,576	34	-	-	576	2,303	1	8,550	11	-	-	-	1	
Pullavakkam	80,421	101	-	-	-	-	65	1,200	2	-	-	-	65	
Punnai	-	-	-	-	1,576	6,302	19	-	-	-	-	-	26	
Randam	79,035	99	-	-	2,060	8,239	158	5,850	7	-	-	-	158	
Sattuvanthangal	12,235	15	-	-	1,387	5,548	33	8,976	11	-	-	-	33	
Sirunallur	-	-	-	-	2,814	11,256	63	105,000	7	-	-	-	22	
Sirunavelpet	45,579	57	-	-	1,094	4,375	40	5,598	7	-	-	-	40	
Siruvanjiipattu	-	-	-	-	-	-	16	-	-	-	1,513	-	16	
Sodiyambakkam	271	0	-	-	-	-	24	8,010	10	486	2,430	-	24	
Sumangali	800	1	-	-	134	668	33	75,000	5	-	-	-	35	
Suruttal	1,860	2	-	-	-	-	26	2,316	3	528	2,640	-	26	
Thenkalani	12,828	16	-	-	-	-	17	1,242	2	-	-	-	17	
Thennampattu	-	-	-	-	-	-	111	20,760	26	1,440	7,200	-	111	

Gram Panchayat	Aff		ARS		AVP		Az		BP		CBP		CS	
	No.	Area	No.	No.	No.	Length	No.	No.	No.	Area	No.	Area	No.	No.
Thirupanangadu	24,000	30	-	-	-	1,827	59	3,200	4	-	-	-	33	
Thiruppanamur	-	-	-	851	-	3,405	-	-	-	-	-	-	-	
Ukkamperumbakkam	-	-	-	804	-	3,217	39	-	-	-	-	-	68	
Umaiyalpuram	1,266	2	-	934	-	3,737	13	995	1	-	-	-	13	
Vadailuppai	16,271	20	-	853	-	3,413	127	3,060	4	1,464	7,320	127		
Vadakalpakkam	-	-	-	-	-	-	49	2,070	3	-	-	-	49	
Vayalathur	6,212	8	-	-	-	-	4	11,718	15	-	-	-	4	
Vedamanapakkam	1,397	2	-	-	-	-	103	13,872	17	2,066	10,330	103		
Velliakulam	3,823	5	-	-	-	-	30	7,830	10	-	-	-	30	
Vembakkam	-	-	-	-	-	-	108	15,252	19	-	-	-	108	
Vengalathur	20,513	26	-	-	-	-	67	-	-	-	-	-	67	

Gram Panchayat	CT		Co		FP		COWRS		CCBF		DLT		DLHAI		FBBTI	
	No.	No.	No.	Area	No.	Area	No.	Area	No.	Area	Plants	Length	No.	Area	No.	Area
Abdullapuram	19	2	-	-	4	4	946	6	-	-	-	-	285	1	1	1
Alinjalpattu		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Alividithangi	29	-	-	-	-	-	712	7	-	-	-	-	12,473	42	17	42
Arasanipalai	38	9	-	-	20	47	11,127	83	-	-	-	-	3,916	20	5	11
Arasankuppam	46	13	-	-	35	11	25,119	145	-	-	-	-	3,461	17	6	15
Ariyur	12	5	-	-	9	5	4,631	30	-	-	-	-	1,257	6	2	5
Brahmadesam	193	21	-	-	26	25	10,039	97	-	-	-	-	7,311	37	10	26
Cheyyanur	25	4	-	-	21	21	15,339	85	-	-	-	-	1,250	6	2	4
Chithathur	32	7	-	-	22	7	16,025	92	-	-	-	-	1,917	10	3	8
Cholavaram	98	31	-	-	46	-	21,685	164	-	-	-	-	9,378	47	15	39
Dusi	79	3	-	-	13	81	-	-	-	-	746	3,731	-	-	9	23
Elacheri	50	13	-	-	19	24	9,256	71	-	-	-	-	4,001	20	6	15
Hariharapakkam	51	18	-	-	22	1	6,548	57	-	-	-	-	4,718	24	9	23
Hasanamapettai	71	4	-	-	9	-	3,712	30	-	-	-	-	1,737	9	2	5
Irumaram	32	8	-	-	12	17	-	-	-	-	-	-	-	-	14	35
Kaganam	40	-	-	-	10	-	-	-	-	364	1,818	-	-	-	-	64
Karanthai	41	-	-	-	10	11	100	1	-	734	3,671	-	-	-	15	38
Kilnayakanpalayam	17	4	-	-	8	2	1,868	16	-	-	-	-	1,136	6	2	4
Kizhnelli	111	26	-	-	32	11	10,203	103	-	-	-	-	8,467	42	13	33
Kodayambakkam	36	8	-	-	13	7	5,060	35	-	-	-	-	1,789	9	3	8
Kundiyanthandalam	7	6	-	-	14	7	7,740	45	-	-	-	-	1,115	6	2	5
Kuthanur	123	32	-	-	40	52	16,226	153	-	-	-	-	11,193	56	16	40
Mamandur	81	7	-	-	12	46	4,553	51	-	-	-	-	3,656	18	3	8
Mangal	29	7	-	-	18	5	11,155	68	-	-	-	-	2,120	11	4	9
Mathur	60	16	-	-	27	23	14,022	103	-	-	-	-	5,364	27	8	20
Menallur	61	11	-	-	17	51	7,555	64	-	-	-	-	4,027	20	6	14
Moonjarpattu		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Moranam	156	42	-	-	46	66	13,521	171	-	-	-	-	15,608	78	21	53

Gram Panchayat	CT		Co		FP		COWRS		CCBF		DLT		DLHAI		FBBTI	
	No.	No.	No.	Area	No.	Area	No.	Area	No.	Area	Plants	Length	No.	Area	No.	Area
Namandi	82	19	-	-	68	-	7	294	53,285	294	-	-	4,957	25	9	22
Narasamangalam	22	-	-	-	3	-	10	-	-	-	378	1,890	-	-	11	27
Natteri	61	23	-	-	60	-	51	260	41,873	260	-	-	7,944	40	12	29
Nemili	2	3	-	-	5	-	4	4	644	4	-	-	103	1	1	0
Pallavaram	39	7	-	-	9	-	19	21	1,824	21	-	-	1,935	10	3	8
Panamugai	24	10	-	-	12	-	9	34	3,444	34	-	-	2,974	15	5	13
Pavoor	20	7	-	-	13	-	15	45	5,811	45	-	-	2,400	12	3	8
Perungattur	42	11	-	-	31	-	14	117	20,400	117	-	-	2,779	14	5	13
Perunmanthangal	22	6	-	-	10	-	24	-	-	-	842	4,209	-	-	6	15
Pillanthangal	35	-	-	-	11	-	10	-	-	-	329	1,647	-	-	43	107
Poonathangal	13	4	-	-	10	-	85	34	5,425	34	-	-	1,133	6	2	4
Pudupalayam	34	11	-	-	21	-	22	85	12,215	85	-	-	3,803	19	6	14
Pulivalam	1	3	-	-	13	-	44	50	9,981	50	-	-	57	0	1	0
Pullavakkam	65	8	-	-	30	-	29	142	22,508	142	-	-	3,991	20	4	10
Punnai	26	-	-	-	4	-	10	-	-	-	289	1,444	-	-	10	26
Random	158	34	-	-	57	-	31	237	30,910	237	-	-	12,564	63	-	-
Sattuvanthangal	33	6	-	-	13	-	25	50	6,802	50	-	-	2,293	11	3	7
Sirunallur	22	-	-	-	3	-	10	-	-	-	234	1,168	-	-	7	17
Sirunavelpet	40	6	-	-	22	-	37	88	14,439	88	-	-	2,257	11	3	7
Siruvanipattu	16	3	-	-	7	-	11	-	-	-	203	1,015	-	-	6	15
Sodiyambakkam	24	5	-	-	11	-	14	32	4,568	32	-	-	1,479	7	2	6
Sumangali	35	-	-	-	10	-	10	-	-	-	153	765	-	-	40	100
Suruttal	26	7	-	-	8	-	5	26	2,695	26	-	-	2,041	10	3	8
Thenkalani	17	2	-	-	7	-	-	21	3,748	21	-	-	379	2	1	1
Thennampattu	111	33	-	-	39	-	3	128	14,822	128	-	-	9,487	47	16	41
Thirupanangadu	33	-	-	-	-	-	-	-	-	-	519	2,595	-	-	-	-
Thiruppanamur	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ukkamperumbakkam	68	-	-	-	4	-	10	-	-	-	331	1,656	-	-	17	42

Gram Panchayat	CT		Co		FP		COWRS		CCBF		DLT		DLHAI		FBBTI	
	No.	No.	No.	Area	No.	Area	No.	Area	No.	Area	Plants	Length	No.	Area	No.	Area
Umaiyalpuram	13	3	-	-	4	-	4	-	-	-	511	2,556	-	-	3	7
Vadailuppai	127	12	-	-	18	-	74	103	7,843	-	-	-	7,870	39	6	15
Vadakalpakkam	49	10	-	-	11	-	30	36	2,984	-	-	-	3,348	17	5	12
Vayalathur	4	3	-	-	8	-	11	25	4,633	-	-	-	219	1	1	1
Vedamanapakkam	103	24	-	-	32	-	18	109	13,255	-	-	-	7,329	37	12	30
Velliakulam	30	11	-	-	15	-	12	48	5,825	-	-	-	3,272	16	5	14
Vembakkam	108	43	-	-	49	-	39	152	15,507	-	-	-	12,848	64	22	54
Vengalathur	67	16	-	-	22	-	41	80	9,723	-	-	-	5,010	25	8	19

Gram Panchayat	FD		GSS		ICP		LDI		LP		MI		NADEP	
	No.	No.	No.	No.	Plants	Length	No.	Area	Plants	Length	No.	Area	No.	No.
Abdullapuram	38				220	1,100	1	1	424	2,122	-	-	-	19
Alinjalpattu					-	-	-	-	167	668	-	-	-	-
Alividithangi	29	11			-	-	-	-	234	937	-	-	-	29
Arasanipalai	76				300	1,500	5	11	169	675	-	-	-	38
Arasankuppam	92				520	2,600	6	15	468	1,873	-	-	-	46
Ariyur	24				150	750	2	5	347	1,388	-	-	-	12
Brahmesam	386				-	-	10	26	379	1,515	-	-	-	193
Cheyyanur	50				-	-	2	4	766	3,066	-	-	-	25
Chithathur	64				620	3,100	3	8	351	1,402	-	-	-	32
Cholavaram	196	-			1,400	7,000	15	39	294	1,175	-	-	-	98
Dusi	118	37			-	-	-	-	363	1,453	-	-	-	79
Elacheri	100				396	1,980	6	15	427	1,710	-	-	-	50
Hariharapakkam	102				410	2,050	9	23	629	2,514	-	-	-	51
Hasanamapettai	142	-			400	2,000	2	5	433	1,733	-	-	-	71
Irumaram	32	45			-	-	1	2	434	1,738	-	-	-	32
Kaganam	27	20			-	-	24	60	1,059	4,236	-	-	-	-
Karanthai	41	28			140	700	-	-	313	1,250	-	-	-	41
Kilnayakampalayam	34				-	-	2	4	309	1,236	-	-	-	17
Kizhnelli	222				708	3,540	13	33	615	2,459	-	-	-	111
Kodayambakkam	72				90	450	3	8	342	1,366	-	-	-	36
Kundiyanthandalam	14				326	1,630	2	5	342	1,367	-	-	-	7
Kuthanur	246				200	1,000	16	40	240	958	-	-	-	123
Mamandur	162				-	-	3	8	116	462	-	-	-	81
Mangal	58				-	-	4	9	199	794	-	-	-	29
Mathur	120				-	-	8	20	414	1,656	-	-	-	60
Menallur	122	-			300	1,500	6	14	183	734	-	-	-	61
Moonjurpattu					-	-	-	-	419	1,677	-	-	-	-
Moranam	312				460	2,300	21	53	104	416	-	-	-	156

Gram Panchayat	FD		GSS		ICP		LDI		LP		MI		NADEP	
	No.	No.	No.	Plants	Length	No.	Area	Plants	Length	No.	Area	No.	No.	
Namandi	164			270	1,350	9	22	575	2,300	-	-	-	82	
Narasamangalam	25	17		-	-	11	27	101	403	-	-	-	25	
Natteri	122			-	-	12	29	1,050	4,200	-	-	-	61	
Nemili	4			-	-	-	0	225	900	-	-	-	2	
Pallavaram	78			1,020	5,100	3	8	201	803	-	-	-	39	
Panamugai	48			-	-	5	13	416	1,665	-	-	-	24	
Pavoor	40			-	-	3	8	362	1,450	-	-	-	20	
Perungattur	84			480	2,400	5	13	800	3,201	-	-	-	42	
Perunmanthangal	22	13		-	-	2	5	353	1,413	-	-	-	22	
Pillanthangal	26	26		-	-	42	106	286	1,145	-	-	-	26	
Poonathangal	26			400	2,000	2	4	257	1,286	-	-	-	13	
Pudupalayam	68			-	-	6	14	66	330	-	-	-	34	
Pulivalam	2			-	-	-	0	1,620	8,102	-	-	-	1	
Pullavakkam	130			990	4,950	4	10	1,133	5,664	-	-	-	65	
Punnai	19	9		-	-	10	26	419	1,677	-	-	-	19	
Randam	316			300	1,500	17	43	104	416	-	-	-	158	
Sattuvanthangal	66			240	1,200	3	7	575	2,300	-	-	-	33	
Sirunallur	63	63		-	-	7	17	101	403	-	-	-	63	
Sirunavelpet	80			600	3,000	3	7	1,050	4,200	-	-	-	40	
Siruvanjiipattu	16	8		-	-	4	9	225	900	-	-	-	16	
Sodiyambakkam	48			-	-	2	6	201	803	-	-	-	24	
Sumangali	33	28		-	-	28	69	416	1,665	-	-	-	33	
Suruttal	52			-	-	3	8	362	1,450	-	-	-	26	
Thenkalani	34			-	-	-	1	800	3,201	-	-	-	17	
Thennampattu	222			-	-	16	41	353	1,413	-	-	-	111	
Thirupanangadu	59	23		-	-	41	102	286	1,145	-	-	-	59	
Thiruppanamur				-	-	-	-	1,201	4,802	-	-	-	-	
Ukkamperumbakkam	39	78		-	-	17	42	376	1,505	-	-	-	39	

Gram Panchayat	FD		GSS		ICP		LDI		LP		MI		NADEP	
	No.	No.	No.	No.	Plants	Length	No.	Area	Plants	Length	No.	Area	No.	No.
Umaiyalpuram	13	11	-	-	-	-	2	6	156	625	-	-	-	13
Vadailuppai	254		600	3,000	6	15	6	15	1,676	8,380	-	-	-	127
Vadakalpakkam	98		410	2,050	5	12	5	12	101	505	-	-	-	49
Vayalathur	8		636	3,180	-	1	-	1	79	394	-	-	-	4
Vedamanapakkam	206		-	-	-	30	12	30	1,273	6,365	-	-	-	103
Velliakulam	60		500	2,500	5	14	5	14	355	1,774	-	-	-	30
Vembakkam	216		328	1,640	22	54	22	54	3,018	15,089	-	-	-	108
Vengalathur	134		680	3,400	8	19	8	19	1,272	6,360	-	-	-	67

Gram Panchayat	ND		RPWDT	Roo	RP		RRWH	SPD		SPC	SPI	WCICD
	Plants	HH			No.	No.		No.	Area			
Abdullapuram	2,765	553	3	-	5	2	-	-	6			1,100
Alinjalpattu			3	-	2	2	-	-	-			-
Alividithangi	960	192	6	-	1	2	6,840	6	-			-
Arasanipalai	1,770	354	1	-	3	2	-	-	4			1,500
Arasankuppam	1,885	377	1	1	3	2	5,832	7	4			2,600
Ariyur	985	197	1	-	4	2	-	-	2			750
Brahmadesam	6,695	1,339	3	-	4	2	7,890	10	13	193		-
Cheyyanur	1,440	288	2	-	3	2	38,904	49	3			-
Chithathur	3,835	767	2	1	7	2	7,782	10	8			3,100
Cholavaram	2,415	483	6	4	5	2	-	-	5			7,000
Dusi	118	24	4	3	3	2	2,584	3	2			-
Elacheri	2,335	467	2	-	4	2	-	-	5	50		1,980
Hariharapakkam	1,315	263	2	-	4	2	2,520	3	3			2,050
Hasanamapettai	2,625	525	-	1	5	2	1,224	2	5			2,000
Irumaram	-	-	4	1	31	2	-	-	2			-
Kaganam	139	28	1	-	6	2	800	1				-
Karanthai	468	94	-	-	4	2	-	-	11	117		700
Kilnayakanpalayam	1,580	316	1	5	2	2	2,202	3	3			-
Kizhneli	2,865	573	3	1	10	2	90	0	6			3,540
Kodayambakkam	1,745	349	3	2	4	2	3,540	4	3			450
Kundiyanthandalam	845	169	1	-	4	2	492	1	2			1,630
Kuthanur	4,250	850	6	-	7	2	4,920	6	9			1,000
Mamandur	5,075	1,015	1	-	3	2	-	-	10			-
Mangal	890	178	2	-	6	2	1,260	2	2			-
Mathur	2,235	447	3	-	7	2	12,060	15	4			-
Menallur	3,045	609	-	-	7	2	13,578	17	6			1,500
Moonjurpattu			-	-	4	2	-	-	-			-
Moranam	3,560	712	2	-	8	2	684	1	7			2,300

Gram Panchayat	ND		RPWDT	Roo	RP	RRWH	SPD		SPC	SPI	WCICD
	Plants	HH					No.	Area			
Namandi	3,815	763	8	-	10	2	4,050	5	8		1,350
Narasamangalam	125	25	1	-	1	2	-	-			-
Natteri	5,795	1,159	3	-	15	2	-	-	12		-
Nemili	675	135	1	-	3	2	2,202	3	1		-
Pallavaram	2,150	430	-	-	4	2	-	-	4		5,100
Panamugai	1,145	229	2	-	6	2	-	-	2		-
Pavoor	1,575	315	1	-	6	2	402	1	3		-
Perungattur	4,375	875	3	-	11	2	2,442	3	9		2,400
Perunmanthangal	556	111	3	-	11	2	-	-	6	66	-
Pillanthangal	132	26	7	-	1	2	-	-			-
Poonathangal	815	163	1	1	3	2	4,392	5	2		2,000
Pudupalayam	1,235	247	-	-	2	2	-	-	2		-
Pulivalam	1,780	356	7	-	4	2	3,480	4	4		-
Pullavakkam	2,235	447	3	-	9	2	-	-	4		4,950
Punnai	480	96	1	-	3	2	20,800	26			-
Randam	3,565	713	5	6	5	2	4,248	5	7		1,500
Sattuvanthangal	1,815	363	2	1	3	2	204	0	4		1,200
Sirunallur	1,580	316	-	-	3	2	-	-			-
Sirunavelpet	2,725	545	2	10	3	2	840	1	5		3,000
Siruvanipattu	108	22	1	3	1	2	-	-	1	8	-
Sodiyambakkam	1,410	282	2	-	7	2	5,436	7	3		-
Sumangali	167	33	-	-	10	2	20,800	26			-
Suruttal	1,390	278	2	-	8	2	-	-	3		-
Thenkalani	2,855	571	2	-	6	2	-	-	6		-
Thennampattu	2,840	568	-	-	11	2	5,838	7	6		-
Thirupanganadu	297	59	2	-	10	2	1,600	2			-
Thiruppanamur			4	-	11	2	-	-	-		-
Ukkamperumbakkam	193	39	2	-	-	2	-	-	-		-

Gram Panchayat	ND		RPWDT	Roo	RP	RRWH	SPD		SPC	SPI	WCICD
	Plants	HH					No.	Area			
Umaiyalpuram	55	11	-	-	2	2	-	-	3	18	-
Vadailuppai	3,030	606	2	-	4	2	-	-	6	-	3,000
Vadakalpakkam	2,970	594	-	6	4	2	-	-	6	-	2,050
Vayalathur	1,000	200	-	2	-	2	-	-	4	-	3,180
Vedamanapakkam	3,250	650	3	9	-	2	13,626	17	7	-	-
Velliakulam	1,510	302	2	1	3	2	720	1	3	-	2,500
Vembakkam	3,460	692	2	-	11	2	3,384	4	7	-	1,640
Vengalathur	2,750	550	2	-	6	2	3,114	4	6	-	3,400

ANNEXURE 7.1

GP WISE WASCA RECOMMENDATION AND WORKS UPLOADED

GP	WASCA Recommendation for 3 Years	Works uploaded for FY-2021-22 as on 02/02/2022
Abdullapuram	323	343
Ariyur	222	308
Arasankuppam	506	166
Arasanipalai	526	212
Azhinjalpattu	253	354
Azhividaithangi	510	410
Brammadesam	1352	276
Cheyyanur	412	245
Chithathur	450	255
Dusi	1092	220
Elacheri	544	374
Hariyarakkamm	565	227
Hasanamapet	519	54
Irumaram	617	222
Kaganam	496	174
Karanthai	322	240
Kizhnelli	1017	299
Kodaiyambakkam	410	199
Kundiyanthandalam	286	108
Kuthanur	1097	376
Keelnayakanpalayam	320	160
Mamandur	716	270
Mathur	703	82
Maangal	558	124
Menallur	684	201
Moranam	1348	319
Moonjurpattu	156	283
Namandi	816	172
Narasamangalam	211	148
Natteri	1014	436
Nemili	224	141
Pallavaram	608	161
Panamugai	307	274
Pavor	352	279
Perungattur	482	147
Perunmanthangal	313	326
Pillanthangal	232	252
Pudupalayam	365	117
Pulivalam	304	374
Pullavakkam	720	387
Punnai	481	148
Poonathangal	425	140

GP	WASCA Recommendation for 3 Years	Works uploaded for FY-2021-22 as on 02/02/2022
Rantham	897	352
Sattuvanthangal	411	492
Sirunallur	246	123
Sirunavalpattu	485	287
Siruvanjiipattu	162	343
Sodiyambakkam	350	201
Sozhavaram	950	479
Sumangali	359	236
Suruttal	294	238
Thenkazhani	185	380
Thiruppanangadu	375	230
Thennampattu	865	316
Thiruppanamur	413	352
Ukkamperumpakkam	322	360
Umaiyalpuram	848	214
Vadailuppai	136	292
Vadamanapakkam	461	155
Vadakalpakkam	457	141
Vellakulam	324	432
Vembakkam	925	211
Vengalathur	687	383
Vayalathur	235	170
Total	33,245	16,390

ANNEXURE 7.2

GP AND WORK CATEGORY -WISE ONGOING WORKS IN VEMBAKKAM BLOCK

GP	Work Category	No. of ongoing works
Abdullapuram	Rural Sanitation	1
Arasanipalai	Water Conservation and Water Harvesting	2
Arasankuppam	Water Conservation and Water Harvesting	2
Azhividaithangi	Water Conservation and Water Harvesting	3
	Works on Individuals Land (Category IV)	16
Brammadesam	Water Conservation and Water Harvesting	3
	Works on Individuals Land (Category IV)	1
Cheyyanur	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	5
Elacheri	Water Conservation and Water Harvesting	2
Hariyarpakkam	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	2
Hasanamapet	Renovation of traditional water bodies	1
	Works on Individuals Land (Category IV)	2
Irumaram	Drought Proofing	1
	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	7
Kaganam	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	9
Karanthai	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	3
Keelnayakanpalayam	Drought Proofing	2
	Water Conservation and Water Harvesting	1
Kizhnelli	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	11
Kodaiyambakkam	Drought Proofing	1
	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	2
Kundiyanthandalam	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	11
Kuthanur	Works on Individuals Land (Category IV)	5
Maangal	Water Conservation and Water Harvesting	1
Mamandur	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	15
Mathur	Water Conservation and Water Harvesting	1
Menallur	Water Conservation and Water Harvesting	2
Moonjurpattu	Renovation of traditional water bodies	1
Moranam	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	1
Namandi	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	2

GP	Work Category	No. of ongoing works
Narasamangalam	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	4
Natteri	Works on Individuals Land (Category IV)	4
Nemili	Works on Individuals Land (Category IV)	1
Pallavaram	Water Conservation and Water Harvesting	2
Pavoor	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	2
Perungattur	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	3
Perunmanthangal	Water Conservation and Water Harvesting	2
Pillanthangal	Works on Individuals Land (Category IV)	4
Poonathangal	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	1
Pudupalayam	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	1
Pulivalam	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	2
Pullavakkam	Works on Individuals Land (Category IV)	3
Punnai	Water Conservation and Water Harvesting	1
Sirunallur	Rural Connectivity	1
	Water Conservation and Water Harvesting	1
Siruvanjiipattu	Water Conservation and Water Harvesting	1
Sodiyambakkam	Water Conservation and Water Harvesting	1
Sozhavaram	Works on Individuals Land (Category IV)	2
Sumangali	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	6
Thenkazhani	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	1
Thennampattu	Water Conservation and Water Harvesting	2
Thiruppanamur	Rural Sanitation	5
Thiruppanangadu	Anganwadi/Other Rural Infrastructure	1
	Water Conservation and Water Harvesting	2
Ukkamperumpakkam	Water Conservation and Water Harvesting	1
Vadailuppai	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	13
Vadakalpakkam	Water Conservation and Water Harvesting	1
Vellakulam	Drought Proofing	1
	Water Conservation and Water Harvesting	1
Vembakkam	Drought Proofing	1
	Rural Connectivity	1
	Water Conservation and Water Harvesting	2
Vengalathur	Rural Sanitation	1
	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	9
Total		231

ANNEXURE 8

KEY CWRM PARAMETERS FOR THE GP'S FALLING IN KALPATTU MICRO-WATERSHED

Key CWRM Parameter	Natteri	Kuthanur
Soil Resources: Status of Available Nitrogen (%)		
Very Low	5.16	-
Low	94.84	100.00
Status of Organic Carbon (%)		
Very Low	27.42	17.54
Low	72.18	80.70
Status of Soil Micro Nutrients (%)		
Sufficient	63	66
Deficient	37	34
Status of Physical condition of the soil (%)		
Moderately Acidic	0.790	-
Slightly Acidic	0.790	-
Moderately Alkaline	98.410	100.000
Soil Texture (%)		
Clay soil	8	32
Fine Soil	79	48
Course loamy	1	-
Soil Water Permeability (Low, Moderate, high)	Moderate	Moderate
Soil moisture and ET		
Volumetric Soil Moisture (%)	23	23
Estimated Soil Moisture (ha.m)	375.69	187.19
ET Losses (ha.m)	434.92	239.19
Means of Water Extraction (%)		
Gravity	5.52	10.41
Lifting	94.48	89.59
Irrigation Methods (%)		
Wild Flooding	70.05	-
Control Flooding	29.95	100.00
Livestock (No.)		
Cattle Population	3,168	1,183
Sheep Population	302	354
Goat Population	1,335	373
Land Resources (ha)		
Non-Agricultural Uses	293.14	333.30
Barren & Un-cultivable Land	-	-
Permanent Pastures and Other Grazing Land	-	8.20
Land Under Miscellaneous Tree Criticalops etc.	31.85	6.15
Cultivable Waste Land	12.85	-
Fallows Land other than Current Fallows	90.00	80.48
Current Fallow land	989.65	435.90
Unirrigated Land	80.83	54.11
Area Irrigated by Source	428.27	229.04







**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