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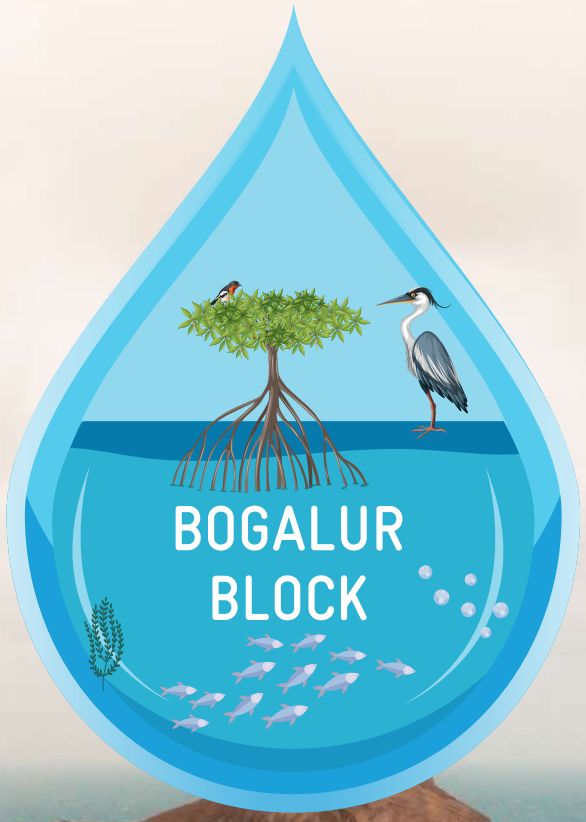
WATER SECURITY AND CLIMATE ADAPTATION IN RURAL INDIA



SUSTAINABLE DEVELOPMENT GOALS

Block Level Composite Water Resources Management Plan under Mahatma Gandhi NREGS

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

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WATER SECURITY AND CLIMATE ADAPTATION IN RURAL INDIA

Block Level Composite Water Resources Management Plan under Mahatma Gandhi NREGS

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

FOREWORD

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

FOREWORD

Rajeev Ahal
Director,
NRM & Agroecology, GIZ India

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

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

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

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

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

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

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

We look forward to its success!

Rajeev Ahal
Director,
NRM & Agroecology, GIZ India

MESSAGES

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

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

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

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

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

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

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

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

MESSAGES

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

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

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

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

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

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

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ABBREVIATIONS AND ACRONYMS

A - D

%
Percentage

^{0}C
Degree Celsius

AR
Assessment Report

CCB
Contour Continuous Bunds

CCCDM
Centre for Climate Change and Disaster Management

CRM
Climate Resilient Measures

CuM
Cubic Meter

CVI
Climate Vulnerability Index

CWRM
Composite Water Resource Management

CWRMP
Composite Water Resource Management Plan

DEM
Digital Elevation Model

D - G

DLSC
District Level Steering Committee

DLT
Drainage Line Treatment

DRD&PR
Department of Rural Development & Panchayat Raj

EC
End Century

ET
Evapo-transpiration

FPO
Farmer Producer Organization

FY
Financial Year

GIS
Geographical Information System

GIZ
Deutsche Gesellschaft für Internationale

Govt.
Government

GP
Gram Panchayat

GW
Ground Water

H - K

ha
Hectare

ha.m
Hectare Meter

HH
Households

ICAR
Indian Council for Agriculture Research

IMD
Indian Meteorological Department

INR
Indian Rupees

IPCC
Intergovernmental Panel on Climate Change

IWRM
Integrated Water Resources Management

Kharif crop
Sown in Monsoon and harvested close to Autumn

km
Kilometer

KML
Keyhole Markup Language

L - M

LULC
Land use and land cover

Max
Maximum

MCM
Million Cubic Meter

MC
Mid Century

Mahatma Gandhi NREGA
Mahatma Gandhi Rural Employment Guarantee Act

Mahatma Gandhi NRGES
Mahatma Gandhi Rural Employment Guarantee Scheme

Min
Minimum

mm
Millimeter

MoEFCC
Ministry of Environment, Forest and Climate Change

MoJS
Ministry of Jal Shakti

MoRD
Ministry of Rural Development

m
Meters

N - P

NAPCC
National Action on Climate Change

NARP
National Agricultural Research Project

NADEP
Nadepkaka

NDC
Nationally Determined Contributions

NEM
North-East monsoon

NGO
Non-Governmental Organization

NITI
National Institution for Transforming India

No.
Number

NRM
Natural Resource Management

NRSC
National Remote Sensing Centre

NWC
National Water Commission

PWD
Public Works Department

R - S

Rabi crop
Sown in winter and harvested in monsoon

RDPR
Rural Development & Panchayat Raj

RF
Reserve Forest

RTRWHS
Roof top rain water harvesting structures

RWHS
Rain Water Harvesting System

SAPCC
State Action Plan on Climate Change

SC
Scheduled Caste

SDG
Sustainable Development Goal

SDMA
State Disaster Management Authority

SDMRI
Suganthi Devadasan Marine Resources Institute

SECC
Socio Economic and Caste Census

S - W

SHG
Self Help Group

SLSC
State Level Steering Committee

ST
Scheduled Tribe

SWM
South-West monsoon

SW
Surface Water

TN
Tamil Nadu

UN
United Nations

WASCA
Water Security and Climate Adaptation

WCWH
Water Conservation and Water Harvesting

வான்நின்று உலகம் வழங்கி வருதலால்
தான்அமிழ்தம் என்றுணரற் பாற்று

குறள் - 11

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

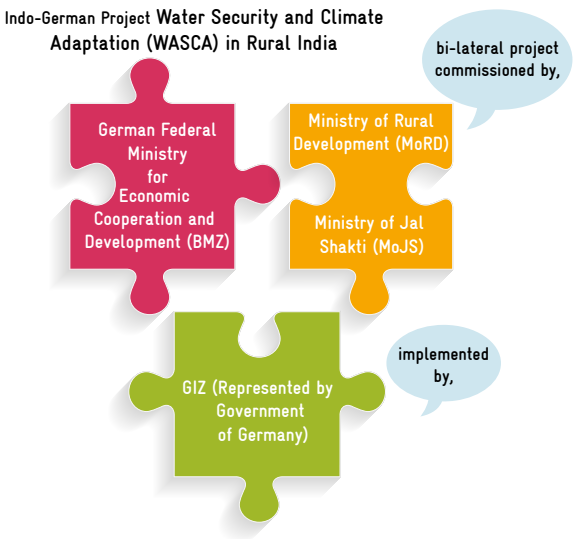
Thirukkural - 11

EXECUTIVE SUMMARY

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

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

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



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

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

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

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

This report is structured with nine complete chapters

1

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

2

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

3

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

4

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

5

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

6

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

7

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

8

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

9

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

துப்பார்க்குத் துப்பாய துப்பாக்கித் துப்பார்க்குத்
துப்பாய தூஉம் மழை

குறள் - 12

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

Thirukkural - 12

CHAPTER 1

1 ABOUT THE BLOCK

Bogalur Block of Ramanathapuram District, Tamil Nadu state lies between 9°19'42.692"N to 9°30'16.58"N latitude and 78°36'57.618"E to 78°47'14.374"E longitude. This Block is surrounded by Ramanathapuram, Nainarkovil, Paramakkudi, Mudukulathur and Thiruppullani Blocks (Figure 1.1). The total geographical area of Block is 21,514 ha (215.14 Km^2). This Block has 26 Gram Panchayats with 91 hamlets.

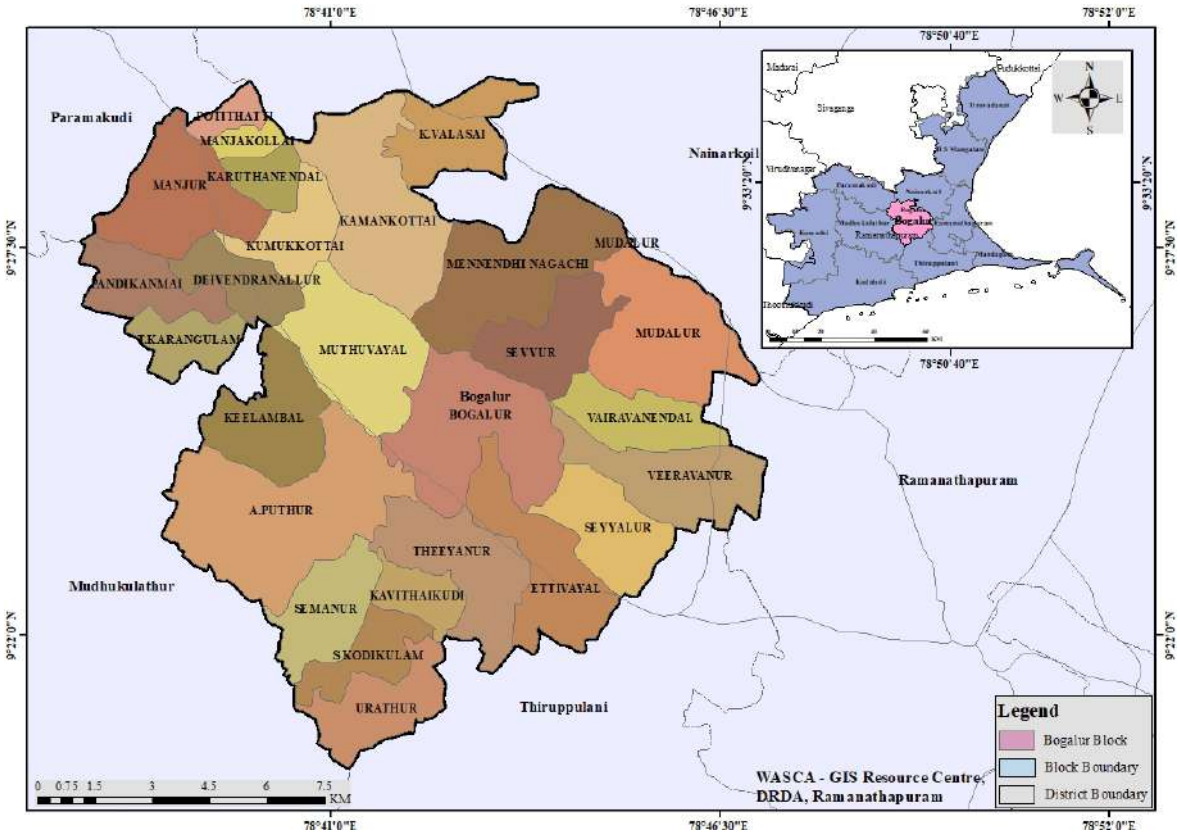


Figure 1.1. Bogalur Block and it's environ

According to Census 2011, the population of the Block is 39,525. The population density of the Block is 227 per Km^2 which is much lower than the District (331Km2) and the State's density (555 Km^2). There is 4.10% increase of in population, observed since 2001, the rate of population increase is very low in Block. The proportion of sex ratio is 972 females for 1000 males. The average literacy rate of this Block is 75.56 % which is much higher than the national average (72.98%). The male literacy rate is high (85.34%) than female literacy rate (65.53%). Vulnerable population, Scheduled Castes and Scheduled Tribes accounted for 42.82 % of the total population. Among the eleven blocks in Ramanthapuram district, this Block has a higher percentage of scheduled caste population.

Economically, this rural Block is one of the Backward Block, the Human Development Index is very low among the District. According to the State Planning Commission, Government of Tamil Nadu's Human Development Report – 2017, 36 % families are in below poverty line (BPL). People of the Block are dependent on the agriculture and allied activities. Paddy is the predominant crop both under irrigated and rainfed conditions 70.19% of the crop area being cultivated by paddy. Dry chilli, Cotton, Sesame and Ground nut are cultivated in small areas. There are 19 milk societies in the Block with 4.2 lakh liters being produced.

> The proportion of sex ratio is 972 females for 1000 males.

> The average literacy rate of this Block is 75.56 % which is much higher than the national average (72.98%)

> 70.19% of the crop area being cultivated by paddy

Hydrologically, Bogalur Block lies in Vaigai and Gundar basin and Lower Vaigai and Uthirakosamangaiyar sub basins. Vaigai River flows through the Block. Lower Vaigai and Terkku Upper macro-watersheds cover the Block and has 48 micro-watersheds. (Figure 1.2). Situated in rain shadow area, Ramanathapuram District has an extraordinary tank irrigation system which was built hundreds of years ago.

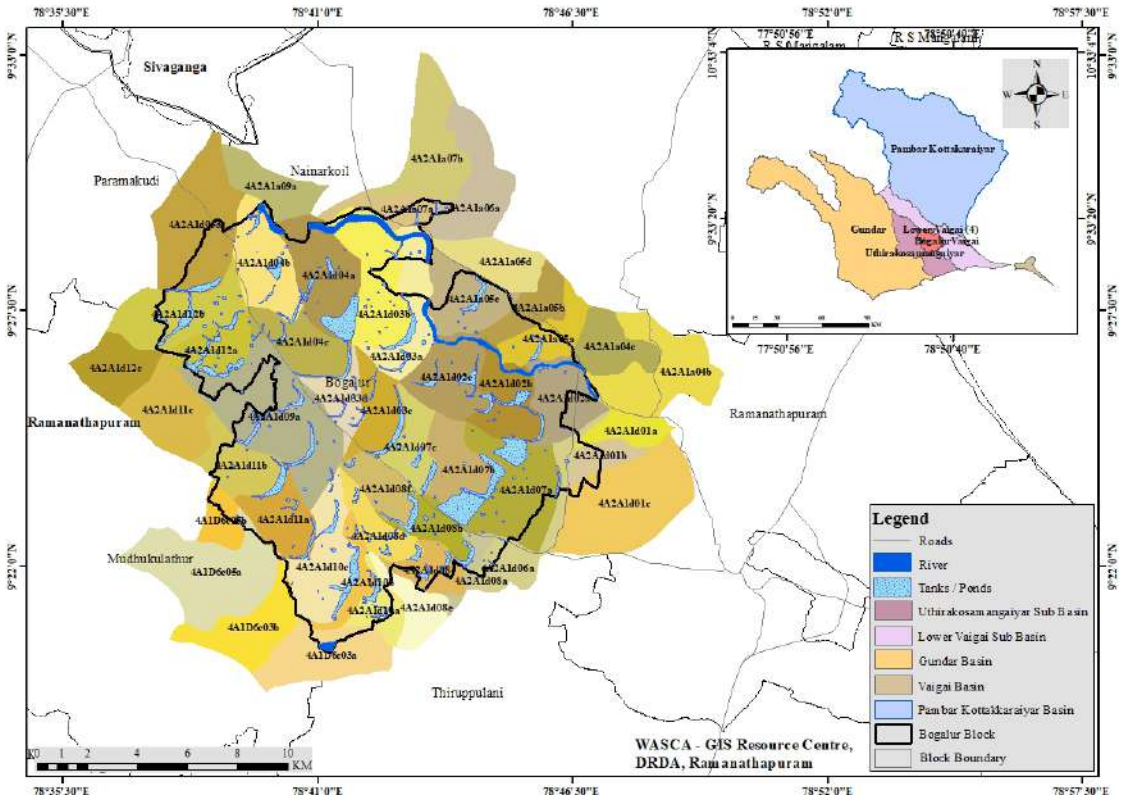


Figure 1.2. Watersheds – Bogalur Block

The tanks were designed in such a way that the outflow from one tank would serve as the inflow for the next tank after it has reached its capacity, allowing the excess water to flow out into the next tank. Water harvesting structures 'Ooranis' also play a huge role in groundwater conservation and recharge, guaranteeing availability of safe drinking water and useful for farmers who do not have water source for irrigation or find it expensive. While this Block has 87 tanks: 49 Ex-zamin MI tanks, 5 panchayat MI tanks, 33 PWD tanks (Vaigai basin) (Human Development Report 2017). Figure 1.3 shows the spatial distribution of water bodies in this Block. Bogalur covers the Block, and is safe in ground water development (CGWB's ground water assessment report 2017).

GROUND WATER LEVEL OF THIS BLOCK

SAFE - <70%	Mandapam, Perunkulam

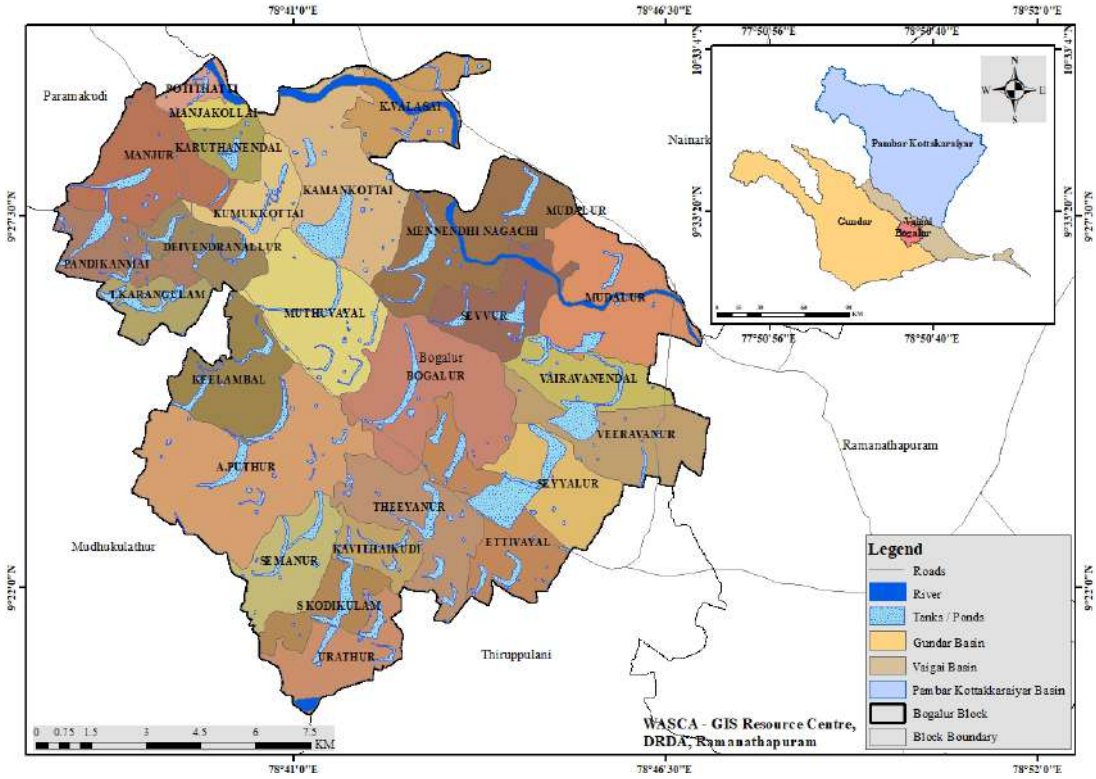
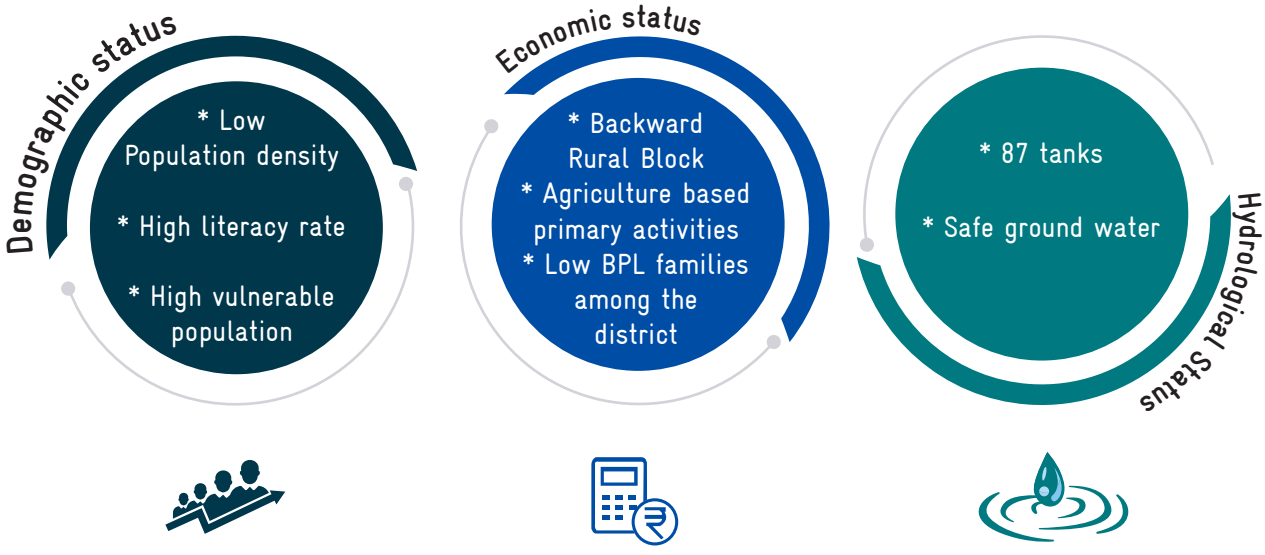


Figure 1.3. Spatial distribution of waterbodies



விண்இன்று பொய்ப்பின் விரிநீர் வியனுலகத்து
உள்நின்று உடற்றும் பசி

குறள் - 13

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

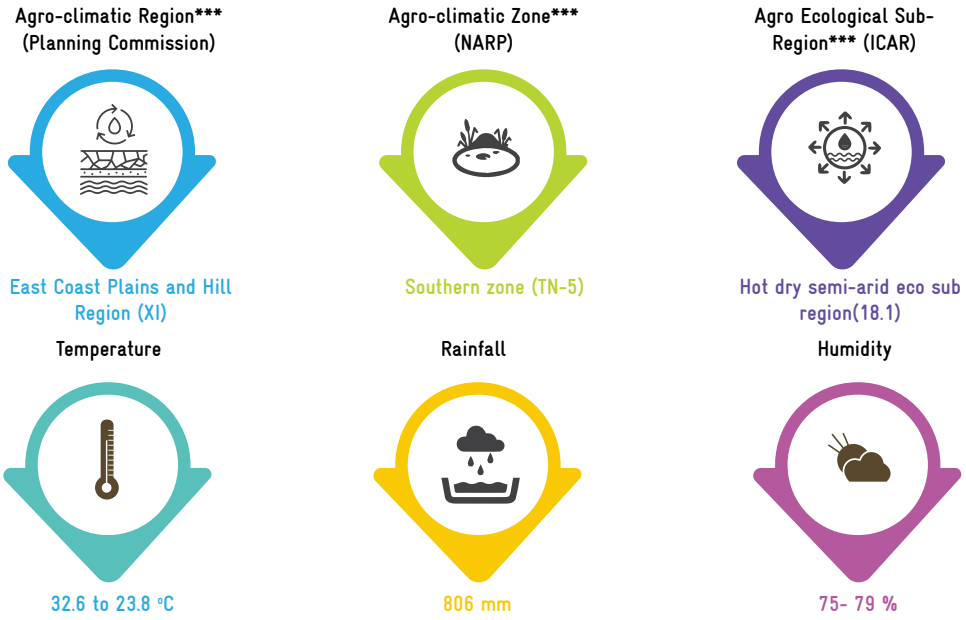
Thirukkural - 13

CHAPTER 2

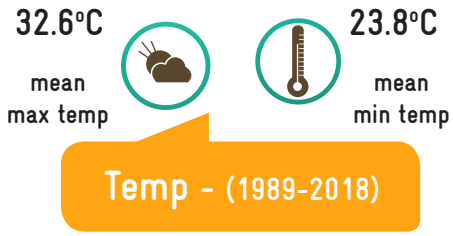
2 CLIMATE AND WATER SECURITY

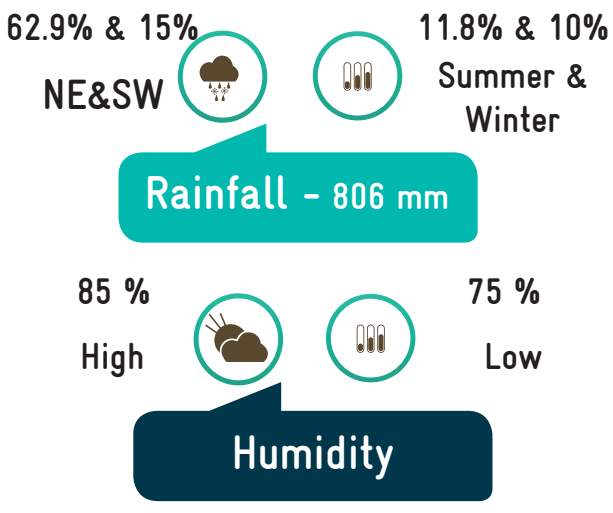
Water has always been a contentious subject in this region. This semi-arid region is classified as southern agro-climatic zone of State and East coast plains and Hills region according to the agro climatic regional classification of planning commission. The general climate description of this region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

TABLE 1. GENERAL CLIMATE DESCRIPTION



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





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

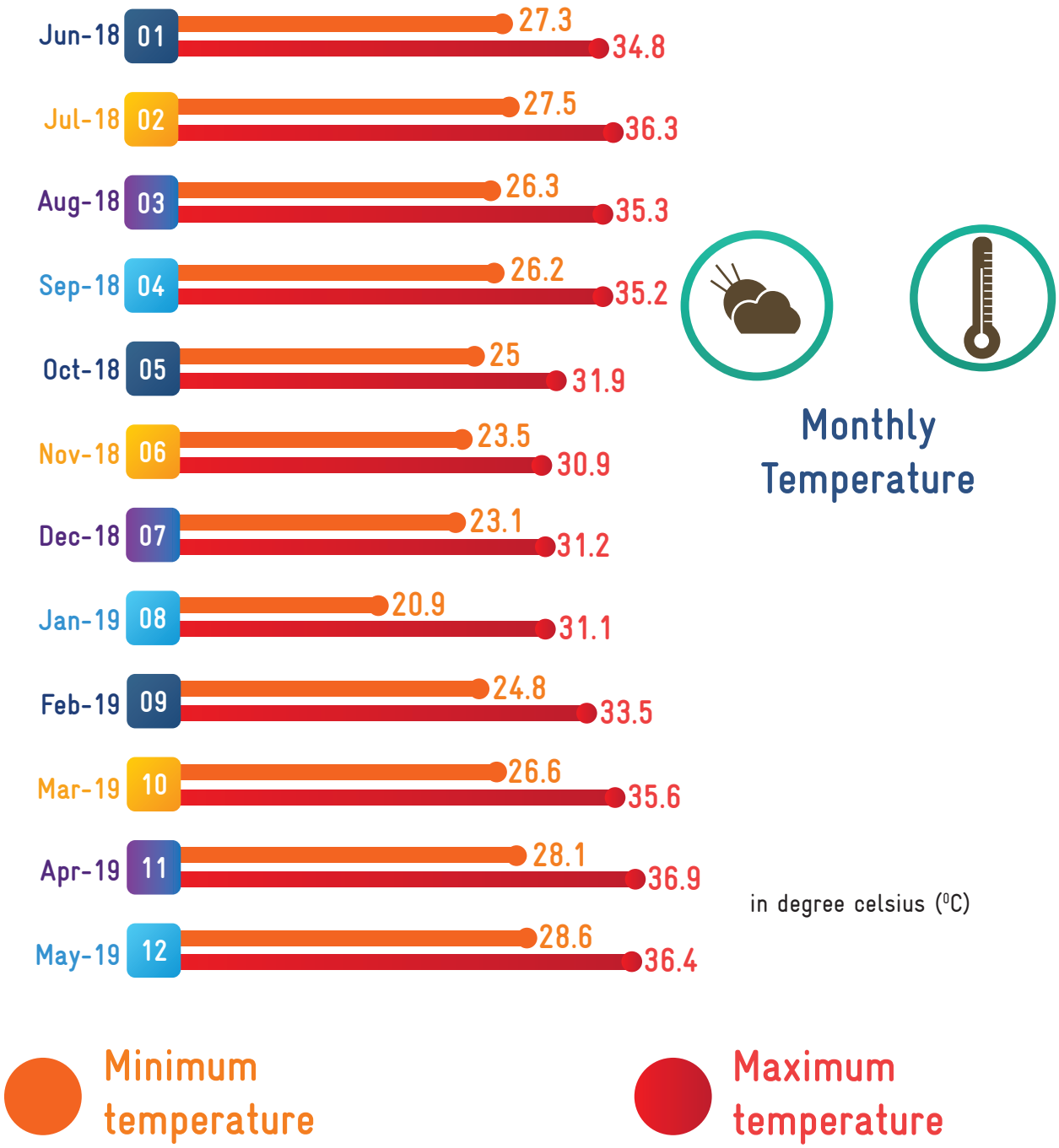


Figure 2.1. Monthly average maximum and minimum temperature

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

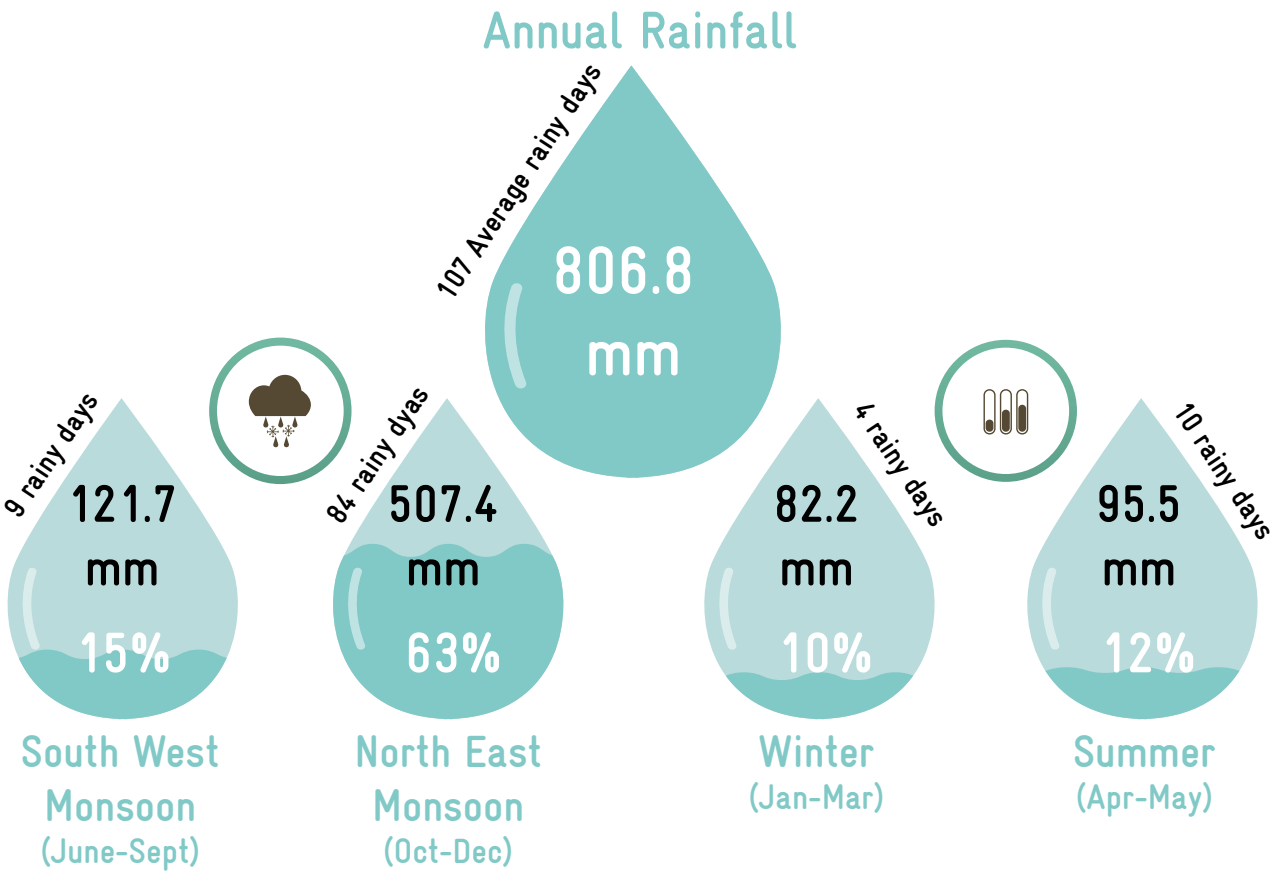


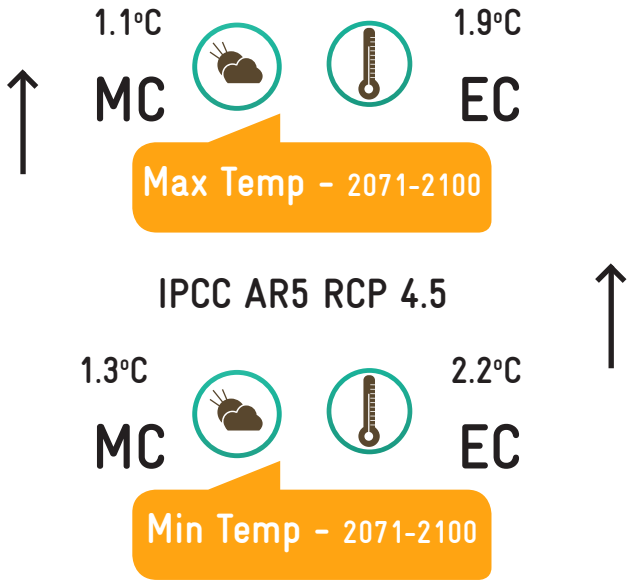
Figure 2.2. Season wise distribution to annual rainfall

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

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

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

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



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

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

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

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

2.1 CLIMATE RISKS

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

* Frequent Droughts
* Cyclones
* Flood inundation

Drought

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

Cyclones

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

Flood

Though it is a low rainfall region, it experiences heavy rain and floods during deep depressions/cyclones forms in the Bay of Bengal. State Disaster Management Authority (SDMA), Government of Tamil Nadu has identified 39 locations of Ramanathapuram District as flood vulnerability of medium category (inundation of water from 2 to 3 feet) based on past events (Ramanathapuram District Disaster Management Plan 2020-2021, SDMA). According to State Disaster Management Authority report, 5 locations are moderately vulnerable to floods in Bogalur Block

Sea level rise

Sea level rise (SLR) is one of the greatest challenges of the low-lying coastal regions of the world. Recent Intergovernmental Panel on Climate Change (IPCC) 2021 report cautioned that the average rate of SLR was 1.3mm/yr. (1901-1971) and rose by 03.7mm yr. (2006-2018), and it would continue to rise to 2 m by the end of the Century under a very high emissions scenario (SSP5-85 low confidence) (IPCC, 2021). IPCC cautions that coastal areas will get continued SLR throughout the 21st century, contributing to more frequent and severe coastal flooding in low-lying areas and coastal erosion. This coastal region will also face sea level rise and future SLR projection studies indicate that there would be 4.51 cm (low range)/ 7.21cm (medium range) increase for the year 2025 and it would be 30.29 (low range), 49.10 cm (medium range) under IPCC AR5-RCP 4.5 scenario (CCCDM, Anna University). In Ramanathapuram district, about 180 coastal habitations are identified for coastal vulnerability based on their distance from sea shore, soil erosion, and saltwater intrusion (Ramanathapuram District Disaster Management Plan 2021-2022). In Bogalur Block there are no vulnerable habitations.

2.2 WASCA CLIMATE VULNERABILITY INDICATORS

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

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

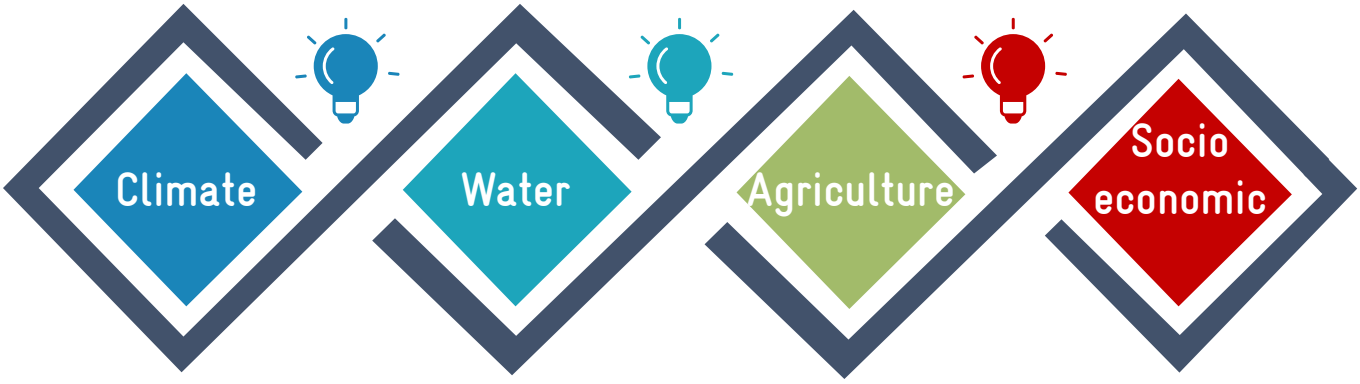
CWRM	Indicators of Rural water security vulnerability	Indicators label	Linked SDG
Climate	Changes in max temperature (^{O}C)	C1	Goal 13
	Changes in min temperature (^{O}C)	C2	
	Changes in rainfall (%)	C3	
	Excess rainfall years	C4	
	Deficient rainfall years	C5	
Water	Ground water extraction (%)	W1	Goal 6
	Ground water Recharge (m^3)	W2	
	Surface water availability (mm)	W3	
	Water gap (mcm)	W4	
	% of contamination	W5	
Agriculture	Rainfed area (%)	A1	Goal 15
	Cropping intensity (%)	A2	Goal 2
	Soil moisture (Kg/m^2)	A3	Goal 15
	Evapo-transpiration (Kg/m^2)	A4	
Socio-economic	Rural proportion (%)	S1	Goal 2
	Multidimensional poverty index	S2	Goal 1
	Source of drinking water within premises in rural (%)	S3	Goal 6
	Marginal farmers land holdings (%)	S4	Goal 1

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

2.3 COMPREHENSIVE ANALYSIS OF BLOCK LEVEL VULNERABILITY

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

TABLE 3. MAJOR PARAMETERS IDENTIFIED FOR BLOCK LEVEL VULNERABILITY ASSESSMENT



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

ஏரின் உழாஅர் உழவர் புயலென்னும்
வாரி வளங்குன்றிக் கால்

குறள் - 14

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

Thirukkural - 14

CHAPTER 3

GRAM PANCHAYAT PLANNING IN MAHATMA GANDHI NREGS

3 GRAM PANCHAYAT PLANNING IN MAHATMA GANDHI NREGS

WASCA, GIZ has evolved a GP based CWRM planning approach for facilitating convergent planning under Mahatma Gandhi NREGA as per the recommendations of National Level Workshop organized by MoRD, MoJS, GIZ along with State Rural Development Department of WASCA implementing states in February 2020. While developing the framework, inputs from all the relevant stakeholders including communities, public institutions, civil society, research organizations, and private agencies were taken into consideration. Both the Annual Master Circular issued by MoRD during 2021-22 and the Annual Planning Circular issued in September 2020 focused on developing GIS based planning in all Gram Panchayats. The planning exercise for Mahatma Gandhi NREGS will be a part of the convergent planning exercise for the Ministry. The thrust is on planning for works related to Natural Resource Management (NRM), agriculture and allied activities and livelihood related works on individual lands leading to sustainable livelihoods as well as provisioning of livestock shelters for the individual households. The NRM related works under Mahatma Gandhi NREGS shall be taken up in convergence with Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), Integrated Watershed Management Programme (IWMP) and Command Area and Water Management (CAD&WM) schemes for better outcomes of the water conservation and water harvesting measures. Technical inputs for planning shall be drawn from the technical resources available in the District under Mahatma Gandhi NREGS, CSO partners and other line department agencies. In case of planning for NRM works, the technical inputs will be drawn from the joint pool of technical personnel of IWMP in Watershed Cell cum Data Centre (WCDC), Mahatma Gandhi NREGS unit, Water Resource Department and the Agriculture Department. The technical inputs relating to Excavation, Renovation & Modernization (ERM)/ water bodies may also be sought from Regional Office of Central Ground Water Commission (CWC). The Gram Panchayats, while deliberating and finalizing prioritization of shelf of projects, will keep in perspective the macro and micro-watersheds of 500-1000 hectares that often comprise of 1-10 Gram Panchayats.

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

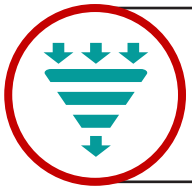
262 Total Kinds of works in Schedule-I of Mahatma Gandhi NREGA

182 Kinds of works relate to NRM alone

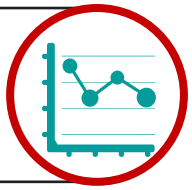
164 Kinds of works related to Agriculture & allied works

85 Water related works out of NRM

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



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

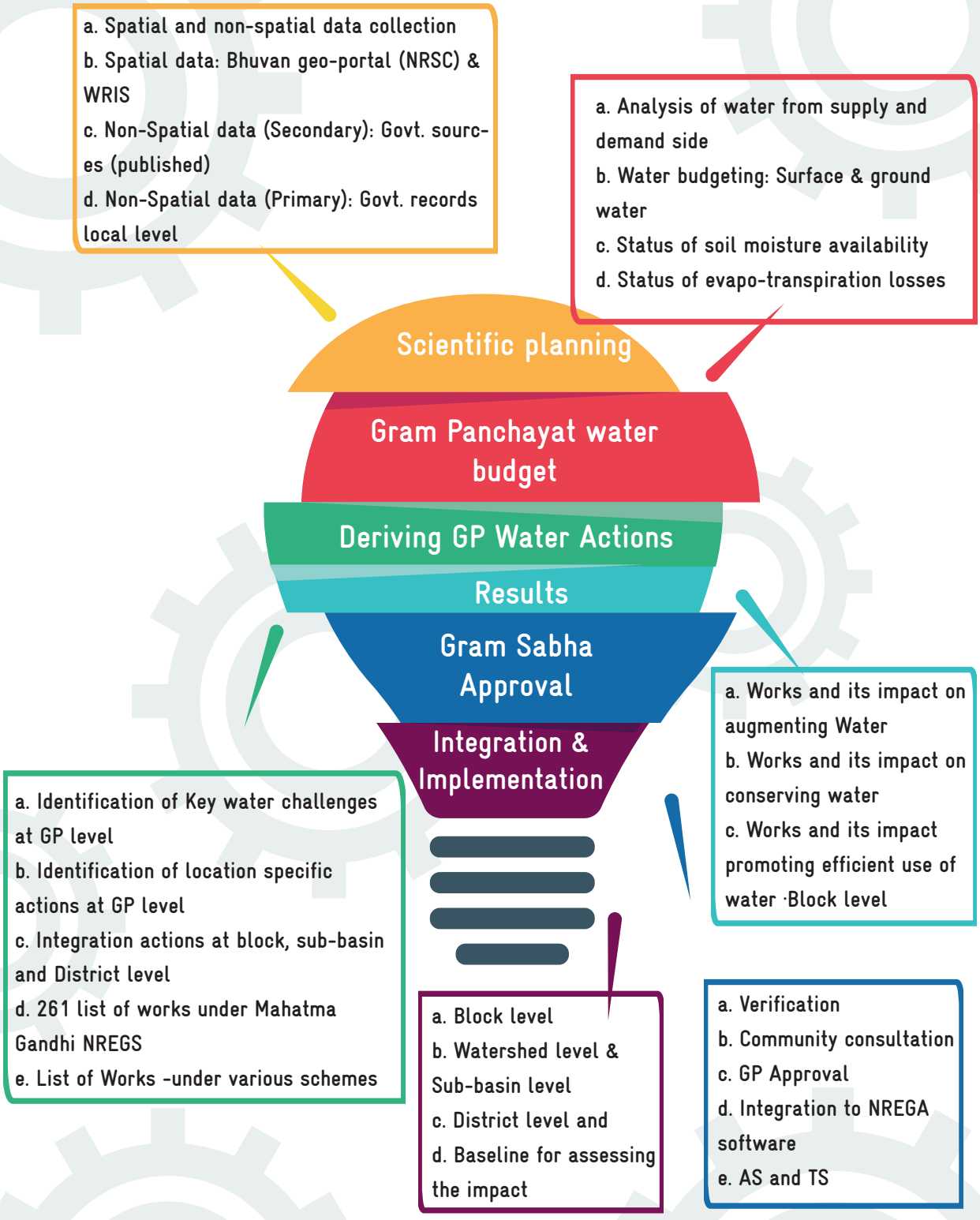


3.1 COMPOSITE WATER RESOURCE MANAGEMENT APPROACH

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

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

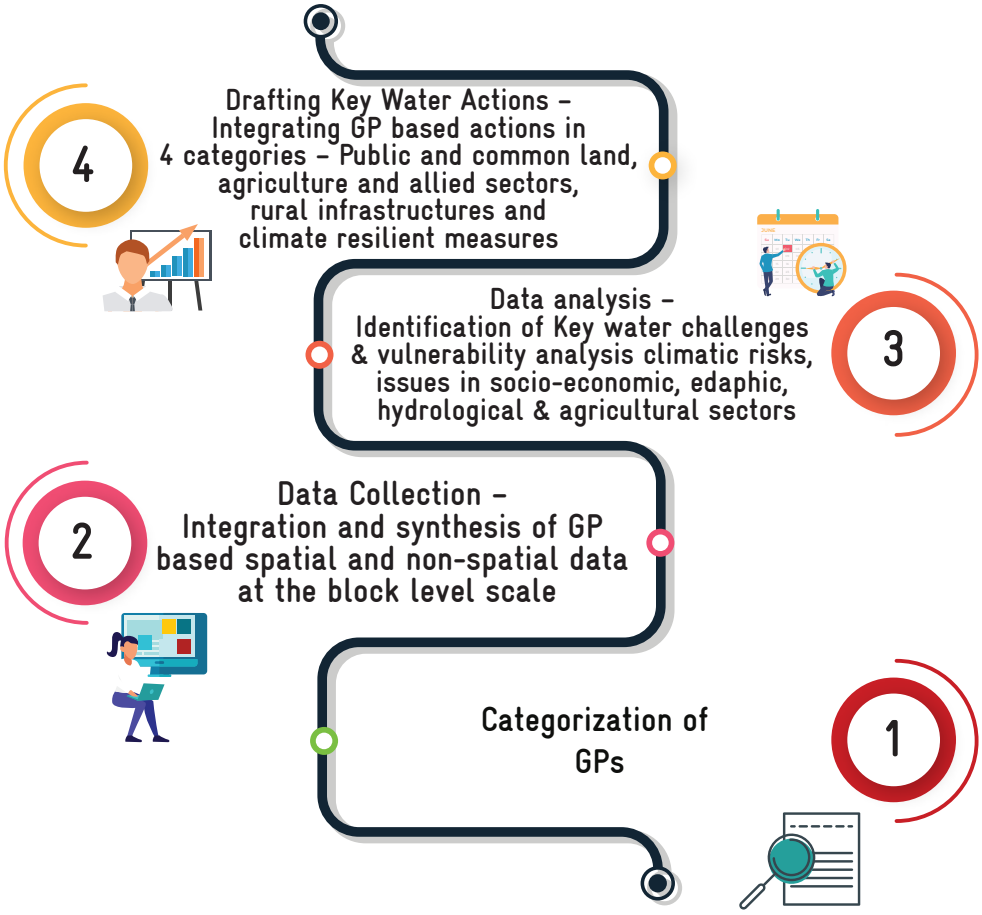
BOX 1. MAJOR COMPONENTS INVOLVE IN CWRM PLANNING WORKOUTS



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

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

STEPS INVOLVED IN BLOCK LEVEL ANALYSIS THROUGH CWRM APPROACH



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

BOX 2. STAGES OF CWRM PLANNING PROCESS

PRE-PLANNING STAGE

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

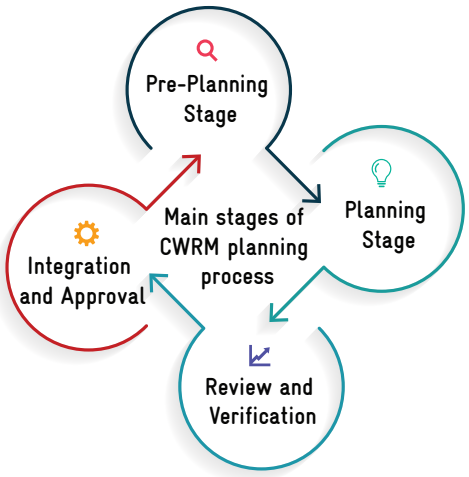
PLANNING STAGE

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

FOUR LEVELS OF CWRM PLANNING UNDER WASCA

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

2. INTEGRATING GP LEVEL PLANS AT BLOCK LEVEL



FOUR LEVELS OF CWRM PLANNING UNDER WASCA

3. INTEGRATING GP PLANS AT WATERSHED AND SUB-BASIN (CATCHMENT) LEVEL ON NRM

4. INTEGRATING GP PLANS TO DEVELOP WASCA DISTRICTS CWRM PLANS

INTEGRATION AND APPROVAL

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

REVIEW AND VERIFICATION

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

3.2 CATEGORIZATION OF GPs

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

TABLE 4. CATEGORIZATION OF BOGALUR BLOCK GPs

NUMBER OF GP	GP TYPE	NAME OF THE PANCHAYAT
8	GP and revenue village data and boundary match (Type-I)	Ettivayal, Bogalur, Manjur, Mudalur, Semanur, Sevvur, Seyyalur, Theeyanur
8	Having more than one GPs in one Revenue Village (Type-II)	Kodikulam, Kavithakudi, Kumukottai, Thievendranallur, Manjakollai, Karudhanendhal, Veeravenur, Vairavenandhal
3	One GP is falling under more than Type 1 one Revenue Village (Type III)	Kamankottai, Mennendhinagachi, Urathur
7	GPs having more than one GP, one Revenue Villages data, boundary (Type-IV)	Ariyakudipudhur, Keelambal, Muthuvayal, K.Vasalai, Pottithatti, Pandikanmai, T.Karungulam

3.3 DATA COLLECTION – SPATIAL & NON SPATIAL

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

SPATIAL DATA

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

NON SPATIAL DATA

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

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

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

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

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

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

ASSESSMENT OF GROUND WATER QUALITY AND SEA WATER INTRUSION

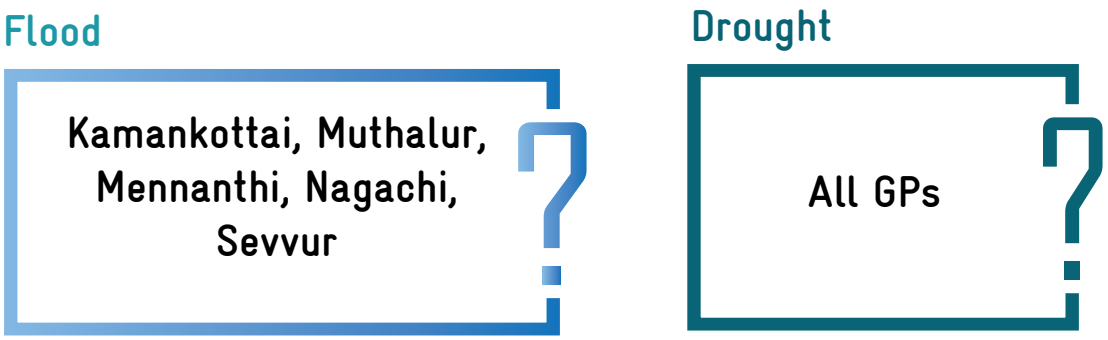
The vulnerability of the groundwater quality, seawater intrusion in the aquifers were assessed and spatially mapped for Ramanathapuram District. The water quality samples were collected from 380 locations throughout the District during pre-monsoon and post-monsoon season. The collected samples were analyzed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

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

3.4 CWRM PLANNING ANALYSIS – CLIMATE

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

TABLE 5. CLIMATE RISKS AND VULNERABLE GP's



3.5 CWRM PLANNING ANALYSIS – WATER

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

3.5.1 SPATIAL DATA

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

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

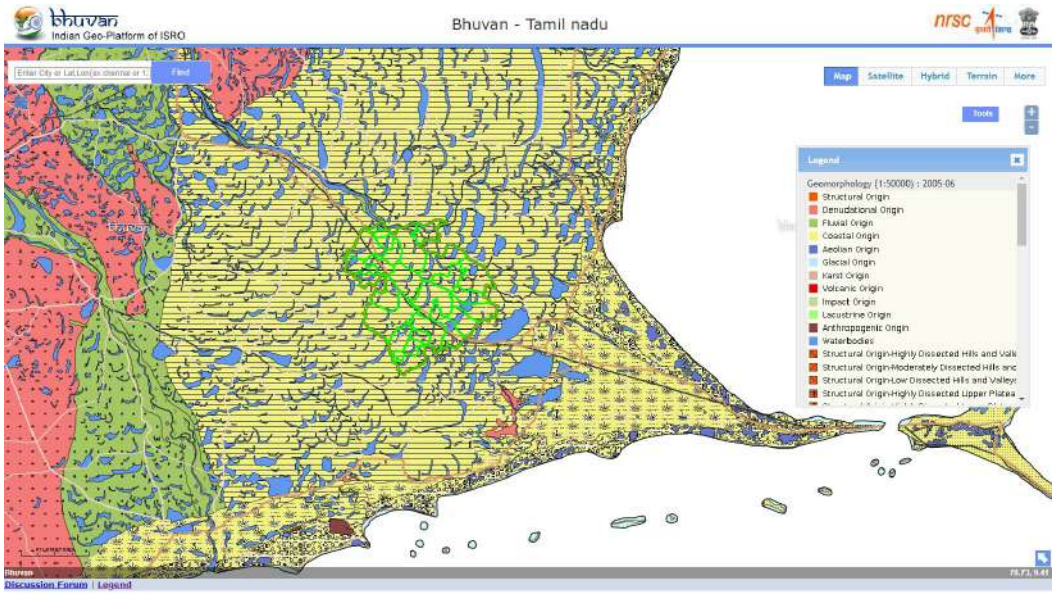


Figure 3.1. Geomorphology map

Landform unit	Area coverage in %	Gram Panchayat
Coastal Origin - Older Deltaic Plain		
	100%	A.Puthur, Bogalur, Deivendranallur, Ettivayal, K.Valasai, Kamankottai, Karuthanenthal, Kavithaikudi, Keelampal, Kumukkottai, Manjakkollai, Manjur, Mennanthi Nagachi, Muthalur, Muthuvayal, Pandikanmai, Pottithatti, S.Kodikulam, Semanur, Sevvur, Sheiyalur, T.Karungulam, Theeyanur, Urathur, Vairavanendal, Veeravanur

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

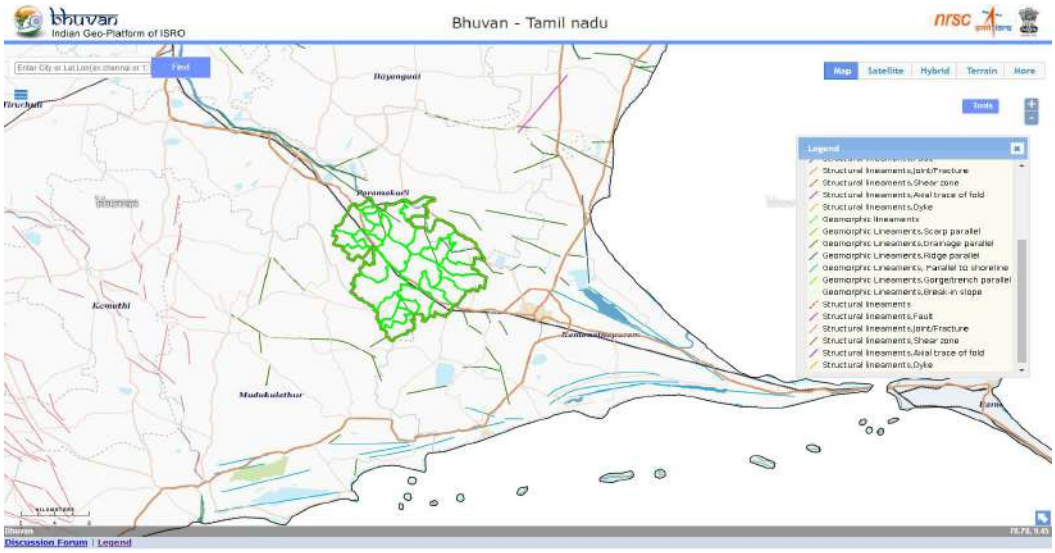


Figure 3.2. Lineament map

Lineament type	Gram Panchayat
Geomorphic lineaments, Drainage parallel	
	K.Valasai, Karuthnendhal, Kavithaikudi, Kumukottai, Mennandhi Nagachi, Mudalur, Sevvur, Kamankottai

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

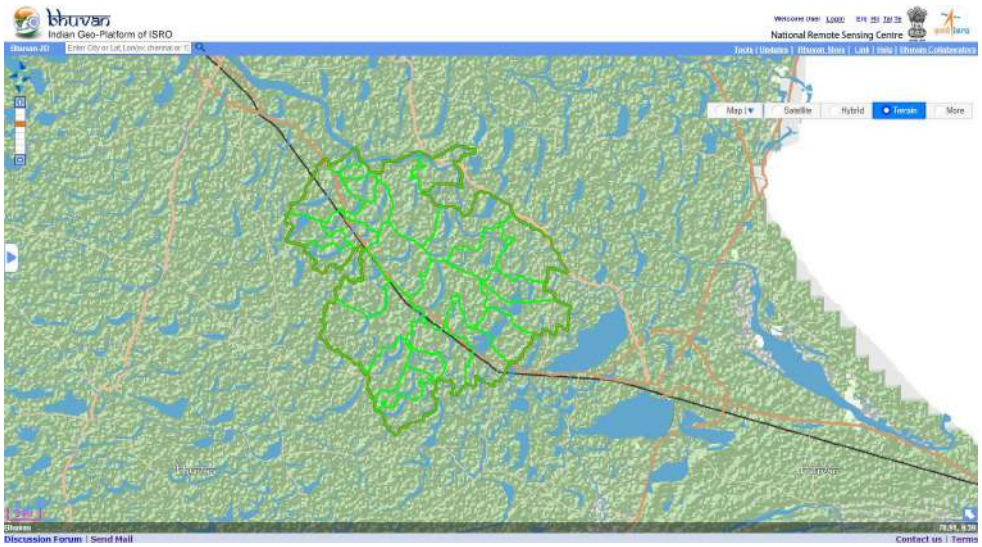


Figure 3.3. Terrain map

3.5.1.4 DEM: The DEM is an important element in the representation of the terrain and only one which determines relief forms such as valleys and hills, and the steepness or gentleness of slopes geometrically. The map plays a vital role in delineation of watershed and its units, used in planning and identifying recharge structures, farm ponds and construction of grey water drain network etc., (Figure 3.4).

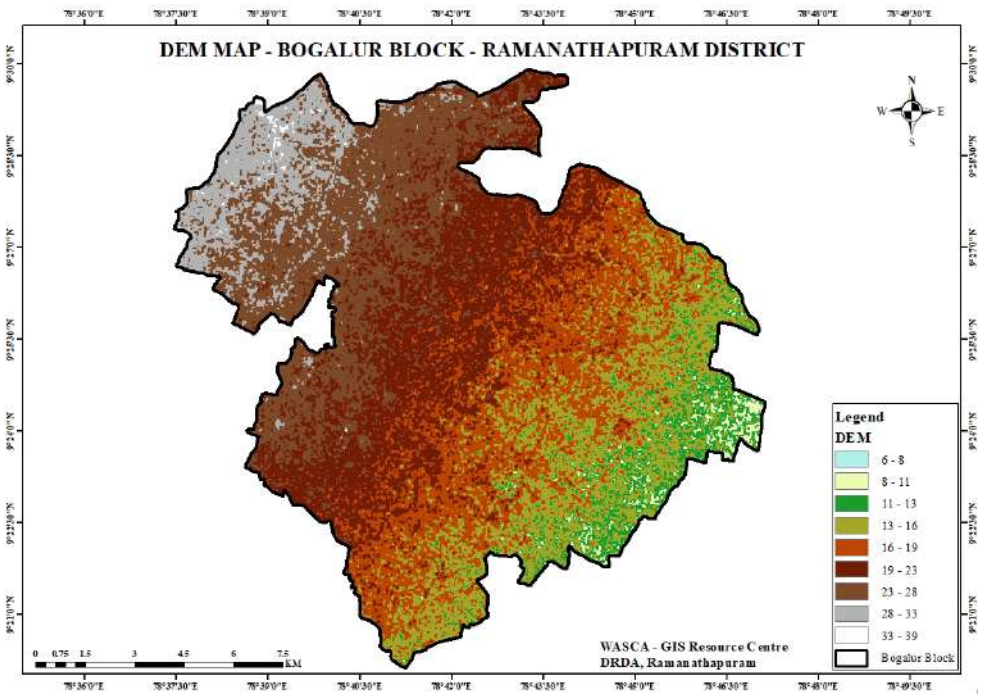


Figure 3.4. DEM map

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

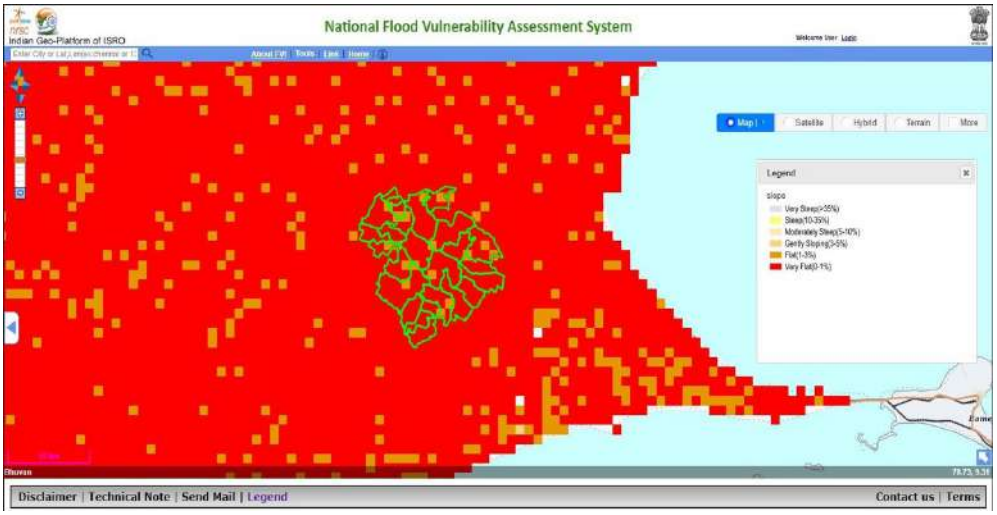


Figure 3.5. Slope map

Slope range	Area in %	Gram Panchayat
Very Flat (0-1%)	95%	A.Puthur, Deivendranallur, Ettivayal, Kavithaikudi, Manjakkollai, Mennanthi Nagachi, Muthuvayal, Pandikanmai, Pottithatti, S.Kodikulam, Semanur, Sevvur, Sheiyalur, Urathur, Vairavanendal, Veeravanur - 100%, Kamankottai - 95%, Bogalur, Karuthanenthal, Kumukkottai, Manjur, Theeyanur - 90%, Muthalur - 85%, K.Valasai, Keelampal, T.Karungulam - 80%
Flat (1-3%)	22%	Karuthanenthal, Kumukkottai - 90%, K.Valasai, Keelampal, T.Karungulam - 20%, Muthalur - 15%, Bogalur, Manjur, Theeyanur - 10%, Kamankottai - 5%

3.5.1.6 Drainage Network : The drainage network pattern of a region is particularly dependent on the lithological characteristics, regional slope, structural control, climate condition etc. It is noticed that very less dense drainage network and a lower order stream is flowing towards Bay of Bengal (Figure 3.6). Drainage network is referred to while identifying suitable sites for soil and water conservation measures such as dams, ponds, bunding, restoration of gullied region etc.

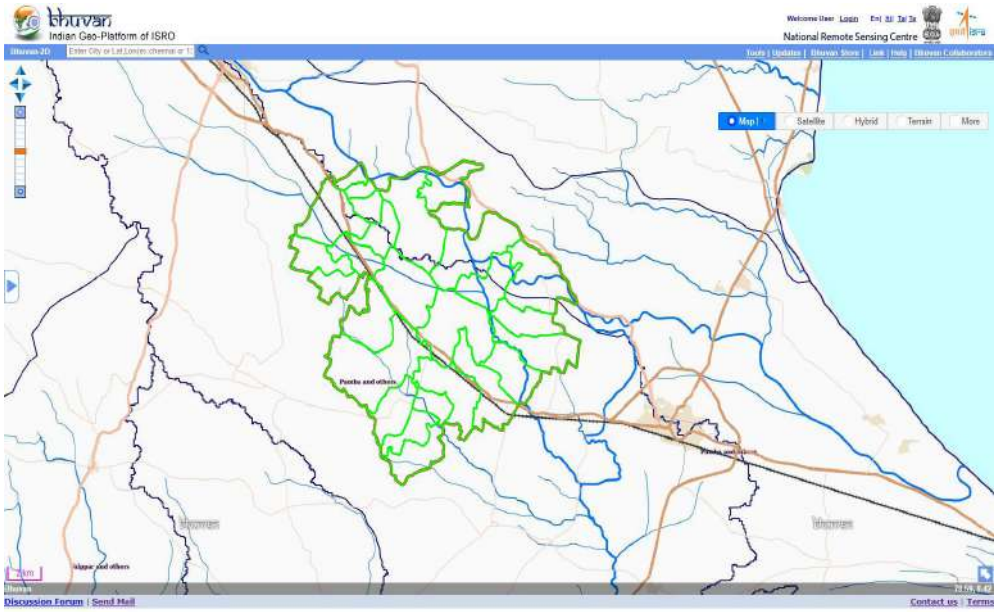


Figure 3.6. Drainage network

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

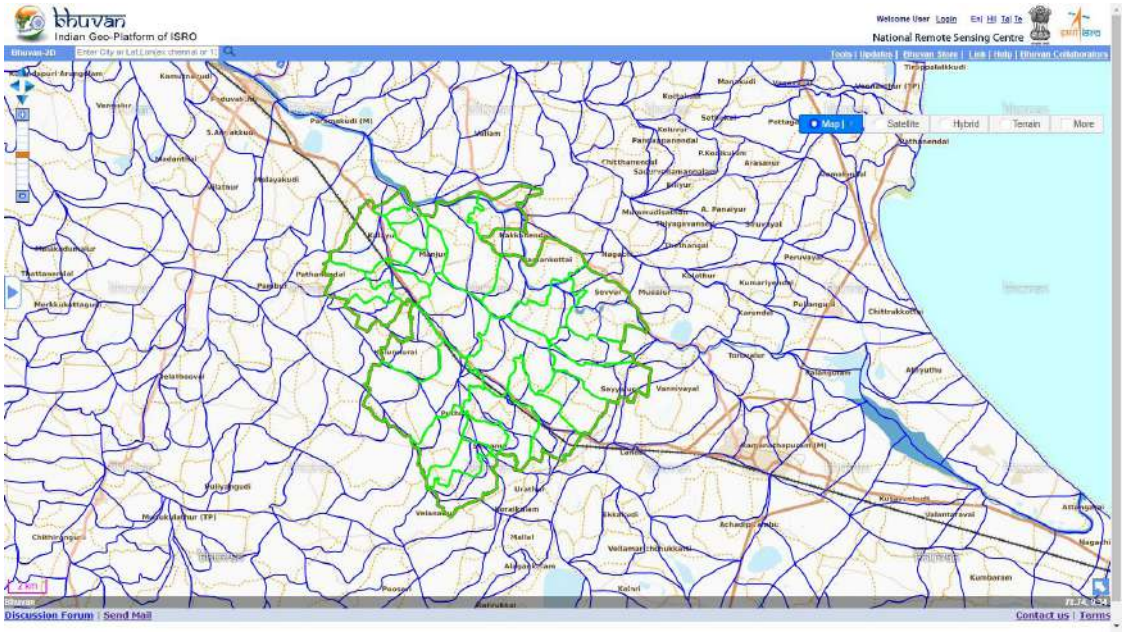


Figure 3.7. Watershed map

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

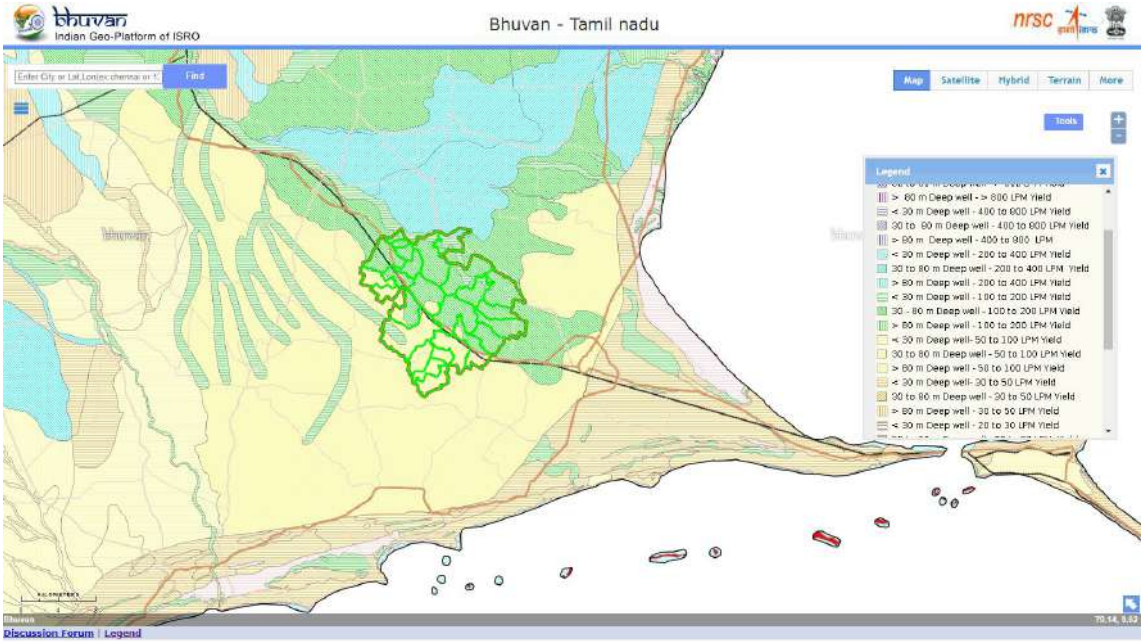


Figure 3.8. Ground water perspective map

Groundwater Prospects	Area in %	Gram Panchayat
<30-80m Deep Well-100 to 200 LPM Yield		
	84%	Bogalur, Deivendranallur, Karuthanendhal, Manjakollai, Manjur, Pottihatti, Seiyalur, Vairavanendal, Veeravanur - 100%, Mennanthi Nagachi, Sevvur - 80%, Keelambal - 75%, Muthuvayal - 70%, Mudalur - 60%, Ettivayal - 45%, K.Valasai - 30%
30m to 80m Deep well - 50 to 100 LPM Yield		
	80%	Kavithaikudi, Pandikanmai, S.Kodikulam, Semanur, T.Karungulam, Theeyanur, Urathur - 100%, A.Puthur - 70%, Ettivayal - 55%, Muthuvayal - 30%, Keelambal - 25%
<30m Deep well -100 to 200 LPM Yield		
	50%	A.Puthur

3.5.2 NON SPATIAL DATA

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

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

Sl. No.	Canal Network	Extent
	Canal Network (m)	
1	Length of Main Canal (m)	64,970
2	Length of Minor Canal (m)	35,571
3	Length of Distributaries (m)	229
4	Water Courses (Field Channels) (m)	1,08,145
	Traditional Water bodies (No.)	
5	Number of Tanks (PWD & Union)	64
6	Number of Ooranis	196
	Irrigation Facilities (ha)	
7	Tank Irrigation	2,367.35
8	Canal Irrigation	61.80
9	Open & Tube Well Irrigation	586.92
	Catchment Area wise Available Runoff (ha.m)	
10	Good Catchment Area	777.37
11	Average Catchment Area	230.50
12	Bad Catchment Area	1,399.82
	Watershed and Drainage Networks	
13	Length of Natural Drainage Lines (m)	91,739.37
14	Number of Natural Drainage Lines (No.)	98
15	Number of micro-watersheds (No.)	147
	Water Demand	
16	For Humans (ha.m)	157.23
17	For Livestock (ha.m)	21.40
18	For Agriculture (ha.m)	6,582.57
19	GW Utilization for Drinking (%)	88.37
20	GW Utilization for Livestock (%)	43.81
21	GW Utilization for Agriculture. (%)	15.15
22	SW Utilization for Drinking (%)	11.63
23	SW Utilization for Livestock (%)	56.19
24	SW Utilization for Agriculture (%)	84.85

3.5.2.1 Existing Water Structures

The Block has structured traditional water storage units such as tanks and Ooranis. It is noticed that the Ooranis are more (196) than tanks (64) (Figure 3.9).

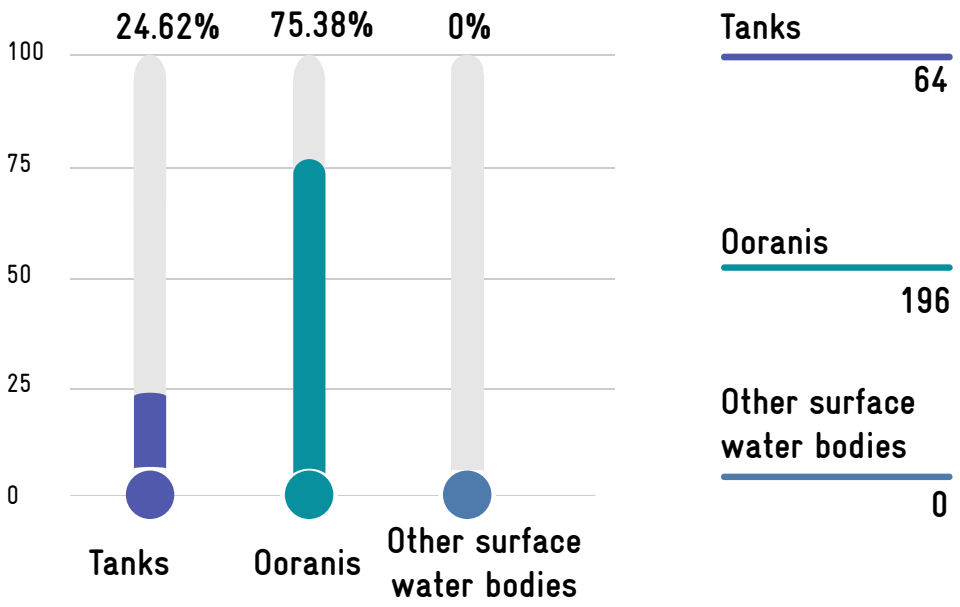


Figure 3.9. Traditional Waterbodies

3.5.2.2 Sources of Irrigation

The total area under irrigation in the Block is 3,016.072 ha, of which 78.49 % (2,367.35 ha) is irrigated through tanks, followed by 19.6 % (586.92 ha) through open/tube well and the remaining 2.05 % (61.80 ha) area is through canal-based irrigation (Figure 3.10).

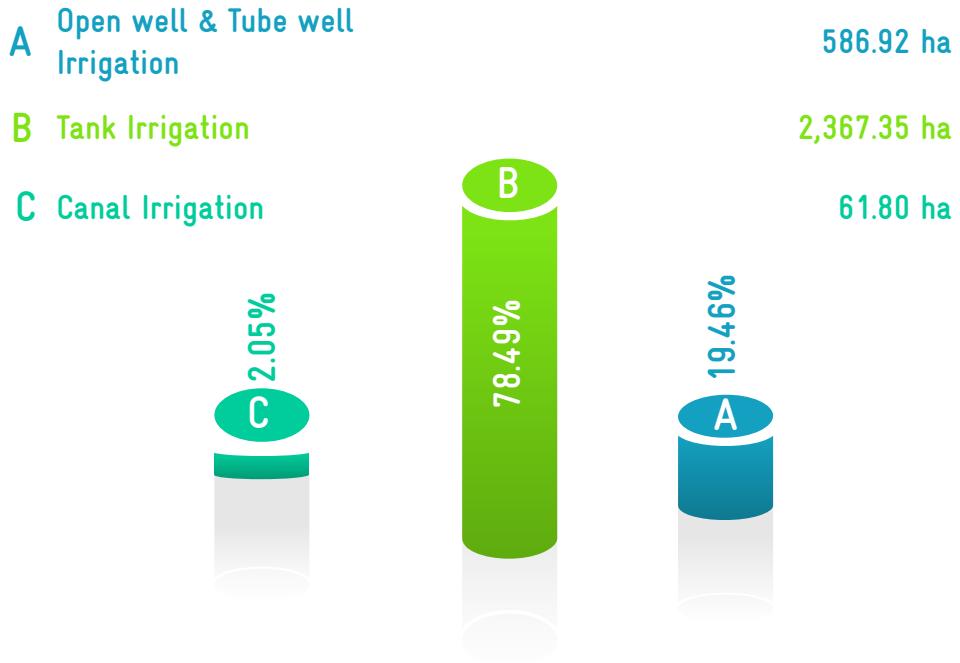


Figure 3.10. Irrigation sources

3.5.2.3 Available Run off

The total available runoff in the catchment area is 2,407.69 ha.m out of which highest of 58.14 % is from bad catchment area followed by 32.29 % from good catchment area and the remaining 9.57% is from average catchment area (Figure 3.11). As the area has bad catchment area, the runoff generated is more.

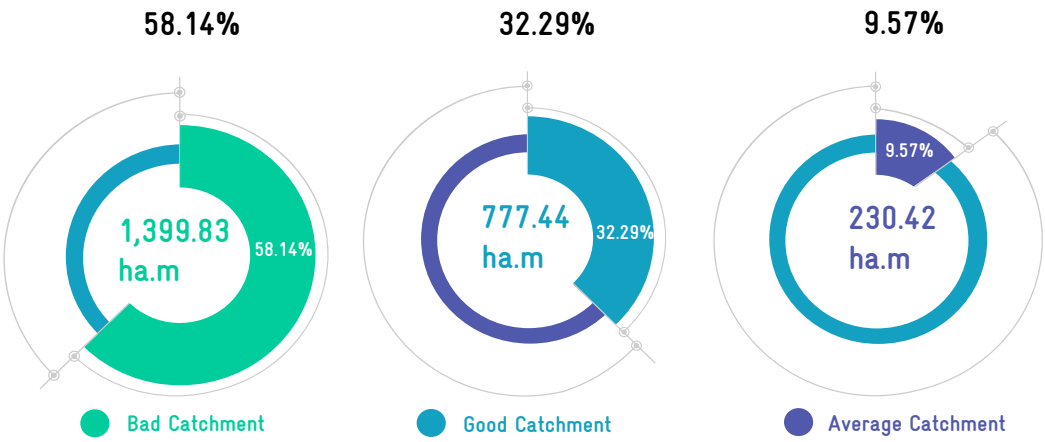
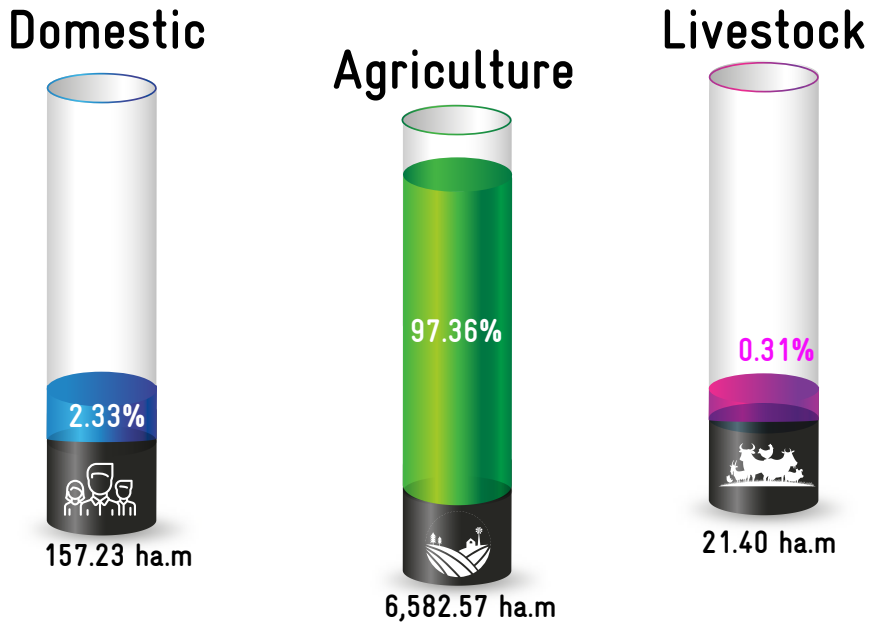


Figure 3.11. Runoff from catchments

3.5.2.4 Water Demand

The total demand for water including domestic, agriculture and livestock purpose is 6,761.2 ha.m. The highest demand is from the agriculture sector of 6,582.57 ha.m (97.36 %) followed by domestic use demand of 157.23 ha.m (2.33 %) and rest is from livestock.



Out of the total water demand, 88.37 % for domestic purpose usage is met through ground water while 11.63% from surface water resources. Utilization of 84.85 % for agriculture is from surface water while 15.15 % is from Ground water. Utilization of 43.81 % of water demand for livestock is met by ground water and 56.19% from Surface water (Figure 3.12).

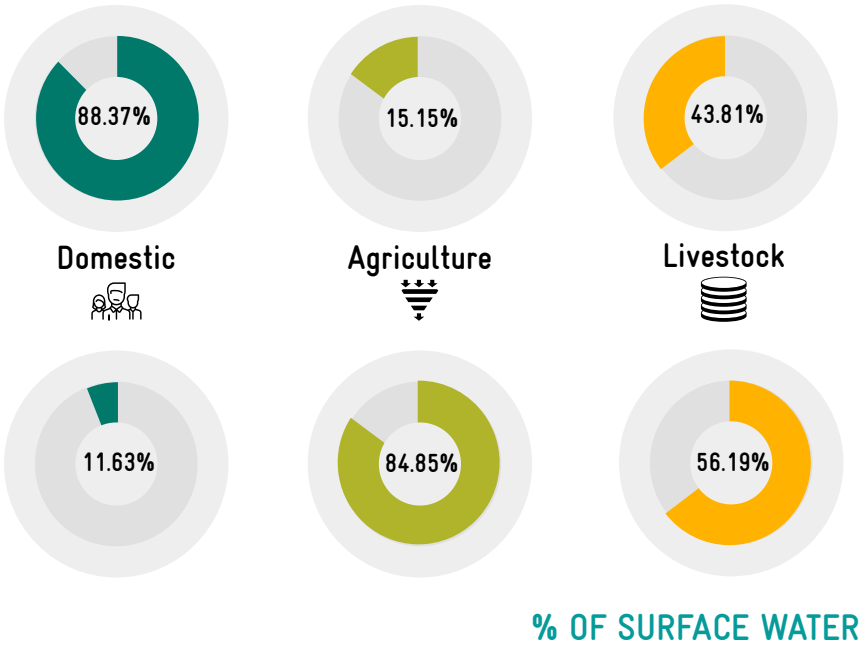


Figure 3.12. Sector-wise water utilization

3.5.3 ANALYSIS OF PHYSICOCHEMICAL PARAMETERS

Physicochemical parameters were assessed to understand their influence on nature of water through Water Quality Index (WQI), Seawater Mixture Index (SMI) and Salinity. To understand WQI and SMI, 15 water samples were collected across the Block area, out of which 18 samples were of open well water and remaining samples were from ground water (Figure 3.13)

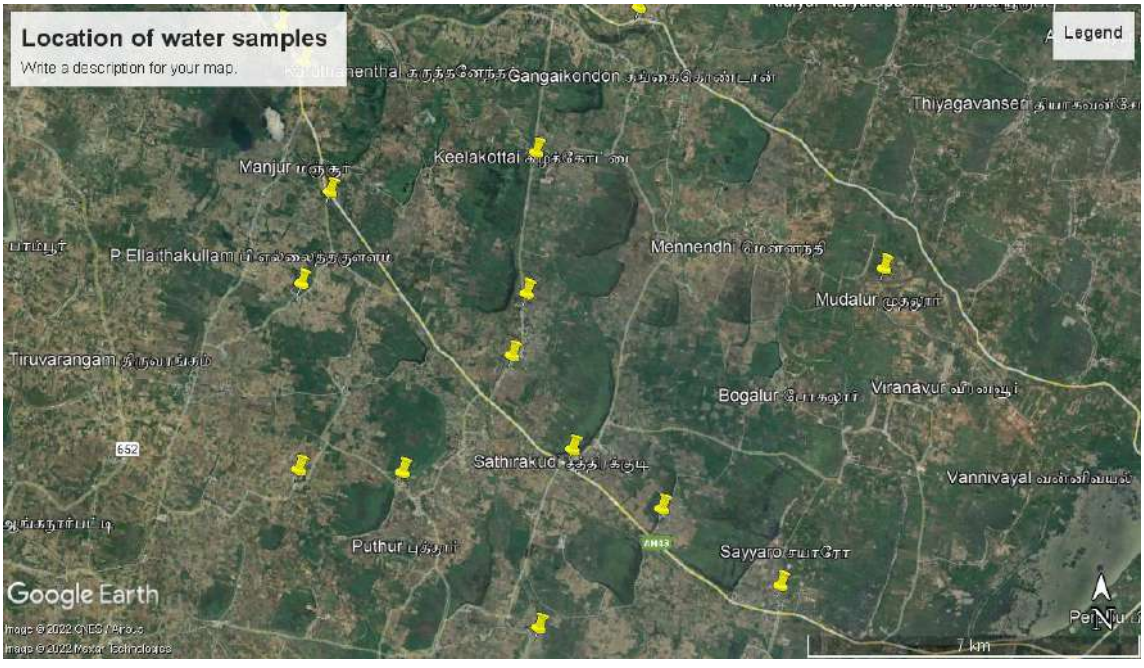


Figure 3.13. Location of water samples

3.5.3.1 Water Quality Index

The WQI is defined as a measure of rating that provides the composite influence of individual water quality parameter to overall water quality. WHO (2004) recommended ten parameters such as pH, TDS, HCO3, Cl, SO4, NO3, Ca, Mg, Na and K to determine the water quality. The results showed that the average content of ions was as follows: Cl > TH > TA > Na > HCO4 > Ca > Mg > CO4 > S04 > NO4 > K. The predominant hydro-chemical facies are Chloride (Cl) and total hardness (TH) while Potassium (K) is very less. The excellent water quality /suitable water for domestic purpose is found in six spots (blue colour in Figure 3.14) over the Block area while very poor-quality water/ unsuitable water for domestic purpose with index value >300 is found in two spots. Buffer areas of very poor sites fall under poor quality water of index zone ranging from 200 to 300. However, most of the area falls under good water quality zone of index value range of good to medium (50-100) (Figure 3.14). These zones act as inputs in identifying suitable sites to propose appropriate treatment measures. GP wise water quality during pre and post monsoons are attached in Annexure 3.8 and 3.9.

Physicochemical parameters	Cl	TH	TA	Na	HCO_4	Ca	Mg	CO_4	S04	NO_4	K
Average in mg/l	904.010	476.200	427.500	399.350	323.533	222.400	155.233	86.200	77.957	30.226	24.373

(TH = Total hardness, TA = Titratable acidity, Ca =calcium, Na= Sodium, Cl= Chloride, HCO_3=Bicarbonate, Mg= Magnesium, SO_4= Sulphate, NO_3= Nitrate, K= Potassium, CO_3= Carbonate)

EXCELLENT QUALITY	<50
GOOD QUALITY	50- 100
MEDIUM QUALITY	100- 200
POOR QUALITY	200-300
VERY POOR QUALITY	>300

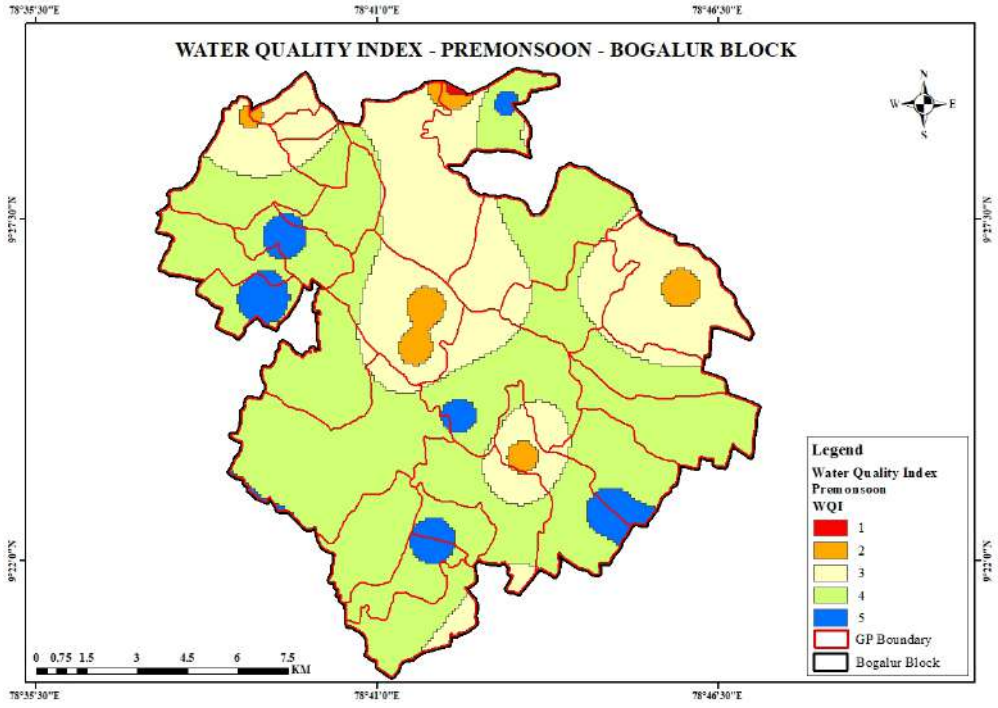


Figure 3.14. Water Quality Index

3.5.3.2 Seawater Mixing Index

SWI parameter is calculated based on mixing of major ionic constituents (Na, Cl, Mg, and SO4) of sea water to ground water during pre-monsoon season. The results show that the average content of ions was as follows: Na > Ca > Mg > S04. The predominant hydro-chemical facies are Sodium followed by calcium while sulphate is less. Geographically one spot was found with high SWI while four zones with less sea water mixed. However, most of the Block area falls under the index value range 1- 2 which is moderate (Figure 3.15).

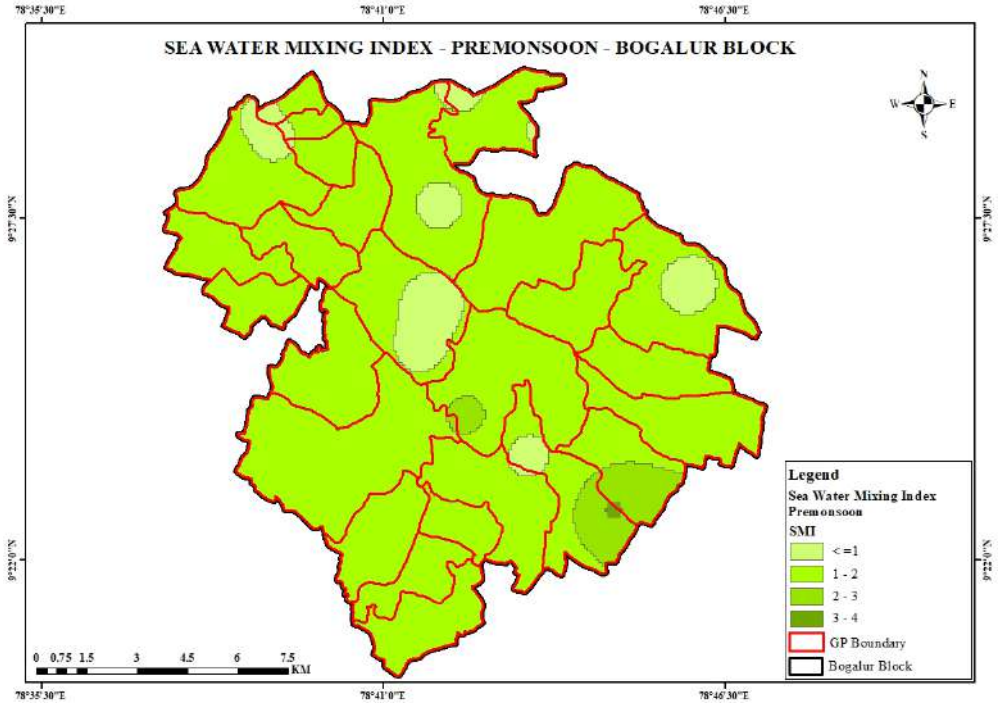


Figure 3.15. Seawater Mixing Index

3.5.3.3 Salinity

Seawater mix and salinity in the water are directly proportional, higher the sea water mix higher the salinity in the water (Figure 3.16). Areas which have proximity to coastal area witnessed high salinity in the Block. Salinity decreases as the distance from the sea shore increases.

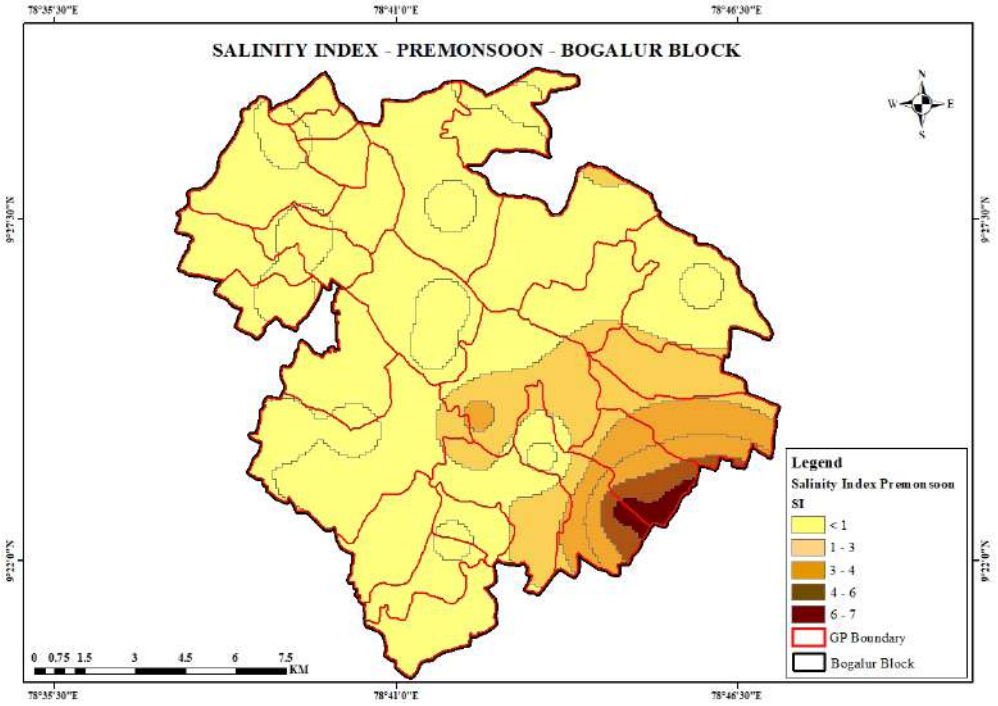


Figure 3.16. Salinity Index

3.6 CWRM PLANNING ANALYSIS- AGRICULTURE

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

3.6.1 SPATIAL DATA

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

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

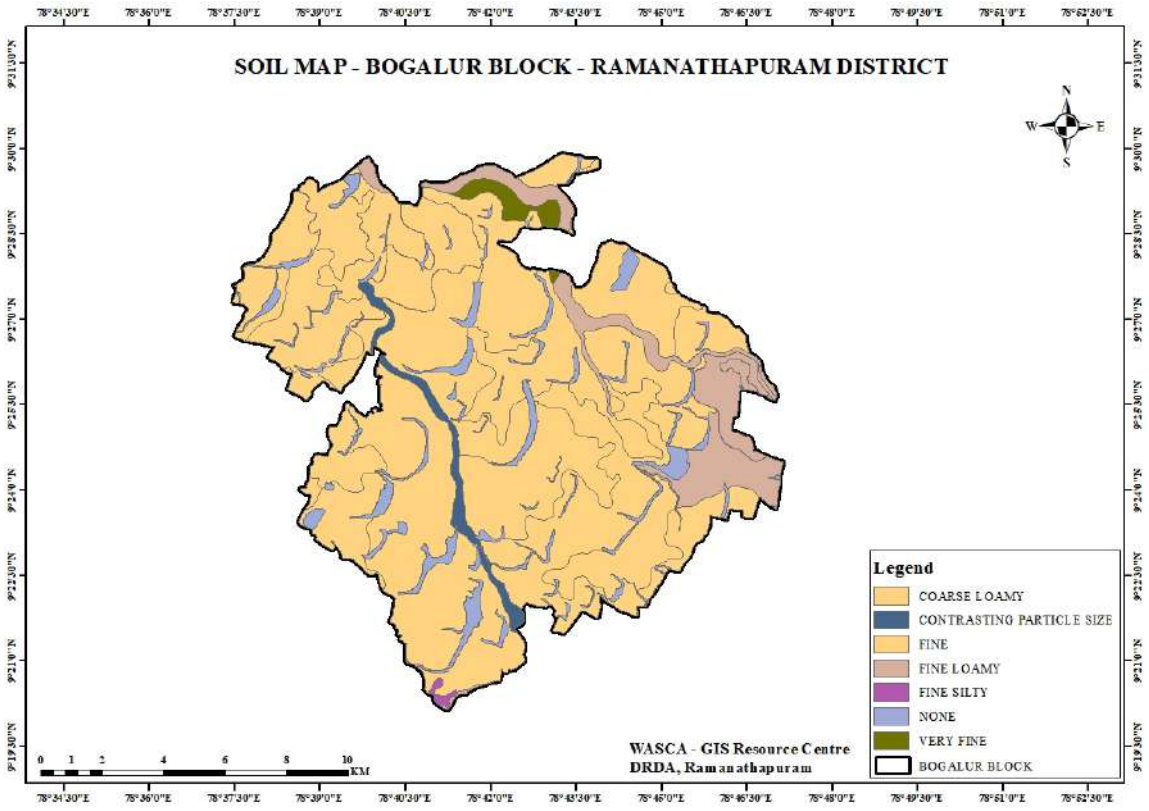


Figure 3.17. Soil texture

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

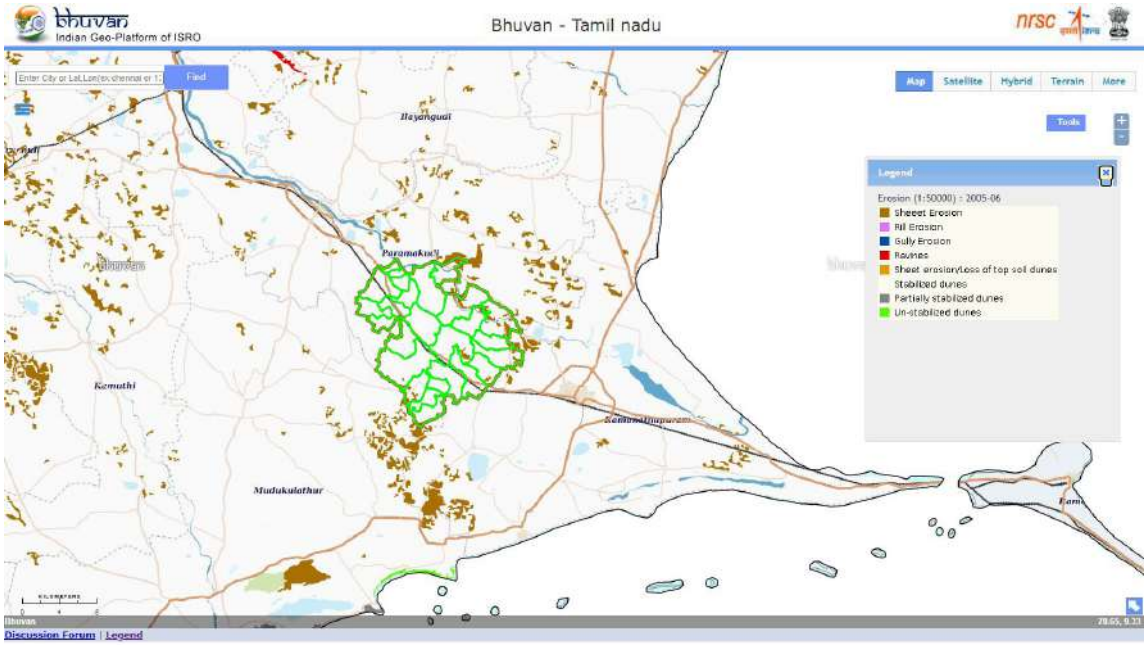


Figure 3.18. Soil erosion map

Erosion type	Area in %	Gram Panchayat
Sheet Erosion		
	7%	Bogalur, K.Valasai, Semanur, Sevvur - 10%, A.Puthur, Mennanthi Nagachi, Mudalur, Seyyalur, Veeravanur - 5%

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

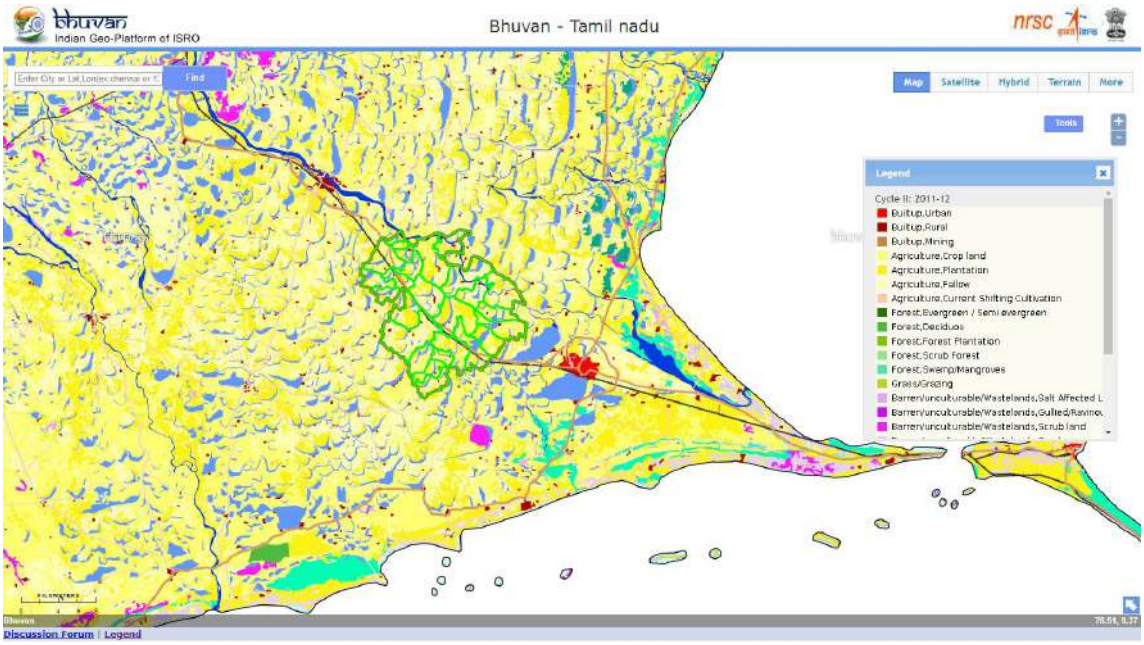


Figure 3.19. Land Use Land Cover map

Land Use	Area coverage in %	Gram Panchayat
Agriculture, Fallow lands	40%	Deivendranallur, Pandikanmai - 85%, A.Puthur, Deivendranallur - 80%, Mennanthi Nagachi, T.Karungulam, T.Karungulam, Vairavanendal - 65%, Sevvur, Urathur - 60%, K.Valasai - 55%, Bogalur, Manjakkollai, Muthuvayal, S.Kodikulam - 50%, Keelampal, S.Kodikulam, Theeyanur - 45%, Theeyanur, K.Valasai, Kamankottai, Kumukkottai, Manjakkollai, Manjur, Muthalur, Semanur, Sheiyalur, Veeravanur - 40%, Kamankottai, Muthalur, Sevvur, Urathur, Vairavanendal - 35%, Bogalur, K.Valasai, Karuthanenthal, Kavithaikudi, Muthuvayal, T.Karungulam, Theeyanur - 30%, Sheiyalur, Veeravanur - 25%, Ettivayal, Kamankottai, Keelampal, Mennanthi Nagachi, Pandikanmai, Pottithatti, Sheiyalur, Theeyanur, Veeravanur - 20%, A.Puthur, Manjur, Pottithatti - 15%
Builtup, Rural	9%	Karuthanenthal - 20%, A.Puthur, Kamankottai - 15%, K.Valasai, Muthuvayal - 10%, Bogalur, Manjur, Pandikanmai, S.Kodikulam, Sevvur, Veeravanur - 5%

3.6.1.4 Waste land: No waste land was found over the Block, however it may be subjected to available data only (Figure 3.20).

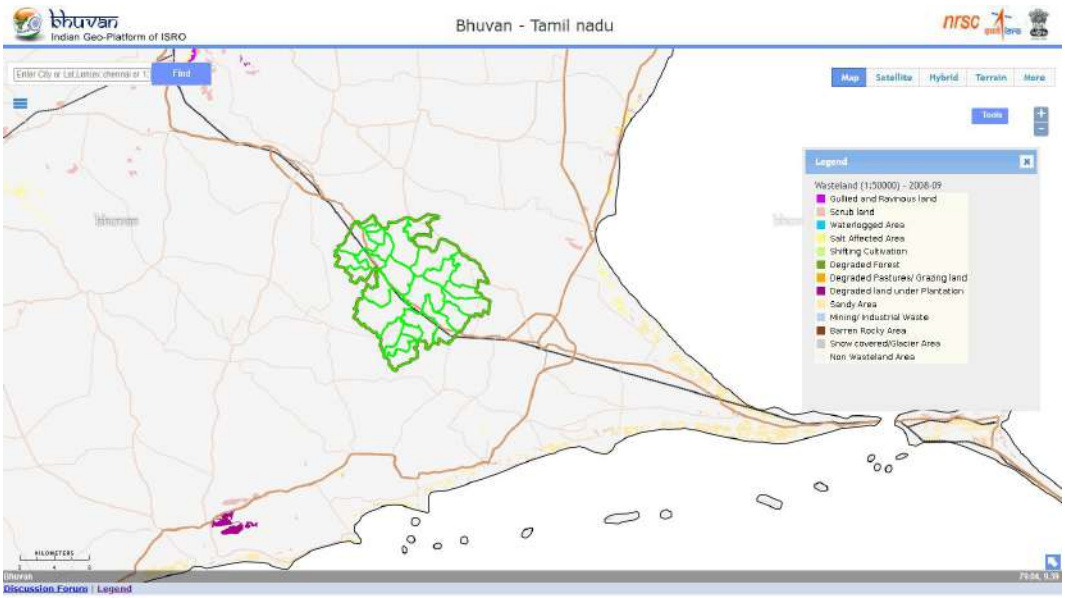


Figure 3.20. Wasteland map

3.6.1.5 Salt affected area: The salt affected area of the Block is very less or negligible (Figure 3.21).

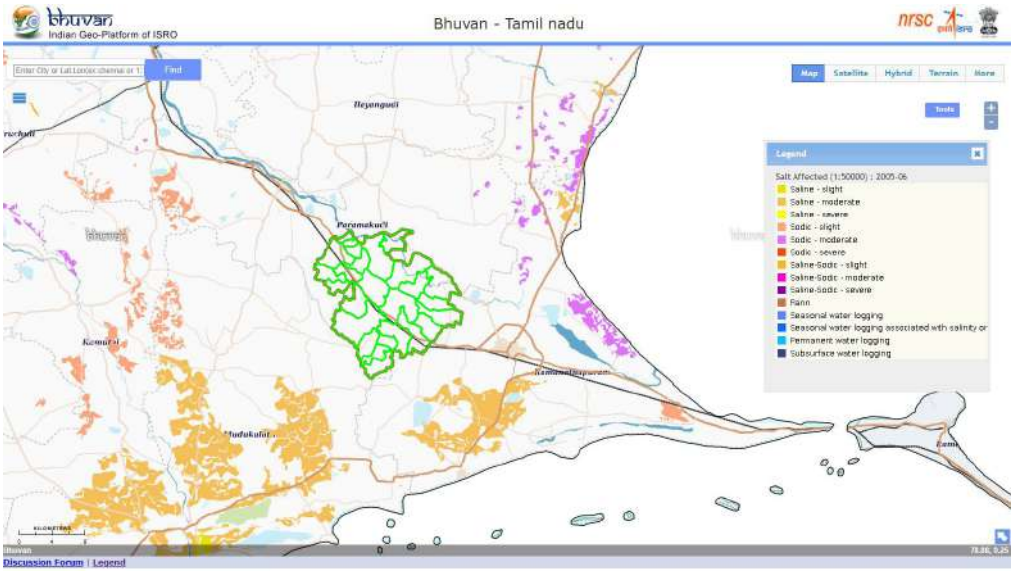


Figure 3.21. Salt affected area

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 Govt. sources (Table 7). The key CWRM parameters of agriculture area for all GPs are tabulated in Annexure 3.10.

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

Sl. No.	Key parameter	Extent
	Area under Land Resources (ha.)	
1	Non-Agricultural Uses	3,461.37
2	Area under Barren & Un-cultivable Land	94.47
3	Area under Permanent Pastures and Other Grazing Land	21.00
4	Land Under Miscellaneous Tree Crops etc.	1,369.65
5	Cultivable Waste Land	34.84
6	Fallows Land other than Current Fallows	1,613.28
7	Current Fallow land	3,837.90
8	Unirrigated Land	4,025.99
9	Area Irrigated by Source	3,232.37
	Land under Catchment Area (ha)	
10	Good Catchment	3,555.84
11	Average Catchment	1,425.50
12	Bad Catchment	12,709.55
	Crop Details	
13	Irrigated Area (ha)	3,330.78
14	Rainfed area (ha)	2,661.23
15	Paddy Cultivation (ha)	4,270.81
16	Crop Water Requirement - Irrigated condition (ha.m)	3,162.15

17	Crop Water Requirement - Rainfed condition (ha.m)	4,132.61
	Soil Resources: Status of Available Nitrogen (%)	
18	Very Low	72.81
19	Low	26.97
20	Medium	0.15
21	High	0.03
22	Very High	0.03
	Status of Organic Carbon (%)	
23	Very Low	45.08
24	Low	47.74
25	Medium	2.82
26	High	0.54
27	Very High	3.81
	Status of Soil Micro Nutrients (%)	
28	Sufficient	68.05
29	Deficient	31.95
	Status of Physical condition of the soil (%)	
30	Strongly Acidic	0.03
31	Highly Acidic	1.42
32	Moderately Acidic	16.78
33	Slightly Acidic	16.17
34	Neutral	0.57
35	Moderately Alkaline	60.19
36	Strongly Alkaline	4.85
	Soil Texture (%)	
37	Fine Soil	86.24
38	Coarse loamy	2.04
39	Soil Water Permeability (Low, Moderate, high)	Moderate
	Soil moisture and ET	
40	Volumetric Soil Moisture (%)	17
41	Estimated Soil Moisture (ha.m)	9,136.04
42	ET Losses (ha.m)	5,934.10
	Means of Water Extraction (%)	
43	Gravity	54.40
44	Lifting	45.60
	Irrigation Methods (%)	
45	Wild Flooding	81.85
46	Control Flooding	18.10
	Livestock (No.)	
47	Cattle Population	2,353
48	Sheep Population	23,786
49	Goat Population	10,754
50	Poultry	16,041

3.6.2.1 Land utilization

The standard land use classification helps to understand the distribution and the extent of different land use categories. As the runoff and water harvesting actions are linked to the land use systems, its distribution across the geographical boundary of the Block is necessary to take decisions. Of the total land area of 17,690.87 ha, the highest of 22.76 % land is unirrigated land, followed by 21.69 % current fallow land, while less than five percent of land is cultivable wasteland, barren and uncultivable land and area under permanent pastures and other grazing land (Figure 3.22).

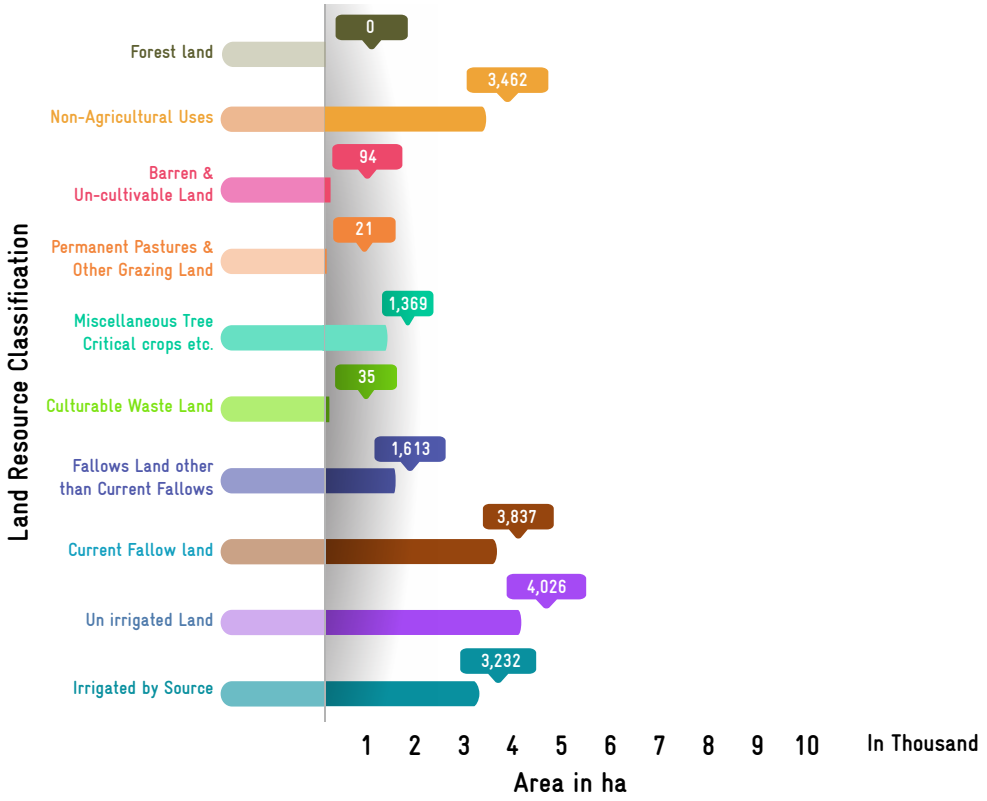


Figure 3.22. Land utilization

3.6.2.2 Catchment Area

The land use types in each of the GPs are categorized into three different types of runoffs; good, average and bad catchment area. Out of total catchment area of 17,690.87 ha, of the Block, the highest of 71.84 % is from bad catchment area followed by 20.10 % from good catchment area and remaining is from average catchment area (Figure 3.23). This analysis helps to focus on prioritizing the works in the land use systems under the good and bad catchment areas.

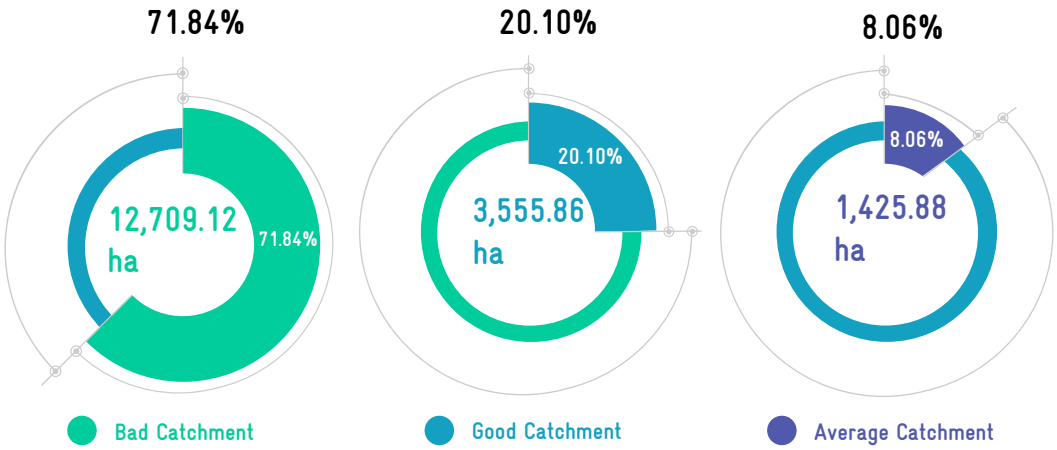


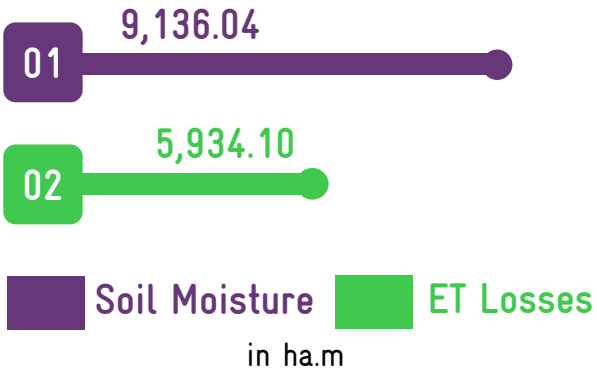
Figure 3.23. Catchment area

3.6.2.3 Soil moisture

Soil is an important medium to store the available water and the storage capacity varies with the type of soil especially its textural composition. In overall composite water budgeting, estimation of stored water in the soil assumes greater significance in this Block because of its significant proportion of area under rain-fed cultivation. The annual average volumetric soil moisture of this Block (17%), is taken for estimating the amount of water stored as soil moisture which accounts to 9,136.04 ha.m

3.6.2.4 ET losses

The transformation of liquid state of water state from earth surface to vapour state of water to atmosphere is the ET loss. The loss of water through ET is important in water budgeting. The Block area witnessed an annual total ET loss of 5,934.10 ha.m during 2018-19, with a monthly average of 506.1 ha.m.



3.6.2.5 Macro-nutrients

Nitrogen

The macro soil nutrients such as nitrogen falls under very low to very high categories in all the soil samples tested. The available nitrogen is very low in 72.81 % of the samples tested while it was 0.03 % under high and very high categories (Figure 3.24). According to soil resource map, this Block is identified as one of the nitrogen deficient Blocks (Ramanathapuram District profile 2020).

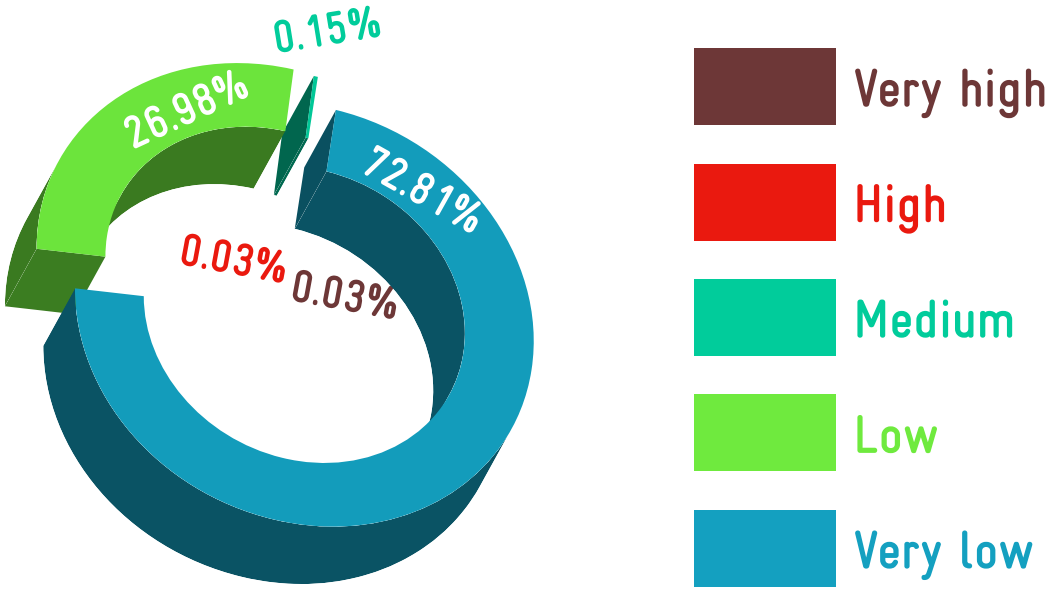


Figure 3.24. Status of available Nitrogen

Organic Carbon

Soil organic carbon ranges between very low and very high in the tested soil samples. Nearly 48 % of the soil samples tested fall under low category followed by 45.08 % which falls under vey low category while 0.54 % samples contains high organic carbon (Figure 3.25). This indicates that the soil fertility is very poor.

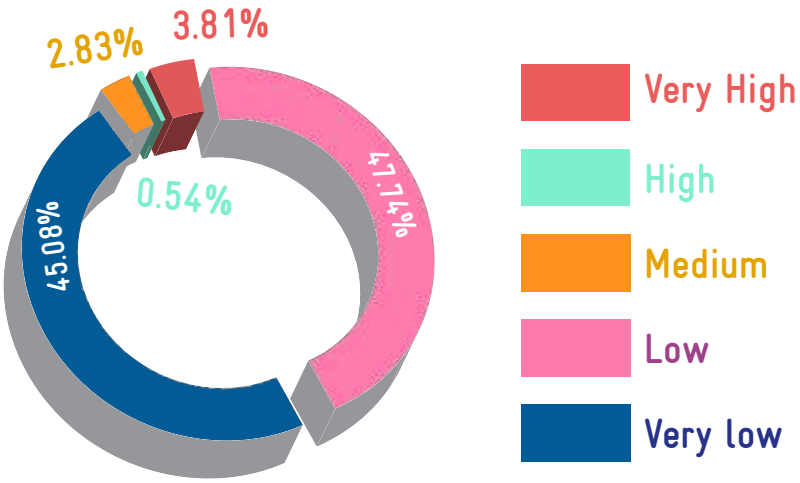


Figure 3.25. Status of soil Organic Carbon

3.6.2.6 Status of the soil micro-nutrients

This Block is one of the Nitrogen, Zinc and Ferrous deficient Blocks of Ramanathpuram District. The micro-nutrient status of the soil with specific reference to Manganese, Boron and Zinc, Ferrous, Copper, and Sulphate are deficient in 31.95 % and 68.05 % sufficient in the soils tested (Figure 3.26).

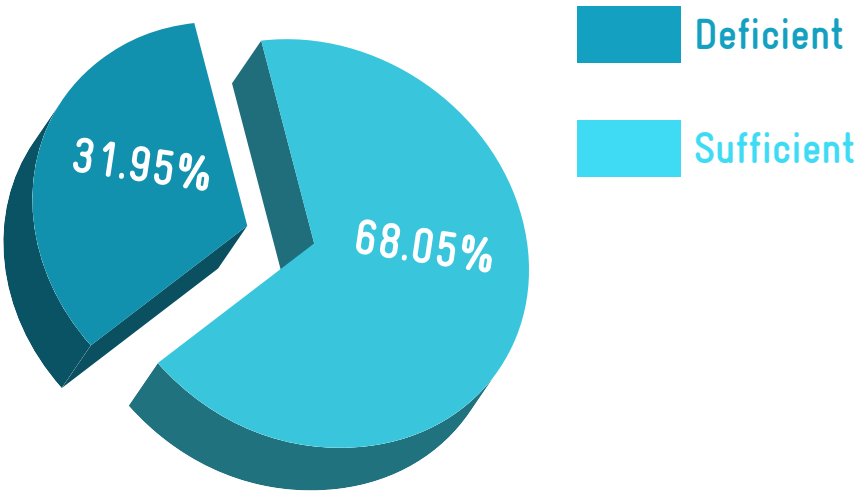


Figure 3.26. Status of soil micro-nutrients

3.6.2.7 Physical parameters – pH status

With reference to the physical parameters, 65 % of the soil is in alkaline in nature and rest is acidic except 0.57 % is neutral (Figure 3.27).

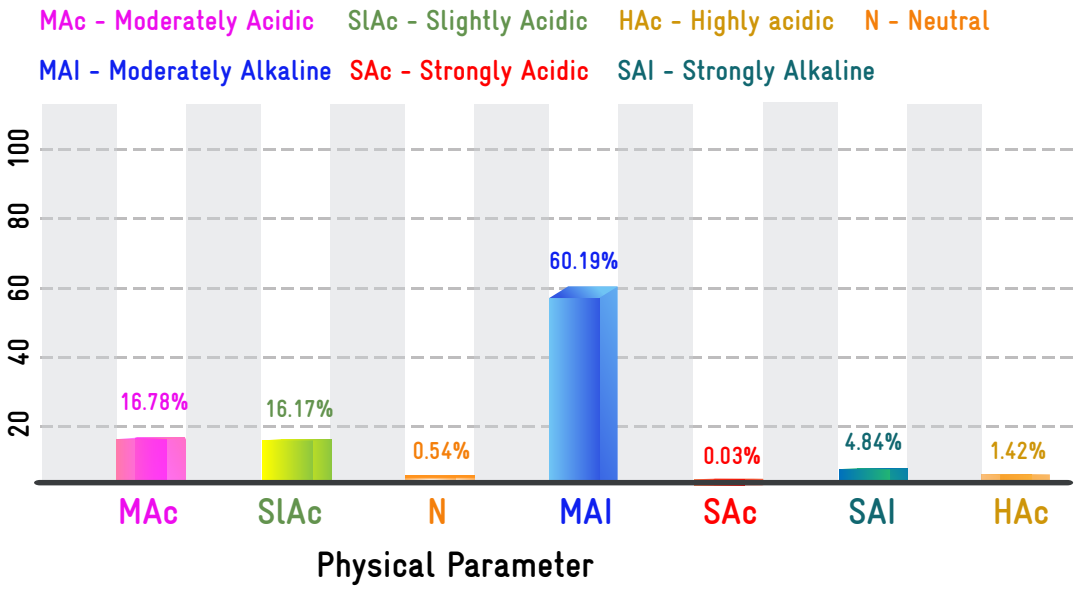


Figure 3.27. Status of pH of soil

3.6.2.8 Cropping pattern and the irrigation

A total of 5,396 ha area is used for crop cultivation in which 44.70 % area is rain fed cultivation and the rest is irrigation based cultivation. Paddy is a major crop with about 3,787.61 ha (70.19 %) followed by dry chilli while vegetables are cultivated in less area. Sugar cane, red gram, ragi, dry chilli, brinjal, water melon, ladies finger, gourds, flower crops, banana, guava, medicinal plants, lemon, mango, tomato are cultivated in less than one percent of the area.

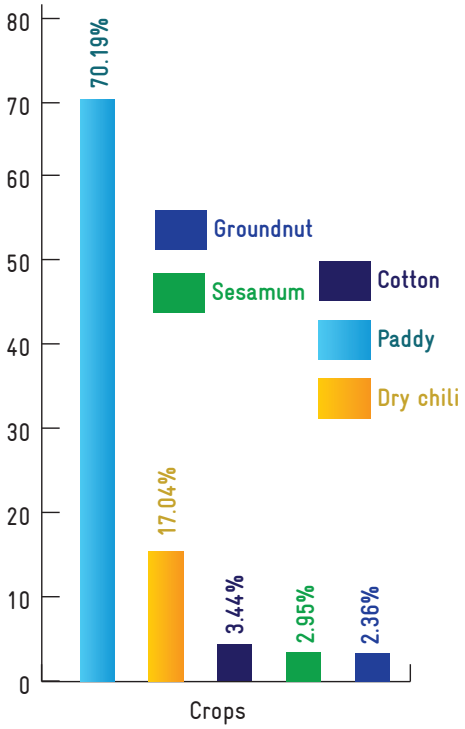


Figure 3.28. Crop pattern (including rain-fed and irrigation area)

3.6.2.9 Irrigation methods

In case of the surface water resources, wild flooding is the primary method of irrigation. But in case of ground water resources, the predominant type of irrigation is control flooding. In the Block, 81.85 % of the irrigation is done by wild flooding and rest of irrigation is done by control flooding (Figure 3.29).

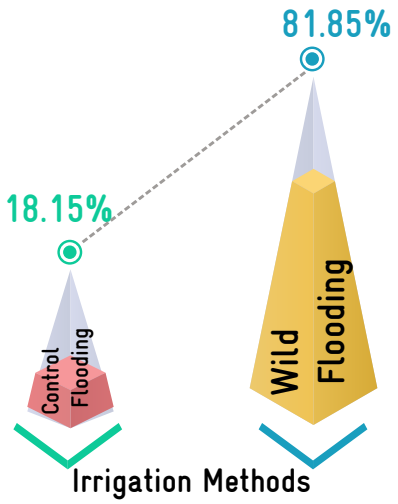


Figure 3.29. Irrigation methods

3.6.2.10 Means of water extraction

Water is extracted in two ways, one by gravity and the other is by lifting. Water is drawn from surface water sources such as tanks, ponds etc., by using gravity method and that of ground water sources such as open well, hand pump, bore well by using lifting method. In the Block, 54.40 % of the water extraction is through gravity and rest comes under lifting means of water extraction (Figure 3.30).

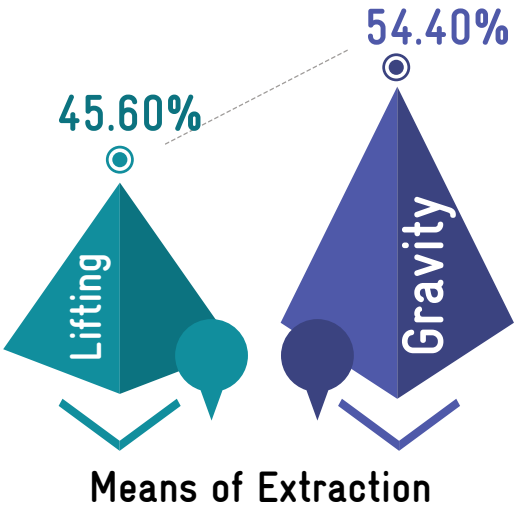


Figure 3.30. Means of water extraction

3.6.2.11 Livestock details

This Block has considerable proportion of livestock resources of about 52,934. Of which sheep population is high 44.9 % (23,786) followed by poultry of 30.3 % (16,041) and goats of 20.3 % (10,754) while cattle is less about 4.4 % (2.353) (Figure 3.31). The total water requirement for livestock is 21.40 ha.m. Of the total water demand, 56.19 % is met through surface water and remaining is from ground water resources.

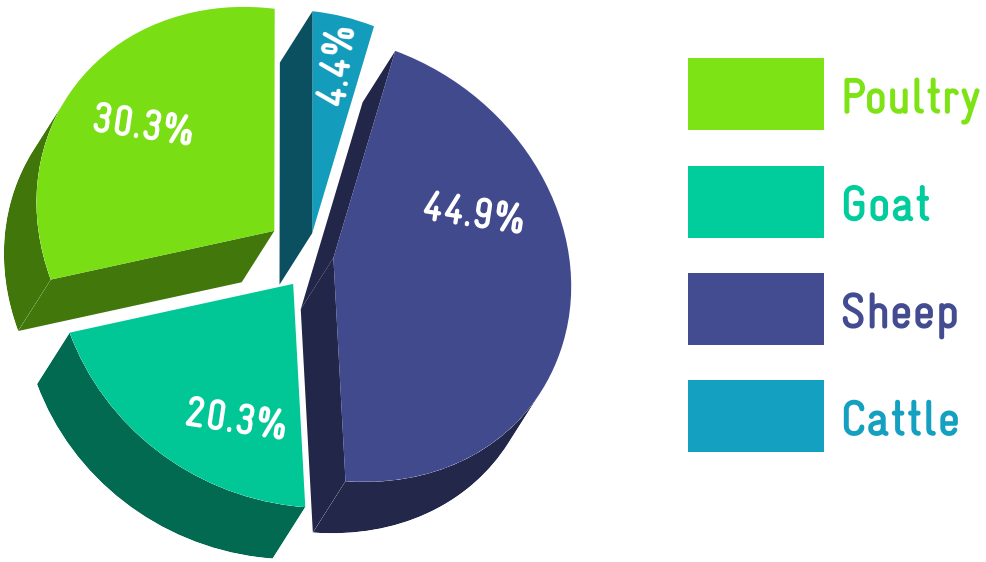


Figure 3.31. Livestock details

3.7 CWRM PLANNING ANALYSIS- SOCIO-ECONOMIC

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

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

Sl.No.	Parameter	Total
1	Geographical Area (ha)	18,349
2	Male Population (No.)	29,114
3	Female Population (No.)	28,321
4	Total Population (No.)	57,435
5	SC Population (No.)	22,846
6	Vulnerable Population (No.)	22,846
7	Households (HH's) (No.)	13,571
8	Only one room HH's (SECC) (No.)	521
9	Female Headed HH's (SECC) (No.)	1,061
10	Vulnerable Households (SECC) (No.)	683
11	% of Vulnerable Households (%)	5
12	Registered MGNREGA Job cards (Persons)	12,585
13	Active person working in MGNREGA job Cards (Persons)	10,030
14	Drinking Water Sources (No.)	1,673
15	HH's have tap water connection for drinking water (No.)	7,571
16	HH's dependent on other sources for drinking water (No.)	6,288
17	Annual Greywater Generation (ha - m)	104.77

3.7.1 Population:

The total population of this Block is 57,435* in which the female proportion is slightly higher than male population. In the CWRM planning process due attention is given for the intersecting variables such as gender, class, caste and marital status and availability of safe drinking water resources. In the Block, about 40 % of the total population are under vulnerable population of SC (Figure 3.32).

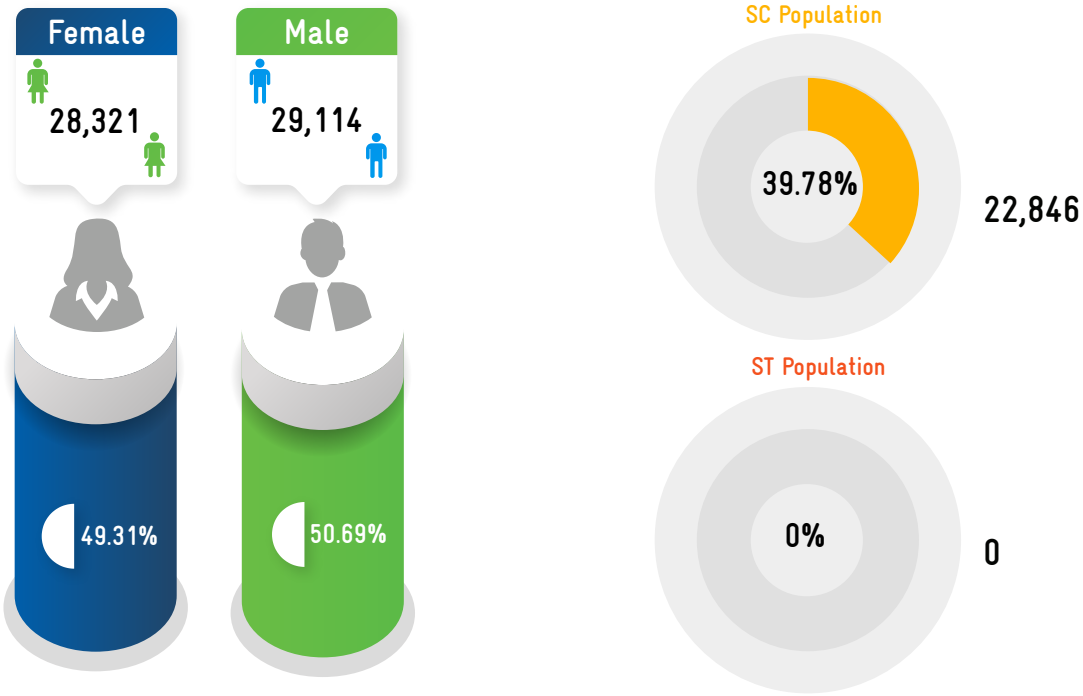


Figure 3.32. Population details

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

3.7.2 Details of households

There are a total of 13.571 households in which 3.84 % households have only one room, 7.82 % households are headed by women and 5.03 % are vulnerable households (Figure 3.33)

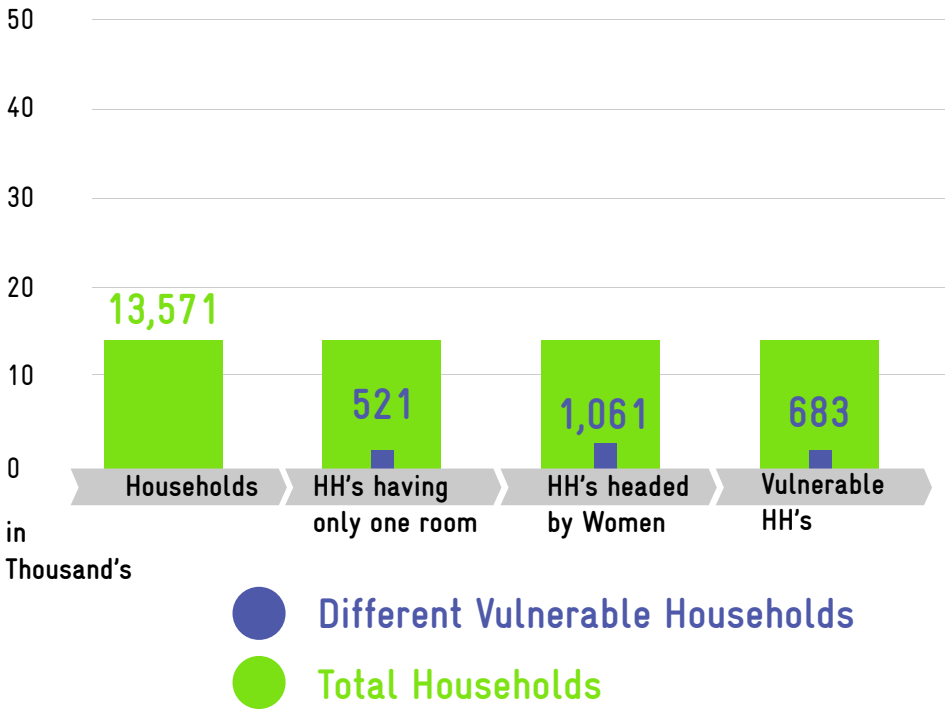


Figure 3.33. Details of households

3.7.3 Status of Mahatma Gandhi NREGA - job card status

In the Block, of the total population of 57,435, 12,585 are registered for job cards in Mahatma Gandhi NREGA scheme in which 80 % of the job cards are in active category (Figure 3.34)

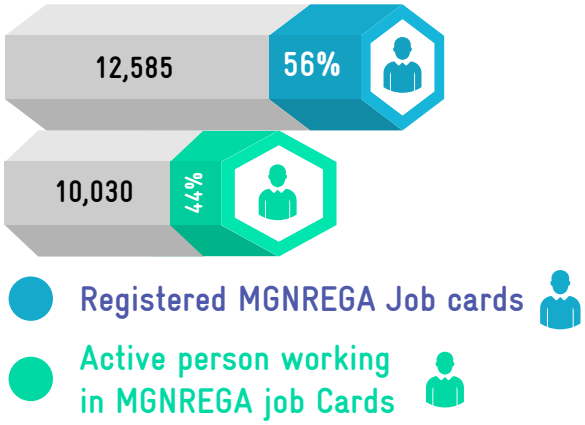


Figure 3.34. Status of MGNREGA job cards

3.7.4 Drinking Water Sources

Nearly 38,824 households have tap water connection and 7,571 households depend on other water sources for domestic use, where other sources include RTRWHS / Tanka (roof rain water harvesting systems, hand pump, open wells, bore wells, tank/ pond/ oorani, springs and river/ streams.

Tap water connection

6,000
Households

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

7,571
Households

3.7.5 Annual Greywater Generation

The grey water generation estimated across this Block is 104.77 ha.m which is available for reuse or recycle.

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

K.Valasai, Karuthnendhal, Kavithaikudi

Morphology

Seyyalur, Bogalur, K.Valasai

Physicochemical parameters

Bogalur, K.Valasai, Semanur

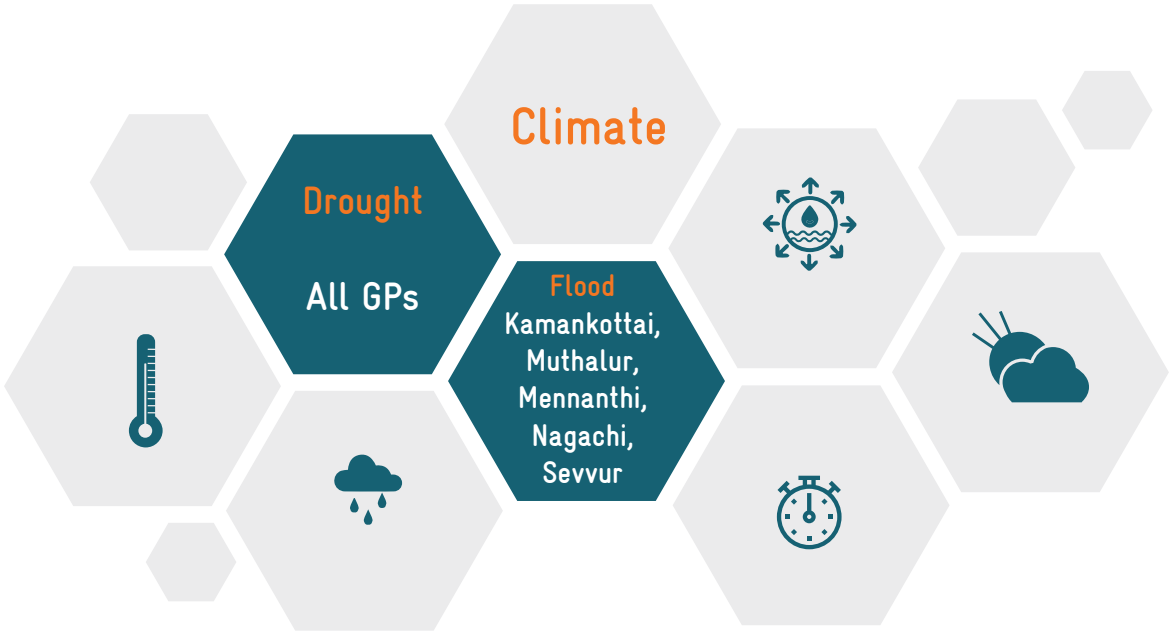
Soil erosion

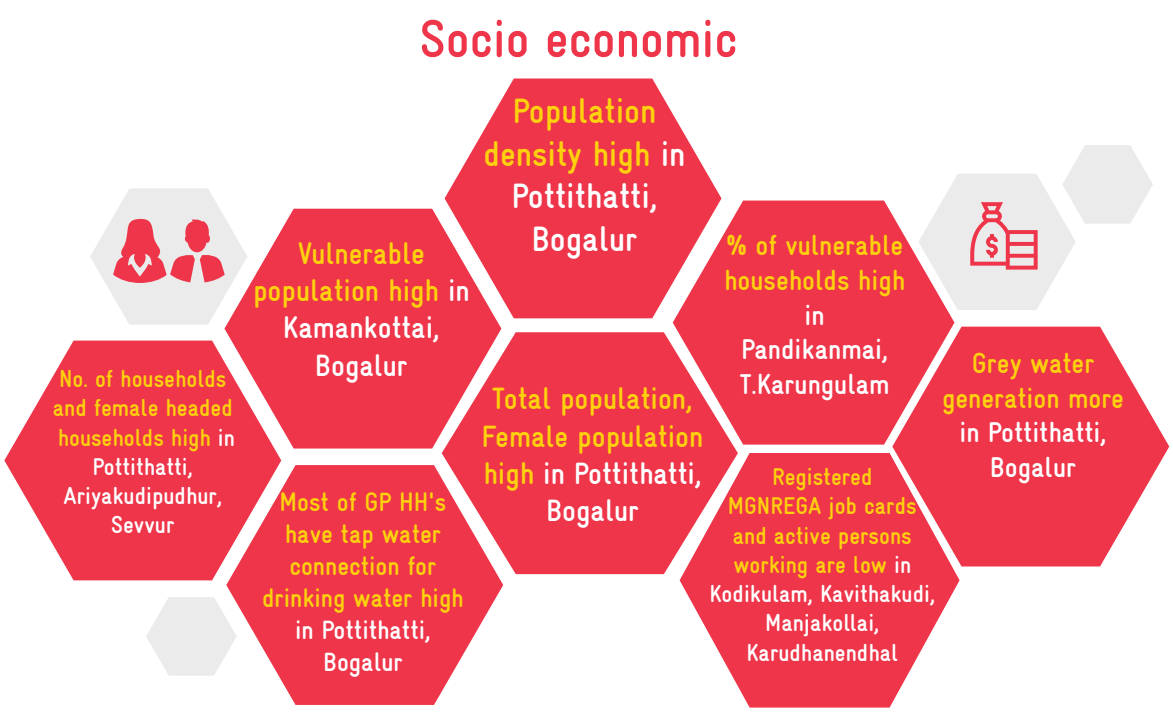
Karuthanenthal, Kumukkottai

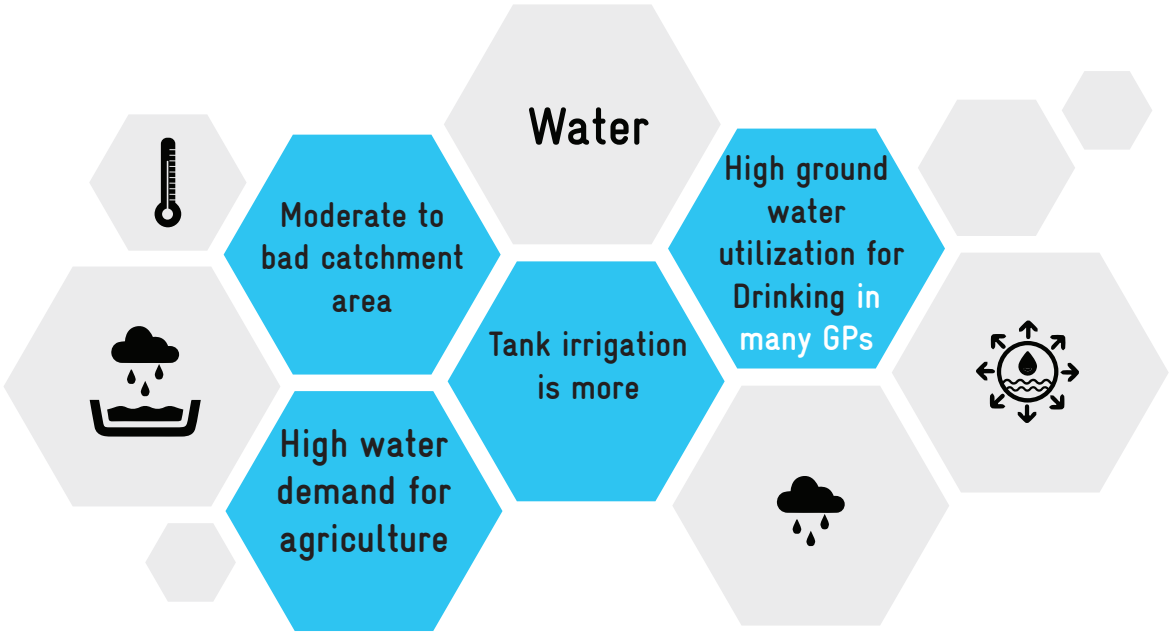
Upland/Slope

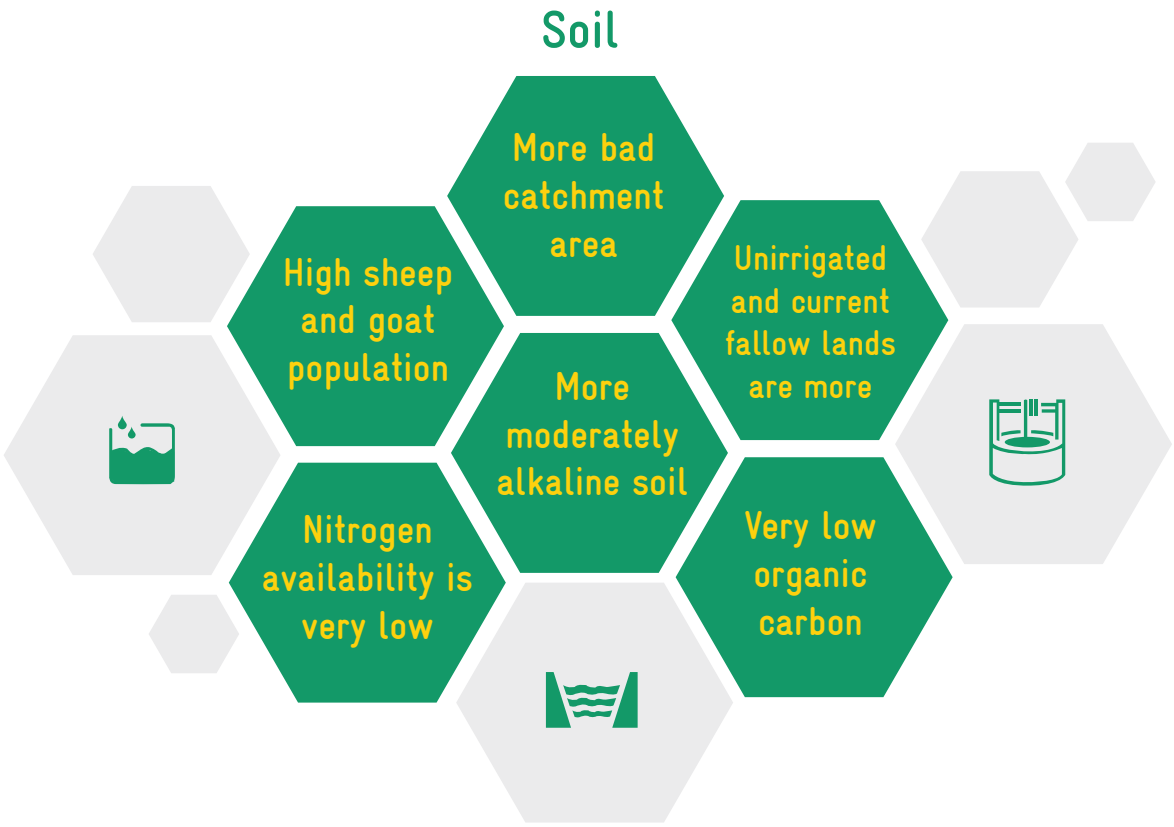
Muthuvayal, Keelambal, A.Puthur

Ground water prosperity


Climate
Drought
All GPs
Flood
Kamankottai, Muthalur, Mennanthi, Nagachi, Sevvur


Socio economic
Population density high in Pottithatti, Bogalur
Vulnerable population high in Kamankottai, Bogalur
% of vulnerable households high in Pandikanmai, T.Karungulam
No. of households and female headed households high in Pottithatti, Ariyakudipudhur, Sevvur
Total population, Female population high in Pottithatti, Bogalur
Grey water generation more in Pottithatti, Bogalur
Most of GP HH's have tap water connection for drinking water high in Pottithatti, Bogalur
Registered MGNREGA job cards and active persons working are low in Kodikulam, Kavithakudi, Manjakollai, Karudhanendhal


Water
Moderate to bad catchment area
High ground water utilization for Drinking in many GPs
Tank irrigation is more
High water demand for agriculture


Soil
More bad catchment area
High sheep and goat population
Unirrigated and current fallow lands are more
More moderately alkaline soil
Nitrogen availability is very low
Very low organic carbon

கெடுப்பதூஉம் கெட்டார்க்குச் சார்வாய்மற் றாங்கே
எடுப்பதூஉம் எல்லாம் மழை

குறள் - 15

Destruction it may sometimes pour
But only rain can life restore

Thirukkural - 15

CHAPTER 4

4 VULNERABILITY RANKING OF GP

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

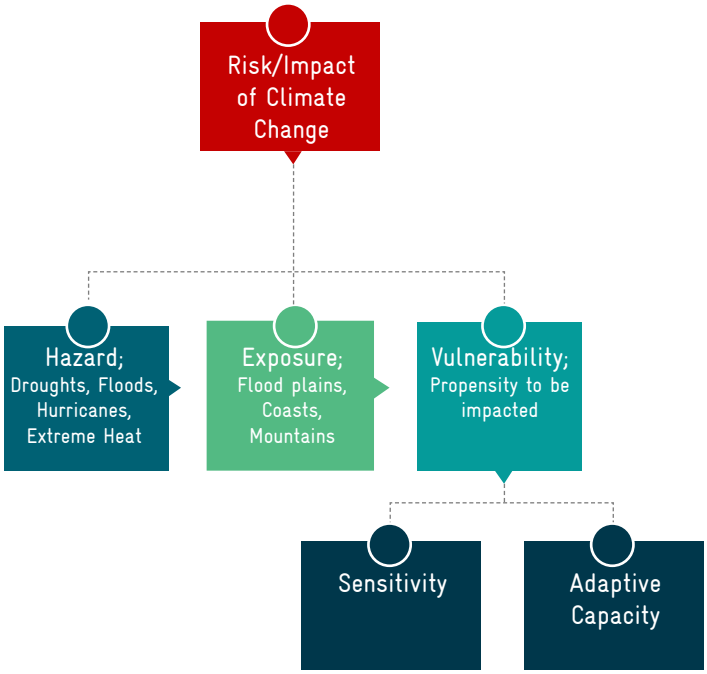


Figure 4.1. Vulnerability of the system as defined by IPCC

Generally, vulnerability assessments are made to identify.

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

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

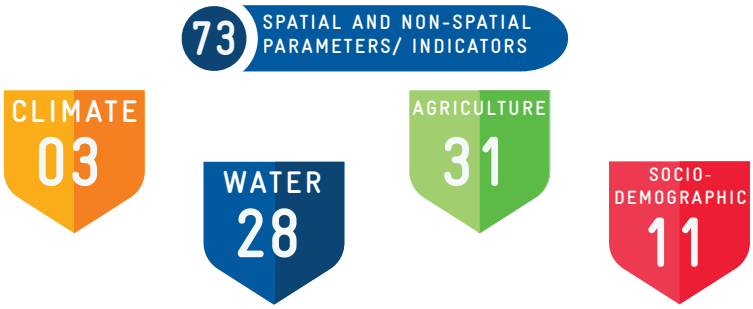


TABLE 9. CWRM PARAMETERS/INDICATORS SELECTED FOR BLOCK LEVEL VULNERABILITY

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

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

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

The identified indicators are from different sources and measured in different units. As the vulnerability assessment is about ranking, the indicators have to be in common units. This is done through normalization. The normalized indicators are aggregated and categorized to different vulnerability levels very high, high, medium, low and very low category. The vulnerability assessment methodology is given in Annexure 4. The GPs categorized based on vulnerability scores are shown in Figure 4.2. T.Karungulam, and Pandikanmai GP has very high rural water security vulnerability to climate risks followed by Ariyakudipudhur, Kodikulam and Keelambal GPs with high vulnerability. Thievendranallur, Manjur, Ettivayal, Karudhanendhal and Seyyalur GPs have very low vulnerability.

Upto	Category	Color range
0.555	Very High	
0.526	High	
0.496	Medium	
0.467	Low	
0.438	Very low	

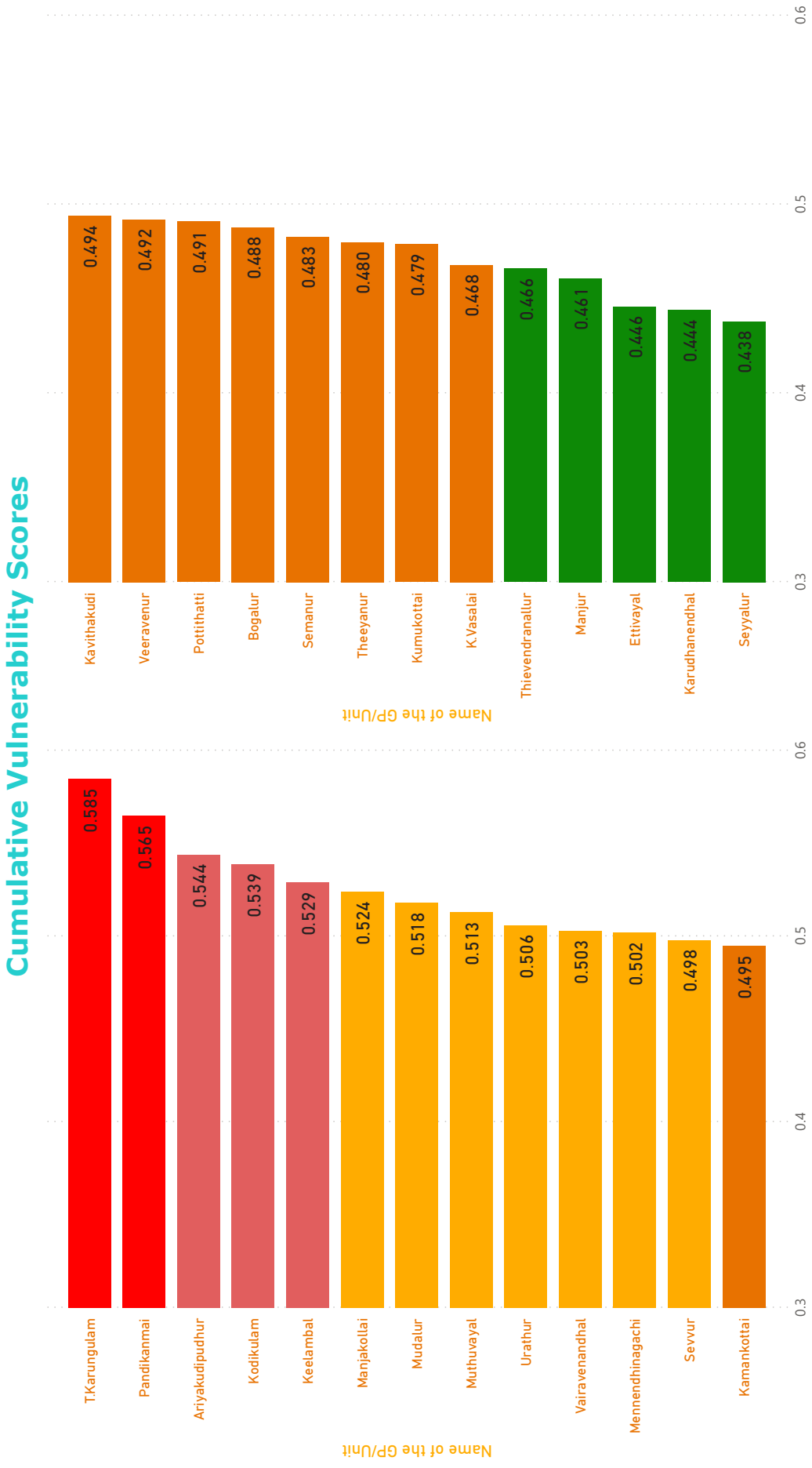


Figure 4.2. Final cumulative vulnerability scores

Sectoral vulnerability

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

Climate risks vulnerability

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

SENGAMPADAI, MANDALAMANICKAM, PAKKUVETTI

Water resource vulnerability

The water resources vulnerability index shows that Bogalur Kodikulam, T.Karungulam, Seyyalur, Pandikanmai and Vairavenandhal GPs have high vulnerability followed by Sevvur, Ariyakudipudhur, Mudalur, Manjakollai, K.Vasalai, Keelambal, Kumukottai, Veeravenur GPs

BOGALUR, KODIKULAM, T.KARUNGULAM, SEYYALUR, PANDIKANMAI, VAIRAVENANDHAL, SEVVUR, ARIYAKUDIPUDHUR, MUDALUR, MANJAKOLLAI, K.VASALAI, KEELAMBAL, KUMUKOTTAI, VEERAVENUR

Agriculture resources vulnerability

In agriculture and allied sectors, T.Karungulam, Muthuvayal, Pandikanmai GPs have high vulnerability followed by Manjakollai, Kavithakudi, Keelambal, Kodikulam, Pottithatti, Ariyakudipudhur, Theeyanur GPs

T.KARUNGULAM, MUTHUVAYAL, PANDIKANMAI, MANJAKOLLAI, KAVITHAKUDI, KEELAMBAL, KODIKULAM, POTTITHATTI, ARIYAKUDIPUDHUR, THEEYANUR

Socio-economic vulnerability

T.Karungulam, Pandikanmai, Ariyakudipudhur, Urathur GPs have high socio economic vulnerability

T.KARUNGULAM, PANDIKANMAI, ARIYAKUDIPUDHUR, URATHUR

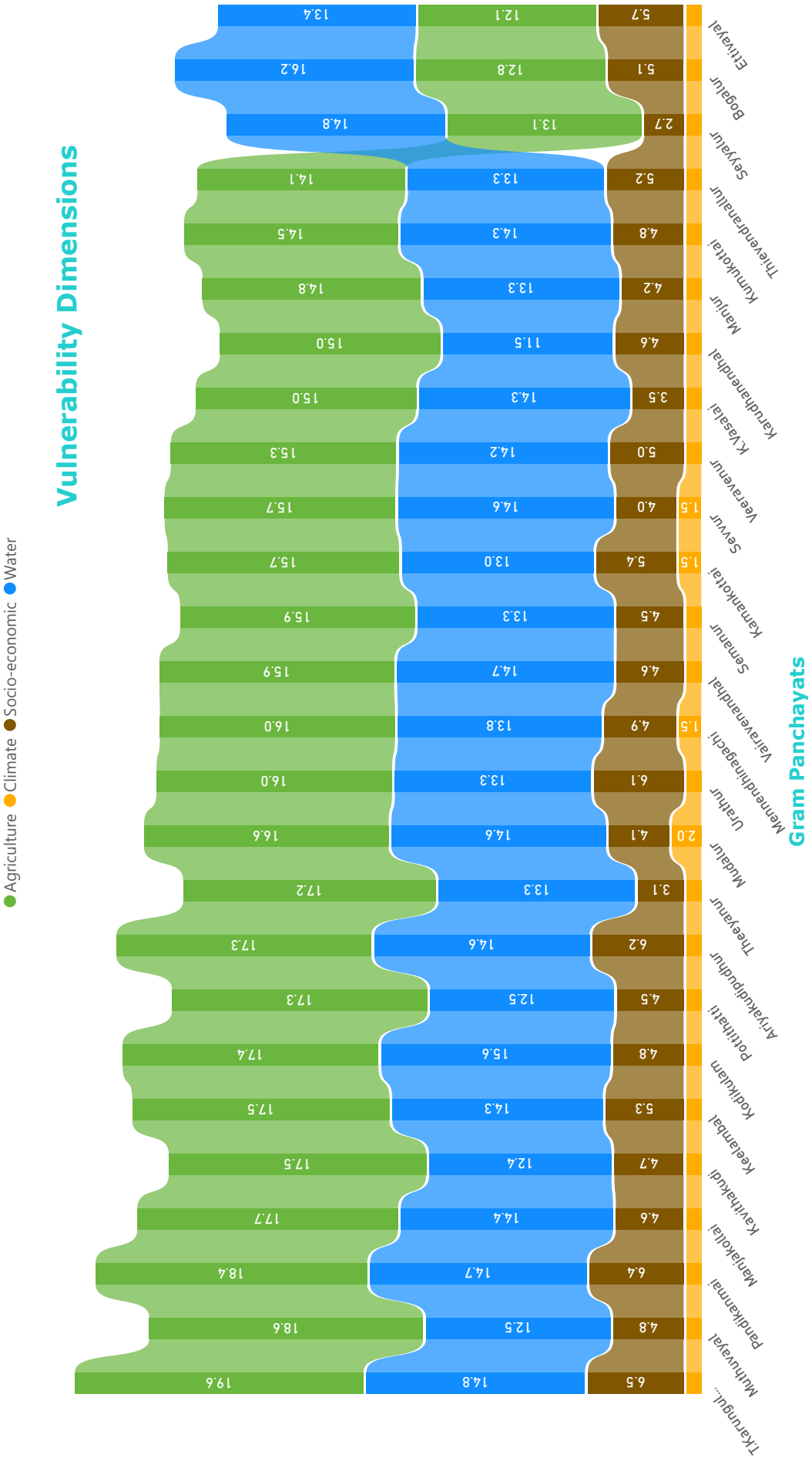
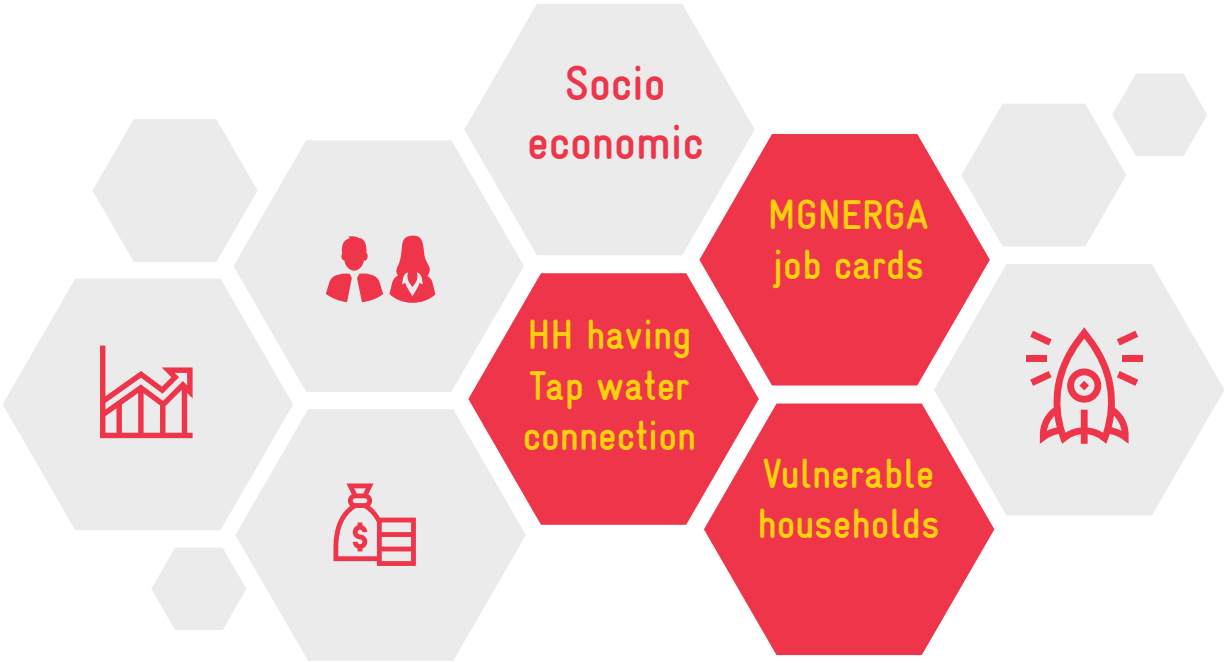
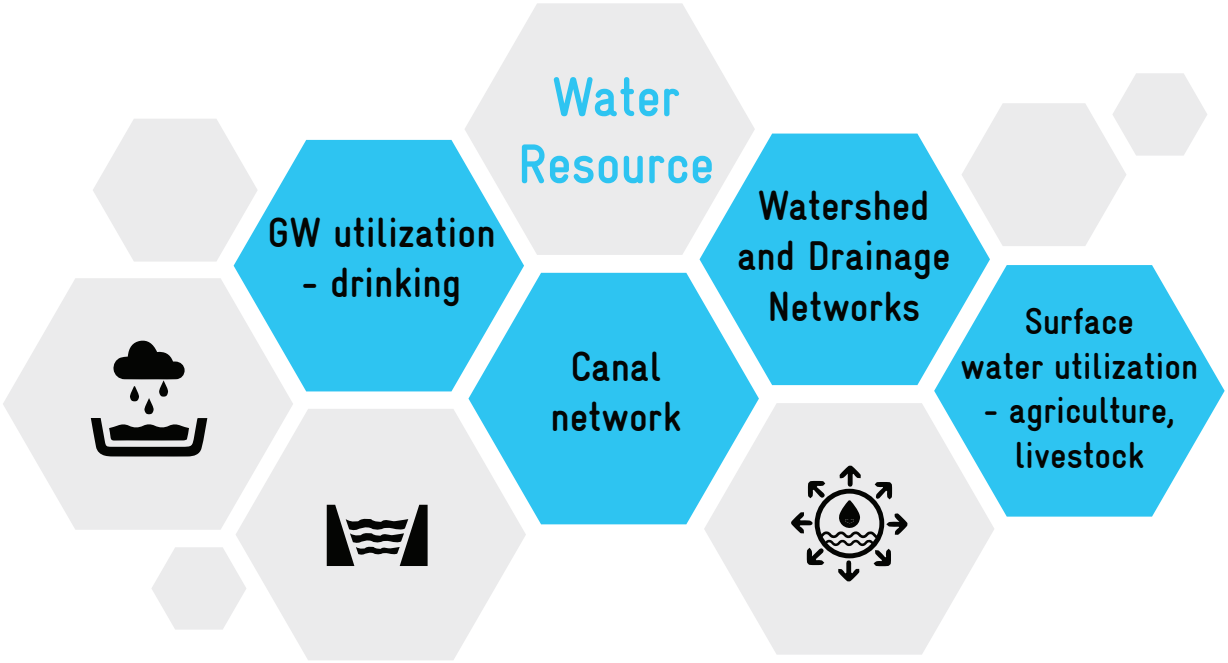
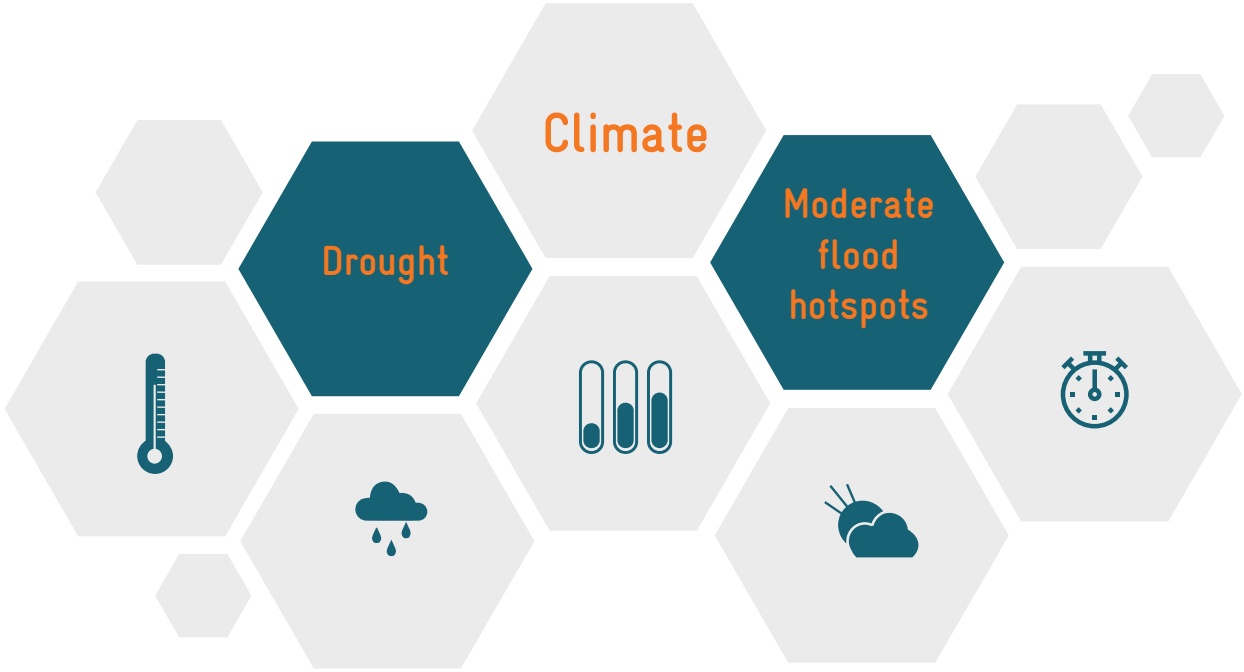


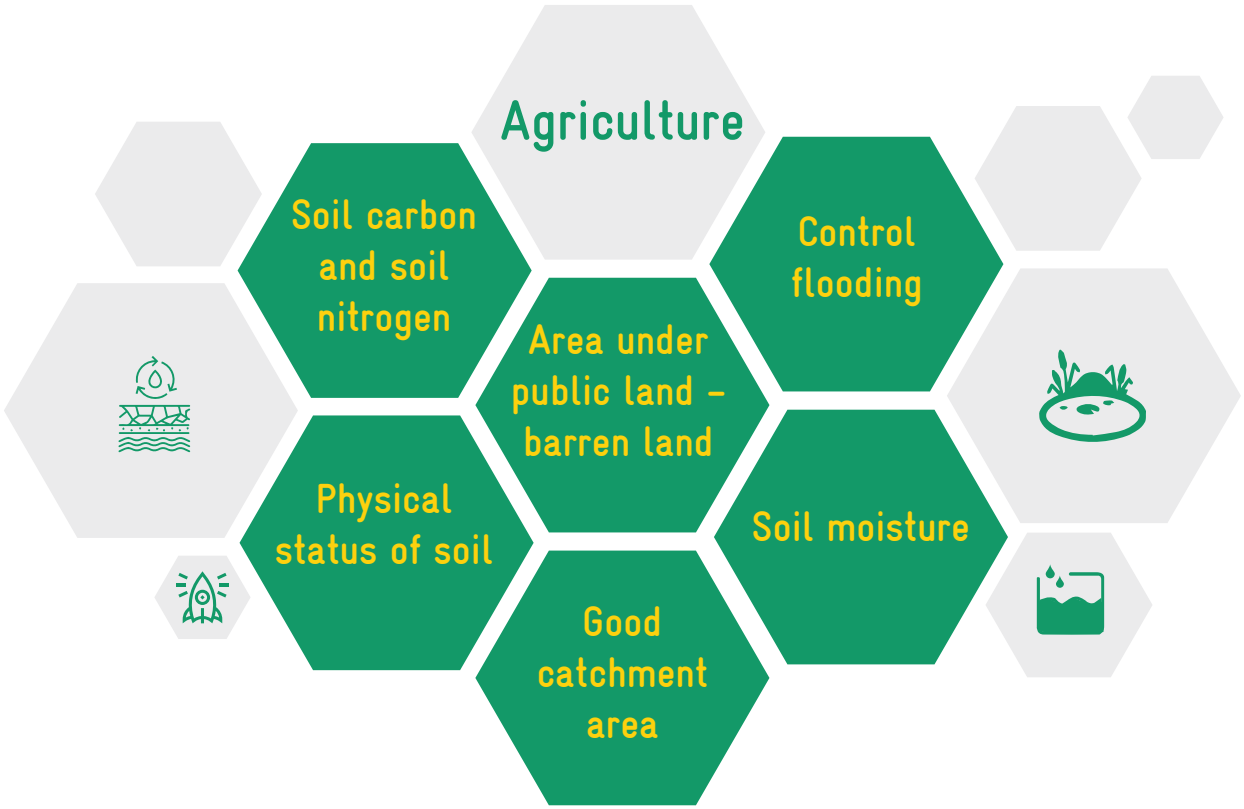
Figure 4.3. GP wise vulnerability dimensions

Contributing indicators to the total vulnerability









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

விசும்பின் துளிவீழின் அல்லால்மற் றாங்கே
பசும்புல் தலைகாண்பு அரிது

குறள் - 16

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

Thirukkural - 16

CHAPTER 5

PROPOSED KEY WATER ACTIONS UNDER MAHATMA GANDHI NREGS CONVERGENCE

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

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

5.1 THE PROPOSED AREA UNDER WASCA TREATMENT

Out of 17,690.88 ha available land in Bogalur Block, 2,211.87 ha (18.78 %) area is proposed for treatment under WASCA TN– CWRM planning. A major portion of Key Water Actions is proposed in 1,164.19 ha of land under miscellaneous tree crops (52.63 % of total proposed area), followed by 248.57 ha of unirrigated land (11.24 % of total proposed area) while least of 17.85 % area under permanent pastures and other grazing land was considered for treatment. The detailed land wise proposal for WASCA treatments is given in the Table 10 and Figure 5.1. GP wise proposed area for treatment is also attached in Annexure 5.1.

TABLE 10. THE PROPOSED AREA FOR WASCA TREATMENT

Land use	Total available land (ha)	WASCA proposed treatment area (ha)
Land Under Miscellaneous Tree Crops etc.	1,369.65	1,164.19
Unirrigated Land	4,025.99	248.57
Current Fallow land	3,837.90	232.40
Area Irrigated by Source	3,232.37	195.75
Non-Agricultural Uses	3,461.37	150.94
Fallows Land other than Current Fallows	1,613.28	92.25
Area under Barren & Un-cultivable Land	94.47	80.30
Cultivable Waste Land	34.84	29.61
Area under Permanent Pastures and Other Grazing Land	21.00	17.85

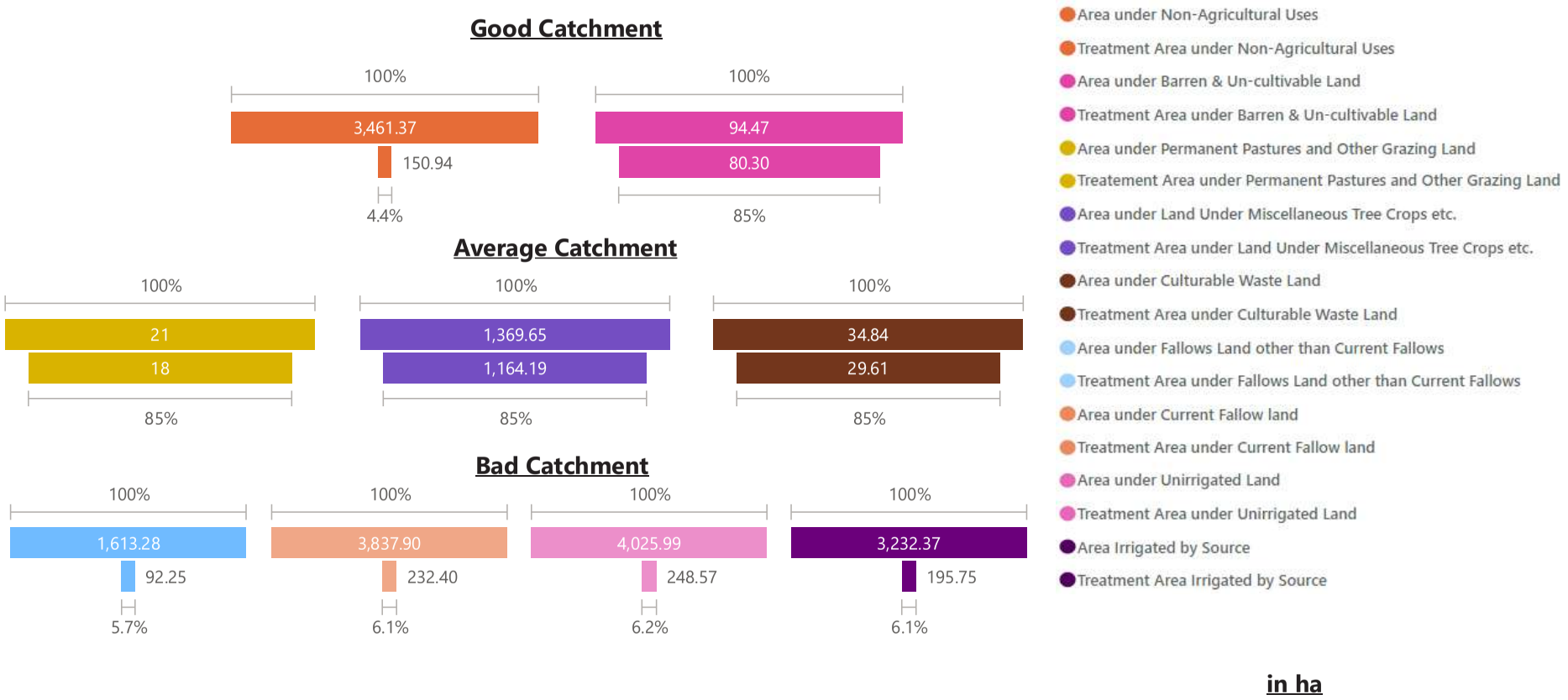


Figure 5.1. WASCA treatment area in percentage

Expected Runoff Conservation after WASCA treatment

The productive developmental activities that were taken up in the WASCA proposed areas are termed as Key Water Actions. With the above proposed treatment area, the expected runoff harvested due to WASCA intervention would be around 657.456 ha.m which is 27.03 % of the total runoff. Of the expected runoff conservation, the highest is from good catchment area of 58.47 % followed by 28.24 % of average and rest from bad catchment (Figure 5.2).

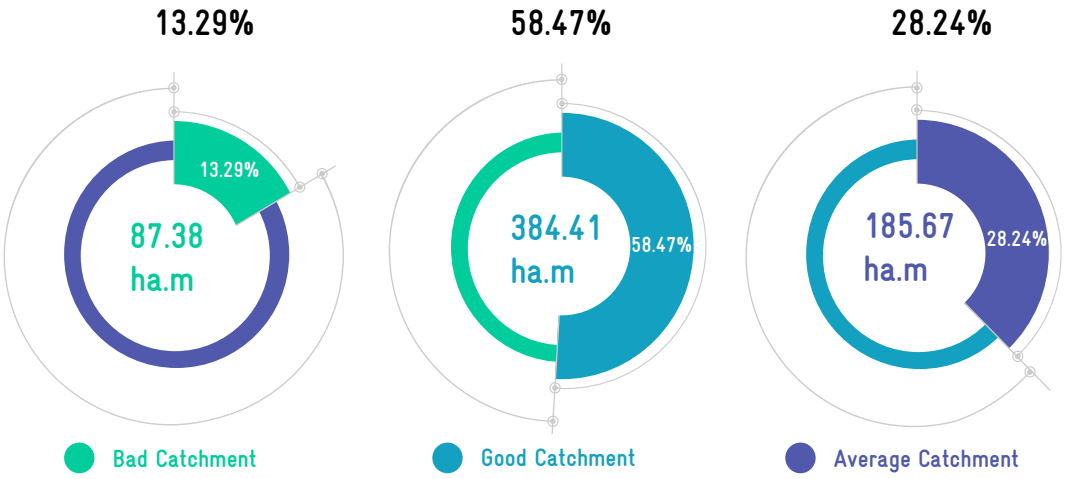


Figure 5.2. Expected conservation after WASCA treatment

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

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

Work (unit)	Abbreviation (unit)	No.	Extent (area in ha or length in m)
Artificial Recharge Structure(Number of units)	ARS	1,185	2,957
Construction of Farm Ponds - Individual (Number of units)	FP	228	769
Restoration of water bodies:PWD and Union Tanks(Number)	RPWDT	64	
Restoration of water bodies:Ooranis(Number)	Roo	196	
Restoration of water bodies:Ponds(Number)	RP	-	
Roof Rain Water Harvesting (Number of units)	RRWH	52	
Water Course - Irrigation Channels - Desilting (Mtrs)	WCICD	32,913	
Azolla units - Individual (Number of units)	Az	61	592
Cattle Shelters (Number of units)	CS	61	592
Cattle Trough(Number of units)	CT	61	592

Fodder development - Community & Individual	FD	61	592
Goat Sheep Shelters (Number of units)	GSS	894	8,937
Poultry Shed (Number of units)	PS	221	2,202
Silvi-pasture Development (ha)	SPD	14,280	18
Soak Pits (Community) (Number of units)	SPC	142	14,206
Soak Pits (Individual) (Number of units)	SPI	1,422	14,206
Afforestation in Public/common lands(ha)	Aff	1,84,995	231
Avenue plantation(km)	AVP	31,099	1,24,384
Block Plantation (Community)(ha)	BP	9,61,855	1,212
Canal Bund Plantation(ha)	CBP	15,823	63,278
Contour Continuous Bunds (CCB) for Afforestation area(Mtrs)	CCBF	46,248	231
Drainage Line Treatment (Mtrs)	DLT	10,257	41,028
Dry land Horticulture/Agro-forestry - Individual (ha)	DLHAI	155	384
Irrigation Channel Plantation (Mtrs)	ICP	8,231	32,913
Linear Plantation(km)	LP	8,726	34,904
Micro Irrigation(ha)	MI	78	196
Nursery Development (Number of units)	ND	71,030	14,206
Composting(Number of units)	Co	228	769
Farm Bunding with Boundary Trenches - Individual (ha)	FBBTI	309	769
Land development - Individual (ha)	LDI	114	287
NADEP Vermi compost (Number of units)	NADEP	61	592


Proposed works are included the drought proofing, livelihood, land development and WCWH, measures
Land development works over 1,417 ha area
More than 13.14 Lakhs plants planting
1,725 sites for WCWH
2,923 livelihood works

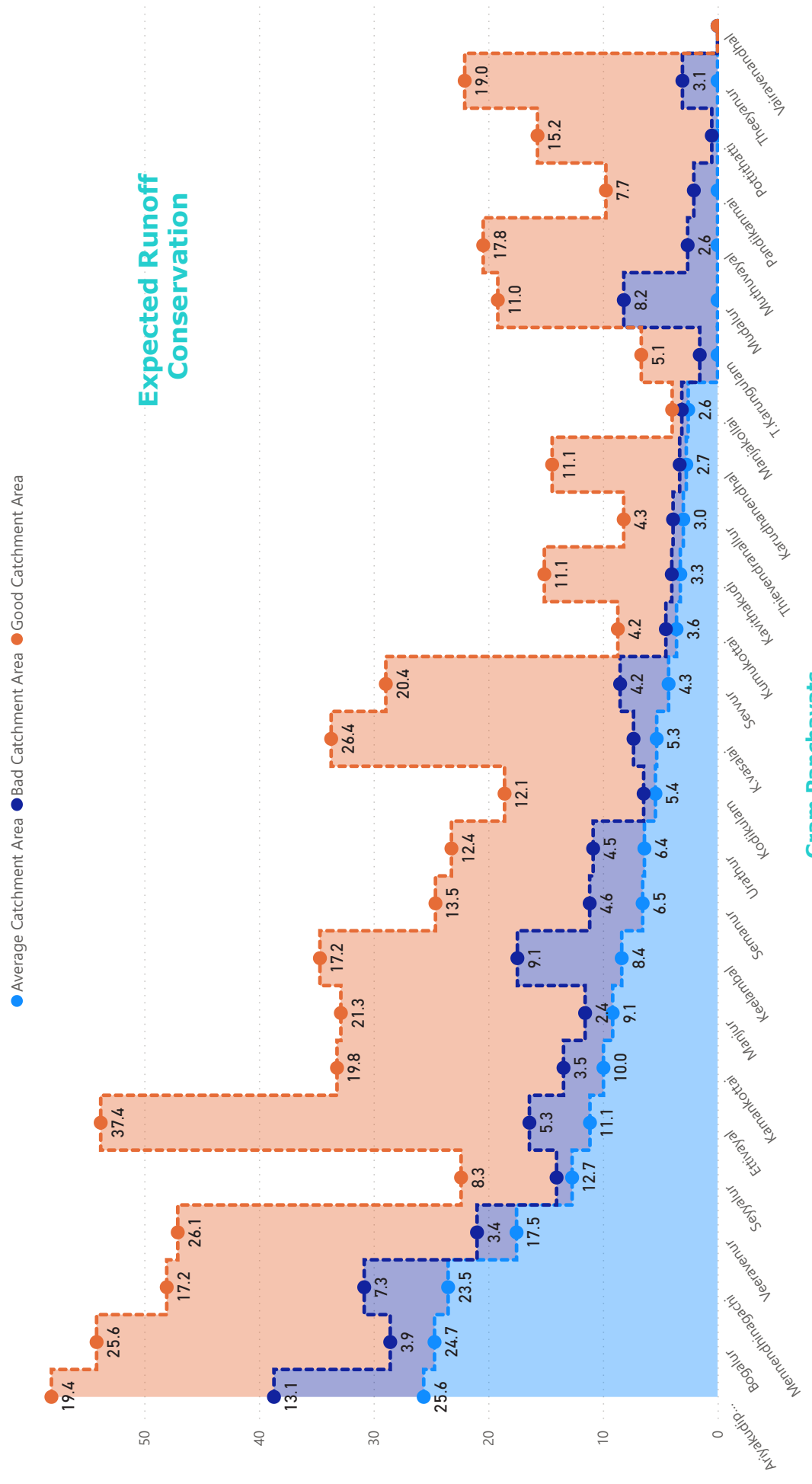


Figure 5.3. Expected GP wise runoff conservation after WASCA treatment

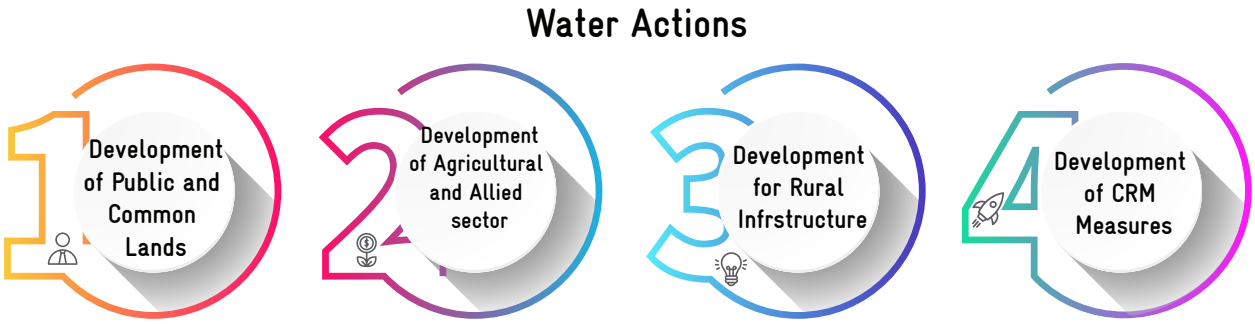
MAHATMA GANDHI NREGS Annual circular 2020-21 (Clause 6.3)

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

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

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

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



5.2 DEVELOPMENT OF PUBLIC & COMMON LANDS

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

DEVELOPMENT OF PUBLIC AND COMMON LANDS

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

	NO. OF WORKS	PERSON DAYS PER UNIT	UNIT COST IN INR (LAKHS)	ESTIMATED COST IN INR (LAKHS)	ESTIMATED PERSON DAYS
CONTOUR CONTINOUS BUNDS (CCB) FOR AFFORESTATION AREA(m)	925	10	0.025	23.12	9,250
COMPOSTING (NUMBER OF UNITS)	228	15	0.17	38.76	3,420
AFFORESTATION IN PUBLIC/ COMMON LANDS (ha)	231	3,344	8.6	1,988.66	7,73,267
BLOCK PLANTATION (COMMUNITY) (ha)	1,212	4,320	11.1	13,449.43	52,34,371
SILVI-PASTURE DEVELOPMENT (ha)	18	6,664	17.1	305.24	1,18,952
LINEAR PLANTATION (km)	34	703	1.8	61.29	23,937
CANAL BUND PLANTATION (ha)	86	2,930	7.5	646.65	2,52,625
IRRIGATION CHANNEL PLANTATION (m)	9,594	6	0.015	143.91	57,564
AVENUE PLANTATION(km)	124	703	1.8	223.89	87,442
NURSERY DEVELOPMENT (NUMBER OF UNITS)	355	2,344	15	5,327.25	8,32,472
RESTOTARATION OF WATER BODIES: PWD AND UNION TANKS (NUMBER)	49	800	5	245	39,200
RESTORATION OF WATER BODIES: OORANIS (NUMBER)	194	200	2	388	38,800
RESTORATION OF WATER BODIES: PONDS (NUMBER)	-	200	1	-	-
ARTIFICIAL RECHARGE STRUCTURE (NUMBER OF UNITS)	287	391	2.5	717.50	1,12,217
WATER COURSE - IRRIGATION CHANNELS - DESILTING (M)	9,594	3	0.0075	71.96	28,782
DRAINAGE LINE TREATMENT (m)	1,026	5	0.03	30.77	5,129

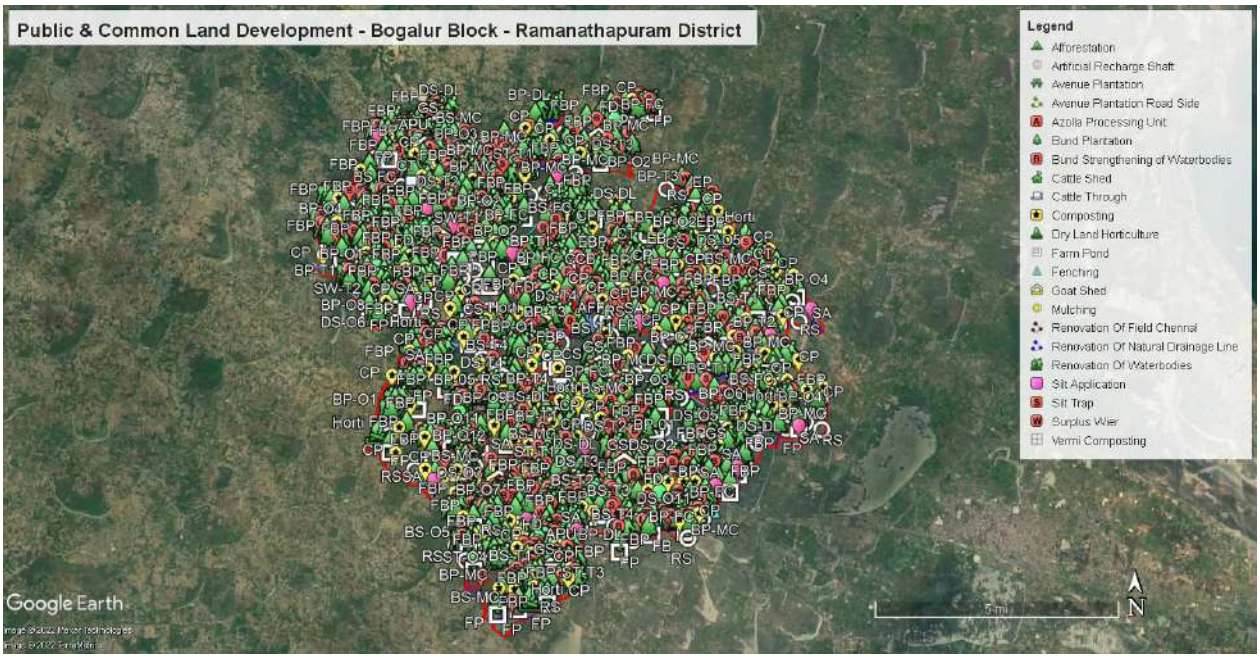


Figure 5.4. Proposed development activities in Public and Common land

5.3 DEVELOPMENT OF AGRICULTURE AND ALLIED SECTOR

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

DEVELOPMENT OF AGRICULTURE AND ALLIED ACTIVITIES

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

	NO. OF WORKS	PERSON DAYS PER UNIT	UNIT COST IN INR (LAKHS)	ESTIMATED COST IN INR (LAKHS)	ESTIMATED PERSON DAYS
FARM BUNDING WITH BOUNDARY TRENCHES - INDIVIDUAL (ha)	769	586	1.5	1,153.50	4,50,634
MICRO IRRIGATION (ha)	78	-	1	78	-
CONSTRUCTION OF FARM PONDS - INDIVIDUAL (NUMBER OF UNITS)	228	781	2	456	1,78,068
LAND DEVELOPMENT - INDIVIDUAL (ha)	287	3,906	10	2,866.20	11,19,538
DRY LAND HORTICULTURE/AGRO-FORESTRY - INDIVIDUAL (ha)	384	3,321	8.5	3,264	12,75,264
AZOLLA UNITS - INDIVIDUAL (NUMBER OF UNITS)	61	23	0.15	9.15	1,403
NADEP VERMI-COMPOST (NUMBER OF UNITS)	61	27	0.18	10.98	1,647
FODDER DEVELOPMENT - COMMUNITY & INDIVIDUAL	61	2,344	1.48	90.28	1,42,984
CATTLE SHELTERS (NUMBER OF UNITS)	61	331	2.12	129.32	20,191
GOAT SHEEP SHELTERS (NUMBER OF UNITS)	894	355	2.27	2,029.38	3,17,370
CATTLE TROUGH (NUMBER OF UNITS)	61	6	0.05	3.05	366
POULTRY SHED (NUMBER OF UNITS)	221	10	0.09	19.89	2,210

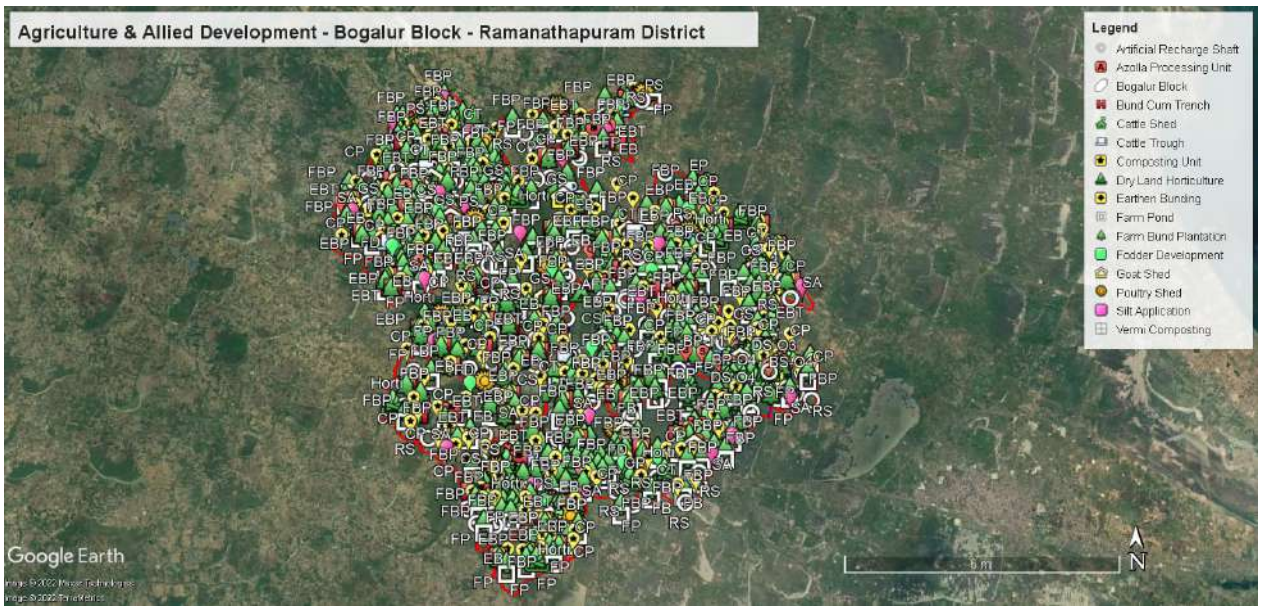


Figure 5.5. Proposed development activities in Agriculture and allied Sectors

5.4 DEVELOPMENT OF RURAL INFRASTRUCTURE

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

DEVELOPMENT OF RURAL INFRASTRUCTURE

TABLE 13. DETAILS OF WORK PROPOSED TO DEVELOP RURAL INFRASTRUCTURE

	NO. OF WORKS	PERSON DAYS PER UNIT	UNIT COST IN INR	ESTIMATED COST IN INR (LAKHS)	ESTIMATED PERSON DAYS
SOAK PITS (COMMUNITY) (NUMBER OF UNITS)	142	20	0.13	18.46	2,840
SOAK PITS (INDIVIDUAL) (NUMBER OF UNITS)	1,422	16	0.1	142.20	22,752
ROOF RAIN WATER HARVESTING (NUMBER OF UNITS)	52	625	4	208	32,500
TANKA - COMMUNITY LEVEL (NUMBER OF UNITS)	1	300	30	30	300

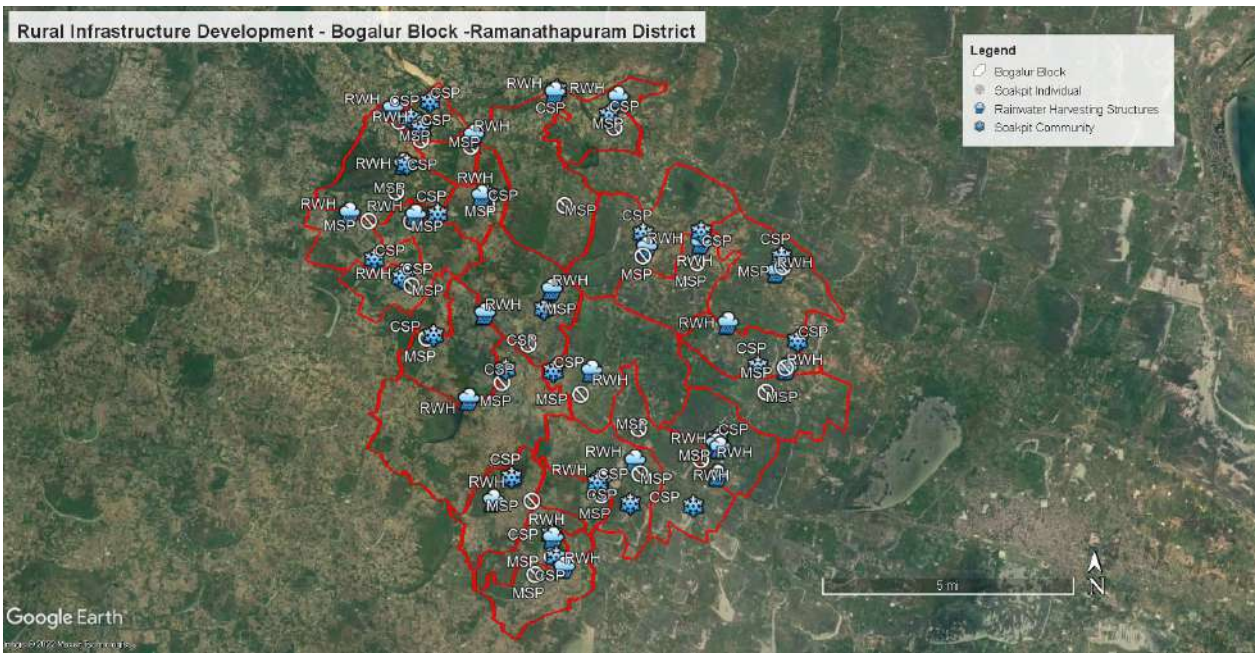


Figure 5.6. Proposed Rural Infrastructure activities

5.5 PROPOSED CLIMATE RESILIENCE MEASURES

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

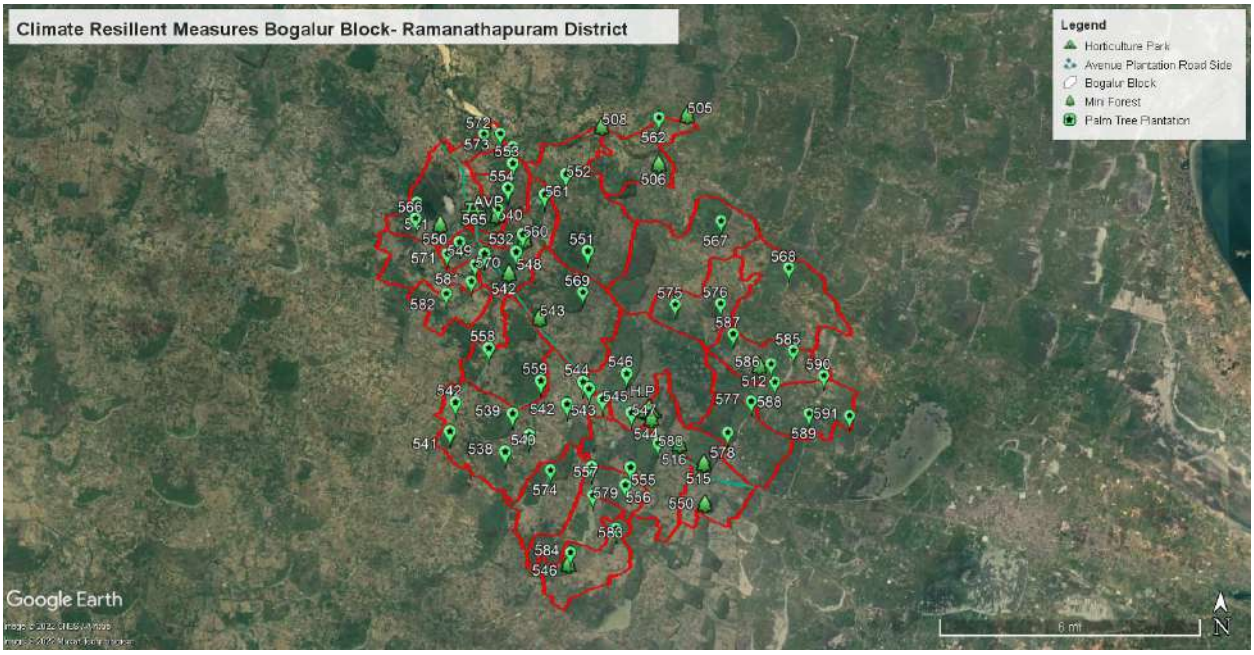


Figure 5.7. Proposed Climate Resilient measures

TABLE 14. GP WISE PROPOSED CRM

GP	Agriculture and allied activities	Public and common land	Rural infrastructure
K.Valasai	Mega Forest	GP level Nursery	Tanka
	Mini forest		
Bogalur	Horticulture Parks	GP level Nursery	Tanka
	Mini forest		
A.puthur	Mini forest	GP level Nursery	Tanka
Deivendranallur	Mini forest	GP level Nursery	Tanka
Ettivayal	Mini forest	GP level Nursery	Tanka
Kavithaikudi	Mini forest	GP level Nursery	Tanka
Manjur	Mini forest	GP level Nursery	Tanka
Pandikanmai	Mini forest	GP level Nursery	Tanka
Semanur	Mini forest	GP level Nursery	Tanka
Sevvur	Mini forest	GP level Nursery	Tanka
Theeyanur	Mini forest	GP level Nursery	Tanka
Urathur	Mini forest	GP level Nursery	Tanka
Manjakollai	Mini forest		Tanka
Kumukkottai		GP level Nursery	Tanka
Vairavanendal		GP level Nursery	Tanka
Veeravanur		GP level Nursery	Tanka
Karuthanendal			Tanka
Keelambal			Tanka
Mennendhi Nagachi			Tanka
Mudalur			Tanka
Potithatti			Tanka
S Kodikulam			Tanka
Seyyalur			Tanka
T.Karangulam			Tanka
Muthalur	Mega Forest	GP level Nursery	
	Mini forest		
Muthuvayal	Mega Forest	GP level Nursery	
	Mini forest		
Kamankottai	Mini forest	GP level Nursery	
Karuthanenthal	Mini forest	GP level Nursery	
Keelampal	Mini forest	GP level Nursery	
Pottithatti	Mini forest	GP level Nursery	
S.Kodikulam	Mini forest	GP level Nursery	
T.Karungulam	Mini forest	GP level Nursery	
Kummukottai	Mini forest		
Mennanthi Nagatchi	Mini forest		
Seiyalur	Mini forest		
Manjakkollai		GP level Nursery	
Mennanthi Nagachi		GP level Nursery	
Sheiyalur		GP level Nursery	

TABLE 15. DETAILS OF PROPOSED FARM PONDS ACTIVITY UNDER CRM

Block Target	Community Farm Ponds	Individual Farm Ponds	Individual Farm Ponds Completed	Individual Farm Ponds Ongoing
21	11	10	8	2

TABLE 16. DETAILS OF PROPOSED HORTICULTURE PARK ACTIVITIES UNDER CRM

GP	Area in ha	No. of Plants (1 ha – 10,000 saplings)	Land type
Bogalur	1.00	300	**Govt Purampokku land**

TABLE 17. DETAILS OF PROPOSED MEGA FOREST ACTIVITY UNDER CRM

GP	Area for Plantation (In ha)	Total No. of Plants (1ha - 10000 saplings)	Classification of land
K.Valasai	0.5 ha in each GP	5,000 in each GP	**Govt. Purampok-ku land**
Muthalur			
Muthuvayal			
Muthuvayal			
Total	**2**	**20,000**	

TABLE 18. DETAILS OF PROPOSED MINI FOREST ACTIVITY UNDER CRM

GP	Area for Plantation (In ha)	Total No. of Plants (1ha - 10000 saplings)	Classification of land
A.puthur	0.15	1,500	**Govt Purampok-ku land**
Bogalur	0.15	1,500	
Deivendranallur	0.2	2,000	
Ettivayal	0.15	1,500	
K.Valasai	0.1	1,000	
Kamankottai	0.15	1,500	
Karuthanenthal	0.1	1,000	
Kavithaikudi	0.1	1,000	
Keelampal	0.1	1,000	
Kummukottai	0.05	500	
Manjakollai	0.1	1,000	
Manjur	0.05	500	
Mennanthi Nagatchi	0.2	2,000	
Muthalur	0.1	1,000	
Muthuvayal	0.1	1,000	
Pandikanmai	0.05	500	
Pottithatti	0.05	500	
S.Kodikulam	0.1	1,000	
Seiyalur	0.1	1,000	
Semanur	0.1	1,000	
Sevvur	0.05	500	
T.Karungulam	0.1	1,000	

Theeyanur	0.25	2,500	**Govt Purampok-ku land**
Urathur	0.1	1,000	
Vairavanenthal	0.1	1,000	
Veeravanur	0.05	500	
Total	**2.85**	**28,500**	

TABLE 19. DETAILS OF PROPOSED TANKA ACTIVITY UNDER CRM

Sl. No.	GP	Classification of land
1	A.Puthur	Government Land
2	Bogalur	
3	Deivendranallur	
4	Ettivayal	
5	K.Valasai	
6	Karuthanendal	
7	Kavithaikudi	
8	Keelambal	
9	Kumukkottai	
10	Manjakollai	
11	Manjur	
12	Mennendhi Nagachi	
13	Mudalur	
14	Pandikanmai	
15	Potithatti	
16	S Kodikulam	
17	Semanur	
18	Sevvur	
19	Seyyalur	
20	T.Karangulam	
21	Theeyanur	
22	Urathur	
23	Vairavanendal	
24	Veeravanur	

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

Sl. No.	GP	Total No. of Plants
1	A.Puthur	1,000 saplings in each GP
2	Bogalur	
3	Deivendranallur	
4	Ettivayal	
5	K.Valasai	
6	Kamankottai	
7	Karuthanenthal	
8	Kavithaikudi	
9	Keelampal	
10	Kumukkottai	
11	Manjakkollai	
12	Manjur	
13	Mennanthi Nagachi	
14	Muthalur	
15	Muthuvayal	
16	Pandikanmai	
17	Pottithatti	
18	S.Kodikulam	
19	Semanur	
20	Sevvur	
21	Sheiyalur	
22	T.Karungulam	
23	Theeyanur	
24	Urathur	
25	Vairavanendal	
26	Veeravanur	
Total		**26,000**

நெடுங்கடலும் தன்நீர்மை குன்றும் தடிந்தெழிலி
தான்நல்கா தாகி விடின்

குறள் - 17

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

Thirukkural - 17

CHAPTER 6

PROJECTED OUTCOMES OF PLANNING

6 PROJECTED OUTCOMES OF PLANNING

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

6.1 OUTCOMES OF DEVELOPMENT OF PUBLIC AND COMMON LANDS

OUTCOMES OF DEVELOPMENT OF PUBLIC AND COMMON LANDS

	INDICATOR	OUTCOMES/ IMPACT
1	Proportion of Land development under WASCA treatment	2211.87 ha (12.5 %) of the total area treated under WASCA
2	Percentage reduction of run off	657.46 ha.m i.e 27.03 % of the total runoff harvested due to WASCA interventions
3	No. of waterbodies restored	243 waterbodies (tanks/pond and ooranis) restored
4	Area under afforestation	231.24 ha area under afforestation
5	Length of drainage line treated	41.02 km length of drainage line treated
6	Canal Bund Plantation	More than 17 thousand plants through 35 works
7	Nursery development	355 units

22,11.87 ha
AREA TREATED

657.46 ha.m
TOTAL RUNOFF HARVESTED

243
WATER BODIES RESTORED

231.24 ha
AREA AFFORESTATION

41.02 km
DRAINAGE LINE TREATED

17,000
PLANTS

355 UNITS
NURSERY DEVELOPMENT

6.2 OUTCOMES OF DEVELOPMENT OF AGRICULTURE AND ALLIED SECTOR

OUTCOMES OF DEVELOPMENT OF AGRICULTURE AND ALLIED ACTIVITIES

	INDICATOR	OUTCOMES/ IMPACT
1	Assessment of sources of water for live-stock and agriculture demand No of structures established for on-farm (in-situ) water harvesting in dry lands	228 farm ponds established which target the harvest of 4,01280 cu.m of water which has the potential to irrigate 79.8 ha area
2	Improvement in soil health	61 NADEP vermicomposting units for soil health improvement
3	Dry land development with agro-forestry	384 ha under dry land horticulture
4	Households established fodder plots	592 vulnerable households established fodder plots
5	Sheds for livestock's (cattle, goat, poultry)	1,176

228 FARM PONDS

61 COMPOST UNITS

592 FODDER PLOTS

384 ha DRY LAND HORTICULTURE

1,176 SHEDS FOR LIVESTOCK'S

6.3 OUTCOMES OF RURAL INFRASTRUCTURE DEVELOPMENT

OUTCOMES OF RURAL INFRASTRUCTURE DEVELOPMENT

	INDICATOR	OUTCOMES/ IMPACT
1	No. of villages having liquid waste management systems	1,422 individual and 142 community level soak pits established for recycle of grey water benefiting 13,571 HHs
2	Roof rain water harvesting measures	52 common roof rainwater harvesting and storage structures with a target to harvest and store 0.1 ha.m of rainwater for use
3	Nutri-garden	13,571 HHs established nutri-gardens in homesteads and planted 67,855 saplings

142 COMMON & **1,422** INDIVIDUAL SOAK PITS

52 COMMON ROOF RAINWATER HARVESTING

13,571 NUTRI-GARDENS

67,855 SAPLINGS

6.4 OUTCOMES OF CLIMATE RESILIENCE MEASURES

OUTCOMES OF CLIMATE RESILIENCE MEASURES

	INDICATOR		OUTCOMES/ IMPACT
1	Climate resilient measures are identified for climate risks	1	6 models are identified via., Farm ponds, horticulture park, GP level nursery, mini forest, mega forest, and tankas 11 community and 8 individual farm ponds are completed in the GP Bamboo plantation in 4.85 ha area with 4,000 plants GP level nursery in 26 GPs with 26,000 plants (1,000 per GP) Horticulture Park in 1 ha. Mega forest in 2 ha area with 20,000 plants Mini forest in 2.85 ha with 28,500 plants Tankas in 24 GPs

11 COMMUNITY & **8** INDIVIDUAL FARM PONDS

4.85 ha BAMBOO PLANTATION

26 GP LEVEL NURSERY

2 ha MEGA FOREST

1 ha HORTICULTURE PARK

2.85 ha MINI FOREST

24 TANKAS

Estimated person days

The total estimated person days required for the above proposed activities are 1,11,85,493 as specified below Figure 6.1.

Estimated Cost

The total estimated cost budgeted for the above proposed activities is Rs 34,169.84 Lakhs as specified below in Figure 6.2.

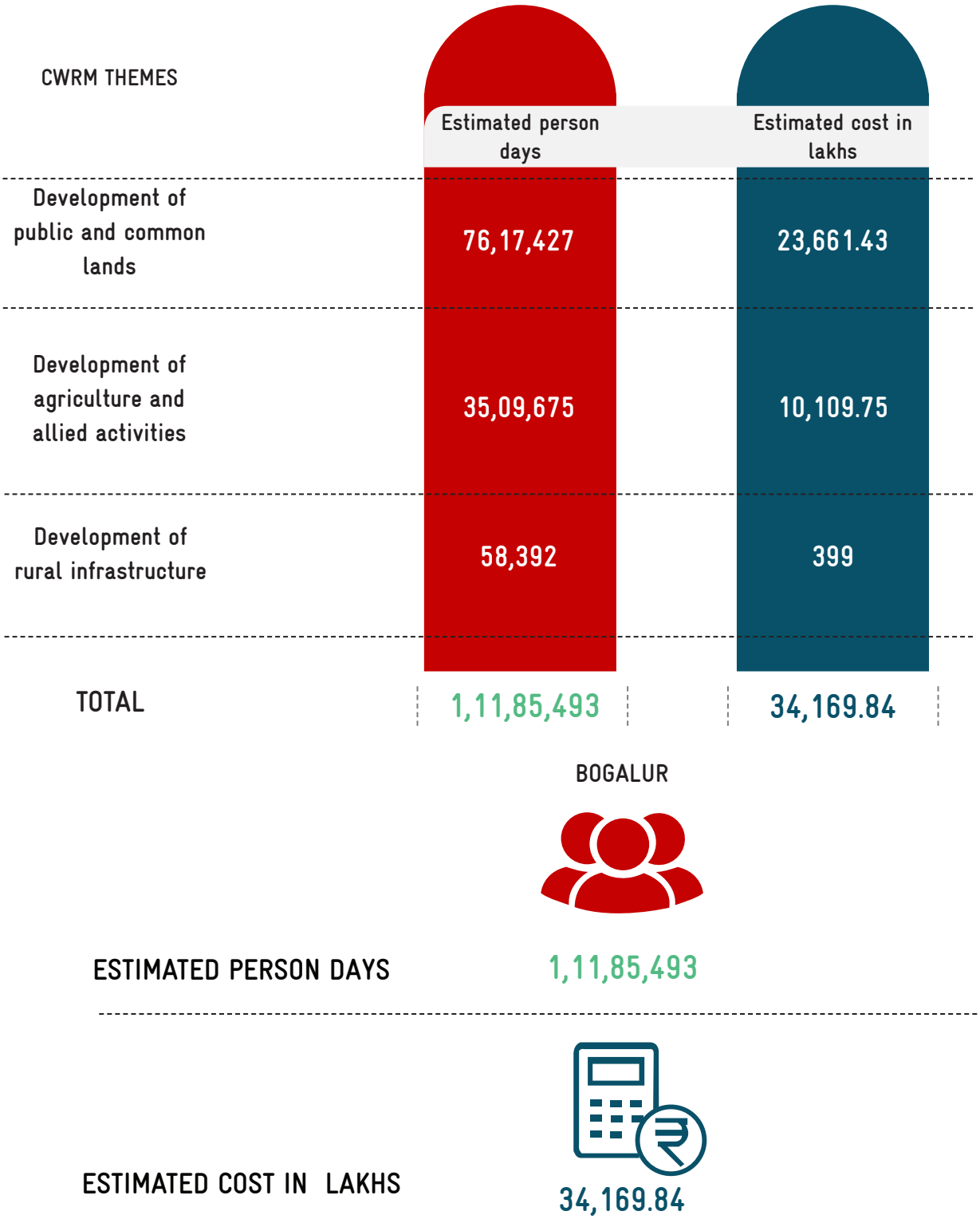


Figure 6.1 & 6.2. Estimated person days & cost for all water actions

6.5 LINKAGES TO SDGS, NDCS

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

6.5.1 NATIONALLY DETERMINED CONTRIBUTION GOALS AND WASCA TN PROGRESS THROUGH NDC

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

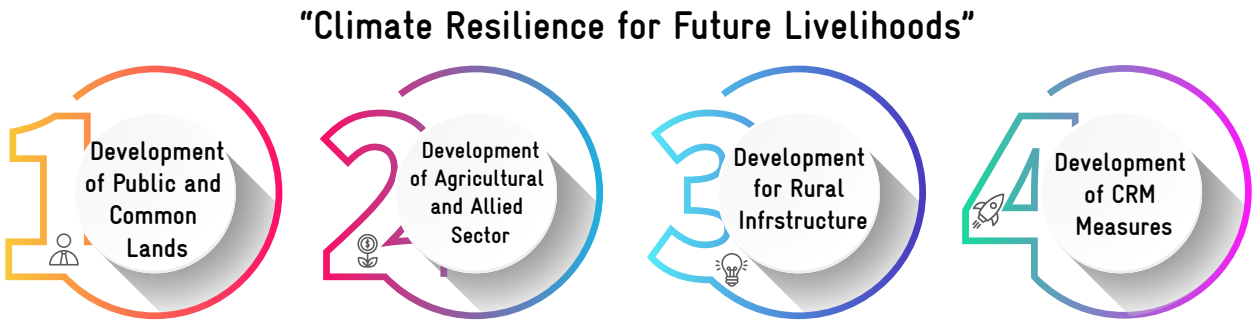
Internationally, the recent process on NDC Enhancement (2020) significantly acknowledge the climate change vulnerability on national sectors including agriculture, energy, and urban areas, especially through impacts on water resources. The role that water and water-related activities play in national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

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

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

6.5.2 WASCA TN SUPPORTS SDG

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



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

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

SDG GOAL 6

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

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

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

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

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

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

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

Percentage of rural population having improved source of drinking water

Percentage of ground water withdrawal against availability

Percentage of Blocks/Mandals/Talukas over-exploited

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

Percentage of degraded land over total land area

Percentage increase in area of desertification

The indicators used for District level vulnerability assessment along with its linked SDGs are already tabulated in (Table 2). The detailed proposed water actions in CWRM which was assessed based on the vulnerability dimensions are linked with climate vulnerability index and SGDs are tabulated in Table 22 to 24.

TABLE 22. WATER ACTIONS ON DEVELOPMENT OF PUBLIC & COMMON LANDS & ITS LINKED SDG

Name of the work	No. of CWRM works	Climate Vulnerability Index Impacting (WASCA TN)	Linked SDG Goal
Contour Continuous Bunds for Afforestation area (m)	925	W3	SDG 1,2, 6,13&15
Composting (No. of units)	228	W1	SDG1& 6
Afforestation in Public/common lands (ha)	231	C1,C2,C3, W3,	SDG 1, 2,6,13&15
Block Plantation (Community) (ha)	1,212	C1,C2,C3,W3,S2	SDG 1,2, 6 &13, 15
Silvi-pasture Development (ha)	18	C1,C2,C3,W3	SGG 12 &15
Linear Plantation (km)	34	C1,C2,C3,W3,S2	SDG 1,2,6,12&13, 15
Canal Bund Plantation (ha)	86	C1,C2,C3,W3,S2	SDG 1, 6&13, 15
Irrigation Channel Plantation (m)	9,594	W4,W5,S2	SDG 1,2& 6, 15
Avenue plantation (km)	124	C1,C2,C3,W3,S2	SDG 1, 6&13

Nursery Development (No. of units)	355	C1,S2,S4	SDG 1,2 &6
Restoration of waterbodies :PWD and Tanks (No.)	49	S2, S1	SDG 6, 1, 13
Restoration of water bodies : Ooranis (No.)	194	S2, S1	SDG 6, 1, 13
Restoration of waterbodies :Ponds (No.)	0	S2, S1	SDG 6,1, 13
Artificial Recharge Structure (No. of units)	287	W3	SDG 1, 2, & 6
Water Course - Irrigation Channels - Desilting (m)	9,594	C1,C2,C3,W3,S2	SDG 1, 6&13
Drainage Line Treatment (m)	1,026	W1,W3,W4	SDG1 & 6

TABLE 23. WATER ACTIONS ON DEVELOPMENT OF AGRICULTURAL AND ALLIED SECTOR & IT'S LINKED SDG

Name of the Work	No. of CWRM works	CVI	SDG
Farm Bunding with Boundary Trenches - Individual (ha)	769	A1,A3,W1,W3	SDG 1,2&6
Micro Irrigation(ha)	78	A1,A3,A5,W5	SDG 1, 2&6
Construction of Farm Ponds - Individual (No. of units)	228	A1,A3,W5,W1, W3	SDG 2& 6
Land development - Individual (ha)	287	W1,W5,A1,A3,S2,S4	SDG 2, 6&
15	786	A1,A3,A4,W1,S4,S2,C1	SDG 1& 2,15
Dry land Horticulture/Agro-forestry - Individual (ha)	384	A1,A3,A4,W1,S4,S2,C1	SDG 1& 2,15
Azolla units - Individual (No. of units)	61	A3,A4,S4	SDG 1& 2
NADEP Vermi compost (No. of units)	61	A3, W1, S4	SDG 1& 2,6
Fodder development - Community & Individual	61	A3, S4	SDG 1& 2, 15
Cattle shelters (No. of units)	61	S4	SDG 1& 2
Goat/sheep shelters (No. of units)	894	S4	SDG 1& 2
Cattle trough(No. of units)	61	W5,S4	SDG 1& 2
Poultry Shed (No. of units)	221	S2,S4	SDG 1& 2

TABLE 24. WATER ACTIONS ON RURAL WATER MANAGEMENT & IT'S LINKED SDG

Name of the work	No. of CWRM works	CVI	Linking SDG
Soak Pits (Community) (No. of units)	142	W3,S2	SDG 1& 6
Soak Pits (Individual) (No. of units)	1,422	W3,S2	SDG 1& 6
Roof Rain Water harvesting (No. of units)	52	W3,S1,S3	SDG 1& 6
Tanka - community level (No. of units)	1	W3,S1,S3	SDG 1& 6

சிறப்பொடு பூசனை செல்லாது வானம்
வறக்குமேல் வானோர்க்கும் ஈண்டு

குறள் - 18

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

Thirukkural - 18

CHAPTER 7

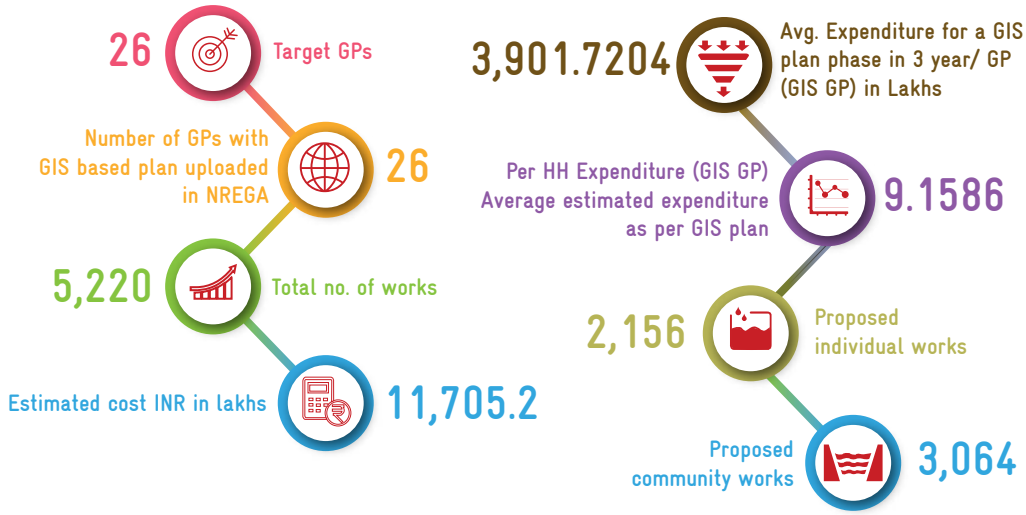
7 IMPLEMENTATION OF GP PLANS

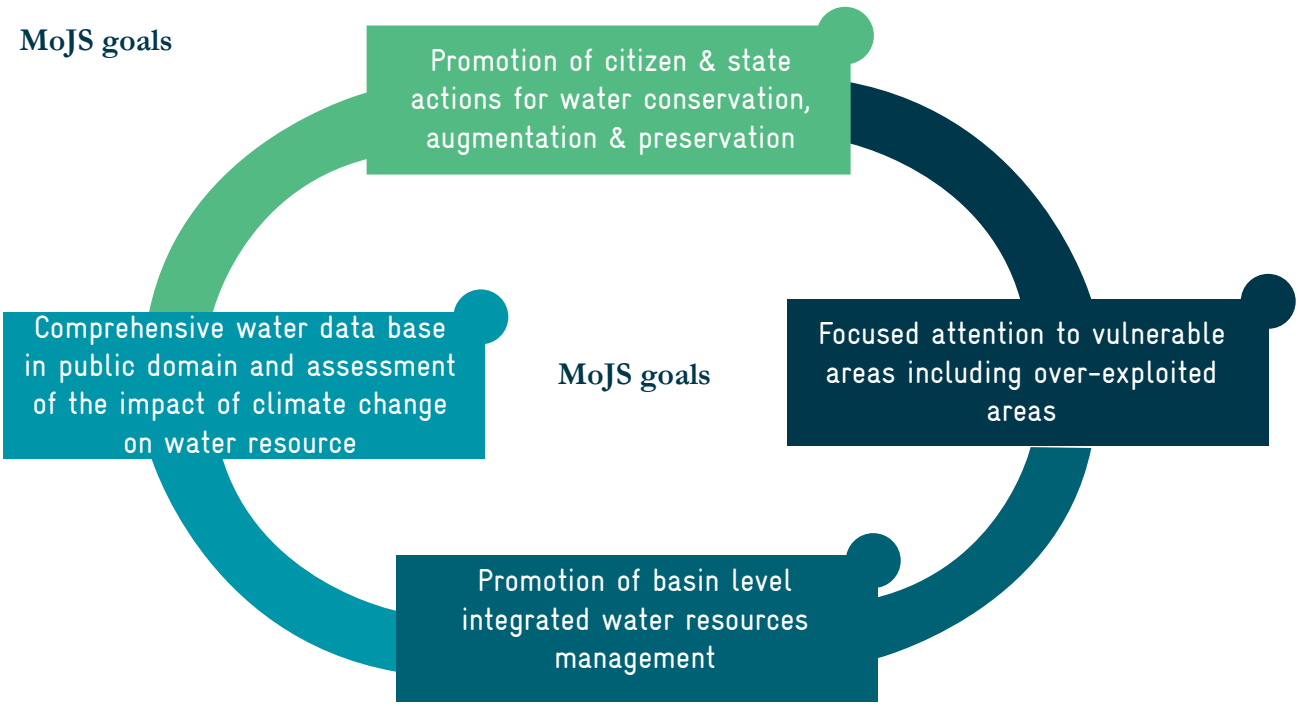
Execution of GP plans includes integrating all verified, approved works in MORD's web enabled application NREGA Soft (https://nrega.nic.in) for mainstreaming WASCA. The target GPs are identified first, the status of GIS based plans and total works along with its expenditure and category wise estimation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

7.1 INTEGRATION INTO NREGA SOFT

WASCA is progressing towards digitizing and integrating GP level GIS based plans, both NRM and Non-NRM into Mahatma Gandhi NREGS portal. The performance and implementation of GP plans of Bogalur Block is listed in Table 25 and work progress, expenditure during the past 3 financial years are shown in Figure 7.1 and 7.2. The Total No. of works, ongoing and completed GIS works are shown in Figure 7.3. The GP wise recommendations and works uploaded are given in Annexure 7.1.

TABLE 25. GIS-BASED PLAN IMPLEMENTATION- KEY PARAMETERS PERFORMANCE IN BOGALUR BLOCK





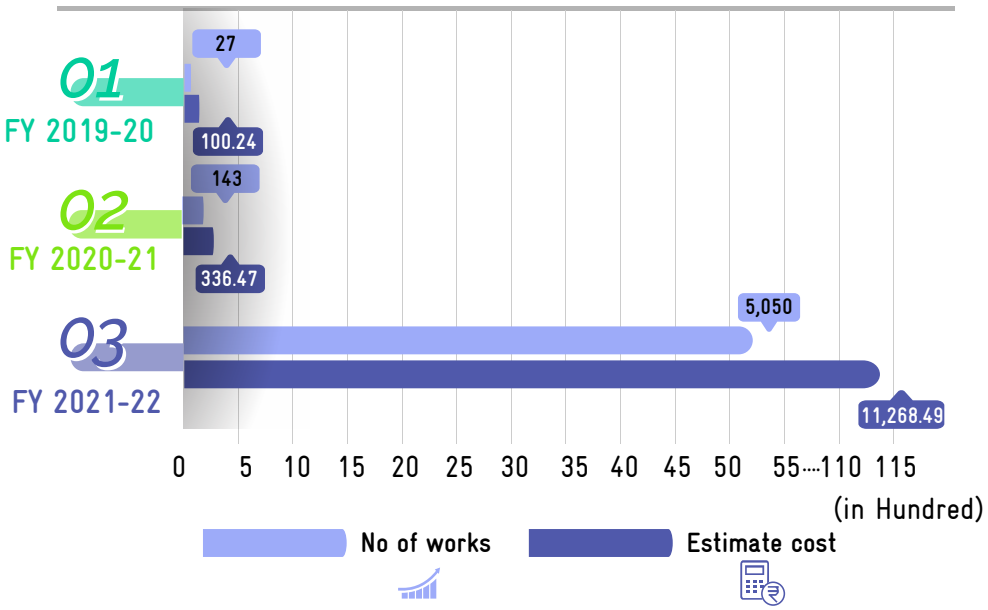


Figure 7.1. Work progress in last three years

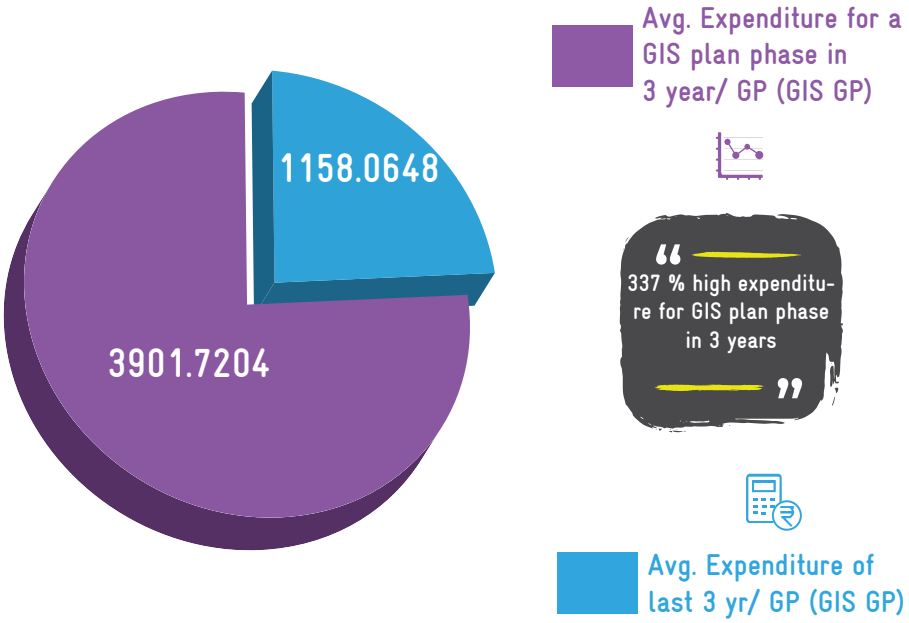
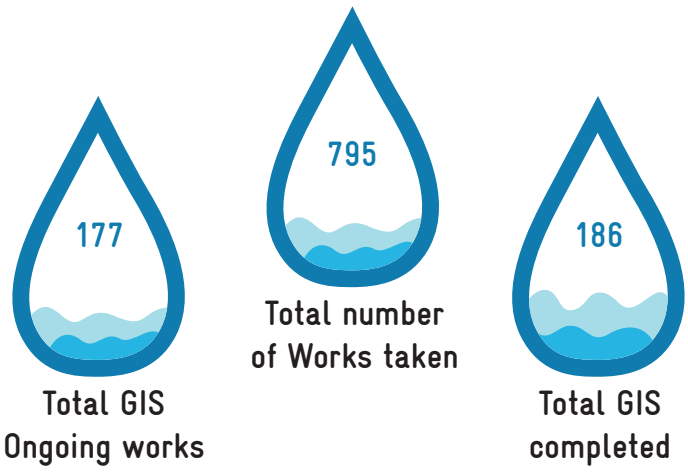


Figure 7.2. Average Expenditure for GIS plan in last 3 years



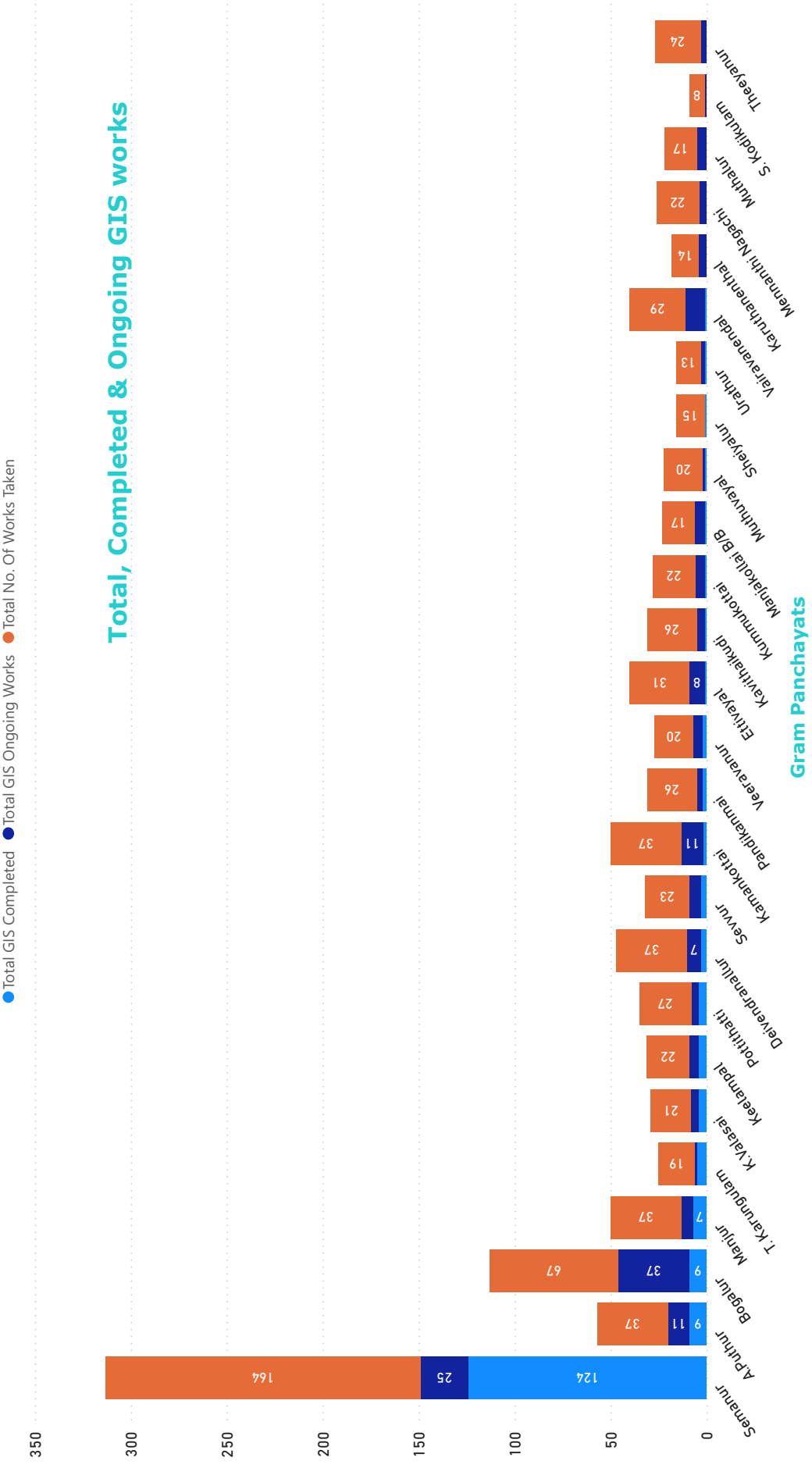
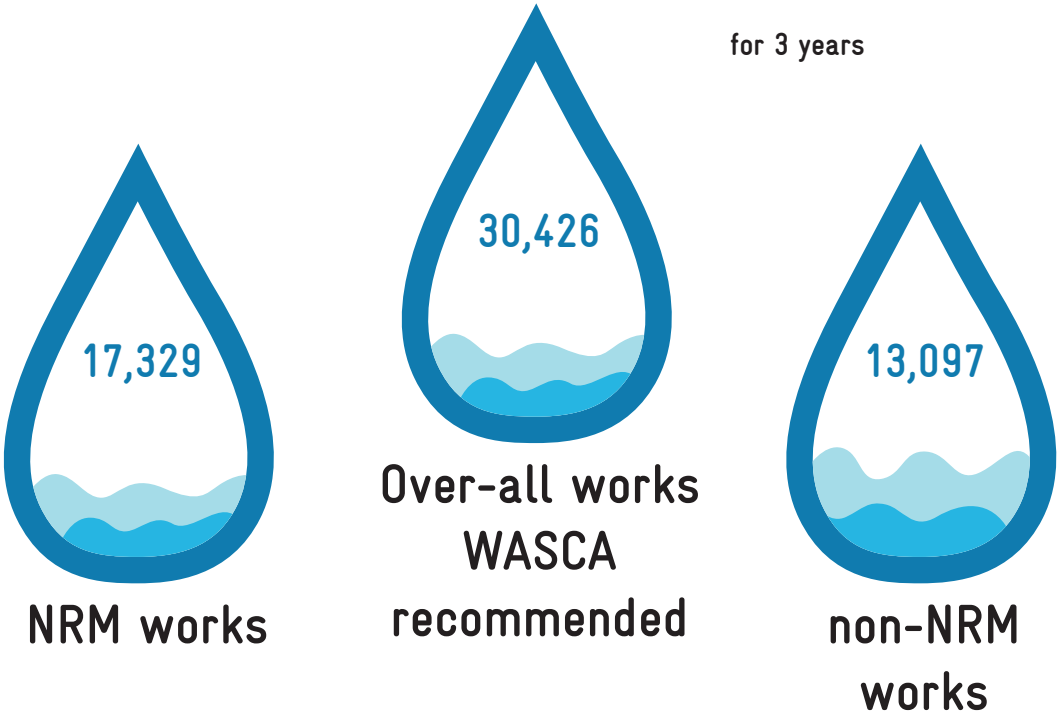


Figure 7.3. GP wise total, completed and ongoing GIS works (2021-22)

7.2 WASCA RECOMMENDED NRM AND NON-NRM WORKS

WASCA recommended 30,426 works for a period of 3 years, out of which 17,329 are NRM works and 13,097 are non NRM works (Figure 7.4). A total of 5,050 works has been uploaded so far for the financial year 2021-22 as on 01/03/2021.



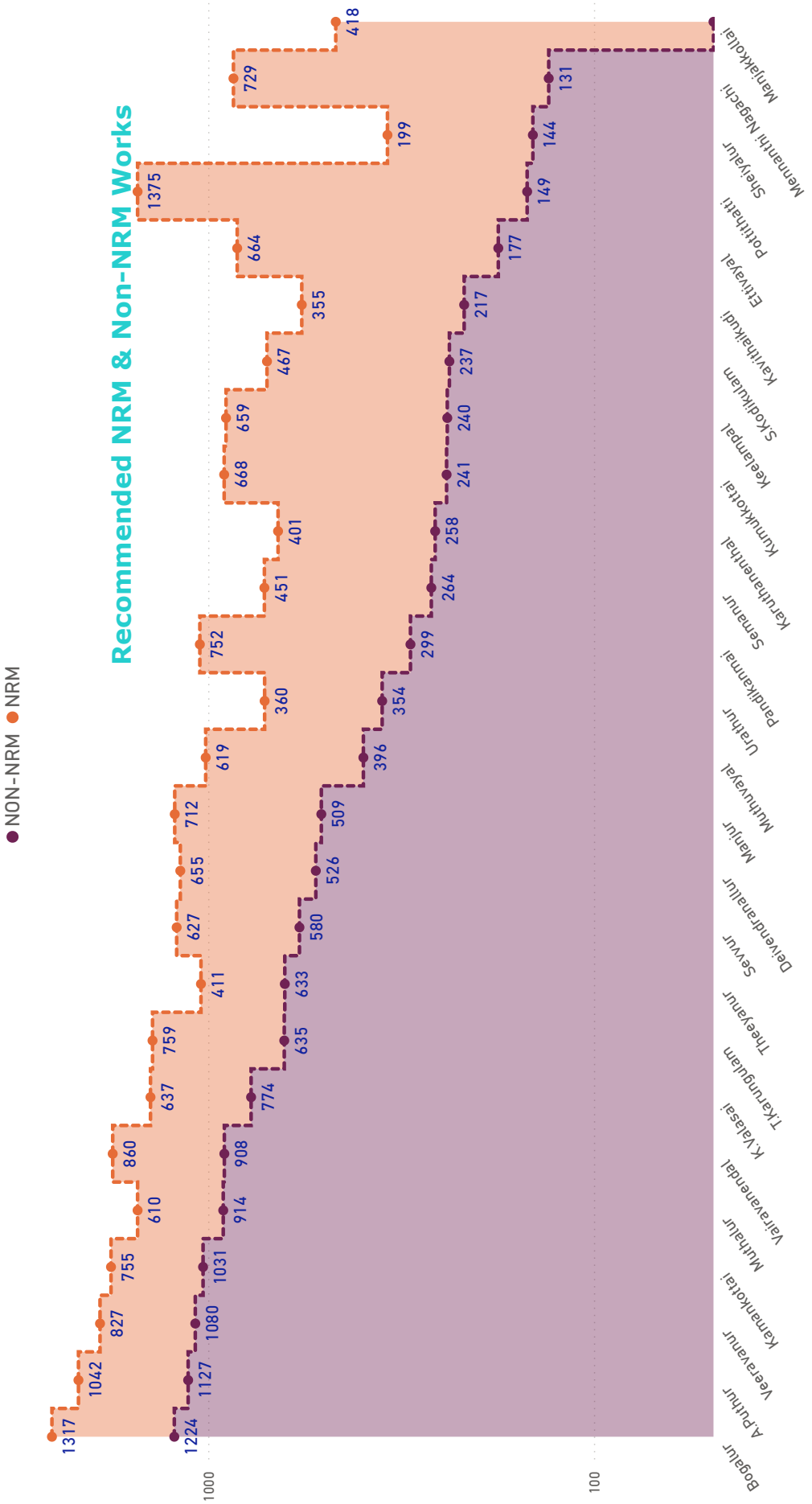


Figure 7.4. GP wise recommended NRM and Non-NRM works

7.3 ONGOING WORKS

The ongoing works in Bogalur Block includes Water Conservation and Water Harvesting, Works on Individual Lands (Category IV), Rural Connectivity, and Drought Proofing. A total of 66 works are ongoing in the Block, in which WCWH works shares the higher in number followed by individual land works while drought proofing and rural infrastructure activists are less (Figure 7.5), GP and work category wise ongoing works are tabulated in Annexure 7.2.

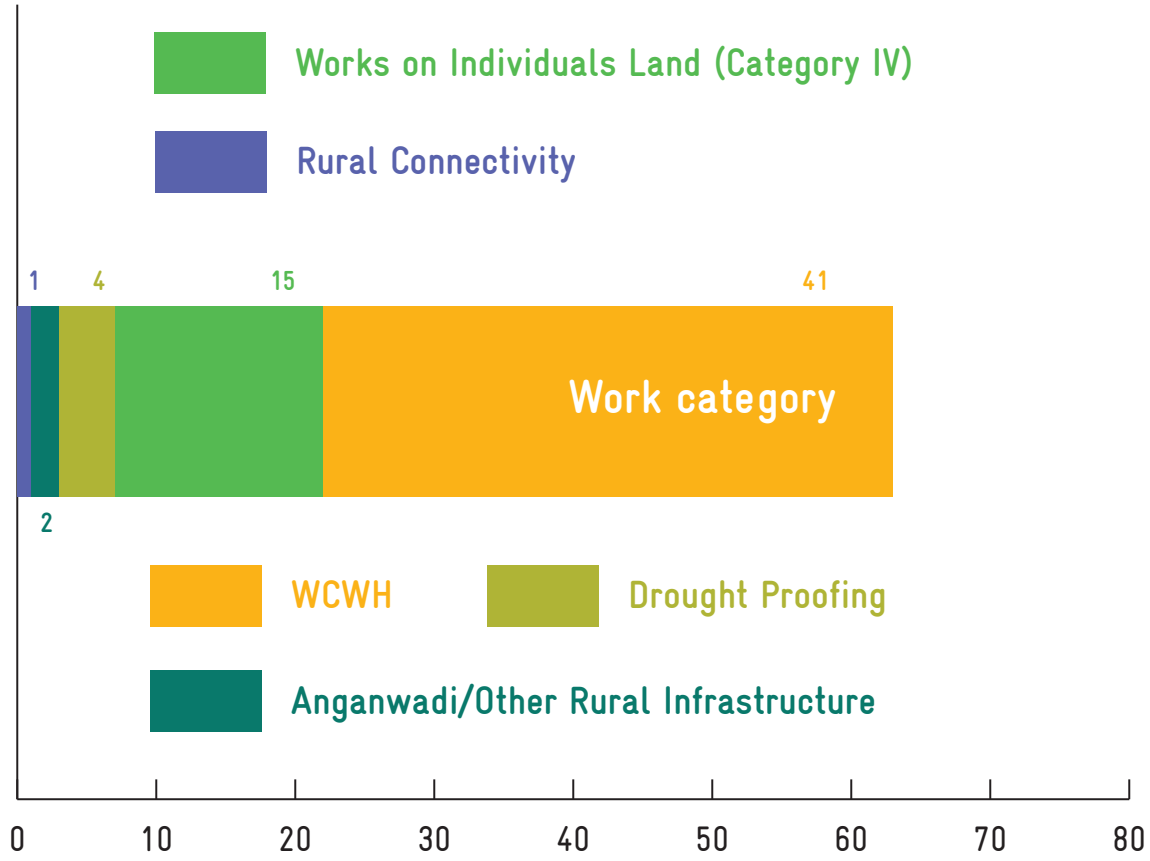


Figure 7.5. Category-wise ongoing works in Bogalur Block

7.4 CATCH THE RAIN

The NWM's campaign "Catch the Rain" with the tagline "Catch the rain, where it falls, when it falls" is to nudge the states and stakeholders to create appropriate Rain Water Harvesting Structures (RWHS) suitable to the climatic conditions and sub-soil strata before monsoon season. Under this campaign, drives to make check dams, water harvesting pits, rooftop RWHS, removal of encroachments and de-silting of tanks to increase their storage capacity, removal of obstructions in the channels which bring water to them from the catchment areas, repairs to step-wells and using defunct bore wells and unused wells to put water back to aquifers etc., are to be taken up with the active participation of people. The total expenditure towards progressive works on Catch the Rain campaign of Bogalur Block is Rs. 1,606.61 Lakhs and nearly 82.6 % of the expenditure utilized for water conservation and Rain water harvesting (Figure 7.6).

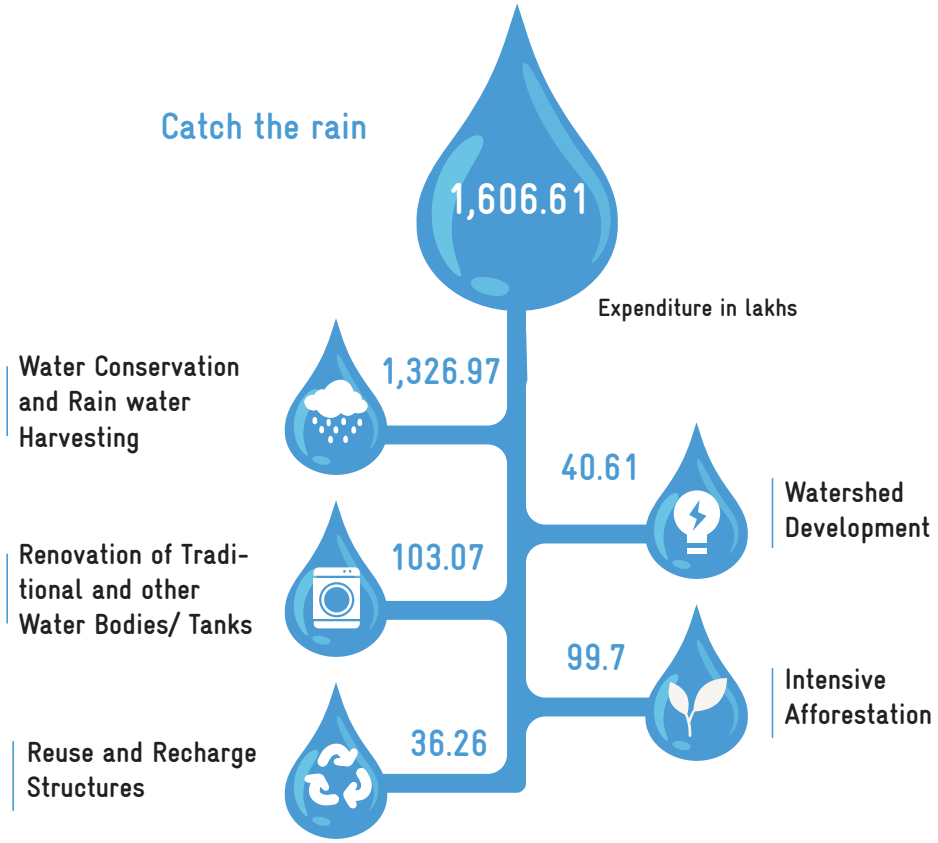
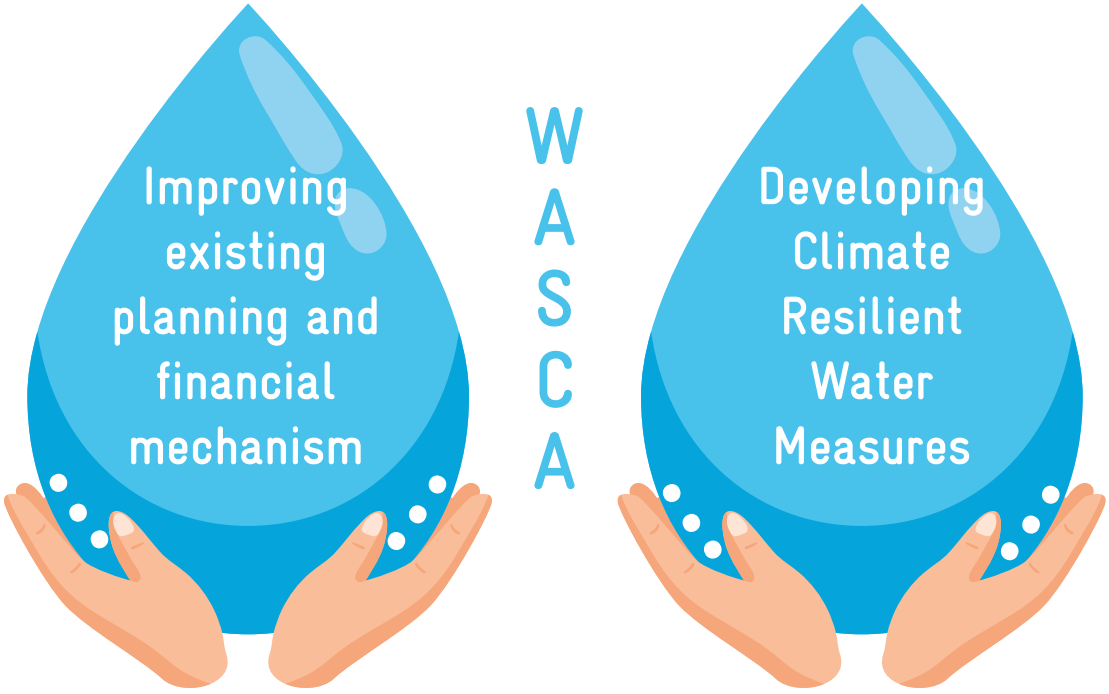


Figure 7.6. Expenditure for Catch the Rain campaign in Bogalur Block



தானம் தவம்இரண்டும் தங்கா வியன்உலகம்
வானம் வழங்கா தெனின்

குறள் - 19

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

Thirukkural - 19

CHAPTER 8

8 CASE STUDY

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

8.1 MACRO-WATERSHEDS OF BOGALUR BLOCK

Bogalur Block comes under Lower Vaigai and Uthirakosamangaiyar sub-basin of Vaigai and Gundar basin. Vaigai River flows through the Block. Lower Vaigai and Terkku Upper macro-watersheds cover 48 micro-watersheds. Lower Vaigai watershed (4A2A1) has 44 micro-watersheds covering an area of 17973.13ha. Terkku Upper watershed (4A1D6) has 4 micro-watersheds covering an area of 252.55 ha (Figure 8.1) and (Table 26). Out of the 26 GPs in Bogalur Block 25 GPs falls under Lower Vaigai watershed and 1 GP falls under Terkku Upper watershed (4A1D6) (Table 27 and Figure 8.2). The micro-watershed related works are identified using Basin, Sub-basin, and micro-watershed with GP administrative boundaries through CWRM approach.

TABLE 26. GENERAL DESCRIPTION OF MACRO-WATERSHEDS COVERING BOGALUR BLOCK

Macro-watershed	Area in ha	No. of micro-watersheds
Lower Vaigai	17973.13	44
Terkku Upper	252.55	4

TABLE 27. NO. OF GPs COVERED UNDER WATERSHEDS IN BOGALUR BLOCK

Name of watershed	No. of GPs
Lower Vaigai	25
Terkku Upper	1

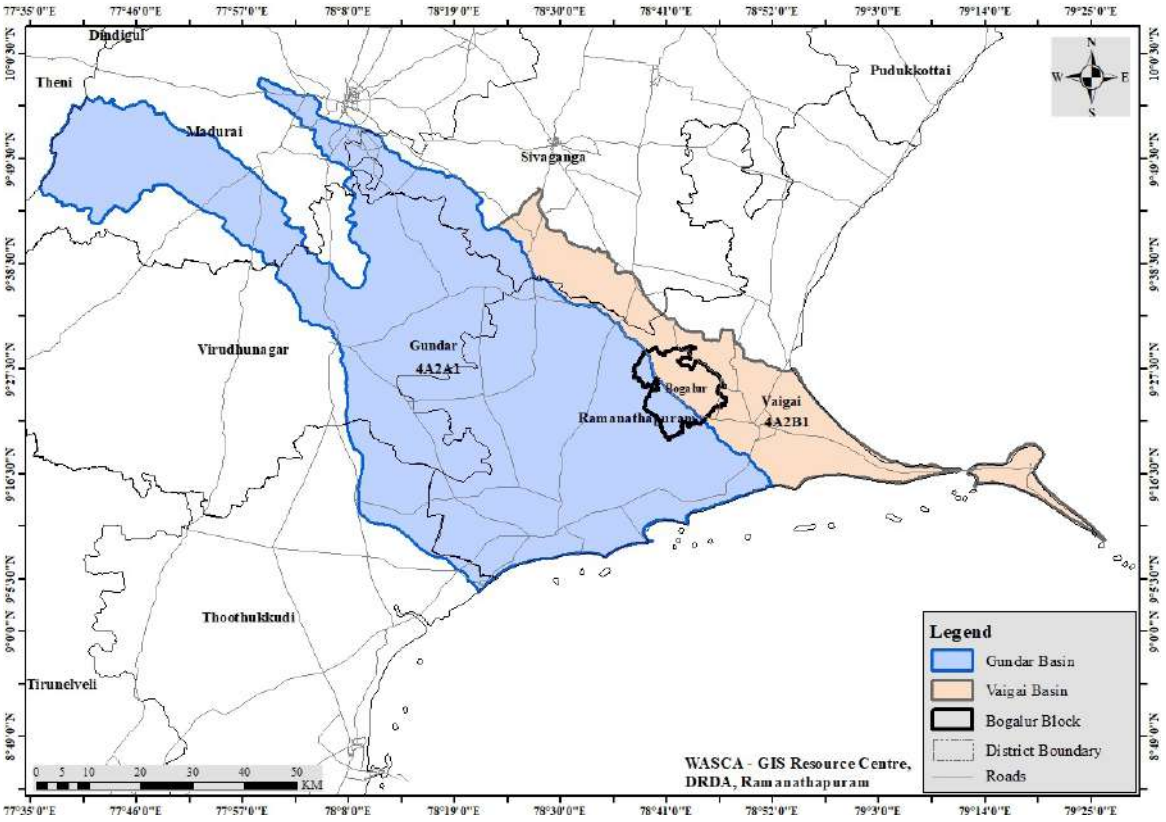


Figure 8.1. Macro-watershed map - Bogalur Block

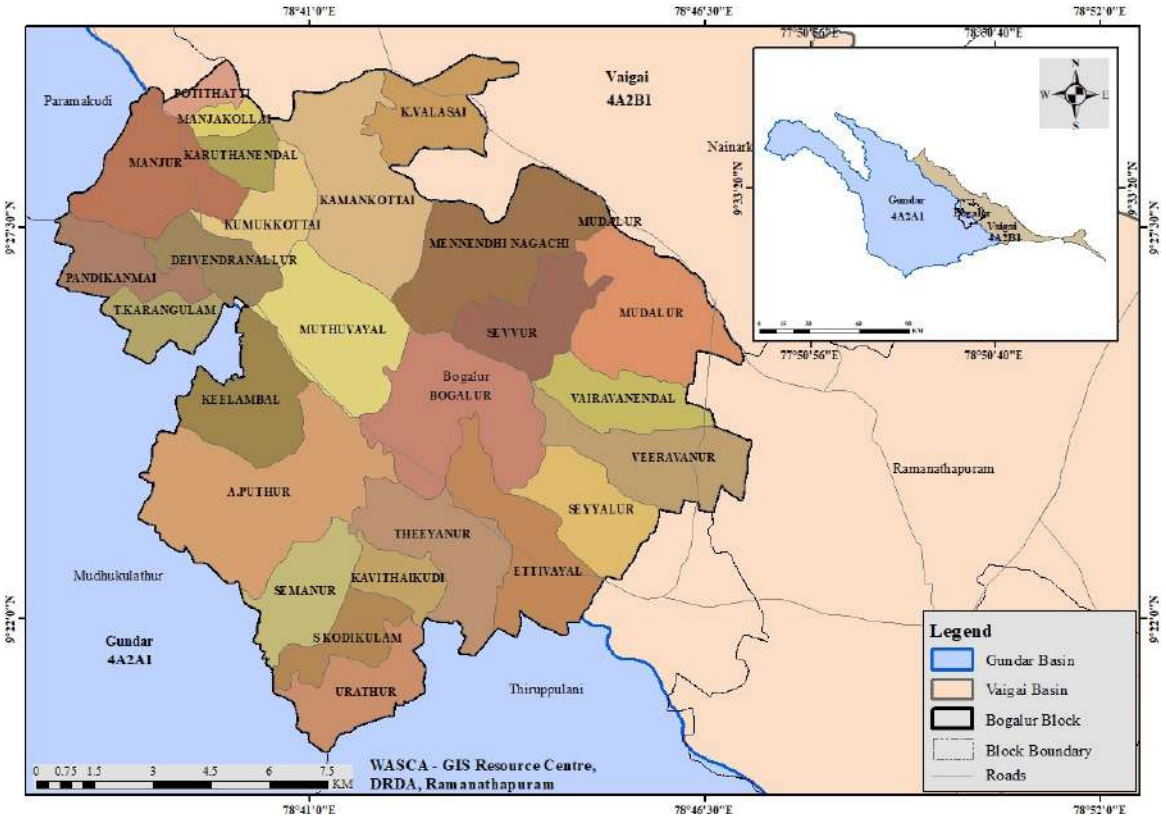


Figure 8.2. Macro-watershed with GPs

All the proposed works are identified using basin, sub-basin, and micro-watershed with GP administrative boundaries through Composite Water Resources Management plan approach. The ridge details, proposed works in all macro-watersheds of GPs in Bogalur Block are listed in Tables 28 to 33.

TABLE 28. MICRO-WATERSHED FALLING UNDER LOWER VAIGAI MACRO- WATERSHED IN BOGALUR BLOCK

Sl.No	Micro-watershed Code	Micro-watershed Area in ha	Ridge Type
1	4A2A1a07b	0.00523049	Lower
2	4A2A1a06a	20.40536132	
3	4A2A1d05a	392.4890163	
4	4A2A1a09a	7.984108879	
5	4A2A1a07a	143.8875923	
6	4A2A1d04b	809.3123919	
7	4A2A1d03b	1000.794682	
8	4A2A1d04a	927.9031056	
9	4A2A1d03a	506.2301006	
10	4A2A1a05d	4.617009831	
11	4A2A1a05c	551.5053368	
12	4A2A1d12b	631.588632	
13	4A2A1a05b	154.6641606	
14	4A2A1a05a	297.6223195	
15	4A2A1d04c	684.8951798	
16	4A2A1a04c	3.5064271	
17	4A2A1a04b	7.224332773	
18	4A2A1d12a	446.9592759	
19	4A2A1d02c	822.0416186	
20	4A2A1d12c	1.224074747	
21	4A2A1d02b	691.7086583	
22	4A2A1d09a	1520.479508	
23	4A2A1d03d	385.2839598	
24	4A2A1d03c	577.9782065	
25	4A2A1d11c	4.316087522	
26	4A2A1d02a	516.1690427	
27	4A2A1d07c	502.130029	
28	4A2A1d01a	7.163377593	
29	4A2A1d06a	188.2819658	
30	4A2A1d11b	465.9878585	
31	4A2A1d07b	768.8799121	
32	4A2A1d07a	1020.32611	
33	4A2A1d01c	42.76890758	
34	4A2A1d01b	152.1306422	
35	4A2A1d08f	482.2869273	
36	4A2A1d11a	598.3400091	
37	4A2A1d08d	436.868985	
38	4A2A1d10c	947.5589807	

39	4A2A1d08b	350.4644382	Lower
40	4A2A1d10b	314.7040074	
41	4A2A1d08a	101.2273387	
42	4A2A1d08c	242.830352	
43	4A2A1d08e	54.05771986	
44	4A2A1d10a	186.3298247	

TABLE 29. LIST OF GPs WITH TYPE OF RIDGE FALLING UNDER LOWER VAIGAI MACRO-WATERSHED IN BOGALUR BLOCK

Sl.No	Name of the GP	Ridge Type
1	A.Puthur	Lower
2	Bogalur	
3	Deivendranallur	
4	Ettivayal	
5	Kamankottai	
6	Karuthanenthal	
7	Kavithaikudi	
8	Keelampal	
9	Kumukkottai	
10	K.Valasai	
11	Manjakkollai	
12	Manjur	
13	Mennanthi Nagachi	
14	Muthalur	
15	Muthuvayal	
16	Pandikanmai	
17	Pottithatti	
18	Semanur	
19	Sevvur	
20	Sheiyalur	
21	S.Kodikulam	
22	Theeyanur	
23	T.Karungulam	
24	Vairavanendal	
25	Veeravanur	

TABLE 30. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPE OF RIDGE FALLING UNDER LOWER VAIGAI MACRO- WATERSHED IN BOGALUR BLOCK

Sl.No	Proposed Work	Ridge Type	Extent
1	Contour Continuous Bunds (CCB) for Afforestation area (m)	Lower	2,190.3
2	Afforestation in Public/common lands (ha)		219.03
3	Drainage Line Treatment (m)		37,214.15
4	Block Plantation (Community) (ha)		1,121.08
5	Avenue plantation (km)		109.29
6	Composting (No.)		208

7	Canal Bund Plantation (km)	Lower	56.99
8	Restoration of water bodies: Tanks and Ooranis (No.)		215
9	Artificial Recharge Structure (No.)		989
10	Farm Bunding with Boundary Trenches - Individual (ha)		695.54
11	Construction of Farm Ponds - Individual (No.)		208
12	Land development - Individual (ha)		261.07
13	Azolla units - Individual (No.)		55
14	NADEP Vermi compost (No.)		55
15	Fodder development - Community & Individual (No.)		55
16	Cattle Shelters (No.)		55
17	Goat Sheep Shelters (No.)		850
18	Cattle Trough (No.)		55
19	Soak Pits (Community) (No.)		134
20	Soak Pits (Individual) (No.)		1,339
21	Roof Rain Water Harvesting (No.)		50
22	Nutri Garden (No.)		25
23	Silt application (No.)		104
24	Mini Forest (ha)		55

TABLE 31. MICRO-WATERSHED FALLING UNDER TERKKU UPPER MACRO- WATERSHED IN BOGALUR BLOCK

Sl.No	Micro-watershed Code	Micro-watershed Area in ha	Ridge Type
1	4A1D6c05b	87.67449752	Lower
2	4A1D6c05a	39.99512262	
3	4A1D6c03b	13.51146137	
4	4A1D6c03a	111.3726852	

TABLE 32. LIST OF GP WITH TYPE OF RIDGE FALLING UNDER TERKKU UPPER MACRO-WATERSHED IN BOGALUR BLOCK

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

TABLE 33. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPE OF RIDGE FALLING UNDER TERKKU UPPER MACRO- WATERSHED IN BOGALUR BLOCK

Sl.No	Proposed Work	Ridge Type	Extent
1	Contour Continuous Bunds (CCB) for Afforestation area (m)	Lower	12
2	Afforestation in Public/common lands (ha)		1.2
3	Drainage Line Treatment (m)		530
4	Block Plantation (Community) (ha)		57.25
5	Avenue plantation (km)		4.46
6	Composting (No.)		11
7	Canal Bund Plantation (km)		43.34
8	Restoration of water bodies: Tanks and Ooranis (No.)		9
9	Artificial Recharge Structure (No.)		2

10	Farm Bunding with Boundary Trenches - Individual (ha)		38.36
11	Construction of Farm Ponds - Individual (No.)		11
12	Land development - Individual (ha)		14.14
13	Azolla units - Individual (No.)		2
14	NADEP Vermi compost (No.)		2
15	Fodder development - Community & Individual (No.)		2
16	Cattle Shelters (No.)		2
17	Goat Sheep Shelters (No.)	Lower	7
18	Cattle Trough (No.)		2
19	Soak Pits (Community) (No.)		3
20	Soak Pits (Individual) (No.)		27
21	Roof Rain Water Harvesting (No.)		2
22	Nutri Garden (No.)		1
23	Silt application (No.)		6
24	Mini Forest (ha)		2

8.2 MODEL MICRO -WATERSHED- BOGALUR

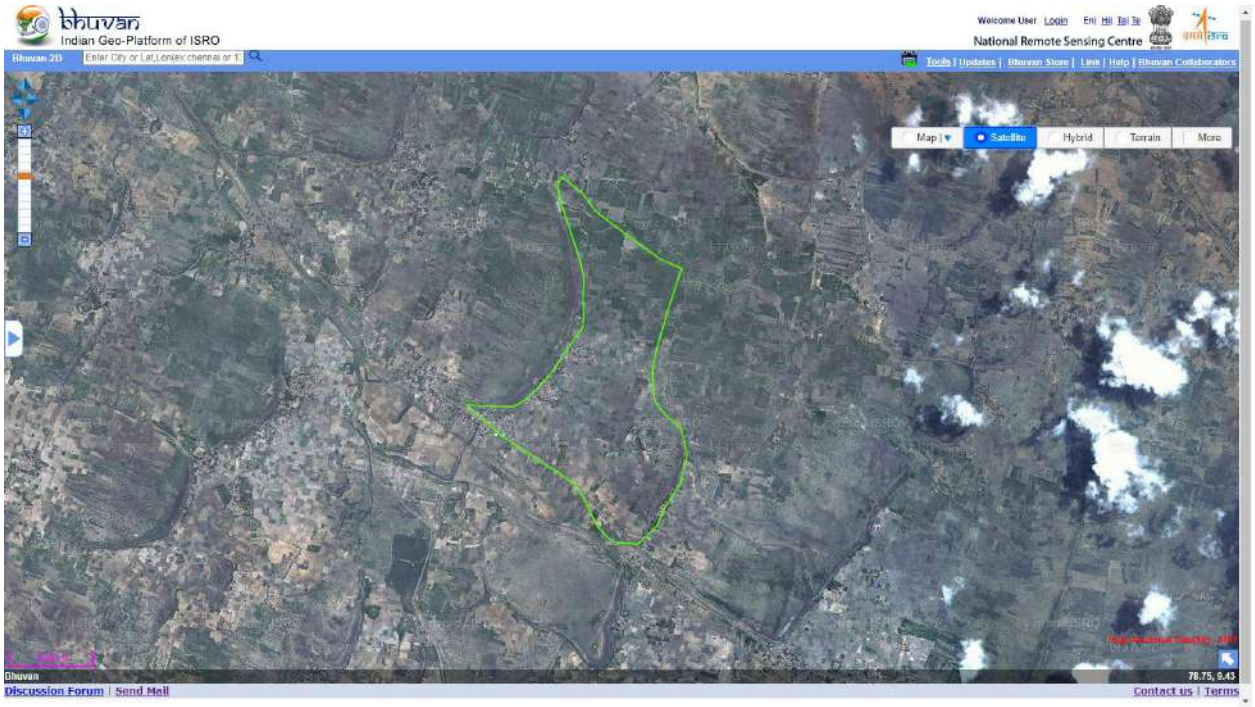


Figure 8.3. Satellite image of Bogalur micro-watershed

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

BOGALUR MICRO-WATERSHED

Bogalur micro-watershed falls under Bogalur and Ettivayal GPs, Bogalur Block in Ramanathapuram District. The satellite image of the micro-watershed is shown in Figure 8.3. This micro-watershed is the part of Lower Vaigai macro-watershed in Lower Vaigai Sub Basin. The general information, geology, hydrogeology, natural drainage lines, catchment area, ground water status, water budget of Bogalur micro-watershed is given below in separate sections followed by proposed works, ridge wise proposed treatment area, estimated cost and required person days and key outcomes. (Table 34 to 46 & Figure 8.4). The key CWRM parameters for the GPs falling in this micro-watershed is given in Annexure 8.

TABLE 34. GENERAL INFORMATION OF THE MICRO-WATERSHED

Description	Name/ Number/ Quantity/ Status
Name of the Micro-watershed	Bogalur Micro-watershed
Micro-watershed Number	4A2A1d07c
Name of the Basin	Vaigai Basin
Name of the sub basin	Lower Vaigai Sub Basin
Name of the Macro-watershed	Lower Vaigai (4)
Number of GPs covered under the Micro-watershed	2
Name of the GPs	1.Bogalur
	2. Ettivayal
Latitude of Micro-watershed (From To)	9°23'29.387"N to 9°25'22.045"N
Longitude of Micro-watershed (From To)	78°42'3.096"E to 78°43'34.265"E
Total area of the Micro-watershed in ha	502.13
% of Micro-watershed area in Bogalur GP	62
% of Micro-watershed area in Ettivayal GP	38
Area of Micro-watershed falling in Bogalur GP (ha)	311
Area of Micro-watershed falling in Ettivayal GP (ha)	191
Total Population of Bogalur GP	5,402
Total Population of Ettivayal GP	1,983
Annual Average Rainfall (mm)	821
Annual maximum Temperature (°C)	32.6
Annual Minimum Temperature (°C)	23.8
Evapo-Transporation Losses of Bogalur GP (ha.m)	18.87
Evapo-Transporation Losses of Ettivayal GP (ha.m)	16.80
Volumetric soil moisture availability (%)	23
Climate Risk	Drought
CVI Index Value for Bogalur (Based on WASCA Climate study)	0.488 (High Agriculture Vulnerability)
CVI Index Value for Ettivayal (Based on WASCA Climate study)	0.446 (High Agriculture Vulnerability)
Agro-Climatic Zone	Southern Zone (TN 05)
Agro Ecological Sub-Region (ICAR)	Hot dry semi-arid eco sub region (18.1)
Status of Ground water in Bogalur GP	Safe
Status of Ground water in Ettivayal GP	Safe

TABLE 35. HYDROGEOLOGY & OTHER CHARACTERISTICS IN MICRO-WATERSHED

Type of Geomorphology	Coastal Origin - Older Deltaic Plain
Geomorphology occurrence in %	58
Principle Aquifer	Alluvium
Salt Affected Area passing through the micro- watershed	None
Type of lineaments passing through the micro- watershed	None
Barren & waste lands	None

TABLE 36. EXISTING WATER HARVESTING STRUCTURES IN BOGALUR AND ETTIVAYAL GPs

Sl.No.	Name of Structure	Bogalur GP	Ettivayal GP
		Existing Structures	Existing Structures
		No.	No.
1	Oorani	6	13
2	Tank	2	5
3	Farm Pond	6	26
	Total	**14**	**44**

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

Catchment Area in ha	Bogalur GP	Ettivayal GP
Good catchment area	194.01	267.15
Average catchment area	166.08	74.91
Bad catchment area	828.19	503.28

TABLE 38. GROUND WATER STATUS OF MICRO-WATERSHED

Name of the Firka (Assessment Unit) falling under micro-watershed	Bogalur
Recharge from other sources during monsoon season (ha.m)	1447.43
Recharge from other sources during non-monsoon season (ha.m)	279.35

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

Pre monsoon Water Quality Index	Very Poor Quality
Post monsoon Water Quality Index	Poor Quality
Pre monsoon Sea Water Mixing Index	1-2
Post monsoon Sea Water Mixing Index	1-2

TABLE 40. WATER BUDGET OF GP'S FALLING IN MICRO-WATERSHED- BOGALUR AND ETTIVAYAL GPs

Water Budget in ha.m	Bogalur GP	Ettivayal GP
Water for human	14.79	5.43
Water for agriculture	321.5	378.3
Water for livestock's	2.50	0.56
Village wise water required	338.8	384.3
Available run-off from rain water (derived from Strange method)	165.4	129.2
Harvested Runoff from Water Harvesting Activities	238.6	209.2
Potential Harvesting from proposed Interventions	80.4	53.8
Total Water harvested	319.0	263.00
Water demand and Supply Difference	-19.8	-121.3
Water demand supply gap status	Deficient	Deficient
Per capita Water Availability in cum	590.52	1,326.3
International Standard per capita water Availability (cum)	1700	1700
Water Availability Gap (cum)	-1,109.48	-373.7
Water security status	Water Stress	Water Stress

TABLE 41. GP WISE PROPOSED MICRO-WATERSHED WORKS – BOGALUR AND ETTIVAYAL GPs

Proposed Work	Bogalur GP	Ettivayal GP
Proposed works in Upper Ridge	0	0
Proposed works in Middle Ridge	0	0
Proposed works in Lower Ridge	62	45
Total works	62	45

TABLE 42. RIDGE WISE TREATMENT AREA ESTIMATED COST AND PERSON DAYS REQUIRED- BOGALUR AND ETTIVAYAL GPs

Ridge Type	Bogalur GP	Ettivayal GP
Lower Ridge		
Estimated cost for Lower Ridge area (INR in Lakhs)	81.49	78.71
Total area in ha of Lower ridge (ha)	311	191
Estimated Person days generated for Treatment of Lower Ridge	**19,045**	**25,180**
Treatment cost of Lower Ridge (Lakhs/ha)	**0.262**	**0.412**

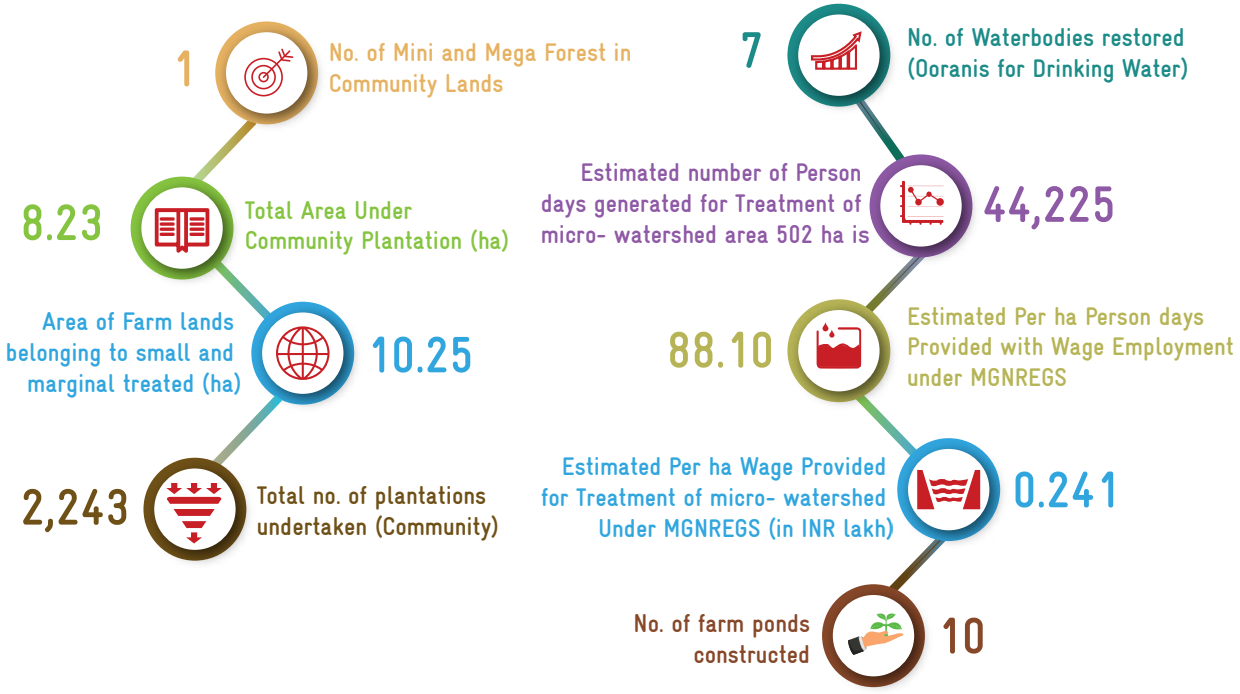
Bogalur GP	Treatment cost (INR in lakhs)	Estimated person days
Upper Ridge	NA	NA
Middle Ridge	NA	NA
Lower Ridge	0.262 lakh/ha	19,045
	0.262 lakh/ha	19,045

Ettivayal GP	Treatment cost (INR in lakhs)	Estimated person days
Upper Ridge	NA	NA
Middle Ridge	NA	NA
Lower Ridge	0.412 lakh/ha	25,180
	0.412 lakh/ha	25,180

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

Description	Number
Total No. of works in micro-watershed area (Arable, Non arable & DLT)	70
Total No. of works in micro-watershed including livelihood Activities	14
Total No. of works in micro- watershed including Rural Greywater Management Activities	23

TABLE 44. KEY OUTCOMES OF INTERVENTION



Expenditure for FY 2020-21 (in INR lakh)

Bogalur GP	145.73 lakh
Ettivayal GP	85.10 lakh

TABLE 45. ESTIMATES OF MICRO-WATERSHED IN BOGALUR GP

Proposed Work	Ridge Type	Status of Work	Quantity (Area or No.)	No. of works as per KML	Estimate cost (INR in Lakhs)	Person days
NRM works in Public and Community Lands						
Restoration of Traditional water bodies: (Oorani & Tank) (No.)	Lower	Not commenced	3	3	24	8,742
Oorani bund Plantation (No.)			368	3	1.69	614
Avenue plantation (km)			2.3	2	2.11	756
Block Plantation (ha)			2	1	4.14	1,516
Dry Land Horticulture (No.)			1	1	5	1,794
Roof Rain Water Harvesting in GP Building (No.)			2	2	0.9	30
Sub total				**12**	**37.84**	**13,452**
Works in Individual Farmer lands (Agriculture and Allied Activities)						
Recharge Shaft for bore well farmers for Salinity Reduction (No.)	Lower	Not commenced	5	5	1.35	60
Farm Bunding with Boundary Trenches - Individual (ha & No.)			10	4	15	1,344
			4	4		
Construction of Farm Ponds - Individual (No.)			6	6	10.8	3,720
Composting (No.)			4	4	0.36	124
NADEP Vermi compost (No.)			1	1	0.12	5
Fodder development - Individual (No.)			1	1	0.2	10
Sub total				**25**	**27.83**	**5,263**
Total				**37**	**65.669**	**18,715**
Livelihood enhancement activities for Individual Farmers (Coastal Area)						
Azolla Production Unit (No.)	Lower	Not commenced	1	1	0.15	14
Cattle Shelters (No.)			2	2	6.2	66
Poultry Shed (No.)			2	2	4	44
Goat Sheep Shelters (No.)			2	2	3.45	90
Cattle Trough (No.)			2	2	0.4	22
Sub total				**9**	**14.2**	**236**
Rural Greywater and Roof Rainwater Management						
Soak Pits (Individual) (No.)	Lower	Not commenced	10	10	1.08	60
Soak Pits (Community) (No.)			4	4	0.52	32
Nutri Garden (No.)			2	2	0.02	2
Sub total				**16**	**1.62**	**94**
Total				**62**	**81.49**	**19,045**

TOTAL ESTIMATES OF MICRO-WATERSHED IN BOGALUR GP

	No. of works as per KML	Estimate cost in INR (Lakhs)	Person days
			
Bogalur GP	62	81.49	19,045

TABLE 46. ESTIMATES OF MICRO-WATERSHED IN ETTIVAYAL GP

Proposed Work	Ridge Type	Status of Work	Quantity (Area or No.)	No. of works as per KML	Estimate cost (INR in Lakhs)	Person days
NRM works in Public and Community Lands						
Restoration of Traditional water bodies: (Oorani & Tank) (No.)	Lower	Not commenced	4	4	33.82	12,388
Oorani bund Plantation (No.)			875	4	4.02	1,459
Avenue plantation			0.75	1	0.78	590
Block Plantation			2	1	4.14	1,500
Afforestation			1.93	1	3.99	1,446
Mini Forest (No.)			500	1	5.75	3,950
Roof Rain Water Harvesting in GP Building (No.)			1	1	0.3	15
Sub total				**13**	**52.8**	**21,348**
Works in Individual Farmer lands (Agriculture and Allied Activities)						
Recharge Shaft for bore well farmers for Salinity Reduction (No.)	Lower	Not commenced	4	4	1.08	48
Farm Bunding with Boundary Trenches - Individual (ha &No.)			7.5	3	11.25	1,008
			3	3		
Construction of Farm Ponds - Individual (No.)			4	4	7.2	2,480
Composting (No.)			4	4	0.36	124
NADEP Vermi compost (No.)			1	1	0.12	5
Fodder development - Individual (No.)			1	1	0.2	10
Sub total				**20**	**20.21**	**3,675**
Total				**33**	**73.01**	**25,023**

Livelihood enhancement activities for Individual Farmers (Coastal Area)						
Azolla Production Unit (No.)	Lower	Not commenced	1	1	0.15	14
Cattle Shelters (No.)			1	1	1.6	33
Poultry Shed (No.)			1	1	2	22
Goat Sheep Shelters (No.)			1	1	1.15	30
Cattle Trough (No.)			1	1	0.2	22
Sub total				**5**	**5.1**	**121**
Rural Greywater and Rooftop Rainwater Management						
Soak Pits (Individual) (No.)	Lower	Not commenced	3	3	0.324	18
Soak Pits (Community) (No.)			2	2	0.26	16
Nutri Garden (No.)			2	2	0.02	2
Sub total				**7**	**0.604**	**36**
Total				**45**	**78.71**	**25,180**

TOTAL ESTIMATES OF MICRO-WATERSHED IN ETTIVAYAL GP

	No. of works as per KML	Estimate cost in INR (Lakhs)	Person days
Ettivayal GP	45	78.71	25,180

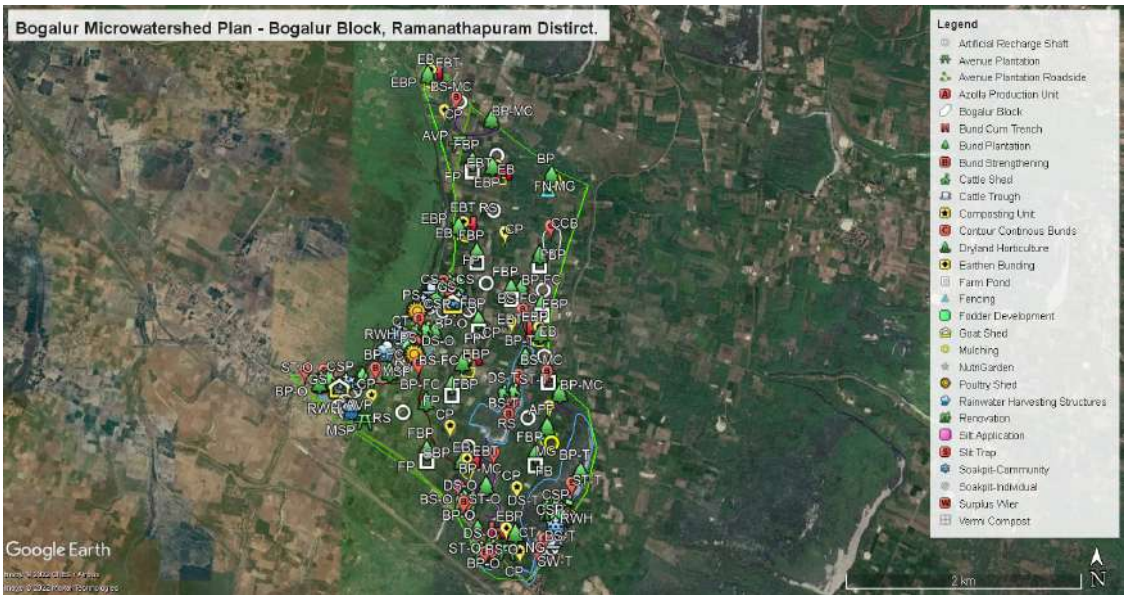


Figure 8.4. Proposed activities in Bogalur micro-watershed

8.3 MODEL GP – T.KARUNGULAM

BACKGROUND OF GRAM PANCHAYAT – T.KARUNGULAM

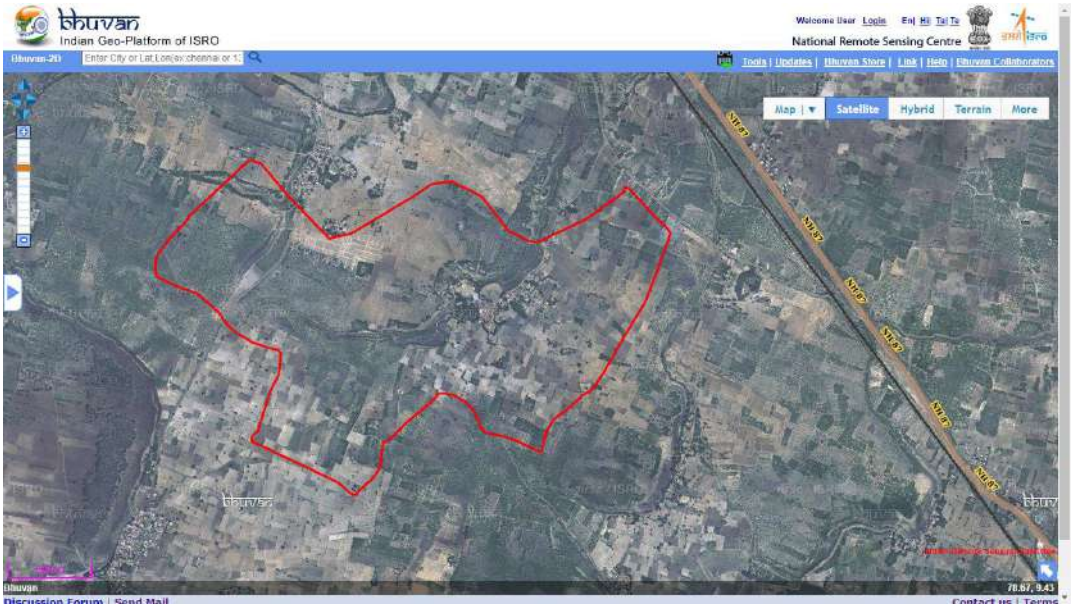
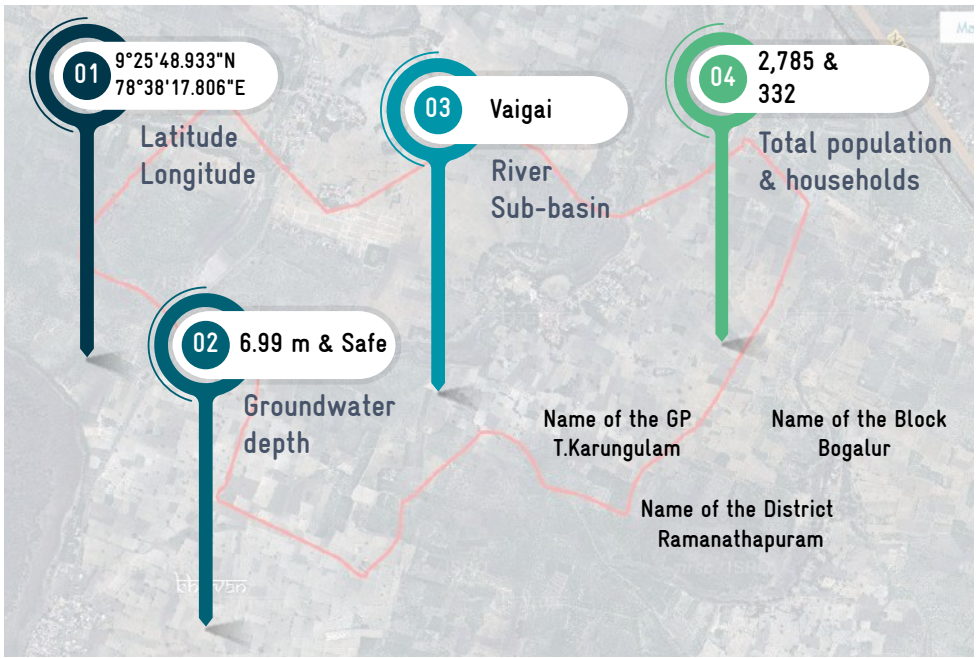


Figure 8.5. Satellite image of T.Karungulam GP

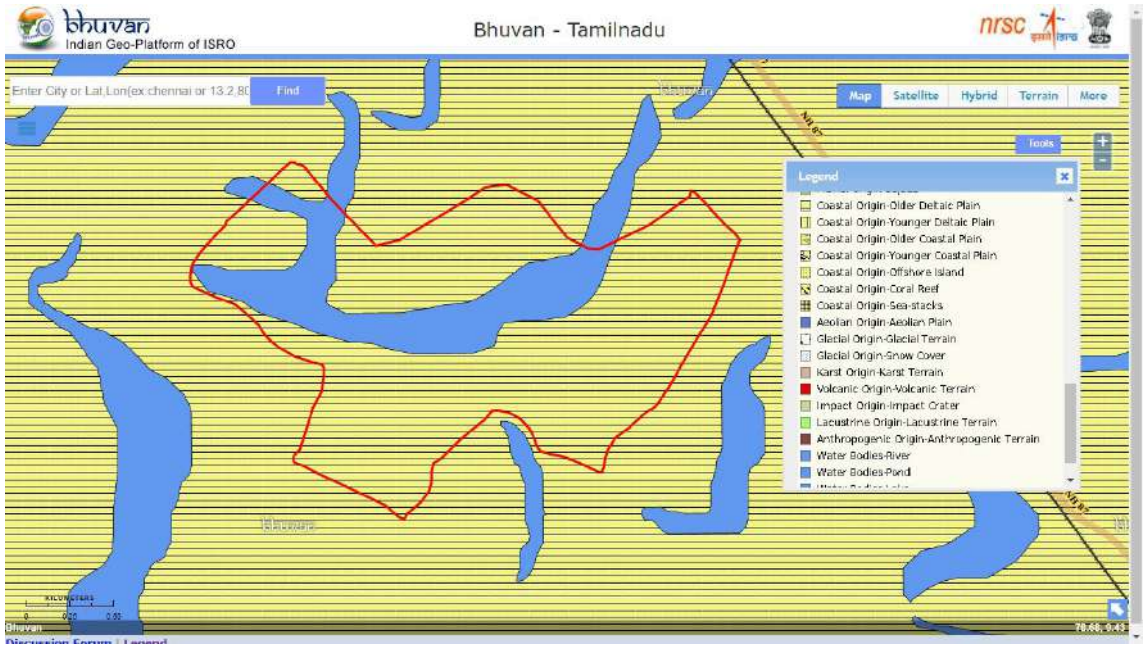
T.Karungulam GP is situated near the coast of the Bay of Bengal, in the Bogalur Block of Ramanathapuram District, Tamil Nadu (Figure 8.5). The total geographical area of the village is about 346 ha. It has a population of 2,785. The male and female populations are 1,439 and 1,346 respectively. 36.69% of the population comprises of SC population and no ST population. The total number of households in the village is 332. The general description of the GP is given in (Table 47).

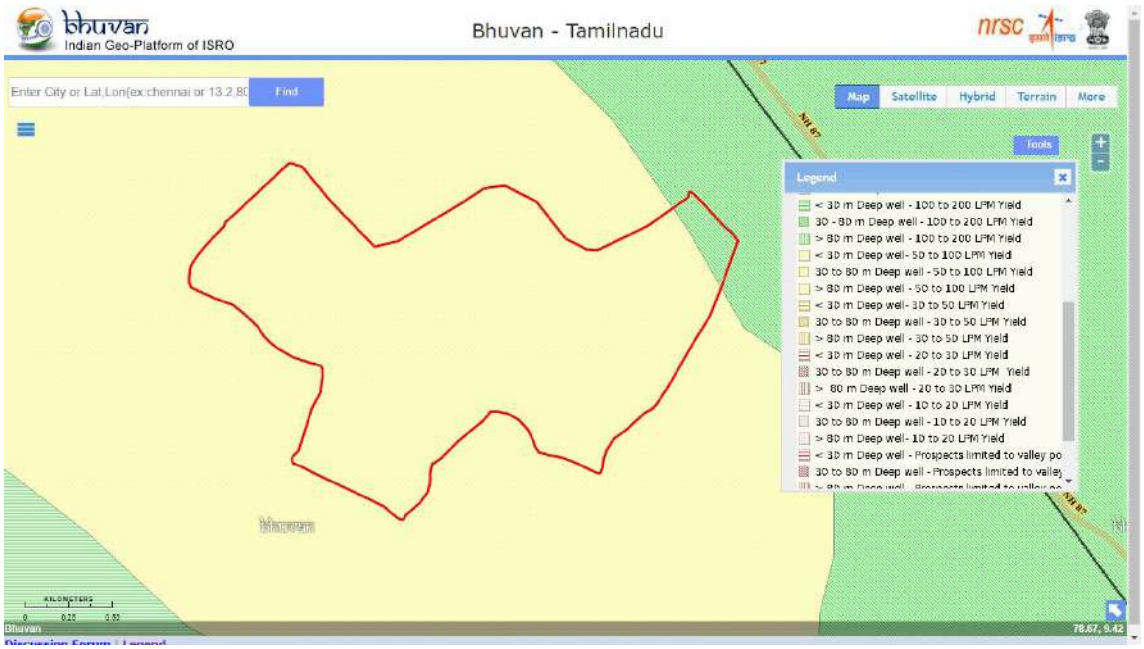
TABLE 47. GENERAL DESCRIPTION OF T.KARUNGULAM GP, BOGALUR BLOCK



8.3.1 CWRM PLANNING - SPATIAL DATA

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





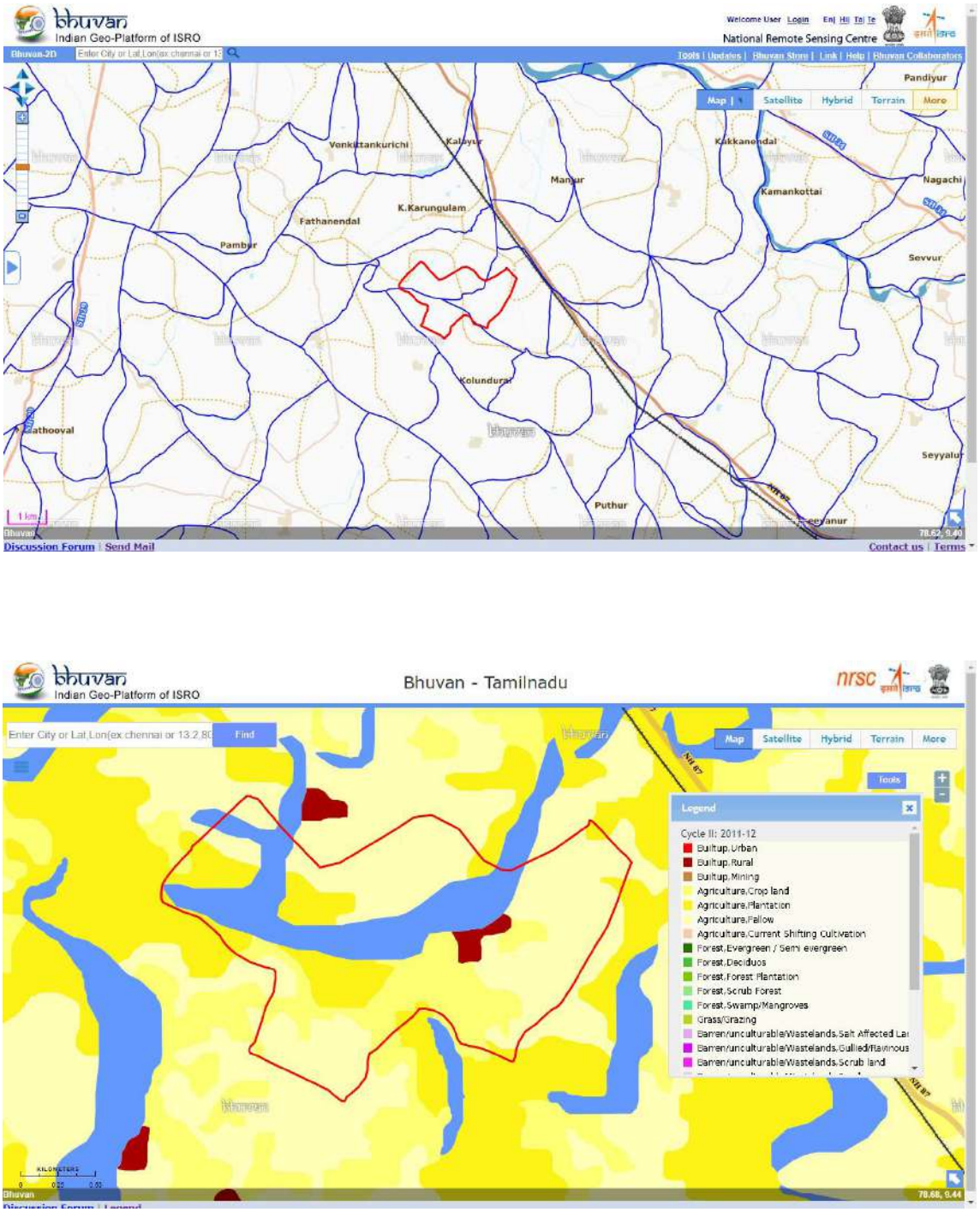


Figure 8.6. Spatial thematic maps of T.Karungulam GP. A. Geomorphology, B. GW prosperity, C. Watershed, D. LULC

The entire GP is under coastal origin- older deltaic plain (A). The groundwater prospectus of the entire GP between 30-80 m deep well with yield from 50 to 100 liters per minute (B). GP area falls under three micro-watershed units (C). It is noticed that agriculture land is dominated followed by agriculture fallow land type, where a parcel of barren land in the central area of the GP (D).

8.3.2 CWRM PLANNING- NON-SPATIAL DATA

The non-spatial data covers four important themes – socio economic, climate, water and agriculture with 116 parameters (Table 48). These non-spatial data are concurrently used for analysis along with the spatial data mentioned above to identify the key water challenges, prepare water budget by understanding the supply and demand and develop water actions to the different land use and slope categories. The process starts with mapping of the administrative (habitations/panchayat/revenue village, Block/taluk), agro-ecological (regional and sub-regional, climatic and agricultural zonation's) and hydrological (drainage points/watersheds/sub basin) units keeping the GP as the lowest unit of planning and execution.

TABLE 48. NON-SPATIAL DATA - T.KARUNGULAM GP

Key CWRM Parameter	Details
Climate Vulnerability Area (CVA) 1: Socio-Economic	
Geographical Area (ha)	346
Male Population	1,439
Female Population	1,346
Total Population	2,785
SC Population	1,022
ST Population	0
Vulnerable Population	1,022
Households (HH's)	332
Only one room HH's (SECC)	31
Female Headed HH's (SECC)	27
Vulnerable Households (SECC)	30
% of Vulnerable Households	9%
Registered MGNREGA Job cards	648
The active person working in job Cards	457
Drinking Water Sources	58
HH's have tap water connection for drinking water	50
HH's dependent on other sources for drinking water	115
Annual Greywater Generation	5.08
Climate Vulnerability Area (CVA) 3: Water Resources	
Canal Network (m)	
Length of Main Canal	266
Length of Distributaries	229
Water Courses (Field Channels)	200
No. of Tanks (PWD & Union)	2
No. of Ooranis	6

Irrigation Facilities (ha)	
Area under Tank Irrigation	4.78
Area under Canal Irrigation	2.72
Catchment Area wise Available Runoff (ha.m)	
Good Catchment Area	7.2
Bad Catchment Area	16.81
Watershed and Drainage Networks	
Length of Natural Drainage Lines (km)	154.57
No. of Natural Drainage Lines	1
No. of Micro Watersheds	2
Water Demand (ha.m)	
Water Demand for Humans	7.62
Water Demand for Livestock	0.38
Water Demand for Agriculture	376.14
% G.W Utilization for Drinking	95%
% G.W Utilization for Livestock	29
% G.W Utilization for Agriculture	0
% SW Utilization for Drinking	5
% SW Utilization for Livestock	71
% SW Utilization for Agriculture	100
Climate Vulnerability Area 4: Agriculture	
Area Under Land Resources (ha)	
Area under Non-Agricultural Uses	32.47
Area under Cultivable Waste Land	0.01
Area under Current Fallow land	87.66
Area under Unirrigated Land	44.63
Area Irrigated by Source	15.71
Catchment Area (ha)	
Land under Good Catchment	32.47
Land under Average Catchment	0.012
Land under Bad Catchment	148.001
Crop Details (ha)	
Irrigated Area	201.595
Rainfed area	104.64
Area under Paddy Cultivation	228.84
Crop Water Requirement - Irrigated condition (ha.m)	295.4
Crop Water Requirement - Rainfed condition (ha.m)	80.739
Soil Resources: Status of Available Nitrogen (%)	
Very Low (VL)	92%
Low (L)	8%

Status of Organic Carbon (%)	
Very Low	83%
Low	17%
Status of Soil Micro Nutrients (%)	
Sufficient	83%
Deficient	17%
Status of Physical condition of the soil (%)	
Highly Acidic	1%
Moderately Acidic	64%
Slightly Acidic	31%
Moderately Alkaline	4%
Soil Texture	
% of Fine Soil	94%
Soil Water Permeability	Moderate to Low (5-20 mm/hr)
Soil moisture and ET	
Volumetric Soil Moisture (%)	17%
Estimated Soil Moisture (ha.m)	25.04
ET Losses (ha.m)	31.5
Means of Water Extraction (%)	
Gravity	43%
Lifting	57%
Irrigation Methods (%)	
Wild Flooding	100%
Livestock (No)	
Cattle Population	30
Sheep Population	596
Goat Population	135
Poultry	86
Livestock Water Requirement (ha.m)	0.38

8.3.3 KEY WATER CHALLENGES

Socio-Economic

1. Female population is slightly less than male population
2. 36.69% percent of the population belongs to the SC category, No ST population according to SECC data
3. 9% of the households are vulnerable, 27 HH are female headed
4. 31 HH have only one room.
5. 5.08 ha.m grey water from 332 households living in the coast needs attention

Water

1. 6 Ooranis in the GP.
2. 95% Drinking water requirement depends on Ground Water
3. 100% of Surface Water utilized for agriculture
4. More water for agriculture (376.14 ha.m)
5. 24.01 ha.m of water is an available runoff in which 70% of the runoff is from Bad catchment
6. 76.69% of the conservation is from the good catchment

Agriculture and Allied Sector

1. 82 % is under Individual lands
2. More bad catchment area (82%)
3. Rain fed area (34.17%)
4. Very Low soil Nitrogen and Carbon
5. 64 % moderately acidic soil
6. 94% fine soil
7. 100% Wild flooding
8. Area under paddy cultivation 228.84 ha

8.3.4 PERSPECTIVE PLAN - WORKS PROPOSED: WATER ACTIONS

The appropriate and site-specific works are identified for the development of public and common land, agriculture and allied activities, rural infrastructures, and climate-resilient measures to reduce the vulnerability in the GP. About 7.69 % of the total land area is taken for WASCA activities like plantation, conservation works. The total proposed area for treatment is 13.88 ha out of which 95.96 % of the proposed work in under individual lands. (Figure 8.7). Through the proposed conservation activities, 6.65 ha.m run off would be harvested in which, about 76.69 % of the run-off is from the good catchment, 23.30% of the run off is from the bad catchment. (Figure 8.8).

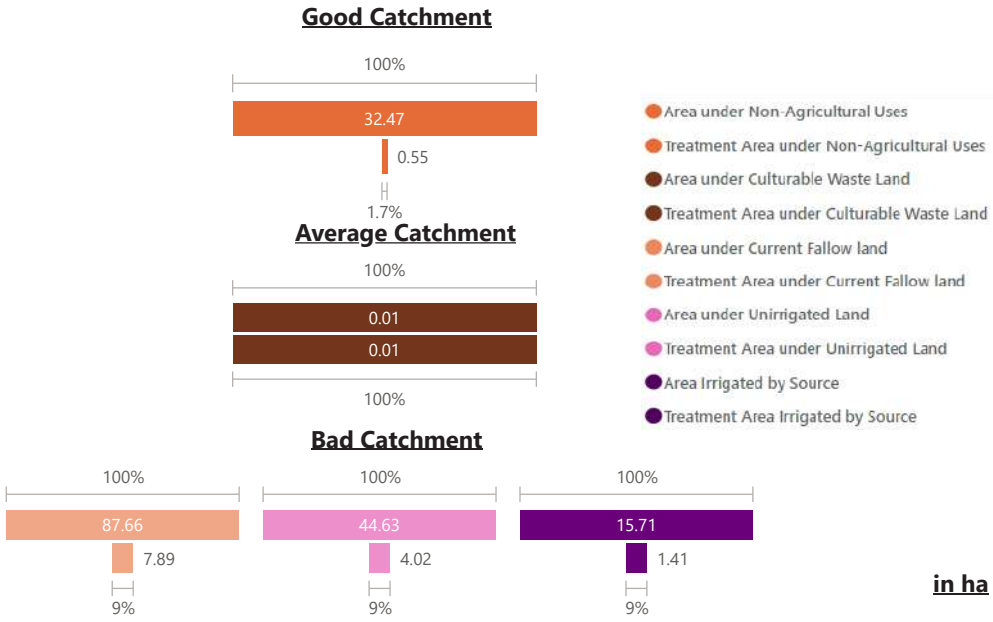


Figure 8.7. Proposed land resource treatment area in T.Karungulam GP

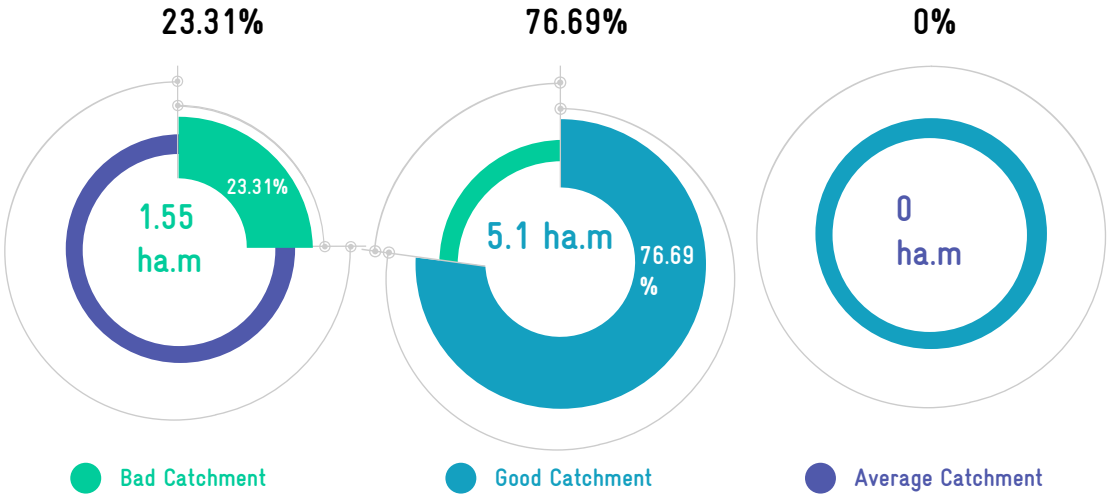


Figure 8.8. Expected run off conservation after treatment in T.Karungulam GP

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

TABLE 49. PERSPECTIVE PLAN OF T.KARUNGULAM GP - FY (2021-2024)

CWRM Water Action 1: Improvement of Public & Common Lands Development				
CWRM Water Action 1: Works in Upper& Middle Ridge				
Name of the Work	**Ridge Type**	**No of Works**	**Estimated cost (INR in Lakhs)**	**Estimated Person Days**
Afforestation in Public/common lands (ha)	Lower	0.55	4.73	1,839.2
Contour Continuous Bunds (CCB) for Afforestation area (m)		2.22	0.06	22.2
Composting (No.)		5	0.85	75
Avenue plantation (km)		3.217	5.79	2,261.551
Block Plantation (Community) (km)		0.01	0.11	43.2
Restoration of water bodies (No.)		8	22	2,800
WC - Irrigation channels - Desilting		45.7	0.34	137.1
Subtotal Water Action - I		**65**	**34**	**7,178**
CWRM Water Action 2: Agricultural and allied Sector development				
CWRM Water Action 2: Works in Lower Ridge				
Farm Bunding (ha)	Lower	13	19.98	7,806
Micro Irrigation (ha)		1	1	0
Construction of farm ponds (No.)		5	10	3,905
Land development (ha)		6	59.5	23,241
Cattle Shelters (No.)		1	2.12	331
Goat Sheep Shelters (No.)		28	63.56	9,940
Fodder development for cattle (No.)		1	1.48	2,344
Azolla units (No.)		1	0.15	23
Cattle Trough (No.)		1	0.05	6
Poultry shed (No.)		2	0.18	20
Dry land Horticulture/Agro-forestry(ha)		7	59.5	23,247
Vermi Compost (No.)		1	0.18	27
Subtotal Water Action - II		**67**	**218**	**70,889**

CWRM Water Action 3: Rural Water Management				
CWRM Water Action 3: Works in Lower Ridge				
Soak pits (Community) (No.)	Lower	7	0.91	140
Soak pits (Individual) (No.)		70	7	1,120
Roof rain Water Harvesting (No.)		2	8	1,250
Community Tanka (Rajasthan Model) (No.)		1	30	300
Subtotal Water Action - III		**80**	**45.91**	**2,810**
Overall Total GP		**212**	**297**	**80,877**

Water actions

Regarding CWRM themes, of the total number of projects identified, 30.66 percent works are in public and common land, 31.60 percent in agriculture and allied sector while it is 37.73 percent under rural infrastructure. (Table 50)

TABLE 50. SUMMARY OF WORKS IDENTIFIED AND ESTIMATED PERSON-DAYS FOR 2021-2024

CWRM themes	No of works	Estimated budget (INR in lakhs)	Estimated person days
Public and common land development	65	35	7,178
Agriculture and Allied sector development	67	218	70,889
Rural water management	80	45.91	2,810
TOTAL	212	298.91	80,877

8.3.5 IMPACTS

The proposed water actions based on the above key water challenges cover three years from 2021-2022 to 2023-2024. At the end of the implementation period the following impacts are envisaged (Table 51). It is expected that the impacts will potentially reduce the vulnerability and improved the resilience of the system to the projected climatic change events and ensures water security.

TABLE 51. WASCA- WATER ACTIONS AND INDICATORS

WASCA CWRM ACTION PLAN

DEVELOPMENT OF PUBLIC AND COMMON LAND

	INDICATOR		OUTCOMES/ IMPACT
1	Number of water bodies restored in the village	1	8 water bodies restored
2	Quantum of water harvested/recharge	2	15.2 ha.m surface runoff is harvested due to WASCA interventions
3	The proportion of land treated under WASCA	3	66.56 percent of the total area treated under WASCA (120.133 ha)
4	Area under afforestation	4	0.55 ha area under afforestation
5	Length of drainage line treated	5	Nil

8
TRADITIONAL WATER BODIES RESTORED

0.55 ha
AFFORESTATION

15.2 ha.m
RUNOFF HARVESTED

66.56 %
AREA OF THE VILLAGE TREATED

WASCA CWRM ACTION PLAN

DEVELOPMENT OF AGRICULTURE AND ALLIED ACTIVITIES

	INDICATOR		OUTCOMES/ IMPACT
1	Assessment of sources of water for live-stock and agriculture demand	1	5 farm ponds established
2	No structures were established for on-farm (in-situ) water harvesting in drylands	2	13.32 ha Farm bunding with trenches
3	Improvement in soil health	3	5 compost units for soil health improve-ment
4	Changes in the irrigation practices	4	1.41 ha covered under micro-irrigation
5	Dryland development with agro-forestry	5	7 ha under dryland horticulture
6	Households established fodder plots	6	7 vulnerable households established fodder plots

5
FARM PONDS

5
VERMI COMPOST

13.32 ha
FARM BUNDING

7 ha
DRYLAND HORTICULTURE

3
FODDER PLOTS

WASCA CWRM ACTION PLAN

DEVELOPMENT OF RURAL INFRASTRUCTURE

	INDICATOR		OUTCOMES/ IMPACT
1	Number of villages having complete solid and liquid waste management systems	1	7 common and 70 individual soak pits were established for recycling greywater benefiting 697 households
2	Greywater drains	2	2 common roof rainwater harvesting and storage and 697 individual level roof rainwater harvesting
3	Roof rainwater harvesting measures	3	697 Households established Nutri-gardens in homesteads
4	Nutri gardens		

7 COMMUNITY & **70** INDIVIDUAL SOAK PITS

2 COMMON & **697** INDIVIDUAL ROOF RAINWATER HARVESTING

697 NUTRI-GARDENS

Table 52 provides both the prospective plan for three years and the annual plan for the one year from 2021-2022 on the shelf of projects/number of works and number of person-days.

TABLE 52. PROPOSAL FOR THE MGNREGS, T.KARUNGULAM GP, BOGALUR BLOCK

	No of works	No of person days
Perspective plan	212	80,877
Annual plan	85	32,351

8.3.6 PROPOSED ACTIVITY MAP

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

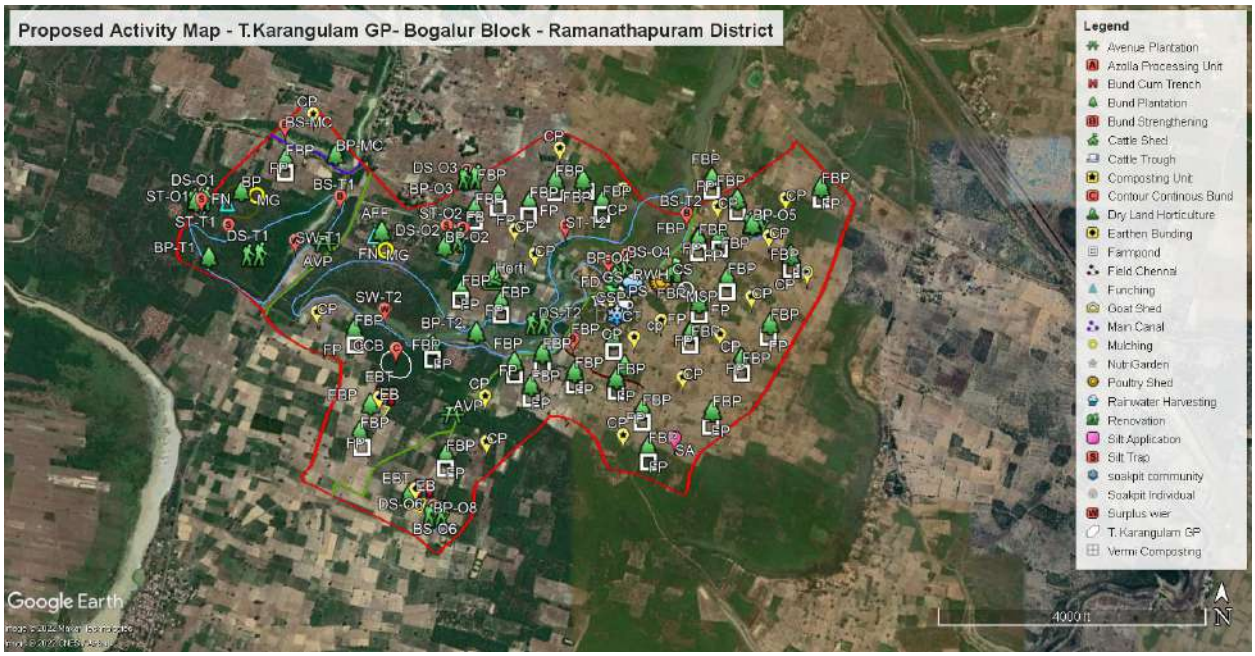
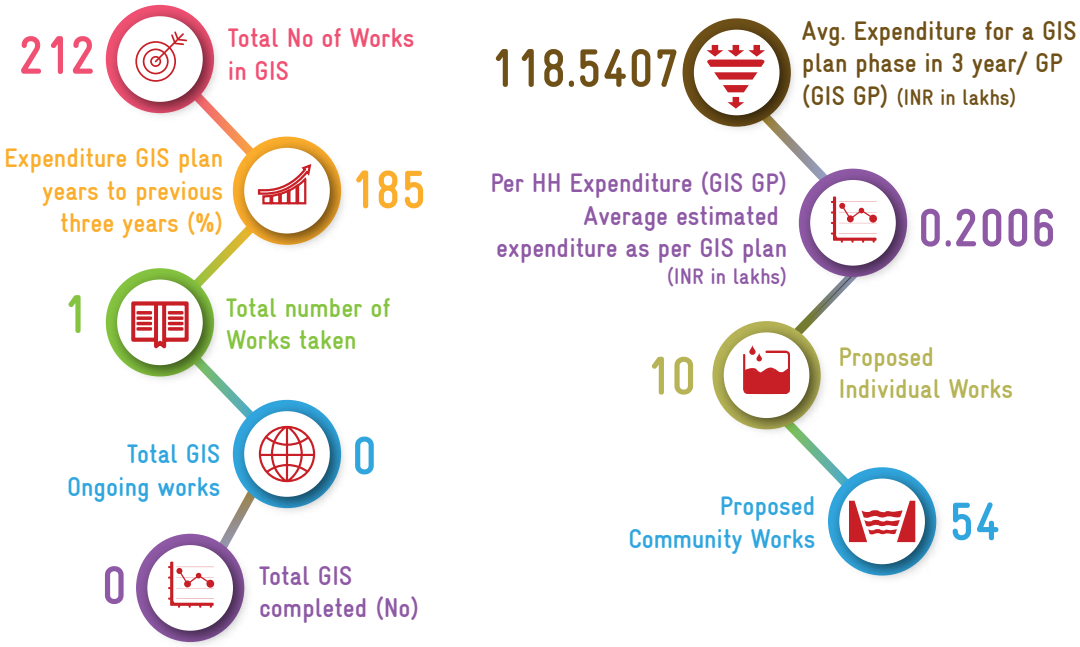


Figure 8.9. Proposed action plan of T.Karungulam GP

8.3.7 GIS PLAN IMPLEMENTATION AND KEY PARAMETERS

The GIS plan implementation and performance of T.Karungulam GP, Bogalur Block is represented in Table 53.

TABLE 53. GIS PLAN IMPLEMENTATION, KEY PARAMETERS PERFORMANCE IN NUMBERS



நீர்இன்று அமையாது உலகெனின் யார்யார்க்கும்
வான்இன்று அமையாது ஒழுக்கு

குறள் - 20

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

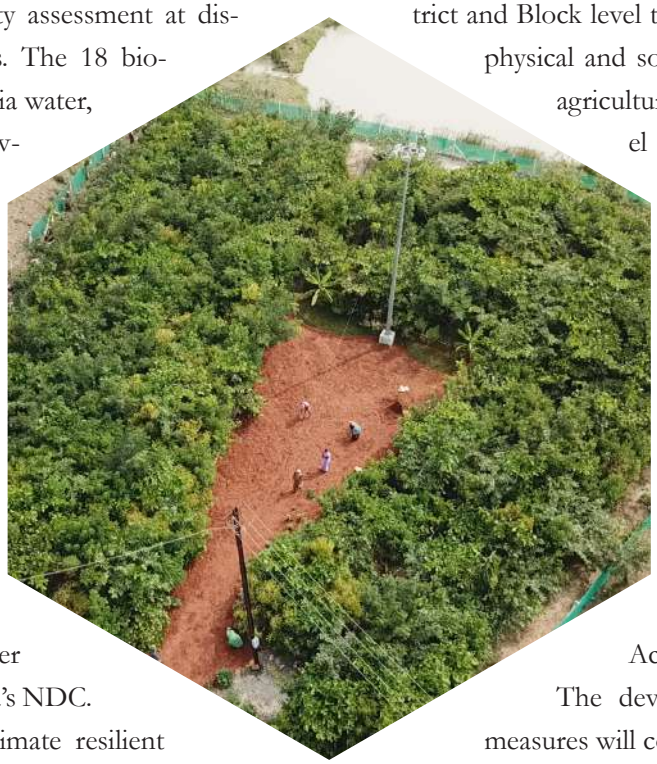
Thirukkural - 20

CHAPTER 9

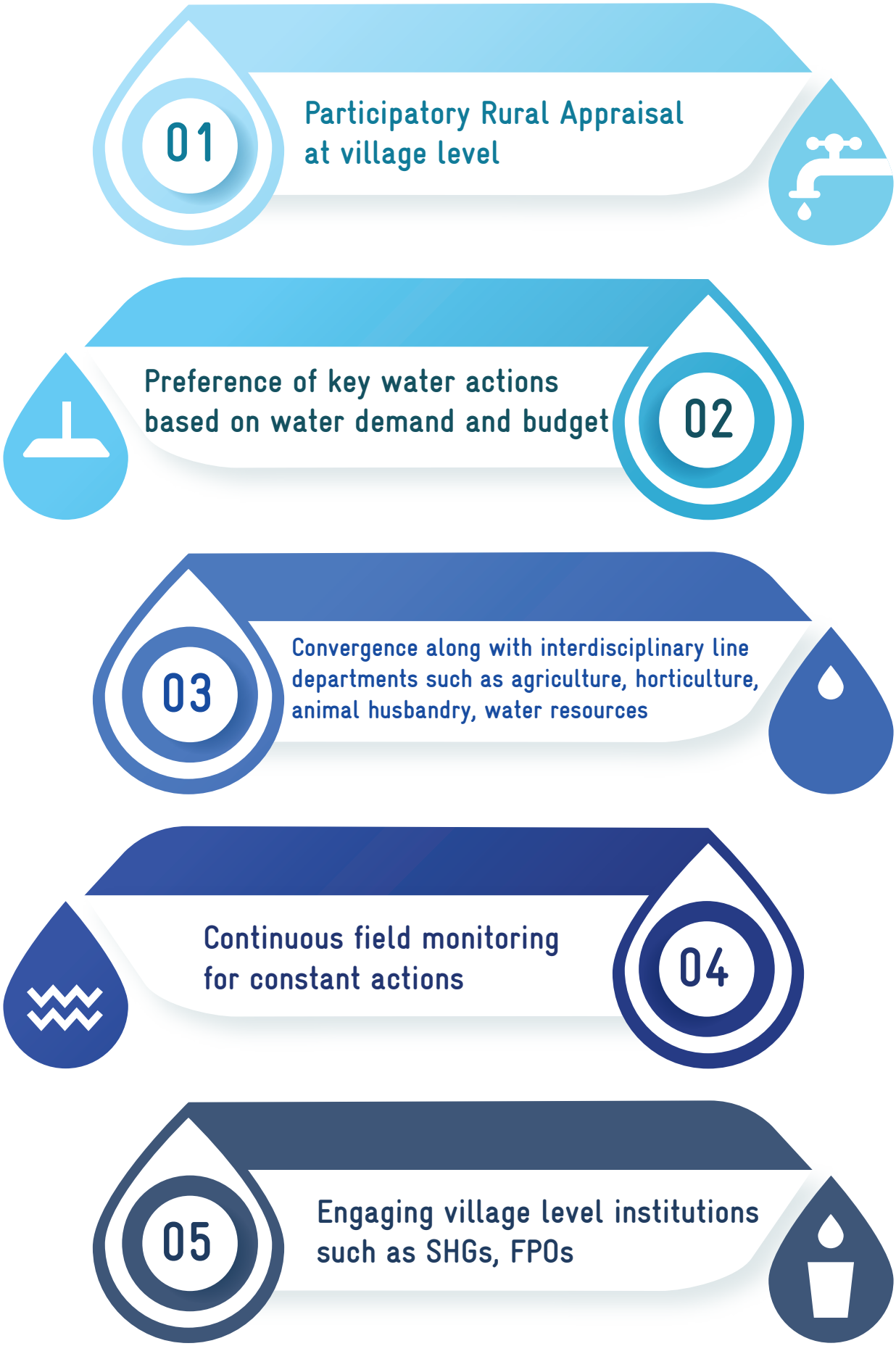
CONCLUSION

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

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



Recommendations towards stable development and its progressive outcome are:


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

ANNEXURES

ANNEXURE 1

TYPES OF GPs

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

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

ANNEXURE 3.1

KEY CWRM PARAMETER FROM SECONDARY SOURCES

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

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

ANNEXURE 3.2

KEY CWRM PARAMETERS FROM PRIMARY SOURCES

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

ANNEXURE 3.3

KEY CWRM PARAMETER GENERATED -PRIMARY DATA

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

ANNEXURE 3.4

STANDARD NORMS FOR CALCULATING WATER DEMAND

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

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

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

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

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

ANNEXURE 3.5

STANDARD NORMS FOR GREY WATER GENERATION CALCULATION

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

ANNEXURE 3.6

WATER QUALITY STANDARDS AND FORMULA USED

RELATIVE WEIGHTS ASSIGNED FOR DIFFERENT WATER QUALITY PARAMETERS

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

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

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

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

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

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

ANNEXURE 3.7

GP WISE STATUS OF WATER RESOURCE AND ITS SUPPLY AND DEMAND

Gram Panchayat	Canal Network				Traditional water bodies		Irrigation Facilities (ha)		
	Length of Main Canal (m)	Length of Minor Canal (m)	Length of Distributaries (m)	Water Courses (Field Channels) (m)	Number of Tanks (PWD & Union) (No.)	Number of Ooranis (No.)	Tank Irrigation	Canal Irrigation	Open & Tube Well Irrigation
Ettivayal	3,500	2,650	-	15,650	5	13	170.29	-	73.28
Bogalur	-	1,350	-	4,200	2	6	151.30	-	47.24
Manjur	-	1,200	-	2,400	4	14	65.17	-	39.77
Mudalur	4,500	4,200	-	9,500	-	5	97.11	-	-
Semanur	-	6,525	-	22,350	3	9	117.84	-	32.93
Sevvur	1,200	1,000	-	7,200	3	7	117.61	-	35.65
Seyyalur	-	2,850	-	8,500	-	6	92.40	-	27.52
Theeyanur	2,400	4,850	-	16,540	4	8	237.15	-	-
Kodikulam	-	1,490	-	2,000	1	6	148.54	-	98.30
Kavithakudi	-	1,350	-	1,200	3	5	9.64	-	-
Kumukottai	-	-	-	-	2	6	174.56	-	30.00
Thievendranallur	1,355	847	-	500	-	5	138.41	-	54.30
Manjakollai	-	-	-	-	-	-	58.32	-	28.26
Karudhanendhal	2,848	714	-	1,854	2	3	10.77	-	4.87
Veeravenur	1,983	-	-	2,054	2	8	85.70	-	12.34
Vairavenandhal	9,819	-	-	542	2	6	170.29	-	40.00
Kamankottai	3,993	6,545	-	3,151	2	15	14.47	3.24	-
Mennendhinagachi	5,532	-	-	1,002	3	10	9.48	-	-
Urathur	4,334	-	-	3,682	3	6	-	4.05	-
Ariyakudipudhur	7,115	-	-	1,736	5	13	240.20	17.85	-
Keelambal	447	-	-	1,518	4	7	9.73	3.15	2.48
Muthuvayal	9,628	-	-	754	4	11	123.00	4.56	2.58
K.vasalai	3,358	-	-	406	3	6	96.26	20.45	56.07
Pottithatti	1,691	-	-	-	1	10	20.02	2.66	1.33
Pandikanmai	1,001	-	-	1,206	4	5	4.31	3.12	-
T.Karungulam	266	-	229	200	2	6	4.78	2.72	-

Gram Panchayat	Catchment Area wise Available Runoff (ha.m)			Watershed and Drainage Networks		
	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.)
Ettivayal	59.27	12.76	57.17	3,139.00	4	8
Bogalur	43.04	28.30	94.08	7,352.37	6	8
Manjur	66.11	10.49	58.56	1,695.72	4	4
Mudalur	36.21	-	99.63	4,143.44	4	8
Semanur	19.76	7.49	56.25	-	-	5
Sevvur	22.36	4.90	58.85	4,539.11	5	6
Seyyalur	34.71	14.54	44.01	1,197.11	4	3
Theeyanur	49.07	-	74.67	2,653.18	4	8
Kodikulam	16.60	6.68	33.37	1,036.31	2	5
Kavithakudi	12.02	4.84	24.16	4,099.87	3	7
Kumukottai	29.74	4.67	30.21	5,676.17	6	5
Thievendranallur	28.57	4.49	29.02	2,648.17	2	5
Manjakollai	18.13	4.06	27.10	2,251.31	4	2
Karudhanendhal	18.87	4.23	28.20	3,710.78	5	2
Veeravenur	17.50	19.03	67.19	5,945.72	5	9
Vairavenandhal	0.07	0.32	0.81	2,952.78	2	5
Kamankottai	44.84	11.45	67.90	8,449.35	7	7
Mennendhinagachi	38.84	25.00	101.88	4,791.36	7	7
Urathur	15.59	11.48	48.42	2,068.46	3	6
Ariyakudipudhur	53.40	34.50	141.40	8,243.30	5	10
Keelambal	50.30	14.90	98.50	4,568.56	5	4
Muthuvayal	35.70	0.20	63.50	5,588.26	4	6
K.vasalai	28.90	6.10	39.30	3,395.57	4	6
Pottithatti	20.96	0.06	16.42	1,438.90	2	4
Pandikanmai	9.60	0.00	22.42	-	-	5
T.Karungulam	7.20	0.00	16.81	154.57	1	2

Gram Panchayat	Water Demand								
	For Humans (ha.m)	For Livestock (ha.m)	For Agriculture (ha.m)	% GW Utilization for Drinking (%)	% GW Utilization for Livestock (%)	% GW Utilization for Agriculture. (%)	% SW Utilization for Drinking (%)	% SW Utilization for Livestock (%)	% SW Utilization for Agriculture (%)
Ettivayal	5.43	0.56	378.28	90	38	30	10	62	70
Bogalur	14.79	2.50	321.49	99	21	24	1	79	76
Manjur	6.87	0.70	256.10	83	72	38	17	28	62
Mudalur	5.04	1.73	205.63	91	75	-	9	25	100
Semanur	3.10	0.72	336.87	85	26	22	15	74	78
Sevvur	5.40	1.65	243.13	84	27	23	16	73	77
Seyyalur	1.40	0.36	170.53	100	42	23	-	58	77
Theeyanur	2.42	0.28	431.57	90	31	-	10	69	100
Kodikulam	3.85	0.74	137.02	92	56	40	8	44	60
Kavithakudi	3.70	0.74	136.57	97	56	-	3	44	100
Kumukottai	5.70	0.81	148.36	95	16	15	5	84	85
Thievendranallur	5.70	0.81	148.36	91	16	28	9	84	72
Manjakollai	3.74	0.25	112.02	98	63	33	2	37	67
Karudhanendhal	3.74	0.25	112.02	92	63	31	8	37	69
Veeravenur	7.73	0.68	168.93	94	68	13	6	32	87
Vairavenandhal	7.73	0.68	168.93	93	68	19	7	32	81
Kamankottai	6.61	1.23	513.68	94	69	-	6	31	100
Mennendhinagachi	6.64	0.70	463.78	96	51	-	4	49	100
Urathur	3.09	0.53	190.49	93	44	-	7	56	100
Ariyakudipudhur	7.98	1.82	550.87	88	15	-	12	85	100
Keelambal	5.51	1.13	463.26	-	21	16	100	79	84
Muthuvayal	5.31	0.52	198.80	90	27	2	10	73	98
K.vasalai	5.64	0.68	122.83	88	36	32	12	64	68
Pottithatti	14.86	0.45	41.18	95	82	6	5	18	94
Pandikanmai	7.62	0.50	185.75	84	29	-	16	71	100
T.Karungulam	7.62	0.38	376.14	95	29	-	5	71	100

ANNEXURE 3.8

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

GP	Locations	Latitude	Longitude	Well type	pH	Salinity	EC (µS/cm)	TDS (ppm)	TA (mg/l)
A Puthur	A Puthur	E 78° 39' 9.58"	N 9° 24' 7.34"	Bore well	7.8	-	3,727	2,260	456
A Puthur	Muthu Selvapuram	E 78° 40' 21.428"	N 9° 24' 5.573"	Bore well	8	-	3,751	2,371	472
Bogalur	Sathirakudi	E 78° 42' 18.857"	N 9° 24' 20.876"	Bore well	7.49	3	10,000	6,370	399
Deivendranallur	Thiruvadi	E 78° 39' 31.388"	N 9° 27' 16.376"	Bore well	7.42	-	6,000	3,700	391
Ettivayal	Theeyanur	E 78° 43' 20.114"	N 9° 23' 40.51"	Bore well	8.02	-	668	404	473
K.Valasai	Arasadi Vandal	E 78° 43' 4.915"	N 9° 29' 21.948"	Bore well	7.07	-	6,630	4,200	314
Kamankottai	Kamankottai	E 78° 41' 53.484"	N 9° 27' 43.355"	Bore well	7.85	-	1,943	1,170	464
Manjur	Manjoor	E 78° 39' 13.284"	N 9° 28' 44.72"	Bore well	7.46	-	1,212	759	443
Mudalur	Madaloor (Vaigai River)	E 78° 45' 53.701"	N 9° 26' 24.025"	Open well	7.82	-	1,164	681	458
Muthuvayal	Muthuvayal	E 78° 41' 46.943"	N 9° 26' 6.907"	Bore well	7.89	-	866	533	465
Muthuvayal	Near Muthuvayal	E 78° 41' 36.978"	N 9° 25' 24.78"	Bore well	8.06	-	874	536	478
Pottithatti	Pattithatti	E 78° 38' 57.372"	N 9° 29' 9.546"	Bore well	7.61	-	1,200	635	475
Semanur	VadukuKodikulam	E 78° 41' 55.158"	N 9° 22' 19.52"	Bore well	7.47	-	9,610	5,810	397
Seyyalur	Seyyalur	E 78° 44' 42.23"	N 9° 22' 48.324"	Bore well	7.24	6	22,130	14,070	342
T.Karungulam	Poganoor	E 78° 39' 11.581"	N 9° 26' 13.826"	Open well	7.41	-	6,800	4,200	390

Gram Panchayat	CO_3 (mg/l)	HCO_3 (mg/l)	TH (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K(mg/l)	$S0_4$ (mg/l)	Cl (mg/l)	NO_3 (mg/l)	WQI	SMI
A Puthur	114	312	444	203	114	524	7	31	1,252	52	262.9	0.72
A Puthur	95	357	447	204	115	497	13	20	1,174	41	257.6	0.66
Bogalur	94	274	480	280	45	1,561	11	19	3,637	85	626.1	1.90
Deivendranallur	101	254	715	327	183	843	1	28	1,137	16	341.7	0.78
Ettivayal	95	357	80	36	20	95	2	21	199	11	56.9	0.15
K.Valasai	47	234	790	361	202	362	16	16	1,567	8	360.3	0.77
Kamankottai	141	293	232	106	59	281	7	18	436	22	132.8	0.30
Manjur	96	315	226	116	64	154	10	51	353	22	103.4	0.29
Mudalur	115	328	139	63	36	184	1	11	273	25	85.2	0.19
Muthuvayal	95	352	103	47	26	86	3	37	114	11	57.9	0.15
Muthuvayal	97	361	510	80	67	98	2	19	176	25	77.4	0.15
Pottithatti	99	348	183	96	56	113	5	12	286	11	84.1	0.18
Semanur	74	295	1,146	524	293	967	5	15	2,227	4	532	1.23
Seyyalur	69	252	2,638	1,206	675	1,356	34	47	5,221	15	1184	2.61
T.Karungulam	102	254	811	371	208	1,174	6	38	1,729	57	439.3	1.13

ANNEXURE 3.9

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

GP	Locations	Latitude	Longitude	Well type	pH	Salinity	EC (µS/cm)	TDS (ppm)	TA (mg/l)
A Puthur	A Puthur	E 78° 39' 9.58"	N 9° 24' 7.34"	Bore well	7.12	-	561	348	166
A Puthur	Muthu Selvapuram	E 78° 40' 21.428"	N 9° 24' 5.573"	Bore well	7.00	-	3,696	2,292	326
Bogalur	Sathirakudi	E 78° 42' 18.857"	N 9° 24' 20.876"	Bore well	6.73	-	8,990	5,574	592
Deivendranallur	Thiruvadi	E 78° 39' 31.388"	N 9° 27' 16.376"	Bore well	6.45	2	8,640	5,357	604
Ettivayal	Theeyanur	E 78° 43' 20.114"	N 9° 23' 40.51"	Bore well	7.09	-	626	388	147
K.Valasai	Arasadi Vandal	E 78° 43' 4.915"	N 9° 29' 21.948"	Bore well	7.19	-	737	457	162
Kamankottai	Kamankottai	E 78° 41' 53.484"	N 9° 27' 43.355"	Bore well	6.94	-	3,997	2,478	381
Manjur	Manjoor	E 78° 39' 13.284"	N 9° 28' 44.72"	Bore well	7.28	-	7,460	4,625	588
Mudalur	Madaloor (Vaigai River)	E 78° 45' 53.701"	N 9° 26' 24.025"	Open well	7.35	-	469	291	79
Muthuvayal	Muthuvayal	E 78° 41' 46.943"	N 9° 26' 6.907"	Bore well	7.05	2	6,480	4,018	492
Muthuvayal	Near Muthuvayal	E 78° 41' 36.978"	N 9° 25' 24.78"	Bore well	6.84	-	851	528	156
Pottithatti	Pattithatti	E 78° 38' 57.372"	N 9° 29' 9.546"	Bore well	7.03	-	5,570	3,453	478
Semanur	VadukuKodikulam	E 78° 41' 55.158"	N 9° 22' 19.52"	Bore well	7.12	-	9,060	5,617	631
Seyyalur	Seyyalur	E 78° 44' 42.23"	N 9° 22' 48.324"	Bore well	6.80	4	18,260	11,321	973
T.Karungulam	Poganoor	E 78° 39' 11.581"	N 9° 26' 13.826"	Open well	6.54	-	8,260	5,121	633

Gram Panchayat	CO_3 (mg/l)	HCO_3 (mg/l)	TH (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K(mg/l)	$S0_4$ (mg/l)	Cl (mg/l)	NO_3 (mg/l)	WQI	SMI
A Puthur	15	136	50	18	22	27	5	37	52	3.05	37.40	0.60
A Puthur	53	262	243	119	106	195	32	146	331	20.12	170.50	0.82
Bogalur	129	453	521	290	218	289	85	197	718	48.92	364.10	2.16
Deivendranallur	106	517	509	279	216	367	82	186	721	38.00	357.20	1.41
Ettivayal	9	129	60	20	28	36	6	41	56	3.41	41.40	0.17
K.Valasai	16	132	55	28	16	21	6	26	61	5.00	40.80	0.43
Kamankottai	57	321	226	124	87	182	36	162	394	21.75	182.90	0.64
Manjur	112	463	547	241	295	324	52	169	791	40.59	347.80	0.74
Mudalur	8	63	24	11	6	10	2	2	22	1.00	26.10	0.20
Muthuvayal	93	385	397	169	213	367	58	186	683	51.00	301.80	0.62
Muthuvayal	12	136	52	27	12	39	8	22	66	4.63	43.10	0.15
Pottithatti	92	369	366	183	164	286	36	188	546	62.00	259.90	0.58
Semanur	130	489	541	293	231	426	31	189	816	58.00	383.00	1.59
Seyyalur	202	763	1,206	589	602	724	90	211	1,336	99.36	750.10	2.32
T.Karungulam	118	502	545	261	278	393	78	193	746	44.95	366.70	1.78

GP WISE STATUS OF AGRICULTURE RESOURCE

ANNEXURE 3.10

Gram Panchayat	Land Resources (ha)								
	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
Ettivayal	267.15	-	1.00	72.31	1.60	80.35	110.13	69.23	243.57
Bogalur	194.01	-	4.00	160.00	2.08	270.08	288.28	71.29	198.54
Manjur	297.99	-	2.00	58.40	1.15	80.23	163.78	166.51	104.94
Mudalur	163.20	-	-	-	-	0.04	498.86	281.03	97.11
Semanur	89.06	-	1.00	41.46	1.51	30.24	71.81	242.35	150.77
Sevvur	100.80	-	-	27.40	1.34	17.10	71.29	276.36	153.26
Seyyalur	156.45	-	2.00	83.35	-	100.27	151.86	15.40	119.92
Theeyanur	221.19	-	-	-	-	-	322.88	97.25	237.15
Kodikulam	74.84	-	0.58	37.70	0.93	53.04	42.42	105.30	92.95
Kavithakudi	54.20	-	0.42	27.30	0.67	38.41	30.71	76.26	67.31
Kumukottai	134.05	-	0.51	26.15	0.75	46.11	25.41	116.03	78.36
Thievendranallur	128.80	-	0.49	25.12	0.73	44.31	24.42	111.48	75.29
Manjakollai	81.72	-	0.49	22.54	0.81	14.89	53.33	142.05	28.26
Karudhanendhal	85.05	-	0.51	23.46	0.84	15.50	55.50	147.85	29.41
Veeravenur	78.86	-	-	111.12	0.57	120.13	191.14	156.16	124.01
Vairavenandhal	52.57	-	-	74.08	0.38	80.09	127.42	104.11	82.67
Kamankottai	202.13	-	-	63.30	3.91	58.32	150.77	156.82	231.83
Mennendhinagachi	175.09	-	2.00	140.00	4.71	124.45	154.39	390.00	227.95
Urathur	70.29	-	2.00	64.14	1.21	59.50	161.79	92.90	112.00
Ariyakudipudhur	241	-	2	199	2	208	240	522	274
Keelambal	227	-	1	86	1	100	275	241	251
Muthuvayal	161	-	1	-	0	-	224	196	139
K.vasalai	130	-	-	27	9	72	96	122	56
Pottithatti	-	94	-	0	0	0	102	23	20
Pandikanmai	43	-	-	-	0	-	117	60	21
T.Karungulam	32.47	-	-	-	0.01	-	87.66	44.63	15.71

Gram Panchayat	Land under Catchment Area (ha)			Crop Details					Soil Resources: Status of Available Nitrogen (%)	
	Good Catchment	Average Catchment	Bad Catch-ment	Irrigated Area (ha)	Rainfed area (ha)	Paddy Cultivation (ha)	Crop Water Require-ment - Irrigated condition (ha.m)	Crop Water Require-ment - Rainfed condition (ha.m)	Very Low	Low
Ettivayal	267.15	74.91	503.28	242.99	59.82	245.36	52.54	378.28	26.02	70.73
Bogalur	194.01	166.08	828.19	205.17	56.91	197.46	45.75	321.49	72.30	27.70
Manjur	297.99	61.55	515.46	119.00	132.25	175.72	114.38	256.09	66.20	33.80
Mudalur	163.20	-	877.04	61.05	211.16	94.70	136.06	205.62	78.64	21.36
Semanur	89.06	43.97	495.17	152.45	134.39	244.28	123.79	336.86	51.65	48.35
Sevvur	100.80	28.74	518.01	130.14	123.34	137.30	89.79	243.13	91.76	8.24
Seyyalur	156.45	85.35	387.45	132.64	10.54	98.23	8.42	170.53	26.39	73.61
Theeyanur	221.19	-	657.28	240.70	89.75	307.93	86.66	431.56	29.13	70.87
Kodikulam	74.84	39.21	293.71	78.23	28.49	96.79	27.83	137.02	67.82	32.18
Kavithakudi	54.20	28.39	212.69	78.45	27.70	96.22	27.03	136.56	67.82	32.18
Kumukottai	134.05	27.41	265.91	71.69	68.33	103.31	87.36	61.00	76.19	23.81
Thievendranallur	128.80	26.34	255.50	71.69	68.32	103.01	87.36	61.00	76.19	23.81
Manjakollai	81.72	23.84	238.53	34.07	88.44	75.66	38.05	73.96	97.14	2.86
Karudhanendhal	85.05	24.81	248.26	34.07	88.44	75.66	38.05	73.96	97.14	2.86
Veeravenur	78.86	111.69	591.44	101.42	60.56	96.90	121.42	47.51	97.14	2.86
Vairavenandhal	52.57	74.46	394.29	101.42	60.56	96.90	121.42	47.51	100.00	-
Kamankottai	202.13	67.21	597.74	282.82	225.77	274.32	343.75	169.93	89.23	9.23
Mennendhinagachi	175.09	146.71	896.79	213.32	221.67	309.41	281.41	182.37	71.50	28.50
Urathur	70.29	67.35	426.19	106.61	69.18	135.47	122.75	67.73	90.79	9.21
Ariyakudipudhur	240.52	202.41	1244.39	214.41	266.39	405.00	303.25	247.62	65.38	34.62
Keelambal	226.83	87.61	867.05	220.77	194.83	308.66	292.11	171.15	82.79	17.21
Muthuvayal	160.74	1.37	559.05	90.44	125.57	109.62	99.95	98.85	41.18	58.82
K.vasalai	130.07	35.71	346.26	24.96	85.39	110.35	37.44	85.39	88.68	11.32
Pottithatti	94.47	0.35	144.53	27.38	0.11	27.49	41.07	0.11	58.52	41.48
Pandikanmai	43.29	0.02	197.33	93.34	58.7	116.24	139.1	46.65	91.74	7.85
T.Karungulam	32.47	0.012	148.001	201.595	104.64	228.84	295.40425	80.739	91.74	7.85

Gram Panchayat	Status of Organic Carbon (%)					Status of Soil Micro Nutrients (%)	
	Very Low	Low	Medium	High	Very High	Sufficient	Deficient
Ettivayal	-	-	0.81	-	99.19	75.88	24.12
Bogalur	23.65	72.97	3.38	-	-	79.28	20.72
Manjur	36.62	63.38	-	-	-	61.97	38.03
Mudalur	31.07	59.22	9.71	-	-	65.64	34.36
Semanur	21.98	78.02	-	-	-	58.42	41.58
Sevvur	96.47	3.53	-	-	-	72.35	27.65
Seyyalur	18.06	66.67	15.28	-	-	52.33	47.67
Theeyanur	10.16	75.00	14.06	0.78	-	62.53	37.47
Kodikulam	34.48	64.37	1.15	-	-	78.96	21.04
Kavithakudi	34.48	64.37	1.15	-	-	66.86	33.14
Kumukottai	33.93	66.07	-	-	-	82.44	17.56
Thievendranallur	33.93	66.07	-	-	-	82.44	17.56
Manjakollai	100.00	-	-	-	-	66.27	33.73
Karudhanendhal	100.00	-	-	-	-	82.97	17.03
Veeravenur	90.00	8.57	-	1.43	-	55.04	44.96
Vairavenandhal	90.00	8.57	-	1.43	-	55.04	44.96
Kamankottai	67.69	32.31	-	-	-	67.00	33.00
Mennendhinagachi	37.31	56.99	5.70	-	-	66.00	34.00
Urathur	66.23	15.58	7.79	10.39	-	61.00	39.00
Ariyakudipudhur	30.77	62.31	6.92	-	-	61.00	39.00
Keelambal	33.61	66.39	-	-	-	71.00	29.00
Muthuvayal	23.53	76.47	-	-	-	51.00	49.00
K.vasalai	16.67	83.33	-	-	-	68.00	32.00
Pottithatti	41.48	51.14	7.39	-	-	60.00	40.00
Pandikanmai	50.00	50.00	-	-	-	83.00	17.00
T.Karungulam	50.00	50.00	-	-	-	83.00	17.00

Gram Panchayat	Status of Physical condition of the soil (%)								Soil Texture (%)		
	Moderately Acidic	Strongly Acidic	Highly Acidic	Moderately Acidic	Slighly Acidic	Neutral	Moderately Alkaline	Strongly Alkaline	Fine Soil	Coarse loamy	Soil Water Permeability (Low, Moderate, high)
Ettivayal	-	-	-	-	-	-	100.00	-	93.95	-	Moderate
Bogalur	-	-	0.68	0.68	2.03	-	75.68	20.95	94.40	-	Moderate
Manjur	-	-	-	-	9.86	1.41	46.48	42.25	94.60	-	Moderate
Mudalur	-	-	-	0.97	-	-	98.06	0.97	81.22	15.65	Moderate
Semanur	-	-	2.17	26.09	33.70	4.35	33.70	-	83.22	0.49	Moderate
Sevvur	-	-	-	-	20.00	-	80.00	-	57.00	36.84	Moderate
Seyyalur	-	-	-	2.78	2.78	-	93.06	1.39	95.00	-	Moderate
Theeyanur	-	0.78	-	40.63	20.31	3.13	35.16	-	93.29	-	Moderate
Kodikulam	-	-	13.79	65.52	19.54	-	1.15	-	78.50	-	Moderate
Kavithakudi	-	-	-	0.88	-	-	54.87	44.25	78.57	-	Moderate
Kumukottai	-	-	-	-	-	-	100.00	-	94.25	-	Moderate
Thievendranallur	-	-	-	-	-	-	100.00	-	85.82	-	Moderate
Manjakollai	-	-	13.79	65.52	19.54	-	1.15	-	98.00	-	Moderate
Karudhanendhal	-	-	-	-	52.86	-	44.29	2.86	97.12	-	Moderate
Veeravenur	-	-	-	-	3.57	1.43	93.57	1.43	89.58	-	Moderate
Vairavenandhal	-	-	-	-	3.57	1.43	93.57	1.43	56.26	-	Moderate
Kamankottai	-	-	-	-	-	-	100.00	-	95.48	-	Moderate
Mennendhinagachi	-	-	-	-	-	-	100.00	-	85.23	-	Moderate
Urathur	-	-	-	3.57	-	-	89.29	7.14	86.31	-	Moderate
Ariyakudipudhur	-	-	1.46	21.90	27.01	-	48.18	1.46	64.80	-	Moderate
Keelambal	-	-	1.46	21.90	27.01	-	48.18	1.46	91.42	-	Moderate
Muthuvayal	-	-	-	25.00	62.50	-	12.50	-	87.77	-	Moderate
K.vasalai	-	-	1.85	-	5.56	1.85	90.74	-	95.40	-	Moderate
Pottithatti	-	-	-	31.82	49.43	1.14	17.05	0.57	79.72	-	Moderate
Pandikanmai	-	-	0.83	64.46	30.58	-	4.13	-	91.31	-	Moderate
T.Karungulam	-	-	0.83	64.46	30.58	-	4.13	-	93.93	-	Moderate

Gram Panchayat	Soil moisture and ET			Means of Water Extraction (%)		Irrigation Methods (%)		Livestock (No.)			
	Volumetric Soil Moisture (%)	Estimated Soil Moisture (ha.m)	ET Losses (ha.m)	Gravity	Lifting	Wild Flooding	Control Flooding	Cattle Population	Sheep Population	Goat Population	Poultry
Ettivayal	17	578.19	201.52	53.00	47.00	69.91	30.09	59	495	427	385
Bogalur	17	994.27	226.46	44.00	56.00	76.21	23.79	142	4502	834	2170
Manjur	17	577.01	173.23	55.00	45.00	56.00	44.00	138	124	382	593
Mudalur	17	877.04	197.39	88.00	12.00	88.00	11.76	355	694	442	1409
Semanur	17	539.14	227.37	79.00	21.00	78.00	22.00	51	881	571	598
Sevvur	17	546.75	238.56	79.00	21.00	78.00	22.00	124	3107	165	262
Seyyalur	17	472.80	115.19	79.00	21.00	78.00	21.00	41	311	246	53
Theeyanur	17	657.28	174.56	79.00	21.00	79.00	21.00	24	295	225	421
Kodikulam	17	332.92	173.30	40.00	60.00	60.18	39.82	112	434	449	497
Kavithakudi	17	241.08	125.49	35.00	65.00	100.00	-	112	434	449	497
Kumukottai	17	293.32	152.72	27.27	72.73	85.33	14.67	33	1624	260	713
Thievendranallur	17	281.84	146.74	47.06	52.94	71.82	28.18	33	1624	260	713
Manjakollai	17	262.37	136.53	66.67	33.33	67.36	32.64	42	49	202	142.00
Karudhanendhal	17	273.07	142.10	66.67	33.33	96.70	3.30	42	49	202	142
Veeravenur	17	703.13	366.73632	71.43	28.57	93.24	6.76	126	224	368	266
Vairavenandhal	17	468.75	244.49	75.00	25.00	80.98	19.02	126	224	368	266
Kamankottai	17	112.49	345.06	44.44	55.56	64.83	35.17	230	647	413	547
Mennendhinagachi	17	176.53	542.25	16.67	83.33	60.74	39.26	92	600	350	1750
Urathur	17	83.49	257.00	40.00	60.00	100.00	-	61	298	515	722
Ariyakudipudhur	17	244.75	754.37	69.23	30.77	100.00	-	74	3407	809	1127
Keelambal	17	161.50	498.04	33.33	66.67	83.85	16.15	62	1621	824	1017
Muthuvayal	17	94.80	292.35	28.57	71.43	98.02	1.98	36	484	556	642
K.vasalai	17	64.62	106.72	54.00	46.00	67.55	32.45	68	203	970	772
Pottithatti	17	40.49	22.43	60.00	40.00	94.31	5.69	100	65	153	137
Pandikanmai	17	33.39	41.99	40.00	60.00	100.00	-	40	794	179	114
T.Karungulam	17	25.04	31.50	43.00	57.00	100.00	-	30	596	135	86

ANNEXURE 3.11

GP WISE DEMOGRAPHIC AND SOCIO ECONOMIC STATUS

Gram Panchayat	Geographical Area (ha)	Male Population (No.)	Female Population (No.)	Total Population (No.)	SC Population (No.)	Vulnerable popupation (No.)	Households (HH's) (No.)	Only one room HH's (SECC) (No.)	Female Headed HH's (SECC) (No.)
Ettivayal	845	1,000	983	1,983	660	660	449	32	60
Bogalur	1,188	2,794	2,608	5,402	2,124	2,124	1,137	39	46
Manjur	875	1,229	1,280	2,509	1,406	1,406	601	10	49
Mudalur	1,040	942	899	1,841	577	577	443	37	29
Semanur	628	577	555	1,132	1	1	443	37	29
Sevvur	648	1,033	939	1,972	373	373	442	17	66
Seyyalur	629	273	239	512	267	267	113	2	7
Theeyanur	878	457	426	883	575	575	227	6	17
Kodikulam	402	705	700	1,405	491	491	318	9	15
Kavithakudi	296	684	667	1,351	511	511	318	9	15
Kumukottai	438	999	1,083	2,082	672	672	553	8	34
Thievendranallur	417	999	1,083	2,082	672	672	553	8	34
Manjakollai	344	688	680	1,368	672	672	378	3	22
Karudhanendhal	245	688	680	1,368	672	672	378	3	18
Veeravenur	809	1,420	1,405	2,825	1,297	1,297	680	20	58
Vairavenandhal	537	1,420	1,405	2,825	1,297	1,297	680	20	58
Kamankottai	1,261	1,226	1,190	2,416	2,021	2,021	646	18	63
Mennendhinagachi	1,192	1,230	1,197	2,427	1,194	1,194	588	36	48
Urathur	578	576	554	1,130	798	798	287	27	19
Ariyakudipudhur	1,752	1,471	1,443	2,914	1,095	1,095	633	49	77
Keelambal	759	1,013	998	2,011	747	747	633	29	67
Muthuvayal	1,013	970	970	1,940	1,039	1,039	347	8	27
K.vasalai	588	1,037	1,023	2,060	272	272	713	18	65
Pottithatti	144	2,805	2,622	5,427	1,369	1,369	1,347	14	84
Pandikanmai	496	1,439	1,346	2,785	1,022	1,022	332	31	27
T.Karungulam	346	1,439	1,346	2,785	1,022	1,022	332	31	27

Gram Panchayat	Vulnerable Households (SECC) (No.)	% of Vulnerable Households (%)	Registered MGNREGA Job cards (Persons)	Active person working in MGNREGA job Cards (Persons)	Drinking Water Sources (No.)	HH's have tap water connection for drinking water (No.)	HH's dependent on other sources for drinking water (No.)	Annual Greywater Generation (ha - m)
Ettivayal	40	9	408	355	106	324	256	4
Bogalur	41	4	1,003	822	155	1,100	1,582	10
Manjur	22	4	613	475	83	558	45	5
Mudalur	35	8	515	480	56	367	58	3
Semanur	35	8	567	419	62	269	33	2
Sevvur	32	7	503	458	57	450	26	4
Seyyalur	4	3	253	211	53	99	114	1
Theeyanur	9	4	236	197	82	194	43	2
Kodikulam	11	3	220	154	59	100	120	3
Kavithakudi	11	3	238	161	60	180	130	2
Kumukottai	16	3	350	306	13	100	70	4
Thievendranallur	16	3	476	398	18	60	260	4
Manjakollai	9	2	238	181	51	80	200	3
Karudhanendhal	8	2	246	178	39	100	230	3
Veeravenur	31	5	340	285	36	120	115	5
Vairavenandhal	31	5	564	517	43	150	140	5
Kamankottai	32	5	792	526	117	300	390	4
Mennendhinagachi	40	7	598	498	109	400	370	4
Urathur	25	9	362	277	57	100	260	2
Ariyakudipudhur	57	9	1,185	902	118	300	770	5
Keelambal	40	6	335	266	56	150	140	4
Muthuvayal	14	4	672	463	59	150	231	4
K.vasalai	32	5	564	498	41	520	210	4
Pottithatti	35	3	368	316	60	1,300	270	10
Pandikanmai	30	9	291	230	25	50	110	5
T.Karungulam	30	9	648	457	58	50	115	5

ANNEXURE 4

IPCC VULNERABILITY ASSESSMENT METHODOLOGY

Normalization of Indicators:

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

- for indicators with positive relationship with vulnerability

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

- for indicators with negative relationship with vulnerability

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

Aggregation and categorization of Indicators

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

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

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

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

ANNEXURE 5.1

GP WISE WASCA PROPOSED TREATMENT AREA

Gram Panchayat	Non-Agricultural Uses	Barren & Un-cultivable Land	Permanent Pastures and Other Grazing Land	Land Under Miscellaneous Tree Criticalops etc.	Cultivable Waste Land	Fallows Land other than Current Fallows	Current Fallow land	Unirrigated Land	Treatment Area Irrigated by Source
Ettivayal	26.38	-	0.85	61.46	1.36	7.23	9.91	6.23	21.92
Bogalur	3.30	-	3.40	136.00	1.77	10.80	11.53	2.85	7.94
Manjur	35.64	-	1.70	49.64	0.98	3.21	6.55	6.66	4.20
Mudalur	2.78	-	-	-	-	0.00	39.91	22.48	7.77
Semanur	1.52	-	0.85	35.24	1.28	2.42	5.74	19.39	12.06
Sevvur	1.71	-	-	23.29	1.14	1.20	4.99	19.35	10.73
Seyyalur	6.47	-	1.70	70.85	-	3.01	4.56	0.46	3.60
Theeyanur	9.74	-	-	-	-	-	12.92	3.89	9.49
Kodikulam	1.27	-	0.49	32.05	0.79	1.59	1.27	3.16	2.79
Kavithakudi	0.92	-	0.36	23.21	0.57	1.15	0.92	2.29	2.02
Kumukottai	12.97	-	0.43	22.23	0.64	1.38	0.76	3.48	2.35
Thievendranallur	12.46	-	0.42	21.35	0.62	1.33	0.73	3.34	2.26
Manjakollai	2.61	-	0.42	19.16	0.69	0.30	1.07	2.84	0.57
Karudhanendhal	2.71	-	0.43	19.94	0.71	0.31	1.11	2.96	0.59
Veeravenur	1.34	-	-	94.45	0.48	6.01	9.56	7.81	6.20
Vairavenandhal	0.89	-	-	62.97	0.32	4.00	6.37	5.21	4.13
Kamankottai	5.70	-	-	53.81	3.32	2.92	7.54	7.84	11.59
Mennendhinagachi	2.98	-	1.70	119.00	4.00	8.71	10.81	27.30	15.96
Urathur	1.20	-	1.70	54.52	1.03	5.36	14.56	8.36	10.08
Ariyakudipudhur	4	-	2	169	1	18.71	21.62	46.98	24.68
Keelambal	4	-	1	73	0	9	24.75	21.71	22.57
Muthuvayal	3	-	1	-	0	-	8.95	7.84	5.57
K.vasalai	6	-	-	23	8	3.61	4.81	6.09	2.8
Pottithatti	-	80	-	0	0	0.00306	3.05376	0.67833	0.60066
Pandikanmai	1	-	-	-	0	-	10.52	5.36	1.88
T.Karungulam	0.55	-	-	-	0.01	-	7.89	4.02	1.41

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	Good Catchment Area	Average Catchment Area	Bad Catchment Area
Ettivayal	37.39	11.13	5.28
Bogalur	25.61	24.69	3.86
Manjur	21.30	9.15	2.40
Mudalur	10.99	-	8.18
Semanur	13.45	6.54	4.62
Sevvur	20.43	4.27	4.23
Seyyalur	8.33	12.69	1.36
Theeyanur	18.99	-	3.07
Kodikulam	12.13	5.42	1.03
Kavithakudi	11.12	3.25	0.74
Kumukottai	4.19	3.58	0.93
Thievendranallur	4.31	2.99	0.89
Manjakollai	0.84	2.56	0.56
Karudhanendhal	11.12	2.73	0.58
Veeravenur	26.10	17.53	3.45
Vairavenandhal	-	-	-
Kamankottai	19.75	9.95	3.48
Mennendhinagachi	17.22	23.50	7.32
Urathur	12.36	6.38	4.47
Ariyakudipudhur	19.41	25.63	13.06
Keelambal	17.22	8.36	9.10
Muthuvayal	17.83	-	2.61
K.vasalai	26.37	5.31	2.02
Pottithatti	15.20	-	0.51
Pandikanmai	7.67	-	2.07
T.Karungulam	5.10	0.00	1.55

ANNEXURE 5.3

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

Gram Panchayat	Aff		ARS	AVP		Az	BP		CBP		CS
	No.	Area	No.	No.	Length	No.	Plants	Area	No.	Length	No.
Ariyakudipudur	3,275	4	7	2,214	8,854	2	136,279	172	-	-	2
Bogalur	2,642	3	61	2,168	8,672	4	112,934	141	338	1,350	4
Ettivayal	21,102	26	68	2,168	8,672	1	50,939	64	1,538	6,150	1
K.Vasalai	4,784	6	-	1,253	5,013	2	24,281	30	840	3,358	2
Kamankottai	4,557	6	7	543	2,172	6	45,703	57	2,635	10,538	6
Karuthanendhal	2,171	3	6	336	1,342	1	16,524	21	-	-	1
Kavithakudi	738	1	4	947	3,787	3	19,020	24	-	-	3
Keelambal	3,089	4	6	1,564	6,254	2	58,895	74	-	-	2
Kodikulam	1,019	1	99	491	1,964	3	26,268	33	-	-	3
Kumukottai	10,373	13	82	1,079	4,314	1	18,292	23	-	-	1
Manjakollai	2,086	3	35	179	714	1	15,878	20	-	-	1
Manjur	28,516	36	26	2,168	8,672	3	41,854	52	417	1,666	3
Mennendhinagachi	2,384	3	4	439	1,754	2	98,403	125	1,383	5,532	2
Mudalur	2,222	3	39	2,168	8,672	9	-	-	1,125	4,500	9
Muthuvayal	2,505	3	3	832	3,329	1	252	1	2,407	9,628	1
Pandikanmai	589	1	-	315	1,260	1	11	0	250	1,001	1
Pottithatti	64,241	80	1	384	1,534	3	235	0	423	1,691	3
Semanur	1,213	2	47	2,168	8,672	1	29,900	37	1,631	6,525	1
Sevvur	1,371	2	47	2,168	8,672	3	19,543	24	550	2,200	3
Seyyalur	5,173	6	37	2,168	8,672	1	58,038	73	713	2,850	1
T.Karungulam	442	1	-	804	3,217	1	8	0	-	-	1
Theeyanur	7,790	10	95	2,168	8,672	1	-	-	489	1,955	1
Thievendranallur	9,966	12	77	381	1,525	1	17,578	22	-	-	1
Urathur	957	1	2	1,116	4,462	2	44,438	57	1,084	4,334	2
Vairavanendhal	716	1	84	482	1,929	3	50,633	63	-	-	3
Veeravanur	1,074	1	348	396	1,584	3	75,949	95	-	-	3

Gram Panchayat	CT	Co		FP	CCBF		DLT		DLHAI		FBBTI	
	No.	No.	Area	No.	No.	Area	Plants	Length	No.	Area	No.	Area
Ariyakudipudur	2	35	112	35	819	4	922	3,689	22	56	45	112
Bogalur	4	10	33	10	660	3	1,838	7,352	7	17	13	33
Ettivayal	1	9	45	9	5,276	26	785	3,139	9	23	18	45
K.Vasalai	2	6	17	6	1,196	6	941	3,765	3	9	7	17
Kamankottai	6	7	30	7	1,139	6	447	1,789	6	15	12	30
Karuthanendhal	1	2	5	2	543	3	-	-	1	2	2	5
Kavithakudi	3	2	6	2	184	1	438	1,752	1	3	3	6
Keelambal	2	22	78	22	772	4	-	-	16	39	31	78
Kodikulam	3	2	9	2	255	1	158	631	2	4	4	9
Kumukottai	1	2	8	2	2,593	13	-	-	2	4	3	8
Manjakollai	1	2	5	2	522	3	-	-	1	2	2	5
Manjur	3	7	21	7	7,129	36	615	2,458	4	10	8	21
Mennendhinagachi	2	19	63	19	596	3	939	3,757	13	31	25	63
Mudalur	9	25	70	25	556	3	1,036	4,143	14	35	28	70
Muthuvayal	1	7	22	7	626	3	-	-	4	11	9	22
Pandikanmai	1	6	18	6	147	1	-	-	4	9	7	18
Pottithatti	3	1	4	1	16,060	80	267	1,067	1	2	2	4
Semanur	1	11	40	11	303	2	-	-	8	20	16	40
Sevvur	3	10	36	10	343	2	663	2,653	7	18	15	36
Seyyalur	1	3	12	3	1,293	6	299	1,197	2	6	5	12
T.Karungulam	1	5	13	5	111	1	-	-	3	7	5	13
Theeyanur	1	7	26	7	1,947	10	663	2,653	5	13	11	26
Thievendranallur	1	2	8	2	2,492	12	-	-	2	4	3	8
Urathur	2	11	38	11	239	1	133	530	8	19	15	38
Vairavanendhal	3	6	20	6	179	1	-	-	4	10	8	20
Veeravanur	3	9	30	9	268	1	113	453	6	15	12	30

Gram Panchayat	FD	GSS	ICP		LDI		LP		MI		NADEP
	No.	No.	Plants	Length	No.	Area	Plants	Length	No.	Area	No.
Ariyakudipudur	2	25	-	-	17	44	503	2,012	10	25	2
Bogalur	4	196	357	1,426	5	13	399	1,597	3	8	4
Ettivayal	1	55	50	200	5	12	404	1,615	9	22	1
K.Vasalai	2	102	102	406	3	7	945	3,778	1	3	2
Kamankottai	6	7	788	3,151	4	9	515	2,060	5	12	6
Karuthanendhal	1	2	-	-	1	2	12	49	-	1	1
Kavithakudi	3	7	-	-	1	2	333	1,330	1	2	3
Keelambal	2	16	-	-	11	28	488	1,952	9	23	2
Kodikulam	3	7	-	-	1	3	371	1,483	1	3	3
Kumukottai	1	11	-	-	1	3	19	77	1	2	1
Manjakollai	1	2	-	-	1	2	-	-	-	1	1
Manjur	3	41	445	1,780	3	8	329	1,315	2	4	3
Mennendhinagachi	2	7	251	1,002	9	23	490	1,961	6	16	2
Mudalur	9	62	2,375	9,500	12	31	31	124	3	8	9
Muthuvayal	1	8	189	754	3	8	502	2,009	2	6	1
Pandikanmai	1	38	302	1,206	3	8	204	815	1	2	1
Pottithatti	3	17	-	-	1	2	302	1,210	-	1	3
Semanur	1	79	1,525	6,099	6	14	407	1,630	5	12	1
Sevvur	3	94	406	1,625	5	13	357	1,429	4	11	3
Seyyalur	1	32	-	-	2	4	37	148	1	4	1
T.Karungulam	1	28	114	457	2	6	408	1,630	1	1	1
Theeyanur	1	30	406	1,625	3	8	498	1,994	4	9	1
Thievendranallur	1	11	-	-	1	3	26	103	1	2	1
Urathur	2	7	921	3,682	6	14	472	1,889	4	10	2
Vairavanendhal	3	5	-	-	3	8	356	1,423	2	4	3
Veeravanur	3	5	-	-	5	12	318	1,271	2	6	3

Gram Panchayat	ND		PS	RPWDT	Roo	RP	RRWH	SPD		SPC	SPI	WCICD
	Plants	HH	No.	No.	No.	No.	No.	No.	Area	No.	No.	Length
Ariyakudipudur	3,635	727	6	5	13		2	1,360	2	7	73	-
Bogalur	5,875	1,175	54	2	6	-	2	2,720	3	12	118	1,426
Ettivayal	2,360	472	10	5	13	-	2	680	1	5	47	200
K.Vasalai	2,765	553	19	3	6	-	2	-	-	6	55	406
Kamankottai	3,280	656	3	2	15	-	2	-	-	7	66	3,151
Karuthanendhal	1,795	359	1	2	3		`	347	0	4	36	-
Kavithakudi	1,550	310	2	3	5	-	2	286	0	3	31	-
Keelambal	2,575	515	5	4	7	-	2	680	1	5	52	-
Kodikulam	1,620	324	2	1	6	-	2	394	0	3	32	-
Kumukottai	2,680	536	4	2	6	-	2	347	0	5	54	-
Manjakollai	1,795	359	1				2	333	0	4	36	-
Manjur	3,015	603	15	4	14	-	2	1,360	2	6	60	1,780
Mennendhinagachi	3,010	602	9	3	10	-	2	1,360	2	6	60	1,002
Mudalur	2,125	425	35	-	5	-	2	-	-	4	43	9,500
Muthuvayal	2,470	494	3	4	11	-	2	680	1	5	49	754
Pandikanmai	3,485	697	3	4	5	-	2	-	-	7	70	1,206
Pottithatti	6,705	1,341	3	1	10	-	2	-	-	13	134	-
Semanur	1,510	302	15	3	9	-	2	680	1	3	30	6,099
Sevvur	2,380	476	7	3	7	-	2	-	-	5	48	1,625
Seyyalur	570	114	1	-	6	-	2	1,360	2	1	11	-
T.Karungulam	3,485	697	2	2	6	-	2	-	-	7	70	457
Theeyanur	1,185	237	11	4	8	-	2	-	-	2	24	1,625
Thievendranallur	2,680	536	4	-	5	-	2	333	0	5	54	-
Urathur	1,340	268	4	3	6	-	2	1,360	2	3	27	3,682
Vairavanendhal	3,570	714	1	2	6		2			7	71	-
Veeravanur	3,570	714	1	2	8		2			7	71	-

ANNEXURE 7.1

GP WISE WASCA RECOMMENDATION AND WORKS UPLOADED

S. No	GP	WASCA Recommendation for 3 Years	WASCA Uploaded for FY-2021-22 as on 01-03-2022
1	A.Puthur		
2	Bogalur	2,541	427
3	Deivendranallur	1,181	203
4	Ettivayal	841	386
5	Kamankottai	1,786	238
6	Karuthanenthal	659	177
7	Kavithaikudi	572	125
8	Keelampal	899	138
9	Kumukkottai	909	228
10	K.Valasai	1,411	234
11	Manjakkollai	467	46
12	Manjur	1,221	176
13	Mennanthi Nagachi	860	42
14	Muthalur	1,524	157
15	Muthuvayal	1,015	185
16	Pandikanmai	1,051	16
17	Pottithatti	1,524	6
18	Semanur	715	136
19	Sevvur	1,207	312
20	Sheiyalur	343	106
21	S.Kodikulam	704	208
22	Theeyanur	1,044	134
23	T.Karungulam	1,394	64
24	Urathur	714	180
25	Vairavanendal	1,768	434
26	Veeravanur	1,907	298

ANNEXURE 7.2

GP WISE ONGOING WORKS IN BOGALUR BLOCK

GP	Work Category	No of ongoin works
A.Puthur	Water Conservation and Water Harvesting	3
	Works on Individuals Land (Category IV)	3
Bogalur	Anganwadi/Other Rural Infrastructure	1
	Water Conservation and Water Harvesting	3
Deivendranallur	Anganwadi/Other Rural Infrastructure	1
	Water Conservation and Water Harvesting	1
Ettivayal	Water Conservation and Water Harvesting	1
K.Valasai	Drought Proofing	1
	Water Conservation and Water Harvesting	2
Kamankottai	Water Conservation and Water Harvesting	2
Karuthanenthal	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	1
Kavithaikudi	Water Conservation and Water Harvesting	2
Keelampal	Water Conservation and Water Harvesting	2
Kummukottai	Water Conservation and Water Harvesting	2
Manjakollai B/B	Rural Connectivity	1
Manjur	Water Conservation and Water Harvesting	2
Mennanthi Nagachi	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	2
Muthalur	Water Conservation and Water Harvesting	2
Muthuvayal	Drought Proofing	2
Pandikanmai	Water Conservation and Water Harvesting	1
Pottithatti	Water Conservation and Water Harvesting	2
S. Kodikulam	Water Conservation and Water Harvesting	2
Semanur	Water Conservation and Water Harvesting	2
Sevvur	Water Conservation and Water Harvesting	1
Sheiyalur	Water Conservation and Water Harvesting	1
T. Karungulam	Drought Proofing	1
	Water Conservation and Water Harvesting	1
Theeyanur	Water Conservation and Water Harvesting	1
Urathur	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	2
Vairavanendal	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	7
Veeravanur	Water Conservation and Water Harvesting	2

ANNEXURE 8

CWRM KEY INDICATORS FOR GPs IN BOGALUR MICRO-WATERSHED

CWRM Parameter	Ettivayal	Bogalur
Soil Resources: Status of Available Nitrogen (%)		
Very Low	26.02	72.30
Low	70.73	27.70
Medium	2.44	0.00
High	0.81	0.00
Status of Organic Carbon (%)		
Very Low	0.00	23.65
Low	0.00	72.97
Medium	0.81	3.38
Very High	99.19	0.00
Status of Soil Micro Nutrients (%)		
Sufficient	75.88	79.28
Deficient	24.12	20.72
Status of Physical condition of the soil (%)		
Highly Acidic	0.00	0.68
Moderately Acidic	0.00	0.68
Slighly Acidic	0.00	2.03
Moderately Alkaline	100.00	75.68
Strongly Alkaline	0.00	20.95
Soil Texture (%)		
Fine Soil	94.00	94.00
Soil Water Permeability (Low, Moderate, high)	Moderate	Moderate
Soil moisture and ET		
Volumetric Soil Moisture (%)	17.00	17.00
Estimated Soil Moisture (ha.m)	578.19	994.27
ET Losses (ha.m)	201.52	226.46
Means of Water Extraction (%)		
Gravity	53.00	44.00
Lifting	47.00	56.00
Irrigation Methods (%)		
Wild Flooding	69.91	76.21
Control Flooding	30.09	23.79
Livestock (No.)		
Cattle Population	59	142
Sheep Population	495	4,502
Goat Population	427	834
Poultry	385	2,170
Land Resources (ha)		
Non-Agricultural Uses	267.15	194.01
Area under Barren & Un-cultivable Land	0.00	0.00
Area under Permanent Pastures and Other Grazing Land	1.00	4.00
Land Under Miscellaneous Tree Criticalops etc.	72.31	160.00
Cultivable Waste Land	1.60	2.08

CWRM Parameter	Ettivayal	Bogalur
Fallows Land other than Current Fallows	80.35	270.08
Current Fallow land	110.13	288.28
Unirrigated Land	69.23	71.29
Area Irrigated by Source	243.57	198.54

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