



Draft
Program Manual
for
Centre of Excellence on Watershed Management
Under REWARD Program

December, 2022

Special Officer
Centre of Excellence on Watershed Management
University of Agricultural Sciences, Bangalore

Abbreviations

ADA	: Assistant Director of Agriculture
AO	: Agricultural Officer
CEO	: Chief Executive Officer
CoE	: Centre of Excellence
DATC	: District Agriculture Training Centre
DC	: Deputy Commissioner
DDA	: Deputy Director of Agriculture
DL	: Digital Library
DoA	: Department of Agriculture
DOAH	: Department of Animal Husbandry
DoF	: Department of Fisheries
DoH	: Department of Horticulture
DoLR	: Department of Land Resources
DoS	: Department of Sericulture
DPR	: Detailed Project Report
DSS	: Decision Support System
FNGO	: Field Level Non-Government Organization
GIS	: Geographic Information System
GKVK	: Gandhi Krishi Vignana Kendra
GoI	: Government of India
GoK	: Government of Karnataka
GPS	: Global Position System
iOS	: iPhone Operating System
ICRISAT	: International Crops Research Institute for the Semi-Arid Tropics
ICT	: Information Communication Technology
JDA	: Joint Director of Agriculture
KRSRAC	: Karnataka State Remote Sensing Application Centre
LRI	: Land Resource Inventory
MIS	: Management Information Systems
M&E	: Monitoring and Evaluation

NBSS&LUP	: National Bureau of Soil Survey and Land Use Planning
NGO	: Non-Governmental Organization
NLNA	: National Level Nodal Agency
NRAA	: National Rainfed Area Authority
NRM	: Natural Resource Management
ORP	: Operational Research Project
PEC	: Project Empowered Committee
PIA	: Project Implementation Agency
PMKSY	: Prime Minister Krishi Sinchayee Yojana
RDPR	: Rural Development and Panchayat Raj
REWARD	: Rejuvenating of Watersheds for Agricultural Resilience through Innovative Development
RS	: Remote Sensing
SAUs	: State Agricultural Universities
SC & WD	: Soil Conservation and Watershed Development
SIRD	: State Institute for Rural Development
SLNA	: State Level Nodal Agency
SO	: Special Officer
ToR	: Terms of Reference
UAS	: University of Agricultural Sciences
UHS	: University of Horticultural Science
WB	: World Bank
WC	: Watershed Committee
WDD	: Watershed Development Department
WM	: Watershed Management

Contents

<i>Sl. No.</i>	<i>Particulars</i>	<i>Page</i>
1	Introduction	1
2	Emergence of REWARD program	1
3	Centre of Excellence on Watershed Management	2
3.1	Vision and Mission	2
3.2	Major Responsibilities of CoE-WM	3
3.3	Organizational Setup	3
3.4	Manpower for CoE on WM	4
3.5	Committees to monitor the activities of CoE-WM	4
3.6	Major Activities of CoE-WM	5
4	Description of Activities of CoE-WM	5
4.1	To Support the mainstreaming of LRI approach for watershed management in the country	5
4.2	Refinement of LRI methodology	6
4.3	Refinement of the Decision Support Systems developed and Development of new Decision Support System	7
4.4	Development of Mobile applications	8
4.5	Developing guidelines/protocols/manuals needed for selection and establishment of Bench-Mark sites and impact evaluation (M&E)	9
4.6	Development of teaching aids and e-products for dissemination of LRI information and advisories:	10
4.7	Imparting Training on LRI, DSS, DL/Portal and other applications	11
4.8	Participate in Knowledge exchange program:	13
4.9	Review of the best practices in watershed management to provide inputs for improving watershed guidelines:	14
4.10	Facilitate the identification of emerging areas/issues and pilot studies related to watershed management	14
4.11	Connecting science and community needs in watershed management for post project sustainability	15
5	Activity Wise Timeline for Completion	16
6	Month wise Abstract of Activities	26
7	Annexure-1 In-house Coordinators nominated for Centre of Excellence on Watershed Management	32
8	Annexure-2 Composition of Technical and Executive Committee	33

Introduction

Out of the total geographic area of 328.73 m.ha, more than 30 per cent is affected by various forms of land degradation and out of this, rainfed areas account for more than 85 percent of degraded lands in the country, mostly occurring in Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Odisha and Rajasthan. Since these rainfed areas contribute significantly to agricultural output (producing 44 percent of country's food grains, 80 percent of the pulses, 73 percent of oilseeds and 66 percent of livestock), conservation and sustainability of their natural capital becomes critical to ensure food security in the country. Karnataka has total 19.05 million ha. geographical area of which 12.97 million ha is the treatable area and in this 6.85 million ha area is already treated and 0.89 million ha is being treated under various watershed programs. Thus about 5.23 million ha (52.31 lakh ha) rainfed watershed area is yet to be treated on watershed approach.

Over the years, Integrated Watershed Management has emerged as an appropriate option to reduce the severity of land degradation in the rainfed areas and to improve the productivity on a sustainable basis. Accordingly, various watershed development programs have been designed and implemented in the past with huge financial outlay.

The experience of World Bank supported Sujala-3 Project in Karnataka has proved the importance of location specific recommendations based on site-specific land resource information and advisories. Land Resource Inventory (LRI) approach provides not only site-specific land resource information, but also thematic maps, advisories and tools (Digital Library, Portal, DSS & Mobile Apps) needed for the preparation of Detailed Project Report (DPR) and for implementation and monitoring of Watershed and other line department programs in the State and as well as in the Country.

Emergence of REWARD Program

To upscale the above approach in order to generate farm level land resource information, and to develop decision support systems, advisories and ICT tools needed for taking up science based watershed planning and development in the country, the World Bank has come forward to support the program for Rejuvenating Watersheds for Agricultural Resilience through Innovative Development (REWARD) program in Karnataka and Odisha. The REWARD program will be implemented in 21rainfed districts of Karnataka with a budget of Rs.600 crores. The budget will be co-shared by the World Bank and Government of Karnataka (GoK) in the ratio of 70:30 and the program will be implemented by Watershed Development Department (WDD), Government of Karnataka. Area selected for the program implementation across 21Districts is about 19.41 lakh hectares to carry out LRI work. Implementation of watershed development on saturation mode based on LRI recommendations in 20 sub-watersheds covering about 1.0 lakh ha. Out of 20 SWS, 11sub-watersheds in Sujala-3 project districts using available LRI data under Sujala-3 project and 9 sub-watersheds in new districts of REWARD program.The Program Development Objective (PDO) of REWARD is "to strengthen capacities of National and State Institutions to adopt

improved watershed management for increasing farmers' resilience and support value chains in selected watersheds of participating state”.

Karnataka Watershed Development Department is considered as a Lighthouse partner for the program to provide technical support to Odisha to implement watershed program using scientific approaches and also to sensitize and train the other States personnel on this novel approach to implement watershed development activities using LRI approach in about 10.00 per cent of area allocated under PMKSY 2.0.

Establishment of Centre of Excellence on Watershed Management

The University of Agricultural Sciences, Bangalore, has significantly contributed for the development watershed management practices based on the outcome of Dryland Agriculture Project and Operational Research Projects (ORPs) on watershed development implemented in Rajanukunte, Kabbalnala, Mittemari and Kalyankere–Mavathurkere watersheds, for which the University received National Productivity Council Award. Also, intensively involved in generation LRI and hydrology data in southern districts of Karnataka under Sujala-3 project.

Considering the contribution and strengths of University of Agricultural Sciences, Bangalore, the Centre of Excellence (CoE) on Watershed Management is given to the University and established at the GKVK campus during 2022 as a component of the World Bank supported REWARD program, implemented by Watershed Development Department, Government of Karnataka. The main objective of the CoE on Watershed Management is to mainstream the LRI technology and science based watershed development in the country. The CoE-WM is expected to play a key role in demonstrating the application of science based approaches in watershed development, impart training to the members of line departments of the State and beyond, develop manuals, refinement of decision support system, exchange knowledge, facilitating the development of dissemination tools and a host of other outputs needed for mainstreaming the LRI approach in the country.

The University has provided an exclusive building with a floor space of about 1500 square meters at the GKVK campus to establish the Centre of Excellence on Watershed Management as a full-fledged institute to carry out the mandated activities. The building has been refurbished to establish RS and GIS lab, excellent training hall, faculty rooms, conference and discussion rooms with all the necessary and latest facilities to function as an institute of higher order. The vision and mission of CoE-WM are as follows:

Vision: Designing and advocating science based approaches in comprehensive watershed management

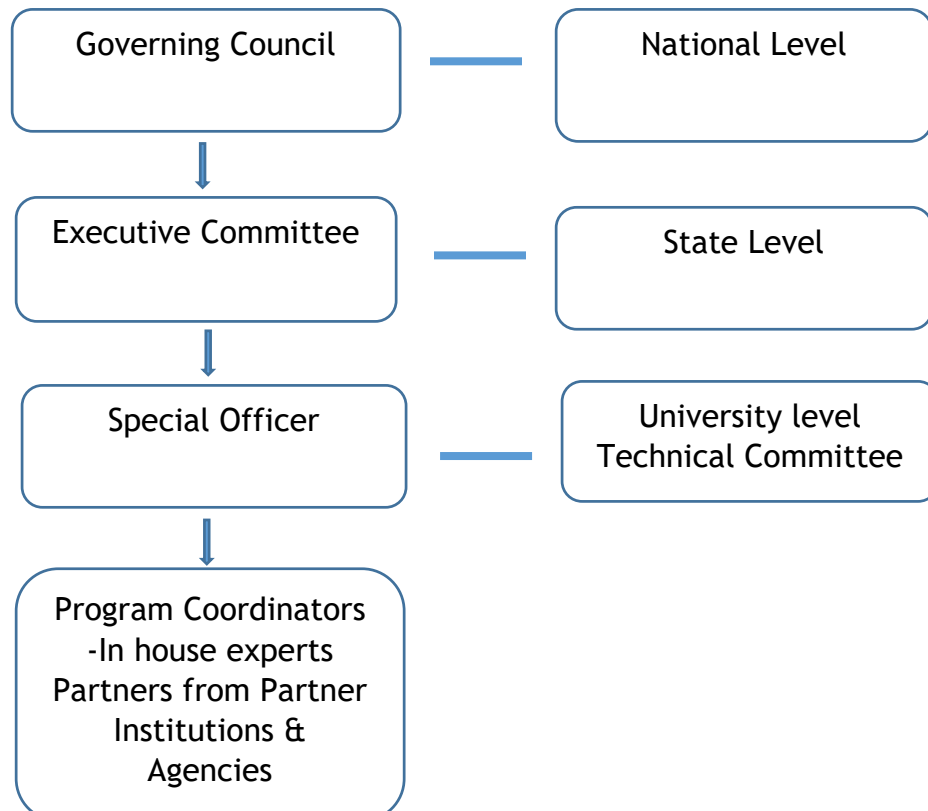
Mission: Facilitating the acquisition of advanced technical skills by the stakeholders of watershed management for agricultural resilience

Major Responsibilities of Centre of Excellence on Watershed Management

Following are the major responsibilities of CoE-WM, (a) demonstrating the application of science based approaches in watershed development, (b) impart training to the members of line departments of the State and beyond, (c) develop manuals, (d) refinement of Decision Support System, Digital Library and Portal, (e) exchange knowledge and (f) facilitating the development of dissemination tools and a host of other outputs needed for mainstreaming the LRI approach in the country. To accomplish the above responsibilities, the centre of excellence has to perform a series of tasks under four major headings (a) Training on RS & GIS, Land Resource Inventory, DSS development, DPR preparation, use of Digital Library, Portal & Mobile applications etc. (b) Development/refinement of protocols, guidelines, manuals etc. on LRI, generation of thematic maps and outputs, DSS, DPR preparation, M&E, use of DL, & Portal, (c) Validation of DSS developed, development of new DSS, Mobile applications and (d) Knowledge exchange program, identification of best practices, emerging issues & pilot studies/demonstrations

Organizational Structure of Centre of Excellence on Watershed Management

To accomplish the responsibilities and tasks assigned to the CoE-WM, following organizational structure has been suggested with the committees established at National, State and University levels to guide, review and monitor the functioning of the Centre. The required manpower is also designated for the Centre. The Organogram of the CoE-WM is given below:



Manpower for Centre of Excellence on Watershed Management

The Special Officer (SO), nominated by the University, will function as Chief Executive in planning, implementation and monitoring of assigned activities to the Centre. The SO, will attend or nominate suitable person for the meetings convened by the Watershed Development Department and GoK. The SO, will appraise to the committees and the World Bank as per the need. The Special Officer is supported by four types of staff namely (a) a team of in- house Coordinators nominated by the University who are experienced and specialized professionals in the areas of RS and GIS, LRI, soil and water conservation, hydrology, crops and crop production, nutrient management, horticulture, forestry, community participation, ICT and monitoring and evaluation, the services of these professionals will be available to CoE WM as per need, (b) experienced senior experts will be taken as consultants in the area of RS& GIS and Capacity building on contractual basis, (c) five Research Associates in the areas of RS and GIS, hydrology/ soil and water conservation, soil science and agronomy on contractual basis and (d) office maintenance and support staff up to ten persons on contractual basis. In addition to the above staff, the Special Officer, may avail the support / services of the Scientists from partner institutions and the University as per the requirement of the Centre. The list of in-house coordinators nominated by the University to serve as domain experts is given in Annexure-1.

Committees to Monitor the functioning of Centre of Excellence on Watershed Management

As Centre of Excellence on Watershed Management is envisaged as National Institute, a Governing council is proposed under the Chairmanship of Secretary DoLR, Chairman of NRAA as Vice Chairman, Chief Secretary, GoK as members and other members as proposed by Chairman.

At the state level, an Executive Committee has been constituted with Secretary to Government, Agriculture Department, GoK, as Chairperson and the Special Officer, CoE-WM as member convener. The main responsibility of the committee is to guide, monitor, facilitate convergence and review the activities of CoE-WM periodically for facilitating effective and speedy implementation of the activities by the Centre. The committee is proposed to hold meetings once in a quarter.

The University of Agricultural Sciences, Bangalore has constituted a Technical Committee with the Vice-Chancellor of the University as Chairperson and the Special Officer, CoE-WM as member convener. This committee will provide technical guidance, facilitate linkages and coordination of different units of the University with CoE-WM, review the progress and extend required support for effective implementation of assigned activities and to oversee the overall activities of the Centre. The committee will meet once in a quarter.

The composition of proposed committee is given in Annexure-2

Major Activities of Centre of Excellence on Watershed Management

Based on the objectives, responsibilities and specialized tasks as suggested in the ToR of the CoE-WM, following major activities will be carried out by the centre during five years of signing the contract in a phased manner. The list of activities and approach in carrying out these activities are described in the subsequent pages of this manual.

1. To support the mainstreaming of Land Resource Inventory (LRI) approach for watershed management in the country
2. Refinement of LRI methodology with the use of advanced tools and technologies as well as Decision Support Systems (DSS) developed
3. Refinement of Decision Support Systems and development of new DSS to meet the needs of farmers, line departments and other stakeholders
4. Development of mobile applications to reach the maximum beneficiaries in the shortest possible time on a regular basis
5. Developing guidelines/protocols/manuals needed for taking up impact evaluation (M&E)
6. Development of teaching aids and e-products for dissemination of LRI information and advisories
7. Imparting training on LRI, hydrology, DSS, Digital Library (DL)/Portal and other applications
8. Participate in knowledge exchange programs within the country and outside
9. Undertake review of the best practices in watershed management to provide inputs for improving watershed guidelines
10. Facilitate the identification of emerging areas/issues and pilot studies related to watershed management
11. To connect science and community needs in watershed management for post project sustainability

Description of Activities

For each of the assigned activity, a brief description of the activity along with approach/procedures in carrying out the activity, protocols and time frame are indicated below.

1. To Support the mainstreaming of LRI approach for watershed management in the country

The outcome of LRI and hydrology inventories and the decision support system evolved during Sujala-3 project and presently used in REWARD program in Karnataka and Odisha, for planning comprehensive watershed development, will be shared with the DoLR, Ministry of Rural Development, GoI, who are supporting all the States to implement watershed development through PMKSY 2.0 in the country as well as the State Level Nodal Agency implementing watershed development in the States. The approaches to share and to sensitize these new methodologies to the target agencies will be through print and electronic media as well as through online course. For initial stage of sensitization of the new approach, print and electronic media will be used effectively. For internalization of skills in adoption of the novel approaches, the training will be conducted in three stages for

different states (a) for project implementing agency (PIA) orientation on new approaches in watershed planning (b) for scientific partner institutes methodology in generation and interpretation of scientific data through LRI and hydrology inventories and (c) for PIA on preparation of tabletop / smart DPR integrating the LRI and Hydrology outputs with decision criteria by developing decision support system. Need based technical support will be provided while implementing the new approaches. An exclusive website of CoE on watershed management will provide updates on new developments, training schedule, manuals and other publications. Approach and time frame will be as follows:

#	<i>Approach</i>	<i>Time frame</i>
1.	Website on CoE-WM	January 2023
2.	Orientation training to technical experts of non-REWARD States	January 2023
3.	Supply of soft copy of the manuals on RS and GIS, LRI, Hydrology, DSS to DoLR and all SLNAs	February 2023
4.	Training to Scientists of partner institutes on methodologies in LRI and hydrology studies	To be decided in consultation with DoLR (may be from March 2023 onwards)
5.	Training to PIA of non-REWARD States on smart DPR preparation using LRI, Hydrology and DSS	To be decided in consultation with DoLR (may be from November, 2023 onwards)
6.	Online interactive teaching through programmed instruction on importance of LRI and hydrology in watershed planning for decision makers	May, 2023

2. Refinement of LRI methodology:

There is a scope for refinement of LRI to fast track the process of capturing the required data through use of advanced tools and technologies like fast changing approaches in remote sensing, GIS, GPS, drones, artificial intelligence, cloud sourcing etc. to meet the demand to treat larger area under watershed in the country. This will be attempted in consultation with relevant institutions within and outside the country. Also, the quality assurance system to be evolved to ensure precise data is available to the public and to plan activities to address real problem. If there are mistakes in capturing and interpreting the data, the whole purpose of scientific planning is defeated. Further, the data will be stored in the portal and accessed by the public. If some mistakes or erroneous data are noticed in the uploaded data, will call for criticism and the credibility will be questioned. This task can be accomplished by a team of experts in the domain areas by studying the existing approaches/ protocols and methodology followed in generation and interpretation of output. Also, the same team can provide a system/ mechanism for assuring the quality of inventories and output. In this regard, the CoE- WM will technically assist Watershed

Development Department, GoK, in identification of a competent technical committee with suitable terms of reference for the committee. Approach and time frame are given below:

#	<i>Approach</i>	<i>Time frame</i>
1.	Facilitation in identifying a technical committee by WDD, prepare ToR for the committee	May, 2023
2.	Technical committee output on quality assurance system	January, 2024
3.	Technical committee output on refinements in the LRI and hydrology approaches to improve the quality and to save time	April, 2024
4.	Preparation of manuals on refined approaches by CoE- WM	May, 2024
5.	Training on refined LRI and hydrology approaches to the scientific partner institutes by CoE- WM	May, 2024 onwards

3. Refinement of the Decision Support Systems developed and Development of new Decision Support System

Under Sujala-3 project, nine DSS are developed and used for the preparation soil and water conservation plan, land capability, crop plan, nutrient management plan, runoff estimation, soil moisture, crop water requirement, water balance and water budget. Though these DSS were tested to some extent, still there is a need to cross check for their applicability in the field situations and to get feedback from domain experts and field functionaries. The Centre will attempt to refine, improve, or modify the DSSs developed by studying existing nine DSS developed, decision criteria tables, flow charts and algorithms, design criteria of various conservation structures and to develop DSS for additional areas. After through testing and feedback from the users, share the same with other participating States in a ready to use framework. This is a dynamic activity throughout the project cycle and beyond.

Taking advantage of availability of huge repository of LRI and hydrology information from REWARD program, the CoE will facilitate to develop appropriate DSS for their mainstreaming in the watershed areas and provide necessary support to develop new models/algorithms, and DSS by involving domain experts, technology institutions, policy makers and based on a multi stakeholder need assessment exercise. Some of the new areas to be considered for the development are (a) identifying methods and models for estimation and monitoring of evapotranspiration, runoff, soil moisture, ground water recharge at different scales and develop appropriate DSS for their mainstreaming in the watershed areas, (b) DSS for the preparation of DPR for flagship programs of Department of Agriculture, Department of Horticulture, Department of Sericulture, Animal Husbandry, Irrigation, Rural Development, and other line departments, (c) suitability criteria development and assessment for crops/varieties/other land uses not done earlier, (d) convergence of all programs at watershed level, (e) pest management, (f) water balance and water budget at village/MWS and other levels, (g) value chain management and logistical support, and (h) other areas as per the need of line departments. This task to be

entrusted to an expert team/ committee in addition to the scientific staff of CoE-WM and consortium partner institutions. In this regard, the CoE- WM will technically assist Watershed Development Department, GoK, in identification of a competent technical team including scientists from consortium partner institutes with suitable terms of reference for the committee. Approach and time frame for achieving the activity are as follows:

#	<i>Approach</i>	<i>Time frame</i>
1.	Facilitation in identifying a technical committee by WDD, prepare ToR for the committee	May, 2023
2.	Provide technical support to WDD for calling tenders/ to identify competent agency to refine/ develop DSS	May, 2023
3.	Refinements in nine DSS already developed under Sujala-3 project	November, 2023
4.	Preparation of DSS for additional areas	From March, 2024 onwards

4. Development of Mobile applications

Mobile applications offer huge potential to reach the maximum number of beneficiaries spread over geographically in the shortest possible time. Some efforts were made under Sujala-3 project to take LRI advisories to different stakeholders but, still there is a huge scope to develop wide range of mobile applications in android and iOS versions to access advisories not only on LRI, but also on crop, pest, weather, market, government policies and programmes, subsidies, facilities available in different sectors etc. The CoE on WM will facilitate to develop mobile application as per the emerging needs. Approach and time frame to complete task are given below:

#	<i>Approach</i>	<i>Time frame</i>
1.	Facilitation to WDD to identify a technical committee. Preparation of ToR for the committee	March, 2023
2.	Technical support to the identified committee for developing mobile applications along with consortia partner institute scientists	November, 2023 onwards or after identifying the agency

5. Developing guidelines/protocols/manuals needed for selection and establishment of Bench-Mark sites and impact evaluation (M&E)

The CoE on watershed management will organize consultations among watershed departments, project partners, M&E specialists and others to evolve a suitable design, sample size, selection of watersheds and benchmark sites, instrumentations needed, mode of data collection (ground, sensor and RS based), indicators to be used and protocols and guidelines to be followed in carrying out M&E in control and treatment areas and before and after situations to assess the impact of the interventions carried out by the departments. Further, CoE will support to develop a state of art MIS system by linking with the repository of LRI data available in the DL and Portal. The Centre will act as a platform to the flow of information on real time basis to the Portal. The approach and time frame to accomplish the task are as follows:

<i>#</i>	<i>Approach</i>	<i>Time frame</i>
1.	Organizing a workshop involving consortium partners, domain experts / technical experts and Officers of WDD to develop protocols, indicators and procedures in assessment, needed equipment, time line for assessments, responsible institutions etc. for selection and establishment of bench mark sites/ impact evaluation	March, 2023
2.	Preparing of manual indicating protocols, indicators, quantification techniques etc.	April, 2023
3.	Technical support to PIA to prepare a detailed plan to develop micro-watersheds selected for intensive monitoring as per LRI approach	April, 2023
4.	Training / Workshop for the PIA staff involved in implementation of watershed development activities as per LRI approach	April, 2023
5.	Identification of bench mark sites for comparison with the developed micro-watersheds based on LRI approach	May, 2023
6.	Technical support to the consortia partners/ concerned staff to assess the changes as per the identified indicators	Throughout the implementing period
7.	Presentation of indicator wise assessments in a workshop to finalize the impact of LRI approach versus conventional approach and finalizing the indicators for monitoring and evaluation of watershed developed	Two months after the phasing out from the developed watershed

6. Development of teaching aids and e-products for dissemination of LRI information and advisories:

With the support of project partners and by using the state of art ICT platform available (Digital Library, Portal, DSS & Mobile Apps) videos, audio-visuals, manuals, brochures, leaflets, guides, display boards, e-books and other online learning aids, and other dissemination products will be generated for imparting training to the stakeholders of REWARD program and also will be delivered through multimedia/social media and other communication channels on regular basis for wider dissemination. The repository of LRI information available from the Portal to be linked with various Remote Sensing products, weather, crop, and hydrological advisories on real time basis to generate various visualization products that can aid in the effective delivery of classroom lectures, online learning, webinars and exchange programs. The approach and time frame are given below:

#	<i>Approach</i>	<i>Time frame</i>
1.	Brochures on Centre of Excellence on Watershed management describing the activities of the centre	March, 2023
2.	Leaflets/ folders on LRI and hydrology approaches in scientific planning of watershed development	March, 2023
3.	Preparation of manual on LRI and hydrology inventories. For the use by scientific partners of non-REWARD States	June,2023
4.	Preparation of manual on smart/ table top DPR preparation by integrating LRI and hydrology outputs with DSS for the implementing agencies of both REWARD and non-REWARD States	August, 2023
5.	Preparation of manual on the refined areas of LRI methodology for its use by scientific partners of both REWARD and non-REWARD States	After the refinement
6.	Preparation of manual on the refined DSS for the benefit of the implementing agencies of both REWARD and non-REWARD States	After the refinement
7.	Preparation of manual on selection and monitoring of benchmark sites and impact evaluation process	April, 2023
8.	Audio- visual aids on different thematic areas for understanding and implementation of LRI and hydrology based watershed management	Periodically from November, 2023
9.	Publishing the best practices adopted in development of watersheds in various parts of the country in both print and electronic formats	Annually from April, 2024
10.	e-books on all the thematic areas of scientific watershed management	Periodically from January 2024

7. Imparting Training on LRI, DSS, DL/Portal and other applications:

The CoE on WM will organize training programmes on LRI, hydrology, digital library, portal, decision support system, mobile applications, DPR preparation etc. to a wide range of participants. It is one of the most effective methods to reach large number of persons. Therefore, training is conceived as a specialized education, which is skill oriented. The concern here is to enhance the ability of an individual to accomplish a set of tasks. This requires the knowledge and skills to perform the tasks, and acceptable standards at which the tasks are performed. Thus, training begins with a set of pre-determined tasks and proceeds to design an educational process, which ensures that the individual acquire the needed competence in terms of knowledge, skills, attitudes and standards. The emphasis is on providing the educational opportunities, which result in the acquisition of new or upgraded abilities in performing the tasks.

Since CoE on WM deal with adults, the training approach will be participatory in nature and involve direct participation of the participants and creates an atmosphere for sharing experience. It involves adults practicing new skills and applying new knowledge and attitudes during activities. Thus, systematic approach in imparting training will be followed. The centre will frame, schedule and conduct certified training programs on LRI methodology, use of remote sensing, GIS, GPS and other technologies for field mapping and data collection, development of decision support systems, preparation of DPR for various schemes, development and maintenance of DL and Portal, monitoring and impact evaluation, social and environmental impact assessment etc. Further, the Centre will facilitate the preparation of training materials, video, and audio visuals, and establish ICT platform for the effective delivery of the training and e-learning programs. The training calendar is given below.

Sl. No	Theme	Participants		Duration (Days)	No. of Training programs	Tentative time
		Category	Number			
REWARD Program implementing State-Karnataka						
1	An overview of REWARD program and scientific approaches in watershed management and agricultural productivity enhancement	PEC members	30	1	2	June-2023
2	Emerging approaches in generation of LRI, hydrology, socio-economic survey data and other inputs and their effective integration for development of DSS	Scientific partners	30	3	4	March-2023

REWARD Program implementing Districts						
3	Effective use of scientific data in watershed management and convergence of programmes of development departments	DCs & CEOs	40	1	1	March, 2023
4	Application of scientific data in preparation of DPR on watershed management	JDA's	40	2	2	February, 2023
5	Application of scientific data in preparation of DPR on watershed management	DDAs	60	2	3	February, 2023
6	Application of scientific data in preparation of comprehensive watershed management plan	ADAs	30	3	3	February, 2023
7	Effective use of scientific data in planning and implementation of line departments programs and their convergence with watershed management	District level line department officers DoA, DoH, DoAH, DoF, DoS, RDPR,	100	2	2	March, 2023
8	Effective use of scientific data in planning and implementation of line departments programs and their convergence with watershed management	Master Trainers (FNGO, DATC, SIRD)	60	3	3	Dec-2023 Dec-2024
Non REWARD Program implementing Districts						
9	Application of scientific data in preparation of DPR on watershed management	JDA & DDA	30	2	1	November, 2023
10	Application of scientific data in preparation of comprehensive watershed management plan	ADA/AO	250	2	12	June-2023/24 July-2023/24 Aug-2023/24 Sept-2023/24
11	Effective use of scientific data in planning and implementation of line departments programs and their convergence with watershed management	Line Departments Officers	200	2	2	July-2023/24 Sept-2023/24

REWARD Program implementing State- Odisha						
12	Emerging approaches in generation of LRI, hydrology, socio-economic survey data and other inputs and their effective integration for development of DSS	Scientific officers	30	2	1	August, 2023
13	Effective use of scientific data for DPR preparation for watersheds	Scientific partners and Officers of SC & WD	20	2	2	December, 2022
Non REWARD States as per the requirement of DoLR						
14	Orientation training on LRI	Technical experts of WSD in non-REWARD states	60	5	2	January, 2023
15	Training to Scientists of partner institutes on methodologies in LRI and hydrology studies	Scientists of partner institutes of non-REWARD States	60	5	2	As indicated by DoLR
16	Training to PIA of non-REWARD States on smart DPR preparation using LRI, Hydrology and DSS	PIA staff of non-REWARD States	60	5	2	As indicated by DoLR

8. Participate in Knowledge exchange program:

As part of knowledge exchange programme, CoE WM will organize three broad types of activities namely (a) need based on-line interaction sessions with scientific partner institutes and SLNA/ PIA across the country for integration of science based approaches in planning and implementation of watershed interventions, (b) organizing national and international workshops/ seminars for sharing the innovative approaches followed in generation data through RS and GIS, LRI and hydrology inventories, DSS, implantation approaches etc. for consolidation, documentation and refinement of existing approaches and sharing with all the concerned, (c) visits to the NRM projects operated by the World Bank or other donors outside the country to the staff working in REWARD program. The approach and time frame are given below:

#	<i>Approach</i>	<i>Time frame</i>
1.	On-line interaction sessions	Once in a quarter from July,2023
2.	National workshop/ seminar	May, 2024
3.	International workshop/ seminar	June,2025
4.	Visit to outside the country in two batches	August, 2024 August, 2025

9. Review of the best practices in watershed management to provide inputs for improving watershed guidelines:

The CoE- WM with multidisciplinary team and domain expertise, will act as a think tank in improving/modifying the existing watershed guidelines or help in bringing out new generation guidelines as and when necessary based on the field experience and feedback from the operationalization of multi state REWARD project and by distilling the experiences of partners associated with similar projects in the country and elsewhere. For this, the Centre work in tandem with National Level Nodal Agency, ICRISAT and World Bank in refining/evolving new guidelines for watershed development in the country.

The approach and time frame to complete the task are given below:

#	<i>Approach</i>	<i>Time frame</i>
1.	Refinement of existing guidelines for implementation of Watershed Development after discussion in a workshop involving representatives of NLNA, ICRISAT, SLNA, World Bank and prominent NGOs etc.	December, 2026

10. Facilitate the identification of emerging areas/issues and pilot studies related to watershed management:

The Centre will facilitate to take up pilot studies related to watershed in association with project partners, research institutions, development departments, advisory bodies, and other stakeholders. Some of the areas are (a) best management practices to enhance soil organic carbon content, carbon sequestration processes and their implications on soil health and livelihood under rainfed situations, (b) dynamic contingent crop plan for climatic distress towards economic sustainability and livelihood of rainfed areas, (c) crop and land management practices for sustainable soil health, economic viability and livelihood of small holder farms, (d) LRI based fertilizer recommendation, (e) market driven production practices for livelihood enhancement of rainfed farmers,(f) rapid techniques for dynamic nutrient management and soil properties and (g) participatory ground water management. These studies will be conducted after consultation with partner institutes. The methodology will be finalized in the thematic wise workshops. The approach and time frame are given below:

#	<i>Approach</i>	<i>Time frame</i>
1.	Best management practices to enhance soil organic carbon content, carbon sequestration processes and their implications on soil health and livelihood under rainfed situations,	Continuously for 3years from July, 2023
2.	Dynamic contingent crop plan for climatic distress towards economic sustainability and livelihood of rainfed areas	Continuously for 3years from July, 2023
3.	Crop and land management practices for sustainable soil health, economic viability and livelihood of small holder farm	Continuously for 3years from July, 2023
4.	LRI based fertilizer recommendation	Continuously for 3years from July, 2023
5.	Market driven production practices for livelihood enhancement of rainfed farmers,	December, 2023
6.	Rapid techniques for dynamic nutrient management and soil properties	Continuously for 3years from July, 2023
7.	Participatory ground water management	Continuously for 3years from July, 2023

11. Connecting science and community needs in watershed management for post project sustainability.

The CoE-WM in collaboration with NGOs working in the field of watershed management will experiment and also document the best practices in sustainable watershed management through institutional approach. Organize activities in such a way that the communities realize the importance of science based approaches in sustainable development of watersheds.

#	<i>Approach</i>	<i>Time frame</i>
1.	Documentation of best practices in the micro-watersheds where LRI based watershed development approach made visible impact of sustainability	October, 2024
2.	Establishing cause and effect relationship between the identified practices and sustainable watershed management	December, 2024
3.	Production of appropriate teaching / audio-visual aids to disseminate the resultant effect of scientific approaches in sustainable watershed management	January, 2025
4.	Educating PIA, NGOs, selected community level organizations on practices leading to sustainable watershed management	March, 2025 onwards

Activity Wise Timeline for Completion

Sl. No	Activity	2022				2023				2024				2025				2026				2027			
		1 ¹	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1. To Support the mainstreaming of LRI approach for watershed management in the country																									
1.1	Website on CoE-WM					√																			
1.2	Interactive teaching/ training through Programmed Instruction on LRI for watershed management for decision makers					√																			
1.3	Supply of soft copy of the manuals on RS and GIS, LRI, Hydrology, DSS to DoLR and all SLNAs					√																			
1.4	Training to Scientists of partner institutes on methodologies in LRI and hydrology studies					T																			
1.5	Training to PIA of non-REWARD States on smart DPR preparation using LRI, Hydrology and DSS					T																			
1.6	Online interactive teaching through programmed instruction on importance of LRI and hydrology in watershed planning for decision makers						√																		

¹ 1,2,3,4 are the Quarters of a year

² To be decided in consultation with DoLR, New Delhi

2. Refinement of LRI methodology:																						
2.1	Facilitation in identifying a technical committee by WDD, prepare ToR for the committee							√														
2.2	Technical committee output on quality assurance system									√												
2.3	Technical committee output on refinements in the LRI and hydrology approaches to improve the quality and to save time										√											
2.4	Preparation of manuals on refined approaches by CoE- WM										√											
2.5	Training on refined LRI and hydrology approaches to the scientific partner institutes by CoE- WM										√											
3. Refinement of the Decision Support Systems developed and Development of new Decision Support System																						
3.1	Facilitation to WDD in identifying a technical committee to develop new DSSs and refine the existing ones. Preparation of ToR for the committee						√															
3.2	Provide technical support to WDD for calling tenders/ to identify competent agency to refine/ develop DSS						√															
3.3	Refinements in nine DSS already developed under Sujala-3 project									√												
3.4	Preparation of DSS for additional areas										√											

4. Development of Mobile applications																					
4.1	Facilitation to WDD to identify a technical committee and preparation of ToR for the committee					√															
4.2	Technical support to the identified committee for developing mobile applications along with consortia partner institute scientists							√													
5. Developing guidelines/protocols/manuals needed for selection and establishment of Bench-Mark sites and impact evaluation (M&E)																					
5.1	Identification of bench mark sites and impact evaluation-organizing workshop to develop protocols, indicators and procedures in assessment, needed equipment, time line for assessments, responsible institutions etc.					√															
5.2	Preparing of manual indicating protocols, indicators, quantification techniques etc.						√														
5.3	Technical support to PIA to prepare a detailed plan to develop micro-watersheds selected for intensive monitoring as per LRI approach						√														
5.4	Training / Workshop for the PIA staff involved in implementation of watershed development activities as per LRI approach						√														

6.4	Preparation of manual on smart/ table top DPR preparation by integrating LRI and hydrology outputs with DSS for the implementing agencies of both REWARD and non-REWARD States						√															
6.5	Preparation of manual on the refined areas of LRI methodology for its use by scientific partners of both REWARD and non-REWARD States									√	√											
6.6	Preparation of manual on the refined DSS for the benefit of the implementing agencies of both REWARD and non-REWARD States									√	√											
6.7	Preparation of manual on selection and monitoring of benchmark sites and impact evaluation process						√															
6.8	Audio- visual aids on different thematic areas for understanding and implementation of LRI and hydrology based watershed management							√		√		√		√		√		√		√		√
6.9	Publishing the best practices adopted in development of watersheds in various parts of the country in both print and electronic media									√			√			√				√		

6.10	e-books on all the thematic areas of scientific watershed management									√			√				√			√			√													
7. Imparting Training on LRI, DSS, DL/Portal and other applications																																				
REWARD Program implementing State-Karnataka																																				
7.1	An overview of REWARD program and scientific approaches in watershed management and agricultural productivity enhancement									√																										
7.2	Emerging approaches in generation of LRI, hydrology, socio-economic survey data and other inputs and their effective integration for development of DSS									√																										
REWARD Program implementing Districts																																				
7.3	Effective use of scientific data in watershed management and convergence of programmes of development departments									√																										
7.4	Application of scientific data in preparation of DPR on watershed management									√																										
7.5	Application of scientific data in preparation of DPR on watershed management									√																										
7.6	Application of scientific data in preparation of comprehensive watershed management plan									√																										

7.7	Effective use of scientific data in planning and implementation of line departments programs and their convergence with watershed management					√																			
7.8	Effective use of scientific data in planning and implementation of line departments programs and their convergence with watershed management							√				√													
<i>Non REWARD Program implementing Districts</i>																									
7.9	Application of scientific data in preparation of DPR on watershed management							√																	
7.10	Application of scientific data in preparation of comprehensive watershed management plan					√	√			√	√														
7.11	Effective use of scientific data in planning and implementation of line departments programs and their convergence with watershed management						√				√														
<i>REWARD Program implementing State- Odisha</i>																									
7.12	Emerging approaches in generation of LRI, hydrology, socio-economic survey data and other inputs and their effective integration for development of DSS							√																	
7.13	Effective use of scientific data for DPR preparation for watersheds				√																				

Non REWARD States as per the requirement of DoLR																								
7.14	Orientation training on LRI																							
7.15	Training to Scientists of partner institutes on methodologies in LRI and hydrology studies																							
7.16	Training to PIA of non-REWARD States on smart DPR preparation using LRI, Hydrology and DSS																							
8. Participate in Knowledge exchange program:																								
8.1	On-line interaction sessions																							
8.2	National workshop/ seminar																							
8.3	International workshop/ seminar																							
8.4	Visit to outside the country in two batches																							
9. Review of the best practices in watershed management to provide inputs for improving watershed guidelines:																								
9.1	Refinement of existing guidelines for implementation of Watershed Development after discussion in a workshop involving representatives of NLNA, ICRISAT, SLNA, World Bank and prominent NGOs etc.																							
10. Facilitate the identification of emerging areas/issues and pilot studies related to watershed management:																								
10.1	Best management practices to enhance soil organic carbon content, carbon sequestration processes and their implications on soil health and livelihood under rainfed situations,																							

10.2	Dynamic contingent crop plan for climatic distress towards economic sustainability and livelihood of rainfed areas								√	√	√	√	√	√	√	√	√	√	√									
10.3	Crop and land management practices for sustainable soil health, economic viability and livelihood of small holder farm								√	√	√	√	√	√	√	√	√	√	√	√								
10.4	LRI based fertilizer recommendation								√	√	√	√	√	√	√	√	√	√	√	√								
10.5	Market driven production practices for livelihood enhancement of rainfed farmers,								√	√	√	√	√	√	√	√	√	√	√	√								
10.6	Rapid techniques for dynamic nutrient management and soil properties								√	√	√	√	√	√	√	√	√	√	√	√								
10.7	Participatory ground water management								√	√	√	√	√	√	√	√	√	√	√	√								
11. Connecting science and community needs in watershed management for post project sustainability																												
11.1	Documentation of best practices in the micro-watersheds where LRI based watershed development approach made visible impact of sustainability																				√							
11.2	Establishing cause and effect relationship between the identified practices and sustainable watershed management																					√						
11.3	Production of appropriate teaching / audio-visual aids to disseminate the resultant effect of scientific approaches in																					√						

	sustainable watershed management																							
11.4	Educating PIA, NGOs, selected community level organizations on practices leading to sustainable watershed management												√	√	√	√	√	√	√	√	√	√	√	√

