Increasing Climate & Disaster Resilience with Geospatial Technologies

Geospatial World Forum, 2023
Rotterdam, Netherlands

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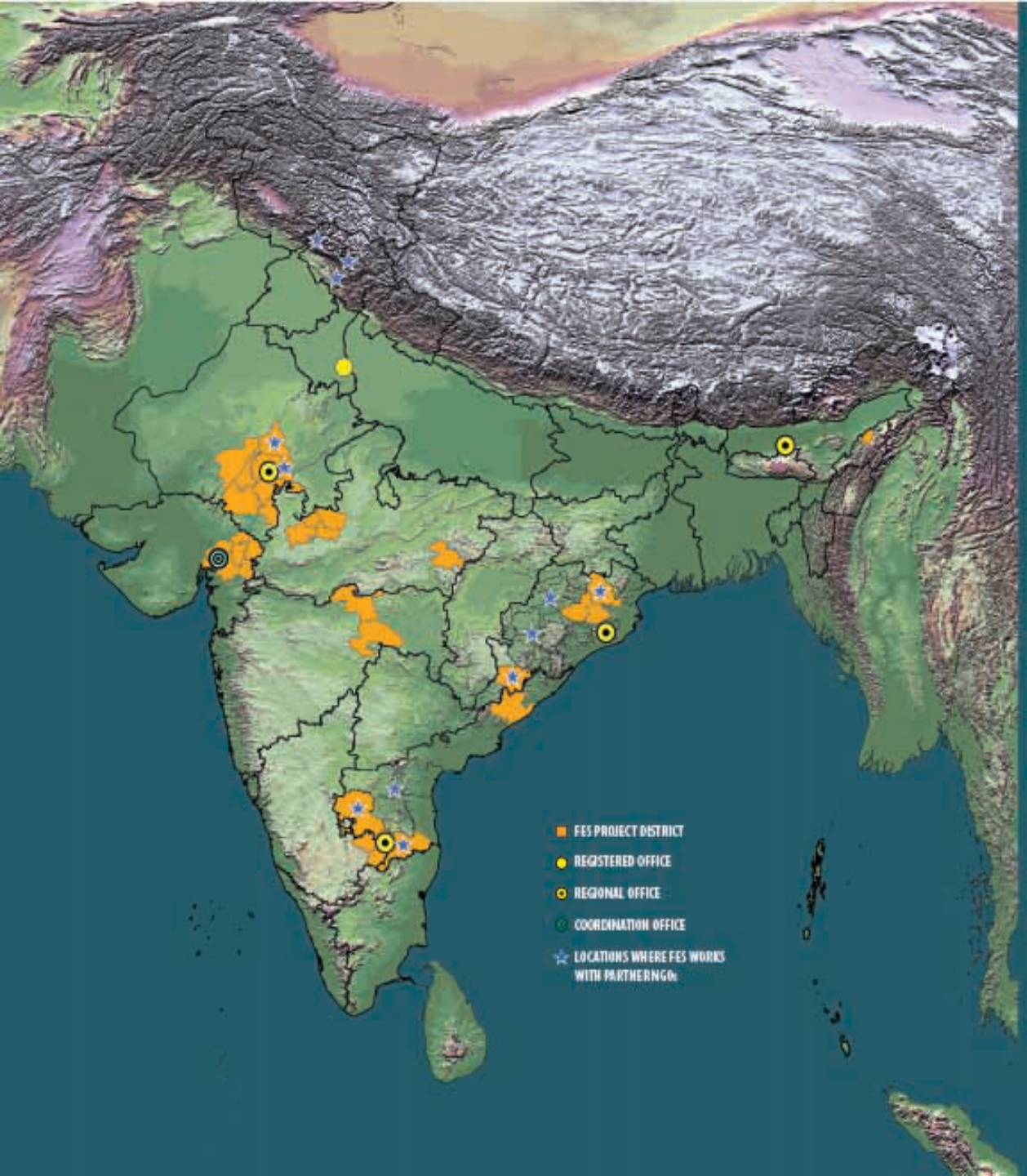
Foundation for Ecological Security, India

Our Mission

Conserving nature and natural resources, village commons in particular, to enhance economic opportunities in rural India



Our Presence

FES activities are spread across **110** districts in **11** states of India, covering 11 agro-ecological zones of the country.

11.38 million acres of common land brought under community management

36,407 habitations assisted in restoring and managing their Commons

22.1 million people impacted

Secure
Land Rights

+

Empower
Local Governance

+

Restore Degraded
Ecosystems

=

+

Ecological
Health

Resilient
Livelihoods

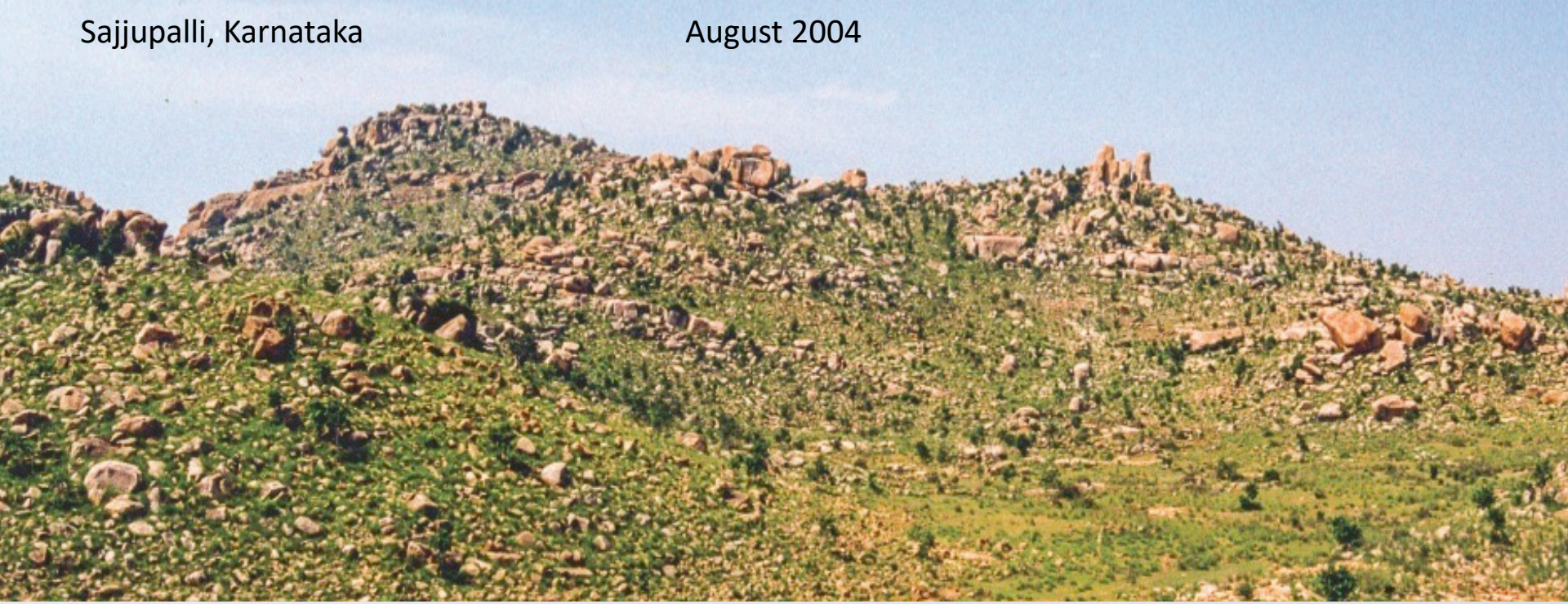
Sarnal, Gujarat

July, 1986

July, 2016

Sajjupalli, Karnataka

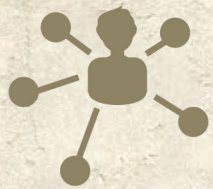
August 2004



October 2017

Enhancing Local Stewardship

Engaging in Partnerships



Honing Capacities

Harnessing Information Technology

Influencing Government Programs

India Observatory BETA

India Observatory

Gaps addressed by IO in Current Developmental Practices

- Most of the data initiatives disregard nature and natural processes, *IO could position itself to advance the mission of Ecological Security and Livelihood Security*
- While there are several data sets, analytics and algorithms available, the 'last mile' gap in access and application is missing, *IO bridges this last mile gap.*
- Much of the development practice is sectorial, inter-disciplinary integration is missing, resulting in subpar outcomes and sometimes working at cross purposes*. IO encourages interdisciplinary thought process.*

IO is intended to **deliver data, knowledge, analytics, insights and advisories** to the village communities drawing from numerous sources including primary data collected through the app

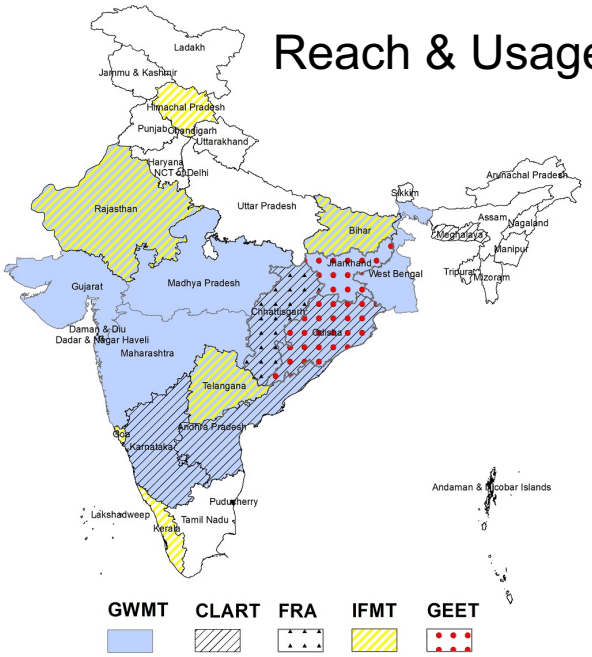
India Observatory components

Data Platform

Indian Biodiversity Information System

Tools/Applications

Tools	Planning	Implementation	Monitoring	Evaluation
Composite Landscape Assessment and Restoration Tool (CLART)	✓	✓		
Crop Water Budgeting (CWB)	✓			
Experimental Game (EG)	✓			
Ground Water monitoring Tool	✓	✓	✓	
Common Land Mapping Tool	✓	✓	✓	✓
Integrated Forest Management Toolbox (IFMT)	✓	✓	✓	✓
Forest Right Act Tool (FRA)	✓	✓	✓	
GIS Enabled Entitlement Tracking (GEET)	✓	✓	✓	✓
Primary data collection tool (Household surveys, MIS etc.)	✓	✓	✓	✓
Data platform (Socio economic, ecological and environmental data from different sources)	✓	✓	✓	✓



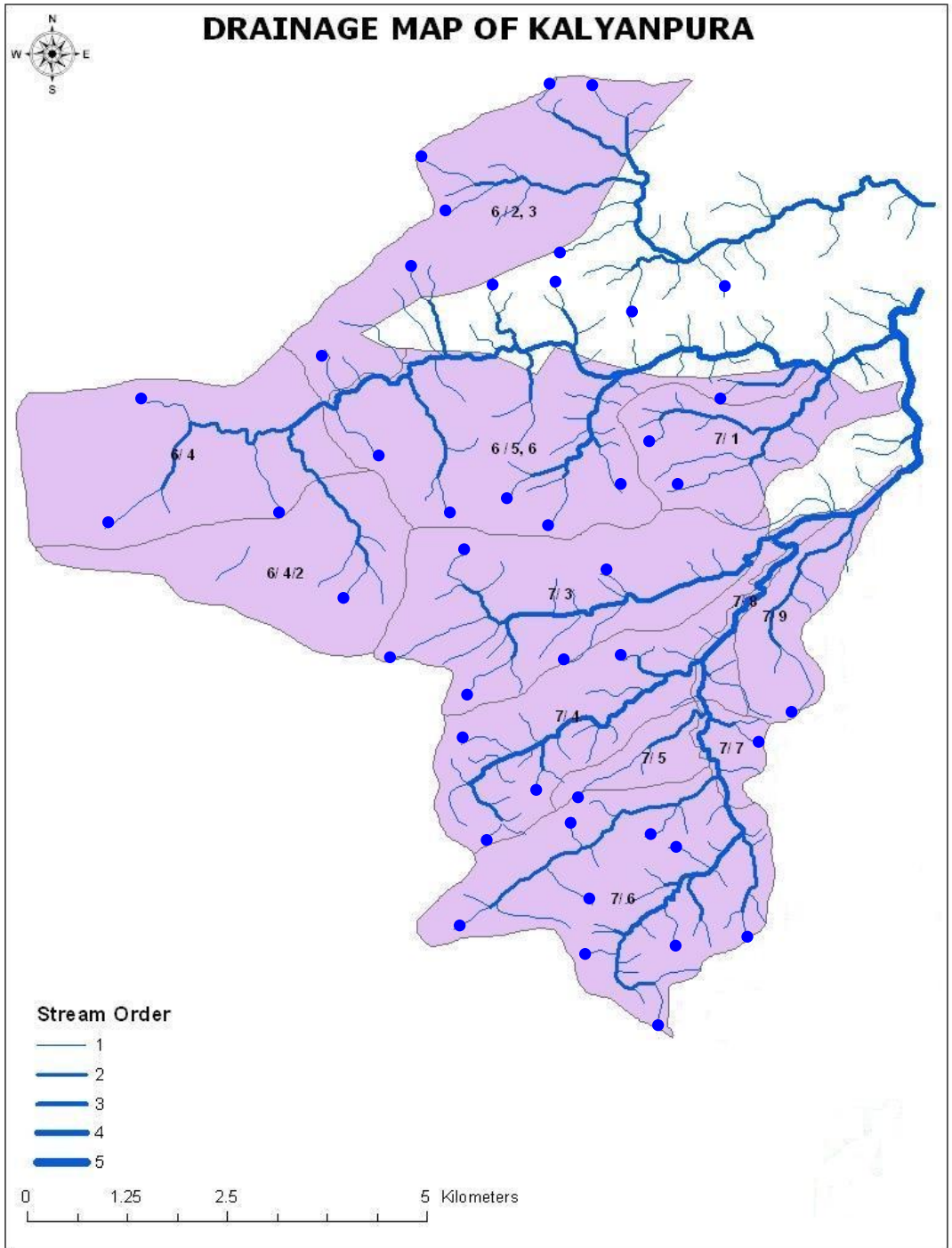
Composite Landscape Assessment & Restoration Tool (CLART)

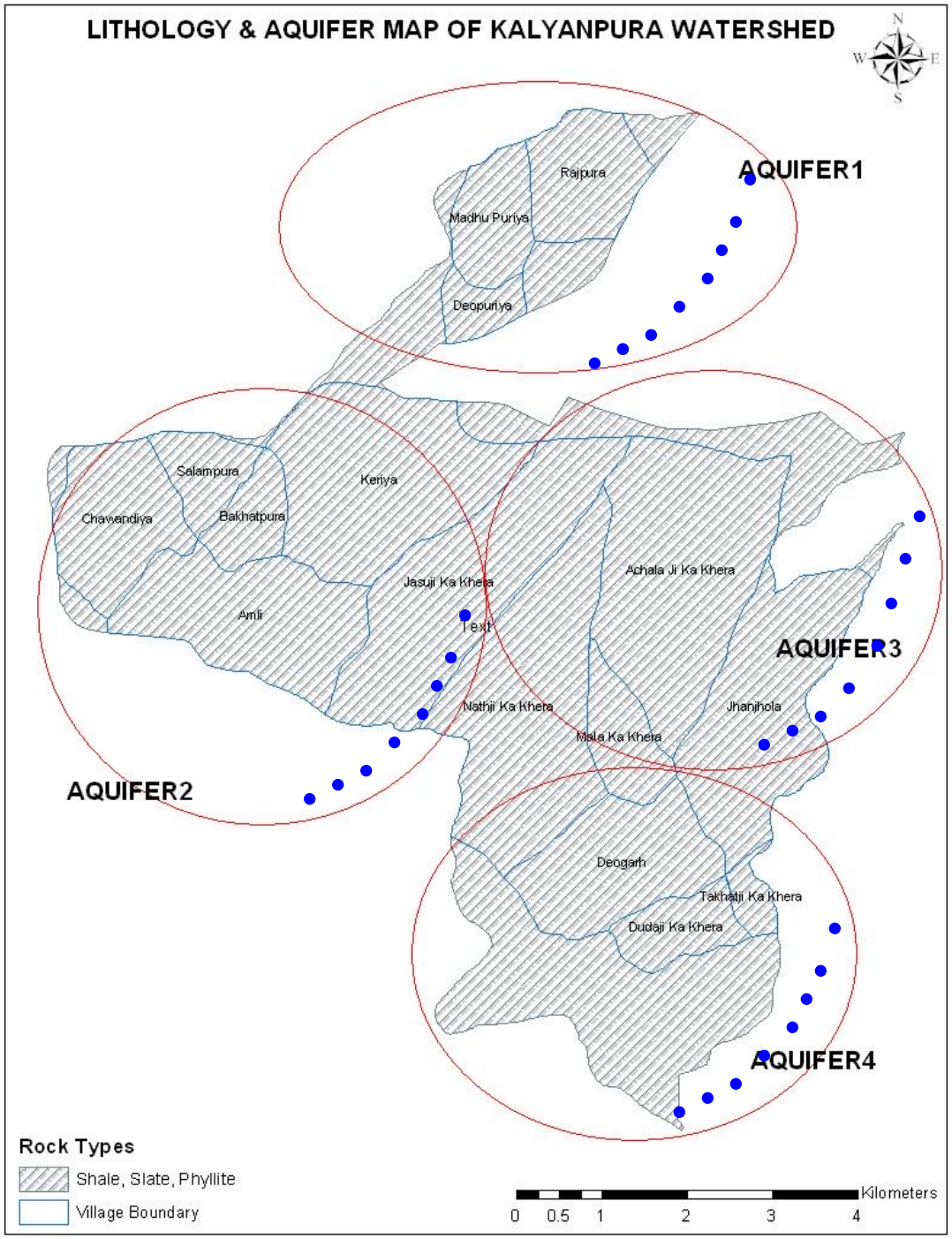
Rationale

- Typical water enhancement measures do not consider scientific information and Huge investments are made on intuitive knowledge leading to injudicious use of public funds
- Access to granular data on soil and water restricts use of data analytics for decision making
- Knowledge and insights is not accessible to layman in a user friendly/ demystified manner
- Limited availability of trained technical staff further adds to planning and implementation gaps.

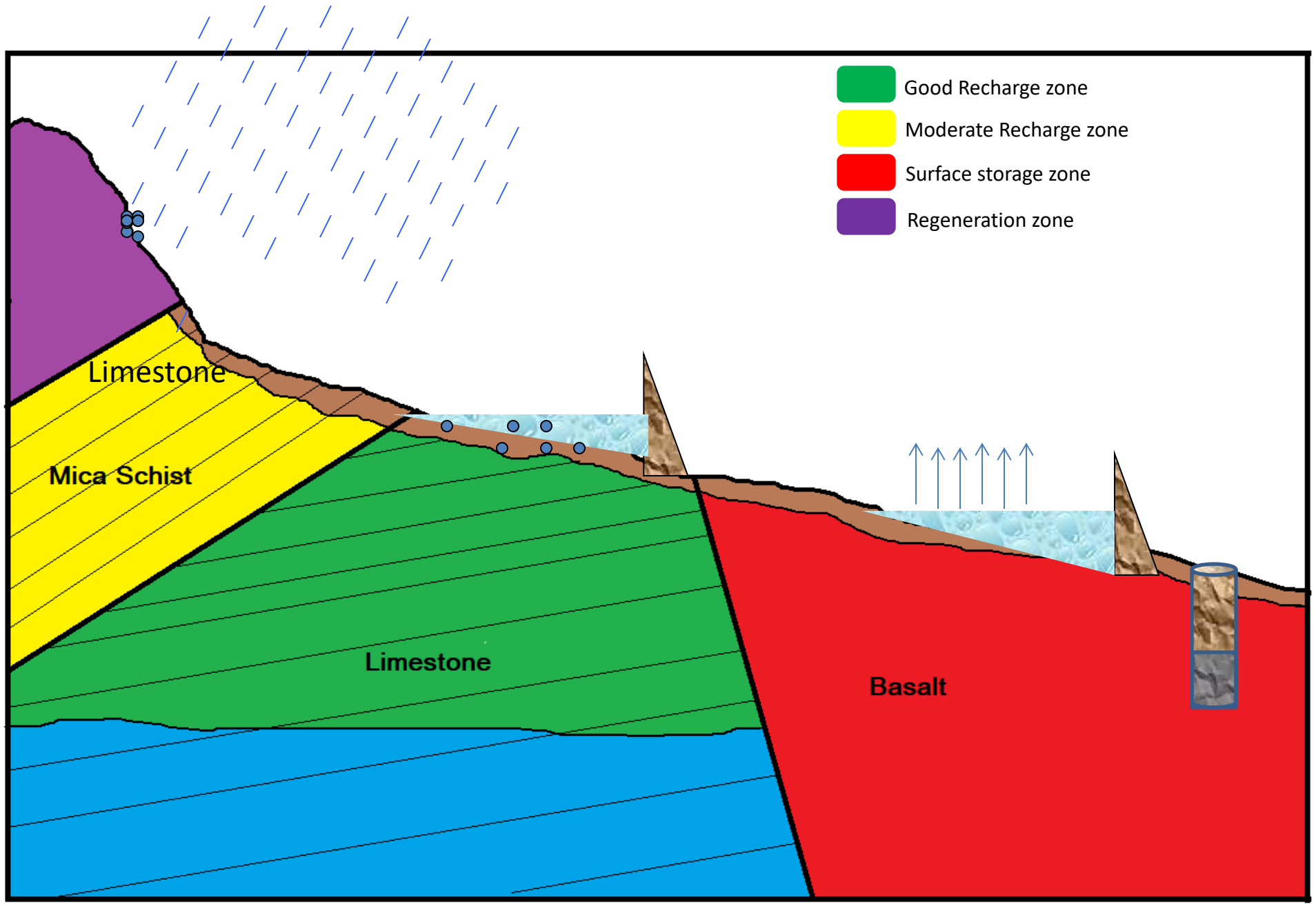
Objective

Decision support tool which provides ***location specific*** information in a ***user friendly*** *manner* to ***enable village communities*** to ***plan*** and ***develop estimates*** of the soil and water conservation interventions ***without help of Engineers and Internet at field***


DRAINAGE MAP OF KALYANPURA
N
W
E
S
6/ 2, 3
6/ 4
6/ 5, 6
7/ 1
6/ 4/2
7/ 3
7/ 8
7/ 9
7/ 4
7/ 5
7/ 7
7/ 6
Stream Order
1
2
3
4
5
0
1.25
2.5
5 Kilometers


LITHOLOGY & AQUIFER MAP OF KALYANPURA WATERSHED
N
W
E
S
AQUIFER1
Rajpura
Madhu Puriya
Deopuriya
Salampura
Keriya
Chawandiya
Bakhatpura
Jasuji Ka Khera
Amli
Text
Achala Ji Ka Khera
AQUIFER3
Nathji Ka Khera
Jhanjhola
Mala Ka Khera
AQUIFER2
Deogarh
Takhatji Ka Khera
Dudaji Ka Khera
AQUIFER4
Rock Types
Shale, Slate, Phyllite
Village Boundary
Kilometers
0 0.5 1 2 3 4

Schematic process flow of CLART



Background dataset used in CLART

Layers used in CLART

- Drainage
- Geology
- Recharge potential
- Slope
- Landuse & Landcover
- Geomorphology
- Watershed
- Lineament
- Village boundary

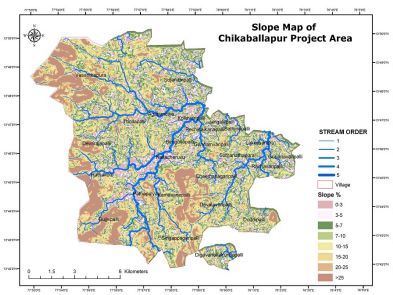
Layers	Source	Scale/Resolution
Geology	Bhukosh (Geological Survey of India)	1:50K
Geomorphology	Geological Survey of India-NRSC	1:50K
Drainage	Generated from SRTM/ASTER-DEM	30 meter (approx 1:60K)
Slope	Generated from SRTM/ASTER-DEM	30 meter (approx 1:60K)
Slope	Generated from Cartosat DEM	5 meter (approx 1:10K)
Micro Watershed	Central Ground Water Board & Bhuvan	1:10K
Landuse-Landcover	LISS IV (2018) Bhuvan	5.8 meter (approx 1:11K)
Landuse-Landcover	Sentinel -2 (few places)	10 meter (approx. 1:20K)
Lineament	NRSC-Bhuvan	1:50K
Ground water level	CGWB - WRIS	15,000 wells (approx)
Ground water table	FES GWMT (available for 450 blocks only)	
Village boundary	Survey of India	

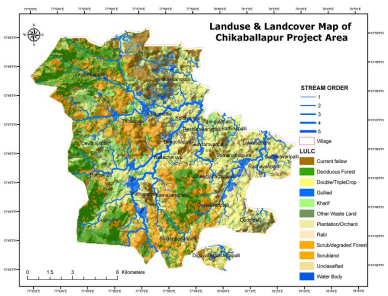
Algorithm built on :

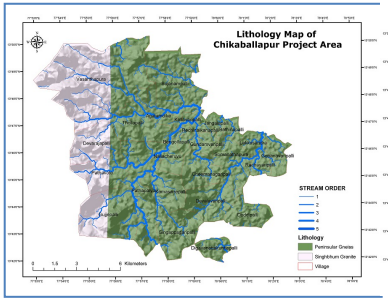
1.According to GEC 97 norm

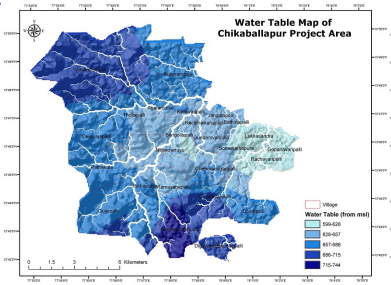
2. REPORT OF THE GROUND WATER RESOURCE ESTIMATION COMMITTEE (Page no 24)

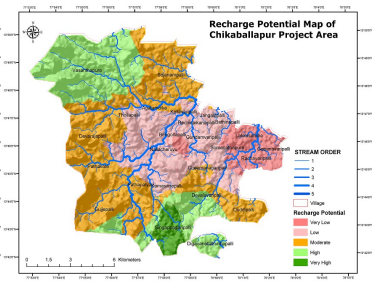
3. www.angelfire.com/nh/cpkumar/publication/Lgwa.pdf











Process of making CLART

Data Used

Recharge Potential Identified from Hydrogeology data	
Recharge Potential	**Recharge Code**
Very High	5
High	4
Moderate	3
Low	2
Very Low	1

Slope classified based on Digital Elevation Model	
Slope (%)	**Slope Code**
0-3	1
3-5	2
5-7	3
7-10	4
10-15	5
15-20	6
20-25	7
>25	8

Landuse Classified based on Remote sensing Images	
Landuse/Landcover	**Landuse Code**
Unclassfied	1
Kharif Crop	2
Rabi Crop	3
Double/Tripple Crop	4
Current Fallow	5
Plantation/Orchards	6
Deciduous Forest	7
Scrub/degraded forest	8
Other Waste Land	9
Gullied	10
Scrubland	11
Water Bodies	12

Combination Matrix Formula

Recharge Code	Multiplied by 10		Slope Code	Recharge+Slope
5	50	"+"	1	51
Very high recharge			0-3 % slope	

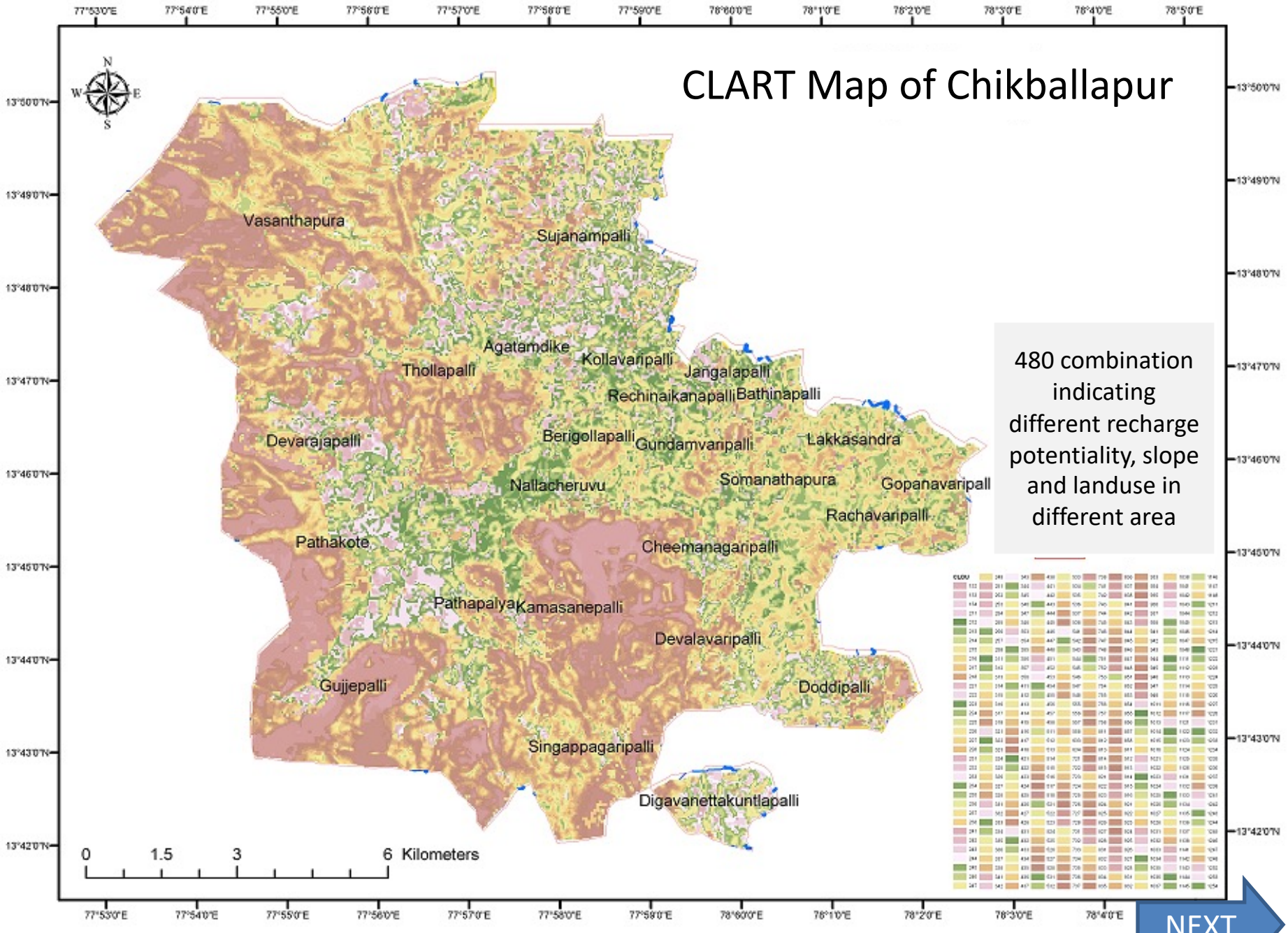
Recharge+Slope	Multiplied by 100		Landuse Code	Recharge+Slope +Landuse
51	5100	"+"	2	5102
			Kharif Crop	

Similarly all the combination prepared which are

(Recharge Code) 5 X (Slope Code) 8 X (Landuse Code) 12 = 480 types of combination

NEXT

CLART Map of Chikballapur



480 combination indicating different recharge potentiality, slope and landuse in different area

NEXT

Treatment plan Preparation based on CLART

Recommended Treatment Code	Recommended Treatment Type	Recharge Potentiality	Slope	Land Use/Land Cover
1	Good Recharge structure (Percolation tank, WHS, CCT etc)	Very High (5) High (4)	3-20%	Current fallow (5), Other Waste land (9), Gullied (10), Scrubland (11)
2	Moderate Recharge structure (WAT, GP, LBCD etc)	Moderate (3)	5-25%	Current fallow (5), Other Waste land (9), Gullied (10), Scrubland (11)
3	Surface water Harvesting structure (WHS, FP, FB etc)	Low (2) Very Low (1)	0-20%	Current fallow (5), Other Waste land (9), Gullied (10), Scrubland (11) Agriculture (2,3,4)
4	Regeneration (Plantation, Veg Int, Grass seeding, stone bunding, bench terracing, trenching etc)	Very Low (1), Low (2), Moderate (3)	25 -30%	Current fallow (5), Other Waste land (9), Gullied (10), Scrubland (11), Mixed, degraded forest, Deciduous forest
5	High Runoff zone (Trenching, stone bunding)	Very Low (1), Low (2), Moderate (3) High (4) Very High (5)	Slope >30	Current fallow (5), Other Waste land (9), Gullied (10), Scrubland (11), Mixed, degraded forest, Deciduous forest

Planning for conservation of land & Water (Composite Approach)

Drainage Line

VERY GOOD RECHARGE STRUCTURE

Percolation Tanks,
Water Harvesting Structure
For Recharge,
Contour Trench

MODERATE RECHARGE STRUCTURE

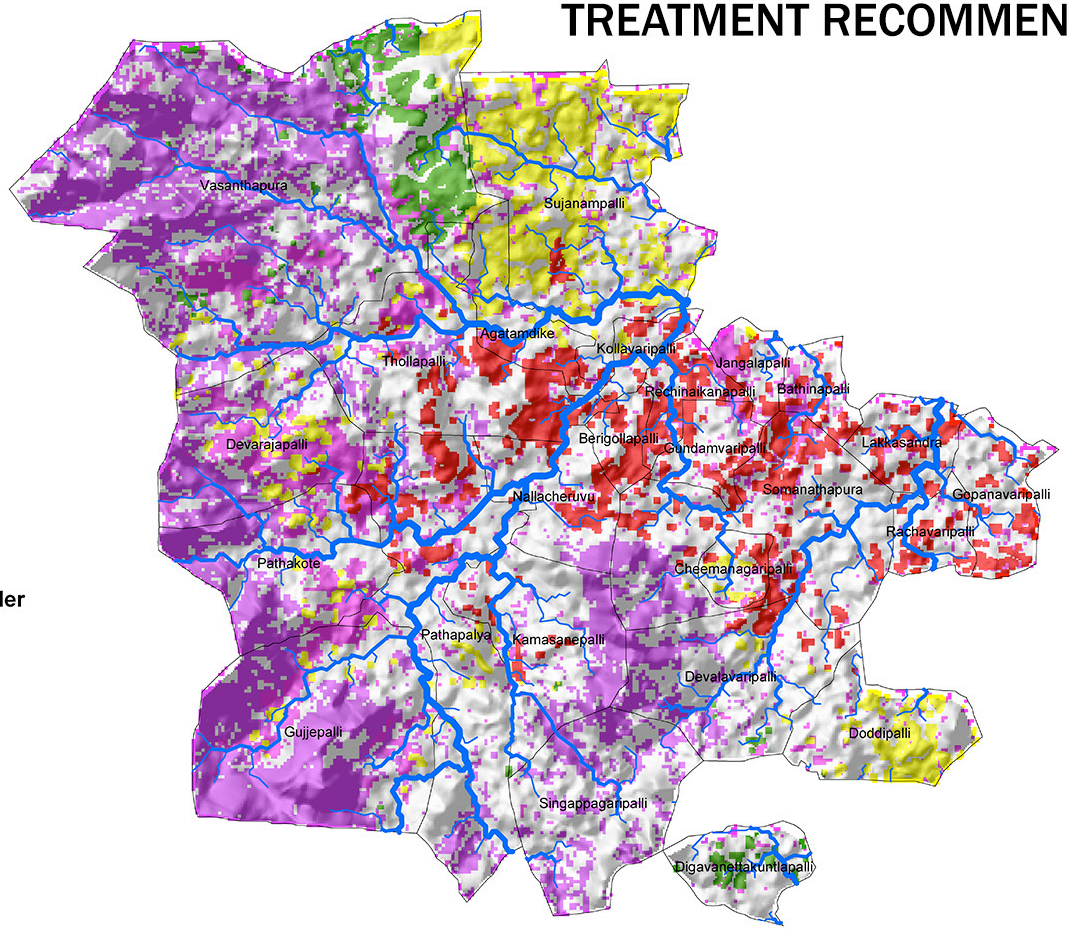
Water Arresting Trench,
Gully Plug, Loose Boullder
Check Dam

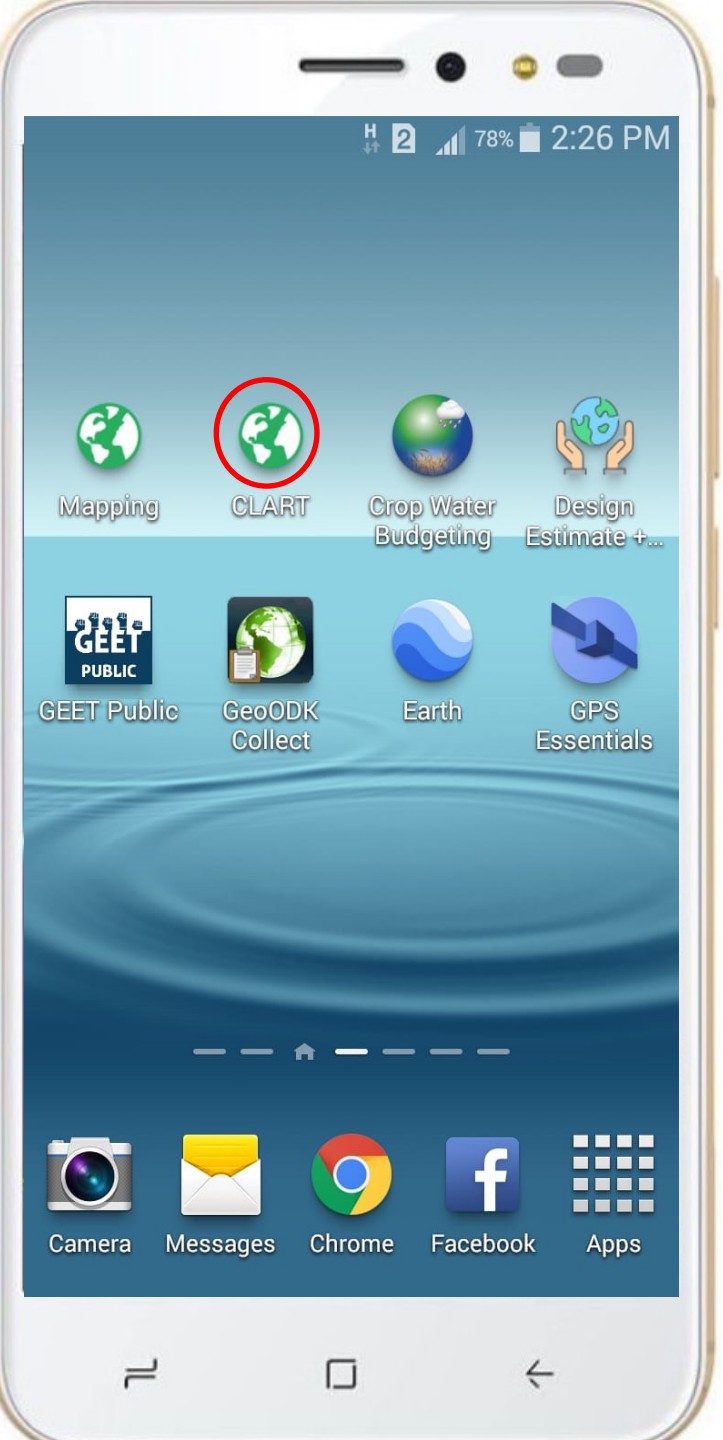
SURFACE STORAGE AREA

Farm Pond,
Surface storage Structure

CATCHMENT CONSERVATION

Grass seeding,
Stone Bunding
Bench terracing
Regeneration





Farm Pond (FP)

Input Sheet A- Basic Details of the Work (Filled for each site)

Location Name of the Site *

Agency *

Select Answer

Purpose of structure *

Select Answer

Input sheet B- Filled in the field

Dimension of Farm Pond (Based on field Survey)

Top Length of Farm Pond in (meter) *

Top Width of Farm Pond in (meter) *

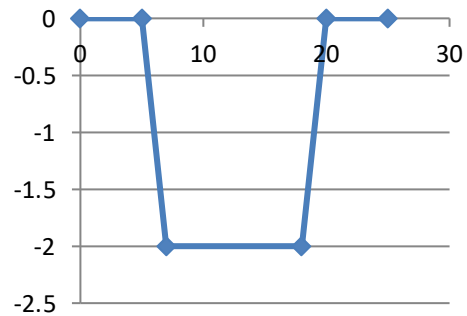
Depth of Farm Pond in (meter) *

SAVE

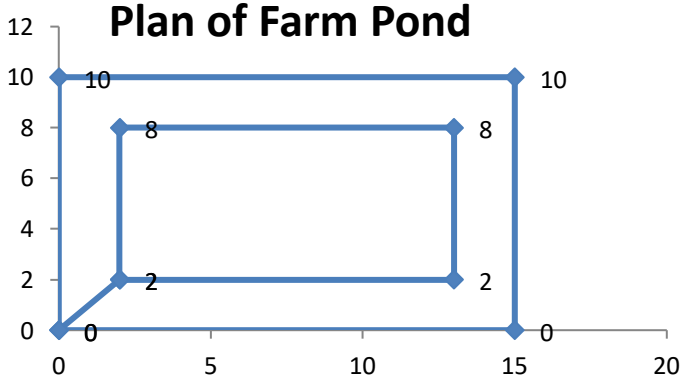
Design Estimate preparation in CLART

Output Sheet B - Cost Estimation Abstract Sheet								
Sr. No.	**Item**	**Quantity of work**	**Unit**	**Unskilled Labour Cost**	**Skilled Labour/ Mate Cost**	**Material Cost**	**Total Cost**	**Total Mandays Generated**
1	Layout marking for farm pond	50	Running Meter	50	25	0	75	0.3
2	Dug belling work up to 5 to 7 cm depth for farm pond	50	Running Meter	100	25	0	125	0.6
3	Excavation of farm pond including initial lead and lift	208						
3a	In soft soil/ordinary soil	41.6	Cubic meter	3328	83	0	3411	18.7
3b	In hard soil	83.2	Cubic meter	8320	166	0	8486	46.7
3c	In murrum	20.8	Cubic meter	2496	62	0	2558	14.0
3d	In hard murrum	41.6	Cubic meter	5824	166	0	5990	32.7
3e	In disintegrated rock	20.8	Cubic meter	4160	104	0	4264	23.4
3f	In hard rock	0	Cubic meter	0	0	0	0	0.0
	Total Cost of farm pond			**24278**	**632**	**0**	**24910**	**136.4**

Cross Section of Farm Pond



Plan of Farm Pond



View Form on Map

Upload File | Form PDF | Rates PDF | Approve | Reject

Location:	Latitude: 16.3602524 Longitude: 74.7958659
Name:	Santosh Kumbar
Organization Name:	MGNREGS Karnataka
State Name:	Karnataka

Supporting Layers

- Clart Output
- LULC

FES :: Design Estimation Portal **Form ID: 192967** **04-05-2023 01:45 pm**

Screenshot:

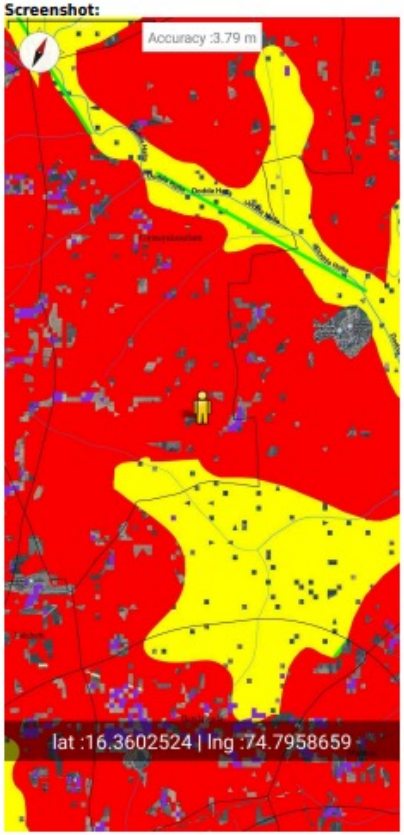
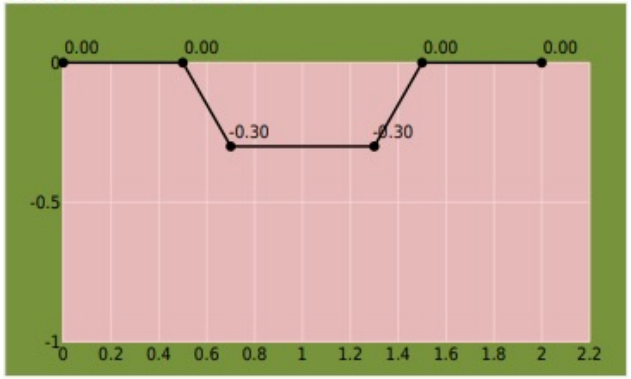


Photo:

Cross Section of Trench Cum Bund



- Good Recharge (Percolation Tank, Water Harvesting Structure, Trenches for Recharge)
- Moderate Recharge (Loose Boulder Check Dam, Gully Plug, Water Arresting Trench)
- Surface Storage (Farm Pond, Farm Bund and Well Deepening)
- Area of Protection and Regeneration (Grass Seeding, Stone Bunding, Bench Terracing, etc.)
- High surface runoff zone

Location:
Latitude: 16.3602524
Longitude: 74.7958659

Planning Year: 2023-2024
Name: Santosh Kumbar
Phone Number: 9731795850
State: Karnataka
District: Belagavi
Block: Raybag
Panchayat: BENDWAD
Village: Girinaikwadi
What Type of Structure planned?: KA Step type Farm Pond (SFP)
If Other, Provide Structure Name: 109
Submit Date: 04-05-2023 12:33 pm
Approval Status: Forms for approval
Reason:

Role based approval process in CLART

Organization Admin:

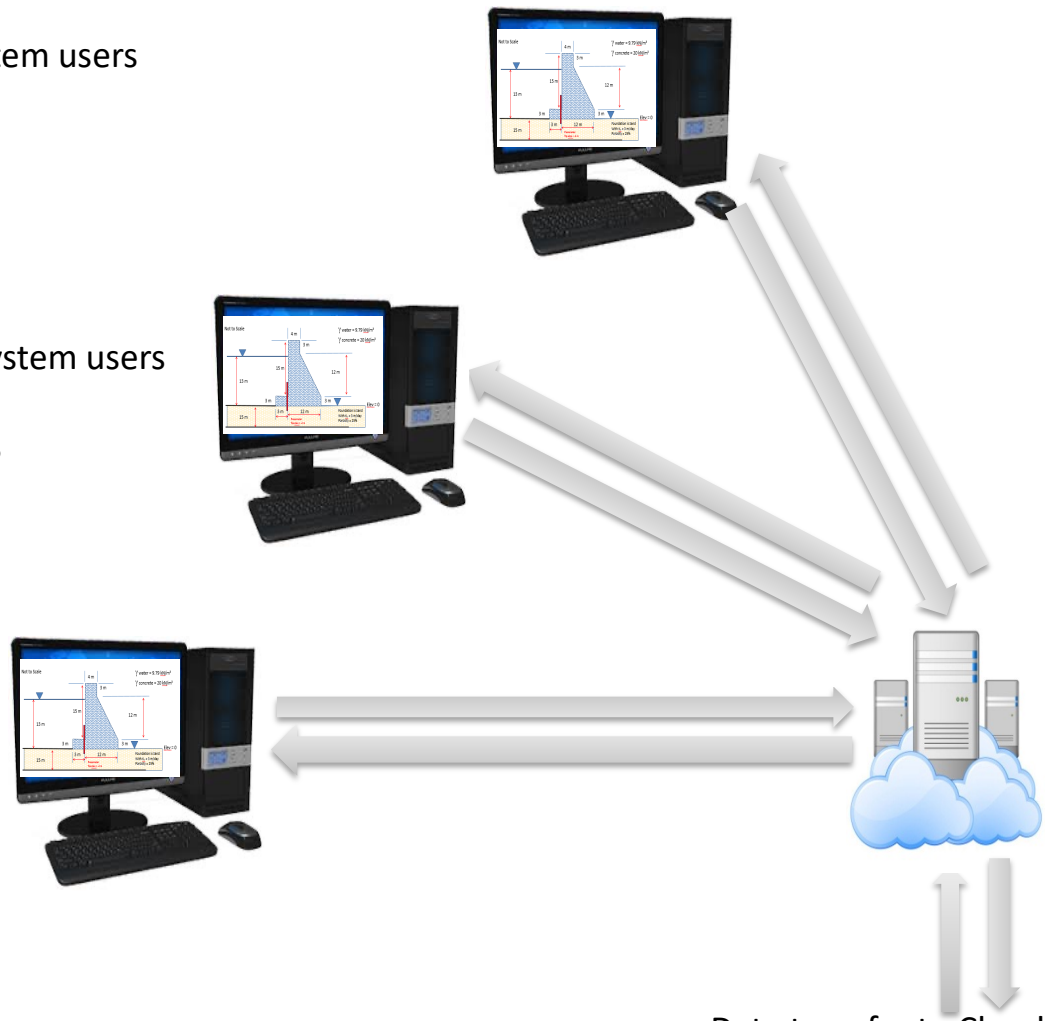
a. Assign program manager and other system users
b. Can visualize all the plans and status

Program Manager

a. Assign program coordinator and other system users
b. Can visualize all the plans and status
c. Responsible for configuration of BSR/TS
d. All the roles of Program coordinator

Program Coordinator

a. Can visualize all the plans and status
b. Approve/Reject the plans



Data transfer to Cloud Server

Field functionary

a. Can make the plan using the app
b. Can visualize the plans made by them only
c. Notified of the approval or rejection of the plans

Turn around time significantly reduced to near real time with site selection and generate design estimate

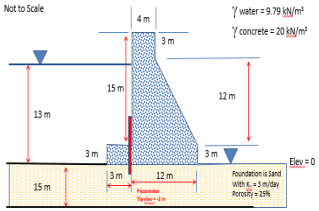
Manual Upload to server

Online Data Entry

Manual data entry

Analog data collection

Design Estimate



DPR Approval for MGNREGA

Automatic data upload to Secure system by API Service

Evidence based real time monitoring

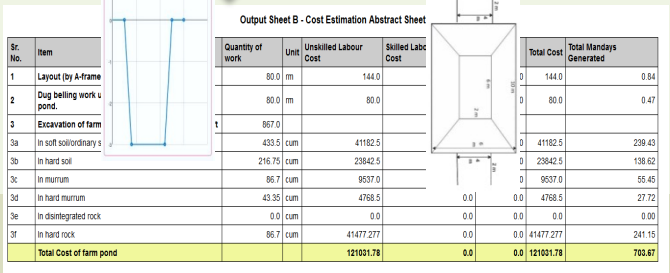
Proposed

FES Cost Estimation

Data transfer to Cloud Server

CLART based Site selection and Digital Data collection

Output of design estimate for preparing DPR with photo, GPS loc, Map



Output Sheet B - Cost Estimation Abstract Sheet

Sr. No.	Item	Quantity of work	Unit	Unskilled Labour Cost	Skilled Labour Cost			Total Cost	Total Mandays Generated
1	Layout (by A-frame	80.0	m	144.0			0	144.0	0.84
2	Dug belling work u pond.	80.0	m	80.0			0	80.0	0.47
3	Excavation of farm	867.0	t						
3a	In soft soil(ordinary s	433.5	cum	41182.5			0	41182.5	239.43
3b	In hard soil	216.75	cum	23842.5			0	23842.5	138.62
3c	In murrum	86.7	cum	9537.0			0	9537.0	55.45
3d	In hard murrum	43.35	cum	4768.5	0.0	0.0		4768.5	27.72
3e	In disintegrated rock	0.0	cum	0.0	0.0	0.0		0.0	0.00
3f	In hard rock	86.7	cum	41477.277	0.0	0.0		41477.277	241.15
	Total Cost of farm pond			121031.78	0.0	0.0		121031.78	703.67

What can be done through the CLART

1. Location specific suggestion on field using app and Preparing Design and Estimate on field
2. Visualization of data/plans/evidences in the portal
3. Role based Onscreen vetting with field evidences (such as photograph, location on google map, screenshot of CLART maps and structure data)
4. Widget for visualization and API connection for sharing

To increase effectiveness and efficacy through Geospatial Technology

- Enhance reach of data sets and analytics to the ground in an intelligible manner
- Position village communities/end users at the center of decision making
- Promote evidence based decision making
- Nurture an ecosystem platform that converges
    - Local and external knowledge
    - Initiatives of various NGOs, GOs, Academia and Funders
    - (into a) Grid of data servers
    - and gives expression to thought leadership

Thanks