

Impact Assessment Report

**Creation of Water Economic Zones through Integrated
Watershed development-Alsigarh, Udaipur, Rajasthan**



March 2026

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Abbreviations

CGWB	Central Ground Water Board
APL	Above Poverty Line
BPL	Below Poverty Line
CAPI	Computerized Assisted Personal Interview
FPO	Farmers Producers Organization
FPO	Farmers Producers Organization
GB	Gabion Bund
CUM	Cubic Meters
DSL/G	Dharampal Satyapal Limited/ Group
GIS	Geographical Information System
GL	Ground Level
GPS	Global Positioning System
GSI	Geological Survey of India
FGD	Focused Group Discussion
Ha.	Hectare
HHs	Households
IA	Institutional Assessment
IMD	India Meteorological Department
In	Inch
KL	Kilo-Liter
M.Y	Million Year
MBGL	Meters Below Ground Level
MSL	Mean Sea Level
NASA	National Aeronautics and Space Administration
NW-SE	Northwest-Southeast
RS	Remote Sensing
RWH	Rainwater Harvesting
SSW	South-Southwest

SOI	Survey of India
SWC	Soil & Water Conservation
TCM	Thousand Cubic Meter
LSCD	Loose Stone Check Dam
MIS	Micro Irrigation System
MPT	Micro Percolation Tank
POP	Package of Practices
WEZ	Water Economic Zone
SB	Stone Bund
SCT	Staggered Contour Trench

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This study is a collective effort, and we hope its findings contribute meaningfully to water resource management and sustainable development in the region.

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Executive Summary

The DS Group, a diversified multi-business corporation and one of India's leading FMCG conglomerates, has evolved "Creation of Water Economic Zone (WEZ)" as a part of its Corporate Social Responsibility (CSR) initiative. The project is being implemented by Mahan Seva Sansthan in the Alsigarh watershed of Girwa block, Udaipur district, Rajasthan.

The project is designed as an integrated watershed development initiative with a focus on enhancing natural resources, particularly water and soil, to strengthen groundwater recharge, improve irrigation potential, and ultimately enhance livelihoods of rural communities. The interventions are implemented using a ridge-to-valley

approach, ensuring systematic treatment of the watershed.

Key interventions under the project include construction and renovation of water harvesting and recharge structures such as anicuts, check dams, Nadis, wells, and percolation tanks, along with soil and water conservation measures like contour trenches, bunding, gabions, and gully plugs. The project also promotes efficient water use through micro-irrigation systems, adoption of improved agricultural practices, and livelihood diversification through horticulture, floriculture, nutrition gardens, and other income-generating activities.

The Water Economic Zone (WEZ) model conceptualizes water as the central driver of rural economic transformation, linking natural resource enhancement with agricultural productivity, income generation, and improved quality of life.

About the Impact Study

The present impact assessment study evaluates the outcomes and impact of the WEZ project in the Alsigarh watershed over the period 2021–2024. The study focuses on assessing changes in water availability, agricultural productivity, livelihood patterns, income levels, and socio-economic conditions of beneficiary households.

Study Approach & Methodology

The study adopts a mixed-method approach integrating both quantitative and qualitative data.

- Quantitative Data: Collected through structured household surveys covering 200 households across 11 villages using CAPI tools.
- Qualitative Data: Captured through 11 Focus Group Discussions (FGDs) and 5 Key Informant Interviews (KIIs) with farmers, community members, and project stakeholders.
- Hydrogeological Verification: Conducted for 35 water harvesting structures using GIS mapping, satellite imagery, field visits, and technical assessments.

The sampling ensured representation across different intervention categories, landholding sizes, and socio-economic groups.

Key Findings

✓ Significant Improvement in Water Security

- As per physical verification and hydrogeological analysis, the project has created over 4.1 lakh cubic meters of water storage capacity through 35 SWC structures. These structures have significantly reduced runoff and enhanced groundwater recharge, resulting in water table rise of 10–20 meters in several locations.

- 100% households reported improvement in groundwater levels
- Nearly 80% households observed 1–3-meter increase in water table
- 94.5% reported increased water availability
- Time to fetch drinking water reduced from 30–120 minutes to 5–10 minutes

This indicates a strong impact of water harvesting structures in enhancing water access, reliability, and recharge.

✓ **Landscape-Level Transformation (LULC Change)**

Remote sensing analysis shows a major shift in land use patterns:

- **Agricultural land increased threefold from 10.41% to 39.09%**
- Barren land reduced by 25.79%
- Fallow land reduced by 7.77%

✓ **Transformation in Agriculture Systems**

- Households engaged in agriculture increased from 22% to 99.5%
- Irrigated area expanded significantly
- Cropping intensity increased with Rabi cultivation becoming common
- Clear shift towards crop diversification, especially:
 - Soyabean: +36 percentage points
 - Rice and pulses increased
 - Adoption of vegetables, floriculture, and high-value crops

Agriculture has transitioned from rain-fed subsistence to productive and income-oriented farming.

✓ **Improvement in Income and Economic Stability**

- Households earning <₹25,000 reduced from 85% to 20%
- Majority now fall within ₹25,000–₹1,00,000 income range
- Emergence of higher income categories (>₹1 lakh)
- Dependence on daily wage labour reduced from 67% to 1%
- Agriculture became the primary livelihood for 99.5% of households
- Seasonal migration declined substantially from 69% to 3%,

Indicates enhanced economic resilience and reduced vulnerability.

✓ **Reduction in Migration**

- Migration reduced drastically from 69% to 3%

Reflects creation of local livelihood opportunities and reduced distress migration.

✓ **Strengthened Livelihood Diversification**

- 98% households engaged in vegetable cultivation
- Wadi and nutrition gardens improved dietary diversity
- Millet cultivation promoted as a climate-resilient practice

Livelihoods are becoming more diversified, nutrition-sensitive, and sustainable.

✓ **Women Empowerment and Reduced Drudgery**

- 99.5% households reported reduction in water collection burden
- 98% reported increased participation of women in decision-making

Indicates time savings, reduced physical burden, and improved agency of women.

✓ **Strong Community Participation and Ownership**

- 84% households' part of Water User Groups
- Community-led maintenance of structures observed

Demonstrates institutional sustainability and collective ownership.

✓ **Ecological Restoration and Climate Resilience**

- NDVI analysis shows increased vegetation density and biomass
- NDMI analysis indicates improved soil moisture retention
- Increase in water bodies and green cover

These findings confirm that environmental restoration has accompanied economic development, enhancing long-term resilience. The project has successfully operationalized the Water Economic Zone (WEZ) model, where improved water availability has triggered a cascade of positive changes across agriculture, livelihoods, income, and social well-being.

Way Forward

While the project has achieved significant outcomes, further strengthening is required to sustain and scale the impact:

- **Micro-Irrigation Expansion:** Despite improved irrigation access, adoption remains low (22%). Given that only 10 drip and 10 rain gun systems have been introduced, there is significant scope for expansion. Scaling micro-irrigation through subsidies and convergence can enhance water-use efficiency, especially

with increased cropping intensity.

- With 98% households engaged in vegetable cultivation but limited market participation, strengthen FPOs, aggregation, storage, and market access to enhance income realization.
- Sustaining hydrological gains will require regular monitoring of groundwater levels, desiltation, and maintenance of structures, as highlighted in physical verification findings.
- Promoting Crop Diversification: While there has been a notable increase in diversification (soyabean from 23% to 59%, rice from 10% to 21.5%, millets from 8% to 13%, and pulses from 6% to 12%), the overall coverage of these crops remains moderate, indicating significant scope for further expansion, particularly for high-value and climate-resilient crops.
- Strengthening Crop Protection: Address open grazing during the post-Rabi period, which limits farmers from utilizing land for vegetables, floriculture, and millets, through low-cost fencing and community grazing management.
- Nutrition Interventions: Expand Wadi and nutrition gardens to more household coverage (50 Wadi beneficiaries)

The WEZ project in Alsigarh demonstrates that water-centered development can transform rural economies, making them more productive, resilient, and self-sustaining. It offers a replicable model for integrated watershed development in similar water-stressed and semi-arid regions.



1. Introduction

Project Overview:

The “Creation of Water Economic Zone (WEZ)” is a Corporate Social Responsibility (CSR) initiative supported by the DS Group and implemented by Mahan Seva Sansthan in the Alsigarh watershed of Girwa block, Udaipur district, Rajasthan. The project is designed as an integrated watershed development intervention with the objective of strengthening natural resource management and enhancing livelihood opportunities for rural communities.

Agriculture is the main source of livelihood, which is dependent on rainfall. Further, the project area falls under the drought-prone category, which consequently affects the socio-economic condition of the farmers. The project is planned around water conservation and sustainable use, such that the agricultural practices can be supported. The programme also aims to improve natural resource management, particularly water and soil, to increase the productivity of the land. The project aims to support small and marginal farmers in building a robust local economy.

The project adopts a ridge-to-valley approach, which ensures systematic treatment of the watershed by addressing soil and water conservation needs from the upper catchment areas to the lower plains. This approach helps in reducing surface runoff, improving soil moisture retention, and enhancing groundwater recharge across the watershed.

The interventions under the project focus on a combination of structural and non-structural measures. These include the construction and renovation of water harvesting and recharge structures such as anicuts, check dams, Nadis, wells, and percolation tanks. In addition, soil and water conservation measures such as contour trenches, bunding, masonry gabions, loose stone check dams and gully plugs have been implemented to control soil erosion and improve land productivity.

To ensure efficient utilization of water resources, the project promotes micro-irrigation systems such as drip and sprinkler irrigation. It also supports the adoption of improved agricultural practices, including the use of certified seeds, organic inputs, and better crop management techniques. Livelihood enhancement is further strengthened through diversification into horticulture, floriculture, and other income-generating activities. The introduction of solar-powered irrigation systems has improved access to water, particularly in areas with irregular electricity supply.

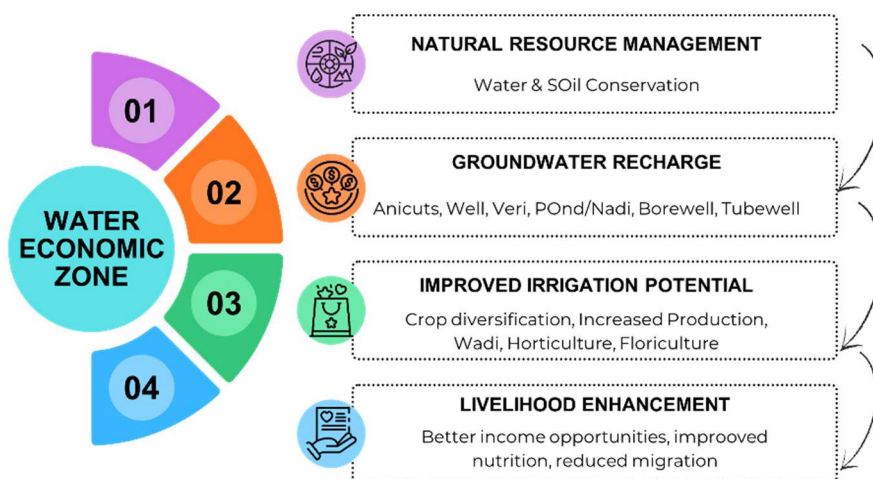


Figure 1 Conceptual Framework - Water Economic Zone

Source: (Author's Compilation with reference to Integrated Watershed Management Programme (IWMP) Government of India (2008). *Common Guidelines for Watershed Development Projects*. Department of Land Resources, Ministry of Rural Development)

The Water Economic Zone (WEZ) model represents a holistic and integrated approach to rural development, where water serves as the central driver of economic transformation. Designed for water-stressed and drought-prone regions, the model focuses on converting resource-constrained areas into productive, resilient, and self-sustaining rural economies.

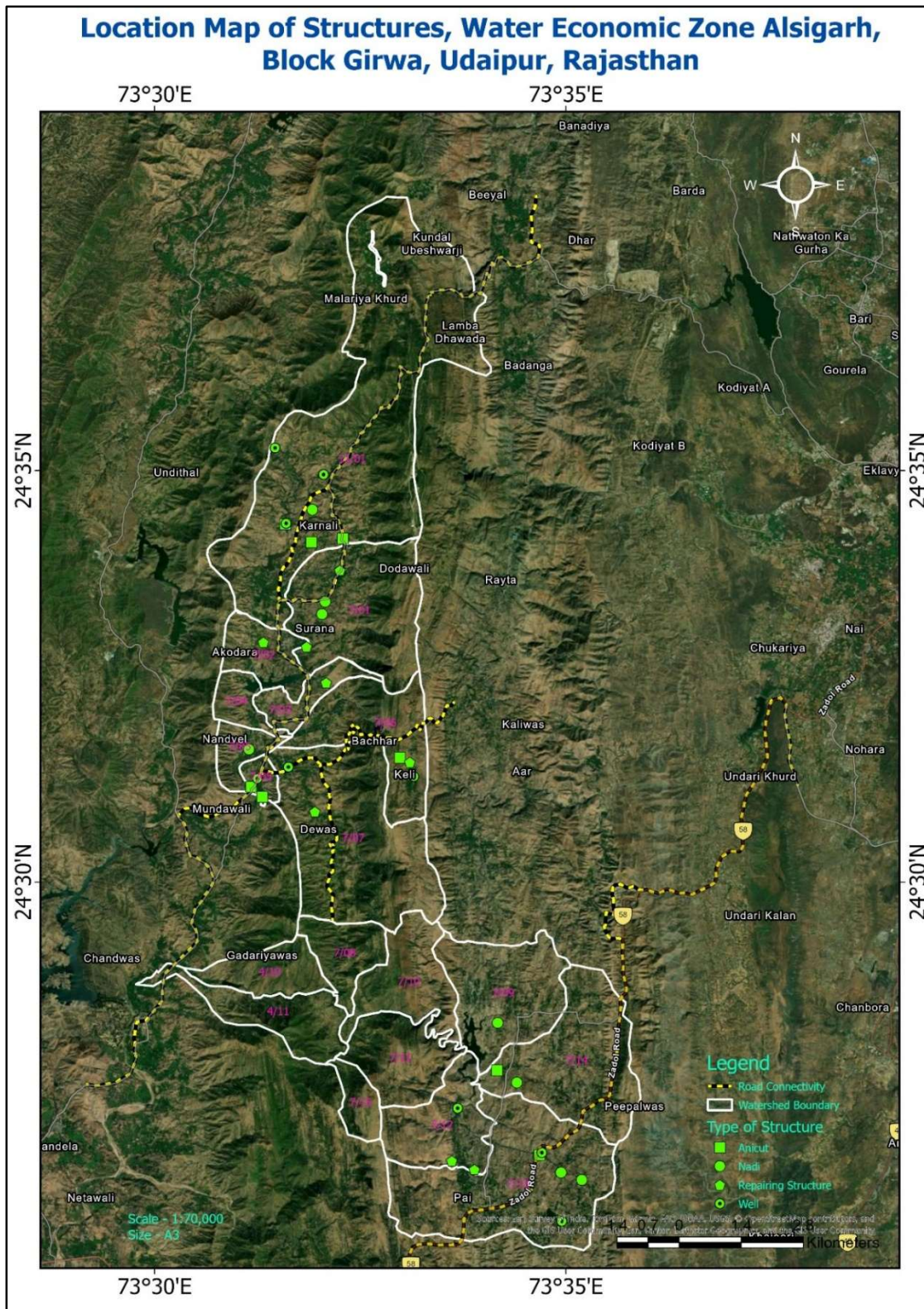
At its core, the WEZ model recognizes that water availability is intrinsically linked to agriculture, livelihoods, income, and overall well-being. By systematically enhancing water resources and promoting efficient utilization, the model creates a cascading impact across multiple sectors.

Total Structure – There are total 207 structures in this Water economic Zone, out of these 35 structures have been selected using a purposive and stratified sampling approach to ensure representation across different types of structures, including anicuts, nadi, repairing, and desiltation works. The sample covers multiple years of construction (2018–2024) to capture both long-term and recent impacts.

Table 1 Table of Total Structures

S. No	Structures	Total	Selected
1.	Anicut	39	8
2.	Desiltation Work	4	8
3.	Nadi	28	8
4.	Repairing Structure	30	11
5.	Wells	106	8

Figure 2 Activity Map of Project Area



The present impact assessment study focuses on the Alsigarh watershed and evaluates the outcomes and long-term impact of the project over the period from 2021 to 2024. The assessment examines how the interventions have contributed to improvements in water availability, agricultural productivity, and livelihood security among small and marginal farmers.

Study Objectives:

The overall objective of the impact assessment is to evaluate the effectiveness, outcomes, and long-term impact of the WEZ project interventions in the Alsigarh watershed.

The assessment majorly focussed on:

1. Assessing the delivery of services in terms of quality, quantity, coverage, and functionality of project interventions.
2. Measuring the satisfaction level of key stakeholders, including beneficiaries, community institutions, and implementing partners.
3. Evaluating the impact of the project in alignment with its stated objectives, particularly with respect to:
 - ✓ Water availability and groundwater recharge
 - ✓ Agricultural productivity and diversification
 - ✓ Livelihood and income enhancement
4. Identifying key learnings, challenges, limitations, and areas of improvement for strengthening future watershed and livelihood programmes.



2. Methodology

Study Approach & Methodology

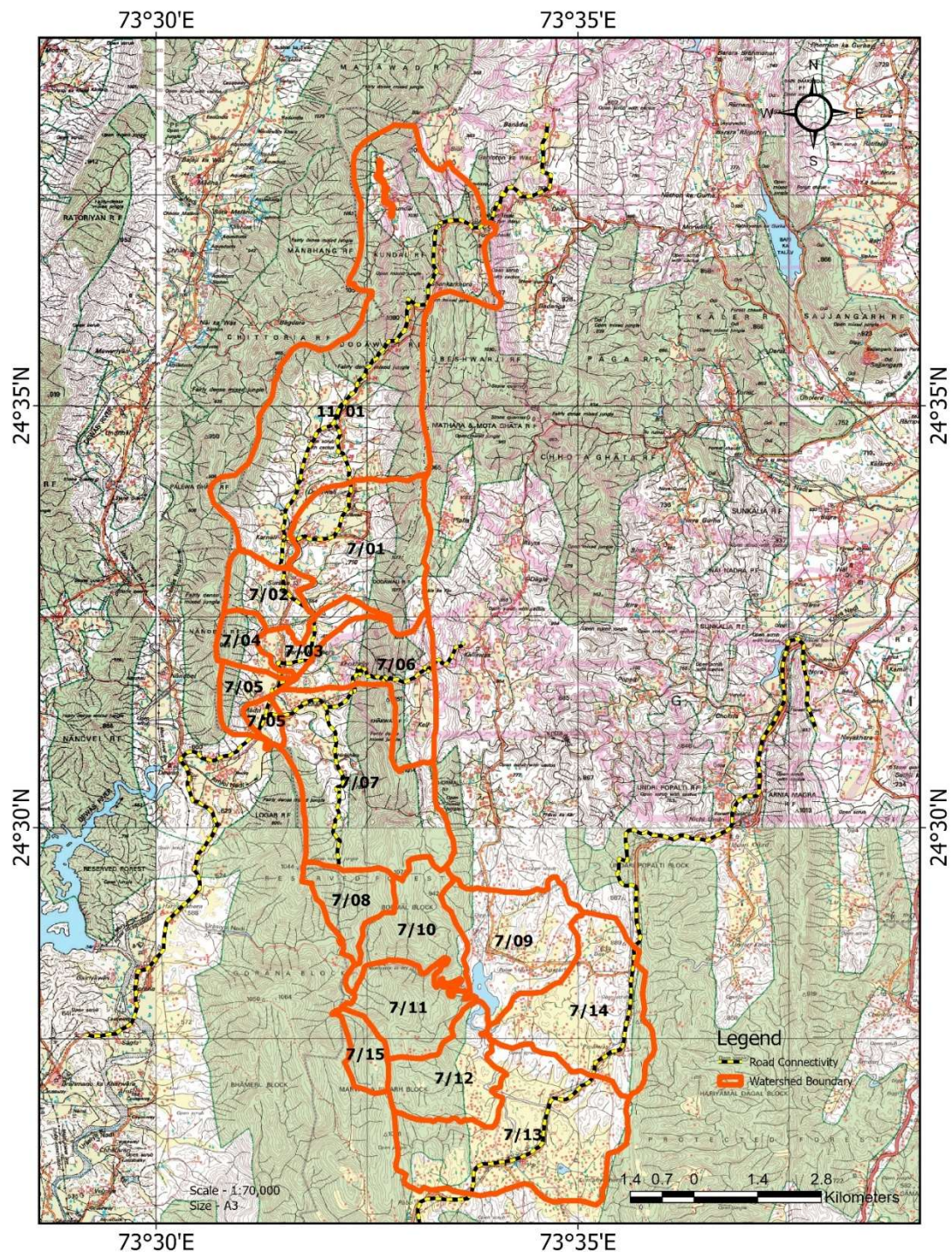
About the Project Area

The study is conducted in the Alsigarh watershed located in Girwa block of Udaipur district, Rajasthan. Alsigarh watershed region is about 30 Km on the south west of Udaipur city and is characterized by undulating terrain with a significant presence of hillocks and rocky formations. The topography contributes to high surface runoff, which limits water retention and affects groundwater recharge.

The climate of the region is semi-arid, with an average annual rainfall of around 645 mm (Central Ground Water Board, 2020–21). Rainfall is largely seasonal and concentrated during the monsoon months, leading to water scarcity during the rest of the year. Variability in rainfall further increases the vulnerability of agriculture and livelihoods in the region. The soil in the Alsigarh watershed is predominantly clayey loam with rocky patches, which makes it prone to erosion and reduces its capacity to retain moisture. These conditions affect agricultural productivity and limit the scope for multiple cropping without adequate irrigation support.

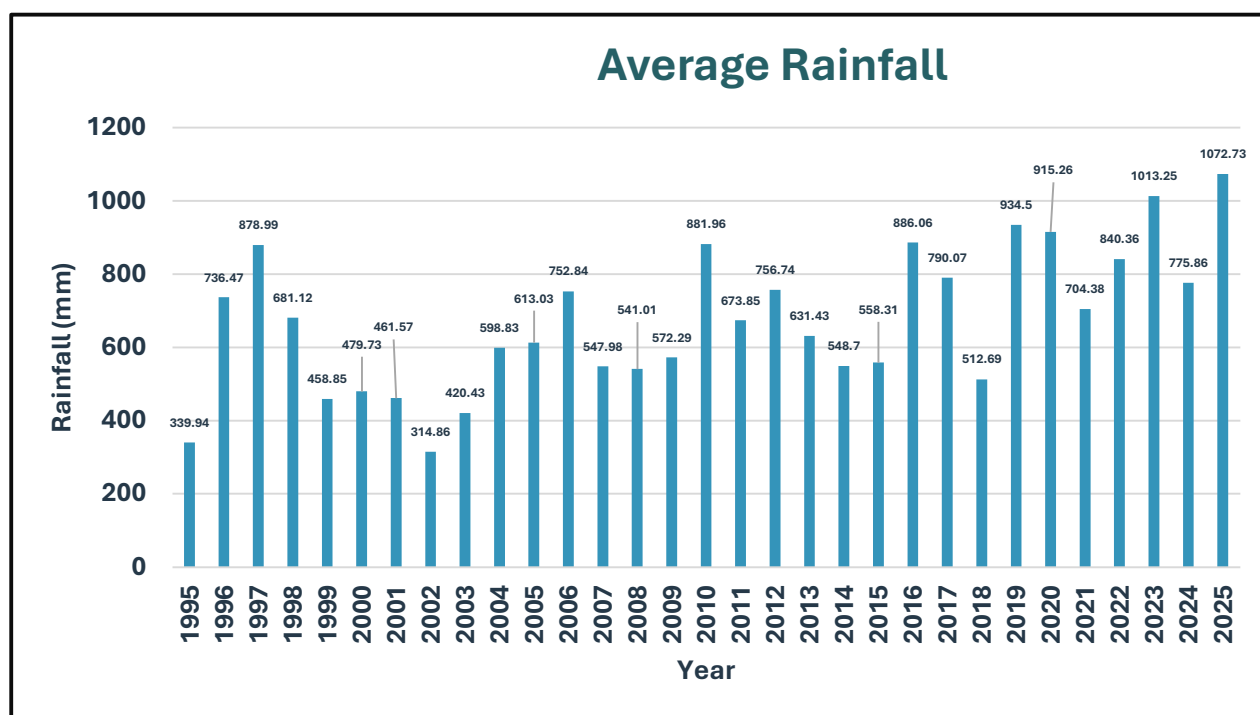
Figure 3 Toposheet of Project Area

**Toposheet (45H/6,7,10,11) Map, Water Economic Zone Alsigarh,
Block Girwa, Udaipur, Rajasthan**



Rainfall Patter

The rainfall analysis for the Alsigarh watershed reveals a long-term annual average of approximately 674mm, with nearly 90% of this precipitation concentrated between July and September. The region is characterized by high temporal variability, often experiencing intense bursts where as much as 85 mm can fall in a single day, leading to rapid surface runoff across the hilly Aravalli terrain. Due to a coefficient of variation of roughly 36%, the area is prone to localized droughts despite these annual totals, making the timing of the rain as critical as the volume. Hydrologically, the "ridge-to-valley" topography naturally yields high discharge, but managed infiltration now captures a significant portion of this monsoon surge. This stored moisture recharges the local phyllite and schist aquifers, raising the water table by 10–20 meters on average. Consequently, the captured rainfall sustains agricultural activities throughout the dry Rabi season, transitioning the landscape from monsoon-dependent subsistence to a more resilient multi-crop system. The high sediment load associated with these intense rains, however, remains a technical challenge, requiring consistent monitoring of drainage channels to maintain



overall watershed efficiency.

Graph 1 Rainfall Pattern of Project Area (Source: IMD)

Table 2 Rainfall data of Alsigarh Block

YEAR	Rainfall	YEAR	Rainfall
1995	339.94	2014	548.7
1996	736.47	2015	558.31
1997	878.99	2016	886.06
1998	681.12	2017	790.07
1999	458.85	2018	512.69
2000	479.73	2019	934.5
2001	461.57	2020	915.26
2002	314.86	2021	704.38
2003	420.43	2022	840.36
2004	598.83	2023	1013.25
2005	613.03	2024	775.86
2006	752.84	2025	1072.73
2007	547.98	Average	674
2008	541.01		
2009	572.29		
2010	881.96		
2011	673.85		
2012	756.74		
2013	631.43		

Water resources in the region are primarily dependent on groundwater sources such as open wells and borewells, along with seasonal surface water bodies like ponds and nadis. However, due to limited recharge and increasing demand, groundwater levels fluctuate significantly, particularly during the summer months.

The socio-economic profile of the region indicates a predominance of tribal communities, with most households belonging to small and marginal farmer categories. Landholdings are generally small, averaging around 3 to 4 bigha per household (Census of India, 2011). Agriculture is largely subsistence-based, with limited marketable surplus (Ministry of Agriculture & Farmers Welfare, Government of India). Livelihoods are supplemented by livestock rearing and seasonal migration, particularly during periods of low agricultural activity. Given these conditions, the region is highly suited for watershed-based interventions aimed at improving water availability, enhancing agricultural productivity, and strengthening livelihood resilience.

Methodology Followed

The study employs a mixed-methodology approach for data collection, integrating both qualitative and quantitative aspects to ensure a comprehensive impact assessment. The study framework was structured to assess performance across key dimensions such as relevance, effectiveness, efficiency, impact, and sustainability.

Quantitative Information is gathered through structured surveys, providing measurable insights into changes in project outcome indicators such as water availability, cropping patterns, productivity, and income.

Qualitative Information is obtained through focus group discussions (FGDs) with farmers and NGO representatives to capture lived experiences and contextual understanding.

Sampling Criteria

A stratified and beneficiary-proportionate sampling approach was adopted to ensure representation across different intervention categories and beneficiary groups. The sampling design focused on households that had directly or indirectly benefited from various project interventions, including water harvesting structures, soil and water conservation works, water management systems, and livelihood enhancement activities.

Households were selected from different villages within the watershed to capture variations in intervention intensity and geographic conditions. Care was taken to include households from different socio-economic backgrounds and landholding categories to ensure a balanced representation of beneficiaries.

Further, Hydrogeological Verification was undertaken for the 35 selected structures which included Satellite imagery, Hydrogeological analysis, Rainfall trends, google Earth Pro for storage capacity estimates, Physical site visits, and GIS mapping of lineaments and recharge zones.

Table 3 Sample Size for Hydrogeological study

S. No.	Village	Anicut	Repairing Structure	Nadi	Well	Veri	Total
1	Alsigarh	1		2	1		4
2	Bacchar	2	1		2		5
3	Dodawali	3	1	3			7
4	Karnali		1				1
5	Keli	1	1		1		3
6	Lamba Dhavda				3		3
7	Madri			1			1
8	Pai	1	2		1	1	5
9	Pipalwas				1		1
10	Ramwas			2	1		3
11	Surana		2				2
12	Total	8	8	8	10	1	35

Table 4 Sample Size for qualitative and quantitative study

S. No.	Tool	No. of Villages	Number
1	Structured Questionnaire	11 villages	200
2	FGD		11
3	KII		5

Household selection was carried out in a manner that included both direct and indirect beneficiaries. Typically, 4 to 5 households associated with each selected structure were included in the sample to capture the impact of interventions at the user level.



Figure 4 :Takra Anicut



Figure 5: Amloi Anicut



Figure 6 : Well 5 in Bacchar



Figure 7 : Well 2 in Bacchar

Table 5 Village Wise Structures

Village Name	Total Number of Structures Selected	Anicut	Repairing Structure	Earthen Nadi	Desiltation Work	Well
Alsigarh	4	2	0	1	0	1
Bacchar	5	2	1	0	0	2
Dodawali	7	2	1	3	1	0
Karnali	1	0	1	0	0	0
Keli	3	1	1	0	0	1
Lamba Dhavda Dodawali	3	0	0	0	0	3
Madri	1	0	1	0	0	0
Pai	5	2	1	0	0	2
Pilawas	1	0	0	0	0	1
Ramwas	3	0	0	2	0	1
Surana	2	0	2	0	0	0
Total	35	9	8	6	1	11

Key Thematic Areas and Areas of Inquiry

The assessment framework was designed to evaluate the project across multiple thematic domains reflecting its integrated nature. Key parameters included water security, agricultural productivity, livelihood enhancement, natural resource management, institutional strengthening, and environmental sustainability.

Table 6 Assessment Parameters

Assessment Area	Parameters
Physical Verification of WH Structures	Location Accuracy Photo Documentation Structure Strength & Condition Storage Capacity Vs. Designed Capacity
Direct Impact of WH Structures	Change in Water Table Access of Water for Irrigation Well Recharging Access to irrigation water across seasons Expansion of irrigated area Reliability of water sources Reduction in dependency on rain-fed agriculture
Soil & Water Conservation Impact	Improvement in soil moisture retention Reduction in soil erosion and runoff Impact on land productivity
Agricultural Impact	Changes in cropping pattern and intensity Area brought under cultivation (including conversion of fallow land) Adoption of improved agricultural practices Crop diversification (millets, vegetables, horticulture, floriculture) Changes in crop productivity
Socio- Economic Impact	Adoption and Impact of Micro Irrigation practices Area brought under cultivation (Waste land to arable land) Adoption of crop diversification Rise in income and nutritional benefits at HH level due to WADI and Nutri-wadi interventions Crop Productivity and change in income Income enhancement and its impact Change in migration patterns Community satisfaction Changes in water use efficiency Reduction in irrigation cost and effort
Community Ownership & Institutional Sustainability	Community participation in planning and implementation Functioning of village-level institutions (Water User Groups, Committees) Ownership and maintenance of assets\ Contribution by community towards sustainability

This structured approach ensures a holistic evaluation of project outcomes, identifying strengths, challenges, and areas for further improvement.



3. Findings

Key Findings / Physical Verification of SWC Structures

Physical verification of the 35 structures in the Alsigarh Water Economic Zone (Block Girwa, Udaipur) confirms that the infrastructure has been executed to high engineering standards, specifically tailored to the rugged Aravalli terrain. The verification process focuses on structural integrity, hydraulic efficiency, and the functional status of both new and restored assets.



Figure 8 Physical Verification of Structure



Figure 9 Physical Verification of Anicuts

- **Design:** Each structure has been designed by qualified technical experts following standard specifications commonly used for watershed structures.
- **Hydrological Assumptions and Design Parameters:** The hydrological analysis of the study area is based on standard watershed modelling approaches and region-specific parameters. The key assumptions and adopted values used for runoff estimation and water resource planning are presented in Table

Component	Parameter / Assumption	Value Adopted	Reference / Source
Hydrological Method	Runoff Estimation Approach	SCS-CN Method	USDA Soil Conservation Service; ICAR Guidelines
Rainfall	Average Annual Rainfall	~650 mm	IMD; MPUAT Udaipur Studies
Runoff Coefficient	Semi-arid / Mixed Terrain	0.30 – 0.40	ICAR Watershed Studies; NIH India
Runoff Generation	% of Rainfall	~25% – 40%	SWAT / ICAR Studies
Catchment-Storage Ratio	Design Consideration	3:1 to 5:1	Standard Watershed Practices
Filling Frequency	Annual Filling Cycles	3 – 4 times	Watershed Literature (P.K. Singh)
Rainfall Pattern	Storm Characteristics	High-intensity, short-duration	IMD; Regional Studies
Evaporation Loss	Annual Evaporation	~1800 mm	Central Water Commission
Seepage Loss	Storage Loss Factor	15% – 25%	ICAR Field Studies

- **Storage Capacity:** The storage capacity for the Alsigarh project area is defined by a strategic mix of 24 specialized structures that collectively provide 407126 cubic meters and 11 well provide 6764 cubic meters of water retention. This capacity is anchored by high-volume masonry interventions, most notably the Bhatada Vala Repairing Anicut, which alone contributes 126,126 Cum, and the Umbiya Wali Dari Nadi at 37,623.10 Cum. The structural diversity includes 8 Anicuts, 8 Repairing Structures, 8 Earthen Nadis, and 11 Wells, ensuring that water is not only stored on the surface but also funneled directly into the aquifer. Large-scale masonry works like the Amloi Mata Wala and Takra Anicuts provide the bulk of the "ridge-to-valley" storage, effectively arresting high-velocity monsoon runoff. Meanwhile, traditional earthen embankments and "low-cost sandwich" structures manage sediment and localized needs across

the hilly Aravalli terrain. Even the smallest units, such as the 11 recharge wells, play a vital role by converting surface storage into a sustained 10–20 meter rise in the local water table. This integrated 4.10 lakh cubic meter buffer has successfully transitioned the tribal community from rain-fed subsistence to a resilient, multi-crop agricultural economy. Ultimately, the emphasis on both new construction and massive repairing works ensures that the total storage volume remains efficient and structurally sound against the region's intense seasonal rainfall.

Table 7 Storage Capacity of the SWC Structures

Sno	Project	Name of Activity	Storage Capacity (in Cum)
1	WEZ - Alsigarh	Anicut-2-Dhorawala Anicut	5632
2	WEZ - Alsigarh	Anicut-8-Lavadariwala Anicut	2288
3	WEZ - Alsigarh	Repair of anicut for control seepage -veriwala	6000
4	WEZ - Alsigarh	Anicut-2-Madliyawala	5100
5	WEZ - Alsigarh	Umbya Wali Dari Nadi	37623
6	WEZ - Alsigarh	Pala Wala Nadi With Core Wall	11405
7	WEZ - Alsigarh	Amloi Mata Wala Anicut	26814
8	WEZ - Alsigarh	Takra Anicut	25519
9	WEZ - Alsigarh	Naal bachhar Repairing Anicut	14896
10	WEZ - Alsigarh	Bhatada vala Repairing Anicut	126126
11	WEZ - Alsigarh	Aamli Wala Anicut	2831
12	WEZ - Alsigarh	Mata Ji Wali Nadi With Repairing Core Wall	4499
13	WEZ - Alsigarh	School Ke Pass Repairing Anicut	4466
14	WEZ - Alsigarh	Futta Wali Nadi With Core Wall	6318
15	WEZ - Alsigarh	Khajur Wali Nadi	5040
16	WEZ - Alsigarh	Dhavda Wala Nera Anicut with Desiltation	34018
17	WEZ - Alsigarh	Earthen embankment (Nadi) with stone pitching 1	6336
18	WEZ - Alsigarh	Earthen embankment (Nadi) with stone pitching 3	7254
19	WEZ - Alsigarh	Jangela Talai Repairing work	26740

20	WEZ - Alsigarh	Mahadev Ji Jhar Wala Repairing Anicut	35720
21	WEZ - Alsigarh	Khajur Wala - Low Cost Sandwich Structure	1350
22	WEZ - Alsigarh	Mitti Mahudi - Low Cost Sandwich Structure	1296
23	WEZ - Alsigarh	Kumbatro Khaliya Repairing Anicut	6705
24	WEZ - Alsigarh	Kad Wali Nadi	3149
TOTAL			407126

Table 8 Storage Capacity of Wells

Sno	Project	Name of Activity	Storage Capacity (in Cum)
1	WEZ - Alsigarh	Kad Wali Nadi	3149
2	WEZ - Alsigarh	Well-11	193
3	WEZ - Alsigarh	Well-5	232
4	WEZ - Alsigarh	Well-2	395
5	WEZ - Alsigarh	Well-5	270
6	WEZ - Alsigarh	Well-2	611
7	WEZ - Alsigarh	Well-1	367
8	WEZ - Alsigarh	Well-2	350
9	WEZ - Alsigarh	Well-3	755
10	WEZ - Alsigarh	Veri-1	4
11	WEZ - Alsigarh	Well-7	314
	WEZ - Alsigarh	Well-8	124
TOTAL			6764

Impact of SWC Structures

Effect on Irrigation

The impact on irrigation in Alsigarh is defined by a shift from subsistence, rain-fed farming to a high-value, multi-crop economy, as the creation of 410741 cubic meters of storage capacity has stabilized the water supply. Before the project, only 10–15% of the cultivated land was irrigated, forcing farmers to rely almost entirely on the monsoon; however, the new infrastructure has expanded irrigation coverage significantly, raising the average water table by 10–20 meters. This increased groundwater availability has allowed for a 1.5x increase in cropping intensity, enabling a transition from single-crop maize to productive Rabi (winter) and Zaid (summer) cycles.

Impact of SWC Structures

The strategic deployment of these 35 units has transformed the local micro-hydrology by focusing on both new storage and the restoration of existing assets. The 8 masonry anicuts and 8 earthen nadis serve as the primary "speed breakers" for monsoon runoff, significantly reducing soil erosion in the steep Aravalli terrain. By slowing the water, these structures allow for deep infiltration, which directly feeds the 11 wells included in the project scope.

This integrated approach has led to a measurable rise in the water table, often cited between 10 to 20 meters in the immediate vicinity of the structures. For the local community, this means that the 11 wells, which may have previously run dry shortly after the monsoon, now provide a reliable water source for the Rabi (winter) season. This water security has enabled a shift from single-crop subsistence to the cultivation of high-value crops like wheat and mustard, and in some cases, specialized horticulture like strawberries.

Furthermore, the 8 repairing structures ensure that the impact is sustainable; by fixing older, leaking, or damaged dams, the project effectively "reclaims" storage capacity without the environmental footprint of entirely new construction. This lean but effective network of 35 structures has successfully converted a flash-flood prone landscape into a managed Water Economic Zone, significantly increasing the per-capita water availability for both irrigation and livestock.



Figure 10 Amloi Mata Wala Anicut (a) Jan 2019 (b) Dec 2023



Figure 11 Dhorwala Anicut (a) Jan 2017 (b) Feb 2022

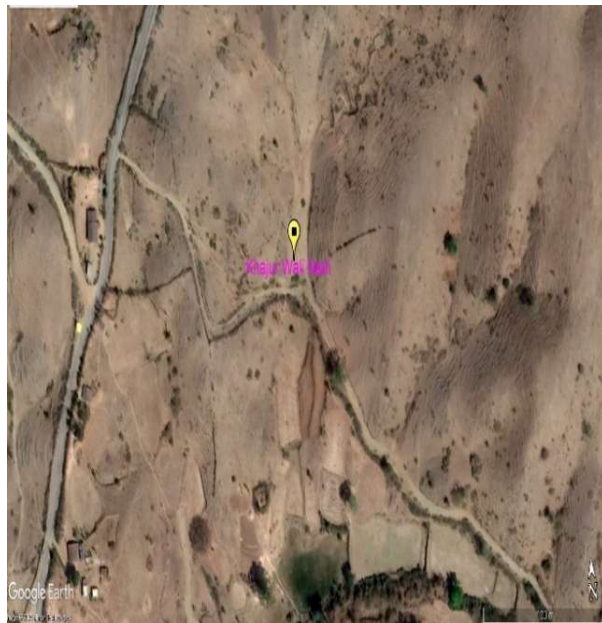


Figure 12 Khajur Wali Nadi (a) Mar 2022 (b) Dec 2023



Figure 13 Lavadariwala Anicut (a) Jan 2019 (b) Dec 2023



Figure 14 Mahadevi Ji Repairing Anicut (a) Jan 2019 (b) Dec 2023

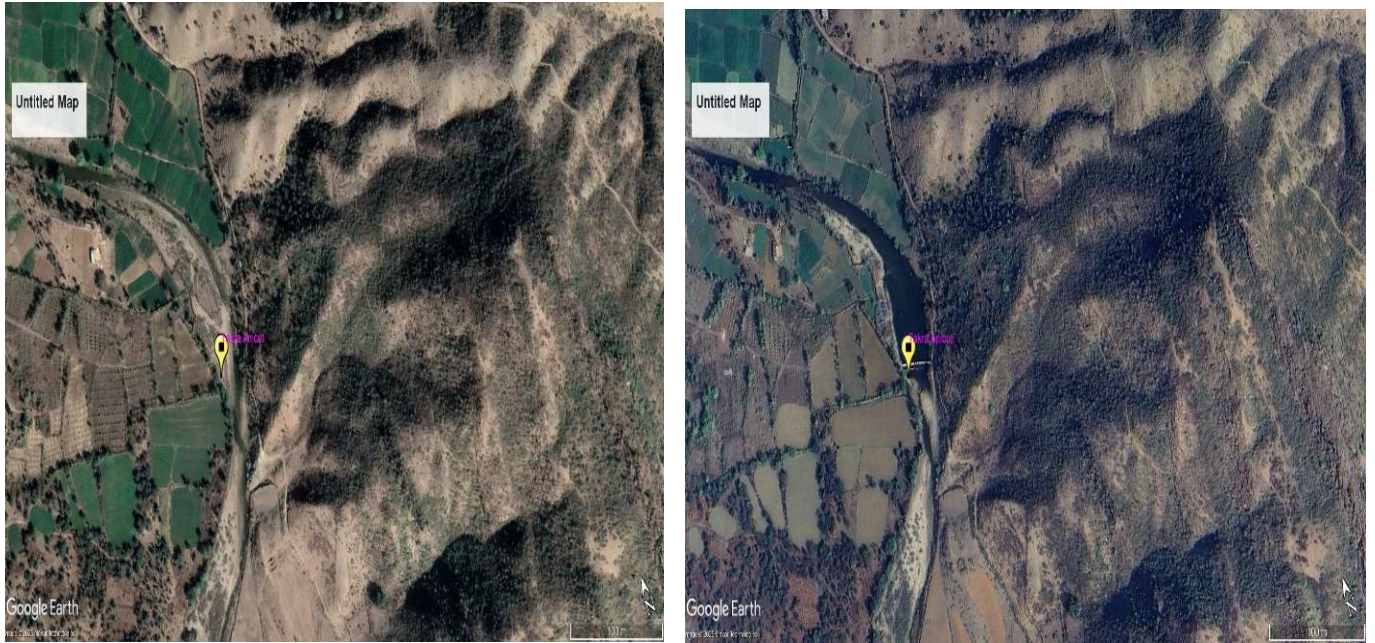


Figure 15 Takra Anicut (a) Jan 2020 (b) Dec 2023

Impact on LULC Change:

Figure 16 LULC Map of Project Area (Rabi Season – 02/01/2019)

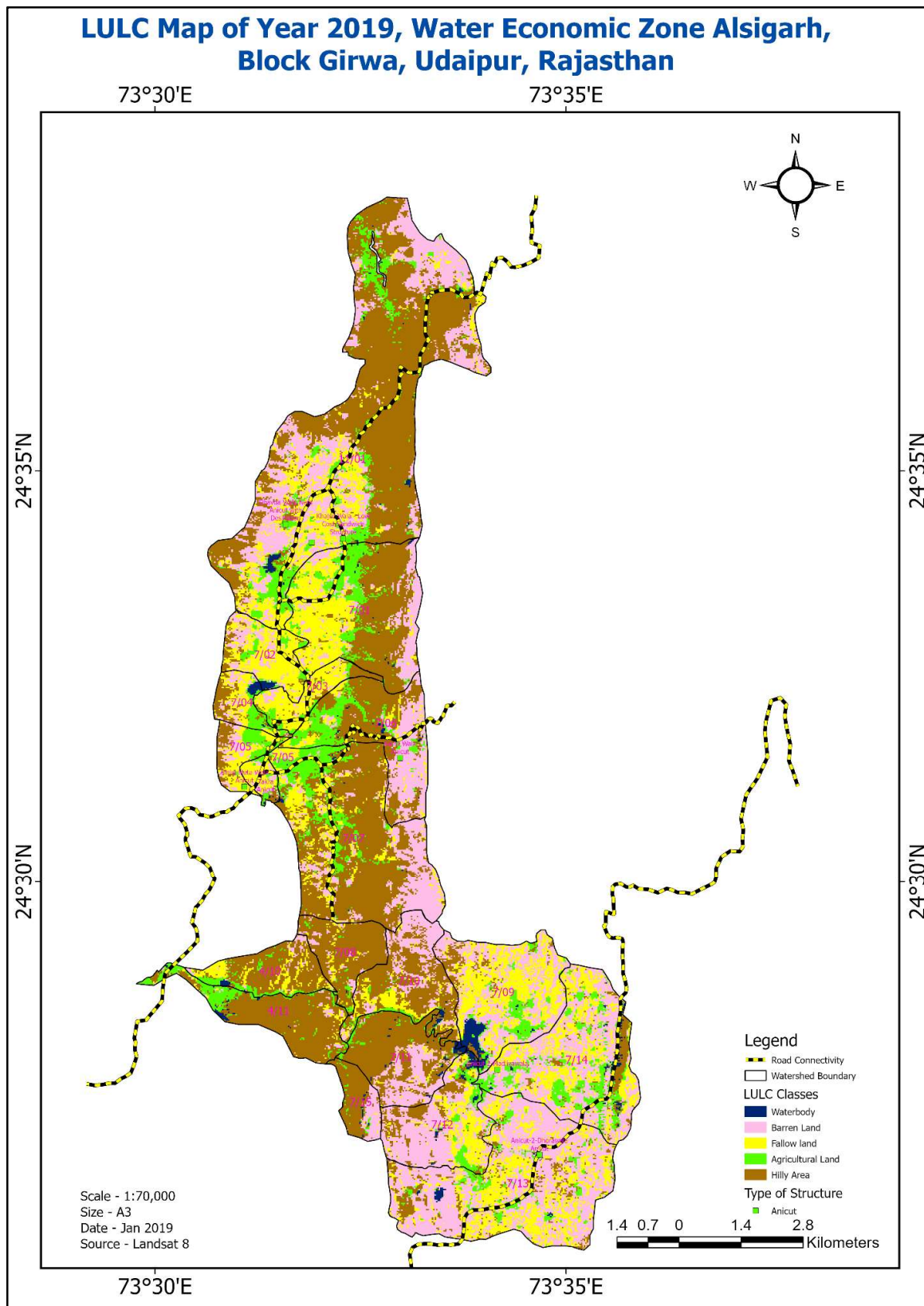
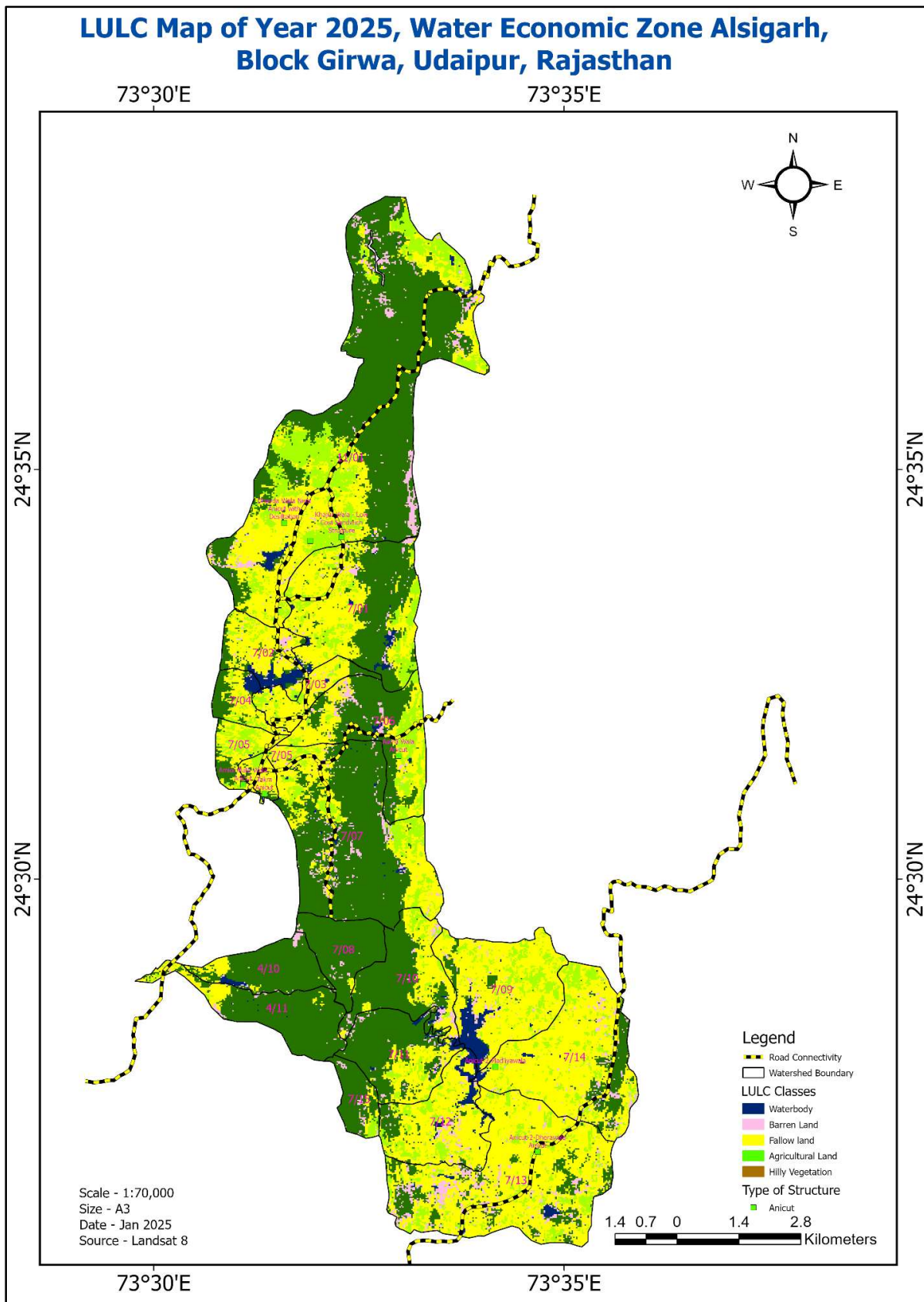
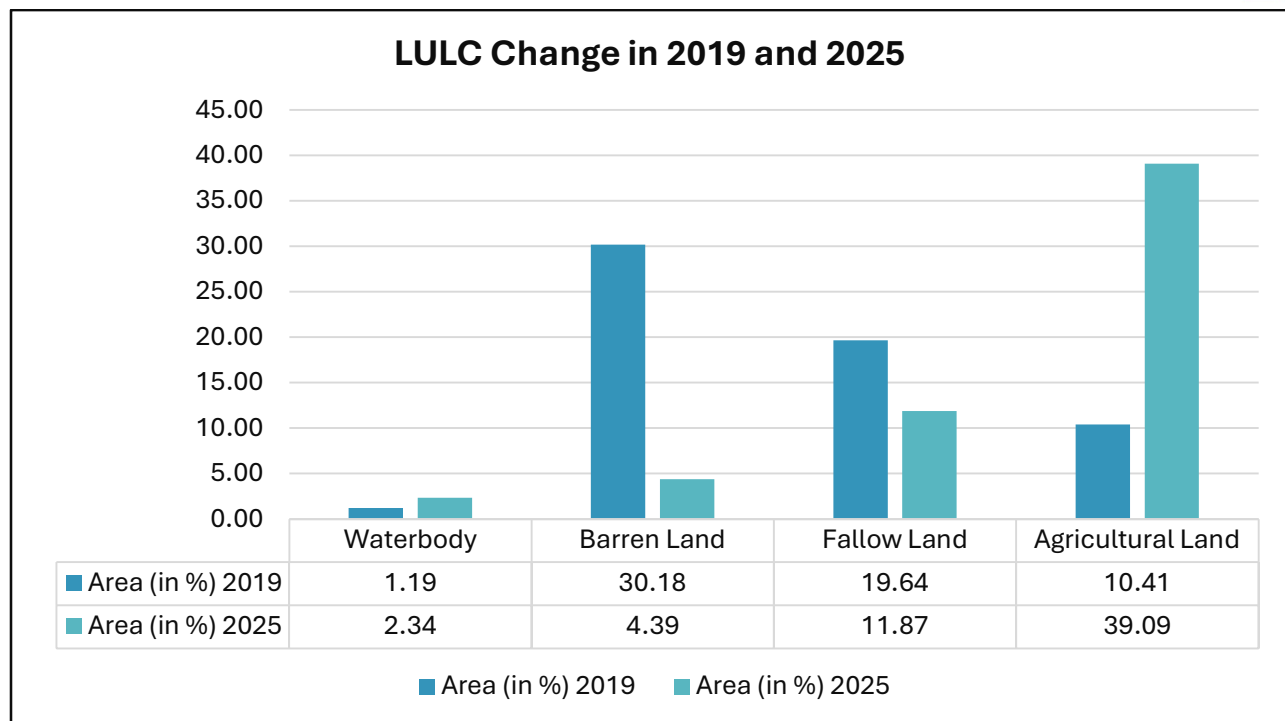


Figure 17 LULC Map of Project Area (Rabi Season – 02/01/2025)





Graph 2 LULC Changes

Table 9 LULC Table of 2019 and 2025

LULC Classes	Area (in %) 2019	Area (in %) 2025	Change in LULC
Waterbody	1.19	2.34	1.15
Barren Land	30.18	4.39	-25.79
Fallow Land	19.64	11.87	-7.77
Agricultural Land	10.41	39.09	28.68
Hills/Hilly Vegetation	38.58	42.32	3.73
Total	100	100	

1. Rapid Agricultural Expansion

From Underutilized to Productive

3.75x

Growth in Cultivation

Nearly fourfold increase in active agricultural land use.

Agricultural land use saw a massive 28.68 percentage point increase post-intervention.

There was a threefold percentage increase in Agricultural land use from 10.41% to 39.09%. This is the most dominant change in the dataset. This reflects the project's success in enhancing water availability and converting previously underutilized land into productive agricultural use. Improved water availability, enhanced soil moisture retention, and better irrigation access enabled farmers to bring previously underutilized land into cultivation and intensify agricultural activities.

- Impact: This suggests a major shift toward food production and rural development. The conversion of Barren Land (-25.79%) and Fallow Land (-7.77%) directly fuels this growth, indicating that previously unproductive areas are being brought under cultivation.
- Consequences: While beneficial for food security, such rapid expansion can lead to increased demand for irrigation, heavy use of fertilizers, and potential soil degradation if not managed sustainably.

2. Drastic Reduction in Barren and Fallow Land

Combined, these categories dropped by 33.56%.

- Impact: This indicates high land-utilization efficiency. It often suggests the implementation of better irrigation facilities or government land-reclamation schemes that have made "waste" land viable for other uses.

3. Growth in Vegetation and Waterbodies

Hilly vegetation saw a steady rise of 3.73%, and waterbodies nearly doubled in area (from 1.19% to 2.34%).

- Impact: The increase in waterbodies likely supports the agricultural boom noted above. The growth in hilly vegetation is a positive indicator of conservation efforts or natural reforestation, which helps in maintaining local biodiversity and carbon sequestration.

4. Environmental & Hydrological Implications

- Groundwater: With more land under agriculture and an increase in surface water, there is likely a higher rate of both water extraction (for crops) and potential recharge.
- Ecosystem Services: The shift from Barren Land to Agricultural and Hilly Vegetation improves the "green cover," which can help reduce soil erosion and manage local micro-climates.

Change in Vegetation Cover:

The comparison shows a clear transition from lower-density vegetation to high-density biomass across the watershed.

1. Shift in Vegetation Density

- 2019 Baseline: The area was dominated by Sparse Vegetation (light green), with significant patches of Barren Land (yellow) scattered throughout the central and southern clusters (specifically in sub-watersheds like 7/07, 7/09, and 7/14).
- 2025 Status: There is a massive conversion of sparse areas into Dense Vegetation (dark green). The dark green pixels now cover the majority of the northern and central blocks. The "Barren Land" patches have almost entirely disappeared or transitioned into "Sparse Vegetation."
- The range varies from 0.34 in 2019 and 0.49 in 2025. This indicates a noticeable increase in vegetation cover over the study period. The rising trend suggests improvement in biomass density and overall vegetation health. Such changes may be associated with better rainfall conditions, land management practices, or reduced land degradation in the region.

Figure 18 NDVI Map of Project area (02/01/2019)

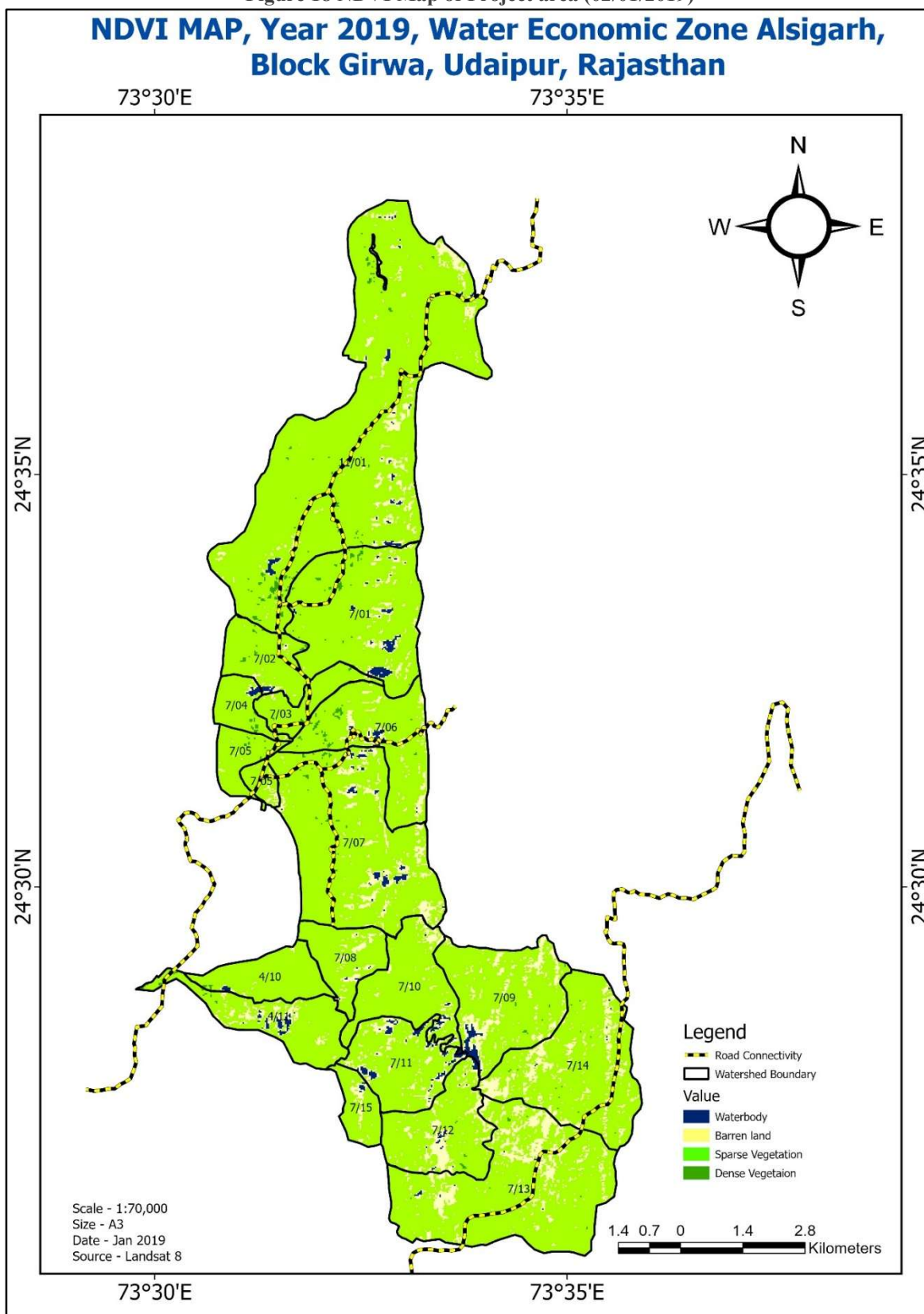
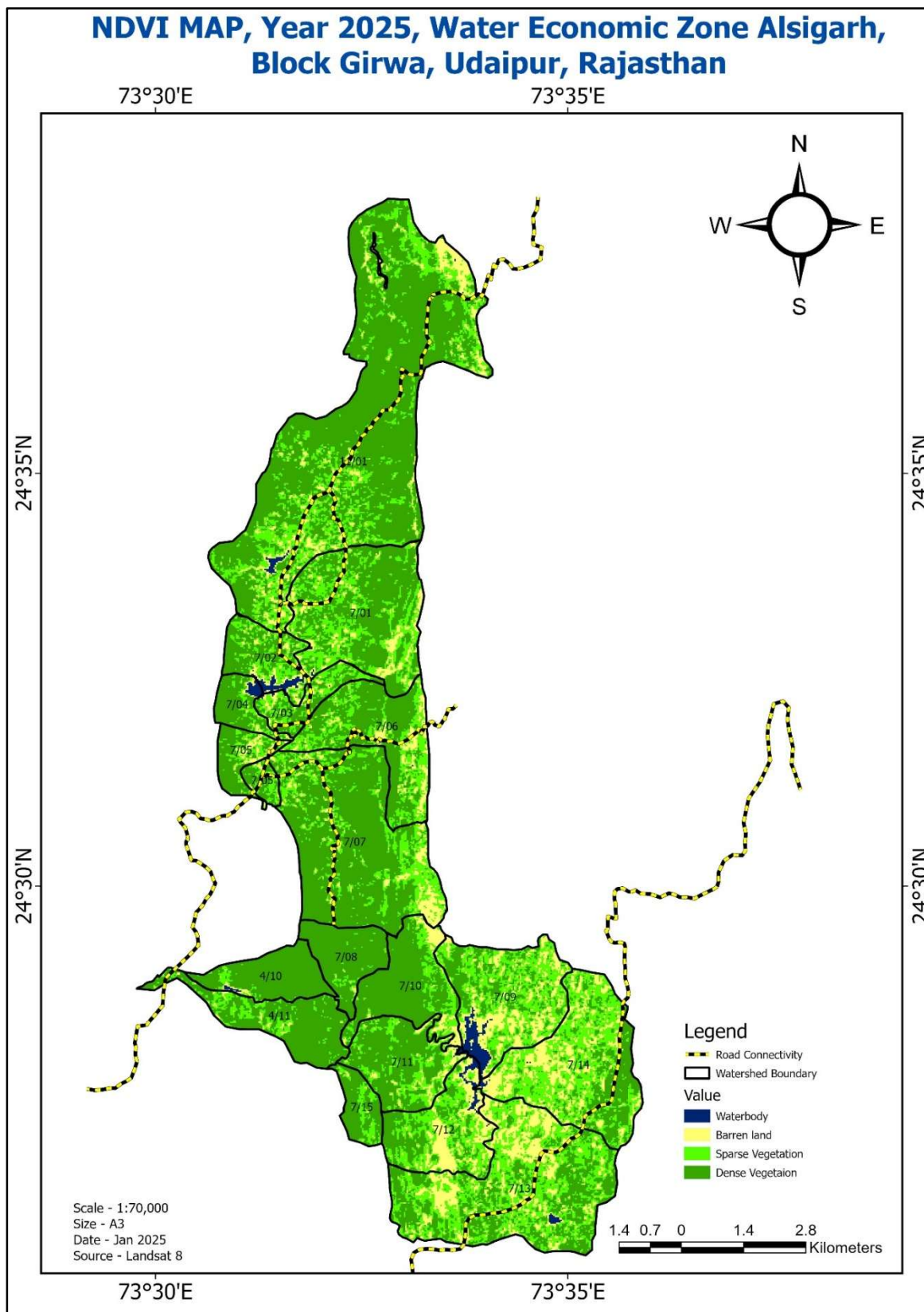


Figure 19 NDVI Map of Project Area (02/01/2025)



Change in Moisture Index:

Increase in Moisture Saturation

- **2019 Baseline:** The watershed exhibited widespread moisture stress. Large areas, particularly in the central (7/01, 7/07) and southern (7/12, 7/15) sub-watersheds, appear in light blue to white, indicating dry soil and water-stressed vegetation.
- **2025 Status:** There is a dominant shift toward deep blue shades across almost the entire zone. This represents a significantly higher moisture retention capacity in both the soil and the plant canopy during the month of January.

The disappearance of the "light/white" patches (low moisture) indicates that the area is much more resilient to dry spells than it was in 2019. The soil likely holds more residual moisture from the monsoon, supporting healthier *Rabi* crops and natural hilly vegetation.

Table 10 Change in Moisture Index

Feature	2019 Observation	2025 Observation	Hydrological Inference
Max NDMI Value	~0.179	~0.197	Higher peak moisture capacity.
Visual Density	Patchy/Lighter Blue	Uniform/Deep Blue	Uniform water distribution.
Water Stress	Moderate to High	Very Low	Healthy plant turgidity.

Figure 20 NDMI Map of Project Area (02/01/2019)

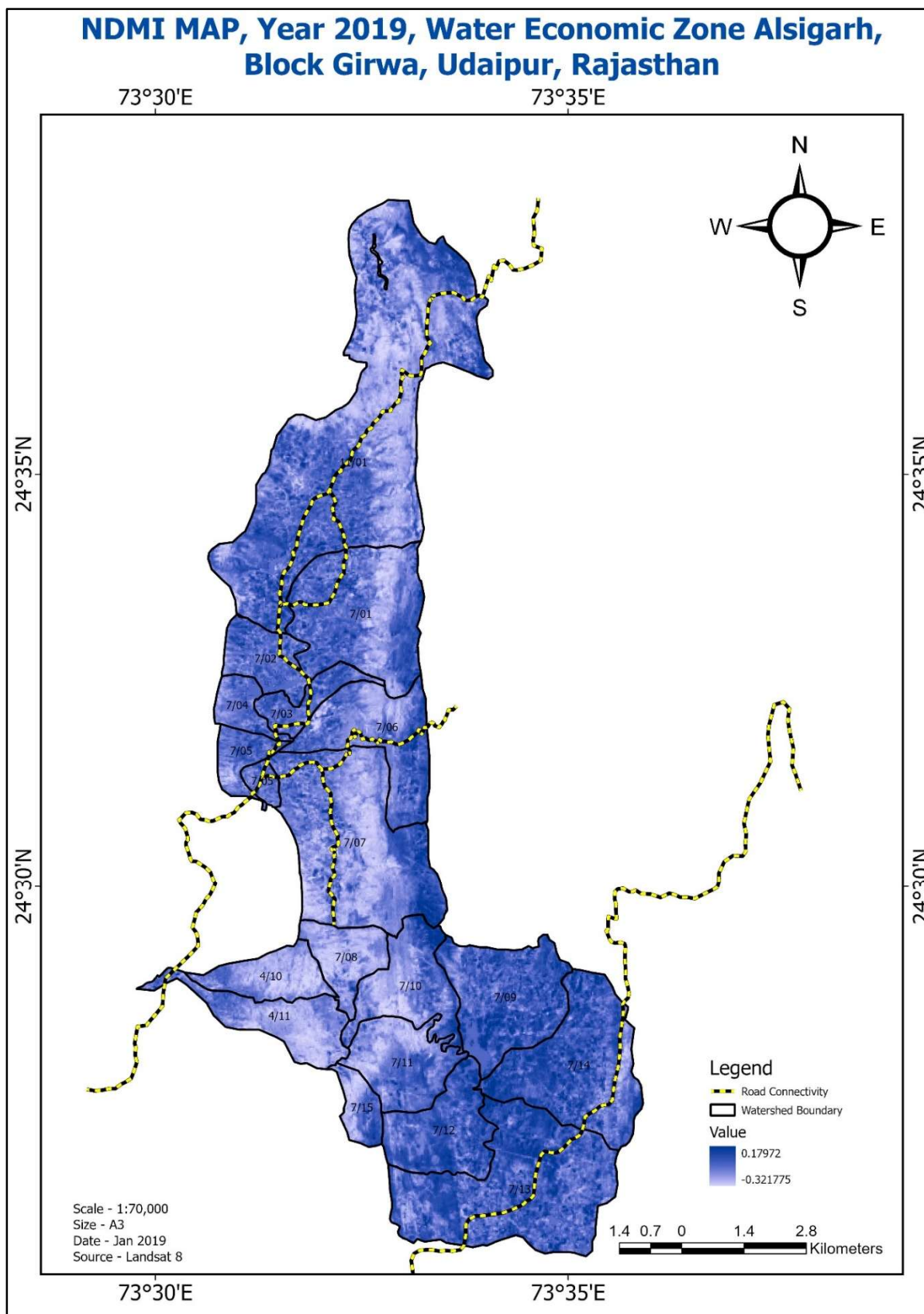
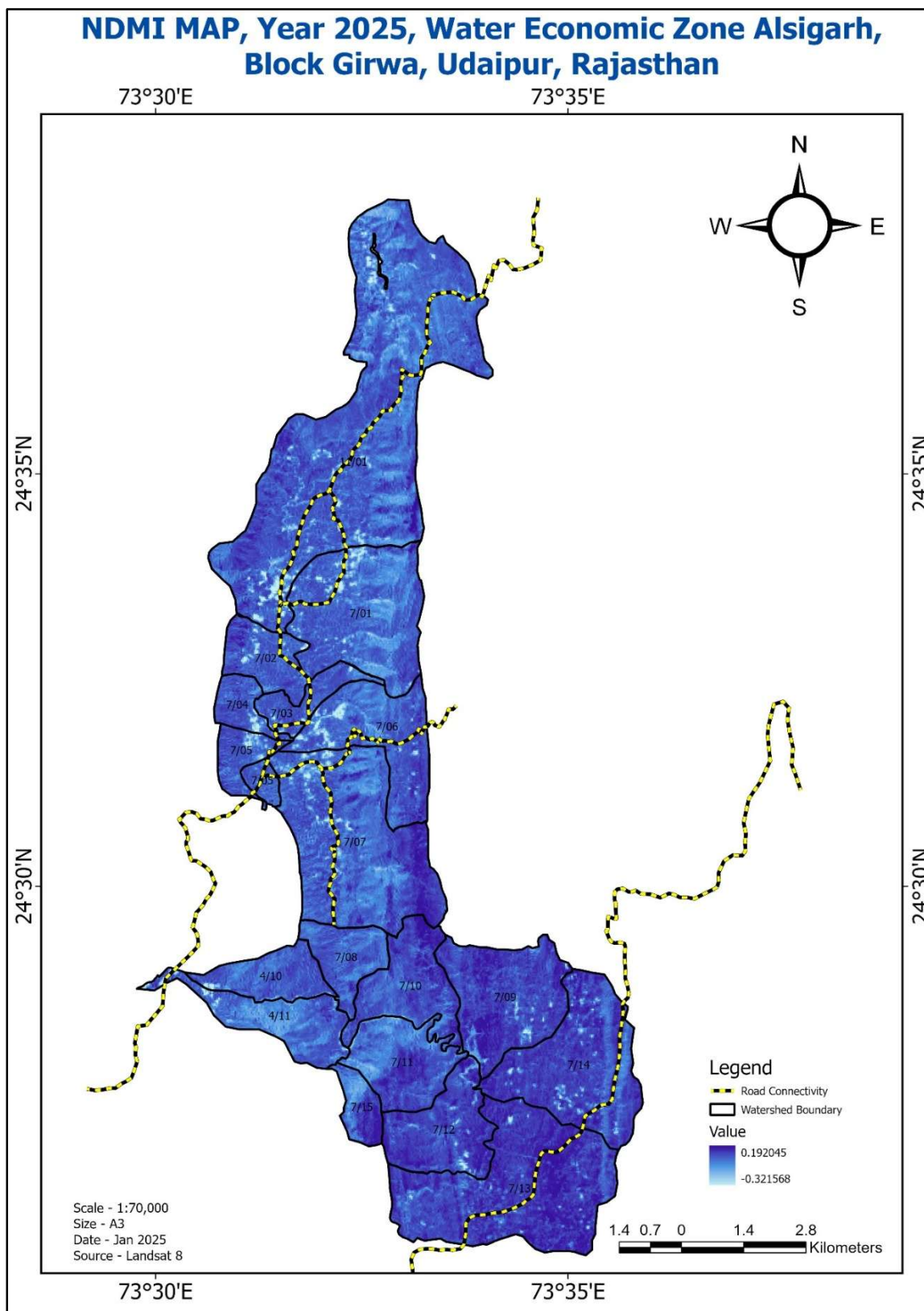


Figure 21 NDMI Map of Project Area (02/01/2025)

1.



Change in Storage Capacity:

Siltation is a major factor affecting the efficiency of water harvesting structures in the study area. Timely and periodic desiltation, along with proper catchment treatment, is essential to ensure long-term sustainability and optimal performance of the structures.

In semi-arid watershed regions such as Alsigarh, siltation of water harvesting structures is a common phenomenon due to soil erosion and runoff from the catchment area. Based on field observations and standard watershed behavior, the average annual siltation rate is estimated to be in the range of 5 cm to 10 cm per year. Accordingly, over a period of 4–5 years, the cumulative silt deposition in structures is likely to be around 0.20 m to 0.50 m (20 cm to 50 cm).

Siltation is a natural and expected phenomenon in semi-arid watershed regions such as Alsigarh, where intense monsoon rainfall generates high sediment loads. While silt deposition gradually reduces the effective storage volume of water harvesting structures over time, it is important to note that all existing structures under the WEZ project are currently in good functional condition, and no immediate desilting intervention is required at this stage.

Key Findings / Assessment Area

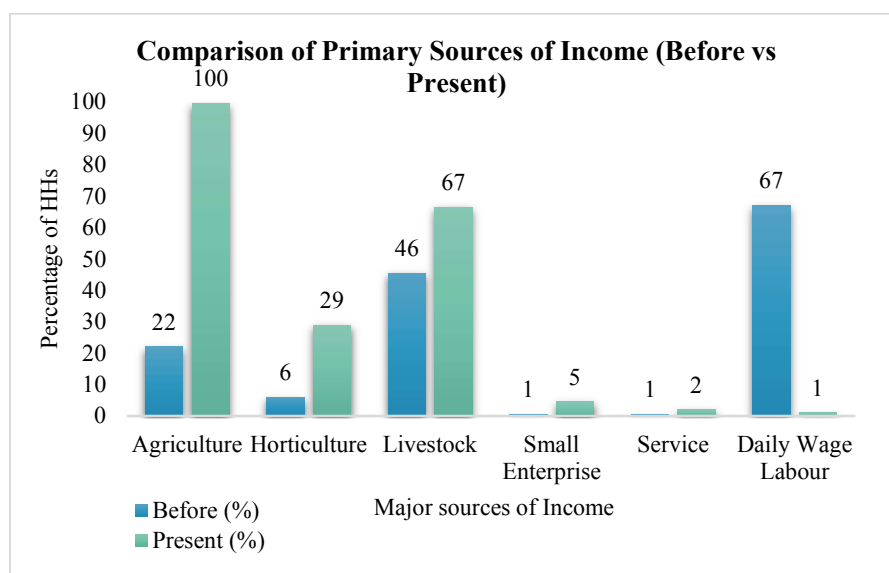
The findings of the study are presented across key thematic areas corresponding to the major components of the project. The analysis is based on quantitative household survey data, supported by qualitative insights from field interactions. The section captures changes observed across water availability, agriculture, livelihoods, and socio-economic conditions in the Alsigarh watershed.

5.1 Socio-Economic Profile of Households

Table 11 Type of Ration Card

Category	Frequency (n)	Percentage (%)
AAY	12	6.0
BPL	86	43.0
APL	102	51.0
Total	200	100.0

The distribution indicates that nearly half of the households belong to economically weaker sections (BPL and AAY), highlighting the project's outreach among vulnerable populations.



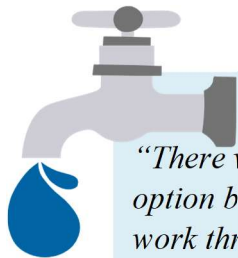
Graph 3 Primary Source of Income - Pre Vs Post
(*Multiple responses possible)

The WEZ model is designed to convert water-scarce, rain-dependent regions into economically productive zones by enhancing water availability, improving resource use efficiency, and promoting diversified livelihoods.

The findings clearly demonstrate that improved water security has acted as a foundational driver of economic transformation in the Alsigarh watershed. The sharp increase in households engaged in agriculture (from 22% to 99.5%) indicates that access to reliable water sources has restored agriculture as a viable and primary livelihood option. This transition is a direct outcome of watershed interventions that have improved groundwater recharge, irrigation access, and soil moisture.

Furthermore, the expansion of horticulture and livestock activities reflects the second-generation impacts of WEZ, where households move beyond subsistence farming towards diversified and income-generating activities. These shifts are critical indicators of economic intensification within the zone, as they enhance income stability and reduce vulnerability to climatic shocks.

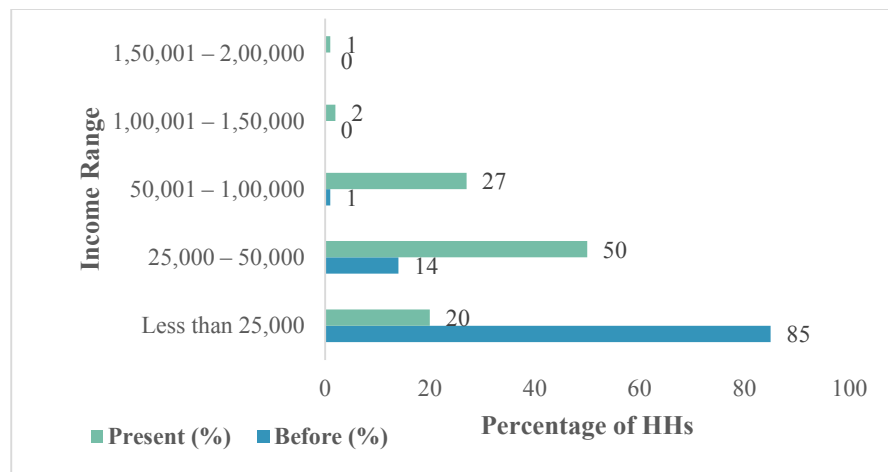
Equally significant is the drastic decline in dependence on daily wage labour (from 67% to 1%), which highlights a reduction in distress-driven livelihoods and migration. This aligns with the WEZ objective of creating localized, sustainable economic opportunities that reduce reliance on external labour markets.



“There was a time when our fields stayed empty for most of the year, and we had no option but to go outside the village for labour work. Today, the same land is giving us work throughout the year, and we are able to stay back with our families.”

— Farmer, Bacchar Village

Overall, the transformation observed in income sources illustrates the successful operationalization of the WEZ concept, where improved water availability has triggered a cascading effect on agriculture, livelihoods, and economic resilience, ultimately contributing to the creation of a self-sustaining rural economy.



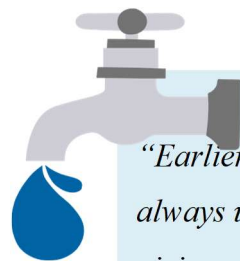
Graph 4 Annual Agricultural Income- Pre vs Post

N=200

The comparative analysis of annual agricultural income reveals a significant improvement in the economic condition of households following the implementation of the project. Prior to the intervention, a large majority of households (85%) were earning less than ₹25,000 annually from agriculture, indicating low productivity and limited income-generating capacity of farming activities.

In contrast, the present scenario shows a substantial reduction in this low-income category to 20%, accompanied by a marked increase in households earning between ₹25,000–₹50,000 (50%) and ₹50,000–₹1,00,000 (27%). Additionally, a small but notable proportion of households has now entered higher income brackets exceeding ₹1,00,000, which was nearly absent before the project.

This upward shift in income distribution suggests that improved water availability, expansion of irrigated area, and adoption of better agricultural practices have collectively enhanced farm productivity and income levels. The transition also reflects increased cropping intensity, diversification into higher-value crops, and improved utilization of land resources.



“Earlier, whatever we produced was just enough to feed the family, and there was always uncertainty about income. Now, farming is not only meeting our needs but also giving us some savings, which was not possible before.”

— Farmer, Dodawali Village

The findings indicate that the project has contributed significantly to strengthening the economic resilience of households, reducing vulnerability, and enabling a transition from subsistence-level agriculture to more income-oriented farming systems.

While the upward shift in agricultural income provides a primary measure of economic enhancement, a more complete picture of household-level improvement emerges when complementary indicators of economic well-being are considered.

Table 12 Complementary Indicators of Household Economic Improvement

INDICATORS	PRE	POST
Households with distress migration	69%	3%
Primary livelihood: agriculture	22%	99.5%
Primary livelihood: daily wage labour	67%	1%
HHs selling vegetables (supplementary income)	NA	18% (avg. ₹4,500/week)
HHs with floriculture income (median)	NA	₹10,000/year (12 HHs)

Together, these indicators confirm that the income enhancement observed under the WEZ project is not limited to agricultural income alone but reflects a broader transformation of household economic well-being encompassing diversified income sources, elimination of distress-driven livelihoods, improved food security, and enhanced capacity for expenditure on education and household development. This multi-dimensional improvement is the clearest evidence of the project's long-term developmental impact.

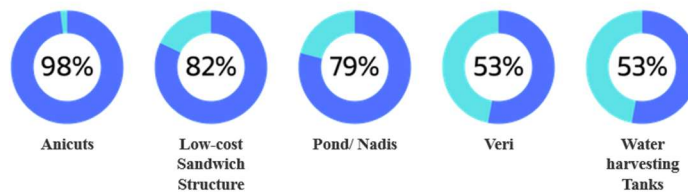
5.2 Effectiveness of WATER HARVESTING & RECHARGE STRUCTURES



Universal Awareness

100% households are aware of water harvesting structures

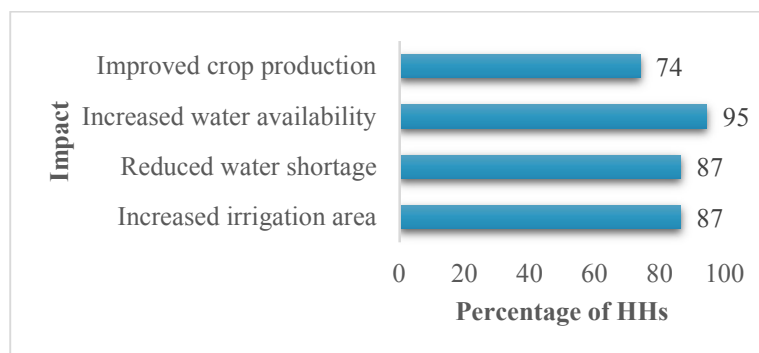
Access to structures



(*Multiple responses possible)

The findings clearly demonstrate that the Water Harvesting Structures created under the project have had a widespread and transformative impact on water security and agricultural systems in the study area. The universal awareness (100%) of these structures reflects strong community engagement and effective dissemination of project interventions.

The high availability of key structures such as anicuts (98.5%), sandwich structures (82.5%), and ponds/nadis (79%) indicates extensive physical coverage across the watershed. This widespread infrastructure has played a crucial role in enhancing water retention and recharge capacities within the region.



Graph 5 Impact of Water harvesting & Recharging structures
(*Multiple responses possible)

A vast majority of households reported increased water availability (94.5%), expansion in irrigation area (86.5%), and reduction in water shortages (86.5%). These improvements have directly contributed to better agricultural outcomes, with 74% of households observing enhanced crop production.

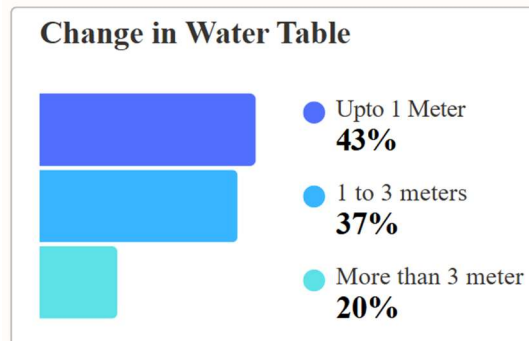
The findings indicate a universal improvement in groundwater levels across the study area, with **100% of households reporting a positive change in the water table**. This reflects the widespread effectiveness of the water harvesting and recharge interventions implemented under the project.



“We used to depend completely on rainfall, and every year we worried whether there would be enough water. Now, even in summer, we see water in our wells, which gives us a sense of security.”

— Farmer, Pai Village

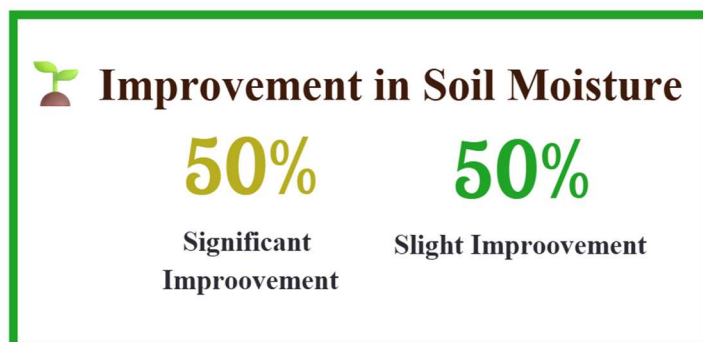
In terms of the extent of change, a significant proportion of households (43%) reported an increase in the water table of up to 1 meter, while 37% observed a rise between 1 to 3 meters. Notably, nearly one-fifth of households (20%) experienced a substantial increase of more than 3 meters, indicating strong localized recharge effects in certain areas.



The distribution of responses suggests that while moderate improvements are widespread across the watershed, deeper recharge impacts are also evident, likely influenced by the proximity to structures, geological conditions, and intensity of interventions.

Graph 6 Change in water table (N=200)

Overall, the consistent increase in groundwater levels highlights the success of the project in enhancing aquifer recharge and strengthening water security. This improvement serves as a critical foundation for sustained agricultural productivity, increased irrigation potential, and long-term resilience of farming systems in the region.



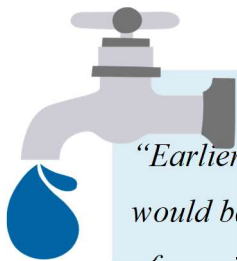
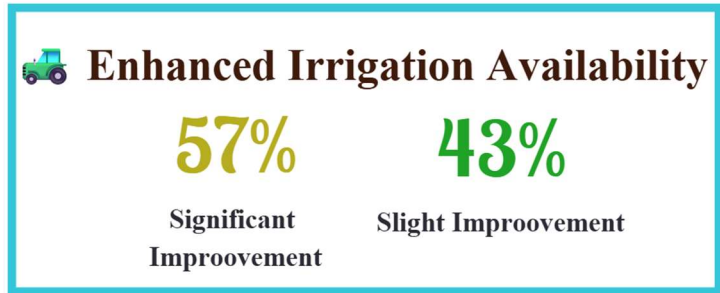
The findings indicate that the project has led to universal improvements in both soil moisture and irrigation water availability across all surveyed households. With 100% of households reporting enhanced soil moisture almost equally divided between

significant (50%) and slight improvements (50%) it is evident that the interventions have effectively improved the water retention capacity of agricultural land.

Improved soil moisture plays a critical role in enhancing crop growth, reducing dependency on frequent irrigation, and increasing resilience to dry spells. The balanced distribution between significant and moderate improvements suggests that while the benefits are widespread, the degree

of impact varies depending on factors such as proximity to water structures, soil type, and land characteristics.

Similarly, all households reported improved irrigation water availability, with a majority (57%) experiencing significant improvements. This reflects enhanced access to water for farming activities, enabling better crop planning, increased cropping intensity, and the possibility of cultivating additional seasons.



“Earlier, we used to hesitate before sowing crops because we were not sure if water would be available later. Now, we can plan our crops with confidence and even think of growing an extra season.”

— Farmer, Surana Village

“Earlier, the soil would dry very quickly, and crops would suffer if irrigation was delayed. Now, the land retains moisture for longer, and crops remain healthy even during dry periods.”

— Farmer, Alsigarh Village

Overall, the combined improvement in soil moisture and irrigation availability demonstrates that the watershed interventions have strengthened the agricultural base of the region, contributing to more reliable and productive farming systems.

5.4 Community Participation and Institutional Sustainability



The findings indicate a strong level of community participation and institutional engagement in the management of water resources. A large majority of households (84%) are members of Water User Groups, and 82% have actively participated in meetings, reflecting effective community mobilization and strengthening of local governance structures.

This high level of engagement suggests that the project has successfully promoted participatory approaches and fostered a sense

of ownership among beneficiaries, which is essential for long-term sustainability.

The findings indicate that 44.5% of households reported that issues or damages had occurred in the water harvesting structures associated with them. However, these issues were largely identified in a timely manner and addressed collectively through the efforts of Water User Groups, local community committees formed by beneficiaries, and the implementing NGO.

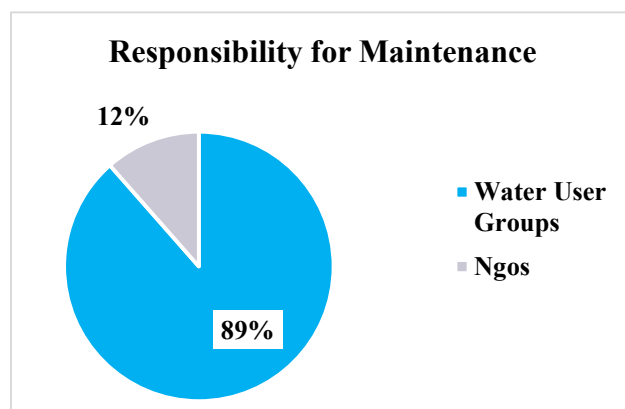


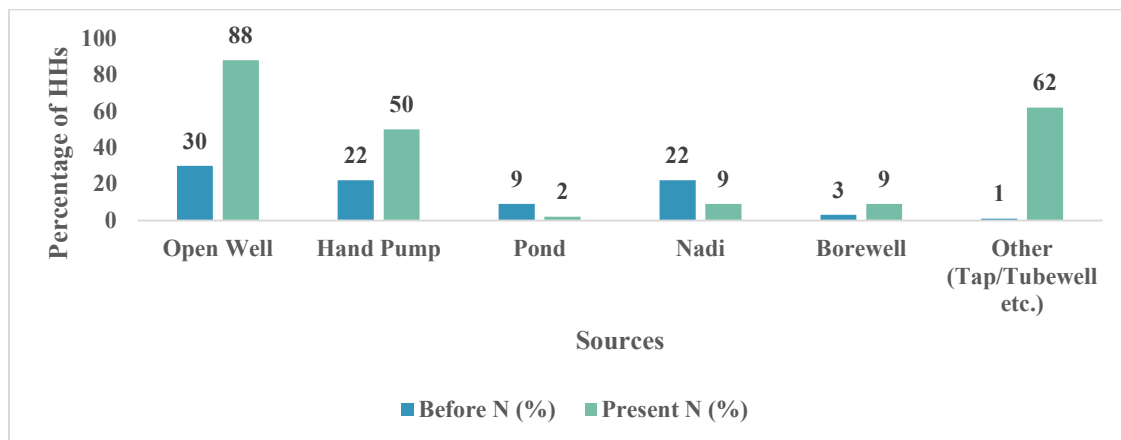
Chart 1 Responsibility for maintenance (N=200)

The responsibility for maintenance is shared among multiple stakeholders, including Water User Groups (89%) and NGO (12%). This reflects a decentralized and participatory model of asset management, where community institutions play an active role alongside implementing agencies.

“Earlier, everyone managed water individually, and there were often issues. Now, we sit together, discuss, and decide how to use and maintain water resources properly.”

— Water User Group Member, Keli Village

5.5 Access to Clean Drinking Water



Graph 7 Primary Sources of drinking water

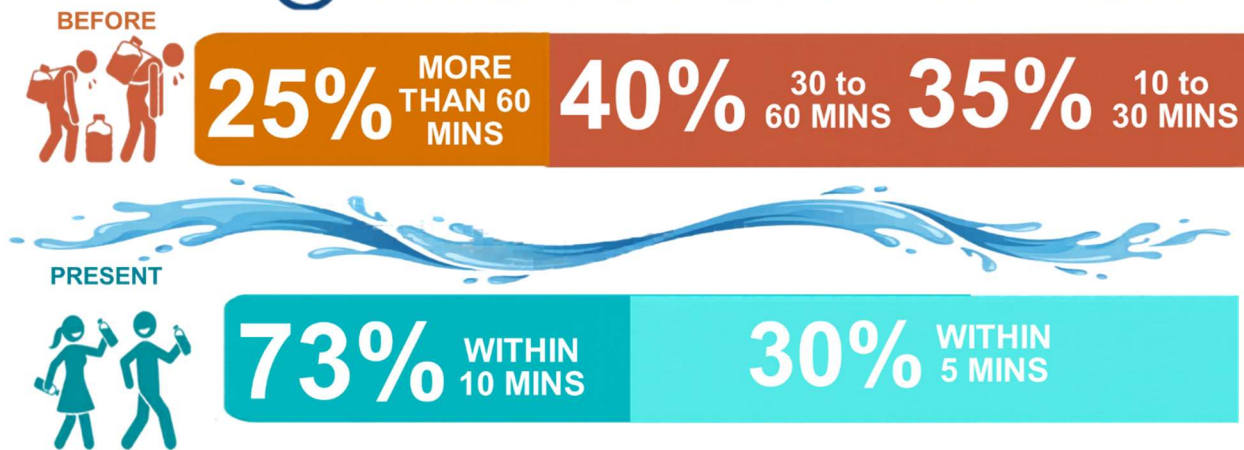
(*Multiple responses possible)

The findings indicate a significant shift in drinking water sources over time. Prior to the project, households relied on a mix of sources, with 29.5% reporting open wells as their primary source, along with notable dependence on hand pumps (22%) and traditional sources such as nadis (22%) and ponds (8.5%). The presence of tanker usage (3%) further reflects water scarcity conditions.

In the present scenario, there is a marked increase in access to improved and multiple water sources. A large proportion of households now report access to open wells (88%) and hand pumps (50%), along with a substantial increase in access to other improved sources such as tap water and tubewells (62%). Additionally, borewell usage has emerged (9%), indicating improved groundwater availability.



TIME TO FETCH WATER



There has been a substantial reduction in time required to fetch drinking water. While earlier households spent considerable time often between 30 minutes to over an hour—water is now accessible within 5 to 10 minutes for the majority of households. This reflects improved proximity and availability of water sources.



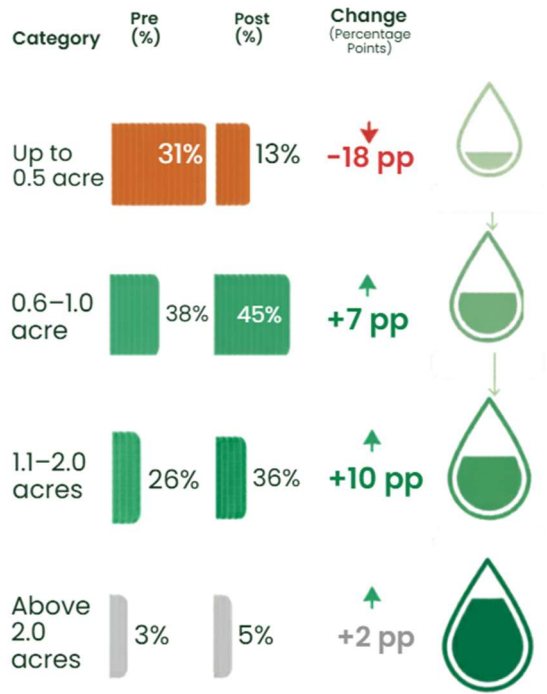
“Earlier, my day used to begin and end with water. I would walk long distances, sometimes two or three times a day, carrying heavy pots. By the time I returned home, I would already feel tired, but there was still cooking, cleaning, and work in the fields left to do.

Now, water is available near the house. I don’t realize it in big ways, but my day feels lighter. I get more time to sit with my children, to look after the house, and even help more in farming. There is less tension in the morning, less rushing... life feels a little easier.”

— Woman Farmer, Pai Village

5.6 Agricultural productivity and access to irrigation sources

Irrigated Land Category Changes Before & After Intervention

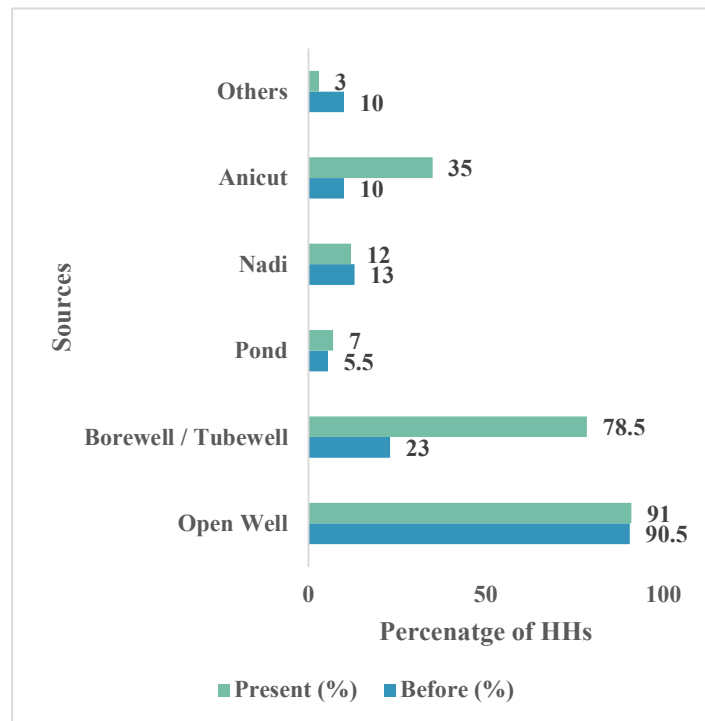


The findings indicate that while landholding size has remained largely unchanged, there has been a **notable increase in the proportion of irrigated land**. Before the project, irrigation was limited and concentrated in smaller land parcels (0.5–1 acre). However, in the present scenario, a larger share of land is irrigated, particularly in the 1-to-1.5-acre category.

This shift reflects improved water availability and better utilization of existing land resources. The reduction in unirrigated land further suggests that water interventions have enhanced access to irrigation across households.

The irrigation source profile shows a significant shift towards more reliable and groundwater-based sources. While open wells continue to be the primary source of irrigation, there has been a substantial increase in the use of borewells/tubewells (from 23% to 78.5%), indicating improved groundwater availability and access.

The increased use of anicuts (from 24.5% to 35%) further highlights the effectiveness of water harvesting



Graph 8 Sources of Irrigation- Pre and Post

structures in supporting irrigation. At the same time, reliance on uncertain sources such as rain and informal arrangements has reduced, reflecting improved water security.



“Before, we had to depend on uncertain sources of water, and many times crops failed. Now, with improved water availability, we can manage irrigation better and reduce the risk.”

— Farmer, Bacchar Village

The adoption of micro-irrigation and improved irrigation technologies remains moderate, with only 22% of households adopting such systems. However, among adopters, the majority reported positive outcomes, with 84% indicating that these technologies were very helpful in improving farming and saving water. This suggests that while awareness and benefits are evident, there is scope for scaling up adoption to maximize water use efficiency and productivity gains.

**22.5% OF HOUSEHOLDS ADOPTED
DRIP, SPRINKLER, SOLAR
IRRIGATION**

Table 13 Table 14 Crop-wise Production Status After Intervention

Crop	Households Cultivating (%)	Major Production Range
Wheat	99.0	400–600 kg
Maize	95.0	100–200 kg
Soyabean	59.0	50–100 kg
Vegetables	63.0	30–100 kg
Black Gram	12.0	50–60 kg
Mustard	9.0	50–100 kg
Flowers	6.0	100–600 kg

The crop-wise production pattern after project intervention indicates a significant strengthening of agricultural production systems, characterized by high cultivation rates of staple crops alongside increased diversification into cash crops, vegetables, and other high-value agricultural activities.

Wheat emerged as the most widely cultivated crop, with **99% of households** reporting cultivation and a production range of **400–600 kg**, demonstrating its continued importance as the primary food security crop for beneficiary households. The high production levels suggest improvements in irrigation access, input utilization, and crop management practices promoted through the project.

Similarly, **95% of households cultivated maize**, making it the second most commonly grown crop. Although the production range of **100–200 kg** was lower than wheat, maize remains a key staple crop contributing significantly to household consumption and livelihood security.

A notable outcome of the intervention was the expansion of **soyabean cultivation**, adopted by **59% of households** with production levels ranging between **50–100 kg**. This reflects increased diversification towards cash crops, creating opportunities for income generation and reducing dependence on traditional cereal crops. The substantial increase in soyabean cultivation compared to the baseline highlights farmers' willingness to adopt more remunerative cropping options.



The project also promoted nutritional and income diversification through **vegetable cultivation**, undertaken by **63% of households**. Production ranged from **30–100 kg**, providing households with improved access to nutritious foods while also generating opportunities for local market sales. Vegetable cultivation is particularly important for enhancing dietary diversity and strengthening household resilience.

Although cultivated by a smaller proportion of households, **black gram (12%)** and **mustard (9%)** contributed to diversification of the cropping system. These crops not only provide additional

income sources but also support soil fertility improvement and crop rotation practices, enhancing long-term agricultural sustainability.

An emerging area of diversification was **flower cultivation**, reported by **6% of households**. Despite relatively low adoption, the production range of **100–600 kg** indicates the potential for high-value agricultural enterprises among a segment of farmers. This suggests that some households are beginning to transition towards more market-oriented production systems with greater income-generating potential.

Table 15 Crop Diversity

Crop	Before (%)of hhs	After (% of hhs)	Change (percentage points (pp))
Wheat	81.5	99.0	+17.5
Maize	93.5	95.0	+1.5
Soyabean	23.0	59.0	+36.0
Rice	10.0	21.5	+11.5
Millet	8.0	13.0	+5.0
Small millets	3.0	5.0	+2.0
Black gram	6.0	12.0	+6.0

The findings indicate a clear shift towards crop diversification and intensification in the post-project period. While maize and wheat continue to remain dominant crops, there has been a significant increase in the cultivation of soyabean (from 23% to 59%), indicating a shift towards more market-oriented and income-generating crops.

The increase in rice, pulses (black gram), and millets also reflects improved water availability and enhanced cropping choices. Overall, the cropping pattern has evolved from relatively limited and traditional crops to a more diversified and resilient agricultural system.



An overwhelming majority of households reported an increase in both cropped area and productivity. The expansion of Rabi cropping indicates improved irrigation access, enabling farmers to utilize land

Change in Crop Productivity and Area



96.5%

Increase in Rabi Crop Area

93.5%

Increase in Crop Productivity



beyond the monsoon season. Similarly, the increase in productivity across crops suggests better water availability, improved farming practices, and enhanced input use.



“Earlier, we used to grow only a few traditional crops, mostly for our own consumption. Now, we are trying different crops like vegetables, Muesli and soybean, which are also helping us earn income.” — Farmer, Ramwas Village

Table 16 Rabi Crop Yield Distribution (Before vs After)

Indicator	Yield (kg/acre)
Before Intervention	359.5
After Intervention	481.5
Increase	122.0
% Increase	33.9%

The data further shows that the project intervention led to a substantial improvement in agricultural productivity, as reflected in the increase in average Rabi crop yield. The average yield increased from 359.5 kg per acre before the intervention to 481.5 kg per acre after the intervention, resulting in an additional 122 kg per acre of production. This represents a 33.9% increase in yield, indicating significant gains in farm productivity. The findings demonstrate that the intervention not only expanded cultivated area but also enhanced the efficiency and productivity of agricultural production systems.



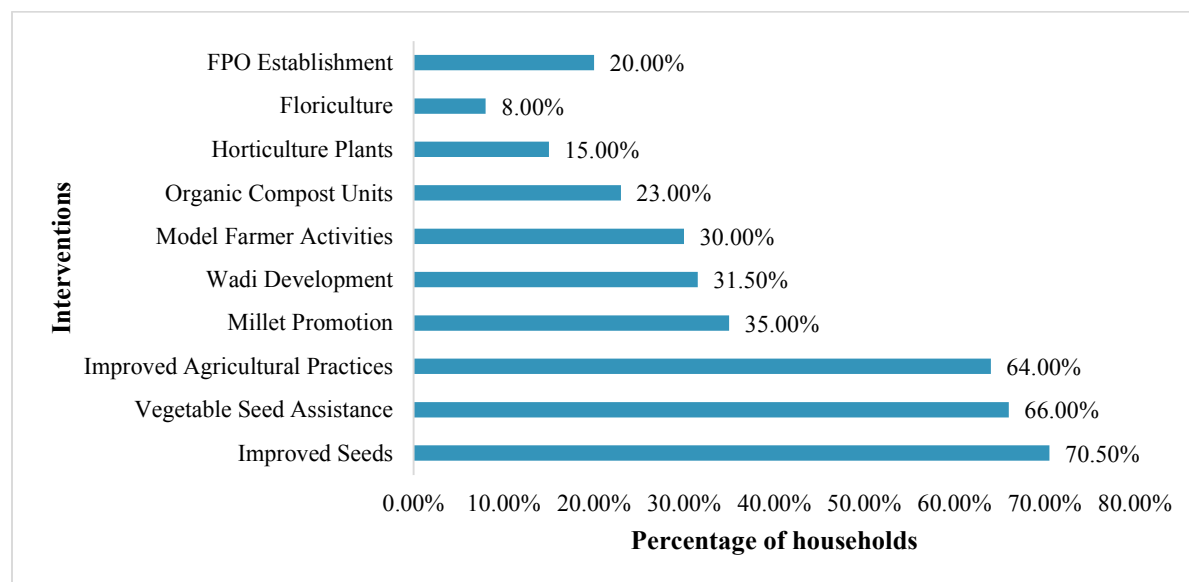
“The land is the same, but the results have changed. With better water and practices, we are getting higher production than before.”



5.7 Livelihood Enhancement



Table 17 Participation in Livelihood Interventions



The intervention strategy shows a clear focus on strengthening agricultural productivity through input support and capacity building. High participation in improved seeds and agricultural practices indicates effective outreach and adoption.

At the same time, moderate uptake of Wadi and millet-based interventions suggests gradual diversification of livelihoods.

WADI ESTABLISHMENT & ITS IMPACT

31.5%
Households with Wadi: 31.5%



0.1–0.5 ACRE
Majority area under Wadi

58.5%
Health improvement reported: 58.5%



49.5%
Willing to expand Wadi: 49.5%

Wadi development has contributed positively to both **livelihood and nutritional outcomes**. More than half of the households reported improvement in family health, indicating better access to fruits and diversified diets.

The fact that nearly half the households are willing to expand Wadi reflects its perceived benefits. However, limited scale of land allocation suggests

scope for further expansion.

Vegetable Production and Income Generation from WADI



The findings indicate that vegetable cultivation has been widely adopted, with nearly all households (98%) engaged in producing a variety of vegetables, reflecting improved agricultural practices and enhanced access to water resources.

However, only 18% of households are actively involved in selling vegetables, suggesting that while production is widespread, market participation remains limited.

Among those engaged in vegetable sales, the data indicates that approximately 80.5% of households earn an average weekly income of around ₹4500, highlighting the income-generating potential of vegetable cultivation when linked to markets.



“Earlier, vegetables were not regularly available at home, and we had to depend on the market. Now, we grow them ourselves and include them in our daily meals.”
— Woman Farmer, Dodawali Village

“We initially started growing vegetables for our own use, but now we are also able to sell some produce and earn additional income for the household.”

— Farmer, Alsigarh Village

Overall, while vegetable production has significantly contributed to household nutrition and food security, it has also begun to emerge as a viable source of supplementary income for a segment of households. Strengthening market linkages and expanding participation in vegetable sales could further enhance income opportunities across the community.

Table 18 Millet Promotion and Outcomes

Indicator	% households
Households producing millets (before)	31.5%
Selling millets	39.5%
Seed preservation	72.0%

Millet promotion has emerged as an important intervention supporting climate-resilient agriculture. With 31.5% of households cultivating millets and 72% practicing seed preservation, the intervention reflects strong sustainability and reduced dependence on external inputs. The adoption of millets has been largely driven by project-led awareness (62%) and training support (36.5%), highlighting the effectiveness of capacity-building efforts. However, with only 39.5% households engaged in selling millets and limited influence of market demand, millet production continues to be primarily nutrition-oriented rather than market-driven, indicating the need for stronger market linkages.



“We have started growing millets again, which our elders used to cultivate. Now we understand that they are not only good for health but also require less water.”

— Farmer, Surana Village

Migration Trends (Pre vs Present)

There is a dramatic reduction in migration, from 69% to just 3%, indicating a major improvement in local livelihood opportunities. Earlier migration was largely short-term (less than 3 months), suggesting distress-driven movement.

The reduction reflects enhanced agricultural productivity and income opportunities within the village, reducing dependency on external wage labor.

Women Empowerment Outcomes



The project has had a strong positive impact on gender outcomes. Increased participation of women in agricultural decision-making reflects enhanced agency and empowerment (98%).

The near-universal reduction in water collection burden indicates improved water access (99.5), which has significantly reduced drudgery and freed up time for productive and household activities.



4. Case studies

Case study Findings



1. Nutrition Security through Behaviour Change: Bhagwan Lal's Journey From Seasonal Availability to Year-Round Nutrition

Bhagwan Lal, a 56-year-old farmer from Pai village, Udaipur, owns 6 bigha of land with access to irrigation and livestock resources. Despite this, his household faced challenges in maintaining a balanced diet due to irregular availability of vegetables and dependence on market purchases.

While staple food production was sufficient, the lack of consistent access to vegetables limited dietary diversity and affected household nutrition.

Under the Water Economic Zone Livelihood Project, Bhagwan Lal received training on establishing a Nutrition Garden based on the Ganga Maa Model. The intervention focused on:

- Seasonal crop planning
- Efficient use of irrigation
- Household-level nutrition awareness

Outcomes

- Complete elimination of vegetable purchase costs (₹3,640 annually saved)
- Regular availability of fresh vegetables throughout the year
- Improved dietary diversity and family nutrition
- Sharing of surplus produce within the community

Impact

The intervention enabled optimal use of existing resources, transforming a partially food-secure household into a nutrition-secure and self-reliant unit. Savings generated are now being redirected toward education and household needs, indicating improved financial resilience.

2. Enabling Livelihood Transformation through Irrigation and Crop Diversification: Kamal Chand's Journey

From Wage Dependency to Progressive Farming



Kamal Chand, a 58-year-old smallholder farmer from Bacchar village, manages a 2.5 bigha landholding, of which only 1.5 bigha is irrigated. With a family of seven members to support, his agricultural activities were largely limited to traditional crops such as maize, soybean, and lentils primarily for subsistence.



Low productivity and inadequate irrigation meant that farming alone could not sustain the household. As a result, Kamal Chand relied heavily on daily wage labour in nearby towns, reflecting a common pattern of distress-driven livelihood diversification among small farmers.

Catalysing Change through Infrastructure and Capacity Building

A significant shift occurred with the introduction of irrigation infrastructure under the project, including the construction of the Amloi Mata Anicut and the installation of a solar lift irrigation system.

This ensured reliable water availability and created opportunities for crop diversification during the Rabi season.

Building on this foundation, the project also introduced to Safed Musli, a high-value medicinal crop with strong market potential. Kamal Chand was supported through:

- Structured training on scientific cultivation practices
- Access to quality planting material
- Continuous technical guidance throughout the crop cycle

This combination of infrastructure and knowledge reduced entry barriers and enabled him to adopt a new and more profitable farming practice.

Tangible Outcomes

- Net income of ₹14,760 from the first harvest of Safed Musli
- Retention of 20 kg of seed, ensuring continuity in future cultivation cycles
- Reduced dependence on daily wage labour, with increased reliance on farm-based income

Impact

The transition to Safed Musli cultivation has enabled Kamal Chand to move beyond subsistence farming toward a more market-oriented and income-generating agricultural system. Improved irrigation access, coupled with technical knowledge, has enhanced productivity and optimized the use of limited land resources. The experience has also strengthened his confidence as a farmer and positioned him as a local example of successful crop diversification, encouraging others in the village to explore similar opportunities.

3. From Migration to Market-Oriented Farming: Surajmal's Journey Towards Stability and Hope Reclaiming Livelihoods at Home



Surajmal, a 30-year-old farmer from Pai village in Udaipur district, represents a young rural household navigating the challenges of limited agricultural productivity and livelihood insecurity. Prior to the project intervention, Surajmal worked as a daily wage labourer in nearby cities, while his father managed farming activities at home.

The family cultivated crops on only half of their land, primarily during the monsoon season. Agricultural production was limited and largely meant for household consumption, with no surplus or income generation. As a result, migration for wage labour became a necessity rather than a choice.

Transition through Project Interventions

With the implementation of the Water Economic Zone (WEZ) project, the family experienced a gradual but significant shift in their agricultural practices. Improved water availability and exposure to new farming techniques enabled Surajmal's father to:

- Expand cultivation across seasons (both Kharif and Rabi)
- Diversify crops beyond traditional practices
- Utilize previously underutilized land for income-generating activities

One of the key changes was the introduction of floriculture on the remaining land. With technical guidance and improved irrigation access, the family began cultivating flowers as a commercial crop.

Outcomes and Achievements

- Expansion of cultivation across the entire landholding
- Adoption of floriculture as an income-generating activity
- Sale of approximately 900 kg of flowers in the last season
- Significant increase in household income
- Reduced dependence on migration and daily wage labour

Impact

The introduction of floriculture has transformed the family's approach to agriculture—from subsistence to income-oriented farming. Surajmal highlights that flower cultivation requires relatively less labour compared to traditional crops while offering better financial returns.

With improved income and stable livelihood opportunities within the village, Surajmal no longer needs to migrate for work. Instead, he actively participates in farming alongside his father, strengthening both family cohesion and agricultural productivity.



4. Conclusion & Way Forward

Conclusion and Way Forward

Conclusion

The impact assessment of the *Creation of Water Economic Zones through Integrated Watershed development* in the Alsigarh clearly demonstrates that integrated watershed development can serve as a powerful catalyst for transforming rural livelihoods in water-scarce regions.

The project has successfully addressed the fundamental constraint of water scarcity, which historically limited agricultural productivity and livelihood opportunities in the region. Through a combination of water harvesting structures, soil and water conservation measures, and improved water management practices, the project has significantly enhanced groundwater recharge, irrigation access, and soil moisture retention.

This transformation is driven by the convergence of three critical pillars: hydrological strengthening, agricultural intensification, and ecological restoration, which together have created a sustainable and self-reinforcing development pathway.

At the core of this transformation lies a significant hydrological breakthrough. As per the physical verification of structures and hydrogeological analysis, the strategic implementation of 35 Soil and Water Conservation (SWC) structures has created a cumulative storage capacity of over 4.1 lakh cubic meters, effectively moderating monsoon runoff and enhancing groundwater recharge. These structures have enabled deep infiltration, resulting in a substantial rise in groundwater levels, with increases of 10–20 meters observed in several locations.

These hydrological improvements are strongly reflected at the community level. As reported in the household survey, all households experienced improved groundwater availability, with nearly 80% reporting a rise of 1–3 meters in water table levels, and a majority indicating improved irrigation access across seasons.

The enhanced water availability has directly translated into a significant socio-economic shift. As per the hydrogeological and remote sensing analysis, there has been a sharp reduction in barren

land (–25.79%) and fallow land (–7.77%), alongside a near fourfold increase in agricultural land (from 10.41% to 39.09%). This landscape-level transformation is mirrored in the household survey findings, where engagement in agriculture increased dramatically from 22% to 99.5%, indicating a return to farming as the primary livelihood.

Improved irrigation access has enabled a transition from single-crop subsistence farming to multi-season cultivation. As reported by farmers during the survey and FGDs, there has been a clear shift towards crop diversification, including soyabean, vegetables, floriculture, millets and other high-value crops. This is further supported by hydrogeological findings indicating improved soil moisture retention and sustained water availability during the Rabi season.

At the same time, the project has strengthened ecological resilience. As per remote sensing analysis (NDVI and NDMI), there is a clear increase in vegetation density and biomass, along with improved soil moisture conditions across the watershed. The transition from sparse to dense vegetation and the increase in moisture saturation indicate that environmental restoration has progressed alongside agricultural expansion.

These changes have translated into tangible improvements in livelihoods and economic stability. As indicated by the household survey, there has been a significant upward shift in income levels, with a sharp decline in low-income households and an increase in higher income categories. Migration has reduced drastically from 69% to 3%, reflecting the creation of sustainable local livelihood opportunities.

The project has also contributed to improved nutrition and social well-being. As reported by beneficiary households, interventions such as Nutrition Gardens, Wadi development, and millet promotion have enhanced dietary diversity and reduced dependence on external food sources. Women, in particular, have experienced a substantial reduction in drudgery due to improved water access and have gained increased participation in household and agricultural decision-making.

Community participation has emerged as a key strength of the project. As per survey findings, a majority of households are actively engaged in Water User Groups and participate in maintenance

activities. This is complemented by physical verification findings, which confirm that the majority of structures are functional and effectively contributing to water storage and recharge.

Overall, the findings validate that the WEZ project has successfully operationalized a Water Economic Zone (WEZ) model, where improved hydrology has triggered a cascading impact across agriculture, livelihoods, environment, and social well-being. The Alsigarh watershed now stands as a strong example of how integrated watershed development can create climate-resilient and self-sustaining rural economies in semi-arid regions.

Recommendations

While the project has achieved significant outcomes, there is strong potential to deepen and sustain its impact through targeted strategic actions:

1. Scaling Micro-Irrigation and Water Use Efficiency

The study shows that while 100% households reported improved irrigation availability, only 22% have adopted micro-irrigation systems, despite 84% of users finding them highly beneficial. Given that only 10 drip and 10 rain gun systems have been introduced, there is significant scope for expansion. Scaling micro-irrigation through subsidies and convergence can enhance water-use efficiency, especially with increased cropping intensity (1.5x rise) and expansion of irrigated land.

2. Sustaining Hydrological Gains through Monitoring and Maintenance

As per physical verification of structures, most water harvesting structures are functional and contributing effectively to recharge. However, some maintenance issues have been reported. Regular monitoring of groundwater levels, desiltation of structures, and timely repairs are essential to sustain storage capacity and recharge efficiency.

3. Enhancing Market Linkages and Value Chain Development

While 98% households are engaged in vegetable cultivation, only 18% are selling produce, indicating a major gap between production and market access. Similarly, millet cultivation (31.5%) remains largely nutrition-oriented rather than market-driven. Given the project's investment in 95

vegetable seed beneficiaries, 89 millet interventions, and 210 horticulture plants, there is a need to:

- Strengthen FPO operations
- Develop aggregation, storage, and transport systems
- Link farmers to local and regional markets

This will help convert agricultural gains into sustainable income growth.

4. Scaling Nutrition-Sensitive Interventions

The study shows strong outcomes from livelihood interventions such as wadi, improved seeds, and floriculture, but coverage remains limited. Given the clear evidence of income increase and reduced migration, scaling these interventions can further strengthen economic resilience by:

- Expanding wadi and nutrition gardens
- Promoting high-value crops (e.g., floriculture, medicinal crops)

5. Strengthening Crop Protection through Fencing Measures

While crop diversification has improved, there remains scope for further expansion. However, open grazing after Rabi harvest limits farmers from utilizing land for vegetables, floriculture, Wadi, and millets during this season as observed during field interactions and FGDs

- Promoting low-cost fencing solutions (such as live fencing, barbed wire, or community fencing models)
- Encouraging community-level grazing management practices to regulate open grazing
- Integrate fencing support within livelihood interventions, especially for nutrition gardens, Wadi plantations, and high-value crops

This will help protect crops, enable post-Rabi cultivation, and enhance income gains.

ANNEXURE A:















ANNEXURE B: STRUCTURES DETAIL

Pt	Project	Activity Name	Hamlet	Village	Latitude	Longitude	Type of Structure	Storage Capacity (in cumec)
1	WEZ - Alsigarh	Anicut-2-Dhorawala Anicut	Dhora Ghati	Pai	24.44474	73.57794	Anicut	5632
2	WEZ - Alsigarh	Anicut-8-Lavadariwala Anicut	Nichla Fala	Pai	24.44361	73.56021	Repairing Structure	2288
3	WEZ - Alsigarh	Repair of anicut for control seepage - veriwala	Gawadi Fala	Pai	24.44186	73.56478	Repairing Structure	6000
4	WEZ - Alsigarh	Anicut-2-Madliyawala	Kada Fala	Alsigarh	24.46192	73.5694	Anicut	5100
5	WEZ - Alsigarh	Umbya Wali Dari Nadi	Kada Fala	Alsigarh	24.45944	73.57337	Nadi	37623
6	WEZ - Alsigarh	Pala Wala Nadi With Core Wall	Kada Fala	Alsigarh	24.47149	73.5695	Nadi	11405
7	WEZ - Alsigarh	Amloi Mata Wala Anicut	Amloi Fala	Bacchar	24.51931	73.51955	Anicut	26814
8	WEZ - Alsigarh	Takra Anicut	Amloi Fala	Bacchar	24.516	73.52195	Anicut	25519
9	WEZ - Alsigarh	Naal bachhar Repairing Anicut	Nal Fala	Bacchar	24.51432	73.53246	Repairing Structure	14896
10	WEZ - Alsigarh	Bhatadavala Repairing Anicut	Surana	Surana	24.54772	73.53078	Repairing Structure	126126
11	WEZ - Alsigarh	Aamli Wala Anicut	Nichla Fala	Keli	24.52518	73.54969	Anicut	2831

1 2	WEZ - Alsigar h	Mata Ji Wali Nadi With Repairing Core Wall	Madri	Madri	24.5269 2	73.51909	Nadi	4499
1 3	WEZ - Alsigar h	School Ke Pass Repairing Anicut	Vera Wala Fala	Dodawali	24.5631 8	73.53754	Repairin g Structur e	4466
1 4	WEZ - Alsigar h	Futta Wali Nadi With Core Wall	Navdiya	Dodawali	24.5543	73.53392	Nadi	6318
1 5	WEZ - Alsigar h	Khajur Wali Nadi	Lamba Dhavda	Dodawali	24.5754 3	73.53197	Nadi	5040
1 6	WEZ - Alsigar h	Dhavda Wala Nera Anicut with Desiltation	Lamba Dhavda	Dodawali	24.5724 9	73.5265	Anicut	34018
1 7	WEZ - Alsigar h	Earthen embankmen t (Nadi) with stone pitching 1	Pargi Fala	Ramwas	24.4397 3	73.58656	Nadi	6336
1 8	WEZ - Alsigar h	Earthen embankmen t (Nadi) with stone pitching 3	Devda Kad Fala	Ramwas	24.4411 8	73.58236	Nadi	7254
1 9	WEZ - Alsigar h	Jangela Talai Repairing work	Jangela Fala	Surana	24.5404 4	73.53475	Repairin g Structur e	26740
2 0	WEZ - Alsigar h	Mahadev Ji Jhar Wala Repairing Anicut	Nichla Fala	Keli	24.5243 3	73.5517	Repairin g Structur e	35720
2 1	WEZ - Alsigar h	Khajur Wala - Low Cost Sandwich Structure	Dodawal i	Dodawali	24.5696 3	73.53813	Anicut	1350
2 2	WEZ - Alsigar h	Mitti Mahudi - Low Cost	Dodawal i	Dodawali	24.5688 5	73.53178	Anicut	1296

		Sandwich Structure						
23	WEZ - Alsigarh	Kumbatro Khaliya Repairing Anicut	Damar Mala Fala	Karnali	24.54863	73.52203	Repairing Structure	6705
24	WEZ - Alsigarh	Kad Wali Nadi	Aamba Khadra	Dodawali	24.55679	73.53458	Nadi	3149
25	WEZ - Alsigarh	Well-11	Kumariya Kheda	Ramwas, Pai	24.43133	73.5825	Well	193
26	WEZ - Alsigarh	Well-5	Patiya Fala	Pipalwas	24.27443	73.35037	Well	232
27	WEZ - Alsigarh	Well-2	Nichla Fala	Bacchar	24.52331	73.5271	Well	395
28	WEZ - Alsigarh	Well-5	Amloi Fala	Bacchar	24.52098	73.52081	Well	270
29	WEZ - Alsigarh	Well-2	Upla Fala	Keli	24.5214	73.55251	Well	611
30	WEZ - Alsigarh	Well-1	Rujiya Khadra Fala	Lamba Dhavda_Dodawali	24.58794	73.5244	Well	367
31	WEZ - Alsigarh	Well-2	Kaliya Badi Fala	Lamba Dhavda_Dodawali	24.58256	73.53423	Well	350
32	WEZ - Alsigarh	Well-3	Dhavda Nera Fala	Lamba Dhavda_Dodawali	24.57266	73.52664	Well	755
33	WEZ - Alsigarh	Veri-1	Dhora Ghati	Pai	24.44523	73.57845	Well	4
34	WEZ - Alsigarh	Well-7	Damliya Fala	Alsigarh	24.28134	73.34256	Well	314
35	WEZ - Alsigarh	Well-8	Nalwat	Pai	24.45423	73.56139	Well	124
						TOTAL		410741



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