Report

Impact Assessment Report: April 2025

Restoring Livelihoods through Rainwater Harvesting Structures in Karauli, Rajasthan

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Abbreviations

Abbreviation	Full Form
CGWB	**Central Ground Water Board**
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	**Rain-Water Harvesting**
SSW	**South-South West**
SOI	**Survey of India**
SWC	**Soil & Water Conservation**
TCM	**Thousand Cubic Meter**
VDC	**Village development Committee**

1. Acknowledgement

We express our sincere gratitude to all individuals and organizations who contributed to the successful completion of this Impact Assessment Study.

Firstly, we extend our heartfelt appreciation to the local communities of the study area and the Team of Gram Gaurav Sansthan for their valuable insights, cooperation, and participation. Their firsthand experiences and knowledge played a crucial role in understanding the effectiveness of various water conservation structures.

We are immensely thankful to the research team, field surveyors, and technical experts whose dedication and meticulous efforts ensured the accuracy and reliability of the data collected. Their commitment to scientific analysis and interpretation has been instrumental in shaping this report.

Our deep gratitude goes to the team of GIS analysts and hydrologists for their contributions in mapping, data visualization, and hydrogeological assessments, which significantly enriched the study's findings.

Finally, we acknowledge the invaluable support provided by Mr. Prabhakant Jain and Dr Pranita Ghalay, DSL and all those who have directly or indirectly contributed to the completion of this study. Their constructive feedback has enhanced the depth and quality of this assessment.

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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2. Executive Summary

This evaluation study assessed the effectiveness and impact of rainwater harvesting (RWH) and soil and water conservation (SWC) interventions implemented by Gram Gaurav Sansthan (GSS), supported by the DS Group, in selected villages of Karauli district, Rajasthan. Using a mixed-method approach—comprising household surveys, focus group discussions, key informant interviews, hydrogeological assessments, and satellite-based LULC analysis—the study triangulated physical, environmental, and socio-economic outcomes of the project.

The key findings reveal that revived traditional water structures such as Pokhars, Tals, Kundas, and Pagaras were physically verified to be structurally sound, well-located, and largely aligned with their designed storage capacity. These structures significantly improved groundwater recharge, irrigation access, and water availability for domestic and livestock use, with visible increases in well recharging and seasonal water table levels. Micro-irrigation practices, including drip and sprinkler systems, were successfully adopted, enhancing water-use efficiency. Substantial areas of wasteland were converted into cultivable land, and there was notable adoption of crop diversification, including wheat, mustard, vegetables, and green fodder.

Community ownership and sustainability were strong, with active involvement of Village Development Committees (VDCs) in structure maintenance and water governance. Livestock management improved due to better water and fodder availability, and cattle insurance supported income generation. WADI interventions led to increased household nutrition and income, while solar-powered irrigation further boosted crop productivity. Agricultural income replaced wage labor as the primary livelihood, reflecting a positive shift in income patterns and improved food security. Most notably, there was a reduction in seasonal migration, indicating the project's success in generating local livelihood opportunities. Women reported significant reduction in time spent collecting water and increased participation in agriculture, demonstrating strong gender and social inclusion impacts. Overall, community satisfaction with the project outcomes was high. In conclusion, the project demonstrated an effective, community-driven model that combined traditional knowledge with participatory planning for sustainable water resource management. To enhance and sustain these outcomes, the study recommends regular maintenance and de-siltation of WHS, creation of a centralized intervention inventory, deeper engagement of Panchayati Raj Institutions and Jal Samitis, gender-inclusive outreach for governance and benefits access, scaling of micro-irrigation practices through linkages with government schemes, promotion of sustainable agriculture, and context-based evaluation for promoting practices like Azolla cultivation.

3. Introduction

Project Overview:

The DS Group (Dharampal Satyapal Group), a prominent multi-business corporation and leading FMCG conglomerate with a significant presence both in India and internationally, launched the "**Community Initiatives for Restoring Livelihood Through Construction of Rainwater Harvesting Structure**" project in 2020-21 as part of its Corporate Social Responsibility (CSR) initiatives. This project focuses on the Dang region in the Karauli district of Rajasthan.

The primary objectives are to enhance natural resources, specifically water and soil, to ensure groundwater recharge and improve irrigation potential in the targeted areas, thereby bolstering local livelihoods. To achieve these goals, the project employs a ridge-to-valley approach, constructing 107 traditional water and soil conservation structures from 2020 to 2023, including:

- **Tal:** Traditional reservoirs designed to store rainwater, serving as a crucial water source during dry periods.
- **Pokhar:** Earthen ponds constructed to capture and store runoff, promoting water infiltration into the soil and serving as a source for irrigation and livestock.
- **Pagara:** Earthen embankments built across slopes to arrest soil erosion and retain moisture, enhancing soil fertility and agricultural productivity.
- **Kunda:** Traditional rainwater harvesting structure prevalent in Rajasthan's arid regions, consisting of a deep, circular or rectangular underground pit lined with bricks or stones to collect and store rainwater for drinking purposes.

Additionally, the project promotes efficient water use through improved irrigation practices such as sprinkler irrigation. It also encourages the cultivation of climate-friendly crops, aligning agricultural practices with sustainable water management.

Study Objectives:

- Evaluating the Effectiveness of RWH Structures
- Measure Agricultural Productivity
- Assess Livelihood Impact
- Identify any challenges or gaps in the implementation of RWH systems and water productivity measures
- Evaluate the role of community involvement in the success and sustainability of the project
- Impact on Gender and Social Inclusion

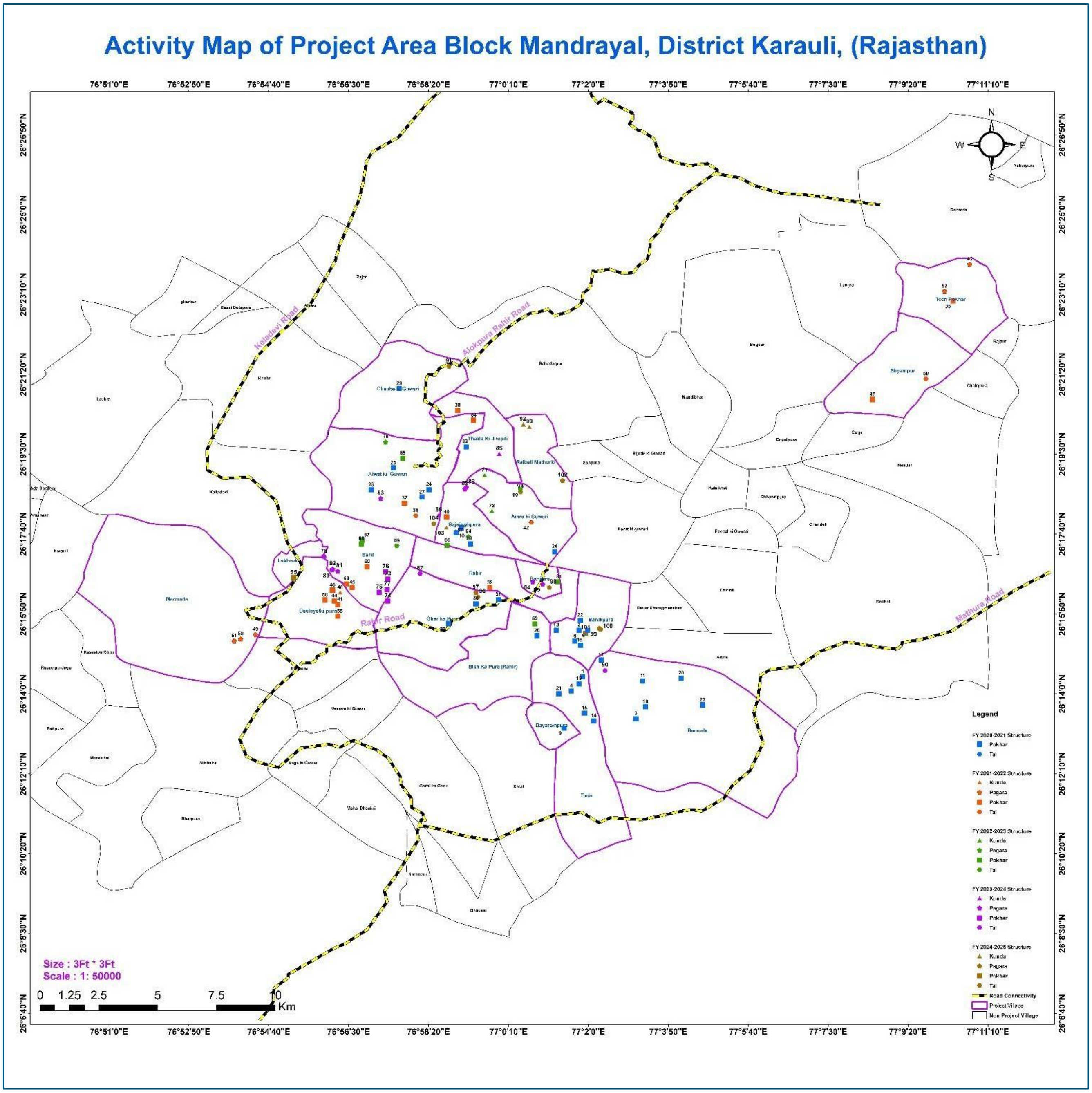


Fig. 1 Activity Map of Project Area

4. Study Approach & Methodology

4.1 About the Project Area

Karauli district, established in 1997, spans approximately 5,043 km² in eastern Rajasthan, India. Its administrative headquarters is the town of Karauli, historically significant as the former capital of the princely state of Karauli. According to the 2011 Census, the district had a population of 1,458,248, with a density of 264 inhabitants per km^2, a literacy rate of 66.22%, and a sex ratio of 861 females per 1,000 males. The economy is primarily agrarian, with wheat, mustard, and millet as the main crops. Karauli is also renowned for its high-quality sandstone, intricate stone carvings, and block printing. The district's terrain is characterized by the Vindhya and Aravalli ranges, featuring hills, valleys, and fertile plains. Soil types include Recent Alluvium along river floodplains, Lithosols and Regosols in hilly areas, and Older Alluvium in certain blocks, influencing agricultural practices and land use patterns.

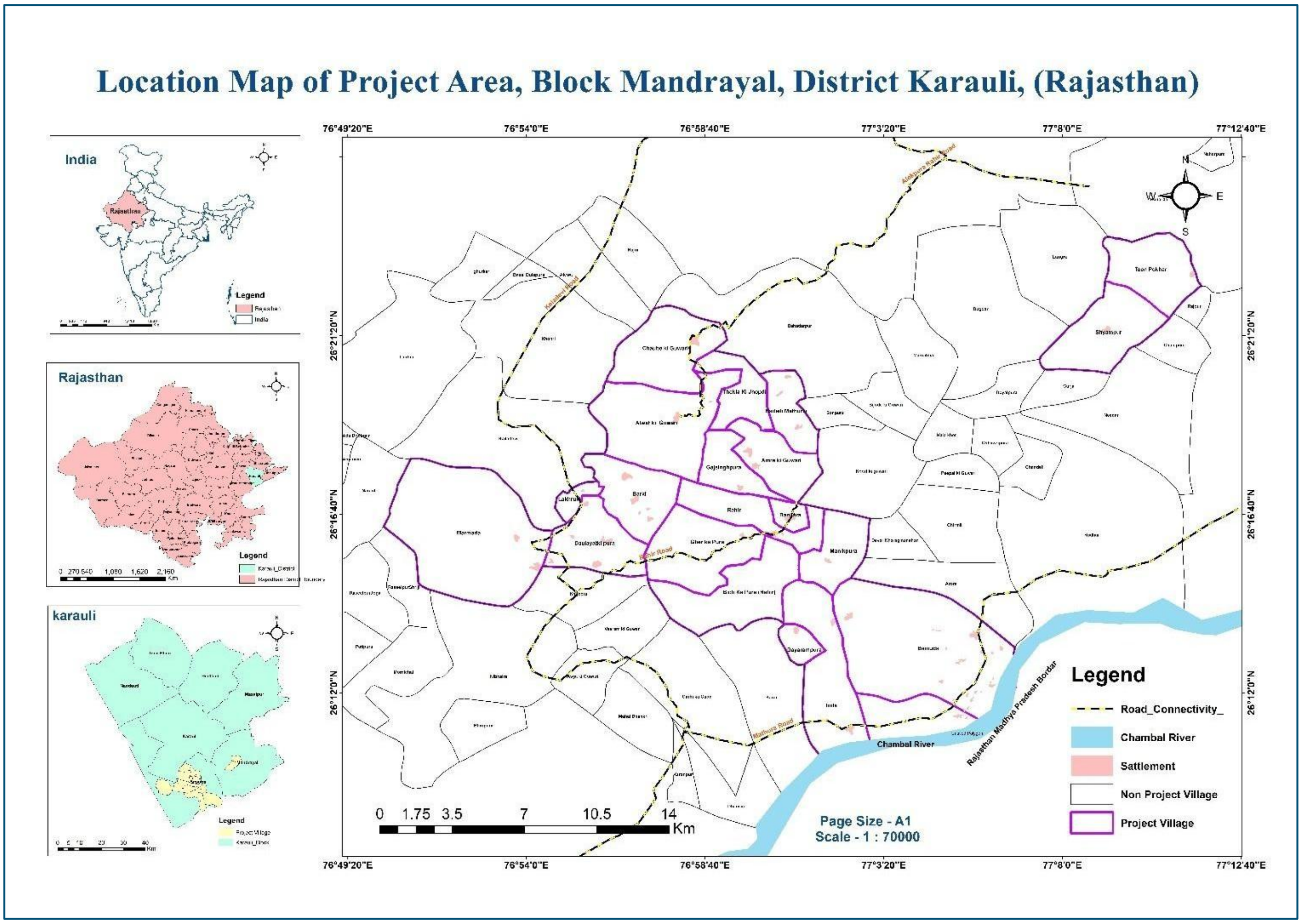


Fig. 2 Location Map of Project Area

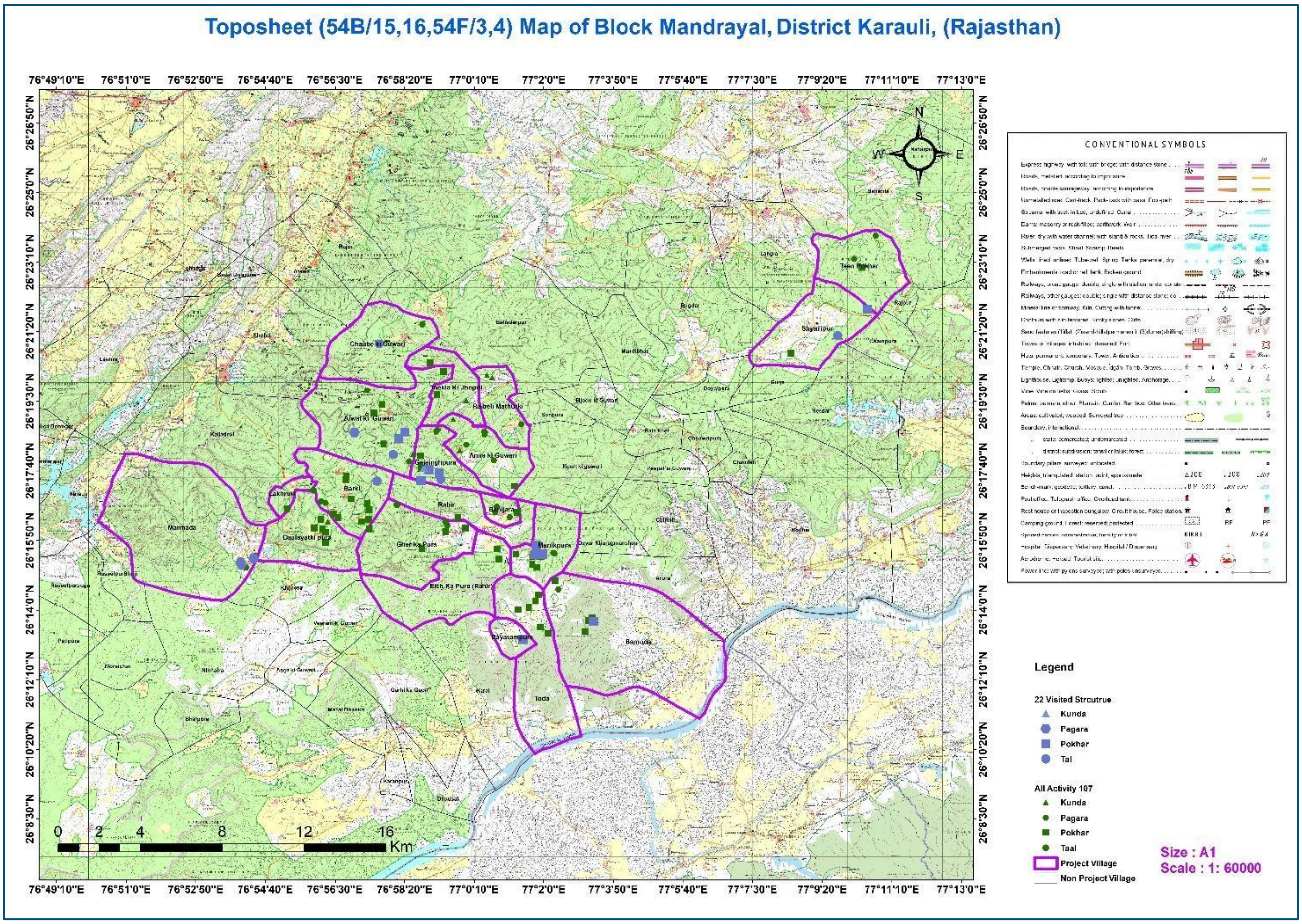


Fig. 3 Toposheet of Project Area

Rainfall Pattern

The Dang region of Karauli has experienced fluctuating rainfall over the past decade, with an average annual rainfall of 724 mm. Rainfall increased until 2016, followed by a sharp decline in 2017. A moderate recovery occurred from 2018 to 2020, with peak levels in 2021 and 2022, indicating strong monsoons. A drop in 2023 was followed by partial recovery in 2024. Despite yearly variations, the long-term average has remained stable, influenced by monsoonal patterns and climatic factors.

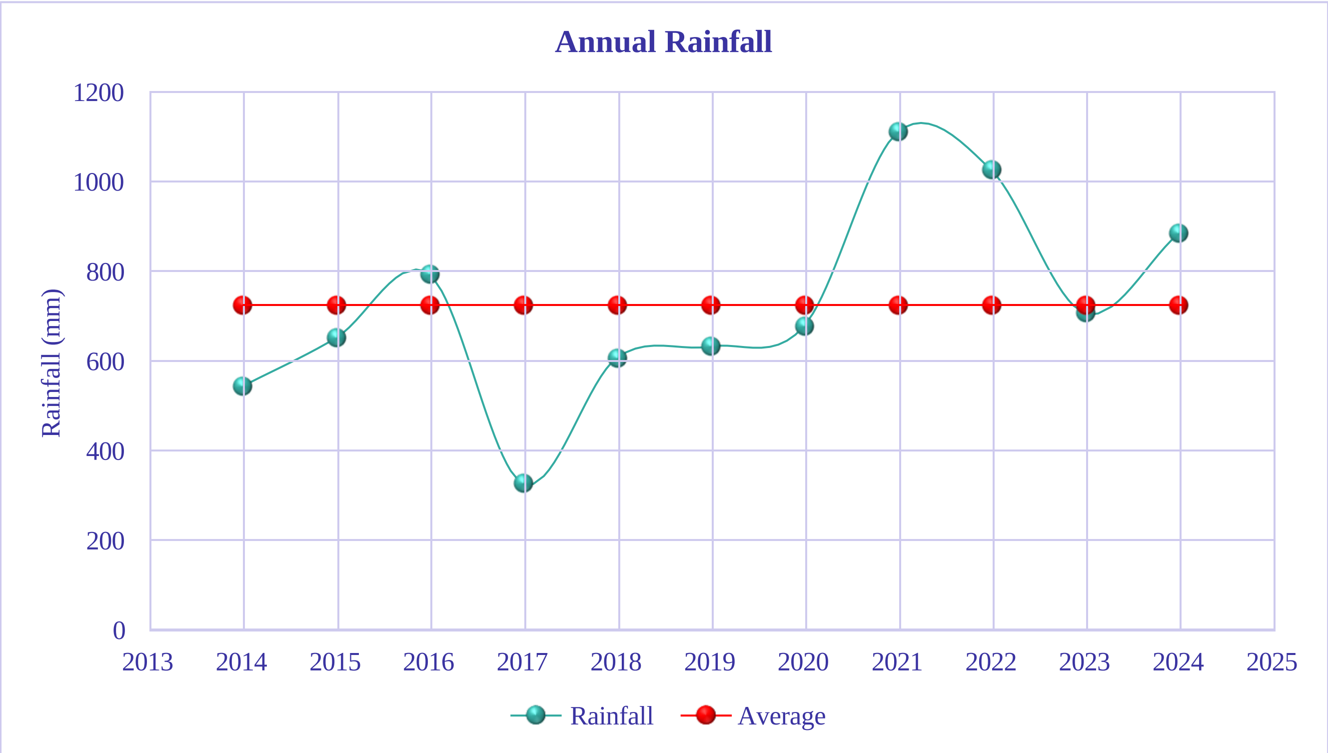


Fig. 4 Rainfall Pattern of Project Area (Source: IMD)

4.2 Methodology

The study employed a **mixed-methodology approach** for data collection, integrating both **qualitative** and **quantitative** aspects to ensure a comprehensive impact assessment.

- **Quantitative Information** is gathered through **structured surveys**, providing measurable insights into project outcomes.
- **Qualitative Information** is obtained through **Focus Group Discussions (FGDs), and Key Informant Interviews(KII)** with farmers and NGO representatives to capture lived experiences and contextual understanding.

Sampling Criteria

The sampling of households was conducted using a **purposive sampling** method, based specifically on the presence and type of rainwater harvesting (RWH) structures implemented in the study area. This approach ensured that the selected households had direct exposure to the project interventions, allowing the assessment to draw relevant and accurate conclusions about the impact of different structures such as Tal, Pokhar, Pagara, and Kunda. The sampling criteria for villages and HHs identification included year of RWH ***structure construction, number of families covered, HHs having livestock, HHs having access to irrigation and diverse crop production***.

The sample selection also ensured representation across various landholding sizes (marginal, small, medium, large farmers) to reflect the diversity in the community's socio-economic status and land-use practices.

Table 1 Sample Size for Hydrogeological study

S. No.	Type of Structure	Number
1	Tal	5
2	Pokhar	12
3	Pagara	4
4	Kunda	1

Table 2 Sample Size for qualitative and quantitative study

S. No.	Tool	No. of Villages	Number
1	Structured Questionnaire	8 villages	100
2	FGD		8
3	KII		8

Key Thematic Areas and Areas of Inquiry

The study evaluates two core thematic areas—**Soil & Water Conservation Structures** and **Community Ownership**—to assess project effectiveness.

Table 2 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
Community Ownership/ Sustainability	- Community Involvement - Village development Committees
Socio- Economic Impact	- Adoption and Impact of Micro Irrigation practices - Area brought under cultivation (Waste land to arable land) - Impact on income through animal husbandry - Adoption of crop diversification - Rise in income and nutritional benefits at HH level due to WADI - Crop Productivity and change in income - Income enhancement and its impact - Change in migration patterns - Community satisfaction

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

5. Key Findings / Assessment Area

5.1 Physical Verification of Soil and Water Conservation Structures

A total of 22 out of 107 SWC structures were physically verified across 10 villages. The key findings are as follows:

- **Location:** All structures mentioned in **Table 3** have been strategically constructed to serve their intended purpose, such as water storage, groundwater recharge, soil erosion control, runoff management, and soil moisture conservation.

Fig. 5 Mudari Wali Pokhar

- **Design:** Each structure has been designed by qualified technical experts following standard specifications commonly used for watershed structures.

- **Structural Quality:** The overall structural integrity is acceptable, with no significant damages observed. However, minor water seepage has been noted in **3 structures** due to geological fractures in the submersible area. Specifically, in Aak Wala Tal, a minor seepage issue was identified. Nevertheless, this seepage is not expected to have any long-term impact on the Tal. The detailed list is discussed in Annexure B.

Fig. 6 Core Wall of Karan Sarovar Tal

- **Storage Capacity:** The storage capacities were estimated using satellite imagery and analyzed in Google Earth Pro. The total storage capacity of the surveyed SWC structures is 434,720 m^3, with variations in depth and catchment areas influencing water retention across different sites.

Table 3 Storage Capacity of the SWC Structures

S. No.	Name of Structure	Catchment (ha)	Submergence Area (ha)	Submergence Area (m^2)	Depth (m)	Storage Capacity (m^3)
1	Aak Wala Tal	397	10	100000	2	200000
2	Shamshan Wala Tal	161	2.56	25600	2	51200
3	Thuvar Ki Bhadkiya Wala Tal	537	0.6	6000	2.5	15000
4	Goan Wala Tal	63.2	1.35	13500	1.8	24300
5	Karan Sarovar	364	0.35	3500	1.5	5250
6	Bandh ki Pokhar	15	0.1	1000	1.5	1500
7	Odi Nali ki Pokhar	20	1.13	11300	1.7	19210
8	Odi Nali ki Pokhar	-	-	-	-	-
9	Jhelan ki Pokhar	30.2	1.63	16300	1.7	27710
10	Kem ki Pokhar	110	0.6	6000	1.8	10800
11	Futi Band ki Pokhar	10	0.28	2800	1.7	4760
12	Dhaweli Wali Pokhar	50	1.12	11200	2	22400
13	Khonde Wali Pokhar	14	0.13	1300	1	1300
14	Khirkari Wali Pokhar	13.9	0.1	1000	1.2	1200
15	Mudari Vali Pokhar	8.21	0.71	7100	2	14200
16	Sej Wali Pokhar	12.4	2	20000	0.6	12000
17	Doman Wali Pokhar	21	0.29	2900	1.5	4350
18	Lodhan Wala Pagara	1398	0.46	4600	1.7	7820
19	Kharol Wala Pagara	70.6	0.14	1400	1	1400
20	Kachariya Wala Pagara	33.8	0.1	1000	1.2	1200
21	Kharol ka Kua Wala Pagara	48.2	0.15	1500	1.2	1800
22	Sirmor Ka Kunda	99.6	0.61	6100	1.2	7320
	Total					434720

Fig. 7 Shamshan Wala Tal

Recharge Potential:

The presence of **major and minor faults**, along with inferred and confirmed fractures, enhances water infiltration and recharge capacity. Shear zones, pegmatite reefs, and quartz reefs further impact groundwater storage, while dykes, typically barriers to water flow, may create localized aquifers in fractured sections.

The project area exhibits dense lineaments, including faults and fractures, making it highly suitable for groundwater recharge structures such as Tal, Pokhar, and subsurface dykes. By strategically aligning water harvesting structures with these fault zones, we can maximize infiltration and ensure sustainable water availability for the region.

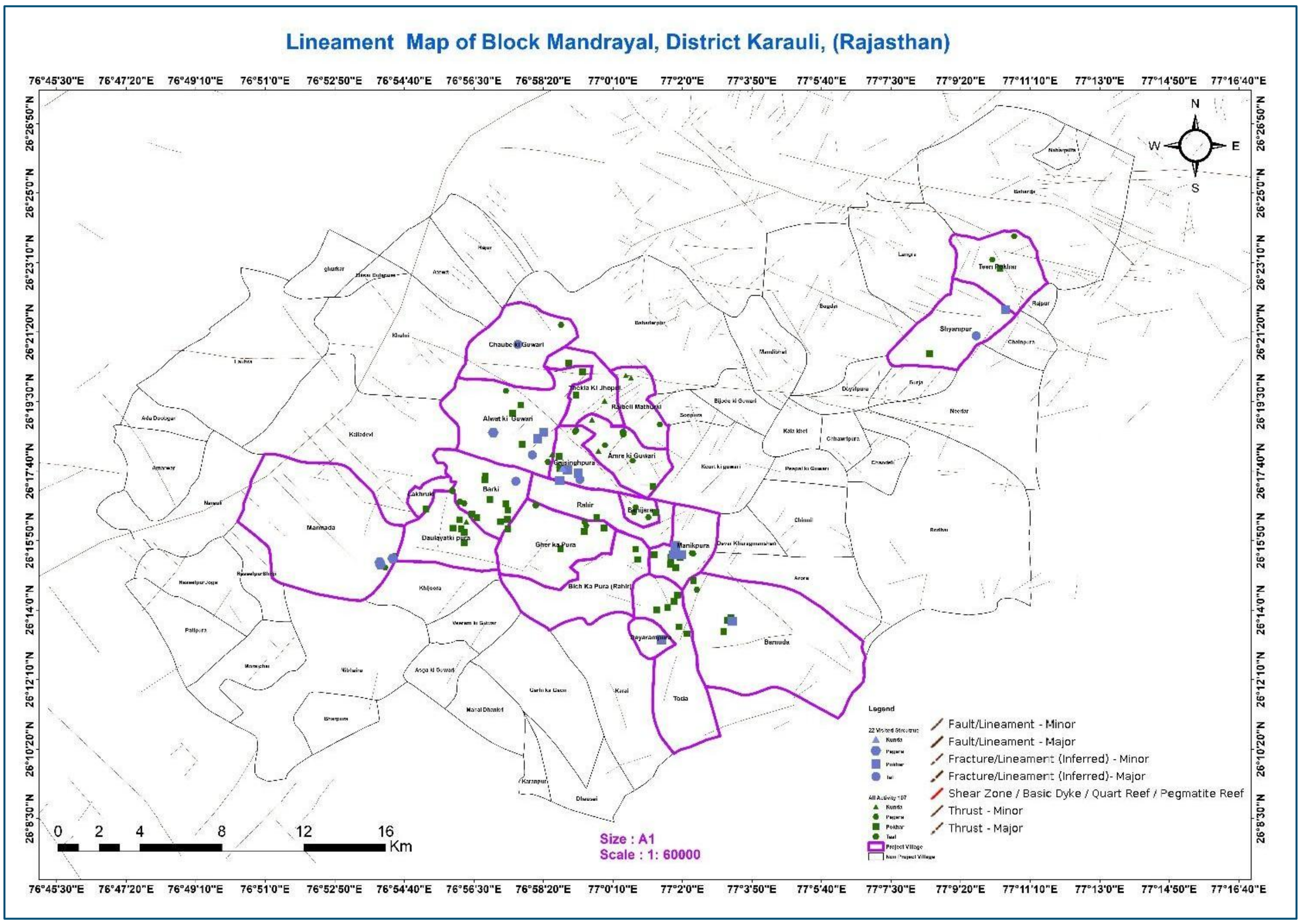


Fig. 8 Lineament Map of Project Area

Based on the rainfall pattern observed in 2024 (Fig. 1) and the geological characteristics of the Daang region in Karauli, the groundwater recharge frequency can be reasonably estimated at 6 to 7 events per year[1] (Mozzi et al., 2021; Dashora et al., 2022). Given a recharge potential ranging between 25% and 30%, the estimated annual recharge volume could amount to approximately 1.75 times the existing storage capacity, assuming favourable infiltration conditions and efficient aquifer response.

[1] Mozzi, G., Pavelic, P., Alam, M. F., Stefan, C., & Villholth, K. G. (2021). Hydrologic assessment of check dam performances in semi-arid areas: A case study from Gujarat, India. Frontiers in Water, 3, 628955. https://doi.org/10.3389/frwa.2021.628955

5.2 Direct Impact of Water Harvesting Structures

Use and Relevance of RWH Structures

The data from the HH surveys indicates the continued use and relevance of various rainwater harvesting structures constructed by the Gram Gaurav Sansthan during the project intervention. Among these, Pokhars (ponds) and Tals (small reservoirs) were the most commonly utilized, reported by 71% and 58% households respectively.

These structures appear to have had a significant impact on improving **local water availability** for irrigation. The widespread usage of these facilities demonstrates the positive and sustainable impact of the project in promoting water security and supporting agricultural livelihoods through effective rainwater harvesting solutions.

Agricultural Land Ownership and Irrigation Pattern

According to the HH survey data, out of the total agricultural land, nearly all households surveyed with 99% own agricultural land, underscoring its central role in rural livelihoods. Among them, a significant proportion are small and marginal farmers, who constitute 66.6% of all land-owning households—22.2% being marginal farmers with less than 2.5 acres and 44.4% small farmers with holdings between 2.5 and 5.0 acres (Source: Table no 3 and 4).

When compared to the extent of irrigated land, it is observed that majority of households with 85.9% of households report having 76% to 100% of their land irrigated, which significantly improves crop yields and household income stability. However, there remains a small portion of the population with 5.1% having less than 50% of their land irrigated. For small and marginal farmers, reliable irrigation is often key to ensuring year-round agricultural production and improving their resilience to climate-related shocks. (Source: Table no 5). This indicates that a significant portion of the land owned is being effectively utilized for irrigation.

The findings suggest a strong correlation between land ownership and irrigation coverage, as the median agricultural land owned by households in the study area is 5 acres, and the median irrigated land is 4.6 acres. This indicates that, for a typical household, a significant portion of their agricultural land is irrigated, reflecting the likely impact of water harvesting structures in improving irrigation access. reflecting that available land for performing farming activities and potential productivity is higher of majority households surveyed (Source: Table no 6).

Findings from the HHs also suggests that 73.7% of farmers reported extracting 500–1000 cubic meters of water per season. Only 8.1% extracted less than 500 cubic meters, reflecting limited irrigation access (Source: Table no. 22).

The substantial number of farmers accessing higher volumes of water per season suggests a notable improvement in water harvesting capacity and distribution efficiency. This increased extraction capacity is largely attributed to:

- Construction of water harvesting structures, which serve dual purposes of storage and groundwater recharge.

Impact of Soil Water Conservation:

- The project area's undulating terrain and steep gradients contribute to water runoff and soil erosion, impacting agriculture and livelihoods.
- Soil and water conservation (SWC) interventions have improved soil moisture retention, supporting seasonal crops.
- Revitalizing traditional Pagaras has effectively reduced runoff and erosion, accumulating fertile soil over rocky surfaces.
- Out of the 22 structures surveyed, the 4 Pagaras contributed to an increase of approximately **16 ha** of cultivable land.
- These improvements have enabled the cultivation of crops like wheat and mustard in previously barren areas.
- The Pagara system has significantly enhanced soil fertility and expanded cultivable land, benefiting local farmers.

Fig. 9 Thuvar Ki Bhadkiya Wala Tal: (a) June 2022 and (b) June 2024

Fig. 10 Shamshan Wala Tal: (a) April 2019 and (b) April 2024

Fig. 11 Karan Sarovar Tal: (a) March 2019 and (b) February 2024

Note: We have prepared a KML file containing all the structures. Anyone using this file can cross-check variations on the Google Earth Pro platform.

Impact on Ground Water Recharge:

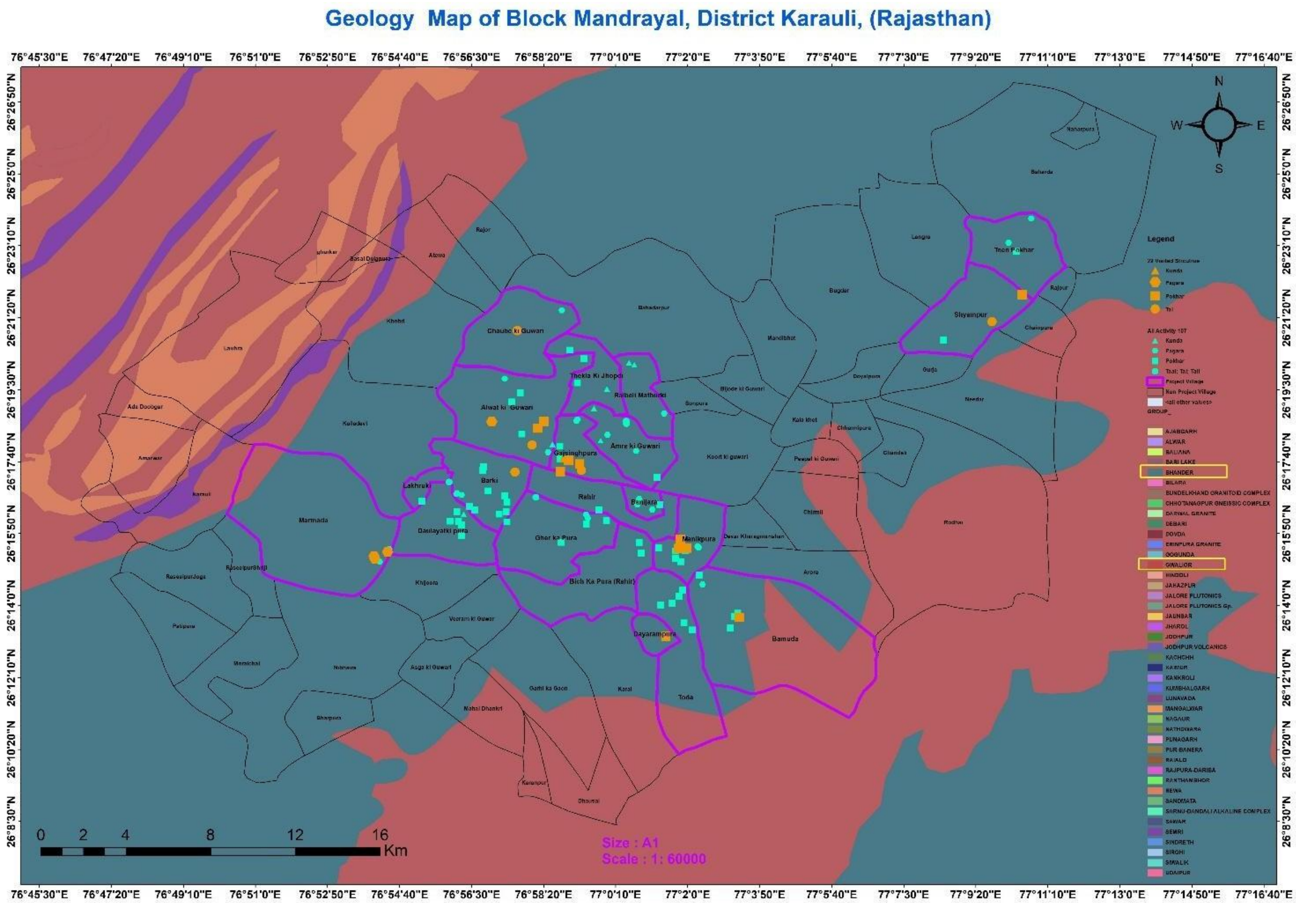


Fig. 12 Geology Map of Project Area

- The majority project areas with **Bhander Sandstone**, exhibit high permeability and infiltration capacity while regions with fractured **Gwalior formations** allow partial infiltration.
- The LULC classification showed that the surface waterbodies increased from **538 ha** in 2019 (Feb) to **707 ha** in 2024 (Jan), reflecting a **31.4%** rise in water spread.
- This expansion enhances water retention, reducing runoff and increasing groundwater recharge.
- With **20-30% recharge efficiency** (as per the project area data), the overall recharge potential of the Dang region of Karauli is estimated at **25-30%** for the entire region.
- As a result, groundwater levels in directly impacted areas are estimated to

increase by approximately **10-15%.**

- Further, discussion with farmers during structures visit has revealed that the level of the water table has increased by **1-2 m** after the intervention of water harvesting structures.

5.3 Community Ownership / Sustainability

Community involvement is a cornerstone for the success, acceptance, and long-term sustainability of any developmental intervention. When local people are actively involved in the design, implementation, and monitoring of a project, it not only builds a sense of ownership but also ensures that the solutions are rooted in the community's realities, values, and traditional knowledge.

"In the initial phase, when our team approached the village members, there was strong resistance. Many people were hesitant and even refused to engage, fearing that we might take over their land or that the intervention would not truly benefit them. It took time to build rapport and earn their trust. Through repeated visits, open dialogue, and consistent presence in the villages, we slowly established a relationship of mutual respect. Gradually, during village meetings, the conversations shifted – community members began to share their traditional knowledge and proposed the revival of water harvesting systems like tal, pokhar, pagara, and kunda. From there, the process picked up momentum. They took the lead in planning, naming the structures, contributing financially, and even managing the use of water resources themselves, which has ensured the project's sustainability."
-GGS staff (KII)

"These structures are not new to us – our forefathers used to build pokhars and pagara for water conservation, especially during dry seasons. With time, we stopped practicing these methods, and the knowledge almost disappeared due to resource constraints. But when we discussed our concerns in the village meetings organised by GGS team, we realized that bringing back our traditional systems could help us again. We named each structure ourselves, just like before. Not only did we help plan and build them, but we also contributed part of the cost. Now, water usage is well-managed, and everyone respects the rules we've set as a community."
-Community (FGD)

The FGDs conducted across the eight villages also highlighted a deep-rooted sense of ownership and active engagement of the community in both the conceptualization and implementation of water conservation structures. Community members shared that the very idea of reviving traditional water harvesting methods—such as pagara, pokhar, tal, and kunda—emerged from within the community itself. These structures, deeply aligned with local religious beliefs and customary practices, were seen not just as water conservation measures but as cultural symbols of sustainability and heritage. Interestingly, the names and designs of these structures were also derived from the community's traditional knowledge systems.

Many participants expressed that these methods were widely used by their ancestors but had faded from practice over generations. The intervention, supported by the DS Group and implemented by Gram Gaurav Sansthan, acted as a catalyst in reviving this knowledge and initiating the construction process. Community involvement was not limited to ideation; they actively participated in budgeting **and co-funding, contributing one-third of the total cost** of each structure, thereby reinforcing a strong sense of responsibility and partnership. Furthermore, the management of these water resources remains entirely community led. Decisions regarding the timing, quantity, and purpose of water extraction are collectively made, ensuring equitable use and preventing misuse.

This participatory approach has not only fostered harmony and reduced conflicts over water but has also reinforced sustainable water use practices that are likely to endure beyond the project lifecycle.

Role of Community in Sustainability

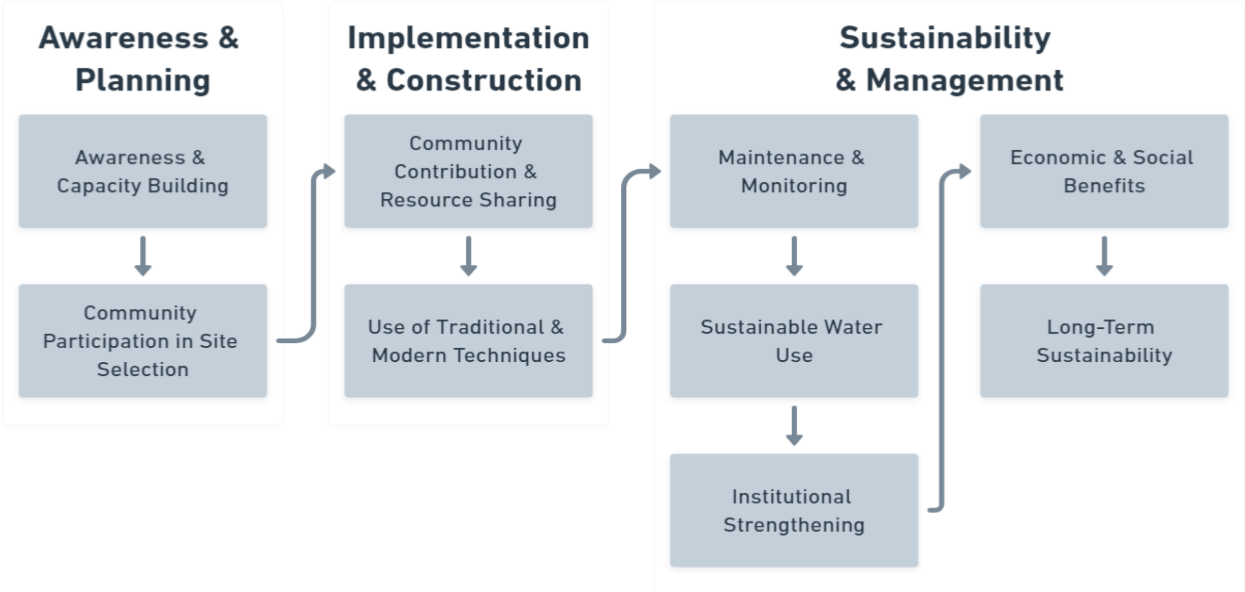


Fig. 19 Role Community in Sustainability

Village Development Committee: A Village Development Committee (VDC) is a collective of individuals or community-based institution formed in each project village to mobilize, empower, and ensure active participation of local people in the planning, implementation, and monitoring of development initiatives. The VDC represents the interests of the village community and serves as a bridge between the villagers and the project implementation team. Role of VDC includes:

- **Resource Management:** Ensures fair water distribution among users.
- **Operation & Maintenance:** Maintains water infrastructure for sustainability.
- **Conflict Resolution:** Manages disputes to promote community cooperation.
- **Financial Oversight:** Collects fees to fund maintenance and resource management.

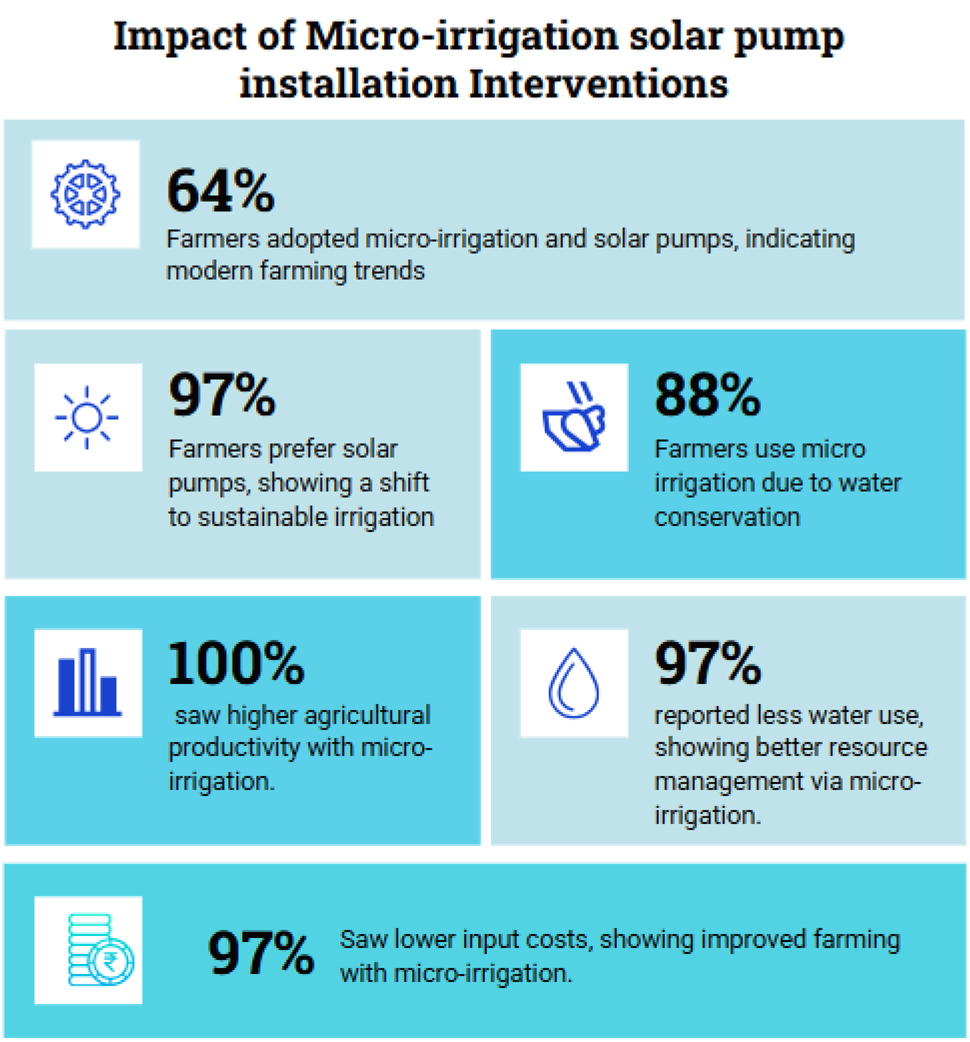
Village development Committees (VDCs) ensure sustainability by locally managing water resources, maintaining infrastructure, and promoting efficient usage. Their adaptability allows them to respond quickly to local water needs and challenges, implementing tailored solutions for long-term resource security.

5.4 Socio-Economic Impact

Adoption and Impact of Micro-Irrigation Interventions and Solar Pumps Installations

Under the project, micro-irrigation interventions—including drip and sprinkler systems—along with solar-powered pumps were introduced in selected villages to address the challenges of water scarcity and inefficient irrigation. The intervention aimed to improve water-use efficiency, reduce dependency on conventional energy sources, lower irrigation costs, and promote sustainable agricultural practices among small and marginal farmers.

The data from household surveys reflects a significant positive impact of micro-irrigation practices introduced under the project (Source: Table no 24 to 30):

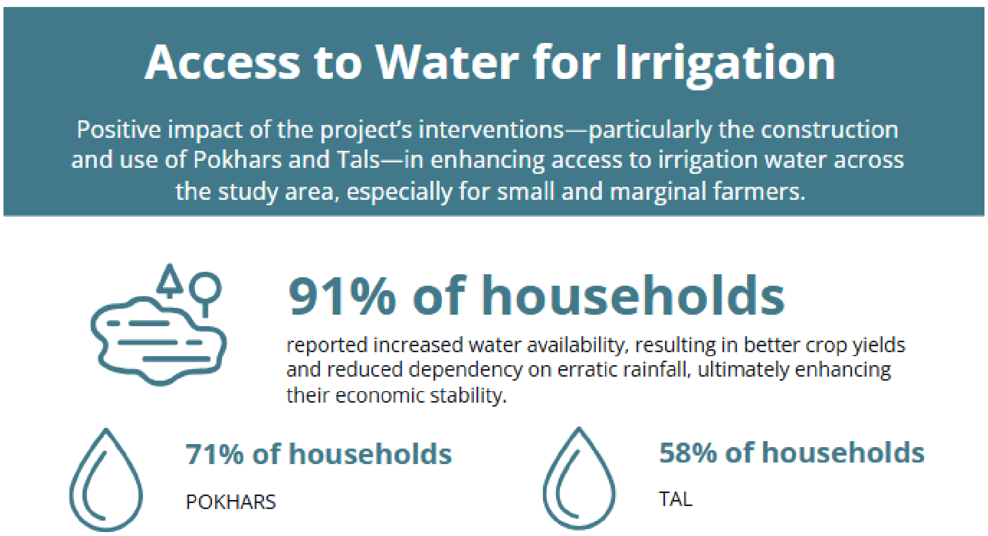


The major motivation of farmers in the intervention site for adopting micro-irrigation was water conservation. Other reasons included reducing labour cost and increasing productivity.

This indicates that there is an increasing sense of awareness among community for environmental sustainability and long term resource management. Overall, the findings reveal that the introduction of micro-irrigation has not only enhanced water availability but also improved agricultural productivity, reduced costs, and encouraged conservation-oriented behavior in the farming community.

Access of Water for Irrigation:

- Water harvesting initiatives have significantly improved irrigation, boosting agriculture and livelihoods by recharging millions of litres of water annually.



(Source: Table no.7)

- Approximately **91% of farmers** have reported increased water availability, resulting in better crop yields and reduced dependency on erratic rainfall, ultimately enhancing their economic stability.
- Reviving traditional systems like Pokhars has enhanced water storage and groundwater recharge.
- Degraded lands previously pushed **15–20% of locals** into stone mining, exposing them to health risks like silicosis.
- Improved water availability has restored soil fertility, enabling former miners to shift to farming, promoting sustainable livelihoods and economic growth.

Impact on LULC Change:

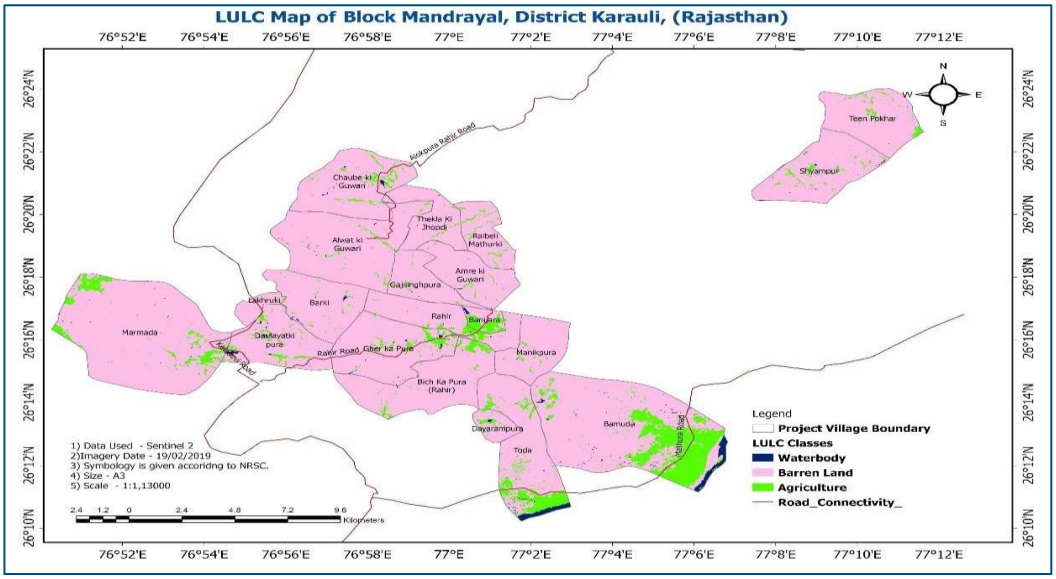


Fig. 13 LULC Map of Project Area (Rabi Season – 2019)

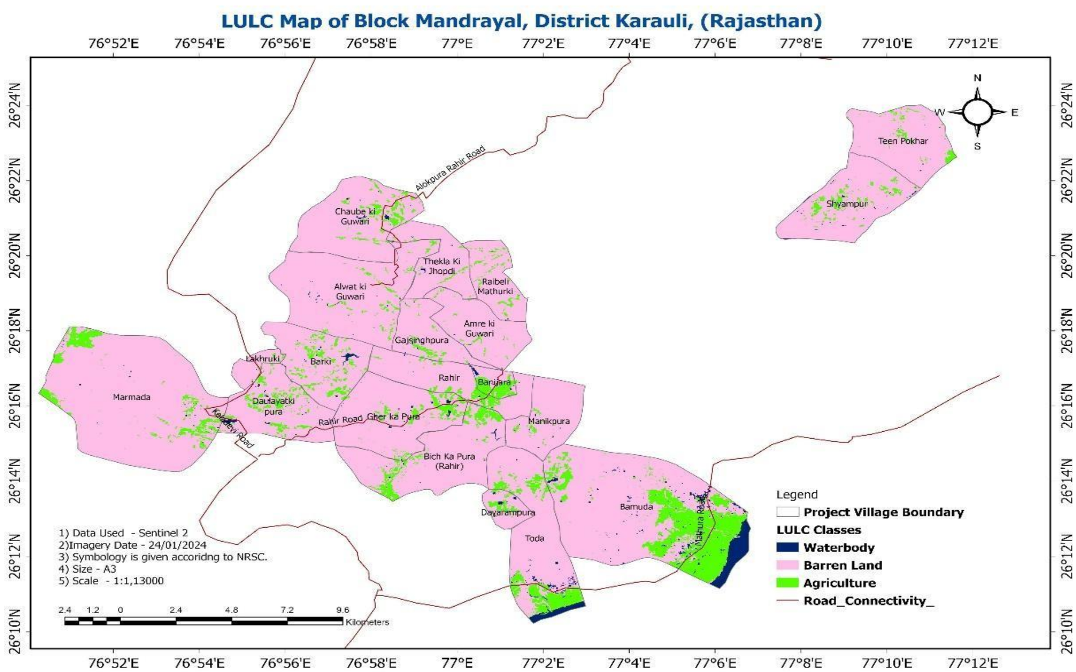


Fig. 14 LULC Map of Project Area (Rabi Season – 2024)

These maps, derived from satellite imagery, visually depict the spatial distribution and changes in land categories such as waterbodies, barren land, and agricultural land over the five-year period. A comparative analysis of these images highlights a substantial improvement in land utilization, directly influenced by the implementation of water harvesting structures under the project.

Water harvesting interventions have reshaped the region's landscape, turning once-barren lands into thriving agricultural fields. The expansion of **waterbodies by 23.85%** has not only boosted groundwater recharge but also provided a lifeline for irrigation, leading to a **19.60% increase in cultivable land**. Meanwhile, the **3.05% reduction in barren land** signifies a shift toward more productive use of natural resources.

Satellite imagery from the Rabi seasons of February 2019 and January 2024 captures this transformation, further supported by improved rainfall (607 mm in 2018 to 707 mm in 2023). These changes have had a profound impact on the local community, ensuring reliable water access, enhancing crop productivity, and reducing dependency on unpredictable rainfall. With greater water security, farmers have diversified their crops, increased their incomes, and strengthened their resilience against climate fluctuations, fostering long-term agricultural and economic stability.

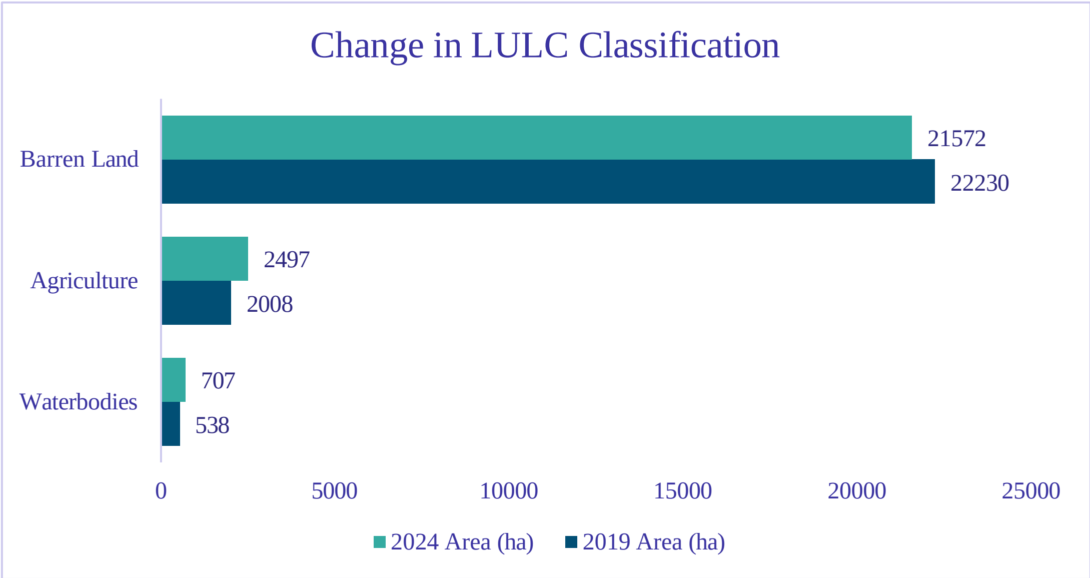


Fig. 15 Change in LULC

Classification Table 4 Sub-classes of LULC Classification

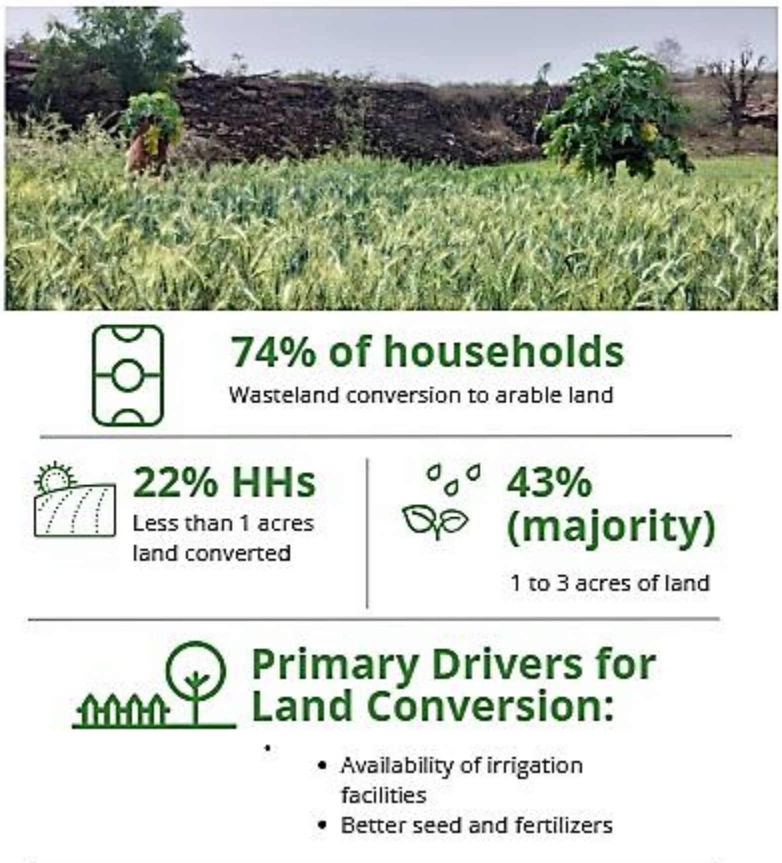
Class Name	**Category**
Waterbody	Pond, lakes, streams, water logging area, wetlands etc.
Barren Land	Wasteland, Hills, pasture land, scrub land, forest contain hills
Agriculture	Cultivable land, Planted, Vegetation on forest

The graph illustrates the changes in Land Use Land Cover (LULC) classification between 2019 and 2024. It shows a reduction in Barren Land from 22,230 hectares in 2019 to 21,572 hectares in 2024, indicating a slight decline in non-productive areas. In contrast, the agriculture area has increased from 2,008 hectares in 2019 to 2,497 hectares in 2024, reflecting a positive shift towards cultivable land. Additionally, Waterbodies have expanded from 538 hectares in 2019 to 707 hectares in 2024, suggesting improved water resource management.

The Land Use Land Cover (LULC) categorizes into three classes based on the Level 1 classification: Waterbody, Barren Land, and Agriculture. Waterbodies include natural and artificial water features like ponds, lakes, streams, and wetlands, essential for ecological balance. Barren Land covers non-vegetated areas such as wastelands, hills, scrublands, and forests with hills, typically having low productivity due to poor soil conditions or adverse topography. Agriculture encompasses cultivable land, including planted areas and forest vegetation. This classification aids in understanding the distribution of land cover types in the study area.

Area Brought Under Cultivation (Waste Land to Arable Land)

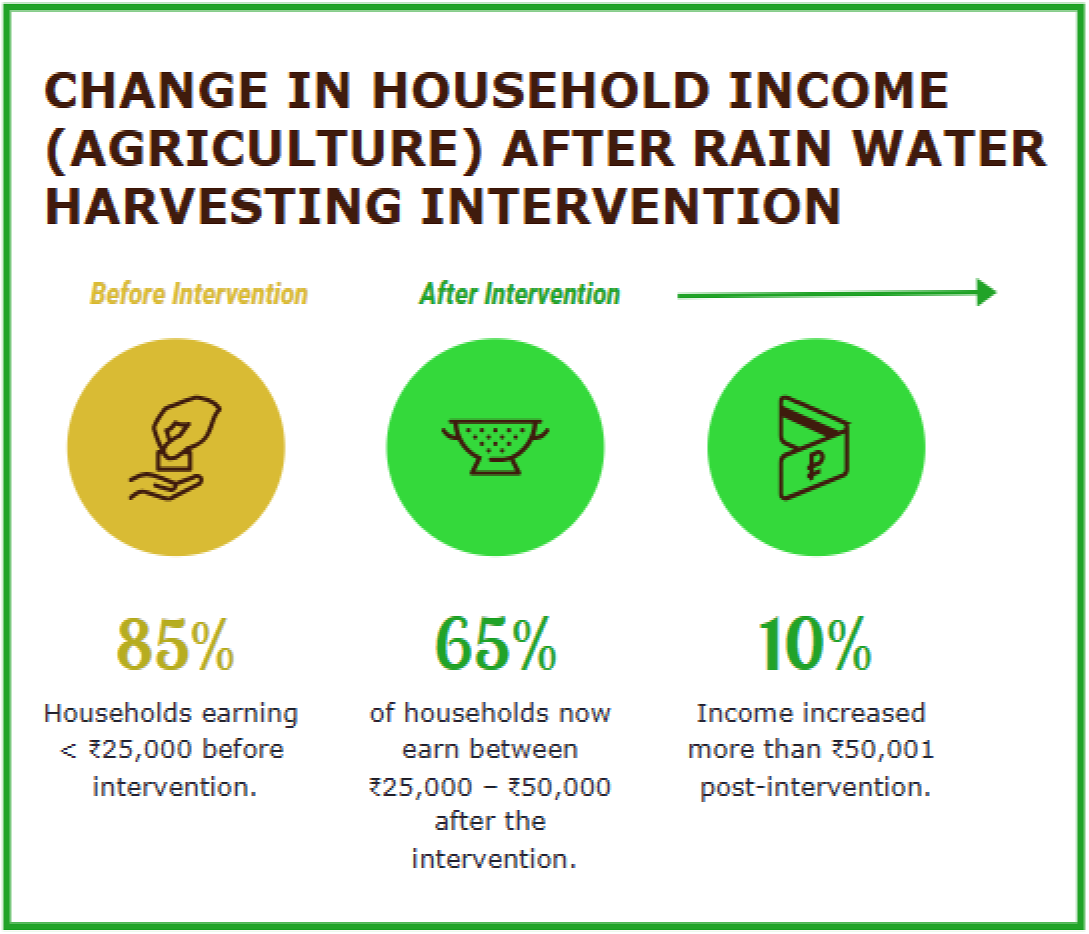
One of the significant socio-economic outcomes of the project interventions has been the conversion of wasteland into arable land, positively influencing agricultural productivity and household livelihoods. (Source: table no. 31, 32, 33)



The project interventions have led to a significant transformation of land use in the study area, with 74% of households reporting the conversion of wasteland into arable land. Most of the conversions ranged between 1 to 3 acres, benefiting small and marginal farmers. The primary driver behind this shift, cited by 96% of respondents, was the improved availability of irrigation facilities introduced by the project. This underscores the pivotal role of water access in enabling productive land use, improving livelihoods, and fostering agricultural sustainability in the region.

The conversion of wasteland to arable land represents a substantial socio-economic gain, especially for resource-poor households. With access to irrigation and improved inputs, previously unproductive land has been turned into a source of income and sustenance. This not only contributes to increased crop production but also fosters greater resilience to climate variability and enhances the economic security of rural households.

Income Enhancement and Its Impact



The HH survey data indicates a significant improvement in the reliance on agricultural activities as the main source of income among households (Source: Table no. 15).

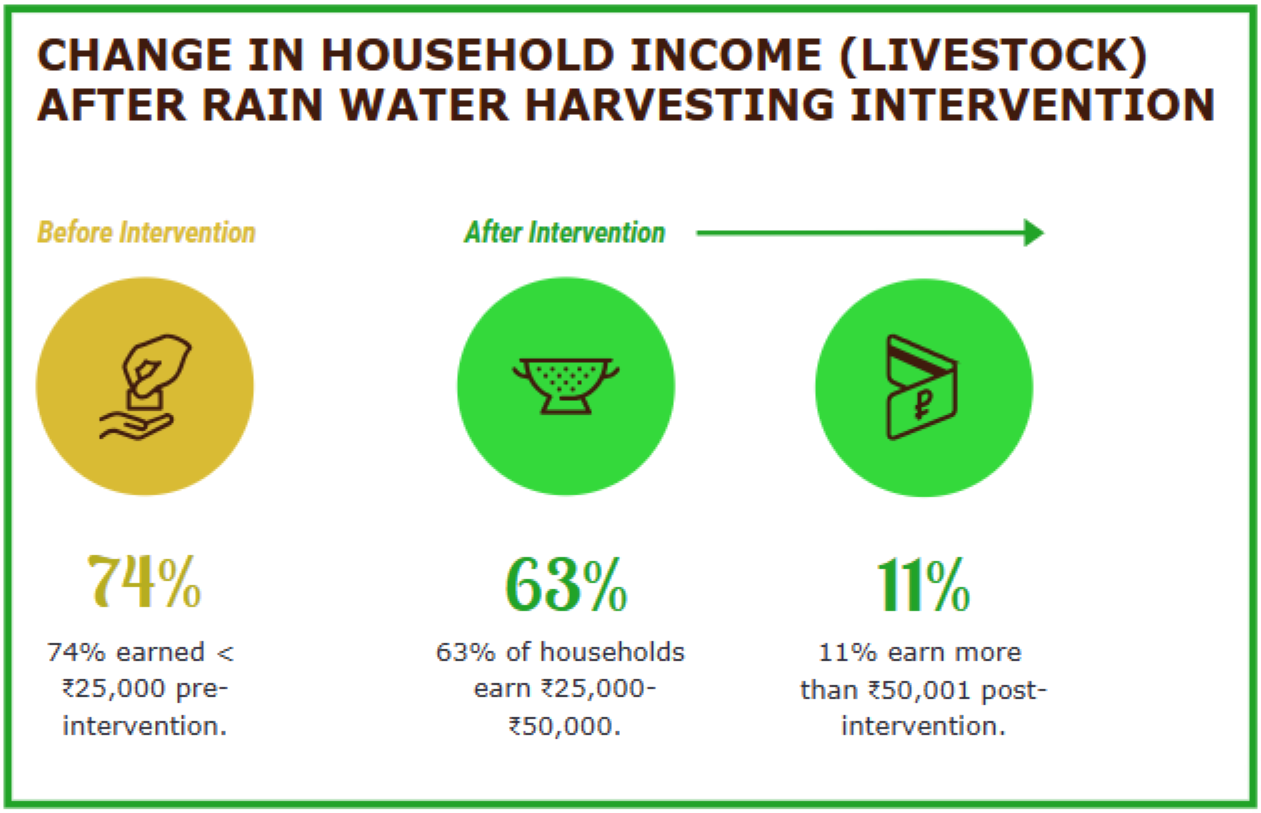
This shift suggests that the RWH structures and soil conservation measures have enhanced water availability and land productivity, encouraging people to return to or strengthen farming activities. Conversely, dependence on daily wage labor decreased notably reflecting better livelihood stability and reduced need for out-migration or uncertain labor opportunities.

Moreover, after the intervention, there has been a clear improvement in household incomes from agriculture. Suggesting substantial income enhancement likely due to improved access to water for irrigation, adoption of micro-irrigation techniques, and increased agricultural productivity.

Livestock Ownership and Management

In accordance to Livestock ownership and management, there has been a high prevalence of buffalo and cow ownership in study area suggesting a strong potential for income enhancement through milk production and dairy-related activities, especially in households that also received cattle insurance support. Additionally, these interventions are likely contributing to improved nutritional intake and economic stability at the household level. The higher herd composition also indicates that households have access to an adequate supply of drinking water and fodder, including chara (green fodder) and crop residues, which is essential for sustaining livestock health and productivity.

Impact on Income Through Animal Husbandry



(Source: Table no. 16).

The soil and water conservation intervention has had a **transformative impact** on household incomes from livestock-based livelihoods. The drastic reduction in the lowest income category and the corresponding increase in the ₹25,000–₹50,000 range signify enhanced productivity, improved water availability, and better fodder conditions. These changes suggest improved **economic resilience**, **reduced vulnerability**, and a **positive livelihood shift** for the majority of the households participating

Seasonal Vegetation:

- **Enhanced Water Availability:** Water harvesting and conservation techniques have improved water resources and soil moisture.
- **Solar-Powered Irrigation:** Many farmers now independently use solar irrigation, ensuring reliable water supply without electricity.
- **Increased Summer Vegetation:** Solar irrigation has enabled timely watering, boosting agricultural productivity.
- There has been a significant increase in **agricultural land (57.71%),** due to land conversion, while **barren land has decreased (−46. 11%).**

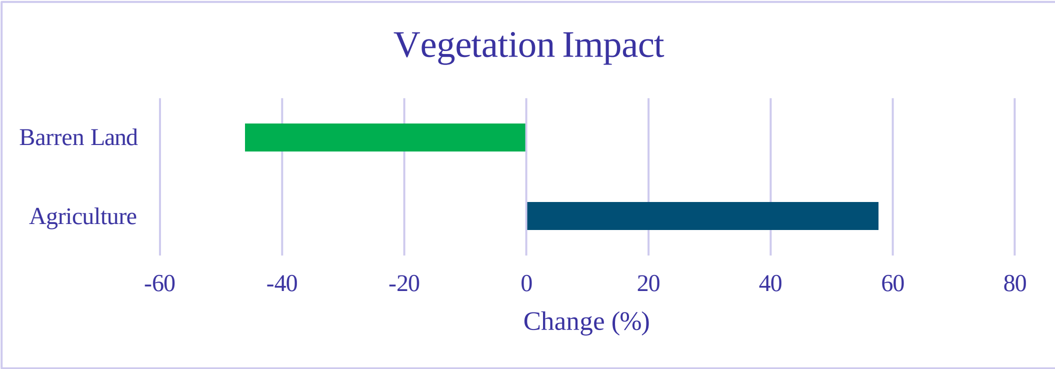


Fig. 16 Impact on Vegetation

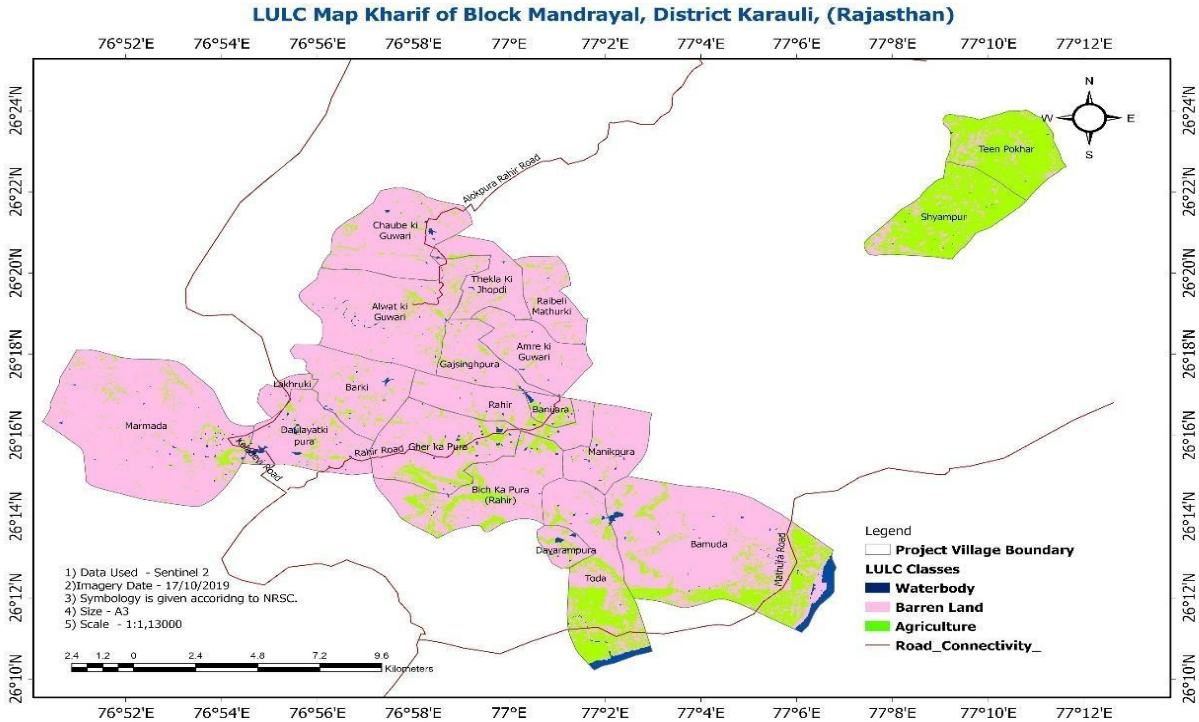


Fig. 17 LULC Map of Project Area (Kharif Season – 2019)

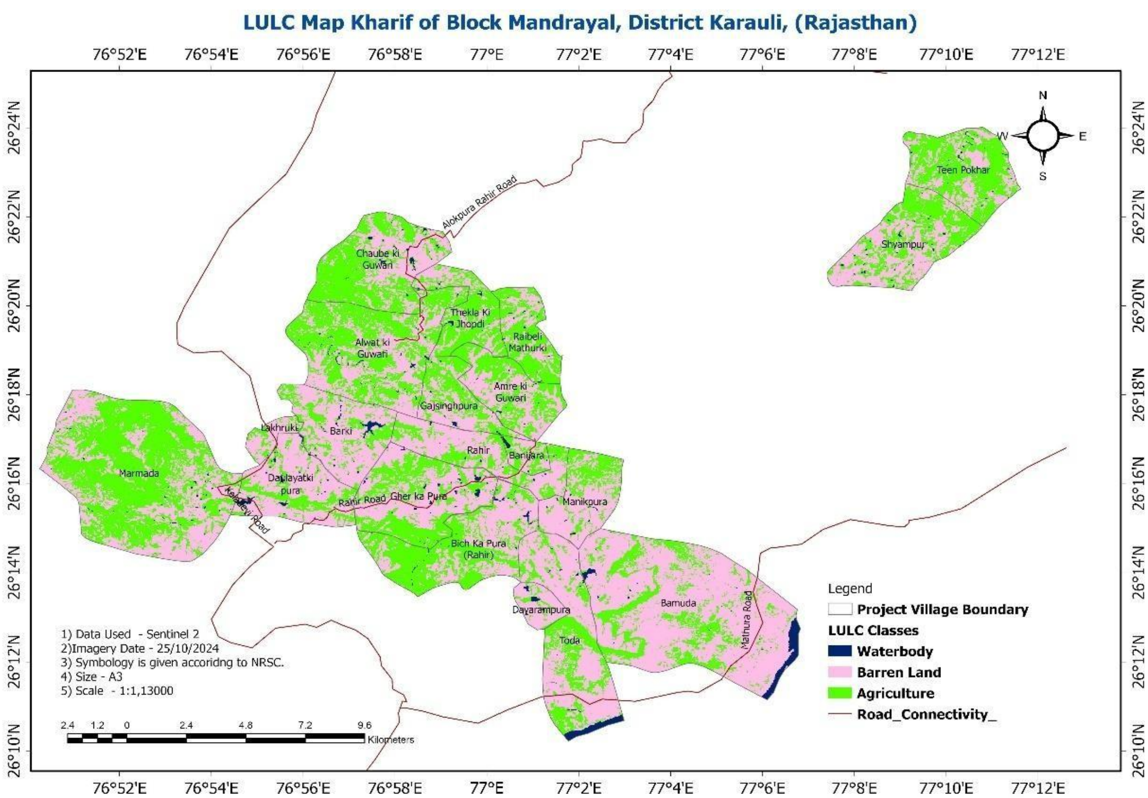


Fig. 18 LULC Map of Project Area (Kharif Season – 2024)

- **Crop Expansion:**

  Kharif Season: Slight increase in vegetable farming, with bajra as the dominant crop.

  Rabi Season: Improved irrigation has led to higher wheat cultivation.

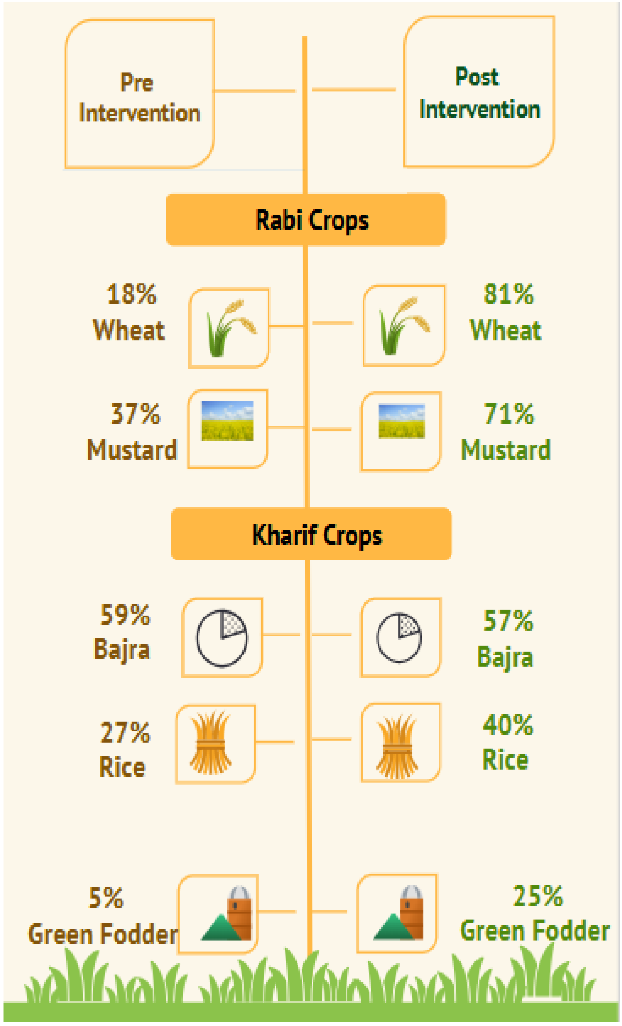
  Summer Season: Better water availability has increased fodder and vegetable cultivation.

- **Food Security:** Increased agricultural productivity contributes to community food stability.

Adoption of Crop Diversification

The HH survey data also clearly demonstrates a positive shift in crop patterns and seasonal crop intensity following the implementation of RWHS (Source: Table no. 35 and 36).

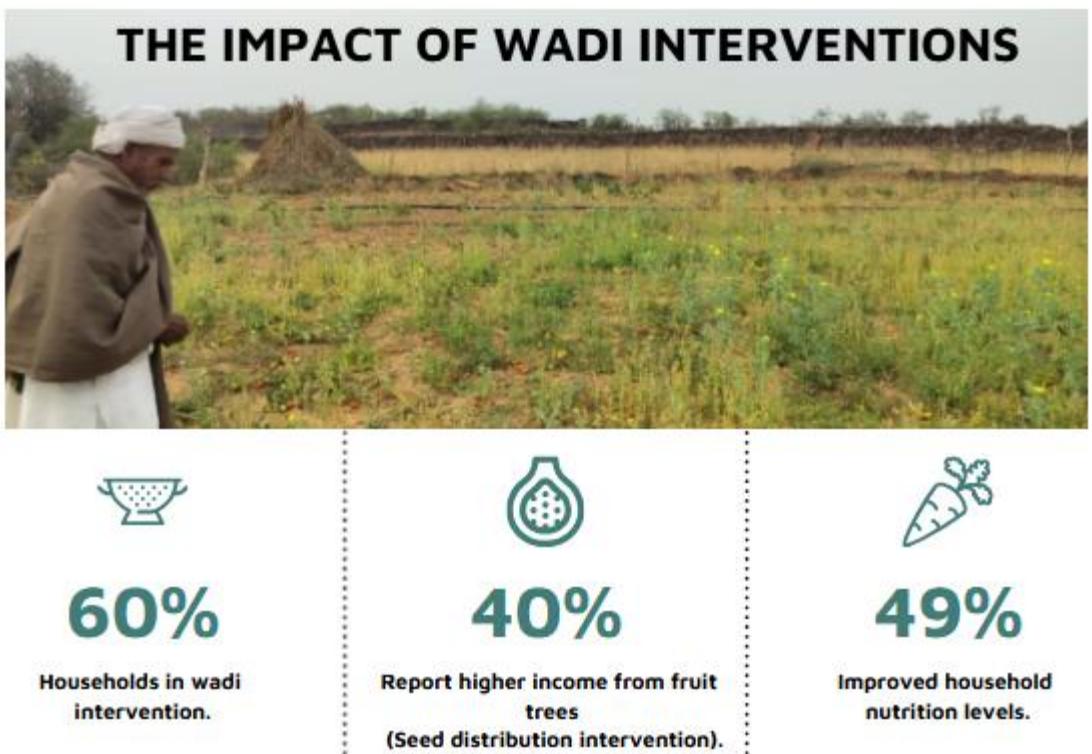
- Before RWHS implementation, Bajra was the dominant crop, with relatively low cultivation of water-intensive crops such as wheat and rice.
- Mustard and green fodder were also cultivated on a smaller scale.
- After RWHS, wheat cultivation surged significantly, mustard production also increased and green fodder cultivation jumped fivefold.
- These changes indicate a strong move towards crop diversification, particularly in the Rabi season.



These findings support the hydrogeological LULC maps, which reflect a shift from single to multi-cropping systems. The increase in green fodder and vegetables during the summer season, as noted by hydrogeologists, is also evident from the expanded cultivation data post-RWHS. The yield increase data from HH surveys also showcases a broad range of productivity improvements, with significant numbers of households reporting gains from 50 kg/acre to as high as 900 kg/acre.This indicates a widespread productivity boost, especially among households with access to better irrigation sources and sustainable farming inputs. These gains directly correlate with the hydrogeological assessment highlighting improved vegetation cover and food security.

*The combined impact of **improved water availability, diversified crops, and enhanced yield** has led to greater **food security and income stability**. Increased cultivation of wheat, mustard, and green fodder ensures not only dietary diversity but also fodder availability for livestock, contributing to nutritional security and resilience in farming systems.*

Rise in Income and Nutritional Benefits at HH level Due to WADI



The above data from HH surveys suggests that the intervention focused on promoting **agro-horticulture-based livelihood** diversification, made possible by improved water access from rainwater harvesting (RWH) structures (Source: Table no. 35). The successful establishment and survival of fruit and vegetable trees under Wadi can be attributed to the availability of assured irrigation from RWH structures such as Tals, Pokhars, and Kunds.

The impact is particularly visible in the increased diversity of species planted and their survival, even in dry spells, which would have been challenging without dependable water sources.

Category	Tree/Plant Name
Fruit Trees	Mango
	Lemon
	Guava
	Papaya
Multipurpose Trees	Neem
	Babul
Vegetables/Greens	Spinach
	Coriander
	Fenugreek
	Tomato
	Chili
	Onion
	Brinjal
	Carrot
	Radish
	Ridge Gourd
	Bottle Gourd
	Cauliflower
	Ramkola (local vegetable/shrub)
	Peas

Change in Migration Patterns

It has been evident from the HH survey data that there has been a significant reduced migration among 87% of households after intervention (Source: Table no. 36). This suggests that the project has had a substantial impact in creating local livelihood opportunities, thereby reducing the need for households to seek work elsewhere. Reduced migration is a strong indicator of livelihood security, especially in rural and semi-arid regions where work availability is often seasonal.

Impact on Gender and Social Inclusion

Aspect	Key Impact
Reduced workload	Significant drop-in time spent on water collection by women (99%)
Livelihood Participation	High engagement (73%) in income-generating activities (agriculture) by women
Empowerment and Inclusion	Increased visibility of women in productive roles and household economy
Time Reallocation	Freed-up time redirected towards childcare, education, and self-care
Nutritional and Financial Security	WADI and animal husbandry enhanced both dietary intake and income

Source: (Table no. 37 and 38)

The project has made a positive difference in the lives of women by reducing their daily workload and involving them in income-earning activities.

"Yes, Didi, I want to share something. Earlier, there was a lot of trouble due to lack of water here. We women had to wake up early and walk 1–2 kilometers to fetch water. Carrying pots on our heads, buckets in our hands—it was exhausting. Especially in the summers, it felt really difficult.
I remember, about five years ago, a marriage proposal came for my elder sister from a village in Daang. We were living near Kaila Devi at the time, where water was easily available. But when my parents found out the proposal was from this village where water was scarce, they refused. They said, 'We can't send our daughter to a place where she will struggle for water.
But last year, when a marriage proposal came for me from this same village, my parents agreed. They said that the situation has improved a lot now. Water is available, there are storage tanks near homes, and there's no longer a need to walk long distances like before."
-FGD with women (BARKI Village)

6. Conclusion and Way Forward

6.1 Conclusion

The construction of Soil and Water Conservation (SWC) Structures in Karauli district has had a significant impact on agricultural productivity, economic well-being, and environmental sustainability. These structures have not only provided much-needed irrigation support to alleviate drought conditions but have also played a critical role in land reclamation, groundwater recharge, and ecological restoration.

One of the most evident impacts of the WHS has been the increase in cultivated and cropped areas, which has led to enhanced food security and improved livelihoods for the local population. The availability of water throughout the year has also contributed to a rise in milk production, as livestock now have adequate water and fodder resources. Additionally, the WHS have contributed to flood control, reduced siltation, and improved biodiversity, making them an essential component of sustainable water resource management.

6.2 Recommendations

While the benefits of WHS are undeniable, there is a need for continuous improvement and further investment to maximize their potential. The following recommendations outline the way forward:

1. **Maintenance and identification and tracking of water harvesting structures:** Regular maintenance and desiltation of existing structures should be prioritized to ensure their long-term functionality. Given the involvement of multiple implementing agencies in the project area, it is essential to maintain a centralized, verifiable inventory of all interventions to avoid duplication, ensure accountability, and optimize resource allocation.

2. **Community Participation:** Strengthening local governance and involving Gram Panchayats and Jal Samiti in the management and upkeep of WHS will promote sustainability and efficiency.

3. **Integrated Water Resource Management:** A holistic approach that combines watershed management, soil conservation and afforestation should be adopted to enhance the overall impact of WHS.

4. **Monitoring and Evaluation:** Periodic assessment of WHS performance should be carried out

to identify gaps and implement necessary improvements through traditional knowledge systems and modern hydrological modelling.

5. **Scale Up Micro-Irrigation Practices:**

- Facilitate access to government schemes promoting drip and sprinkler irrigation, especially for smallholder farmers.
- Link water harvesting benefits with micro-irrigation to improve water-use efficiency and crop productivity.

6. **Incorporate Gender Equity Focus:**

- Design special outreach activities for women and marginalized groups to ensure inclusive participation in water governance and access to project benefits.
- Women farmers' collectives should be institutionalized with the support of VDCs across villages.

7. **Promotion of Sustainable Agriculture:** Encouraging the adoption of water-efficient irrigation techniques like drip irrigation (boond-boond sinchai), crop diversification, and soil conservation measures will further optimize the benefits derived from WHS.

8. While **Azolla cultivation** has proven beneficial in many regions for livestock fodder and soil enrichment, its adoption under the current project was limited and not notably successful in the intervention areas. The intervention may redesign the intervention/strategy in place of Azolla.

   Key challenges included lack of awareness, and unsuitability of micro-climatic conditions in some locations. Future interventions should assess local feasibility more rigorously and ensure sustained technical support for effective implementation.

By implementing these strategies, WHS can continue to play a crucial role in enhancing agricultural productivity, improving water security, and ensuring environmental sustainability for future generations.

Annexures

A: HH survey tables

Table 1

Demographic profile of respondents by age, gender and Education	
Age	*Frequency (N=100)*
Mean Age	45.73
Gender	*Frequency (N=100)*
male	58
Female	42
Total	**100**
Education	*Frequency (N=100)*
Illiterate	61
Primary - 1 to 5	16
Middle - 6 to 8	10
Secondary - 9 to 10	8
Higher Secondary - 11 to 1	2
Graduate or above	3
Total	**100**

Table 2

No. of members in household	
Members	HHs (Frequency)/(Percentage) *(N=100)*
1	13
2	38
3	23
4	13
5	7
6	4
7	2
Total	100

Table 3

Households owning agricultural land	
	HHs (Frequency)/(Percentage) ***(N=100)***
Yes	99
No	1
Total	**100**

Table 4

Agricultural land owned by households (In Acres)			
Landholding Category	Land Range (in Acres)	HHs (Frequency) (N=99)	Percentage (%)
Marginal Farmers	Less than 2.5 acres	22	22.20%
Small Farmers	2.5 to 5.0 acres	44	44.40%
Medium Farmers	More than 5.0 to 10.0 acres	34	34.30%
Large Farmers	More than 10.0 acres	4	4.00%
Total		**99**	**100%**

Table 5

Distribution of % Irrigated Land		
% Irrigated	**HHs (Frequency) (N=99)**	**Percentage (%)**
Less than 50%	5	5.1
51% to 75%	9	9.1
76% to 100%	85	85.9
Total	**99**	**100.0**

Table 6

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Agricultural land owned by HH	99	.5	20.0	5.146	3.3535
Irrigated Land of HH	99	.5	20.0	4.662	3.0986

Table 7

Sources of irrigation		
Source	**HHs (Frequency) *(N=100)***	**(Percentage %)**
Open Well	13	13
Tube Well /Bore Well	15	15
Tal	58	58
Pokhar	71	71
Note:	***Multiple responses Recorded***	

Table 8

Household owing Livestock	
	HHs (Frequency)/(Percentage) *(N=100)*
Yes	95
No	5
Total	**100**

Table 9

Type of Livestock owned by HHs		
Livestock	**HHs (Frequency) *(N=100)***	**(Percentage %)**
Sheep	10	10
Goat	19	19
Cow	27	27
Buffalo	92	92
Note:	***Multiple responses Recorded***	

Table 10

No. of Livestock	**Livestock Herd Composition**			
	Cow	**Buffalo**	**Sheep**	**Goat**
01 to 5	25	56	0	6
6 to 10	3	28	0	3
11 to 15	0	7	0	2
15 to 20	0	1	3	0
21 to 25	0	0	1	1
26 to 30	0	0	1	3
31 to 35	0	0	0	0
36 to 40	0	0	1	1
41 to 45	0	0	0	0
46 to 50	0	0	2	2
51 to 55	0	0	2	0
55 to 60	0	0	0	1
61 to 65	0	0	0	0
Total Livestock	28	92	10	19
Note:	***Multiple responses Recorded***			

Table 11

Main sources of your family income before 2020-21 (Pre intervention)	
Sources	**HHs (Frequency)/(Percentage) *(N=100)***
Agricultural activities	53
Horticulture	1
Livestock	20
Small enterprise	1
Daily wage	25
Total	**100**

Table 12

Main sources of your family income (Post intervention)	
Sources	**HHs (Frequency)/(Percentage) *(N=100)***
Agricultural activities	74
Livestock	17
Daily wage	9
Total	**100**

Table 13

Secondary sources of your family income at present (post-intervention)	
Sources	**HHs (Frequency)/(Percentage) *(N=100)***
Agricultural activities	92
Horticulture	1
Livestock	61
Small enterprise	1
Daily wage	23
Note:	***Multiple responses Recorded***

Table 14

Secondary sources of your family income before 2020-21 (Pre-intervention)	
Sources	**HHs (Frequency)/(Percentage) *(N=100)***

Agricultural activities	83
Horticulture	1
Livestock	59
Small enterprise	1
Daily wage	28
Note:	***Multiple responses Recorded***

Table 15

Annual Household income from Agriculture		
Annual Income Range	**Before Intervention (%)**	**After Intervention (%)**
Less than ₹25,000	85%	25%
₹25,001 – ₹50,000	8%	65%
More than ₹50,001	6%	10%
Not Known	1%	0%
Total	**100%**	**100%**

Table 16

Annual Household income from Livestock		
Annual Income Range	**Before Intervention (%)**	**After Intervention (%)**
Less than ₹25,000	74%	18%
₹25,001 – ₹50,000	11%	63%
More than ₹50,001	5%	11%
Not Known	10%	8%
Total	**100%**	**100%**

Table 17

Quantity of Milk Produced (Litres/Month)	
Class Interval (Litres)	**Frequency**
0 – 10	15
11 – 50	19
51 – 100	19
101 – 150	11
151 – 200	8
201 – 300	5
301 – 400	4
401 – 500	2
501 – 600	2
601 – 1000	1

Total	**96**

Table 18

HHs aware of water conservation structures implemented in their village	
	HHs (Frequency)/(Percentage) ***(N=100)***
Yes	100
Total	100

Table 19

Availability of SWCs in their area	
Structure	**HHs (Frequency)/(Percentage)** ***(N=100)***
Tal	56
Pagara	17
Pokhar	77
Kunda	10
Solar Pump	50
Sprinkler Irrigation	1
Note:	***Multiple responses Recorded***

Table 20

HHs using these structures for irrigation	
	HHs (Frequency)/(Percentage) ***(N=100)***
Yes	99
No	1
Total	**100**

Table 21

Usage of SWCs	
Structure	**HHs (Frequency)/(Percentage)** ***(N=99)***
Tal	34
Pokhar	37
Solar Pump	29
Total	**99**

Table 22

Availability of irrigation water improved after the implementation of these structures	
Responses	**HHs (Frequency)/(Percentage)** ***(N=100)***
Yes, significantly	87
Yes, slightly	12
Total	**99**

Table 23

Water extraction for irrigation (in cubic meters per season)	
Cubic meters	**HHs (Frequency)/(Percentage)** ***(N=100)***
Less than 500	8
500-1000	73
More than 1000	18
Total	**99**

Table 24

HHs adopted micro-irrigation practices (drip/sprinkler irrigation, solar pumps, etc.)	
	HHs (Frequency)/(Percentage) ***(N=100)***
Yes	64
No	36
Total	100

Table 25

Type of micro-irrigation system used by HHs	
	HHs (Frequency)/(Percentage) ***(N=100)***
Drip Irrigation	1
Sprinkler Irrigation	1
Total	2

Table 26

Solar pumps used by HHs		
	HHs (Frequency) ***(N=64)***	**(Percentage)**

Yes	62	97

Table 27

	Primary reason for adopting micro-irrigation	
Reason	**HHs (Frequency) *(N=64)***	**HHs (Percentage)**
Water conservation	56	88
Reduction in labor cost	7	11
Increase in productivity	1	1
Total	**64**	**100**

Table 28

Increased agricultural productivity due to micro-irrigation		
	HHs (Frequency) *(N=64)*	**Percentage**
Yes	64	100

Table 29

Micro-irrigation helped in reducing water consumption for irrigation		
	HHs (Frequency) *(N=64)*	**(Percentage)**
Yes	62	97
No	2	3
Total	64	100

Table 30

Adoption of micro-irrigation affected your input costs (fertilizer, labor, electricity, etc.)		
	HHs (Frequency) *(N=64)*	**(Percentage)**
Decreased significantly	46	72
Decreased slightly	16	25
Increased	2	3
Total	64	100

Table 31

Land been converted from wasteland to arable land due to project interventions

	HHs (Frequency)/(Percentage) *(N=100)*
Yes	74

Table 32

Size of the land converted		
	HHs (Frequency) *(N=74)*	(Percentage)
Less than 1 acre	22	30
1-3 acres	43	58
More than 3 acres	9	12
Total	74	100

Table 33

Primary reason for converting wasteland into arable land		
	HHs (Frequency) *(N=74)*	(Percentage)
Availability of irrigation facilities	71	96
Availability of better seeds and fertilizers	3	4
Total	74	100

Table 34

Iimprovements in the health of livestock after the intervention	
	HHs (Frequency)/(Percentage) *(N=100)*
Yes	96
No	4
Total	100

Table 35

Crops grown before RWHS implementation	
Crops	**Percentage of HH**
Wheat (Rabi)	18
Rice (Kharif)	27
Bajra (Kharif)	59
Mustard (Rabi)	37
Green Fodder	5
Note:	***Multiple responses Recorded***

Table 36

Crops grown after RWHS implementation	
Crops	**percentage of hh**
Wheat (Rabi)	81
Rice (Kharif)	40
Mustard (Rabi)	71
Green Fodder	25
Note:	***Multiple responses Recorded***

Table 37

Impact of WADI Intervention	
Impact	**% of HHs**
Increased income from fruit trees	40
Improved soil fertility	5
Increased household nutrition	49
Note:	***Multiple responses Recorded***

Table 38

Project reduced migration for work	
	HHs (Frequency)/(Percentage) *(N=100)*
Yes	87
No	13
Total	100

Table 39

Women's workload related to water collection decreased	
	Frequency

Yes	99
No	1
Total	100

B: Impact of Structures

Table 5 Details of Structures Surveyed

S. No.	Name of Structure	Village	Families Benefitted	Irrigation area (ha)	
				Direct	Indirect
1	Aak Wala Tal	Barki	64	420	14
2	Shamshan Wala Tal	Chobeki	115	55	-
3	Thuvar Ki Bhadkiya Wala Tal	Shyampur	10	17	-
4	Goan Wala Tal	Gajsinghpura	75	110	6
5	Karan Sarovar	Albatki	5	9	-
6	Bandh ki Pokhar	Manakpura	4	-	4
7	Odi Nali ki Pokhar	Albatki	18	50	22
8	Odi Nali ki Pokhar	Albatki	14	42	18
9	Jhelan ki Pokhar	Dayarampura	9	17	-
10	Kem ki Pokhar	Gajsinghpura	7	11	4
11	Futi Band ki Pokhar	Manakpura	6	8	-
12	Dhaweli Wali Pokhar	Gajsinghpura	20	13	-
13	Khonde Wali Pokhar	Rahir	11	22	14
14	Khirkari Wali Pokhar	Bamuda	5	11	1
15	Mudari Vali Pokhar	Bamuda	5	9	-
16	Sej Wali Pokhar	Manakpura	3	5	-
17	Doman Wali Pokhar	Albatki	3	4	-
18	Lodhan Wala Pagara	Albatki	7	-	-
19	Kharol Wala Pagara	Bhopara	4	4	-
20	Kachariya Wala Pagara	Bhopara	2	2	6
21	Kharol Ka Kua Wala Pagara	Bhopara	4	4	-
22	Sirmor Ka Kunda	Gajsinghpura	1	6	1

C: Quality of Structures

Table 6 Quality of Structures

S. No.	Name of Structure	Village	Condition	Remarks
1	Aak Wala Tal	Barki	Good	Supports good recharge
2	Shamshan Wala Tal	Chobeki	Good	Supports good recharge
3	Thuvar Ki Bhadkiya Wala Tal	Shyampur	Seepage problem in the catchment area	To control the seepage, core wall must be constructed
4	Goan Wala Tal	Gajsinghpura	Good	Efficient for recharge
5	Karan Sarovar	Albatki	Good	Well-maintained
6	Bandh Ki Pokhar	Manakpura	Seepage Problem due to leakage in submersible area	To control the seepage, core wall must be constructed
7	Odi Nali Ki Pokhar	Albatki	Good	Well-maintained
8	Odi Nali Ki Pokhar	Albatki	Good	Well-maintained
9	Jhelan Ki Pokhar	Dyarampura	Good	Properly functioning
10	Kem Ki Pokhar	Gajsinghpura	Good	Well-maintained
11	Futi Band Ki Pokhar	Manakpura	Seepage problem in the catchment area	To control the seepage, core wall must be constructed
12	Dhaweli Wali Pokhar	Gajsinghpura	Good	Supports recharge
13	Khonde Wali Pokhar	Rahir	Good	Well-maintained
14	Khirkari Wali Pokhar	Bamuda	Good	Properly functioning
15	Mudari Vali Pokhar	Bamuda	Good	Properly maintained
16	Sej Wali Pokhar	Manakpura	Good	Efficient for recharge
17	Doman Wali Pokhar	Albatki	Good	Well-maintained
18	Lodhan Wala Pagara	Albatki	Good	Helps in soil conservation
19	Kharol Wala Pagara	Bhopara	Good	Supports water retention and soil conservation
20	Kachariya Wala Pagara	Bhopara	Good	Supports soil conservation
21	Kharol Ka Kua Wala Pagara	Bhopara	Damage	Due to high rainfall intensity.
22	Sirmor Ka Kunda	Gajsinghpura	Good	Helps in local water recharge

D: Photographs

Fig. 20 Discussion with farmers during site visit

Fig. 21 Map verification at site

Fig. 22 Sirmor Ka Kunda

Fig. 23 On-field Map Discussion with DS Group and IIHMR Team

Fig. 24 Kharol Ka Kua Wala Pagara

Fig. 25 Aak Wala Tal

Fig. 26 Team Members of DS Group, IIHMR and Gram Gaurav Sansthan at Aak Wala Tal

Fig. 27 Doman Wali Pokhar

E: Sample size and Criterion

S. No.	Name of Structure	Type of Structure	Year of construction	Name of Village	Families benefitted	Livestock benefitted	Irrigation area(ha)		Type of crop grown	Sample Size for HH survey (25-30%)	FGD	KII	Selection Criteria
							Direct	Indirect					
1	Aak Wala Tal	**Tal**	2022-23	Barki	60	1500	400	15	Wheat,Rice ,Bajara,Mustard & green fodder	**18**	**1**	**1**	New structure, community resource, high no . Of livestock benefitted, irrigation uses, diverse crop production
2	Shamshan Wala Tal	**Tal**	2020-21	chobeki	120	300	60	-	Wheat,Rice ,Bajara & Mustard	**26**	**1**	**1**	old structure, community resource, high no . Of livestock benefitted, irrigation uses in direct, diverse crop production
3	Thuvar Ki Bhadkiya Wala (Khonda) Tal	**Tal**	2021-22	Shyampur	9	500	16	-	Wheat	**2**	**1**		Old structure, community resource, high no . Of livestock benefitted, irrigation uses, diverse crop production
4	Goan Wala Tal	**Tal**	2020-21	Gajsinghpura	70	800	100	5	Wheat,Rice ,Bajara & Mustard	**21**	**1**	**1**	Oldest structure, community resource, high no . Of livestock benefitted, irrigation uses, diverse crop production
5	Bandh ki Pokhar	**Pokhar**	2020-21	Manakpura	3	300	-	3	-	**1**			Old structure, community resource, high no . Of livestock benefitted, irrigation uses, diverse crop production
6	Odi Nali ki Pokhar	**Pokhar**	2020-21	Albatki	16	400	45	20	Wheat,Rice ,Bajara & Mustard	**4**		**1**	old structure, community resource, high no . Of livestock benefitted, irrigation uses in indirect, diverse crop production
7	Odi Nali ki Pokhar	**Pokhar**	2020-21	Albatki	16	400	45	20	Wheat,Rice ,Bajara & Mustard	**4**	**1**	**1**	old structure, community resource, high no . Of livestock benefitted, irrigation uses, diverse crop production
8	Jhelan ki Pokhar	**Pokhar**	2020-21	Dyarampura	10	-	16	-	Wheat & Rice	**3**	**1**	**1**	Oldest structure, community resource, irrigation uses in both direct and indirect, diverse crop production
9	Kam ki Pokhar	**Pokhar**	2020-21	Gajsinghpura	8	70	10	3	Wheat,Rice ,Bajara & Mustard	**2**		**1**	old structure,Crop production
10	Futi Band ki Pokhar	**Pokhar**	2020-21	Manakpura	5	400	7	-	-	**1**	**1**	**1**	Old structure, community resource, high no . Of livestock benefitted, irrigation uses, diverse crop production

11	Dhaweli Wali Pokhar	**Pokhar**	2022-23	Gajsinghpura	18	600	12	-	Wheat,Rice & Bajara	**5**			new structure in same village (Scalability)
12	Khonde Wali Pokhar	**Pokhar**	2021-22	Rahir	10	300	20	15	Wheat & Rice	**3**	**1**		Old structure, community resource, high no . Of livestock benefitted, irrigation uses, diverse crop production
13	Khirkari Wali Pokhar	**Pokhar**	2020-21	Bamuda	4	400	12	1	Bajara & Mustard	**1**	**1**	**1**	Old structure, community resource, high no . Of livestock benefitted, irrigation uses, diverse crop production
14	Mudari Vali Pokhar	**Pokhar**	2020-21	Bamuda	4	250	8	-	Rice & Mustard	**1**			Old structure, community resource, high no . Of livestock benefitted, irrigation uses, diverse crop production
15	Sej Wali Pokhar	**Pokhar**	2020-21	Manakpura	4	200	6	-	Wheat & Rice	**1**			Old structure, community resource, high no . Of livestock benefitted, irrigation uses, diverse crop production
16	Adi nali Ki Pokhar	**Pokhar**	2020-21	Albatki	5	360	-	15	-	**1**			old structure, indirect irrigation, crop production
17	Lodhan Wala Pagara	**Pagara**	2020-21	Albatki	6	-	-	-	Wheat & Rice	**1**			old structure
18	Seel ka Pagara	**Pagara**	2022-23	Albatki	4	-	-	-	-	**1**			new structure in same village (Scalability)
19	Kharol Wala Pagara (Bhopara)	**Pagara**	2021-22	bhopara	3	-	3	-	-	**1**			old structure
20	Kachariya Wala Pagara (Maramda, Bhopara)	**Pagara**	2021-22	maramda,Bhopara	3	-	3	7	-	**1**			Old structure in same village (Scalability)
21	Kharol ka Kua Wala Pagara (Bopara, Maramda)	**Pagara**	2021-22	Bopara, maramda	3	-	3	-	-	**1**	**1**	**1**	Old structure in same village (Scalability)
22	Sirmor Ka Kunda (Gajsingpura)	**Kunda**	2021-22	Gajsinghpura	1	-	5	2	Wheat,Rice ,Bajara & Mustard	**1**			Old structure, diverse crop production (Scalability)
	Total				**382**					**100**	**10**	**10**	

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