INTEGRATED APPROACH FOR AUGMENTING GROUND WATER IN CHIRAWA BLOCK OF JHUNJHUNU DISTRICT, RAJASTHAN

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Impact Assessment Report

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Summary

Rajasthan is a desert state. It also suffers from chronic water scarcity and quality problems. The difficult natural conditions prevailing in the state poses serious challenge to supply safe drinking water to large number of villages, habitations and scattered rural population. The task becomes more difficult when the population growth is also higher than rest of the India increasing thereby the demand for water manifold.

The most critical challenge before the State is ensuring sustaining supply of water both for drinking/domestic use and irrigation for rural and urban population. Groundwater in the state plays significant role it supports 90% of drinking water supply and 60% of irrigation in the state. Over exploitation of groundwater has lead to 'groundwater drought'. This is largely a man made phenomenon and presently the increasing over-exploitation of groundwater is a cause of concern allover Rajasthan and particularly in the Jhunjhunu District.

The water resource availability in the Jhunjhunu District is critical in the absence of major surface water sources in the district. People are mostly dependent on the groundwater. Irrigation use account for 83.4% of total groundwater draft and with the increase in number of tube wells the stage of groundwater exploitation has reached to 228%, which is unsustainable in future unless special measures are taken to recharge groundwater or reduce irrigation demand drastically. The block wise status of groundwater in the district is also very bad, except for Alsisar block all other blocks are overexploited. Further, this depleting status of groundwater in the Jhunjhunu District has led to deterioration in the quality of groundwater. Fluoride, Nitrate and brackishness are the major groundwater pollutants found at varying quantity in the district.

There were three major objectives of the IIAGW Project: (1) Sensitizing the target population of the hazards of ground water table depletion and ways of augment ground water- by holding a series of workshops and lecture demonstration in the area. (2) To create a sustainable system for harvesting and conservation of rain water in project area and training local people to use and maintain them and (3) To demonstrate the efficacy of the measures undertaken in the project for augmentation of ground water.

The methodology adopted for the project impact study was as follows: In order to assess the impacts of interventions the project area was visited, parameters of change were identified and based on those a questionnaire for field survey was prepared. The questionnaire was field tested and commissioned in the project villages by selecting a sample of beneficiary households. The survey of 10 percent of beneficiary households were randomly selected from the five project villages. Besides the household survey interviews were also organized with the key informants and group discussions with the beneficiaries in the project villages. The survey data was analyzed using SPSS statistical package.

As per the project document seven major activities were planned beside capacity building of beneficiaries those activities were: Construction of RWH Tanks, Recharge Wells, Monitoring Wells, Ponds, Soak Pit, Improved Toilets, and Plantation. The physical project activities were undertaken in the 12 villages of Chirawa Block of Jhunjhunu District comprising nearly 19,000 beneficiaries of 2800 households.

Findings of the Impact Study

The perceived outcome and impact of project activities has to be seen in the larger context of the status of natural resources is Rajasthan or Jhunjhunu. The intensity of impact and gains are always more important in case when there is a scarcity of resources. Since the interventions were more to overcome the water scarcity situation faced by the people in the region, particularly fast depleting ground water, therefore, in this study impact of project interventions more specifically on water resources were studied.

The severe scarcity situation of ground water in the district has arisen because of the lack of awareness of people about the serious consequences of overexploitation just to bring more area under irrigation. *Therefore, besides the proposed intervention of recharging groundwater more emphasis was on awareness and capacity building of people to understand the severity of the problem faced by the present and future generation.*

The impact of the project can be assessed from various points of view, such as, donors/Project funder's point of view, implementer's point of view, and beneficiary's point of view. The first

important aspect of project is direct or indirect benefit to the individual beneficiary and community as a whole and *it is heartening to note that 100 percent beneficiary were of the view that this project has brought benefit on both counts. Beneficiaries have benefited in terms of increase in availability of safe drinking water & income from wages by employment in project activities*. As per the beneficiaries perception the project was successful in achieving its major objective of recharging groundwater by measures taken for harnessing rain water falling within the geographical boundary of the project villages. The beneficiaries were of the view *that groundwater was recharges and the discharge capacity of their wells, tube wells and Handpump increased.* More water was also made available to livestock and for agriculture. *There was complete satisfaction of the beneficiaries participating in the project*.

Social impact: The social gains are equally important in any project outcome and this project too has brought significant social gains. Beneficiary awareness and participation is the key to the success of any intervention and this project has shown remarkable results on both these parameters.
Beneficiaries have benefited in terms of increase in availability of safe drinking water, reduction in drudgery in fetching water, saving in time particularly of women in fetching drinking water, reduction in the health expenditure because of reduction in water born dieses and income from wages by employment in project activities.
The other major positive feature of the project is overwhelmingly satisfaction of beneficiaries about financial transparency and quality of work done that is also rarely observed in government programs. It shows the good image and credibility of the implementing agency.

Economic Impact: The major activity in the project is augmenting the supply of water, both for drinking and irrigation and that has affected the household income in at least two direct ways. *First, increase in groundwater supply, because of the activity relating to rainwater harvesting and recharging the aquifers, and second reduction in the expenditure on health, because of safe drinking water availability made by the project.*

As 60% of the disease in the villages are water born and presently the quality of drinking water is affected by fluoride, nitrate, brackish and also TDS causing lot of disease in the village and households are becoming indebted because of medical expenditure. The project has provided an alternative safe source of drinking water. Also shows that because of Tankas constructed under the

project there were saving on account of household expenditure in purchasing drinking water. Good monsoon rains can fill these Tanka's 2 to 3 times in a rainy season. The full Tanka can provide drinking water up to 8 months depending upon the family size and household water demand.

Environmental Impact: The micro-level studies suggest that family migration from rural areas in India occurs largely as a survival option. The family migration is largely push induced movement (induced by a deterioration in living conditions in the place of origin particularly degradation of natural resources). Of between sector mobility, our concern is rural-urban migration caused by change in environmental parameters, particularly because of change in water availability and access to rural population. There are evidences that depletion of groundwater resulting in no Rabi crops and in such condition if there is even mild drought year leading to Kharif crop failure creates tremendous pressure on rural labour and agriculture households to migrate. Since groundwater exploitation is highest in the Jhunjhunu district including the project area migration of human population is caused by environmental factors. *As this projects helps in augmenting groundwater by rainwater harvesting it has definitely helped in reducing the intensity of forced out migration from the rural areas. The project will have long term positive environmental impact.*

The five out of seven project activities were directly linked to rainwater harvesting, conservation and recharging groundwater in the project area. *The outcome of these interventions shows that because of the community participation in rainwater harvesting and recharging the quality of groundwater has improved. This is the most prominent environmental impact of the project.* Infect it will set a massage for the rest of the society/people to go for such measures for sustainable future in the region. *It is also a policy massage for the State and National Government to deal with groundwater quality problem in the country. In all the project villages the water quality parameters, i.e. Fluoride and TDS has improved as the concentration of fluoride and TDS has declined significantly. It will have long term positive impact on the health of the people.*

Integrated Approach for Augmenting Ground Water In Chirawa Block of Jhunjhunu District, Rajasthan

(Amrit Jalam Pariyojana)

1. Introduction

Rajasthan is a desert state with a geographical area of 34.3 million hectare and supports a population of 56.5 million human and54.6 million livestock. Of the total human population 76.6 per cent reside in rural areas in 37889 villages and 56057 habitations. Only 23.4 per cent live in 222 urban town and cities. The average per capita income of the people of Rajasthan is Rs. 13066(at current prices) or Rs. 7930(at constant price 1993-94 prices).The land utilization pattern of the state shows that of the total geographical area 48.9 per cent is cropped/cultivated area, and 25.9% is potential cultivable area presently in the form of current and permanent fallow or culturable waste. Only 7.7% is as barren and uncultivated lands, pastures and grazing lands, etc. State also suffers from chronic water scarcity as the quantity and duration of rainfall is uncertain. There are significant variation in regional and temporal distribution of rainfall as evident from the fact that 60 per cent of its area is classified as arid and semi-arid, mainly the Western and North-Eastern parts. The uneven distribution of rainfall creates an imbalance in water availability for drinking, irrigation and other usage, influencing the social and economic development of the regions. The rainfall is highest in the southern region while lowest in the western region. On an average Rajasthan receives 157439 million Cubic meters (MCM) of rainfall annually of this 90 percent is received during the monsoon season. The implication of this skewed distribution of rainfall is in terms of water storage capacity of reservoirs to maintain supply during rest of the year. Uncertainty in rainfall also results in frequent droughts. The frequency and intensity of droughts i.e. moderate or severe vary across districts/ regions over time significantly. The condition can be understood by the fact that since 1901 i.e. over 102 years there were only 9 years when none of the district and village was affected by drought. These facts indicate the difficult natural conditions prevailing in the state posing serious challenge before the State Government to supply safe drinking water to large number of villages, habitations and scattered rural population. The task becomes more difficult if the growth in population is also higher than rest of the India increasing thereby the demand for water manifold. The population of Rajasthan increased from 15.97 million in 1951 to 56.47 million in 2001, at an annual growth rate of 2.56 percent. The most critical challenge before the State is ensuring sustaining supply of water both for drinking/domestic use and irrigation for livelihood of rural people.

The decades ahead will see population growth and along with it growth in demand for food, health and other dependent services all of which impact on the use of water. Feeding the increasing population will require massive increase in agricultural output. Opportunities for expansion of agricultural land and development of new irrigation sources to increase food production are limited. Therefore, all the additional output must come through increasing yields from the existing cropped area. This would be possible only by efficient and sustainable management of water resources. Groundwater will be of particular importance as it supports 90% of drinking water supply and 60% of irrigation in the state.

Groundwater as a source of drinking and agricultural use sustains large population. Groundwater has been viewed as a reliable and only alternative source of drinking water. Even today, groundwater forms the basis of most government rural drinking water supply schemes to serve dispersed population. One of the principal advantages of groundwater supply arises from the buffering effect of groundwater aquifers in relation to climatic variability and water demands. The most significant aspect of groundwater behavior in relation to drought is the time lag between changes in recharge and responses in groundwater levels and well yields. This contrasts with the relatively flashy behavior of surface water sources. This does not mean that groundwater is unaffected by meteorological drought. The time lag between a meteorological drought and its impact on a groundwater source depend on many different factors, such as severity and duration of drought, physical characteristics of aquifer, etc. However, the buffering capacity is not without limits. Over exploitation of groundwater may lead to 'groundwater drought'. This is largely a man made phenomenon and presently it is this increasing over-exploitation of groundwater a cause of concern in Rajasthan and particularly in the Jhunjhunu district.

1.1 Water Resources in Jhunjhunu

The water resource availability in the Jhunjhunu district is shown in Table1. In the absence of major surface water sources in the district people are mostly dependent on the groundwater. Irrigation use account for 83.4% of total groundwater draft and with the increase in number of tube wells the stage of groundwater exploitation has reached to 228%, which is unsustainable in future unless special measures are taken to recharge groundwater or reduce irrigation demand drastically.

Table 1: Groundwater Estimation in Jhunjhunu District (Figures in MCM)

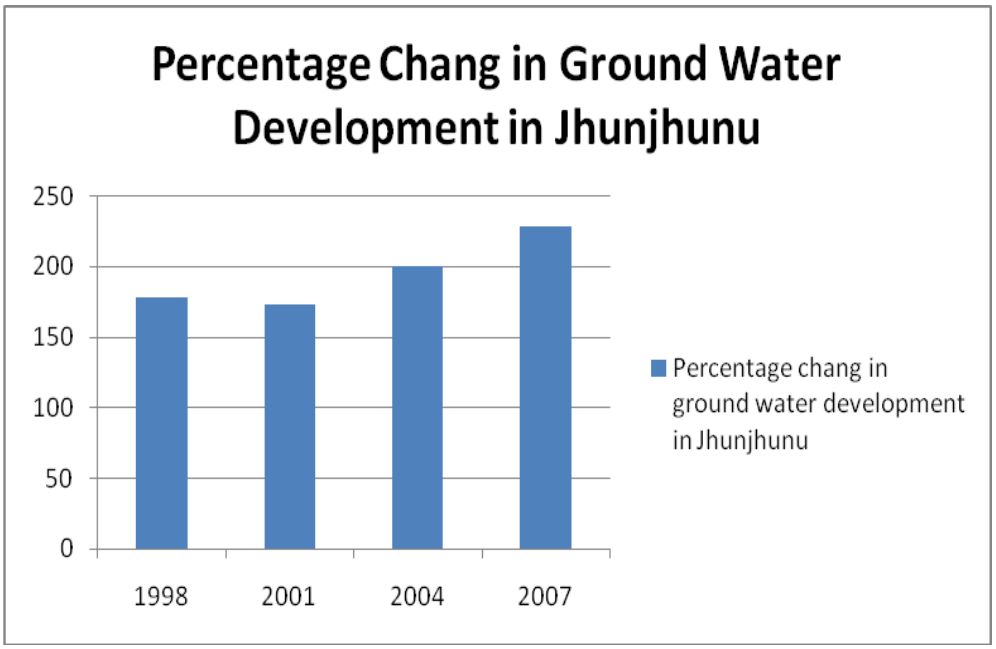
Item	Year			
	1998	2001	2004	2009
Gross/ Net groundwater recharge	220.27	243.04	235.12	269.53
Groundwater Draft (1)Irrigation (2)Domestic & Industrial	 335.22 56.39	 358.09 61.59	 399.33 71.03	 463.89 92.38
Gross draft(1)+(2)	391.61	419.68	470.36	556.27
Groundwater balance				
Stage of groundwater Development in %	177.79	172.68	200.05	228

The block wise status of groundwater in the district is also very bad as except for Alsisar block all others are overexploited. In Alsisar the situation is safe because mostly the groundwater is brackish and availability is limited. The Figure also shows that percentage change in groundwater development in the Jhunjhunu is increasing at an unsustainable rate and future water crisis is written on the wall unless people understand the situation and take urgent action in reversing the trend by community action.

Table 2: Block wise ground water potential in the Jhunjhunu District

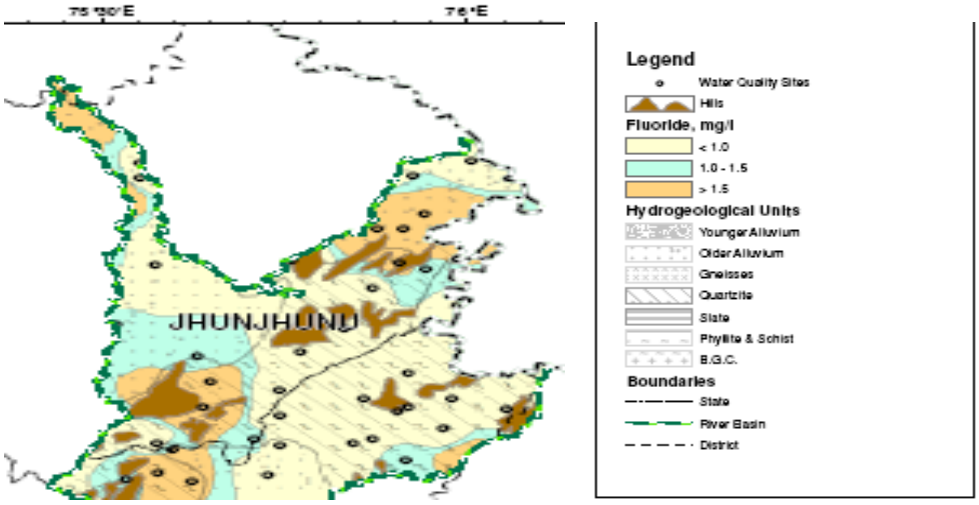
S.No.	Name of the block	Water bearing formation	Net annual ground water availability (mcm)	Ground water draft for irrigation (mcm)	Existing gross GW draft for domestic and industrial (mcm)	Net ground water availability for future irrigation development (ha.m)	Category of block
1	Alsisar	Ao	25.7358	168937	13.2000	-4.3579	Critical
	Alsisar	Ao (s)	4.2931	1.4129	0.0000	2.8802	Safe
2	Buhana	Ao/Q	31.9587	47.3000	14.3200	-29.6613	Over.Exp.
3	Chirawa	A/Ao	22.6543	62.9694	13.5000	-53.8151	Over.Exp
4	Jhunjhunu	Ao	28.6454	53.0384	21.5000	-45.8930	Over.Exp
5	Khetri	A/Ao/Q	31.2366	33.1695	11.4200	-13.3529	Over.Exp
6	Nawalgarh	AO/Q	31.1660	71.9326	19.5700	-60.3366	Over.Exp
7	Surajgarh	Ao	31.9147	64.9764	14.5000	-47.5617	Over.Exp
8	Udaipurwati	A/Ao/Q	37.7406	76.1713	22.1300	-60.5607	Over.Exp
	Total		245.3452	427.8642	130.1400	-312.6590	

Source: SGD/CGWB as on 31.03.2008 are given in the table 1.2.1

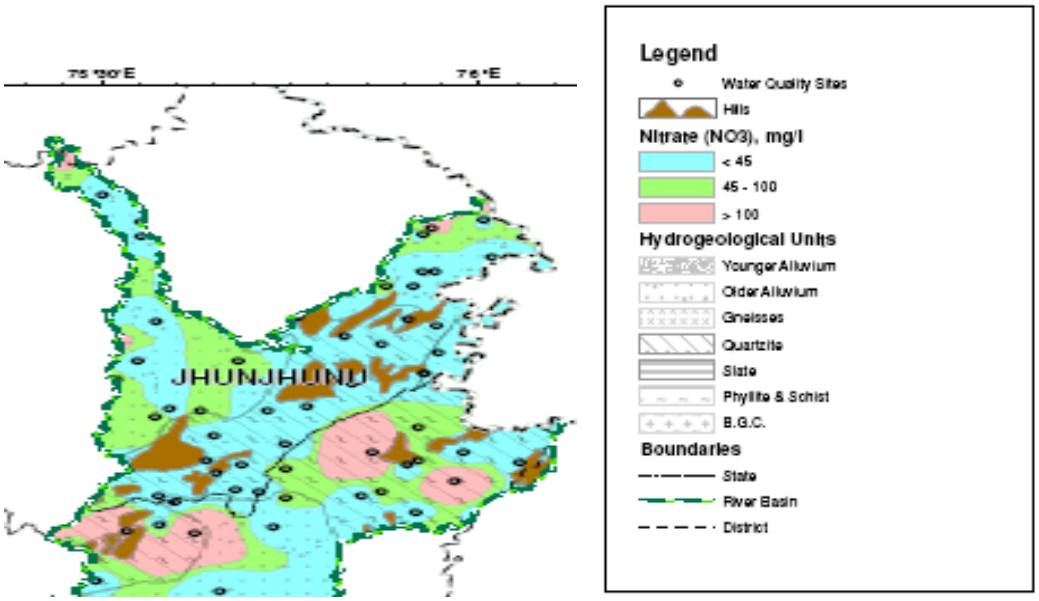


This depleting status of groundwater in the Jhunjhunu district has led to deterioration in the quality of groundwater. Fluoride, Nitrate and brackishness are the major pollutants found at varying quantity in the district. The groundwater pollution affected areas are shown in the two figures shown below. The quality of groundwater has affected the health of the people seriously.

Fluoride Affected Area in Jhunjhunu District



Nitrate Affected Area in Jhunjhunu District



1.2 Objectives of the Project

1. Sensitizing the target population of the hazards of ground water table depletion and ways of augment ground water- by holding a series of workshops and lecture demonstration in the area

2. To create a sustainable system for harvesting and conservation of rain water in project area and training local people to use and maintain them.

3. To demonstrate the efficacy of the measures undertaken in the project for augmentation of ground water.

1.2.1 Intermediate Objectives

a) Assured availability of quality drinking water to each household for at least 300 days through in house rain water harvesting intervention.
b) To contribute to the extent of nearly 50% of net draw down.
c) Increased awareness among the target group for management of this scarce resource.
d) Promotion of better Health and Hygiene practices through increased awareness.

1.3 Methodology adopted for Impact Assessment of the Project

The methodology adopted for this project impact study was as follows: In order to assess the impacts of interventions the project area (Map 1) was visited, parameters of change were identified and based

on those a questionnaire for field survey was prepared. The questionnaire was field tested and commissioned in the project villages by selecting a sample of beneficiary households. The survey of 10 percent of beneficiary households were randomly selected from the five project villages, the details are shown in the Table 3. Besides the household survey interviews were also organized with the key informants and group discussions with the beneficiaries in the project villages. The survey data was analyzed using SPSS statistical package and the results are discussed in the subsequent sections.

Table 3: Sample villages and number of households for primary survey

Name of Village	Total households (No.)	Beneficiary Households (No.)	Sample Households (No.)	Sex of Respondents (%)		
				Male	Female	Total
Ghumansar Khurd	283	109	11	90.9	9.1	100.0
Govindpura	149	67	7	100.0	0.0	100.0
Kishorpura	377	194	20	85.0	15.0	100.0
Kyamsar	392	118	12	75.0	25.0	100.0
Tigiyas	294	77	8	100.0	0.0	100.0
Total		565	58	87.9	12.1	100.0

In this project it is claimed to have included some innovative components and also was more of a participatory in nature. Those features are mentioned in the project proposal and are reproduced below. These features were also examined as how these have brought different results in the project area. From the impact assessment study point of view these features were kept in mind while conducting the survey and assessing the impact. The special features are listed below.

1.3.1 Innovative elements/components of the Project:

The project has demonstrated innovative approach for augmenting the ground water in identified 15 villages of Chirawa Block of Jhunjhunu District. The approach had the following features:

- Participatory approach in planning and execution of work elements of the projects.
- Beneficiaries' contribution in construction of rain water harvesting structures.
- Scientific determination of effective runoff for augmenting the ground water.
- Periodic monitoring to ascertain efficacy of the intervention and mid-term corrections.

1.3.2 Implementation Strategy

The following special implementing strategy was followed in the project:

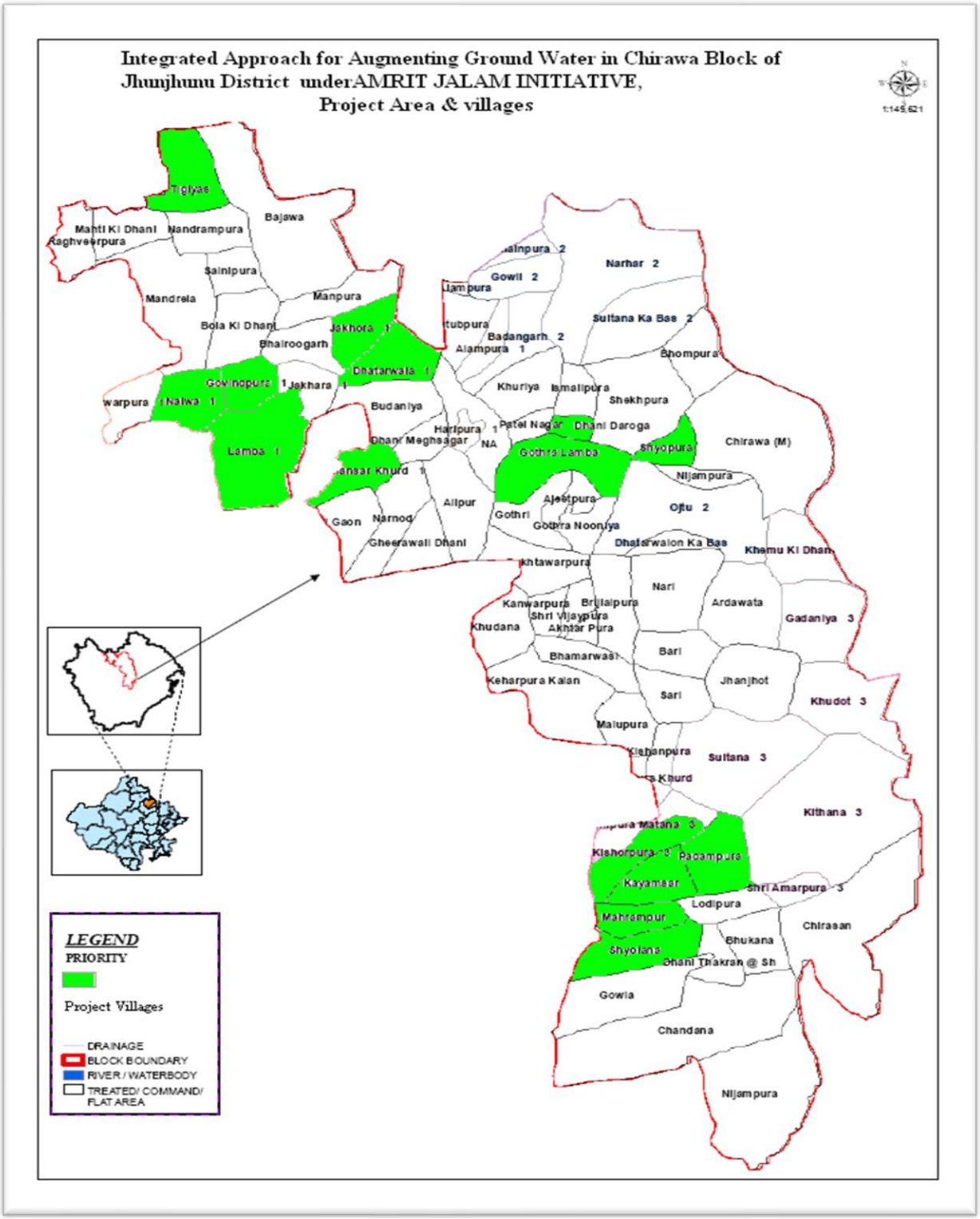
- Preparation of detailed implementation plan after the completion of baseline survey..to be submitted within 1 month after the baseline survey.

- Detailed discussion about the project with every village Development committee.
- Selection of beneficiaries in the first stage of the discussion.
- Training of all the labor and workers who will be involved in this project.
- Motivation by the Krishi Vigyan Kendra, Abusar, Jhunjhunu regarding usage of less water in agriculture and marinating the same level of income to ensure that the quality water conserved is used more for drinking purpose.
- Procurement of quality material.
- Execution of the project with the diligent and expert staff of the organization.
- Monitoring of the project from the experts from and outside the organization
- Evaluation of the project by the experts outside the organization

The ultimate expected outcome of the project is supposed to be improvement in the ground water level and quality and that can be verified by the Ground Water Department, Jhunjhunu and PIIED, Jhunjhunu to ensure the impact of interventions.

These innovative special features and implementation strategy of the project was kept in mind while designing the questionnaire for the impact study and also conducting key informant interviews and group discussions with the beneficiaries in the project villages. The project area map is shown below.

MAP 1: Project Area



2. Socio-economic characteristics of the project Population

2.1 Social Aspects of Beneficiary Population

The social composition of sample households is reported in Table 4. It shows OBC category of households account for 51.7 percent of the beneficiary followed by the SC 32.8%, ST 8.6% and general category 6.9%.

Table 4: Caste wise distribution of sample households. (Percentages)

Village	SC	ST	OBC	General	Total
Ghumansar	18.2	9.1	63.6	9.1	100.0
Govindpura	42.9	0.0	57.1	0.0	100.0
Kishorpura	40.0	10.0	45.0	5.0	100.0
Kyamsar	25.0	16.7	41.7	16.7	100.0
Tigiyas	37.5	0.0	62.5	0.0	100.0
Overall	32.8	8.6	51.7	6.9	100.0

The family size of sample households is reported in the Table 5. It indicates that overall the household size is of 7 persons of which 3.7 male and 3.4 female with the sex ratio of 934 lower which is than the State sex ratio (Table 6.)

Table 5: Sex wise distribution of sample population in sample villages.

Villages	Population (Number)				Family size
	Male	Female	Male child	Female child	
Ghumansar	3.8	2.4	1.6	1.2	9.0
Govindpura	1.9	2.0	1.0	1.3	6.1
Kishorpura	2.3	2.3	1.2	1.4	7.2
Kyamsar	2.3	2.6	1.2	0.8	6.8
Tigiyas	1.9	2.1	0.8	0.8	5.5
Overall	2.5	2.3	1.2	1.1	7.1

Table 6: Sex wise distribution of population in sample households

(Percentages)

Name of Village	Population	Sex Ratio

	Male	Female	Male child	Female child	Total	
Ghumansar	42.4	26.3	18.2	13.1	100.0 (99)	650
Govindpura	30.2	32.6	16.3	20.9	100.0 (43)	1150
Kishorpura	32.2	32.2	16.1	18.9	100.0 (43)	1058
Kyamsar	34.1	37.8	17.1	11.0 82	100.0 (143)	952
Tigiyas	34.1	38.6	13.6	13.6	100.0 44	1095
Overall	35.0	32.6	16.5	15.6	100.0 (411)	934

The education status of sample population is shown in the Table 7. Shekhawati is known for higher literacy rate compared to rest of State and it is evident from the table that illiterate population is only 19% and literate is 81% of which 32.7% are above 10th standard.

Table 7: Educational status of sample households. (Percentages)

Village	Illiterate	Literate	Primary	Middle	Higher Secondary	Graduate	Total
Ghumansar	0.0	9.1	27.3	27.3	27.3	9.1	100.0
Govindpura	14.3	0.0	28.6	14.3	28.6	14.3	100.0
Kishorpura	30.0	0.0	15.0	35.0	15.0	5.0	100.0
Kyamsar	25.0	0.0	16.7	16.7	33.3	8.3	100.0
Tigiyas	12.5	12.5	25.0	12.5	12.5	25.0	100.0
Total	19.0	3.4	20.7	24.1	22.4	10.3	100.0

The source wise income of households for the year 2009, i.e. before the start of project, and 2013 at the end of project, was compared and given in Table 8,9 and 10. Table 8 shows that income from all the occupations/sources i.e. agriculture, livestock, service and hired out labour increased over the year 2009. The per household income reported in 2009 was Rs. 66,807 and that increased to Rs. 97,050 in the year 2013 (Table 9). Service being the major source of household income has declined while earnings from all other occupations increased in the year 2013. Of the total sample beneficiary 37.9% have income more than one lac per year. Of the sample households only 5.2% have income lower than Rs. 12000 in 2013, i.e. below poverty line, which was 17% in year 2009 (Table 10).

Table 8: Village wise occupation wise income per household in 2009 and 2013.

(Rupees)

Village	Agriculture	Livestock	Labour	Service	Total
2009					
Ghumansar	23,636	2,564	8,091	53,091	87,382
Govindpura	15,571	4,000	8,000	42,857	70,429
Kishorpura	12,900	5,080	21,300	24,000	63,280
Kyamsar	14,833	1,583	10,833	18,750	46,000
Tigiyas	16,125	2,375	9,375	47,500	75,375
Overall	16,103	3,376	1,3379	33,948	66,807
2013					
Ghumansar	35,818	3,636	15,182	60,182	1,14,818
Govindpura	24,571	6,929	9,429	46,429	87,357
Kishorpura	18,750	8,375	39,010	32,960	99,095
Kyamsar	23,833	3,167	23,325	46,417	96,742
Tigiyas	25,000	5,250	14,950	31,250	76,450
Overall	24,603	5,793	24,357	42,297	97,050

Table 9: Occupation wise share in total household income (2009 & 2013).

(Percentages)

Village	Agriculture	Livestock	Labour	Service	Total
2009					
Ghumansar	27.0	2.9	9.3	60.8	100.0 (87,382)*
Govindpura	22.1	5.7	11.4	60.9	100.0 (70,429)
Kishorpura	20.4	8.0	33.7	37.9	100.0 (63,280)
Kyamsar	32.2	3.4	23.6	40.8	100.0 (46,000)
Tigiyas	21.4	3.2	12.4	63.0	100.0 (75,375)
Overall	24.1	5.1	20.0	50.8	100.0 (66,807)
2013					
Ghumansar	31.2	3.2	13.2	52.4	100.0 (1,14,818)
Govindpura	28.1	7.9	10.8	53.1	100.0 (87,357)
Kishorpura	18.9	8.5	39.4	33.3	100.0 (99,095)
Kyamsar	24.6	3.3	24.1	48.0	100.0 (96,742)
Tigiyas	32.7	6.9	19.6	40.9	100.0

					(76,450)
Overall	25.4	6.0	25.1	43.6	100.0 (97,050)

Note: *The figures in parenthesis are per household income in rupees.

Table 10: Village wise, Income group wise distribution of sample households

(Percentages)

Village	<12000	12001-30000	30001-60000	60001-100000	>100000	Total
2009						
Ghumansar	0.0	18.2	45.5	9.1	27.3	100
Govindpura	14.3	28.6	28.6	0.0	28.6	100
Kishorpura	15.0	20.0	10.0	45.0	10.0	100
Kyamsar	33.3	0.0	33.3	8.3	25.0	100
Tigiyas	25.0	25.0	25.0	0.0	25.0	100
Overall	17.2	17.2	25.9	19.0	20.7	100
2013						
Ghumansar	0.0	0.0	27.3	45.5	27.3	100
Govindpura	0.0	42.9	0.0	28.6	28.6	100
Kishorpura	10.0	5.0	15.0	30.0	40.0	100
Kyamsar	8.3	16.7	0.0	16.7	58.3	100
Tigiyas	0.0	37.5	12.5	25.0	25.0	100
Overall	5.2	15.5	12.1	29.3	37.9	100

The Table 11 shows the type of dwelling houses owned by the beneficiary households, 94.8% of them have pucca houses. This is positive aspect of the project as rooftop rainwater harvesting was the most important activity and strategy to address the depleting groundwater problem in the region.

Table 11: Type of houses owned by sample households.

(Percentages)

Village	Kutcha	Semi Pucca	Pucca	Total
Ghumansar	0.0	0.0	100.0	100.0
Govindpura	0.0	28.6	71.4	100.0
Kishorpura	0.0	0.0	100.0	100.0
Kyamsar	8.3	0.0	91.7	100.0
Tigiyas	0.0	0.0	100.0	100.0
Total	1.7	3.4	94.8	100.0

Livestock is part of farming system of the household. It not only provides income, food, nutrition but also takes care of climatic risk as animal husbandry is less risky than crop husbandry. But besides human beings animas also need drinking water and therefore additional demand for water.

The livestock number, composition and value of animals owned by the beneficiaries is given in Tables 12 and 13. The average number of livestock owned per household was 1.9 and 1.3 animals in the year 2009 and 2013 respectively. The composition of livestock in Table 11 shows that small ruminants, i.e. goats account for the highest share of 34.6% followed by buffaloes 33.1% and cattle 32.3% of the total livestock owned. The composition of livestock has changed in favour of large animals and it is sign of assured supply of drinking water in the project villages.

Table 12: Livestock number and value of livestock asset owned by sample households (Number per household)

Items	Village					
	2009					
	Ghumansar	Govindpura	Kishorpura	Kyamsar	Tigiyas	Total
Cattle	0.6	0.7	0.3	0.5	0.6	0.5
Value	7455	7714	2250	5833	6375	5207
Buffalo	0.5	1.1	0.6	0.5	0.3	0.6
Value	11818	16143	12150	12917	5625	11828
Goat	0.6	0.4	0.9	0.3	2.1	0.8
Value	1364	614	3950	625	4125	2393
Overall	1.8	2.3	1.7	1.3	3.0	1.9
Value	20636	24471	18350	19375	16125	19428
	2013					
Cattle	1.1	1.0	0.4	0.8	1.0	0.7
Value	15773	12429	4350	12583	14375	10578
Buffalo	1.0	1.3	0.8	0.4	0.4	0.8
Value	27091	26429	24850	14583	14375	21897
Goat	1.2	0.4	0.7	0.4	1.4	0.8
Value	4164	929	3075	1542	4725	2933
Overall	3.3	2.7	1.9	1.6	2.8	2.3
Value	47027	39786	32275	28708	33475	35407

Table 13 : Composition of livestock owned by sample households.
(Percentages)

Items	Sample Villages					
	2009					
	Ghumansar	Govindpura	Kishorpura	Kyamsar	Tigiyas	Total
Cattle	35.0	31.3	14.7	40.0	20.8	25.7
Buffalo	30.0	50.0	32.4	40.0	8.3	30.3
Goat	35.0	18.8	52.9	20.0	70.8	44.0

Overall	100	100	100	100.0	100	100
	2013					
Cattle	33.3	36.8	18.9	47.4	36.4	32.3
Buffalo	30.6	47.4	43.2	26.3	13.6	33.1
Goat	36.1	15.8	37.8	26.3	50.0	34.6
Overall	100	100	100	100	100	100

3. Impacts of Project Interventions

As per the project document seven major activities were planned beside capacity building of beneficiaries those activities, targets and achievements are as follows:

Table 14: Project activities, target and achievements

Serial no.	Activity	Target till July 2013	Progress till 31st July 2013
1	RWH Tanks	685	685
2	Recharge Wells	12	15
3	Monitoring Wells	12	12

4	Ponds	3	3
5	Soak Pit	3325	2022
6	Improved Toilets	600	600
7	Plantation	70000	89600

The expected outcome and impacts of these activities, as listed in the project document are as follows:

Outcome:

- Augmentation of Ground Water through rain water harvesting and conservation of water

Impact:

- Assured availability of quality drinking water to each household for at least 300 days through in house rain water harvesting intervention.
- To contribute to the extent of nearly 50% of net draw down.
- Increased awareness among the target group for management of this scarce resource.
- Promotion of better Health and Hygiene practices through increased awareness.

The expected physical outcome of the project activities as per the project document in12 villages of Chirawa Block of Jhunjhunu District comprising nearly 19,000 beneficiaries of 280 households were as follows.

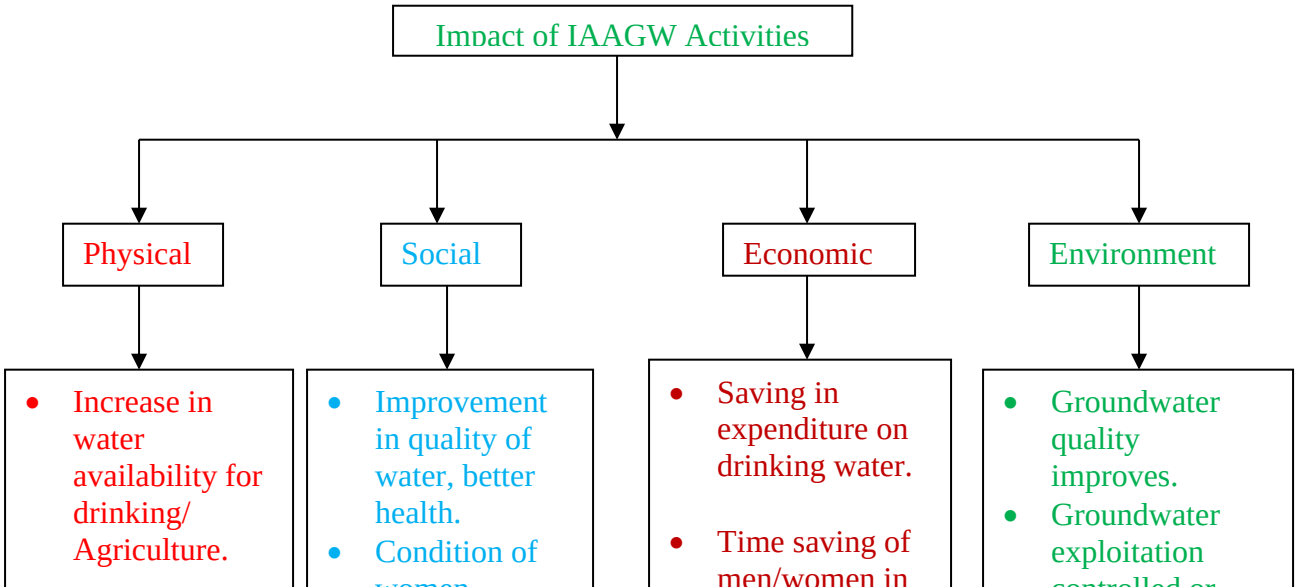
*Project activities in three additional villages have also been undertaken in accordance to the approval of the committee.

Table 15 : Expected physical outcome.

Particulars	Year 1	Year 2	Year 3	Total
Rain water harvesting tanks(Tanka)	220	235	230	685
*Recharge well	4	4	4	12
Ponds	1	1	1	3
Soaking pits	1000	1200	1125	3325
Toilets	200	200	200	600
Plantation	50000	10000	10000	70000

*Its expected outcome, therefore, the figure should be which we have mentioned in the project proposal.

The impacts of the project interventions if looked from a wider perspective can be as shown in the following diagram



The perceived /expected outcome and impact of project activities has to be seen in the larger context of the status of natural resources is Rajasthan or Jhunjhunu. The intensity of impact and gains are always more in case when there is a scarcity of resources. Since the interventions were more to overcome the water scarcity situation faced by the people in the region, particularly fast depleting ground water. In this study impact of project interventions more specifically on water resources in the intervention area is being studied.

The severe scarcity situation of ground water arises because of overexploitation for irrigation as discussed in the section 1.2 above. The situation is not improving despite government has taken up highly subsidized micro irrigation adaptation programs. Infect, there are evidences that extension of micro irrigation system has encouraged farmers to extend area under cultivation on marginal and undulating lands resulting in higher extraction of groundwater. Therefore, besides the proposed intervention of recharging groundwater more emphasis was on awareness and capacity building of people to understand the severity of the problem faced by the present and future generation.

There were mainly five activities planned under the project in 15 villages 2800 beneficiary households. The first three activities, namely construction of Tanka, Sock Pit, and Toilet was taken up with all the beneficiaries as shown in the Table 16. Plantation and training activity beneficiary were 55.2 and 56.6 percent respectively.

Table 16: Households benefited by type of activities under taken in IAAGW Project.

(Percentages)

Name of Project Village	Household covered under project activity				
	Tanka construction	Sock Pit construction	Toilet	Plantation	Training
Govindpura	100.0	100.0	100.0	56.0	46.0
Kishorpura	95.0	100.0	100.0	70.0	87.0
Kyamsar	100.0	100.0	100.0	64.7	36.0
Tigiyas	100.0	100.0	100.0	37.0	42.0
Overall	98.3	100.0	98.3	55.2	56.6

The impact of the project can also be assessed from various points of view, such as, donors/Project funder's point of view, Implementers point of view, and beneficiary's point of view. The Table 17 provides information about beneficiary perception about the impact of the project interventions.

The first important aspect of project is direct or indirect benefit to the individual beneficiary and community as a whole and it is heartening to note that 100 percent beneficiary were of the view that this project has brought benefit on both counts. Beneficiaries have benefited in terms of increase in availability of safe drinking water, reduction in drudgery in fetching water, saving in time particularly of women in fetching drinking water, reduction in the health expenditure because of reduction in water born dieses and income from wages by employment in project activities. As per the beneficiaries perception the project was successful in achieving its major objective of recharging groundwater by measures taken for harnessing rain water falling within the geographical boundary of the project villages. The Table 17 shows those beneficiaries were of the view that groundwater was recharges and the discharge capacity of their wells, tube wells and Handpump increased. More water was also made available to livestock and for agriculture. There was complete satisfaction of the beneficiaries participating in the project.

Table 17: Respondents perception about the impact of the project activities

(Percentages)

Perceptions/Village	Ghumansar	Govindpura	Kishorpura	Kyamsar	Tigiyas	Overall
Did you Benefit	100	100	100	100	100	100
Did village Benefit	100	100	100	100	100	100
Reduction in health & health related Expenditure	100	100	95.0	100	100	98.3

Earned wages from project works	90.0	100	10.0	100	100	64.2
Helped in Food security	100	100	55	100	100	80.0
Decrease in distance of drinking Water source	100	100	100	100	100	100.0
Improve Capacity of HP/Tube well	100	100	100	100	100	100.0
Increase in Fodder availability	100	100	94.7	100	100	98.1
Increase in water availability for cattle	100	100	90.0	100	100	96.4
Increase in Agriculture production	100	100	60.0	66.7	100	79.3
Increase in Livestock production	100	100	60.0	100	100	86.0
Increase in GW recharge	100	100	100	100	100	100.0

As mentioned above the impact of the project activities can be in terms of physical, social, economic and environmental, in the subsequent sections all these aspects are discussed based on the results of beneficiary survey conducted in the project villages.

3.1 Physical Impact

The Table 18 shows the year wise target set for the activities and achievements. Except for construction of target number of soaking pits all other physical targets were achieved, rather over achieved in case of plantations. The rainwater harvesting tanks are the asset created for the beneficiaries that has long term vale as it will ensure safe drinking water at much less cost to the household and also serve as tank for storage of water when no rain water is available.

Table 18: Physical targets and achievements in the project.

Project Activity	Target				Achievement			
	Year				Year			
	I	II	III	Total	I	II	III	Total
Rain water harvesting tanks	220	235	230	685	222	235	238	685

Recharge well	4	4	4	12	2	4	9	15
Ponds	1	1	1	3	1	1	1	3
Soaking pits	1000	1200	1125	3325	761	479	803	2022
Toilets	200	200	200	600	198	200	203	601
Plantation	50000	10000	10000	70000	49755	12760	27085	89600

3.2 Social Impact

The social gains are equally important in any project outcome and this project too has brought gains as evident from the Tables 19, 20 and 21. Beneficiary awareness and participation is the key to the success of any intervention and this project has shown remarkable results on both these parameters. The Table 19 shows that respondents were fully aware about the project activities, project implementing agency and the user group. Also 86.2% of the respondents knew about the project and 79.3% even about the objectives of the project.

Table 19: Respondents awareness about IAAGW Project and its activities.

(Percentages)

Name of Villages	About the Project	About the Project Objective	About the Project activities	About the Project officials	About the User group
Ghumansar	90.9	72.7	100	100	100
Govindpura	100.0	85.7	100	100	100
Kishorpura	85.0	70.0	100	90	100
Kyamsar	91.7	91.7	100	100	100
Tigiyas	62.5	87.5	100	100	100
Overall	86.2	70.7	100	96.6	100

Active participation of beneficiary in the project ensures long term sustainability and quality of any activity/intervention. Table 20 shows participation of respondents in different steps/phases of project implementation. The table shows that beneficiaries were active at all levels of project implementation, such as, planning of activity, work selection, site selection work execution, maintenance and overall decision making. That is generally not found in the government run schemes/projects/programs. Even the participation of beneficiary as providing labour contribution in the project activity had doubly benefited by first getting financial gain from employment and second ensuring the quality of work by his direct supervision. The other major positive feature of the project is overwhelmingly satisfaction of beneficiaries about financial transparency and quality of work done that is also rarely observed in government programs. It shows the good image and credibility of the implementing agency.

These achievements of RJDSS were mainly because of the pre-project groundwork and the proposed capacity building activity in the project. Respondents' perception about the capacity building activity is reported in Table 21. The table shows that 56.6% of the respondent had attended the trainings organized for their capacity building and 22.4% were member of Village Development Committee (VDC). The trainings were of one day and more than one day, 64% respondents attended one day trainings and 36% more than one day trainings

Table 20: Participation of respondents in the project activities. (Percentages)

Activities/Villages	Ghumansar	Govindpura	Kishorpura	Kyamsar	Tigiyas	Overall
Decision-making	100	100	100	100	100	100

Planning	90.9	100.0	95.0	100.0	87.5	96.6
Work selection	90.9	100.0	85.0	100.0	100.0	93.1
Site selection	100.0	100.0	85.0	91.7	100.0	93.1
Work Execution	90.9	85.7	70.0	83.3	100.0	82.8
Maintenance	100.0	100.0	100.0	100.0	100.0	100.0
Wage worker	90.9	100.0	85.0	83.3	87.5	87.9
Financial Transparency (Satisfied)	100.0	85.7	95.0	100.0	100.0	96.6
Quality of work (satisfied)	100.0	85.7	100.0	100.0	100.0	98.3

Table 21 Respondents perception about capacity building activities under IAAGW

(Percentage)

Village	Member of VDC	Member of user group attended training	Durations of Training	
			One day	More than one
Ghumansar	18.2	72.0	40.0	60.0
Govindpura	42.9	46.0	33.3	66.7
Kishorpura	40.0	87.0	100.0	0.0
Kyamsar	8.3	36.0	33.3	66.7
Tigiyas	25.0	42.0	0.0	100.0
Overall	22.4	56.6	64.0	36.0

3.3 Economic Impact

The economic background of the sample households is discussed in Section 2, it shows that in the occupation wise source of household income service and agriculture occupation contributes significantly in the household income. However, this composition is changing since 2009 and that to because of the project interventions. The major activity in the project is augmenting the supply of water, both for drinking and irrigation and that has affected the household income in at least two direct ways. First, increase in groundwater supply, because of the activity relating to rainwater harvesting and recharging the aquifers, and second reduction in the expenditure on health, because of safe drinking water availability made by the project. As 60% of the disease in the villages are water born and presently the quality of drinking water is affected by fluoride, nitrate, brackish and also TDS causing lot of disease in the village and households are becoming indebted because of medical expenditure. The project has provided an alternative safe source of drinking water as shown in Table 22. There is significant shift in the household source of drinking water from government source, i.e., Handpump and ground level reservoir (GLR) to private individual *Tanka* based on rainwater supply. In the year 2009 household were 89% dependent on government source of drinking water supply and that drastically came down to 9% in 2013 as the project provided alternative source called Tanka and now 91.4% household reported using this as the major source of drinking water. This has also helped in reducing the distance of the source, time taken in fetching water and drudgery of women. In the year 2009 in 99.3% cases the water was fetched from the distance of 500 meters and that got reduced to zero and now in 2013 almost 98% household has that facility within house. Lot of time saved of women in fetching water so they can do other productive work and generate household income.

Table 22: Village wise source of drinking water for humans' in the sample villages.

	Source of drinking water (Percent)				Distance		
	Handpump	Tanka	GLR	Total	Within House	Up to 500 meter	Up to 1000 meter
Village	2009						
Ghumansar	0.0	9.1	90.9	100.0	0.0	100.0	0.0
Govindpura	0.0	14.3	85.7	100.0	0.0	100.0	0.0
Kishorpura	0.0	20.0	80.0	100.0	0.0	100.0	0.0

Kyamsar	8.3	0.0	91.7	100.0	0.0	91.7	8.3
Tigiyas	0.0	0.0	100.0	100.0	0.0	87.5	12.5
Overall	1.7	10.3	87.9	100.0	0.0	96.6	3.4
	2013						
Ghumansar	18.2	81.8	0.0	100.0	100.0	0.0	0.0
Govindpura	0.0	100.0	0.0	100.0	100.0	0.0	0.0
Kishorpura	0.0	100.0	0.0	100.0	95.0	5.0	0.0
Kyamsar	0.0	75.0	25.0	100.0	100.0	0.0	0.0
Tigiyas	0.0	100.0	0.0	100.0	100.0	0.0	0.0
Overall	3.4	91.4	5.2	100.0	98.3	1.7	0.0

The Table 23 shows the average family size and the size of Tankas owned by sample beneficiaries. Also shows that because of these tankas amount saved on account of household expenditure in purchasing drinking water in a year. Good monsoon rains can fill these tankas 2 to 3 times in a rainy season. The full tanka can provide drinking water up to 8 months depending upon the family size and water demand. Table 24 shows the number of months water was available in the Tanka after monsoon season to the beneficiaries. It is to be noted that 47.4% beneficiary reported that Tanka water was available up to 6 months, despite the fact that the 2013 year was not a good rainfall year in the region. In village Govindpura 28.6% beneficiary reported that the tanka water was available up to 8 months. This is a very positive and significant impact of the project.

Table 23: Water availability in Tanks of the sample households. (Months after monsoon)

Village	Family Size (Number of members)					Average capacity of	Amount saved (Rs)
	<3	4 to7	8 to 10	>10	Overall		

						Tanka (Lts.)	Per household
Ghumansar	0	4.5	4	3.4	3.9	19360	3600
Govindpura	0	5.6	4.5	0	5.5	18857	3600
Kishorpura	6	7	5.7	5.3	5.6	18789	2150
Kyamsar	6	6	5	4.5	5.4	18900	2150
Tigiyas	6	5	0	4.5	5	19400	3600
Overall	6	5.6	4.8	4.4	5.2	19061	3600

Note: * Rs.450 and 275 per tanker of drinking water. The capacity of tanker is 4000 liters.

Table 24: Rain water availability in Tanka for domestic use.

(Percentages)

Village	Availability of rain water after monsoon season (months)						
	2	3	4	5	6	7	8
Ghumansar	9.1	18.2	54.5	9.1	9.1	0.0	0.0
Govindpura	14.3	14.3	28.6	0.0	14.3	0.0	28.6
Kishorpura	0.0	0.0	21.1	5.3	68.4	5.3	0.0
Kyamsar	0.0	0.0	25.0	8.3	58.3	8.3	0.0
Tigiyas	0.0	25.0	12.5	0.0	62.5	0.0	0.0
Overall	3.5	8.8	28.1	5.3	47.4	3.5	3.5

The above facts reveal that there was a very significant economic impact of the project in the Shekhawati region and its demonstration affect/impact will travel to many villages in the region and will bring change in the of drinking water supply policy of PHED, Government of Rajasthan.

3.4 Environmental Impact

3.4.1 Environmental factor based Migration

Family migration could be induced by push, or pull or a combination of push and pull factors.

One can deduce two strands of reasoning on migration: one that emerges from economic growth theory and the other that emerges from Third World urbanization. But the recently emerging factor is Environmental Change based migration (caused by depletion of natural resources or climate change factors). Growth theories consider two types of mobility of labour and population as inevitable or as a normal process of economic growth. Such movements are seen to be induced by the prosperity of

the recipient sector: industries located in urban centres. Technological innovations improve productivity in the industrial sector and lead to expansion in employment opportunities and an increase in wages in that sector. Simultaneously, mechanization that takes place in agriculture, which is labour-saving, creates of a surplus labour and also improves productivity in that sector. Labour pushed" out of the agricultural sector due to labour-saving technological transformation gets absorbed in the industrial sector. In the next stage, the increase in prosperity of the industrial and agricultural sectors triggers off the demand for services and consequently the tertiary sector (often located in urban areas) and expands to attract labour from the rural areas. Thus, migration in this scheme is pull or prosperity induced.

The micro-level studies suggest that family migration from rural areas in India occurs largely as a survival option. The micro-level studies offer a limited amount of evidence which suggest that family migration is largely push induced movement (induced by a deterioration in living conditions in the place of origin particularly degradation of natural resources). However, casual empiricism suggests that family migration of the push, pull, and push-pull types occur in India.

However, an examination of the data on spatial movement suggests that four types of movements – rural-rural, urban-urban, rural-urban and urban-rural – occur in India. While the first two are within sector mobility, the second two are between sector mobility. Of between sector mobility, our concern is rural-urban migration caused by change in environmental parameters, particularly because of change in water availability and access to rural population. There are evidences that depletion of groundwater resulting in no Rabi crops and in such condition if there is even mild drought year leading to Kharif crop failure creates, tremendous pressure on rural labour and agriculture households to migrate. Since groundwater exploitation is highest in the Jhunjhunu district including the project area migration of human population is caused by environmental factor. The results of survey conducted in the project villages regarding migration is reported in Table 25. The table shows that on an average 26.7 percent people migrate because of drought/crop failure. The intensity of migration is much higher in case of Kyamsar and Ghumansar. As this projects helps in augmenting groundwater by rainwater harvesting has definitely helped in reducing the intensity of forced out migration from the rural areas. The project will have long term positive environmental impact.

Table 25: Village wise sample households reporting migration and place of migration.

(Percentages)

Village	Household reported migration	Place of migration				Reasons of migration		
		Within District	Within Rajasthan	Out of Rajasthan	Total	Regular practice	Crop failure	Total
Ghumansar	27.3	0	66.7	33.3	100.0	66.7	33.3	100.0
Govindpura	28.6	0	0.0	100.0	100.0	100.0	0.0	100.0
Kishorpura	35.0	14.3	0.0	85.7	100.0	85.7	14.3	100.0
Kyamsar	25.0	100.0	0.0	0.0	100.0	33.3	66.7	100.0
Tigiyas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Overall	25.9	26.7	13.3	60.0	100.0	73.3	26.7	100.0

3.4.2 Groundwater quality improvement

The five project activities listed below were directly linked to rainwater harvesting, conservation and recharging groundwater in the project area.

Activity	Progress till 31st July 2013
RWH Tanks	685
Recharge Wells	15
Monitoring Wells	12
Ponds	3
Soak Pit	2022

The outcome of these interventions is reported in Table 26. It shows that because of the community participation in rainwater harvesting and recharging the quality of groundwater has improved. This is the most prominent environmental impact of the project. Infect it will set a massage for the rest of the society/people to go for such measures for sustainable future in the region. It is also a policy massage for the State and National Government to deal with groundwater quality problem in the country. The Table 26 shows that in all the project villages the water quality parameters, i.e. Fluoride and TDS has improved as the concentration of fluoride and TDS has declined significantly. It will have long term positive impact on the health of the people.

Table 26: Impact of the Project on the Groundwater quality in the project area.

Project Villages	Fluoride - 2001	Fluoride-2013	TDS-2001	TDS-2013
Ghumansar	0.9	0.8	1120	870
Govindpura	4.3	2.5	1960	960
Tigiyas	5.4	3.4	1890	1800
Kishorpura	0.4	0.3	770	880
Kayasmar	0.3	0.3	710	755

Because we have covered only five villages in study so in my opinion, we should give data of only these villages.

4. Conclusions

Rajasthan is a desert state. It also suffers from chronic water scarcity and quality problems. The difficult natural conditions prevailing in the state poses serious challenge to supply safe drinking water to large number of villages, habitations and scattered rural population. The task becomes more difficult when the population growth is also higher than rest of the India increasing thereby the demand for water manifold.

The most critical challenge before the State is ensuring sustaining supply of water both for drinking/domestic use and irrigation for rural and urban population. Groundwater in the state plays significant role it supports 90% of drinking water supply and 60% of irrigation in the state. Over exploitation of groundwater has led to 'groundwater drought'. This is largely a manmade phenomenon

and presently the increasing over-exploitation of groundwater is a cause of concern allover Rajasthan and particularly in the Jhunjhunu District.

The water resource availability in the Jhunjhunu District is critical in the absence of major surface water sources in the district. People are mostly dependent on the groundwater. Irrigation use account for 83.4% of total groundwater draft and with the increase in number of tube wells the stage of groundwater exploitation has reached to 228%, which is unsustainable in future unless special measures are taken to recharge groundwater or reduce irrigation demand drastically. The block wise status of groundwater in the district is also very bad, except for Alsisar block all other blocks are overexploited. Further, this depleting status of groundwater in the Jhunjhunu District has led to deterioration in the quality of groundwater. Fluoride, Nitrate and brackishness are the major groundwater pollutants found at varying quantity in the district.

There were three major objectives of the IIAGW Project: (1) Sensitizing the target population of the hazards of ground water table depletion and ways of augment ground water- by holding a series of workshops and lecture demonstration in the area. (2) To create a sustainable system for harvesting and conservation of rain water in project area and training local people to use and maintain them and (3) To demonstrate the efficacy of the measures undertaken in the project for augmentation of ground water.

The methodology adopted for the project impact study was as follows: In order to assess the impacts of interventions the project area was visited, parameters of change were identified and based on those a questionnaire for field survey was prepared. The questionnaire was field tested and commissioned in the project villages by selecting a sample of beneficiary households. The survey of 10 percent of beneficiary households were randomly selected from the five project villages. Besides the household survey interviews were also organized with the key informants and group discussions with the beneficiaries in the project villages. The survey data was analyzed using SPSS statistical package.

As per the project document seven major activities were planned beside capacity building of beneficiaries those activities were: Construction of RWH Tanks, Recharge Wells, Monitoring Wells, Ponds, Soak Pit, Improved Toilets, and Plantation. The physical project activities were undertaken in

the 12 villages of Chirawa Block of Jhunjhunu District comprising nearly 19,000 beneficiaries of 280 households.

Findings of the Impact Study

The perceived outcome and impact of project activities has to be seen in the larger context of the status of natural resources is Rajasthan or Jhunjhunu. The intensity of impact and gains are always more important in case when there is a scarcity of resources. Since the interventions were more to overcome the water scarcity situation faced by the people in the region, particularly fast depleting ground water, therefore, in this study impact of project interventions more specifically on water resources were studied.

The severe scarcity situation of ground water in the district has arisen because of the lack of awareness of people about the serious consequences of overexploitation just to bring more area under irrigation. Therefore, besides the proposed intervention of recharging groundwater more emphasis was on awareness and capacity building of people to understand the severity of the problem faced by the present and future generation.

The impact of the project can be assessed from various points of view, such as, donors/Project funder's point of view, implementer's point of view, and beneficiary's point of view. The first important aspect of project is direct or indirect benefit to the individual beneficiary and community as a whole and it is heartening to note that 100 percent beneficiary were of the view that this project has brought benefit on both counts. Beneficiaries have benefited in terms of increase in availability of safe drinking water, reduction in drudgery in fetching water, saving in time particularly of women in fetching drinking water, reduction in the health expenditure because of reduction in water born dieses and income from wages by employment in project activities. As per the beneficiaries perception the project was successful in achieving its major objective of recharging groundwater by measures taken for harnessing rain water falling within the geographical boundary of the project villages. The beneficiaries were of the view that groundwater was recharges and the discharge capacity of their wells, tube wells and Handpump increased. More water was also made available to livestock and for agriculture. There was complete satisfaction of the beneficiaries participating in the project.

Social impact: The social gains are equally important in any project outcome and this project too has brought significant social gains. Beneficiary awareness and participation is the key to the success of any intervention and this project has shown remarkable results on both these parameters. The other major positive feature of the project is overwhelmingly satisfaction of beneficiaries about financial transparency and quality of work done that is also rarely observed in government programs. It shows the good image and credibility of the implementing agency.

Economic Impact: The major activity in the project is augmenting the supply of water, both for drinking and irrigation and that has affected the household income in at least two direct ways. First, increase in groundwater supply, because of the activity relating to rainwater harvesting and recharging the aquifers, and second reduction in the expenditure on health, because of safe drinking water availability made by the project.

As 60% of the disease in the villages are water born and presently the quality of drinking water is affected by fluoride, nitrate, brackish and also TDS causing lot of disease in the village and households are becoming indebted because of medical expenditure. The project has provided an alternative safe source of drinking water. Also shows that because of Tankas constructed under the project there was saving on account of household expenditure in purchasing drinking water. Good monsoon rains can fill these Tankas 2 to 3 times in a rainy season. The full Tanka can provide drinking water up to 8 months depending upon the family size and household water demand.

Environmental Impact: The micro-level studies suggest that family migration from rural areas in India occurs largely as a survival option. The family migration is largely push induced movement (induced by a deterioration in living conditions in the place of origin particularly degradation of natural resources). Of between sector mobility, our concern is rural-urban migration caused by change in environmental parameters, particularly because of change in water availability and access to rural population. There are evidences that depletion of groundwater resulting in no Rabi crops and in such condition if there is even mild drought year leading to Kharif crop failure creates tremendous pressure on rural labour and agriculture households to migrate. Since groundwater exploitation is highest in the Jhunjhunu district including the project area migration of human population is caused by

environmental factors. As this projects helps in augmenting groundwater by rainwater harvesting it has definitely helped in reducing the intensity of forced out migration from the rural areas. The project will have long term positive environmental impact.

The five out of seven project activities were directly linked to rainwater harvesting, conservation and recharging groundwater in the project area. The outcome of these interventions shows that because of the community participation in rainwater harvesting and recharging the quality of groundwater has improved. This is the most prominent environmental impact of the project. Infect it will set a massage for the rest of the society/people to go for such measures for sustainable future in the region. It is also a policy massage for the State and National Government to deal with groundwater quality problem in the country. In all the project villages the water quality parameters, i.e. Fluoride and TDS has improved as the concentration of fluoride and TDS has declined significantly. It will have long term positive impact on the health of the people.