Interlinking Of Water Harvesting Structures Through Link Water Channels

A Viable Alternative At Micro-Level

1. BACKGROUND

The coastal areas of Gujarat especially the villages lying within 20-25 km from the seashore are suffering from the problem of Salinity Ingress. Most of the rivulets that drain this region like Goma, Somat are seasonal at best and their water does not last beyond monsoons. The other aquifers like ponds, which get water from these rivers, also dry up as early as October.

This problem of water shortage has worsened over the last few years because of the cultivation of water intensive crops like Sugarcane, Banana, Betel-Nut Leaves, Wheat, and Coconut. It has resulted in lowering of the water table and ingress of saline water. This has had far reaching implications for both household and agricultural uses of water as the availability of fresh water has steadily declined.

This has also meant that there is increased dependence on outside agencies like the state and other civil society organisations for basic needs like drinking water etc. Since 1980s conflicts have arisen over the access to limited fresh water resources available in this region.

2. INNOVATION BY ACF (INTERLINKING)

Ambuja Cement Foundation (ACF) is active in the Kodinar and surrounding areas and has been working in the field of participatory Natural Resource Management, Health, Women/Child Development.

Taking a cue from the much hyped and talked about interlinking of rivers project (which has been in the pipeline for quite a few years now), ACF has initiated an innovative project called interlinking of local rivers/rivulets, Water Harvesting Structures like percolation tanks, and other water bodies.

Many experts say that this concept of diversion of water from surplus to scarce areas is possible only in a limited geographical context where the distance to be covered for interlinking is very small or the possible impacts of such interlinking do not affect a large number of people. ACF has applied this concept in salinity-affected areas of Kodinar, where a lot of water from the local rivers flows into the sea every year while the coastal population is left with no choice but to use saline Groundwater. To overcome this problem a plan was made to divert this water to other water bodies like ponds/other aquifers to minimise the outflow to the sea.

ACF wanted to ensure that these rivers recharge the ground water and therefore the network also includes other existing water-harvesting structures and water bodies like Tidal Regulators, ponds etc. Depending upon the local topography the interlinking has been done between various rivulets like Goma, Somat and Singoda and the water bodies lying in between.

3. VARIOUS STEPS TAKEN TO BRING ABOUT INTERLINKING

1. Linking up of the water-bodies like Percolation Tanks, Ponds etc. through construction of link water channels.
2. Deepening of ponds and rivers to increase their water-holding/storage capacity.
3. Further building of physical features like Waste-Weirs, Check Dams, or Percolation Tanks to increase the water recharging capacity in the Watershed (a Geo-Hydrological Unit) region
4. Construction of canals from the rivers to village ponds.
5. Construction of Radial canals from existing tidal-regulator *(Panch Pipalava)*.
6. Interlinking of existing tidal-regulators (Barda Bandharas) through pipelines.

4. HOW WE PROCEEDED

After identification of watershed dynamics and excess capacity in the existing rivers during the monsoon, potential sinks (like other rivulets, ponds, percolation tanks etc.) are identified and then the shortest possible route to that sink is selected. The direction of flow of water alavays follows the natural gradient i.e towards the sea. Therefore the direction of the interlinking canals is usually kept towards downstream bodies in order to ensure natural flow. Since water has a tendency to find the shortest route therefore the direction which the overflowing water acquires, is taken up for interlinking with the other sinks (water bodies which can accommodate excess run-off) from the rivers. Using local

know-how the site is selected where maximum number of farmers can be benefited and the least amount of water run-off to the sea is allowed.

Following are examples of a few projects.

INTERLINKING OF PONDS IN THE VILLAGES OF MITIAZ, DEVLI, KADODARA, DAMLI AND PIPLI.

This project was undertaken to enable these 5 villages lying adjacent to each other to benefit from the waters of the Goma River. For this purpose ACF undertook interlinking of the ponds in these villages. Ambuja Cement Foundation identified the village ponds in these areas and after increasing their capacity through pond deepening measures, established a few link water channels. When this stream overflows during the monsoon, the water gets collected in the pond and as soon as it crosses a stipulated height it automatically gets diverted to the downstream pond in the neighbouring village. For the above purpose following construction activities were carried out by ACF with people's participation.

Table 1: Various activities taken up under this project

Work/Activity Undertaken	Storage capacity in million cubic feet	Number of wells benefited	Area covered in hectares	Number of Farmers benefited	Water table in feet	
					Before	After
River Widening And Pond Deepening At Pipli	2.1	40	140	40	22	40
Percolation Tank at Mitiaz	2.32	132	462	121	8	55
Well Recharging at Mitiaz	-	20	64	20	9	29
Percolation Tank & Waste weir at Devli	2.12	30	105	25	12	32
Percolation Tank At Kadodara	1.97	18	63	18	11	38
Percolation Tank At Damli	3.78	35	122	28	5	42
Renovation Of Check Dam At Pipli	0.52	32	93	32	20	32
Percolation Tank At Pipli	1.92	32	112	32	18	34
Total	**12.41**	**339**	**1161**	**316**		

A total storage capacity of 12.41 Million Cubic Feet has been built up while benefiting 339 wells and 1161 hectares of parched land. Thus it has benefited 316 farmers of this region.

In all the five villages the ponds were deepened during the period of 1999-2001. An interlinking canal was constructed between Devli and Mitiaz villages with a total expenditure of Rs 11,67,593. In Devli, a sum total of Rs 5,99,555 was spent for pond deepening and interlinking. Similarly in the Mitiaz village Rs. 5,68,038 were spent for linking up with the ponds in Devli. A lot of water, which used to flow into the sea earlier on, has now been diverted into the downstream ponds of Kadodara, Damli and Pipli. The ponds in these villages have also been deepened with an expenditure of Rs. 5,38,259, 2,49,501 and 7,08,141 respectively.

Case 1: *Pipli*

Deepening and widening of Goma River was carried out in the year 2000-01 and 2002-03. The active involvement of the farmers of Pipli village facilitated the process of inter-linking the village pond with the river Goma. After excavation of the river canal, salinity of this area has reduced considerably. Ever since the river canal has been excavated, farmers are taking two-three crops every year.

Table 2: Change brought about due to the link canal at Pipli

Activity	Before	After
Agriculture	Groundnut	Sugarcane and Wheat in 715 acres of land
Water available for drinking	Saline	Sweet/Fresh
Drinking water pumps and Wells	Dry	60 wells Recharged
Water availability	Till October	Till January

Since salinity has been reduced, the farmers require less seeds for sowing compared to the salinity-affected times. Below shown table depicts the same.

Table 3: Yield change for Pipli

Name of Crop	Yield/acre before the project	Yield/acre after the project
Pearl Millet	525 Kg	1050 Kg
Groundnut	700 Kg	1050 Kg
Sugar Cane	35 MT	53 MT
Lucerne	30 Kg	60 Kg
Wheat	1050 Kg	1750 Kg

Table 4: Change In Seed Input required for Sowing /acre

Name of Crop	Seeds required before the project (Kgs.)	Seeds required after the project. (Kgs.)
Wheat	75	50
Jowar	70	30
Lucerne	30	12
Groundnut	70	40
Pearl millet	04	2.5

Case 2: *Damli*

The storage capacity of existing pond has been increased and water table in the surrounding wells of village Damli, Devli and Pipli has also increased. The fertile pond soil has been of great use in improving the fertility of the land in the surrounding area. Today the average depth of wells in this area is 60 feet while before the project average water table was just 15 feet. Thus the project has been able to achieve an increase of 45 feet in the water table.

Case 3: *Mitiaz*

The percolation tank here has been deepened to bring about an increase of 2.32 million cubic feet in the storage capacity, which has benefited 121 farmers in the neighbourhood area of 462 hectares. Besides this, well recharging for 20 farmers was taken up to alleviate the irrigation problem in the vicinity of the canal. This enabled irrigation in 400 *Bighas* of land and the water table went up from earlier level of 9 feet to the present 29 feet.

PANCH PIPALAVA-JANTRAKHADI RADIAL CANAL

A Tidal Regulator *(Bandhara)* constructed by the government acts as a barrier between the agricultural land and saline water from the sea in the Panch Pipalava village. ACF supported the construction of a Radial/Reverse canal of 1.5 Km in the year 2002 from Panch Pipalava Bandhara to Jantrakhadi village. The ponds deepening work was carried out in the village of Pipalava in the year 2000-01 and 2002-03 with an expenditure of Rs 2,68,747 and Rs 1,24,425 respectively. Benefits of the project are illustrated in the table 5 below.

Table 5: Various activities taken up under this project

Work/Activity Undertaken	Storage capacity in million cubic feet	Number of wells benefited	Area covered in hectares	Number of Farmers benefited	Water table in feet	
					Before	After
Link Water Channel At Panch Pipalava	0.8	35	122	35	3	38
Percolation Tank At Panch Pipalava	1.41	32	112	32	8	30

Table 6: Change Brought About Due To The Link Canal at Panch Pipalava

Activity	Before	After
Agriculture	Groundnut	Sugarcane and Wheat in 115 acres of land
Water available for drinking	Saline	Fresh (Salinity reduced by 20-25 %)
Drinking water pumps and Wells	Dry	6 wells Recharged

Water availability	October	March (5-6 months extra)

(Per Unit acre)

Table 7: Yield Change For Panch Pipalava		
Name of Crop	Pre-project Yield/Bigha	Post project Yield/Bigha
Groundnut	315 Kg	525 Kg
Pearl Millet	700 Kg	1050 Kg
Wheat	-	1050 Kg
Sugarcane	18 MT	35 MT
Cotton	-	875 Kg

GOMA-PANADAR LINK WATER CHANNEL

There is a small river/stream called Goma, which flows into the Arabian Sea draining the coastal villages like Pipli, Panadar, etc. Income from agriculture has been steadily on the decline in these areas due to the salinity problem. Due to increase in salinity, most of the farmers started cultivating Bajri (Pearl millet) crop instead of Sugarcane, Groundnut and Wheat. To bring about Groundwater recharge a link water channel of length 1.5 Km was established in the month of May 2002 from the existing empty pond of Panadar village till Goma river The farmers have excavated five minor water channels of 100 Metres each, from the main channel and they irrigate their fields from these channels. Due to this link water channel agriculture yield has increased by 60 to 65%. Pond deepening was undertaken at an expenditure of a meagre Rs.39,075 in the year 2002-03.

Table 8: Various activities taken up under this project						
Work/Activity Undertaken	**Storage capacity in million cubic feet**	**Number of wells benefited**	**Area covered in hectares**	**Number of Farmers benefited**	**Water table in feet**	
					Before	**After**
Reverse Water Canal At Panadar	1.77	30	105	30	14	29

Table 9: Change Brought About Due To The Link Canal at Panadar		
Activity	Before	After
Agriculture	Pearl millet	Groundnut and wheat in 212 bigha of land
Water available for drinking	Saline	Fresh (salinity reduced by 50%)
Drinking water pumps and Wells	Dry	29 wells Recharged
Water availability	Till October	Till March

Table 10: Yield Change For Panadar		
Name of Crop	Yield in Saline water / acre	Yield in sweet water / acre (2003)
Groundnut	450 (Kg.)	1660 (Kg.)
Pearl Millet	1000 (Kg.)	1400 (Kg.)
Wheat	1250 (Kg.)	2000 (Kg.)
Sugarcane	44 (MT)	87 (MT)

INTERLINKING OF BARDA-BANDHARA AND SINGODA RIVER AT MULDWARKA-MATH

During the year 2002, a pipeline was laid to divert excess water from the River Singoda to adjacent Barda-Bandhara (Tidal Regulator). The capacity of Barda-Bandhara is 165 Mcft., which was not fully utilized to its capacity at that point of time. The farmers of the surrounding four villages approached ACF for the above project. A 900 mm diameter pipeline of length one km has been installed and water has been diverted from Singoda River to Barda-Bandhara. Water table in the surrounding wells belonging to farmers has shown an increase of 40 feet from the earlier seen 8 feet to 48 feet. The quality of water has also shown considerable improvement. Farmers are now cultivating Rabi crops, which earlier they were not able to. Total 900 hectares have been brought under irrigation while 180 farmers have been benefited. The total expenditure on the project was around Rs.6 lakhs.

Table 11: Various activities taken up under this project						
Activity Undertaken	**Storage capacity in Mcft.**	**No. Of wells benefited**	**Area covered in hectares**	**No. Of Farmers benefited**	**Water table in feet**	
					Before	**After**
Water Diversion Canal	165	180	900	180	8	48

5. BENEFITS ACCRUING FROM THE PROJECT

Some of the benefits that have accrued from the above projects are as follows:

5.1 Crop diversification

Increased water availability and assurance of a sustained water table has encouraged farmers to take up other crops as well as Horticulture and Vegetable farming. This has led to increased annual household income for the families. Besides this, the farmers can pursue other livelihood activities like Animal Husbandry/Vegetable Cultivation to supplement their income.

5.2 Better farm practices

ACF has been instrumental in encouraging farmers to take-up better farm practices to bring about an increase in income and keep the fertility of the land intact. ACF has

conducted training camps for the farmers of the various villages. It has been proven time and again that horticultural crops are far less water intensive and give better return per acre of cultivation. For the above purpose farmers have been shown model demonstration farms as well made to do the cost benefit analysis on their own.

5.3 Improved productivity for the same input of land

Assured water supply has resulted in improved yield for both vegetables as well as cereal crops for a given area of land. This is illustrated in the annexure one.

6. CONCLUSION AND RELEVANCE IN THE CONTEXT OF WATER MANAGEMENT

Interlinking has meant that the water bodies contain water for a much longer period than in the past. Percolation of water has increased bringing about greater ground water recharge. As a result the problem of Salinity Ingress has also been controlled to some extent in this region. Water quality has improved considerably as a result of continuous recharging and increased fresh water content. Farmers of this area opine that the water table has reached the level that was only seen three decades ago. In recognition of the work done by ACF in the direction of salinity ingress mitigation, it has been nominated as member in the state level steering committee constituted by the Government of Gujarat for further replication of the programme of salinity prevention in the coastal areas of the state. Some of the ways in which this interlinking is relevant in the context of water management are as follows:

1. Inter-linking of the water harvesting structures helps in maximizing the efficiency of these structures since they are able to buffer the excess water, thereby preventing run-off to the sea.
2. The need for land acquisition doesn't arise and hence it is a major saving in terms of compensation required for the stakeholders. Besides, the rehabilitation of the people in the adjoining regions is not required.
3. Adverse environmental consequences are not seen here and hence it helps in getting people's participation and avoiding conflicts in future.
4. The interlinking process is very cost effective in terms of the amount of benefits compared to other Water Harvesting projects.
5. This project has paved a way to the alleviation of Salinity Ingress in this area.

Annexure One

Table 12: Improved vegetable yield							
Vegetable yield before deepening and interlinking of pond							
Sr. No.	Name of crop	Land (bigha)	Yield in Kg.	Rate / Kg.	Total Income (Rs.)	Total Exp (Rs.)	Net income (Rs.)
1	Brinjal	1	714	7	4998	2500	2498
2	Beans	0.75	181	11	1991	1500	491
3	Guvar	0.75	180	10	1800	1500	300
Vegetable yield after deepening of pond							
1	Brinjal	1	1500	7	10500	2500	8000
2	Beans	0.75	636	11	6996	1500	5496
3	Guvar	0.75	636	10	6360	1500	4860
* Source of information: Vajubhai Jesingbhai Gohil							

His net profit from vegetable crop was Rs. 3300 before deepening of pond and Rs.18356 after deepening of pond. 10 small farmers adjacent to pond, cultivate vegetable crops have been immensely benefited by deepening of pond.

Table 13: Increased income of the farmers.									
Sr. No.	Name of crop	Land (acre)	Requirement of seed Kg.		Yield in Kg.		Rate / Kg.	Total Income (Rs.)	
			Before	After	Before	After		Before	After
1	Groundnut	3	80	50	400	700	17	6800	11900
2	Pearl millet	3	3	1.5	500	500	5	2500	2500
3	Wheat	3	50	40	800	1200	7	6300	8400
* Source of information: Kanabhai Masaribhai Gohil									

Shri Kanabhai Gohil's Total income from three crops was Rs.15600 before the project and after the project he has earned Rs. 22800 i.e. net profit is Rs.7200.

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