A report

Viable Options in Drinking Water along Gujarat's Coastline

submitted to
India Water Partnership

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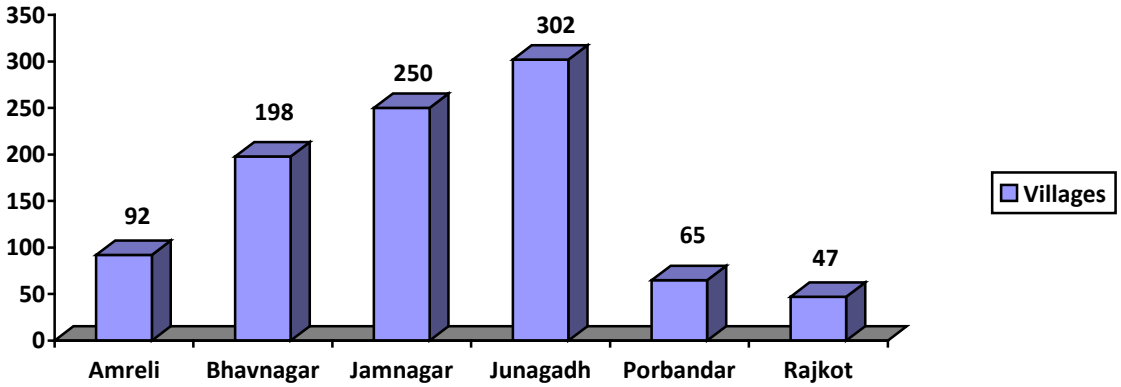
1. **Background**

The state of Gujarat, in India has a 1669 kilometre long coastline. However, the geophysical attributes of this coastline are varied. Along the coastline, one can find hard rock, clay or soil around the gulf areas. Because of this varied geophysical attributes, the overall issues that these areas face are different. The coastline of Saurashtra is of about 765 kms, spanning from Jamnagar to Bhavnagar. Six districts are located on the coast. These include Jamnagar, Porbandar, Junagadh, Amreli, Rajkot and Bhavnagar. Of these, Jamnagar has 41% of the coastline in Saurashtra that is 370 km long. This is followed by Junagadh 19 %, Bhavnagar 18%, Porbandar 12%, Amreli 7%, and Rajkot 3%.

These coastal districts have 19 Blocks (Talukas) and 954 villages. Of these, 886 are inhabited villages[1]. The following table shows the distribution of villages.



Compared to the percentage of the coastline, Junagadh has 19% of the coastline but has the maximum number that is 302 villages. These are the details of the aquifers in Saurashtra.

Name of Aquifer	Places where found more productive	Aquifer material	Nature of aquifer	Nature of Porosity	Thickness
Recent alluvium	-	Alluvium (multiple layer of sand, clay, and limestone)	Unconfined	Porous	15m to 20
Milliolite	1. Badra Hill (western most area) 2. Mangrol to Veraval	Limestone	Unconfined	1. Porous, 2.Fractured 3.Solution cavities	15m –more than 20m.
Gaj Formation	Kodinar - Una area	Limestone, Grit and Sandstone	1.Upper Unconfined 2. Lower Confined	1. Porous, 2.Fractured 3.Solution cavities	-
Deccan Trap	Kodinar - Una area	Massive and Amygdaloidal basalt	1.Upper Unconfined 2. Lower Confined	1.Weathered material 2. Fractured Shears	5m-15m (in places unsaturated)

[1] As per Census 2001 data

2. Impacts of Salinity

For example, because of salinity ingress, the agricultural production / yield has gone down. Salinity has impacted livelihoods, as lands have degraded. This has resulted in out migration of people, in search of livelihoods. As well, numerous natural disasters such as cyclones and floods have impacted the health and the education of the communities. These issues in a sense are impacting the coastal regions and require serious consideration.

If one focuses upon drinking water, then there are numerous problems in the coastal regions of Saurashtra. Saline water tables also mean a major problem of adequate drinking water or reduction in drinking water sources.

Numerous options have been implemented to tackle the drinking water problem. These options have been implemented by Community Based Organizations and or Non Government and Government Organizations in a collaborative manner. The major focus of these options has been to harvest rain water. To harvest rain water numerous technological options have been implemented which include roof rain water harvesting tanks, plastic lining of ponds, well recharge, hand pump recharge, Reverse Osmosis water plants or solar powered innovative techniques.

3. The Study

To understand the various options implemented, UTTHAN took up a study in the coastal areas of Saurashtra. UTTHAN's experience of working in the Saurashtra coastal areas over the years would value adds to the study.

4. Objectives

- To study the options / new techniques that has been implemented in the Saurashtra region that mitigates drinking water problems.
- To study the reasons for non acceptance by the community of the options / new techniques developed to mitigate drinking water problems.
- To study the success / failures of the options / new techniques and analyse the role of the intervening agency.
- Use the findings of the study to advocate for changes in the policy to adopt / discard the options / new techniques developed for drinking water.

5. Scope

Key villages based on the intervention – technology option adopted to mitigate the drinking water problem. Hence, the following areas and the organizations were contacted and access to the villages sought.

Area	Organisation
Bhavnagar	Mahiti
Bhavnagar and Amreli district	People's Learning Centre- Coastal
Tantivela Village, Block-Veraval, District-Junagadh	Anarde Foundation
Veraval, District- Junagadh	Aga Khan Rural Support Programme,
Mangrol, District- Junagadh	Sarvodaya Seva Mandal
Probandar	Sava Jam
Block Kalyanpur, District- Jamnagar	Kalyani Sanstha
Mithapur	Tata Chemical Service Rural Development
Dwarka	Gram Vikas Trust
Kodinar	Ambuja Cement Foundation
Village Mocha, District- Probandar	Central Salt & Marine Chemical Institute
Village- Bamanwada, Block-Mangrol, District - Junagadh	Kanbhai member of Taluka Panchayat,

Case Study 1		
	Organization	Gram Panchayat
	Village	Bamanwada, Block , Mangrol Dist. Junagadh
	Technology Option	R O Plant and Water Recharge
	Information Provider	Mr. Kanbhai Nandaniya, Sarpanch, and Taluka P Member and Sharadbhai Mehta of Sarvoday Seva Samiti

Background

The village of Bamanwada, of Mangrol block in Junagadh District is located 12 kilometres from Mangrol, on the Mangrol –Porbandar road. The coast is nearby, about 2 to 3 kilometres away from the village. The village has a population of 3500. In the village, the main communities comprise of Ahirs, Dalits and Bavajis.

Since the coastline is near, one can observe the impact of salinity in this village. Kanbhai and other members stated that the drinking water and water for agriculture began becoming saline at a faster rate after the big drought of 1986-87. But before this, barring some wells near the coast, the water in others was fit for drinking and irrigation. But after the drought, the TDS levels in the wells rose up to 18000 – not fit for use. Since the water was not fit for drinking, this water also harmed the cattle when they were given to drink. Over time, they would become useless. Their skin would stick to their bones and eventually they would die.

Mitigation Efforts

A visit to the village was made by a team comprising of World Bank officials and Shri Anilbhai Shah of DSC, Ahmedabad. They primarily suggested that to begin with for 3 years, the village must first stop water drawal for irrigation. The reason cited was salinity ingress. Based on their suggestion, as a village, we stopped drawing water from the ground for irrigation. This to some extent this helped to curtail salinity.

Over the years, Government and NGOs such as Sarvoday Seva Samiti, Aga Khan Rural Support Programme - AKRSP (I) and the Water and Sanitation Management Organization - WASMO supported our cause and launched mitigation efforts. These included farm bunds for ground water recharge and well recharge and home based rain water harvesting tanks were constructed in 99% of the homes. This rain harvested sweet water would also be given to the cattle as the ground water was still saline with high TDS levels. When the rain harvested tanks would go dry, then water would be sourced from some farm bores or sourced from other places using water tankers.

Gujarat Water Supply and Sewerage Board (GWSSB) had also came in to provide piped water supply. Stand posts were constructed in all the hamlets. To reach the water to the homes – as individual connections, Rs.200.00 per household was collected as people's contribution. This was another manner in which water was distributed.

Post the drought of 1986-87, the local drinking water sources became saline and the water became unfit for consumption. The public water distribution system – scheme too failed. The village communities faced an acute drinking water shortage. Subsequently, AKRSP (I) and Sarvoday Seva Samiti constructed individual rain water harvesting tanks. But the quantity of the harvested rain water was limited. It could not cater to the needs of the families and their cattle for a year. Hence, water would be sourced from farms or other villages using tankers and this water would then be poured into the (rain water) tanks for use. The water sourced would be sweet sometimes or shade saline. As well, the water would be expensive.

R O Plant

Subsequently, with the support of WASMO, an R O Plant was sanctioned that would provide quality drinking water to the village community. The total cost of the R O Plant was Rs. 32 Lakhs. As per the procedure laid down by WASMO, the community had to pay Rs. 3, 20,000.00 as their 10% contribution. With Kanbhai as their leader, the village Pani Samiti (Water Committee) was formed.

The process of collecting people's contribution was initiated. The money thus collected was deposited into a bank account of the Pani Samiti. Once this money was deposited, the work to commission the R O plant was initiated by WASMO. To distribute this water, the three old tanks (from the older system) and the pipelines connecting these tanks were utilized. To curtail wastage of this water, a special system was installed – similar to draw water.

R O Plant Specifications

Aspect	Amount / Numbers
Total Cost of the R O Plant	Rs.32 Lakhs
Capacity to Produce Saline Free Water	50,000 litres per day
Water Requirement	Per person 40 litres, per cattle head 60 litres
Operation and Maintenance	Formed the Pani Samiti
Cost Recovery	Water to Tankers at Rs.200.00 is sold

At this moment, the village community is able to get adequate quantity and quality of drinking water.

Sarvoday Seva Samiti

Sharadbhai Mehta is the Director of Sarvoday Seva Samiti. This NGO, since the last 10 years has been focusing on issues related to natural resource management as well as drinking water issues. The NGO, on a scale has constructed rain water harvesting tanks in the villages of Mangrol. Further, the organization works on issues like education and operates old age homes.

Sharadbhai shared his experiences about the drinking water situation in Mangrol Block. He said that the geophysical attributes of the villages is of two types here in coastal Mangrol. One section has limestone, while the “Ghed” area is like an upturned saucer. The issues with the villages of these two areas are different.

In the area where there is limestone, re-charging opportunities are plenty. But the rate and the quantum of water withdrawn for irrigation is extremely high. This has resulted in sea water ingress. If salinity is to be reduced, then recharging efforts on a large scale have to be taken up. As well, to compliment this, controls on water withdrawal will have to be in place and farmers disciplined. But in the “Ghed” area, the land too is saline. Hence there are issues of surface water too becoming saline.

He belies – from these factors and experience that the best option is to construct rain water harvesting tanks. This is the best option for drinking water needs of families in this area. This is the rationale behind the focus of Sarvoday Sea Samiti to focus upon rain water harvesting tanks. Currently, all the homes in 10 villages have constructed rain water harvesting tanks.

AKRSP (I) team

A meeting with the AKRSP (I) team was organized at their Mangrol office. Mr Lalitbhai from AKRSP (I) provided the information on the options created by AKRSP (I) based on the geophysical attributes of the Mangrol area.

The organizations work has focused upon well sealing in coastal villages. As well, they have focused on constructing rain water harvesting tanks on a large scale. They strongly recommend these options suitable to mitigate the issues of drinking water for this area.

Case Study 2		
	Organization	Anarde Foundation
	Village	Tativela, Block Veraval Dist. Junagadh
	Technology Option	Water Conservation
	Information Provider	Mr. Hardasbhai Patel

Background

Anarde Foundation started its work in 5 villages in Gujarat in the year 1979. Today, Anarde Foundation has grown big. The Foundation now implements various rural development related projects covering 79 districts in 16 states of India. Anarde Foundation has a qualified and experienced staff of 450.

Anarde Foundation operates on certain key principles. The focus is on nurturing peoples groups / unions and capacity building these groups / unions to achieve total rural development. The strategy is economic upliftment through incomes. Anarde Foundation strongly believes that:

- Village water should stay in the village.
- Village Youth should stay in the village
- Village wealth should stay in the village

Anarde Foundation has developed viable economic options within its work frame. These include:

- Watershed Management
- Organizing and nurturing Self Help Groups
- Developing Entrepreneur perspectives amongst the community
- Create awareness and understanding amongst the communities about the administrative and governance mechanisms for the total development of the village
- Economical housing
- Small credit activities

Village Information

As part of this study, Anarde Foundations work in Tativela Village of Veraval Block in Junagadh District was observed. Tativela is situated 7 kilometres to the north of Veraval town, 6 kilometres away from the sea. The total population of Tativela is 2000. The main communities that reside here are Ghediya Koli, Rabari, Dalit and Bavaji. The main occupation of these communities is agriculture and agricultural labour. For irrigation, dug wells are the main source from which water is lifted. The main crops grown in this village either irrigated or not irrigated are ground nuts, bajra, wheat, bananas and vegetables.

Geographical Area

The geophysical structure here is that the limestone is visible on which the village is located. And because of the limestone, the possibilities of water storage increases. Apart from the limestone, the village has two smaller streams flowing in the east and the west. Additionally, the land here is very fertile.

Situation Deteriorated

Before Anarde Foundation began implementing their work in Tativela, the water table had dropped to 150 feet. The waters had become saline to some extent and this had a direct impact on the quality of drinking water and water for irrigation. The communities would go to the farms to fetch drinking water. There was no facility created to provide drinking water for the cattle. The existence of lime stone and the two streams provided ample opportunity to recharge water.

Work of Anarde Foundation

Anarde Foundation sought the support of the District Rural Development Agency (DRDA). DRDA, under its watershed programme portfolio, provided support to recharge the ground water of this village. Anarde Foundation constructed a series of structures on the streams. The main structures constructed were: 4 check dams at the cost of Rs.12 Lakhs and 11 nullah plugs. To facilitate quick recharge of harvested water, 10 recharge wells were dug in the stream beds.

The recharging efforts have made a positive impact. Today, the water table is observed as follows:

Season	Water Table
Monsoons	15 Feet
Winters	60 Feet
Summers	150 Feet

The drinking water is used from 5 hand pumps – 3 of these are government, while 2 are private. Further, with the quantum of ground water increasing, Tativela village has developed a home to home water distribution system under the Coastal Area Development Project (CADP) with the support of AKRSP(I).

Analysis

Anarde Foundation has implemented water conservation and recharge structures in Tativela village. A discussion with the Watershed Committee on the impact of the interventions on drinking water and water for irrigation and site visit, the analysis is as follows:

1. Considering the geophysical conditions of the village, the work of water conservation and recharging has been done in an appropriate manner.
2. Where there is limestone, the potential to recharge the ground water is very high and recharging can impact the ground water.
3. The success of the interventions can be attributed to the series of check dams, nullah plugs and the recharge wells constructed in the steams.
4. The recharging efforts have directly impacted the drinking water availability. Today, the village draws upon its local source for its drinking water needs all the year round.

Case Study 3		
	Organization	Ambuja Cement Foundation
	Village	Mul Dwarka, Block Kodinar Dist. Junagadh
	Technology Option	Water Conservation
	Information Provider	ACF Team Members

Background

The Ambuja Cement Foundation (ACF) works with a competent team of professionals at all its 19 locations. Its approach towards work is defined by its mission statement and the mandate of the people. The Foundation makes sure that it encourages establishing partnerships with like-minded Government and Non Government Organizations.

Inception

ACF was formally registered in 1993 after two years of interaction and engagement with rural communities. The mission set forth was to “energise, involve and enable communities to realize their potential”. ACF began working with a few rural communities around the parent cement factory at Kodinar. Today, ACF is functional in 770 villages in 10 states covering a population of 15.8 Lakhs across India. ACF takes its values from its parent company and with is “I Can” spirit. It aims to make people prosperous where they are.

Genesis and Approach

The ACF team in all the locations supports the village community to work to constantly plan and implement developmental programmes. With the support and co-operation of our communities, ACF has been able to bring about tangible changes in different aspects of their lives.

Partnerships

ACF, in partnership with rural communities, local NGOs and Governmental and International organizations where in numerous developmental activities are carried out. This helps generate a common pool of knowledge which makes tackling complex social issues much easier.

Working in communities poses different challenges, some anticipated and some completely unexpected. Dealing with these challenges needs determination. From interlinking water bodies and creating a cadre of Village health Functionaries, to using sports as a means of excellence for mentally challenged children, ACF has developed a variety of methods.

Implementation Methodology

Initially, in Mul Dwarka, Kodinar, Sutrapada and Una Blocks, ACF conducted a detailed study on sustainable solutions to the drinking water in the costal areas. Based on the geophysical conditions of the area that was studied, ACF constructed underground rain water harvesting tanks or sealing wells to curtail salinity. For these tasks, ACF organized Gram Sabhas and a Samiti to address issues of and facilitate implementation.

ACF has according to them, constructed 2500 underground rain water harvesting tanks covering 40 villages of Jafrabad, Kodinar and Sutrapada. This has been the best option here. The family is motivated and once that is done, support is provided. The efforts are focused towards involving all the families.

But the work of constructing underground rain water harvesting tanks, and reaching 100% of the homes was a challenge in itself. The challenges were:

- There would not be enough space to construct the underground rain water harvesting tanks
- If there was land, the issue of ownership of the land was a challenge
- Or the family was not economically stable to contribute towards the construction cost

In 30 villages under Sutrapada, Una and Kodinar blocks, drinking water and sanitation issues are being addressed through the CADP. Of these 30 villages, 10 have been given the technical and administrative approvals.

Mul Dwarka

A study visit was made to ACF's village – Mul Dwarka in Kodinar Block of Junagadh District. This village is located on the coast. It is 10 kilometres to the South of Kodinar. The total population of this village is 2500. The majority here is that of Koli Patels who are engaged in farming or working as farm labourers.

In terms of the geophysical attributes, under the village and surrounding areas, one can observe limestone. But 20 feet below this, is a sandy zone wherein the there is sea water ingress. The limestone layers provide an opportunity to recharge ground water however to a certain depth. Beyond that, the water will becomes saline. To the West of this village, the Singoda River flows into the sea.

As well, the land in this village is very fertile. Using the water from the limestone layer, the communities primarily during monsoons – cultivate ground nut, bajra, cotton and vegetables.

Situation before the Work of ACF

Before the work was taken by ACF, the saline waters of the sea had ingressed into the ground water of Mul Dwarka village. The communities would fetch their drinking water from the farms. There was no water facility for the cattle. The saline waters had impacted the drinking water and water for agriculture. The limestone layer is 20 feet deep. If recharged, then water can be made available post monsoon. For water to last the remaining two seasons, recharging further and restricted use of water can solve the issue for the village.

Works Implemented

Since Mul Dwarka is situated on a limestone layer that is 20 feet deep, the capacity of recharging water gets limited. But, this very layer was used to recharge rain water. To not allow water to percolate beyond 20 feet, as well not allow the saline waters to come up the lime stone layer, an innovative experiment at sealing was taken up by ACF. This helped to create water for drinking and use for other purposes.

- In the village, keeping the population in focus, in each hamlet 20 wells were sealed. The unit cost was Rs.20, 000.00 per well of which the community contribution was 20%.
- The water thus recharged and made available was just enough to solve and make available drinking water.
- During winters / summers, the village uses the sweet water that gets stored in the Singoda River because of the structure. This water is then used for drinking and irrigating the vegetable plots.

Analysis

ACF has been able to recharge the limestone layer by sealing the floor, while creating water storage on the Singoda River. A discussion ensued with the Village samiti as well as the sites were observed. The analysis is as follows:

1. The solution implemented here is appropriate that of sealing so that saline water does not come up while sweet water does not percolate down and become saline. This way, the quantum of sweet water was increased.
2. Since the limestone layer of 20 feet had a limited capacity to store recharged water, the storage created on the Singoda River added top the quantum of the water and made it available to the village community.
3. Water conservation is important here. The waste water from washing clothes / vessels is diverted into vegetable plots and creates a supplementary food for the family.
4. In this village, the impact of recharging on the drinking water sources is visible. Through the efforts of ACF, drinking water has been made available to the village atleast for two seasons in a year.

Case Study 4		
	Organization	Sava Jam
	Village	Miyani, Block Porbandar Dist. Porbandar
	Technology Option	Drinking Water and Sanitation, Health, Women Empowerment and Natural Resource Management
	Information Provider	Sava Jam Team Members

Background

Sava Jam as an NGO works in the villages of Mangrol and Porbandar blocks. The main focus of Sava work is drinking water and sanitation, health, women's empowerment, Natural Resource Management, agricultural inputs and creating agro based livelihood options. Sava Jam also networks with other like minded organizations in Saurashtra.

A discussion ensued with the Sava Jam Team members. They shared that Sava Jam's work related to drinking water and sanitation along with the implementation process for the installation of an R O plant could be observed at Miyani Village.

Miyani Village

Miyani village is located on the coast in the Porbandar Block bordering Jamnagar District. The total population of the village is 4500. The major communities residing here are Kolis, Mer and Dalits. The major occupations are agriculture, animal husbandry, agricultural labour and fishing.

Geophysical Situation

The village is located on the sea coast. Since years, the ground water is saline / bitter. The village community stated that they had not tasted sweet water in their village. Perhaps the old wells may have stored sweet water. Similar to lime stone, the red stone layers makes it difficult to dig pits. Hence pits to construct rain water harvesting tanks pits for a toilet are not possible. Yet, Sava Jam has been successful – wherever possible in making underground rain water harvesting tanks in many homes.

Drinking Water

Currently, majority of the community buys 200 litres of water for Rs.75. For the cattle, the community mixes the saline water with the potable water purchased. But this water impacts the health of the cattle and their production capacity and life gets curtailed.

RO Plant

Sava Jam organized the communities of Miyani village and made them aware about R O plant and its efficacy. The R O plant, worth Rs.60 Lakhs is being funded by General Motors, CSPC and Community Participation. The community is inclined to do everything possible to get the R O plant operational. The communities have been struggling for sweet drinking since years and hence the R O plant will be a boon to their lives. Hence the communities have been plans and are committed to operate and maintain the system. Water distribution is being planned. The R O plant capacity will be 1100 litres per hour.

Analysis

Based on the discussion these were the key points that emerged:

1. Community stated that where there is no availability of drinking water / local source, underground rain water harvesting tanks is the best option.
2. Miyani's geophysical structure is such that R O plant is the only option and that needs to be accepted.
3. Community's wisdom in operation and maintenance needs to be harnessed that will play a crucial role in sustaining the system.

Case Study 5		
	Organization	Kalyani Charitable and Welfare Trust
	Villages	Asota, Navda, Satapar, Block Kalyanpur Dist. Jamnagar
	Technology Option	Soil and Water Conservation, Health and Women Empowerment
	Information Provider	Kalyani Charitable and Welfare Trust 's Team Members

Background

Kalyani Charitable and Welfare Trust (KCWT) is a partner organization of Saurashtra Voluntary Action Network. KCWT works in the Kalyanpur Block of Jamnagar District especially in those villages that have been impacted because of salinity ingress. The main office is located at Bhatia village. KCWT's primarily works is strengthening people's groups for development. The core areas are women's empowerment and gender, reproductive health, soil and water conservation, water and sanitation and agricultural inputs for livelihood improvement.

Because of the inputs from KCWT, capacity built and strong people's groups have been made operational in the villages that it works with. The people's groups have been working on women's empowerment in their respective villages. Further, to work on natural resource management aspects, KCWT has helped form Pani Samitis and farmer's groups. Through these groups, water and sanitation, soil and water conservation and agricultural inputs for livelihood improvement are carried out.

One of the technological options that KCWT has focused upon is water conservation. Through its loan option, the Trust has implemented farm ponds. These have been in great demand locally.

Geophysical Situation

The Kalyanpur block and its villages fall under the semi-arid zone. In this area, the rainfall is scanty and erratic. The agriculture therefore is rain fed – only possible during the monsoons. The main monsoon crops are ground nut, cotton, bajra and chillies. Because of scanty and erratic rain fall, the monsoon crops do require additional water through irrigation. Hence, the loan based farm ponds has been a successful option.

In the villages on the coast, one finds red hard stone. Recharging rain water is not a viable option here. In the villages a little further from the coast, there is an abundant bauxite resource. Some of the unused bauxite mines have become water reservoirs while some have saline water that has ingressed from the sea. Hence salinity is a major issue.

Asota Village Visit

Asota village is located 29 kilometres North West of Bhatia village. The village has a population of 4000 and the main communities that live here are Ahirs, Koli, Bavaji and Brahmins. The village is 2.5 kilometres from the coast. There are Bauxite mines around the village hence most of the people from the village are engaged in the supply of bauxite or work as labourers in the mines. Agriculture and agri-labour are other occupations though this is monsoon specific.

Drinking Water

In the village, there was a public well. Water was sweet in monsoons, but tasteless and at times saltish during the winters. Based on the study conducted by KCWT, 300 underground rain water harvesting tanks were constructed. Discussing with the groups that had constructed these tanks, it was stated that to solve the drinking water issue, the underground rain water harvesting tanks has been the best option. Earlier, they would have to search for water day and night. Now with the tanks in place, this has helped to save time and there is less hardship especially for the women. Children have now begun devoting more time for their schooling. For the cattle and washing needs, water from the dug well is used.

During the discussions in the village, the community stated that when they drink the water they mix the rain water and the water from the dug well. But when they have to entertain guests, then they only use the rain water stored in their tanks. When the rain water gets exhausted, then sweet water is purchased and tankers are emptied in the underground tanks.

Navda Village Visit

Navda village in Kalyanpur Block is situated on the coast towards Porbander from Bhatia. The total population of the village is 2500 and the majority are Ahirs, Rabaris and Brahmins. When KCWT began its work, the shortage of drinking water was acute. The village community was buying drinking water through tankers.

Subsequently, under the Swajaldhara Scheme, a drinking water distribution system and rain water harvesting tanks were sanctioned and implemented. In this context, numerous Gram Sabhas were organized. During the discussions at these Gram Sabhas, the community suggested that there is a place in the west near the village boundary where sweet water can be sourced. KCWT got a geologist to come and ascertain this claim. Based on the geologists report, a well was constructed which was sanctioned under Swajaldhara. Sweet water in abundance was available from this well. A pump was set up on the well, and drinking water was pumped and distributed in the village. This is one village between Porbander and Dwarka that is located on the coast yet has this local source of sweet water. Next to this source is a large pond which is further recharged by the bauxite mines. This source there fore looks like it will provide drinking water to the village for a long time.

Satapar Village Visit

KCWT has developed a dew harvesting demonstration in the primary school of Satapar village in Kalyanpur Block. Initially, the demonstration worked well. But the maintenance cost of this technology is very high. The channels and the plastic used in this method to capture dew cracks / breaks constantly. This creates numerous problems. The demonstration at the moment is not functioning.

Analysis

Based on the visit to KCWT sites, the key points that emerge are:

1. The primary focus of KCWT was to develop local sources.
2. KCWT had studied the drinking problems of the villages properly where they work. KCWT provided technology options that were suitable to the village and its geophysical conditions. This has been a major success for KCWT.
3. Keeping the geophysical aspects, underground rain water harvesting tanks has been a very successful option. People have accepted this option in their homes / lives.
4. The level of awareness amongst the communities is high regarding using the water harvested through the farm ponds for a little extra irrigation or if need be for drinking purposes only. As well, the availability of a loan to develop farm ponds has been a unique enabling activity.

Case Study 6		
	Organization	Utthan
	Villages	Mithivirdi, Block Talaja, Dist. Bhavnagar
	Technology Option	Rain Water Harvesting Tanks and Developing Local Sources
	Information Provider	Utthan's Team Members

Background

Utthan initiated its work in 1981. Utthan began its work in the Bhal area where salinity is a way of life and there are meagre natural sources. At the moment, Utthan works in 4 districts on various rural development projects with a team of 55 members. Utthan's focus areas are drinking water and sanitation, natural resource management, women's empowerment and policy level advocacy at the national and international levels. Utthan works on the principle of developing people's organizations and capacity building them that would lead to total rural development. Utthan believes that:

- Savings and credit is a medium that builds capacities of the community to resolve their problems themselves.
- To harvest and recharge the water of the village in the village itself thereby enhancing water quantity for drinking purposes and also for strengthening livelihoods.
- Through action research, understand local wisdom with a scientific perspective that helps create innovative options for drinking water and livelihood options.
- That the youth from the village stay put in their village and are able to get employment and participate in conflict resolution for peace.
- Capacity build the area's Women's Federation members to reduce the physical / mental atrocities on women

These principles have helped Utthan implement various options of development and livelihoods. These have also helped to reduce atrocities on women. These have been achieved through the following development perspectives:

Perspectives
• Watershed and Water Resource Management
• Action Research and Capacity Building on Drinking Water and Sanitation
• Organize Self Help Groups, Groups of Young Females and Males
• Entrepreneur Development Programmes
• Create awareness amongst the communities about the village level institutional mechanisms and move towards complete / overall village development
• Impact of global warming on humans by capacity building for disaster management and livelihood security

Geophysical Situation

Mithivirdi is situated on the coast of Gulf of Cambay. Because of Mirthivirdi's geophysical attributes are such that its capacity to recharging rain water is very large. Below the ground, one can find sandy stone and sand layers that are soft and reddish. The soil here is fertile. Grains, vegetables, pulses and horticulture products grow well here. Because of over withdrawal of water from the ground, the aquifers had gone saline. But with recharge techniques, the water had once again been made sweet. Hence, mango, sapota outputs have gone up. With irrigation and fruit gardens, there is greenery in the village. In terms of agriculture produce, communities are engaged in farming ground nut, cotton, bajra, onion and at times wheat in the winters.

Village Information

Mithivirdi is in the northwest direction 32 kilometres from the Talaja Block head quarters. The total population is 1550. The main communities residing here are Talpada Kolis and Bharwads. The main occupation is agriculture and agri-labour. During summers / droughts, communities work as labour at the Alang ship breaking yard which is 9 kms away. While 15% of the youth, work as diamond polishers at the workshops in the village.

Before the Intervention

Though Mithivirdi was located on the coastline, yet the sweet water aquifers were present. Even when the sea water came 1.5 kilometres inside through the river mouth, the sweet water aquifers were never affected. During the ebb period, the communities would dig shallow wells called *virdas* and drink sweet water.

The community got their drinking water from the *virdas* and the dug well. A pump was set up on the dug well and water was stored in the overhead tank and the cattle trough. The ground nut of Mithivirdi was very popular as a product. Mango production too was high.

But with the advent of electricity and more powerful pumps, water withdrawal from the ground increased. Sweet water aquifers as deep as 150 feet were emptied. This meant that sea water ingress was now eminent. Water in about 4 square kilometres of farm lands became saline. The dug well too became saline. If water was stored for two days, the vessels would have salt lining.

In 2003 a study was conducted which indicted that of the 116 wells, water in 82 wells had become saline. Because saline water was used for irrigating the crops, ground nut production decreased by 50%. Saline water destroyed the mango gardens. Instead of ground nut, bajri became the main crop, while sapotas replaced mangoes. Women walked 2.5 kilometres to the farms of Jasapara village to get their drinking water. Parents resisted giving their daughters in marriage to grooms from Mithivirdi.

Intervention

Utthan began working with this village since 1996. Initially, to understand the changes in the geophysical, economic, and social conditions Utthan conducted several studies. Efforts were initiated through the Self Help groups of the village to ameliorate problems of drinking water and water for irrigation. Awareness was created amongst the Pani Samiti / SHGs members about harvesting rain water in underground tanks. This was implemented through the construction committee that derived its wisdom from the experiences of the women. With the community support – physical and financial as well as with the support of the State Government, 162 underground rain water harvesting tanks were constructed. This safe source would be very useful during the months of summer.

In terms of strengthening the local water resources especially for drinking water, discussions ensued with the Pani Samiti members. Through these discussions, the Pani Samiti wrote down resolutions that validated their need for seeking solutions. Water and Sanitation Management Organization (WASMO) was approached to support the solutions. A policy to construct check dams and recharge works was in place and hence, it was decided to construct a check dam that would not allow the sea water to come in through the river mouth.

As part of the people's contribution towards this check dam, a sum of Rs.50, 000.00 was collected from the community. For the balance amount of the people's contribution the community would also contribution in terms of labour. When the foundation for the check dam was being dug, many stated that this check dam was just not happening. But Utthan was convinced. A sand bund was created to stop sea water which a pit was dug. Saline water was pumped into this pit. This was to enable the team to dig the foundation. A check dam measuring 76 metres long and 08 metres wide was constructed. On the left bank, an embankment measuring 180 metres and on the right an embankment measuring 360 metres was constructed. Another check dam measuring 46 metres wide and 08 metres wide was also constructed.

With this check dam constructed at the mouth of the river, sea water ingress stopped while during monsoons, rain water harvested in the river became available to the communities at a depth of 5 feet. A dug well was constructed on the banks. The sweet water for drinking was then pumped and distributed through the overhead tanks to the stand posts.

Analysis

In Mithivirdi, Utthan was able to strengthen the local sources of drinking water through underground tanks and check dams that would help harvest rain water. This was then further distributed through a water overhead tank, pipelines and stand posts. This water resource management helped the community resolve their water related problems.

1. Providing seasonal and alternate drinking water sources was the best option here.
2. The technological options provided to mitigate the drinking water problems of Mithivirdi were the best options based on the location and geophysical attributes of the village.
3. For the operation and management of the village water schemes, support from the community was sought as well collective decision making process was initiated.
4. Public works were successfully completed with the active support of the gram Panchayat and the Pani Samiti members.
5. The role of the Pani Samiti and the women is important in operation and management of the water systems.

Case Study 7		
	Organization	Utthan
	Villages	Chaya, Block Ghogha, Dist. Bhavnagar
	Technology Option	Ensuring Drinking Water through the Development of Local Sources
	Information Provider	Utthan's Team Members

Background

Utthan initiated its work in 1981. Utthan began its work in the Bhal area where salinity is a way of life and there are meagre natural sources. At the moment, Utthan works in 4 districts on various rural development projects with a team of 55 members. Utthan's focus areas are drinking water and sanitation, natural resource management, women's empowerment and policy level advocacy at the national and international levels. Utthan works on the principle of developing people's organizations and capacity building them that would lead to total rural development. Utthan believes that:

- Savings and credit is a medium that builds capacities of the community to resolve their problems themselves.
- To harvest and recharge the water of the village in the village itself thereby enhancing water quantity for drinking purposes and also for strengthening livelihoods.
- Through action research, understand local wisdom with a scientific perspective that helps create innovative options for drinking water and livelihood options.
- That the youth from the village stay put in their village and are able to get employment and participate in conflict resolution for peace.
- Capacity build the area's Women's Federation members to reduce the physical / mental atrocities on women

These principles have helped Utthan implement various options of development and livelihoods. These have also helped to reduce atrocities on women. These have been achieved through the following development perspectives:

Perspectives
• Watershed and Water Resource Management
• Action Research and Capacity Building on Drinking Water and Sanitation
• Organize Self Help Groups, Groups of Young Females and Males
• Entrepreneur Development Programmes
• Create awareness amongst the communities about the village level institutional mechanisms and move towards complete / overall village development
• Impact of global warming on humans by capacity building for disaster management and livelihood security

Geophysical Situation

Chaya village is located 6 kilometres from the sea coast. 30% of the land in this village consists of government's fallow land, village common pastureland and undulated land. A small stream passes 3 kilometres of the village. The soil is black, soft and reddish. The layers below are stray grey and black stones. The soil is very fertile for agriculture. Through lift irrigation, water from wells is used in the farms. The main crops are ground nut, bajri, wheat, cotton and vegetables.

Village Information

Chaya is located 20 kilometres South of Block headquarters Ghogha. The total population is 1650. The main communities that reside here are Talpada Kolis, Bharwads, Dalits and Potters. Agriculture and agri-labour are the main occupations in Chaya.

Intervention

A small dug well was the main source of drinking water during the monsoons. If the rains were in excess, then this source would also be used during the winters. If the rains were inadequate, then there would be drinking water problem in the winters. But whether rains were adequate or inadequate, summers always brought about drinking water shortages.

But with the help of the committee of the community, these sources had to be strengthened and these were included under the watershed programme. Hence, it was planned to construct series of check dams on the small stream near the village. In all 4 check dams were constructed. The harvested water would recharge the ground water especially around the dug well that was the source of drinking water. This source was finally made usable for the entire year.

Under the Netherland and Government of Gujarat supported water supply scheme, a Pani Samiti was constituted. A distribution plan was chalked out with the active participation of the community, Pani Samiti and the women. Hence, the dug well was repaired and made proper. Other facilities constricted under this scheme were a sump, an overhead tank, and distribution pipeline network and water stand posts. To sustain the operations and maintenance of the water system, the responsibilities of the Pani Samiti and the Operator were discussed and finalized. As well, based on the population, a water cess was fixed that would be collected every month for the operations and maintenance. Now, if the rains are scanty, water is available to the houses of Chaya through the source and the distribution system thus created.

Analysis

Utthan was able to develop water resource management and reach the water to the homes though the distribution system. Some of the important points were:

1. The technological options provided to mitigate the drinking water problems of Chaya were the best options based on the location and geophysical attributes of the village.
2. For the operation and management of the village water schemes, support from the community was sought as well collective decision making process was initiated.
3. The four check dams on the small stream, well recharge and pond deepening have been instrumental in recharging the ground water of this village.
4. The role of the Pani Samiti and the women is important in operation and management of the water systems.

Case Study 8		
	Organization	Utthan
	Villages	Neswad, Block Ghogha, Dist. Bhavnagar
	Technology Option	Innovation and Support provided to Ensure Drinking Water and Sanitation
	Information Provider	Utthan's Team Members

Background

Utthan initiated its work in 1981. Utthan began its work in the Bhal area where salinity is a way of life and there are meagre natural sources. At the moment, Utthan works in 4 districts on various rural development projects with a team of 55 members. Utthan's focus areas are drinking water and sanitation, natural resource management, women's empowerment and policy level advocacy at the national and international levels. Utthan works on the principle of developing people's organizations and capacity building them that would lead to total rural development. Utthan believes that:

- Savings and credit is a medium that builds capacities of the community to resolve their problems themselves.
- To harvest and recharge the water of the village in the village itself thereby enhancing water quantity for drinking purposes and also for strengthening livelihoods.
- Through action research, understand local wisdom with a scientific perspective that helps create innovative options for drinking water and livelihood options.
- That the youth from the village stay put in their village and are able to get employment and participate in conflict resolution for peace.
- Capacity build the area's Women's Federation members to reduce the physical / mental atrocities on women

These principles have helped Utthan implement various options of development and livelihoods. These have also helped to reduce atrocities on women. These have been achieved through the following development perspectives:

Perspectives
• Watershed and Water Resource Management
• Action Research and Capacity Building on Drinking Water and Sanitation
• Organize Self Help Groups, Groups of Young Females and Males
• Entrepreneur Development Programmes
• Create awareness amongst the communities about the village level institutional mechanisms and move towards complete / overall village development
• Impact of global warming on humans by capacity building for disaster management and livelihood security

Situation

Neswad is 15 kilometres away from Bhavnagar city. The total population of the village is 1900. The major communities living here are Kolis and Maharaj. The main occupation of the community is agriculture and diamond polishing.

The work was launched in this village in 1996-97 when a women's Self help Group was constituted for savings and credit activities. Through this activity, women began sharing their problems. One of the major problems that the women faced was access to drinking water. Hence, Utthan decided to work in Neswad to help the community resolve their drinking water and sanitation related problems.

Water Scheme

Subsequently, in 1998, the Ghogha Regional Water Supply and Sanitation Project (GRWSSP) was launched. Under this project, local source based schemes were to be implemented and hence the work of drilling bore wells began in the selected 82 villages.

In Neswad, 8 bore wells were drilled. Of these 5 were unsuccessful while 3 had some water but the fluoride content was very high. The water situation did not improve. The village depended upon one well and two hand pumps. Summers saw these sources go dry. Hence the women walked more than 2 kilometres and fetched water from the farms. Numerous meetings, Gram Sabhas were organized to resolve the issue especially based on the GRWSSP components.

The components were constructed. These included 5 stand posts, 2 cattle troughs, 2 bathing ghats, one elevated water tank and pipelines. To strengthen the local sources such as the wells and the bore wells of the village, a check dam was constructed in the upper part of the bore well. This helped to recharge the ground water helping reduce the fluoride content in the drinking water. These are the main sources used by the community for their drinking water needs.

Women's Role

The entire water supply scheme is managed by the women. The Panchayat of Neswad was assigned the task of completing the water supply scheme under GRWSSP. During the construction phase, when the elevated tank was being built, the village women would get to do the labour work. This way they could earn and keep a watch on the construction. Because of pre-construction trainings and information servicing by Utthan, the women realized that the levels and the measurement of the steel was incorrect. They knew that something was amiss. They called the Panchayat and the Pani Samiti members. Later, the Water Supply Department officials too were called in. Finally the mistake was rectified. 12 more cement bags were used which otherwise would have been saved thereby making gains for the contractor.

Analysis

1. The local source was strengthened because the GRWSSP had a water resource management component inbuilt. Else, merely constructing storage and a distribution system would not have served any purpose.
2. The role of the Gram Panchayat and the Pani Samiti was critical in garnering support from the community and getting the community to contribute financially for the operations and maintenance.
3. Involving women and enhancing their technical knowledge helped to maintain the quality of construction materials and the construction itself. This will ensure that the systems work for a longer time and have less of maintenance.