SELECTED BEST PRACTICES IN WATER MANAGEMENT

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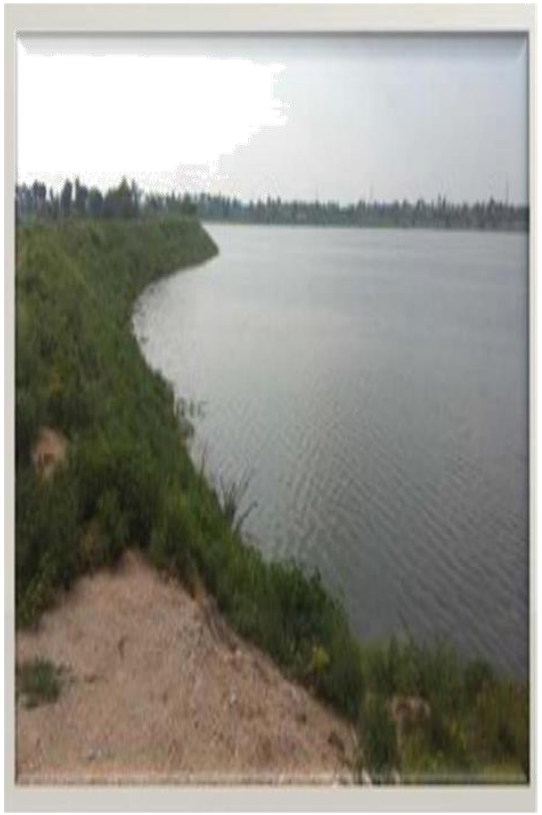
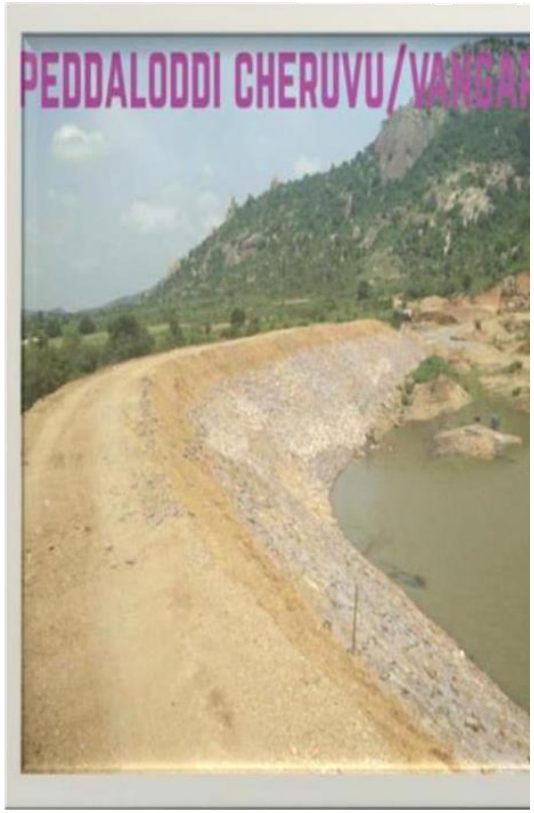
SECTION 1:

BEST PRACTICES IN IRRIGATION WATER MANAGEMENT





Source: missionkakatiya.cgg.gov.in

Case 1: Mission Kakatiya-Telangana

Place of implementation: **Telangana**

Implementing agency: **Telangana State Government**

Intervention

Mission Kakatiya is a flagship program under Telangana government aimed at restoring minor irrigation sources of water like ponds and tanks. The objective is to enhance the development of Minor Irrigation infrastructure, strengthening community based irrigation management in a decentralized manner and to adopt a comprehensive programme for restoration of tanks and sources of water to effectively utilize 265 TM of water allocated for minor irrigation sector under Godavari and Krishna river Basins. Gram Sabha were conducted and the proposed plans were discussed with the villagers. Farmers were motivated to co-operate and were suggested to deposit the silt for field preparation. Several district level coordination committees were formed. Emphasis was given for improvement in delivery time of services. Steps like tank de-siltation, restoration of the feeder channels, re-sectioning of irrigation channels, repair of bund, weir and sluice, raising of FTL (Full Tank Level) wherever required were carried out.

Achievements

The intervention helped in increasing the storage capacity of tanks and other water bodies. It helped in making water available and accessible to small and medium farmers in particular and benefitted other farmers as well. The intervention helped in increasing the water retention capacity of the sources and also helped in improving the on-farm moisture retention capacity. The intervention bridged the 63% ayacut gap and also helped in stabilization of ayacut under minor irrigation. Measures like mixing of the slit on farm land preparation reduced the use of chemical fertilizers and also improved the land water retention capacity. An appreciable change was observed in the nutritive values of the soil. It resulted in diversification of high value crop and crop intensification and also gave rise to loop irrigation. Other achievements that accompanied the project are development of fisheries and livestock and rise in the ground water levels in that area. The increase in plantation of palm trees on the slopes also added to the income generation for the rural people.

Takeaways

- Public participation will lead to ownership and help in long-term sustainability of the interventions.
- Restoration and maintenance of water resources should be a continual process and local people should be trained to manage their resources.

Source: missionkakatiya.cgg.gov.in

Source: www.cwc.gov.in

Case 2: Narmada (Sanchore), Rajasthan

Place of implementation: **Rajasthan**

Implementing agency: **Govt. of Rajasthan**

Intervention

The use of micro irrigation technology like sprinkler and drip irrigation was made mandatory. Several initiatives that were taken up during the course were encouragement and enforcement of PIM (Participatory Irrigation Management) and formation of 2236 Water Users Association (WUA) for effective water management. Judicious usage of bio drainage in command area and tree plantation along the 1570 km length of canal was also taken up. Wide variety of salinity resistant crop for plantation was proposed. Steps were taken up for reduction of water allowance to handle drainage and salinity issues. Command Area Development and Water Management work were taken in tandem. The construction of canal network to utilize the full potential was created. Further steps like conjunctive ground water and surface water use has been proposed.

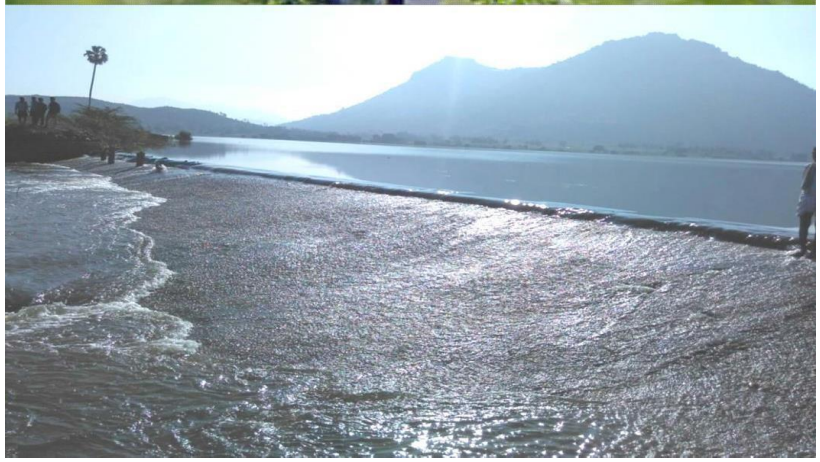
Achievements

The adoption of sprinkler irrigation system in place of conventional irrigation method resulted in numerous benefits. The Culturable Command Area (CCA) increased from 1.35 Lac hectares to 2.46 hectares with same quantity of water by adopting Sprinkler system in the entire project. There has been significant reduction in losses, both in cultivation and land loss. A comparatively high amount of efficiency is attained with automation and mechanization of the facility and irrigating structure. Outcomes of the irrigation intervention enabled extension of benefit from 89 villages to 233. Drinking water facility has also been provided in 1541 villages and three towns, which was not proposed earlier. The food production has increased from 534 cr. to 1480 cr. i.e. by 946 cr. (277%) based on year 2013-14. 20% of the area has been dedicated to growing Kharif crop in the modified project.

Takeaways

- Micro irrigation processes help in achieving high efficiency and reduces water use as in the conventional methods.
- Establishment of integrated irrigation system that comprises of canal systems, micro irrigation facilities and a network that even handles the problems of salinity, soil moisture, drainage etc.
- Conjunctive use of ground and surface water.

Source: www.cwc.gov.in



Source: mowr.gov.in/

Case 3: Chittoor, Andhra Pradesh- Har Khet ko Paani

Place of implementation: **Andhra Pradesh** **Implementing agency**: **MoWR, RD & GR**

Intervention

The steps taken up during intervention were renovation of traditional water structures and promotion of crop diversification. Under the program "**Har Khet Ko Pani**" comprehensive Repair, Renovation and Restoration (RRR) of all components in the chain of Tanks was carried out through extensive training of newly formed 610 WUAs and 1383 Community Based Organisations (CBOs). The State programme: "Neeru Pragathi" was also implemented and beneficial outcomes were seen during the course. Under More Crop per Drop, the advanced technologies were installed and the bore well mapping was done. By implementation of GIS based technologies like geo-tagging of assets the online application procedure was simplified. The highest priority was given to creating many water harvesting structures and SMC works under MGNREGS (Mahatma Gandhi National Rural Employment Guarantee Scheme). Other steps like incorporation of solar pumping methods, promotion of drip and sprinkler Micro- Irrigation(MI) techniques of irrigation and several other sustainable methods of modern day agriculture were also promoted.

Achievements

The impact of the intervention was remarkable as it sets benchmark and suggests several best practices for sustainable agriculture. Through this intervention, the irrigation potential was increased by 5,023 Ha, with increase in coverage under micro irrigation by 28, 324 Ha. Approximately 45,000 water harvesting structures have been created across the whole area in the district. These practices also led to a remarkable rise in water table at some points which was estimated as 32.37m to 10.15m. The increase in area under mulching with drip irrigation was 6000Ha and resulted in 60% water saving over the conventional method that were being followed. The concept of loop irrigation was also introduced in that area.

Takeaways

- Restoration and renovation of water bodies can lead to water use efficiency
- Optimal utilisation of the resources.
- Creation of WUAs helped in sustainability of the project.

Source: mowr.gov.in/

Source: darpg.gov.in

Case 4: Mulching: Harvesting Many Benefits in Cardamom

Place of implementation: Western Ghats

Implementing agency: **The Indian Cardamom Research Institute (ICRI)**

Intervention

Any material, usually organic, that is spread on the ground to protect the soil and the roots of plants from the effects of soil crusting, erosion, or freezing is known as a Mulch. A mulch may be made of materials such as straw, sawdust, grass clippings, peat moss, leaves, or paper etc. For large areas under cultivation a tilled layer of soil serves the purpose of a mulch but intensive cultivation of cardamom, ignoring the traditional cultural practices, has resulted in repeated losses. The Indian Cardamom Research Institute (ICRI) studied the soil fertility on a farm and found that the organic carbon/humus content is higher in the farms where this technique is practiced compared to neighbouring plantation. The soil bulk density is also very low. Mulching reduced the acidity of the soil and increased the soil moisture.

Achievements

The studied showed significant achievements like high humus content on farm. It was observed that mulching resulted in several advantages- the plant growth is healthy and the damage due to thrips on capsules and stem borer is negligible; the height of the 17 year old plant is 15 – 20 feet tall and there are about 100 tillers in each clump. Usually cardamom fields are replanted with new suckers in 8-10 years of cultivation. But mulching helped in retaining the plantation successfully for 17 years with compact clumps. There is no need for weeding as the soil is not exposed and self- shade of cardamom clumps discourages weed growth.

Takeaways

- Mulching helps in conserving soil moisture
- It also acts as temperature regulator in hot summers and cold winters.
- Live mulching technique is very good for nitrogen fixation.
- Organic waste generated from field can fruitfully be utilised to reap significant benefits.
- Growth of unwanted weeds can be controlled in farm using this technique.

Source: www.thehindu.com/sci-tech/science/mulching

Source: mowr.gov.in/

Case 5: Participatory Irrigation Management (PIM) - Waghad, Maharashtra

Place of implementation: Maharashtra **Implementing agency: MoWR**

Intervention

The steps carried out during the intervention were awareness programs that promoted conjunctive use of surface and ground water and enforcement of water use entitlement which is monitored and regulated by Maharashtra Water Resources Regulatory Authority. Steps were taken up to achieve equitable distribution of the resources using the tail to head principle. As gender realisation and equal participation of both men and women is need of an hour thus during formation of WUA's equal and active participation of women was also encouraged. The integrated approach for participation of several stakeholders was done during the course of institution building. The farmers contributed 50 Lakh for rehabilitation cost and 15% cost of office building. Also formation of CMC for supervising rehabilitation works was also done.

Achievements

There was an improvement in water use efficiency and water productivity of irrigation projects through participation of farmers in irrigation management. WUAs were formed and the area covered by of entire project was around 10000 Ha. The overall irrigation area increased from 7885 Ha in 2004 to 9354 Ha in 2014-15. The water saving was 27%. In addition to this the drip irrigation coverage increased from 25% in 2004-05 to 40% in 2014-15 with approximately 100% recovery of water charges. The area saw an increase in average income from INR 60000 to INR 2, 92,139.

Takeaways

- Participatory approach can help is judicious use of resources
- Representation of an equitable percentage of women in formation and working of WUA's is highly important.
- Tail to head distribution of resources helps in achieving equity.
- Capital and labour contribution in building of an institutional structure gives a sense of ownership to the beneficiaries.

Source: mowr.gov.in/

Source: ggrc.co.in/webui/home.aspx

Case 6: Micro-irrigation in Gujarat

Place of implementation: **Gujarat**

Implementing agency: **Gujarat Green Revolution Company Ltd.**

Intervention

The intervention was an integrated approach to promote uniformity of provisions under various schemes to remove their inequalities and anomalies. The objective was establishment of a special purpose vehicle – Gujarat Green Revolution Company which would promote and implement Micro Irrigation Scheme in Gujarat. The initiative educated the farmers in adoption of scientific water management techniques and benefits of value-addition in crop production and marketing of their produces. The initiative embarked upon Jal Sanchay Abhiyan which is a drive for Storage of Water in which the Micro-Irrigation Scheme is an integral part of the programme. The Gujarat Green Revolution initiative also took care of providing electricity connections to approximately 1, 16,146 farmers on a priority basis who adopted Micro- Irrigation Systems on their agricultural lands.

Achievements

The intervention in true sense set a green revolution. From the time of implementation till 2014, a total number of 6, 40,853 farmers had adopted Micro Irrigation Systems (MIS) in a total area of 10, 34,930 Ha and were able to reap out on the benefits of the program. In many tribal areas, 1, 31,293 farmers adopted Micro-Irrigation System over a cumulative area of 1, 78,745 Ha. Out of the total area of 10,34,930 Ha covered under the Micro-Irrigation Scheme, 4,96,305 Ha has been covered under Drip Irrigation and 5,38,625 Ha under Sprinkler Irrigation. Gujarat has achieved double digit growth in agriculture sector and the state is a pioneer of second green revolution in the country. Farmers' earnings have increased due to progressive agriculture policies of the state government.

Takeaways

- This model sets as a benchmark that could be implemented across nation.
- Strict monitoring and dedicated agencies played a crucial role in making the programme a success.
- Effective storage and management of water is equally important as is the availability.

Source: ggrc.co.in/webui/home.aspx

Source: https://www.cechyd.org/

Case 7 : Root Zone Watering by SWAR (System of Water for Agriculture Rejuvenation)

Place of implementation: **Hyderabad** **Implementing agency**: **Centre for Environment Concerns**

Intervention

The intervention was carried out by the Hyderabad-based Centre for Environment Concerns (CEC). The intervention discovered a unique irrigation technology called System of Water for Agriculture Rejuvenation (SWAR). The innovative SWAR system attained a global recognitions and awards. SWAR shifts irrigation from surface to measure moisture at plant root zone. Soil moisture content in the root-zone is an important variable in modelling hydrological and biophysical processes and agricultural applications and SWAR works on these parameters. The root zone also serves as an ecosystem to foster soil micro-organisms besides rationing plant water requirements. The system involves storing of water in overhead tanks and sending it through a small diameter pipe to a customised locally-made clay pot that is buried near the root area. The clay pot contains micro-tubes that transmit water through a sand pouch, to prevent the roots from invading the pipes and the pot. The slow oozing of water provides moisture for a prolonged period, the level of which is calculated based on soil type, plant species and its age. SWAR uses a very less amount of water and there is zero wastage of water.

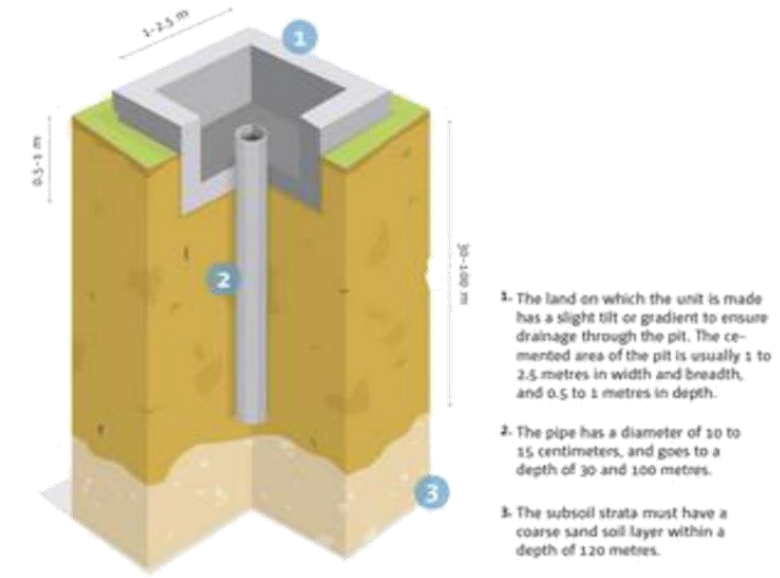
Achievements

The innovation has been highly recognised by the Andhra Pradesh government. The government has placed orders for implementation of the system in an extent of 400 acres in Anantapur, Kurnool and Chittoor. The system is suitable for the massive tree plantation programme. In 2015, this technique was also used to grow vegetables and flowers. This helped show immediate results in terms of both soil and plant health and farmers' incomes. In vegetables and fruits, where close planting is done, it was discovered that one eighth of the water suffices, compared to drip irrigation. It was due to these promising early results that SWAR received the Global Champion Innovation Prize for Water and Forestry at the 2015 Paris International Agricultural Show. SWAR, desires to bring more low rainfall areas under irrigation.

Takeaways

- It is important to shift from rain dependent farming to harvesting and storing rain water and using it efficiently to cultivate crops.
- It is important to use water optimally providing moisture rather than 'concentrated' loads of water.
- Heathy farming practices should be adopted for soil improvement.
- Agricultural innovations should be sustainable and offer improved incomes to smallholder farmers.

Source: securingwaterforfood.org



Source: http://www.naireetaservices.com/

Case 8: Bhungroo – Ground Water Injection Well

Location of Implementation: Gujarat **Implementation Agency: Govt. of Gujarat**

Intervention

'Bhungroo' is a water management system that injects and stores excess rainfall water underground. This water is then used for irrigation during summers .The intervention was carried out in sites identified by the Gram Panchayat through resistivity surveys by the Ground Water Department and Geologists from DWMA (District Water Management Agency) for this purpose. Design and estimation was done under MGNREGS. The pilot project was carried out in Gujarat with user groups. The steps such as installation of one unit with sub-surface storage at three levels between 25 to 110 feet with a total capacity of 2 crore litres was implemented. The farmers were trained in installation of Bhungroos. Installation of piezometer was done for water level monitoring on a day-to- day basis.

Achievements

Artificially recharging of aquifers by adding rainwater to underground water reservoirs enables the communities to continue farming for more than half of the year. The non-saline rainwater when mixed with the underground saline water brings down the salinity of the groundwater, making it fit for agricultural use. The system also enables one to lift up and use the stored water during dry spells. The massive underground reservoir can hold as much as 40 million litres of rain water. It harvests water for about 10 days per year and can supply water for as long as seven months. These wells can hold up to two crore litre of rain water.

Takeaways

- Major beneficiaries of this pilot program were the underprivileged female farmers who were completely depended upon rain fed agriculture.
- This system has reduced drudgery of women thus making them the chief owner and expert of this practice.
- It provides food security and sustainable livelihoods to more than 18,000 marginal farmers (with over 96,000 dependent family).
- It has helped in contributing to food security. .
- This technique can be replicated in other parts of country for groundwater recharge.

Source: http://www.naireetaservices.com/

Source: http://www.dowrorissa.gov.in/Citizen/PIM/PIM.htm

Case 9: Pani Panchayat : Orissa Water Resource Consolidation Project

Place of implementation: Orissa **Implementing agency: Department of Water Resources Orissa**

Intervention

The primary objective of Orissa Water Consolidation Project (OWRCP) was to improve the planning and development process for the state's water resource; thus increasing the overall agricultural productivity through investments for improvement of the existing scheme. Participatory Irrigation Management was introduced in Orissa in 1995 on a pilot basis under Orissa Water Resources. Consolidation Project (OWRCP) under the banner of Farmers Organization and Turnover (FOT). Experiencing its success at large, it was extended to all the commands of Major, Medium, Minor and Lift Irrigation Projects. The main objectives of the intervention were to promote and secure equitable distribution of water among its users, adequate maintenance of irrigation system, efficient and economical utilization of water to optimize agricultural production and to protect the environment and to ensure ecological balance inculcating sense of ownership of the irrigation system in accordance with the water budget and the operational plan.

Achievements

The intervention has a well-defined institutional framework. The legal system comprises of several acts and policy framework "The Odisha Pani Panchayat Act-2002" has been enforced in the state since 15.11.2002, "The Odisha Pani Panchayat Rules" 2003 has also been enforced since 23.04.2003. Prior to enforcement of Pani Panchayat Act & Rules, Pani Panchayats were registered under the Societies Registration Act-1860. Some amendments to the 2002 Pani Panchayat act has been made since then like inclusion of fisher folk, increase in tenure of Pani Panchayat office Bearers and Executive Body from 3 years to 6 years subject to replacement of 50% by lottery, election of members from the Chaks on a rotational basis and representing, head, middle and tail reach and inclusion of women by reservation of 1/3rd of the total number of seats in the Executive Committee. Other outcomes that mark the empowerment of Pani Panchayat are like a quarterly Publication of Pani Panchayat Samachar that helps in exchange of knowledge, organization of Pani Panchayat fortnight from 26th December to 9th January every year, broadcasting of program on All India Radio and Television, felicitation of best performing Pani Panchayats during the fortnight celebration every year, regular on campus and off campus training program by Water and Law Management Institute Orissa (WALMI) and interstate and intra-state training-cum-exposure visit.

Takeaways

- The success stories published in the quarterly journal "Krushak Bandhu Arnapurna" Published helps in exchange of knowledge with larger audience.
- Bottom-up institutional framework helps in sustained and effective management of the resource.
- Capacity development helps in continual improvement of the office bearers

Source: http://www.dowrorissa.gov.in/Citizen/PIM/PIM.htm

SECTION 2:

BEST PRACTICES IN DRINKING WATER MANAGEMENT

Source: http://www.wasmo.org/showpage.aspx?contentid=72

Case 1: Community managed drinking water supply program, Gujarat

Place of implementation: **Gujarat**

Implementing agency: **Water and Sanitation Management Organization (WASMO)**

Intervention

A community managed, demand-driven, decentralized approach for rural water supply program was implemented at village level as an initiative to provide adequate and safe water supply to village community. It then brings together the community through Pani Samitis, NGOs, and International organizations like UNICEF, WASH and World Bank along with technical assistance from WASMO to ensure equitable availability of safe drinking water to the community. The villages covered by this drive have been connected to the piped water supply network, overhead storage tanks have been built in villages and drinking water supply is being administered with community participation.

Achievements

The initiative serves as a sustainable system of providing clean water to rural households and has established a financially sustainable model for water provision. Around 76.84% of rural households in Gujarat have been covered under this intervention as of 2014. Significant improvement has been observed in the community, especially for girls, to continue their education instead of fetching water from long distances, reduction in water borne diseases, overall improvement in health status and better living standards of the community. Pani Samitis have been formed in 18,185 out of 18,478 villages in the State, apart from formation of water quality teams in 16,860 villages, distribution of field test kits in 14,216 villages and fixing and collection of water tariffs by 7,131 villages.

Takeaways

- Collaboration with communities and use of maximum use of existing infrastructure ensures adequate, regular, safe, sustainable and convenient water supply at household level.

- Engagement of communities in the implementation process reduces the need for government support, makes the program self-reliant and ensures social sustainability.

Source: http://www.wasmo.org/showpage.aspx?contentid=72
WASMO and One World Foundation India, 2014

Source: http://www.undp.org/content/dam/india/docs/good_practices_in_water_security_ideas_for_praxis.pdf

Case 2: Jal Dal- Children's Institutions for Water Management

Place of implementation: **Barmer** **Implementing agency: Jal Bhagirathi Foundation, Rajasthan**

Intervention

Due to lack of availability of drinking water, Government School in Godawas experienced poor enrolment and attendance rates. Children had to help their mothers fetch water from distant places and were at the suffering end of the problem of water access. The Gram Panchayat of the village constructed a 40,000 liter tank in school, enlargement of village pond and created a Jal Sabha in the village. To ensure maintenance of the newly constructed tank, a student body of 10 members called Jal Dal was constituted. The Jal Dal took the responsibility of cleaning the roof and ensuring clean water in the tank. They were also responsible for cleaning of silt chambers and meticulous functioning of the hand pump. The school children were also involved in environment conservation drives and in disseminating information about water stress to the villagers. This is an ongoing practice which is passed down to the younger students to maintain the tank. The students have also started a piggy bank in which students from higher classes contribute one rupee per month for maintenance of tank and purchased of water during times of scanty rainfall.

Achievement

This intervention has positively impacted education in the region and has yielded a growth in literacy rate. There has been a noticeable fall in the school dropout rate and attendance has become more consistent. Incidences of water borne diseases have reduced, clean water is available throughout the year for the village. The village has become self-reliant and is now no longer dependent on pricey water tanks run by mafia to fulfil their water requirements.

Takeaway

- The Jal Dals provide an excellent example of volunteerism and community service, enabling children to learn about water management practices through hands on experiences
- It also puts forward an instance of uniting the school administration and students to work together to ensure that every child gets access to clean water and right to education.
- Community driven initiatives are better maintained and demonstrate longevity in terms of resource management.

Source: http://www.undp.org/content/dam/india/docs/good_practices_in_water_security_ideas_for_praxis.pdf

Sources: http://mazhapolima.org/about-us/
http://www.indiawaterportal.org/articles/mazhapolima-recharging-open-wells-kerala

Case 3: Mazhapolima Initiative - Thrissur District, Kerala

Place of implementation: **Thiruvilwamala Gram Panchayat**
Implementing agency: Thrissur District Administration, Kerala

Intervention

Rural Kerala fulfils its drinking water needs by using water collected in open dug wells. But increase in dependency on groundwater has led to drying up of these wells and has deteriorated the quality of existing water sources. In this context, the Thrissur District Administration along with various NGOs working in Kerala launched an artificial groundwater recharge program called Mazhapolima, meaning bounty of rain. In the rainy season, the rooftop rain water is led through pipes with sand filter at the end, to open dug well to replenish the aquifer. Under this initiative, employees of 100 NGOs received training to install roof water harvesting systems. The intervention gives subsidies to poorer households especially in over-exploited groundwater blocks and in areas of high salinity. When multiple wells are recharged in that area, the groundwater table goes back up. When the water table is low, the water is retained in wells for a while, and then pushed into the ground.

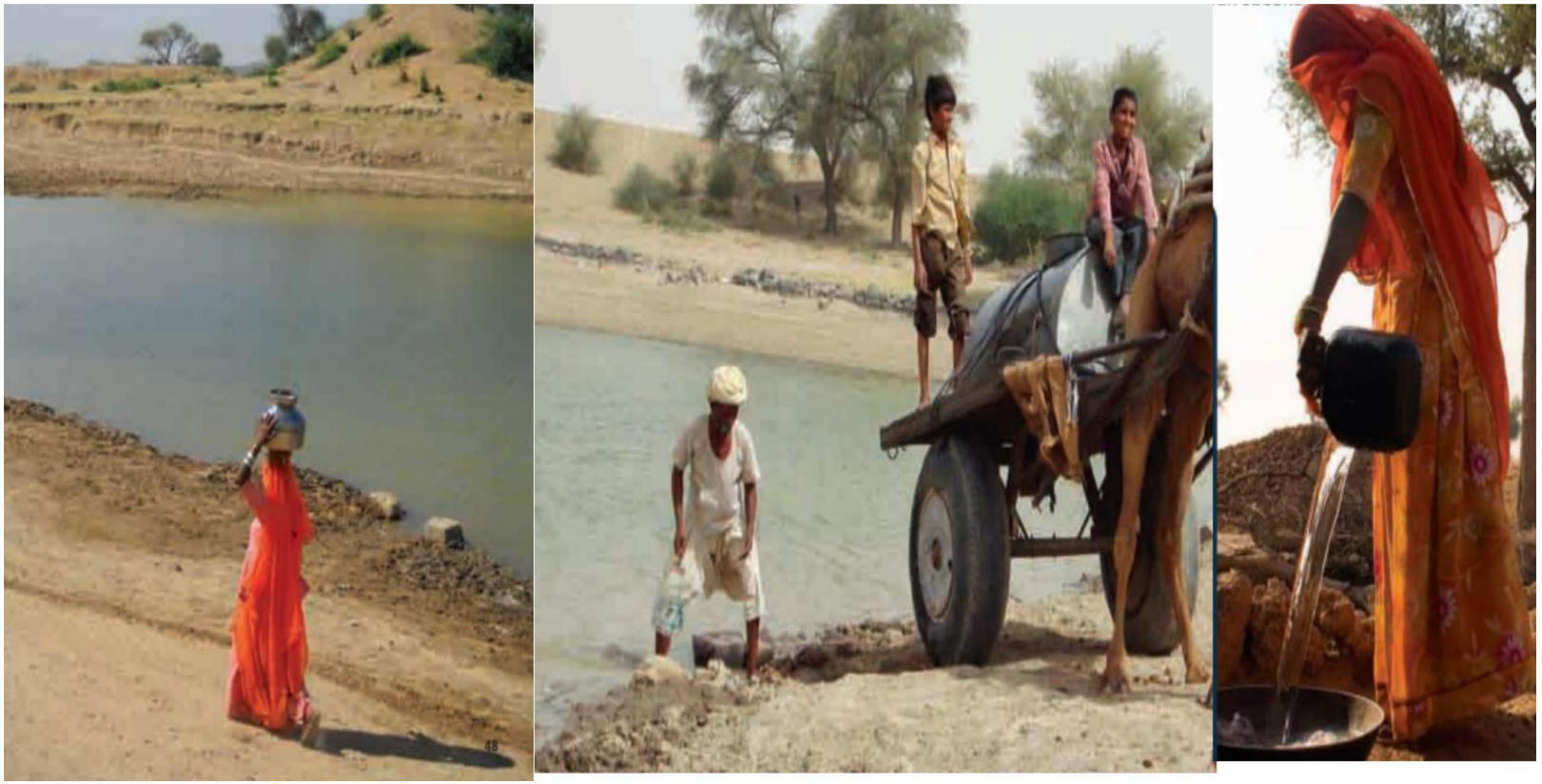
Achievement

Abundance of drinking water free from nitrates, iron content and reduced salinity is now available for the community. 20,000 well recharging units were established and over 1, 00,000 people have benefitted. It also provides a replicable model of water conservation which can be emulated anywhere. Money which was earlier spent on obtaining drinking water through tankers is now spent on building self-sustaining rooftop rainwater harvesting structures.

Takeaway

- Localized and affordable efforts help in implementation of a technique which can even be employed by a layman
- Community based consciousness will make great strides in confronting water stress in the country

Sources: http://mazhapolima.org/about-us/
http://www.indiawaterportal.org/articles/mazhapolima-recharging-open-wells-kerala



Source: http://www.undp.org/content/dam/india/docs/good_practices_in_water_security_ideas_for_praxis.pdf
https://yourstory.com/2015/02/jbf-water-management/

Case 4: Adaptive Water Management in Mandli, Rajasthan

Place of implementation: **Mandli Village, Rajasthan**
Implementing agency : Jal Bhagirathi Foundation and Community members

Intervention

The villagers of Mandli, inspired by success of Jal Sabha's in Rajasthan came together and formed a Jal Sabha with active women participation in their own village to deal with crisis of drinking water. The members undertook a participatory planning exercise and decided to increase the area of pond which would allow it to capacitate more water. The main source of water for the village was a pond called the Gawai Talaab which has the capacity of 2,869 cubic meter. Owing it to its small catchment area and improper construction, the pond would become dry and women had to collect water from afar. The government was supplying limited water which was very saline and it was causing health hazards to the community. The members of the Jal Sabha then undertook a participatory planning exercise and generated funds through contribution of every household in the village. The money was then pooled into a Jal Kosh and to ensure maximum accountability. Once the pond was sufficiently enlarged, the villagers decided to help neighboring village communities to obtain water from it using a 'coupon system' at a charge of INR 100 for a 4000 liter tanker. This money is used for regular maintenance of the catchment by renovation of water channels and tree plantation to improve water inflow. The pond has since been able to provide water even in drought years and has greatly solved drinking water crisis in the area.

Achievement

Availability of sweet drinking water round-the-year and water security ensured even in a severe drought year. Expansion of capacity of Gawai Talab from 2869 to 5218 CuM and that of Narsingh Nasa from 2308 to 26601 CuM. Further, 13 villages benefited through this intervention by sourcing water through tankers. The Jal Sabha has achieved a sustainable financial source for regular maintenance of the talaab through coupon system. The village, has been able to adapt to changing climatic patterns and recurring droughts.

Takeaway

- Investment in building robust and sustainable community systems and institutions positively impact round the year availability of water
- It also exhibits how an external agency with cooperation of the local community of the local community can facilitate revival of a sustainable water management system
- Emergence of community participation along with enhancement of leadership skills and self-confidence.

Source: http://www.undp.org/content/dam/india/docs/good_practices_in_water_security_ideas_for_praxis.pdf
https://yourstory.com/2015/02/jbf-water-management/

Source: https://gwssb.gujarat.gov.in/rural-water-supply-programme

Case 5: Meeting Water Requirements through Innovation

Place of implementation: **Chinchojhar village, Valsad, Gujarat**
Implementing agency : **Swajaldhara**

Intervention

The Chinchojhar village of Dharampur Taluka in Valsad had only one open well which was being used by all residents of the village to fulfil their water requirements. In summer months the well would run completely dry and women had to walk 1.5 km to another habitation to get water. Under the Swajaldhara program, a collection tank was built near a perennial spring at a height of 120 meters from the main village. A storage tank was built 40 meters above the village and connected with pipelines. The tank capacity was 10000 liters and stand posts were constructed to provide water to the village.

Achievement

Through this intervention villagers were able to obtain water in their village and they no longer had to depend on one single open well to meet their daily water requirements. Steps were taken up like the storage tank was covered and kept water free from contamination and reduced health risks. The intervention also allowed the villagers to tap into a perennial source thereby ensuring maximum water security.

Takeaway

- The village has taken the benefit of existing natural conditions and made use of a source available at an altitude.
- A simple innovation to arrest water coupled with principles of gravity and pressure has been applied to meet the needs of a scattered tribal population

Source: https://gwssb.gujarat.gov.in/rural-water-supply-programme

SECTION 3:

BEST PRACTICES IN URBAN WATER MANAGEMENT

Source: https://www.ocwindia.com/

Case 1: Nagpur Orange City Water Project

Place of implementation: Nagpur

Implementing agency: Nagpur Municipal Corporation

Intervention

The project aimed at addressing problems related to unbilled water. Out of the total 575 MLD of treated water being supplied by the city, only 175 MLD was being paid for due to non-existence and dysfunctional water meters. Erratic water supply (8-10 hours/day) and tanker mafia also added to the problem. To overcome these losses, the NMC with funding under JnNURM replaced canal water supply with pipelines. Furthermore, treatment capacity at Kanhan River was increased to 240 MLD from 120 MLD. When NMC passed the resolution for city-wide 24X7 water supply, the onus was transferred to Veolia-Vishwaraj consortium through a transparent bidding process and Orange City Water Pvt. Ltd was formed. Tariffs are decided by MNC and collections are carried out by the consortium. It operates and maintains the system with an O&M contract for 25 years. The model follows a PPP framework wherein Asset Ownership lies with the NMC, operations are looked after by a private consortium and investment is done by Government of India and Govt. of Maharashtra with ULB share by private at 116 crores.

Achievements

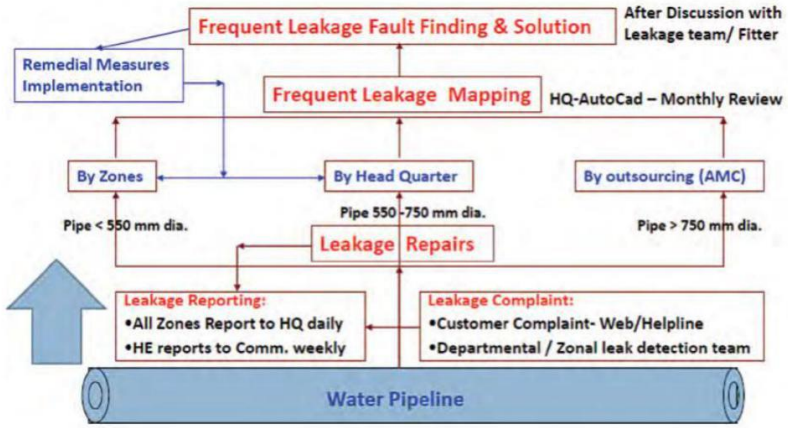
OCWPL has taken over water supply and replaced 85000 out of 321,000 connections along 450 km of the pipeline coverage. Close to 100,000 unauthorised connections have been identified during rehabilitation phase and commercial losses have reduced along with improvement in NMC revenues. Service delivery issues being tackled through infrastructure augmentation and increase in capacity of Elevated Service Reservoirs. 24x7 water supply has ensured better standards of living for Nagpur residents.Consumer grievances being addressed through round the clock call centre, bill payments managed through zone level kiosks set up by OCWPL.

Takeaways

- PPPs hep ULBs in governance by separating monitoring and regulation from service provision and bringing in technical and managerial know-how along with proper implementation.
- PPPs need to be backed with contract monitoring and administration capacity building, and wide stakeholder engagement.
- Maximum liability, full accountability and wholesome planning ensures greater availability of water, minimal losses and consumer satisfaction.

Sources: http://smartcities.gov.in/upload/uploadfiles/files/Nagpur_water_PPP_Final_case.pdf
http://www.veolia.in/about-us/about-us/our-contracts/municipal-dbo-contracts/kanhan-nagpur-maharashtra

EXHIBIT 4.1: **LEAKAGE MAPPING MECHANISM**



Source: https://pearl.niua.org/sites/default/files/books/GP-IN2_WATSAN.pdf

Case 2: Surat: Formation of Non-Revenue Water Cell

Place of implementation: Surat **Implementing agency: Surat Municipal Corporation**

Intervention

Surat Municipal Corporation NRW's scores under the SLB framework had been a dismal 'D' with respect to reliability levels suggesting that this is a serious cause of concern. SMC received continued complaints from various zones about pressure, leakages and breakages in the system. To address these issues, SMC decided to adopt a systematic approach of leakage mapping and leak repairs; while city wide auditing was also carried out. However, these initiatives were on piecemeal approach without necessary institutional support and clarity for implementation and monitoring. Recognising this need to improve service delivery, SMC formed an NRW cell to make a thorough estimate of non-revenue water and then to maintain overall NRW levels at 20%[13]. As part of this, water audit and initial leakage mapping exercise of the core city area was conducted. The NRW cell identified leakage mapping as a priority initiative and involved identification of leakages based on current and historical complaints from citizens and ground level assessment. As per leakage mapping, few pipelines in the area were replaced stage wise in the year 2010-2011 and the same initiative was extended to other zones of the city too. Corrective action of changing the required pipeline and faulty valves was initiated and repair work was carried out. Leakage repairs were done at three levels:

- Leakages in pipe sizes > 750mm: outsourcing by municipal corporation to private operators
- Leakages in pipe sizes 550-750 mm: by Ahmedabad Municipal Corporation
- Leakages in pipes < 550 mm: by Zonal Offices.

Achievements

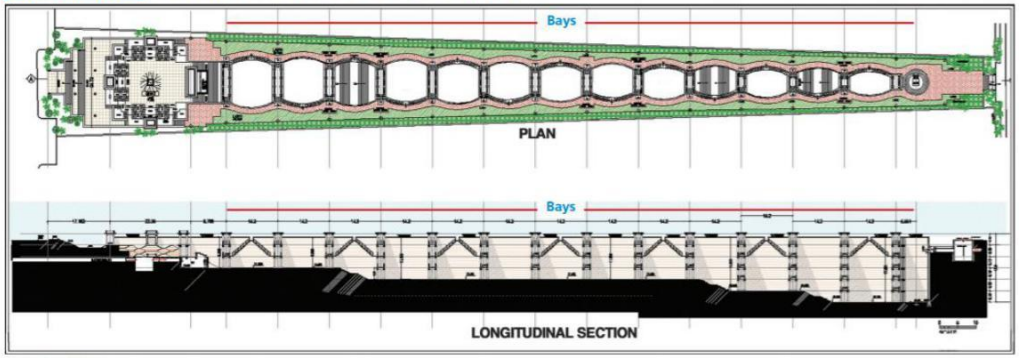
The early stage leakage mapping exercise bore constructive and impactful results like reduction in leakages per km length of pipeline in the last 7 years. Recently, the length of water supply network has increased to 3000 km at present. Reduction in number of consumer complaints. Better complaint tracking and redressal. Leak repairs and water savings.

Takeaways

- Creation of dedicated institutional mechanisms to tackle critical aspects like NRW reduction create accountability and early enthusiasm which is reflected in the results of the leakage mapping exercise.
- Integrated planning, diligent process transformation and sustained institution building are instrumental in success of such initiatives.
- Institutional strengthening ensures phase wise governance and timely grievance redressal.

Source: NIUA, Compendium of Good practices-Urban Water Supply and Sanitation in Indian Cities, https://pearl.niua.org/sites/default/files/books/GP-IN2_WATSAN.pdf

DIAGRAM 3 Plan and section of the *Birkha Bawari*



Source: *A Mridul*

Sources: Devyani Jayakar 2012, 'Birkha Bawari-a modern step well', Inside Outside, September (2012) 134-142
Mridul A, 2012, 'Birkha Bawari', Indian Architect & Builder, November 2012

Case 3: Birkha Bawri, Jodhpur

Place of implementation: **Jodhpur**

Implementing agency: **Umaid Heritage Real Estate**

Intervention

The Umaid Heritage Site is a private township located in southeast of the Umaid Bhawan Palace in Jodhpur, Rajasthan and was faced with acute water shortage. To overcome this problem, a Rain Water Harvesting (RWH) system was developed inside the housing complex. The Birkha Bawri as the structure draws inspiration from traditional step wells in the region and is used to catch rainwater from the site catchment area. Apart from storage and conservation of rainwater, the project also highlights sustainable storm water management in the housing complex, as it collects runoff and minimizes water logging in the area. The rainwater is collected from open areas through natural slopes as well as from the roof top of the house connected through drainage conduits. The water enters from both sides of the underground longitudinal storage structure (Bawri) and holds 17.5 million liters of harvested rainwater annually and serves as a reliable source of water for meeting landscape requirements. The steep depth of the tank (18 meters) provides shade to water and reduces evaporation losses. The water stored in the structure is used to supply water to the residents during lean periods and also to meet horticulture needs.

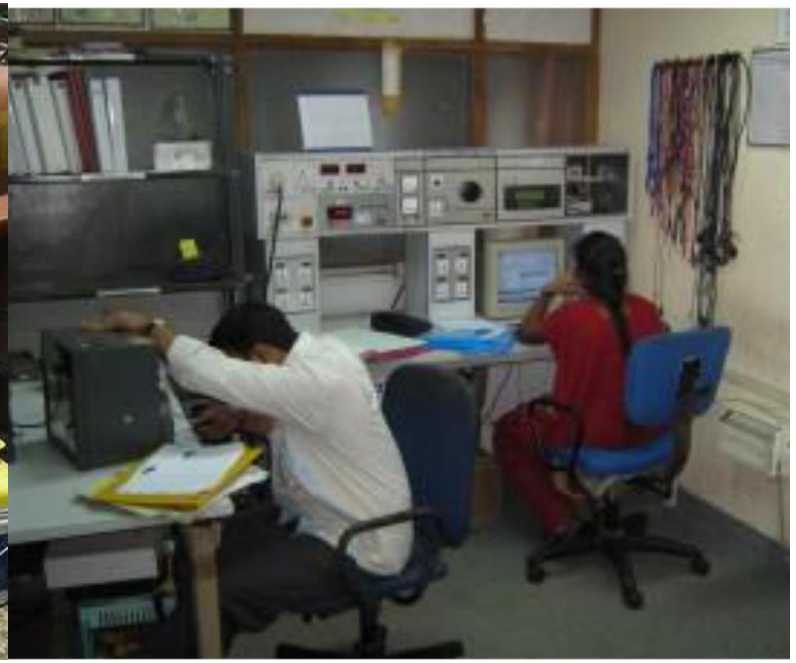
Achievements

The RWH system has greatly reduced dependence on municipal water supply and groundwater extraction by 50%. Economic benefits such as reduction in use of water tankers have led to savings of Rs. 2.36 crore annually. The structure has increased property value of the complex by demonstrating perfect combination of good architectural design and well maintained green spaces in scanty rainfall region. Overall dependence on municipal storm water structure has lessened and water logging controlled. The project provides green landscaped area to the site, which is hugely sustainable.

Takeaways

- The structure is an example of how environmental benefits can be achieved with simple integration of historical concept to better utilise and conserve in-situ resources.
- The intervention is a good example of sustainable urban development and water management practise in a low rainfall region, demonstrating the value of water by conserving rainwater.

Sources: Devyani Jayakar 2012, ‘Birkha Bawari-a modern step well’, Inside Outside, September (2012) 134-142
Mridul A, 2012, ‘Birkha Bawari’, Indian Architect & Builder, November 2012
Interview with CV Arora, Chartered accountant, Umaid Heritage, Jodhpur, January 6, 2014



Sources: http://www.thehindu.com/real-estate/bengalurus-looming-water-crisis/article19294851.ece
http://kswn.in/images/Venkata_Raju_BWSSB-Demand_management_final(2).pdf

Case 4: Bulk Metering System, Bangalore

Place of implementation: **Bangalore** **Implementing agency**: **Bangalore Water Supply & Sewerage Board**

Intervention

This case involved initiatives by the Bangalore Water Supply and Sewerage Board to install bulk meters at strategically important locations and to develop an ICT application to capture information from these meters to improve the water supply infrastructure. The project was sanctioned under JNNURM. Flow meters were installed at critical locations including inlet and outlet of all Ground Level Reservoirs and Elevated Service Reservoirs and on feeder mains which feed water directly to the distribution network. All the meters were geo-tagged so aid data collection. A specific quantity of flow was assigned to a meter based on the requirement of service area and water availability and an alarm was triggered if the flow would go above or below the set limit to monitor and alter the flow. An ICT application is also being developed by IBM to capture data from bulk meters and transmit it to users for analysis.

Achievements

Bulk flow metering helps water operators in assessing the overall water balance along with identification of illegal connections. It provides indicators for leakage reduction program and helps inefficient water distribution management by helping BWSSB control drawing of water.Combining instrumentation with software solutions has helped in leveraging operational data holistically to create insights and improve water management and to anticipate potential delivery disruption and better forecast long term water demands. In areas where this intervention has been put in place, a huge reduction has been seen in water wastage and an account of water supply to each division is being maintained.

Takeaway

- Integration of information technology with system wide metering helps the utility in capturing data from various components of the water supply system and helps water operators use it as a tool for decision making.
- In large urban water supply systems, comprehensive monitoring and real-time data procurement ensures control, decision support and sustainable use of water resources.
- This ensures affordable and equitable water supply to citizens while minimizing wastages consistently and reliably.

Sources: http://kswn.in/images/Venkata_Raju_BWSSB-Demand_management_final(2).pdf
https://pearl.niua.org/sites/default/files/books/GP-IN2_WATSAN.pdf

SECTION 4:

BEST PRACTICES

-TRADITIONAL KNOWLEDGE

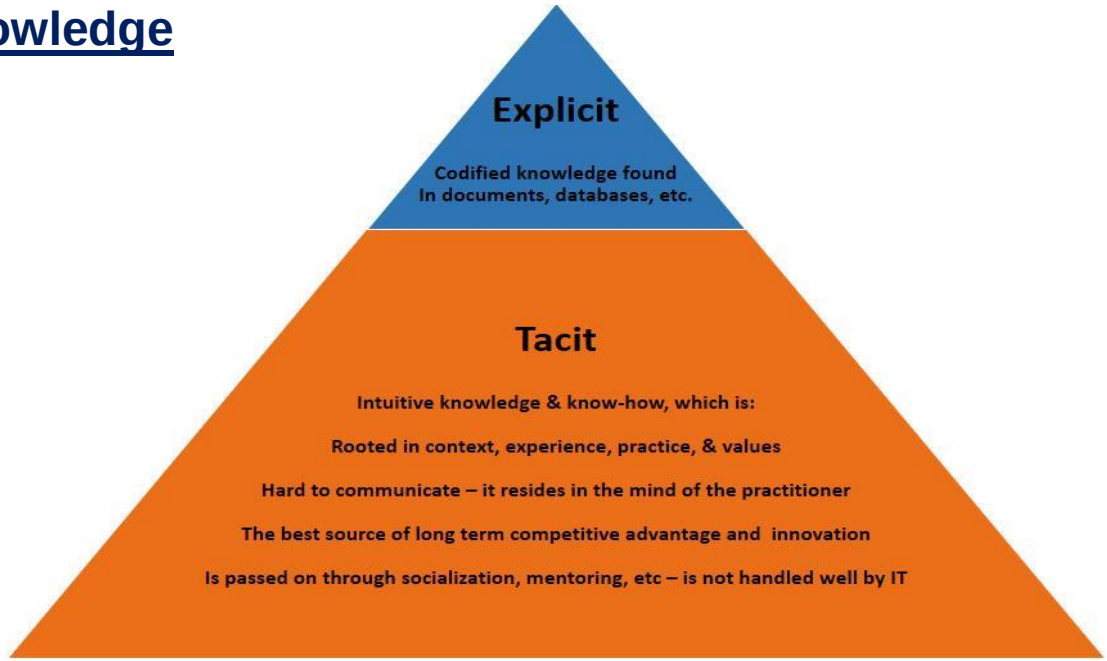
Traditional Knowledge

The Director General of United Nations Educational, Scientific and Cultural Organization (Mayor, 1994) defines traditional knowledge-

“The indigenous people of the world possess an immense knowledge of their environments, based on centuries of living close to nature. Living in and from the richness and variety of complex ecosystems, they have an understanding of the properties of plants and animals, the functioning of ecosystems and the techniques for using and managing them that is particular and often detailed. In rural communities in developing countries, locally occurring species are relied on for many - sometimes all - foods, medicines, fuel, building materials and other products. Equally, people’s knowledge and perceptions of the environment, and their relationships with it, are often important elements of cultural identity.”

(Source: http://www.nativescience.org/html/traditional_knowledge.html)

Types of Knowledge



Source: https://www.knowledge-management-tools.net/different-types-of-knowledge.html

Source: http://www.ecotippingpoints.org/our-stories/indepth/india-rajasthan-rainwater-harvest-restoration-groundwater-johad.html

Case 1: Johads in Haryana, Uttar Pradesh and the Thar Desert of Rajasthan

Johads

Johads are simple mud and rubble barriers built across the contour of a slope to arrest rainwater. It is one of the oldest systems used to conserve and recharge ground water. Johads collect monsoon water, which slowly seeps in to recharge groundwater. As the maximum rainfall is around monsoon season thus the rainfall during July and August is stored in Johads and used in coming months. Sometimes, many Johads are interconnected with a gulley or deep channels with a single outlet in a river or stream nearby to prevent structural damage. These earthen check dams are meant to catch and conserve rainwater, leading to improved percolation and groundwater recharge and maintain soil moisture. Acts as source of water for drinking purpose by humans and cattle. Are called as "khadins" in Jaisalmer and tanks in most parts of the country.

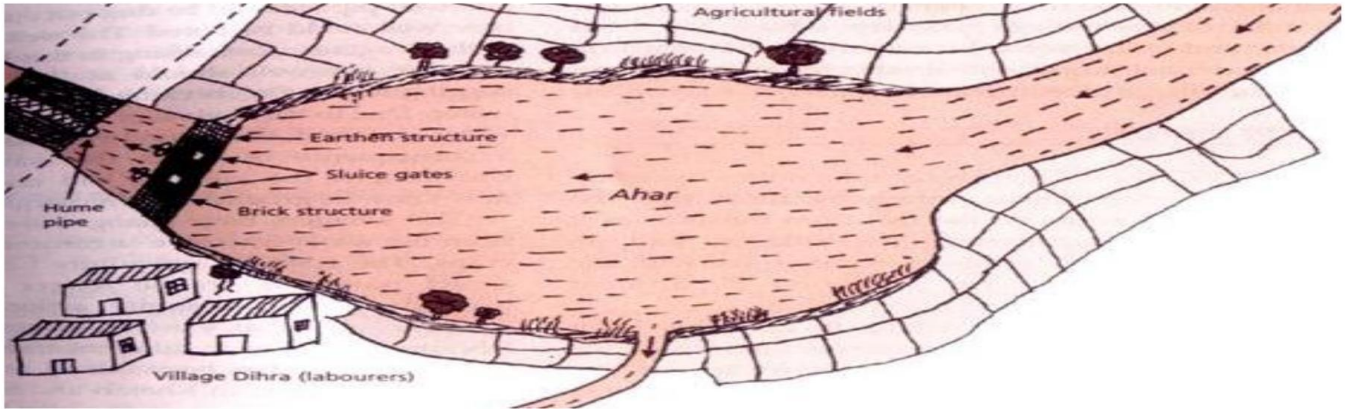
Initiatives

Several initiatives have been taken up by government of India in conserving and promoting Johads Irrigation Department of Haryana spent INR435.26 crore (INR4.3 billion or US$7 million) to renovate and restore water bodies in the state to for conservation of water, recharging of ground water, preservation of environment and enhancement of tourism. In 2016, Government of Haryana announced a plan to map the district-wise map of water flow and to create a database of all water bodies within the state. During the drought of 1985-86 in Alwar district in Rajasthan volunteers from the Tarun Bharat Sangh (TBS), came to Alwar and since then over 5000+ Johads have been thrived all over Rajasthan significant results have been seen in improvement of the water table level in those areas.

Takeaways

- Johads have always been a point of release of social energy.
- Results in increased water availability and acts as a resource to agriculture, animal husbandry etc.
- Acts as a protection of forests and green cover in catchments.
- Positive impact on education and health
- Decline in distress migration
- Requires constant and timely maintenance which in turns motivates several stake holders and government to invest in and raise their quality of work

Source: http://www.rainwaterharvesting.org/rural/traditional1.htm
http://www.ecotippingpoints.org/our-stories/indepth/india-rajasthan-rainwater-harvest-restoration-groundwater-johad.html



Sources: http://mwrd.bih.nic.in/Proposed%20Schemes.htm
http://www.cpreecenvis.nic.in/Database/AharPyne-TraditionalfloodwaterharvestingsysteminSouthBihar_3810.aspx

Case 2 : Ahar Pyne : Bihar

Ahar Pyne

It is an indigenous irrigation practice in South Bihar. Ahar is a rectangular embankment type water harvesting structure - embanked on three sides & fourth side being the natural gradient of land- also used to grow Rabi Crops. Pyne are the irrigation channels. In south Bihar, the terrain has a natural slope. And the soil morphology is like of a sandy soil thus water does not retain for a longer time. The Groundwater levels are comparatively low. Rivers in this region swell only during the monsoon to a huge extent, but the water is swiftly carried away or percolates down into the sand. Thus for this region floodwater harvesting the best option here, to which this system is admirably suited. The Water supply comes from natural drainage after rainfall or through Pynes. The water for irrigation is drawn out by opening outlets made at different heights in the embankment. The Water is mostly used for cultivation of paddy.

Initiatives

As due to modernization and lack of convergence between old systems, new system and development of new irrigation techniques and abolishment of the Zamindari there has been a decrease in the adoption and usage of this system. Though some villages in Bihar have taken up the initiative to re-build and re-use this system for storage and agriculture. One such village is Dihra in southwest of Patna city. In 1995, the villagers realized the waters of the Pachuhuan could be impounded (a seasonal stream passing through the village that falls into the nearby river Punpun) and use its bed as a reservoir to meet the village's irrigation needs. Initiative were taken up and funds were collected and work began that resulted in a successful system.

Takeaways

- It is a cheap source of water for irrigation.
- Requires a Collective action and community participation and distribution of responsibility, earlier was looked after by three functionaries- the headman, the supervisor (Barahill) and the watchman (Gudait).
- Repair and maintenance needs to be a continuous process.
- In the earlier institutional system the major responsibility and central control were with the landlords and the amount spent on it was realized under Gilandazi (improvement of irrigation works)
- Minor responsibilities were distributed amongst cultivators like de-silting and cleaning.

Source: http://nopr.niscair.res.in/bitstream/123456789/13855/1/IJTK%2011%282%29%20266-272.pdf

Source: http://www.cpreecenvis.nic.in/Database/ApataniFarmingSystem_3788.aspx

Case 3 : Apatani - Arunachal Pradesh

Apatani

It is a wet rice cultivation cum fish farming system practiced by Apatani Tribes of Ziro in lower Subansiri district of Arunachal Pradesh. This area receives and average annual rainfall of 1700mm. This system harvests both rainwater and surface water which is simultaneously used for irrigation and pisciculture. In this method water from small streams and springs is tapped by creating temporary mud walls that acts as barriers and provide storage. They also acts as flow regulators ad helps in diverting the flow towards the required area in the terraces and vicinity of agriculture the land in valley. As the system uses the rainwater and surface water flowing along the slope. The water tapped at the hill top is mixed with the organic waste and passed across the village through small channels. Terraced plots at distance of 0.6m is created along with earthen dam and bamboo frames which helps in regulating and diverting the flow. The local drainage system is merged with the irrigation system which, in turn, improves the nutrient content of water required for rice cultivation. Thus the organic way of agriculture is followed.

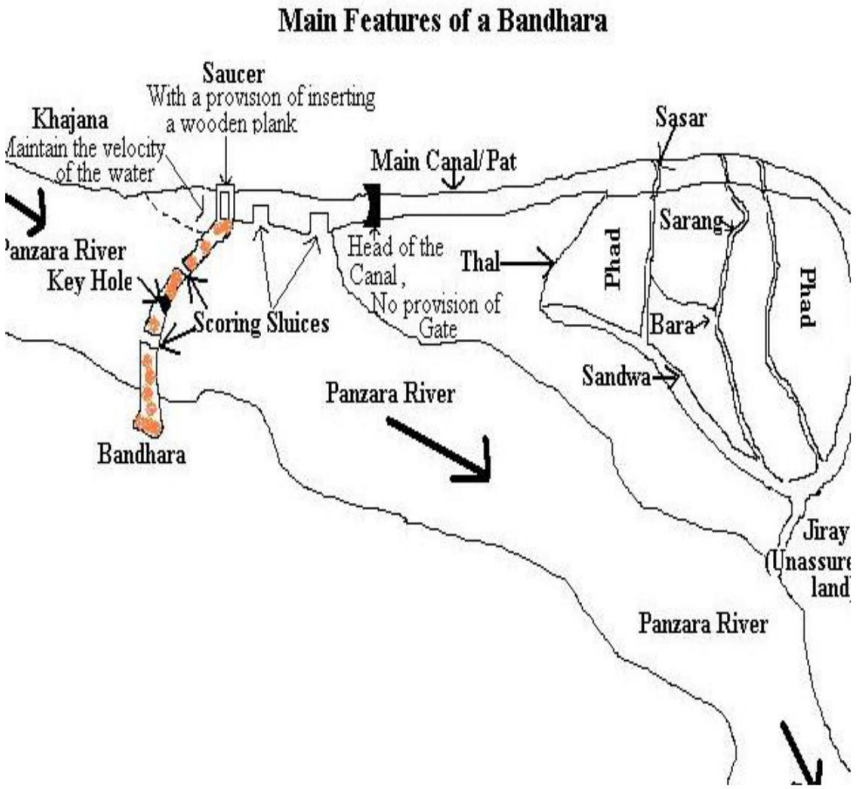
Initiatives

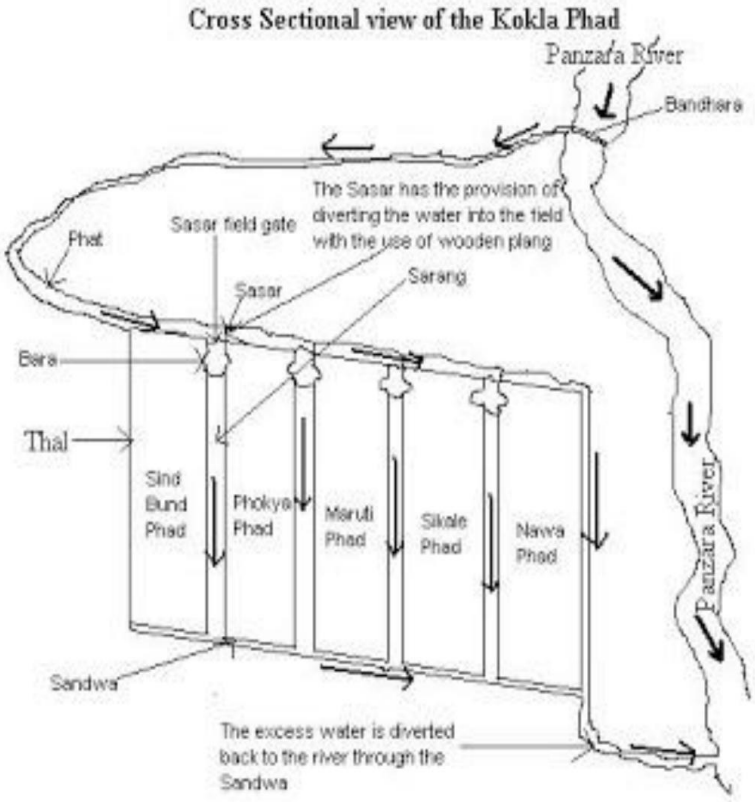
Apatani tribe is unique for its history and its traditions. They follow a unique agricultural practices where the intention is the maximum utilization of resources. They utilize land available for agriculture very judiciously for cultivation, even the agricultural plot bunds are used for millet cultivation, the water utilization is highly organic and optimal to the best level. The Apatani are known for the meticulous care they take of their agricultural fields. The tribe is rich and high in cultural values with highly enrooted practices through which they take care of the agricultural land. After transplantation of paddy seedlings three cycles of weeding is repeated to ensure a weed-free field and healthy crop. The Apatani have had an intricate irrigation system along with fish rearing the waste produced also acts as manure to the field. Though this combined practice is relatively modern and was introduced in the 80s with great success. This practice is unique to Arunachal Pradesh the practice is highly sustainable and marks as a great practice that could be adopted in several regions of the country.

Takeaways

- The land gives sustained yield year after year.
- The economic and energy efficiency of this agro-ecosystem is exceptionally high and rice is exported after meeting local needs.

Source: http://www.rainwaterharvesting.org/rural/Traditional3.htm
http://www.niscair.res.in/sciencecommunication/researchjournals/rejour/ijtk/Fulltextsearch/2005/January%202005/IJTK-Vol%204(1)-January%202005-pp%2065-71.htm
http://www.cpreec.org/pubbook-traditional.htm





Source: http://adityabastola.blogspot.com/2007/06/phad-system.html

Case 4: Phad - Maharashtra

Phad

It is one of the best example of community-managed irrigation system. It is prevalent in north-western Maharashtra and the system came into existence about 400 years ago. Majorly this practice is followed on three rivers in the Tapi basin - Panjhra, Mosam and Aram. Phad means a block of land used for irrigation purpose. In village one command area usually has 3-5 Phads. Each Phad has a name been given by the village community. Group of Phad are known as Thal. The Phad receives water from the Bandhara (A check dam) and is diverted through the canal or Pat. The excess water is diverted back to the main river through Sandwa (the waste weir). Between each Phad, there are small opening called Bara. Gravity acts as the main force for distribution of water from one Phad to another.

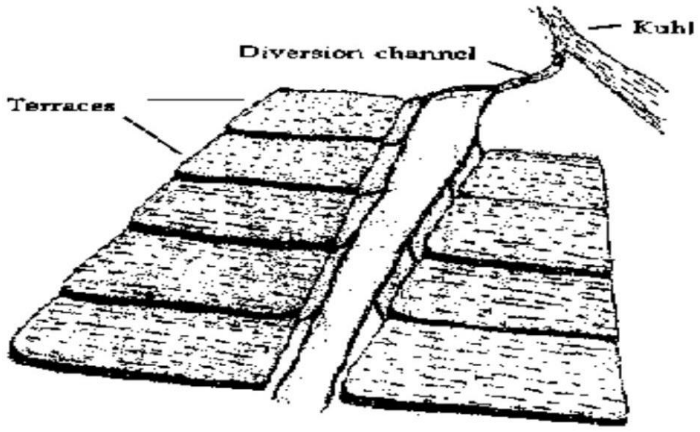
Initiatives

Every village has an effective system of management. A village level committee is formed by the irrigators. The members of the committee are elected mostly by consensus in the general body meeting. The elections are generally held once in every two to four years. The general body also chose the chair person. The chair person may continue for several years. The number of committee members not fixed. It varies from place to place and village to village. The phad system of irrigation is entirely managed by the community. It has its own controlling organization. Generally, the command lies in one village boundary only. All the important functions like choice of crops to be grown, water distributions (watering), maintenance of water distribution system etc.; are managed by the committee.

Takeaways

- Small quantities of water flowing in the streams which would have otherwise gone as waste, is utilized for irrigation to the maximum possible extent.
- As the canal system in this case extends over a short length, the seepage and evaporation losses are less.
- The area irrigated being small and close to the source, irrigation can be carried out with ease.
- The initial and maintenance costs of system are low.

Sources:
https://www.ijirset.com/upload/2017/april/284_A_Review.pdf
http://www.icid.org/wif2_full_papers/wif2_w.2.4.06.pdf
http://www.rainwaterharvesting.org/rural/traditional2.htm



Sources: http://www.indiawaterportal.org/articles/kuhl-kohli-and-lost-tradition
http://www.fao.org/docrep/x5672e/x5672e03.htm

Case 5: Kuls/Kuhls in Himalayan Region (Himachal Pradesh)

Kuls / Kuhls

Kuls are community managed traditional irrigation system of Himachal Pradesh. These are surface channels that divert water from natural flowing streams (khuds). A typical community kuhl has a capacity to serve approximately 6 to 30 farmers and irrigate an area of 20Ha. The structure consist of a temporary headwall (constructed usually with river boulders) across a khud for storage and diversion of the flow through a canal to the fields. The Kul consist of moghas i.e. the kuccha outlets) to draw out water and irrigate nearby terraced fields. The water would flow from one field to another and surplus water, if any, would drain back to the khud forming a closed loop structure. The institutional system consist of different positions and persons for efficient management of the system at the beginning of the irrigation season, the Kohli (the water tender) organizes the irrigators to construct the headwall, repair the kuhl and make the system operational. The Kohli played the role of a local engineer. Any person refusing to participate in construction and repair activities without valid reason, would be denied water for that season. Since denial of water was a religious punishment, it ensured community participation and solidarity. A person was also free to participate by providing a substitute for his labor.

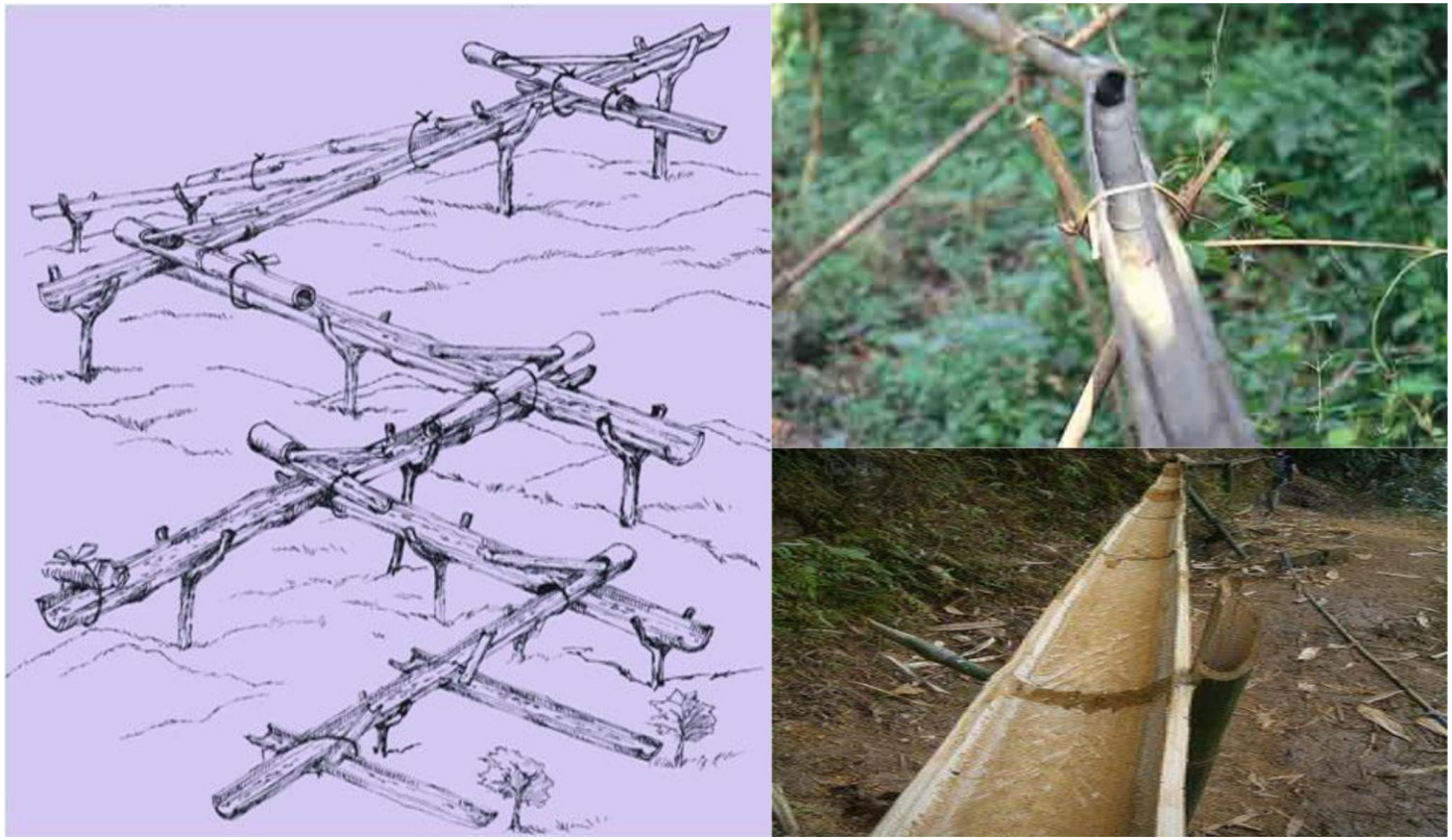
Initiatives

Government of India has taken several initiative and conducted several programs to restore and protect Kuhls. Community water storage tanks were repaired and several farmers were benefitted from this. 12 Kuhls have been completed and 325 Ha of Cultural Command Area has been created for irrigation. Apart from this 903 farmers were provided HDPE pipes for irrigation, covering an area of 122 Ha along with encouragement to adopt the Drip and Sprinkler system for irrigation. For an effective institutional system 69 WUAs and 18 watershed committees have been formed and training program for the farmers on irrigation and information on latest technology that could be adopted were carried out. Convergence of the program with schemes such as Rashtriya Krishi Vikash Yojana, MGNREGS, Food Security Mission, and National Mission for Sustainable Agriculture helped in aching remarkable success in this area.

Takeaways

- Integration of the traditional methods and modern day technologies helps in aligning the technology to local requirements.
- Government Schemes and training program bridge the gap of knowledge and funds for the farmers thus helping in achieve success.
- Community participation acts as the backbone of any program.

Sources: http://www.indiawaterportal.org/articles/kuhl-kohli-and-lost-tradition
http://www.fao.org/docrep/x5672e/x5672e03.htm
http://www.rainwaterharvesting.org/rural/Traditional3.htm



Source: http://www.rainwaterharvesting.org/methods/traditional/bamboo.htm

Case 6 : Bamboo Drip Irrigation - Meghalaya

Bamboo Drip Irrigation

An ingenious practice of North East India where water from stream and spring is tapped by using bamboo pipes to irrigate plantations. The capacity is around to carry 20-25 litres of water that enters the bamboo pipe system and gets transported over several hundred of meters across the irrigation land. This traditional practice is around 200 years old which harnesses force of gravity for transportation of water. The zig-zag structure of holed bamboo shoots is arranged downhill, that diverts the natural flow of streams and springs across terraced croplands.

Initiatives

Bamboo drip irrigation system is normally used to irrigate the betel leaf or black pepper crops planted in areca nut orchards or in mixed orchards. The channel sections, made of bamboo, divert and convey water to the plot site where it is distributed without leakage into branches, again made and laid out with different forms of bamboo pipes. Manipulating the intake pipe positions also controls the flow of water into the lateral pipes. Reduced channel sections and diversion units are used at the last stage of water application. The last channel section enables the water to be dropped near the roots of the plant. It is practiced in the areas of Jaintia, Khasi, and Garo hills of Meghalaya are largely made up of steep slopes and generally rocky terrain where the soil has low water retention capacity. As the terrain is rocky the se of groundwater channels is impossible thus this system helps easy transportation of water from the source to the fields. Though the farmers who practice this system are very well aware of the high density pipes availability but they trust this system more. Government efforts are to incorporate and promote advancements in this area using the same working principle.

Takeaways

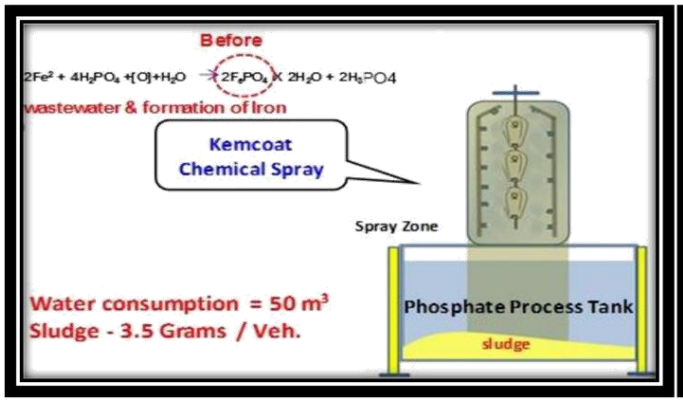
- Bamboo Drip Irrigation practice helps in preventing leakage and also increase crop yield with less water consumption.
- Use of natural, local, and inexpensive material helps in giving a boom to local produce and also form a market for local goods.
- Highly sustainable and natural way of creating a water distribution channel.
- Engineered structure with the traditional roots which is highly user friendly and customizable.
- Maintenance of the pipes and supports is done by the farmers themselves.

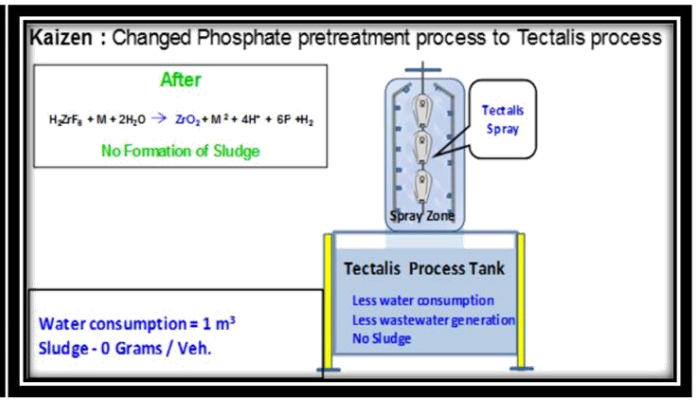
Sources:
http://www.rainwaterharvesting.org/methods/traditional/bamboo.htm
http://cpreecenvis.nic.in/Database/BamboodripIrrigation_3767.aspx
https://www.cseindia.org/bamboo-drip-irrigation-2839

SECTION 5:

BEST PRACTICES

IN INDUSTRIAL WATER MANAGEMENT





Case 1: Use of TecTalis Process to Reduce Water Consumption

Place of implementation: **Paint Shop**

Implementing agency: **Bajaj Auto Ltd., Aurangabad**

Intervention

Phosphating process is used for coating on vehicle body for corrosion resistance, lubricity, or as foundation for further painting applications. Process involves pre degreasing, water rinse, surface activation and post phosphating involving water rinse and passivation, It operates at bath temperature of 50 deg.centigrate. The process of phosphating generates hazardous sludge and also has high water consumption used in rinsing.

Bajaj Auto continually expands its contribution towards Environmental conservation and emerged with the idea of implementing TecTalis process instead of Phosphate in the benefit of natural resource consumption and waste generation. The new TecTalis process is a nanotechnology involving zirconium oxide coating (zirconisation) instead of conventional phosphate and is called as green process. The process is free of heavy metals such as nickel, zinc and manganese. Tectalis process does not involve presurface activation and post passivation and operates at ambient temperature.

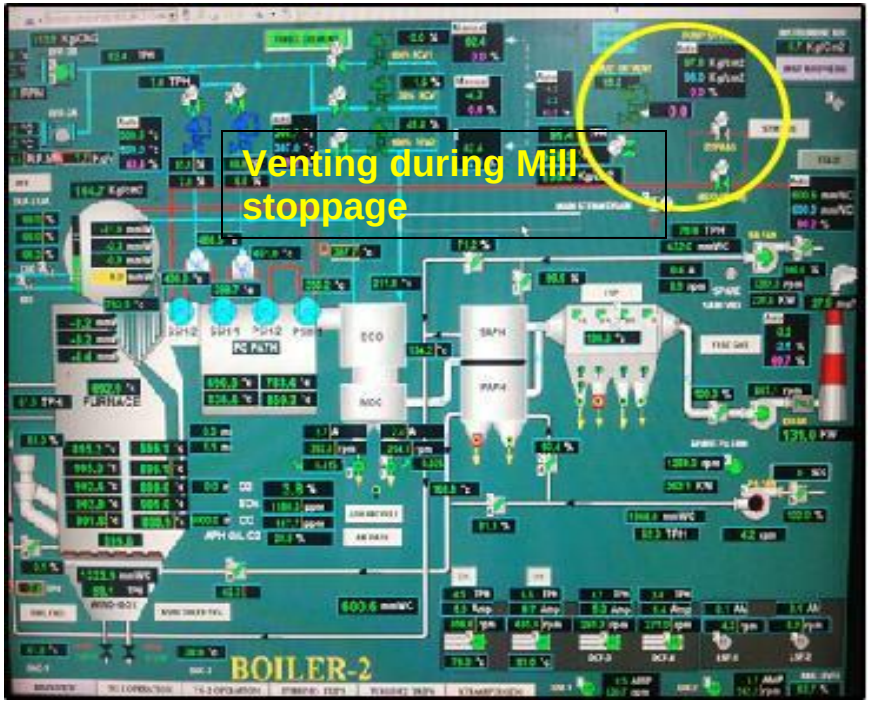
Achievements

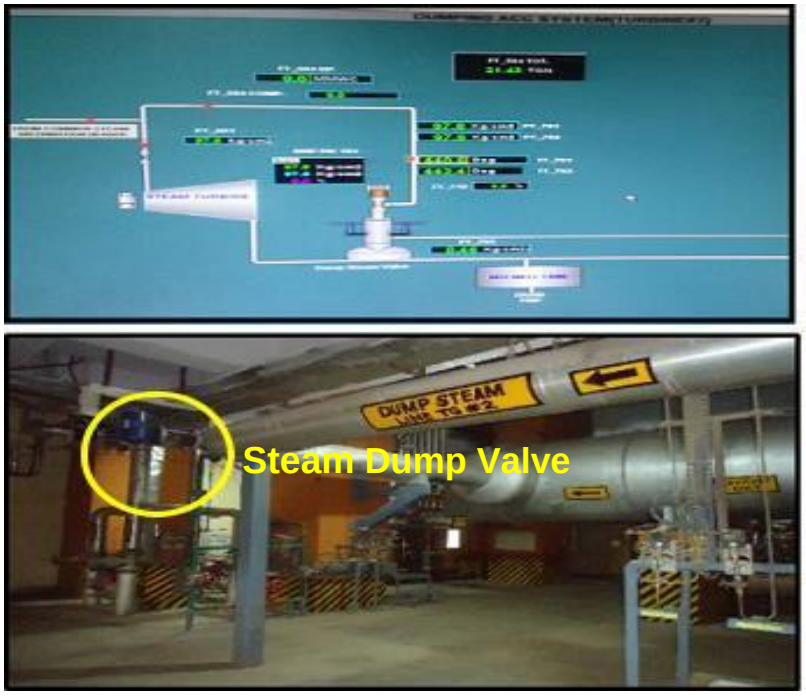
The changeover from phosphating to TecTalis process has helped in reducing water consumption from 50 m3/day to 1m3/day, with annual water saving of 14700 m3. Phosphate sludge generation has been eliminated from annual generation of 5 MT. Electricity consumption is reduced from 61KW/hr to 30 KW/hr as process has reduced steps and also operates in ambient temperature. LPG consumption has been reduced to 250 kg/day from 330 kg/day thus giving annual saving of 29000 kg. The implementation of TecTalis process helped to minimize heavy metal load, wastewater treatment, phosphate sludge and hence is greener process. Apart, the process chemical reaction is faster and takes 60 sec as compare to 3 minutes earlier improving tact time of operation and significant lesser maintenance.

Takeaway

- Innovative alternative process which is environmental friendly is the need of the hour and need to be continually captured and positively implemented in Industries.

Source: https://www.globalbajaj.com/media/23115/business-responsibility-report-2015-16.pdf





Case 2 - Steam Dumping System & Recirculation of Condensate Water

Place of implementation: **Kotputli, Rajasthan**

Implementing agency: **UltraTech Cement Ltd.**

Intervention

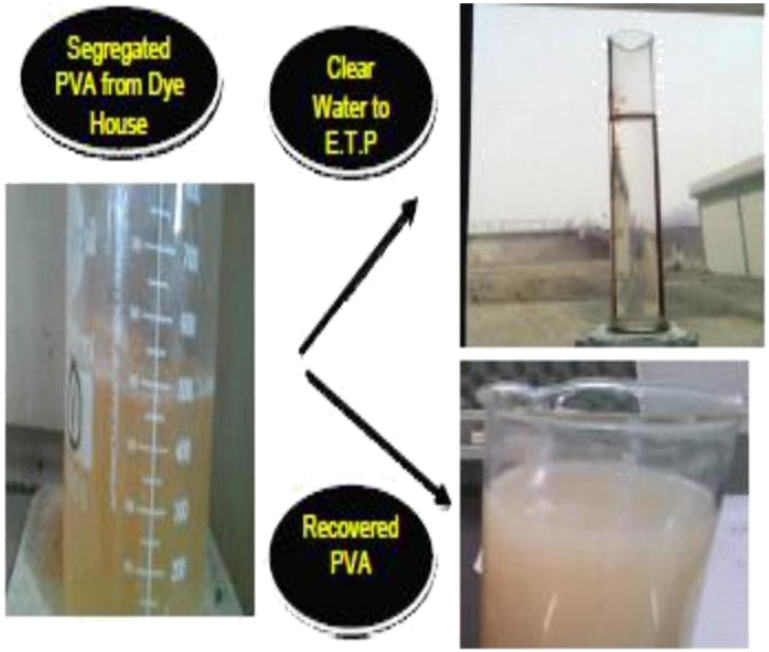
UltraTech Cement Ltd.Kotputli Cement Works- Power Plant implemented this intervention due to the cement plant load fluctuations which resulting in a lot of steam venting from the boiler to maintain the load on TPP. Hence there was a huge steam wastage which resulted in wastage of water, chemicals and heat. The intervention involved the Dump system refurbishment being done and a logic incorporated in the system. During load fluctuations, complete steam was taken into the dump valve and the same will be condensate through ACC and recycled into the boiler. Hence there was a recovery of the complete steam venting.

Achievements

- Reduction of DM water consumption: 48 KL / day
- Reduction in power saving by avoiding multiple pumping by Rs.2.45 Lac/year

Takeaways

- Complete recovery of steam venting.
- Conservation of natural resources.
- Reduction in energy consumption due to recycle of water



Case 3 - Recovery of Poly Vinyl Alcohol & Hot Water from Segregation of Bath

Place of implementation: Dhaula, Punjab

Implementing agency: Trident Home Textile

Intervention

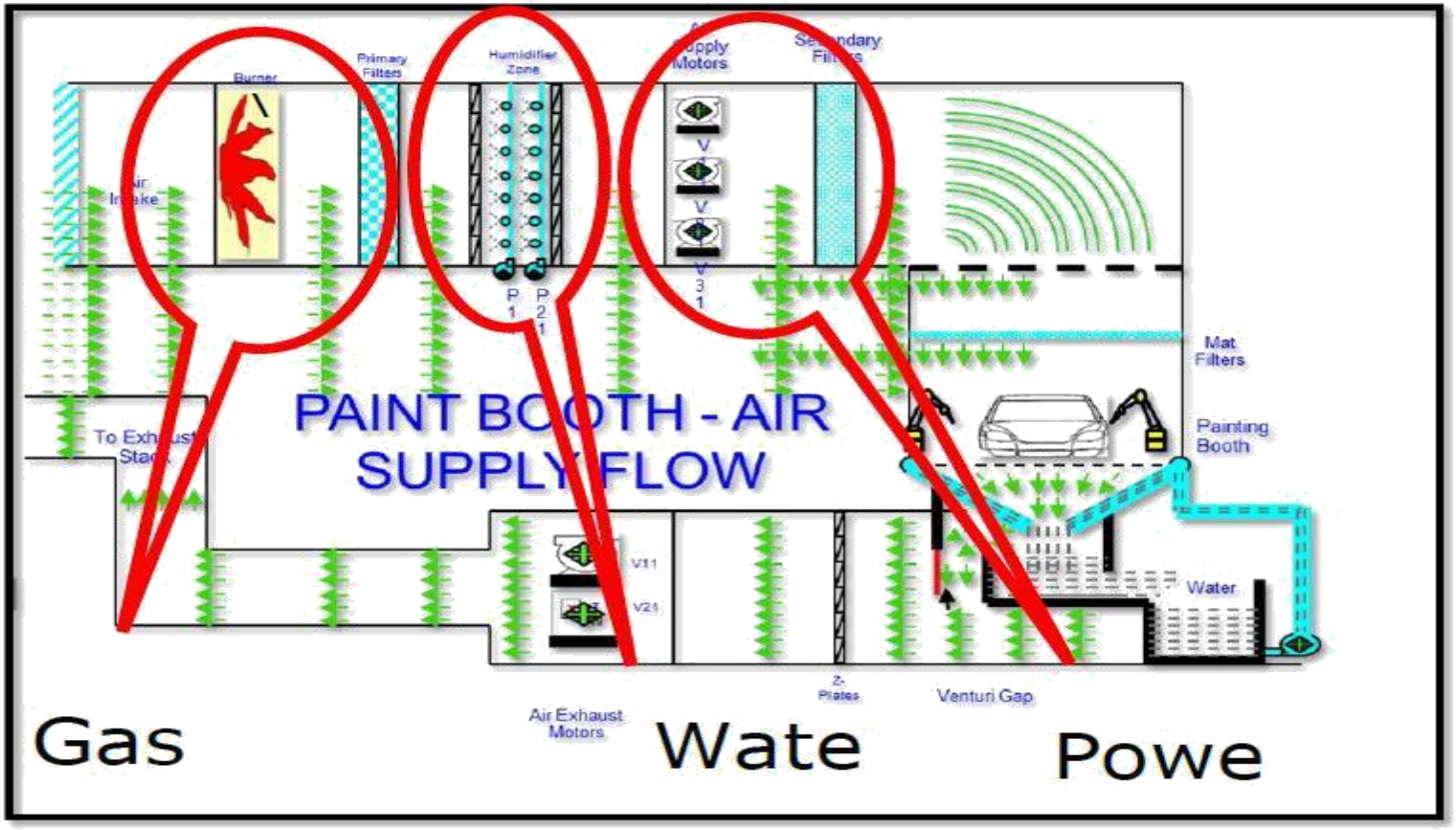
Trident Home Textile unit located in Dhaula of Punjab implemented an intervention to reduce the organic load at the ETP. The intervention involved the recovery of hot water and polyvinyl alcohol from the first two baths of dyeing process. The intervention when implemented in the Dhaula plant was observed to reduce the load on ETP by 50%. Project Appreciated by all International Suppliers. The project was also shared at International forum at Sweden. It is the first of its kind installation. The IKEA team congratulated Trident on successful completion of the project. The JC Penny team appreciated the venture and requested to show case such initiatives to Asian Textile Industry.

Achievements

- Recovery of hot water 150 m3/day (70^0 C)
- Recovery of Poly Vinyl Alcohol (adhesive agent).
- Reduction in hydraulic load to E.T.P
- Reduction in Organic Load to E.T.P

Takeaway

- Recovery of materials like Poly vinyl alcohol and hot water.
- Reduced pollution load on the ETP.



Case 4 - Use of Ambient Air during for Winter Season for Water Usa

Place of implementation: Nashik, Maharashtra
Implementing agency: Mahindra & Mahindra

Intervention

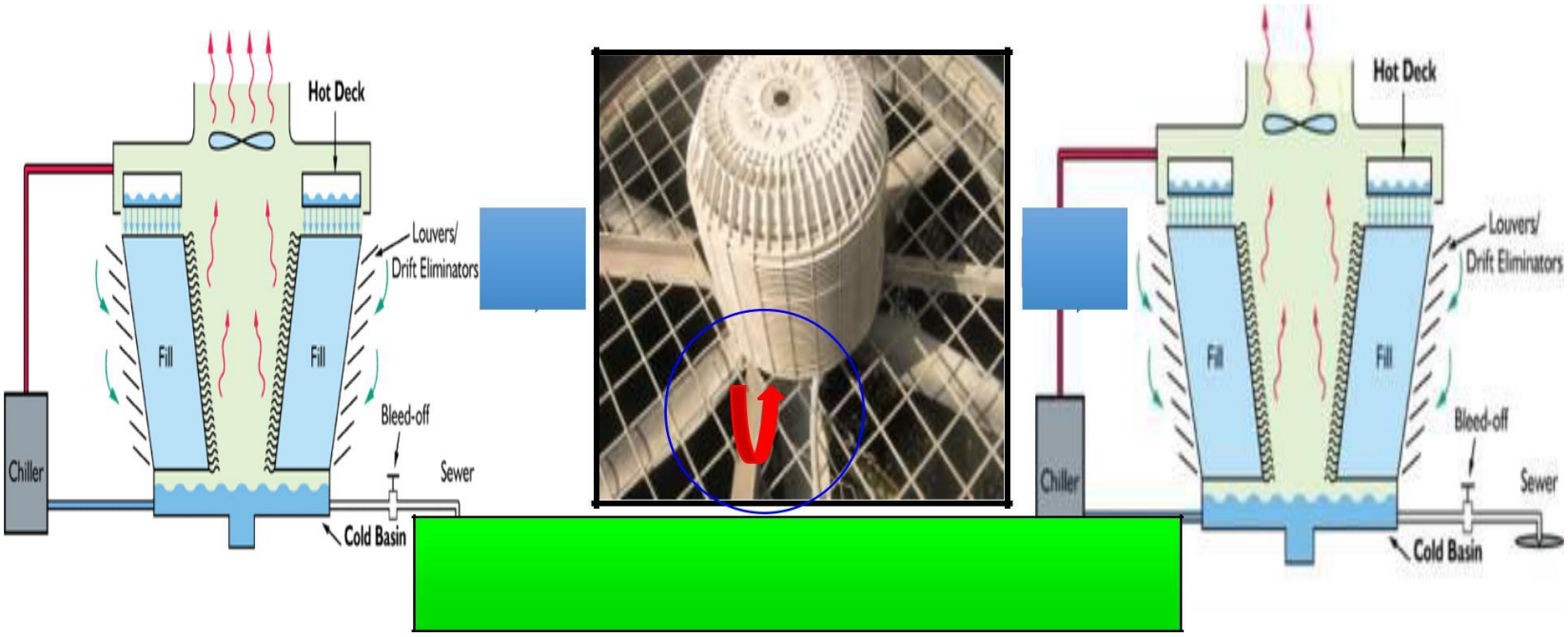
The project is focussed on the optimization of resources, especially the water resources. In any automobile plant, painting is the most water intensive unit contributing to 55% of plant's water consumption, followed by the cooling process. To supply the conditioned air in the painting operation –Air suppliers are provided, which work through a process of heat developed by gas operated burners and cooling by using water humidifiers. Thus, three important required resources are-Gas, Water and Power. After studying the consumption pattern /process requirements/human comfort requirements, the team thought that there is a potential to conserve all 3 resources during winter season when ambient temperature itself is on lower side. Therefore the innovative idea of using low temperature ambient air directly (without conditioning) for non spray booth areas during winter season was implemented.

Achievements

- The intervention helped in reducing water consumption drastically by reducing Average water consumption to 643 KL (from 846KL).The positive impact was even on the Gas and Power Consumption.

Takeaway

- Team work and involvement of end user /associates will lead to ownership and help in long-term sustainability of the interventions.
- Optimization and conservation of water should be a continual process and entire plan should be trained to manage the same.



Saving of 750 KL of water per year

Case 5 - Optimization of Blade Angle to Reduce Evaporation Losses

Place of implementation: **Satara, Maharashtra** **Implementing agency**: **Godrej & Boyce Mfg. Co.Limited**

Intervention

Godrej & Boyce Mfg. Co. Ltd. – Appliance Division Shirwal unit in Satara district of Maharashtra implemented the intervention with respect to optimizing the blade angles of the cooling tower fans to reduce water losses incurred due to evaporation. One of the cooling towers in the unit was selected for experimentation, where the cooling water temperature was pre-defined. The pitch angle of the cooling tower fan was reduced by half degree each time and the performance was monitored on the basis of the weekly water temperature recordings. This exercise was continued until an increase in the water temperature requirement was observed. Thus the cooling tower fan blade angles were modified to reduce evaporation losses. The intervention was further extended to the other cooling towers. The Heat load was found to vary with weather conditions i.e heat load in winter was found to be less as compare to summer season. Hence different angle settings for winter and summer seasons are being adopted.

Achievements

- The intervention helped in potential water savings up to 750 KL in the Godrej & Boyce Mfg. Co. Ltd. – Appliance Division Shirwal unit in Satara district of Maharashtra on an annual basis without any additional investment. This further motivated the unit to suggest the implementation of the intervention across its units in India.

Takeaway

- The intervention leads to 750 KL/year of water savings without any additional investments. It is replicable.

SECTION 6:

BEST PRACTICES

IN WATERSHED MANAGEMENT




Source: http://www.thebetterindia.com/14672/man-creates-artificial-glaciers-chewang-norphel-ladakh

Case 1: Artificial Glaciers in Ladakh

Place of implementation: **Ladakh** **Implementing agency**: **Chewang Norphel**

Intervention

Ladakh's picturesque beauty and landscape is enough to take anyone's breath away. But this cold, mountainous region is plagued with infertile land and water scarcity. The annual average rainfall is 50 mm and people are dependent on glacier meltwater to fulfil their water requirements. However, meltwater alone cannot meet both irrigation and domestic requirements. To overcome this problem, Mr. Norphel came up with the concept of artificial glaciers and made canals to divert water from the main glacial stream to a small shaded catchment area away from the village to keep water frozen. Ice retaining walls were constructed on the sides in series to store frozen water. This creates a secondary source of substantial volume of water which melts in the spring-summer months and is carried to village via pipelines and irrigation channels and is used for both domestic and irrigation purposes. So far, 10 such glaciers have been built in the region.

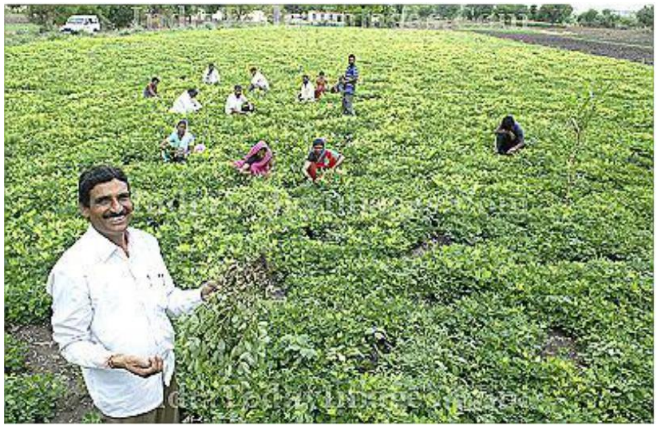
Achievements

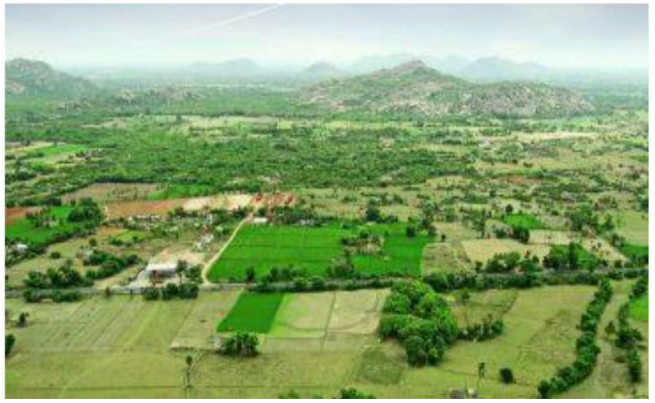
- Significant increase in agricultural production, thereby increasing income of the locals. This technique brought water close to the village and made it available when it was needed the most. Reduction in travel time to fetch water, lessened dependency on already scarce natural sources. Adaptation to climate change and enhanced sustainability. Reduction in migration to cities. Overall improvement in water availability to the watershed.

Takeaway

- Use of a remarkable engineering technology provides water security to communities otherwise dependent on a limited natural resource
- Artificial glaciers ensure year round water availability and have tremendous positive implications on communities, agricultural productivity, access to clean water and adaptation in the light of climate change.
- Serves as a model which can be replicated in high altitude regions where perennial water sources are very far off.

Source:
http://www.thebetterindia.com/14672/man-creates-artificial-glaciers-chewang-norphel-ladakh



Source: http://www.nosplan.org/convention-2016/entries/BP/BP1.pdf

Case 2: Hiware Bazar, Maharashtra

Place of implementation: **Maharashtra** **Implementing agency**: **Yashawant Krishi Gram and Watershed Development Organization**

Intervention

The steps taken during the intervention included measures like complete ban on grazing and cutting down trees in Hiware Bazar. Workshops were conducted to uplift the socio economic status of the people. People were encouraged to quit liquor and even a ban was imposed on it. Programs were conducted to tell people about the importance of family planning. Under the watershed development program, cause specific steps were taken like implementation of artificial recharge structure, contouring on hill top, structures to store water and proper distribution channels, and shift in the conventional cropping method was also adopted by the farmers. The infrastructural activities carried out were mainly contributed and supervised by the local people in form of shramdan. Capital was generated with the help of several agencies to make it a successful intervention.

Achievements

Massive achievements were seen as a result of this successful intervention. Ban on grazing increased production of grass from 200 tons in 2000 to more than 6000 tons in 2004. There was a significant rise in the groundwater level. Due to increase in surface water availability there was a reduction in pumping lift. Sub-surface storage is free from environmental hazards. As there was a contribution from all the stakeholders and localized resources were used, the construction of recharge structure was low cost, small in dimension with negligible submergence. Proper distribution helped in achieving equitable allocation of water resources. It also helped in mitigating flash floods, soil erosion, silting of major reservoir and river channels.

Takeaway

- Provide sustainability to existing ground water resources.
- Public participation and encouragement for the use of local resources helps in increasing economic feasibility of any intervention.
- Healthy practices for socio-economic upliftment are necessary for any sustainable intervention.

Source: http://www.nosplan.org/convention-2016/entries/BP/BP1.pdf

Source: http://niti.gov.in/writereaddata/files/bestpractices/Dhara%20Vikas%20Creating%20water%20security%20through%20spring-shed%20development%20in%20Sikkim.pdf

Case 3: Dhara-Vikas: Enhancing rural water security in drought prone areas, Sikkim

Place of implementation: Sikkim

Implementing agency: Department of Rural Development

Intervention

The chief objective of Dhara Vikas Yojna was to ensure water security in the water scarce areas, to enhance the hydrological contribution of the mountainous ecosystem as water tower for the people, and to ensure disaster risk management by reducing landslides and floods. Some of the measures taken were adoption of a landscape-level approach for reviving springs, streams and lakes. Community participation and community-driven initiatives were taken for successfully implementing pilot projects for spring-shed development. Collaboration was done with ongoing programs like MGNREGA for continuous sustainable funding and support. Programs were organized to develop specialized knowledge and skills in areas of rainwater harvesting, geohydrology, and spring discharge measurement. Use of GPS and laying of contour trenches were also carried out for marking of the prime areas.

Achievements

Dhara Vikas has created significant impact by recharging lakes and reviving as many as 50 springs in Sikkim. It has also led to reforestation of seven hill- top forests at Simkharka, Sadam, Tendong, Maenam, Gerethang, Chakung and Sudunglakha. It has brought about 900 million liters of annual groundwater recharge and creation of the village spring atlas web portal (www.sikkimsprings.org) which provides information on 700 springs. It has also developed seven master trainers as in-house cadre of para- hydro geologists. . An average of 15% increase in crop yield and 25% increase in the cultivation of irrigated crops such as paddy, tomato and vegetables. Another notable impact is the improvement in sanitation. It got awards and national recognitions like Prime Minister's Award for Excellence in Public Administration (2011–2012) to Rural Management and Development Department (RMDD), Government of Sikkim National Groundwater Augmentation Award (2010–2011) to WWF-India for technical support to MGNREGA-Dhara Vikas of RMDD; given by the Ministry of Water Resources, Government of India, etc.

Takeaway

- This technique strengthened the understanding of recharge areas and pinpoint specific locations for optimal recharge of a spring.
- Dhara Vikas has initiated an environmental isotopic fingerprinting study of springs in Sikkim to increase knowledge of mountain aquifers.
- It is a highly educative intervention that could be replicated in different parts of the country.

Source:Social Sector Service Delivery: Good Practices Resource Book 2015, Niti Ayog, Government of India
http://niti.gov.in/writereaddata/files/bestpractices/Dhara%20Vikas%20Creating%20water%20security%20through%20spring-shed%20development%20in%20Sikkim.pdf




Source: http://www.anandana.org/Project-bhujal.html

Case 4: Project Bhujal: Watershed Rejuvenation

Place of implementation: **Bundelkhand** **Implementing agency**: **Anandana**

Intervention

The Bundelkhand region of central India is the hotspot of water scarcity. Degraded lands, poverty stricken area along with inefficient institutional structures for health and education have just worsen the situation. This has led to a poor socio economic condition of the whole region. The region of intervention, Parasai-Sindh watershed of Jhansi district, comprises of three villages and covers nearly 1,250ha land. From 2012, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) along with local community has successfully implemented watershed interventions in this area. The steps taken up were the construction of 6 check dams and 15 farm ponds, renovation of 60 existing structures, recharging of 100 wells along with contouring in 8 locations.

Achievements

Project Bhujal along with project Jalnidhi and project Unnati has created a remarkable impact in areas of Bundelkhand. Project Bhujal specifically aimed in rejuvenating the watershed and it created a storage capacity of 100 million liters of water. After this intervention the cropping intensity increased up to 30% and there was a significant increase the ground water recorded up to 2 to 5 meters. Around 100 acres of land was made cultivable resulting in extra source of income up to Rs.20,000 per acre for the farmers of the area. The framework included development of essential infrastructure, the labor was mostly generated from within the community thus gave a huge scope of employment. The community was also encouraged for effective utilization of resources. Regular public interaction platform was developed in which there was equal representation of women, men and all the stakeholder groups which provided a platform for discussion and suggestions and gave a fare and transparent evaluation of the intervention.

Takeaway

- Significant improvement in level of water resources can be achieved with collective efforts.
- The solution of problem often emerges from within the system but an effective transparent institution is required.
- It is important to train each individual and ask for their collective efforts thus giving them a sense of belongingness to the intervention.
- NGOs and CSR should work for collective good of the people and set benchmarks for future interventions.

Source: http://www.anandana.org/Project-bhujal.html




Source: http://tarunbharatsangh.in/wp-content/uploads/2013/06/25years.pdf

Case 5: Tarun Bharat Sangh

Place of implementation: **Kishori-Bhikampura** **Implementing agency**: **Tarun Bharat Sangh Alwar Rajasthan**

Intervention

The first intervention by TBS was undertaken in Kishori village and subsequently the success story was repeated in other villages. The main objective of the intervention carried out was building and rejuvenation of Johads, which is a traditional rainwater storage tank in Rajasthan. They focused upon programs for community management and village swaraj. Till today, they have constructed over 10,000 johads in Rajasthan. Through community participation and management recharge structures and rain water storage structures were created. Supervisory groups were formed to look after proper operation and maintenance and desilting. The remarkable transformation wrought by the efforts of TBS is most apparent in Alwar district, particularly in the villages of Bhaonta-Kolyala.

Achievements

TBS has achieved remarkable improvements and progress in the interventions they carried out. Till date they have around constructed and restored 10,000+ water storage structures that serves thousands of people. About 750 villages spread over 6,500 sq kms have benefited from the water harvesting techniques introduced by the Tarun Bharat Sangh and have successfully mitigated their vulnerability to the severities of drought. In corporation to this collective actions were carried out through which measures were taken up for forest conservation thus giving rise to formation of a gram sabha as an institution for sustainability of the project. Farmers have also taken up several measures and changes in their agricultural practices thus making it more sustainable. For community upliftment work, TBS has attained several national recognitions and has set an example at global level.

Takeaway

- This kind of intervention and community participation reflects the strength in collective actions and also a framework to develop around the future interventions and policies.
- Apart from just rejuvenation of watershed land and forest conservation is also equally important.
- Interventions should increase the scope for all round development of the area and scope employment for the marginal people.
- TBS has set a best example of integration of modern and traditional techniques of conservation.

Source: 25 years of evolution, Tarun Bharat Sangh, http://tarunbharatsangh.in/wp-content/uploads/2013/06/25years.pdf