Inspiring Change

Stewards of Sustainable Water Management



FICCI Water Mission

© Federation of Indian Chambers of Commerce and Industry, February 2021

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Inspiring Change

This Book is a compilation of good practices by industry and NGOs based on the final shortlisted nominations as well as the winners of the 5th, 6th and 7th Editions of the FICCI Water Awards (2017-2019).

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Acknowledgements

FICCI acknowledges the eminent members of the Jury for their tremendous contribution to the final shortlisting of the nominations based on intensive deliberations and rigour. FICCI also acknowledges the valuable contributions of the Expert Screening Panel in assessing and evaluating each nomination. We also extend our gratitude to the organizations who have sent us the nominations over the years contributing to the enrichment of the knowledge base on sustainable water management practices in India.

The development of this repository has been possible with the effort of the FICCI Secretariat - Rita Roy Choudhury, Assistant Secretary General, FICCI; Kirtika Arora, Senior Assistant Director, FICCI; Kalyan Verma, Assistant Director, FICCI and Deya Roy (ex-FICCI colleague).

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Stewards of Sustainable Water Management

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PREFACE

PREFACE

Water is the foundation of life and also of sustainable development. Yet current development models are driving the planet towards a water crisis. Water is fundamental for food production, energy, human health, industry, and peace and security. But its competing uses alongside increasing urbanisation, industrialisation and population growth makes water management a complex issue. The world needs nuanced, yet strong, responses that engage citizens, companies and governments to act towards the common goal of water for all.

Effective management of water is the biggest challenge that India faces today. Water conservation along with water harvesting and judicious and multiple use of water are key to tackling the water challenge in India. It is predicted that by 2050, the per capita availability of water at the national level will drop by 40 to 50 percent due to rapid population growth and commercial use. The main sectors that are heavily dependent on water, such as India's agriculture and power generation, will also affect the quality of water available, both for other productive sectors and for public use. The demand, availability, and varying use of water all have an impact on India's water resource management.

To effectively navigate the water crisis, holistic strategies need to be developed that addresses all aspects of water management, both from supply and demand sides. The government is taking various initiatives for water conservation and management, including rejuvenation of water bodies, harvesting rainwater and reuse of wastewater.

Although corporates, technology providers, wastewater companies, end users, NGOs and other stakeholders are aligning with government policies, there is a dire need for all stakeholders to work cooperatively in the direction towards preserving our water resources in a holistic manner and adopting integrated water resource management.

"Inspiring Change: Stewards of Sustainable Water Management" is a knowledge repository of good practices by corporates and NGOs who have undertaken innovative approaches and exemplary initiatives towards sustainable water management. The case studies in this book have been vetted by leading experts who are part of the FICCI Water Awards Jury and comprises the case studies of those who were in the final shortlist as well as the winners of FICCI Water Awards during 2017 to 2019. Although awardees can only be a select few each year, the Awards process brings to the fore the plethora of good initiatives taken up by industry and NGOs in India and enriches the knowledge base in the country, serving as examples of the positive difference being made by enlightened companies and organisations towards sustainable water management in India. While we recognize the winners through the Awards and showcase them in the Awardees Compendium released each year at FICCI's annual India Industry Water Conclave, we feel it is important to also disseminate the good work of the organisations who the jury found worthy of the final round, through this book.

MESSAGES

गजेन्द्र सिंह शेखावत
Gajendra Singh Shekhawat



सत्यमेव जयते

स्वच्छ भारत
एक कदम स्वच्छता की ओर

जल शक्ति मंत्री
भारत सरकार
Minister for Jal Shakti
Government of India

15 FEB 2021

Message

Inspiring Change: Stewards of Sustainable Water Management

Water and its management are the biggest challenges that India faces today. Nearly 600 million which is half of India's population faces high-to-extreme water stress. About 70 per cent of our water is contaminated. By 2030, India's demand for water is estimated to be double the available water supply.To fight India's water woes, the government launched the Ministry of Jal Shakti by merging the Ministry of Water Resources, River Development and Ganga Rejuvenation and Ministry of Drinking Water and Sanitation. The integration of the ministry has led to more holistic approach, focusing on both demand and supply side management of water.

To effectively navigate water crisis, holistic strategies need to be developed that addresses all aspects of water management. The government is taking various initiatives for water conservation and management focusing on rejuvenation of water bodies, regulating industrial consumption, harvesting rainwater and reuse of wastewater.

Although corporates, technology providers, waste-water companies, end-users, NGOs and other stakeholders are aligning with government policies, there is a dire need for all stakeholders to work cooperatively in the direction towards preserving the water resources in a holistic manner.

I congratulate FICCI for taking up this initiative and bringing up this knowledge base of sustainable water management practices by industry and NGOs. This should serve as an inspiration for all stakeholders and lead to wider adoption of such good practices by them to help our country address both supply and demand side management of water.

(Gajendra Singh Shekhawat)

जल शक्ति अभियान
संचय जल, बेहतर कल



This Compendium of Best Practices ably fulfils the Ficci Water Mission's objective of enabling replication of successful practices while celebrating the success stories in the important area of water management and water efficiency.

Naina Lal Kidwai
Chair, FICCI Water Mission, Past President, FICCI

This compendium of case studies on water is truly inspiring. Spanning case studies from industrial to agricultural, with contributions from corporates, municipalities and NGOs, there is a best practice here for each of us. Hats off to the contributors, who are truly the champions of water in India. I am sure their work and this compendium will have a ripple effect throughout the country

Mukund Vasudevan
Co-Chair, FICCI Water Mission





That India needs a paradigm shift in water has been well-recognised for some time now. But what the country requires are real-life instances that exemplify this paradigm shift, both to show that it is possible and to indicate the direction in which it must occur. This is what the FICCI Water Awards are striving to do.

Mihir Shah
Chair of Jury, FICCI Water Awards

This knowledge repository 'Inspiring Change: Stewards of Sustainable Water Management' resonates with our theme for 2020-21 on Inspired India and will serve as an inspiration to catalyze action by different stakeholders in the water sector towards adoption of sustainable water management practices.

Dilip Chenoy
Secretary General, FICCI





Case Studies

Adani Foundation

Case Study	:	Water Initiatives by NGO
Area of Work	:	Grassroot Intervention in Rural India
Project Name	:	Participatory Groundwater Management
Project Region	:	Mundra Taluka, Kutch, Gujarat
Key Impact	:	Watershed Management

About Adani Foundation

The Adani Foundation was established in 1996 as a tribute to the ideals of late Smt. Shantaba and late Shri Shantilal Adani. Their work began in a few rural communities around Mundra Port, Gujarat, and has now expanded to 18 states in India, going far beyond the regions where Adani Group companies are functioning. They work on grass root intervention in all areas and activities involving the global Sustainable Development Goals.

Case Study

In Region Kutchh, in many cases, groundwater or surface water may be unavailable for drinking water. The objective of the project is to reduce the salinity ingress in and around the coastal regions of Mundra, Kutchh and mitigate the ill-effects of this manmade problem to improve the livelihoods of the rural people. The Project will help to get water table high, also it will help in agricultural activities.

Initiative

The project aim was participatory groundwater management of Kankavati sandstone aquifer to create water secure future. Construction of a large number of water harvesting structures was taken up. 18 check dams were created in coordination with the salinity department to conserve water. Ground recharge activities like pond deepening work for more than 15 ponds and building of 26 new ponds under Sujlam Suflam Jal Abhiyan were taken up, leading to a significant increase in water table and higher returns to the farmers. Regular training workshops were conducted for participatory groundwater management and user groups were created.

Impact

The expected short-term impact of the project is groundwater recharge augmentation, regular groundwater monitoring and budgeting, salinity reduction, and promotion of technological intervention like drip irrigation and horticulture development. The long-term impact would be strengthening of village institutions, creating drinking water source protection guidelines for all surrounding villages, protocol development for monitoring and protection of sources and demonstration in project villages.

- **Conservation Measures**

  The participatory groundwater management (PGWM) is a concept that evolved based on decades of experiences and management initiatives by various stakeholders including government. The project has various aspects:

- **Groundwater Recharge and Management**

  Groundwater recharge structures were upgraded to provide recharge support to drinking water sources. Artificial recharge bore wells were constructed and disused bore wells were converted into recharge bore wells. The check dams created benefited 637 hectares. Ponds were deepened and total storage capacity increased to about 84.52 million litres. The activities led to an increase of 61,900 cu m water storage. Local resource centers of Bhujal Jankar (keepers of knowledge about groundwater) were set up. 520 observation wells across the aquifer in four blocks were established. Bi-weekly and monthly monitoring network of 108 wells have been established in all clusters. Technological interventions like drip irrigation and horticulture development have also been promoted.

- **Water Management Knowledge System**

  Village-wise PGWM committees have been formed in 10 villages to raise awareness among various stakeholders about participatory groundwater management in water scarce and coastal region. Cluster level water resource management groups were set up for engaging the local community and strengthening community-based surface and groundwater management. Eight youths have been trained as 'Bhujal Jankars' (BJs). These BJs are involved in data collection, site monitoring and demand management side activities. About 140 farmers have been identified to work on practice level guideline development and drinking water source protection guidelines are under preparation for 10 villages. Baseline data was created from observing 140 farmers. Awareness campaigns were carried out for farmers on adaptation of indigenous and low water consumptive crop variety.

Capacity Building & Scalability

The objectives were to generate water management knowledge system with community and transfer it to the next generation through capacity building of Bhujal Jankars and Khet Jankars (those with knowledge about farms). It helped set up water enterprises in the project area, develop decision making tools to increase water use efficiency for different usages and establish observation network for hydro-geological cycle of the area. Seven capacity building training modules were designed and executed. Drinking water source protection guidelines were developed for all the villages.

The knowledge gathered during successful implementation of the programme including the aspects of public-private coordination, community involvement and exit strategy (after handing over to local bodies) give the initiative a good potential for scalability.

Aga Khan Rural Support Programme (AKRSP)

Case Study	:	Water Initiatives by NGO
Area of Work	:	Rural Support and Development
Project Name	:	Water Harvesting
Project Region	:	Meghal River Basin Management, Junagadh district, Gujarat
Key Impact	:	Water Conservation and Agricultural Productivity

About AKRSP

Aga Khan Rural Support Programme (India) is a programme of the Aga Khan Development Network (AKDN) which works in over 30 countries around the world. It is a non-denominational, non-government development organization. AKRSP (India) works as a catalyst for the betterment of rural communities by providing direct support to local communities.

Case Study

The Saurashtra region of Gujarat in western India is prone to droughts being a semi - arid region with mainly basaltic rocks. The rocks being unable to retain much storage of water for longer periods have also been unable to sustain water requirements during such drought periods. Erratic rainfall coupled with overexploitation of groundwater led to gradual drying up of River Meghal located in Junagadh District in the coastal Saurashtra region of Gujarat. The rocks being unable to retain much storage of water for longer periods have also been unable to sustain water requirements during such drought periods. This led to scarcity of drinking water and drying up of irrigation wells.

Initiative

AKRSP (India) motivated the villagers to participate in the water conservation programmes of the Government. The objective of the intervention was to create ownership of the village community on the revival of sustained management of Meghal River. 55 villages (19,450 households) were targeted for the initiative over several years.

Impact

The impact varies between seasons and the most significant impact can be seen for the summer season. The summer cultivated area in 2011 has become more than 5 times of what it was in 2000-01. 10% increase in the agriculture outputs through water recharge and use efficiently has been observed. The gross value of output produced in all three seasons has grown from 150 crores in 2000-01 to 400 crores in 2010-11. The cropping intensity in Meghal has grown from 1.50 to 1.96. The (average) value of output per hectare has also more than doubled.

Conservation Measure

AKRSP besides providing the material support to building the boribunds, also helped

the community with arriving at technical specifications of the structures in each location. These structures were built at the end of the monsoon as flow velocity is reduced making it easy to build structures that last the season. This also helped people know exactly how much water is there and how much more they need to help them design the structures, accordingly.

- **Water Harvesting**

  306 Water Harvesting Structures having a storage capacity of 115.61 MCFT were built, including Rain Roof Water Harvesting Structure (RRWHS), small and medium checkdams and reservoirs. Boribunds were also constructed. AKRSP and people build the boribunds once the monsoon is in its receding phase unlike the 'scientific' way where structures are built prior to the monsoon. The former approach helps the community to locate structures where water is already flowing so there is no chance of speculation going wrong.

- **Harness Riverine Resources**

  AKRSP-I and community found 8 locations and created check dams and channels to restore water flow to the river basin. Data observation from the river basin clearly shows a significant increase in the water flow.

- **Awareness Generation & Community Involvement**

  AKRSP-I promoted improved agricultural practices, adoption of drip and sprinkler irrigation. Core group was taken to Alwar in Rajasthan to see the much acclaimed water conservation work done by the Tarun Bharat Sangh.

  Local traders and farmer groups fund for the construction of the boribunds in the area. Promoting participatory and democratic village level institutions in the form of Jal Bachao Juthsand Gram, Jal Bachao Sangathans and Mahila Manch.

Capacity Building & Project Sustainability

The Jal Bachao Juth (Water Conservation Group, JBJ) is a representative body located within a village formed of landed and landless farmers. They are entrusted with micro-planning of this area, program planning and implementation, and awareness building. They also act as a local pressure group for water conservation activities. Women members of the JBJs have gone on to form a district level federation called the Mahila Manch. They help their members take up business activities, get their rights and entitlements and address drinking water problem in the villages through the roof rainwater harvesting scheme. They also contribute to the water conservation agenda by sometimes paying for construction of boribunds.

Project Update

Drip irrigation, lift irrigation, and roof rainwater harvesting are still ongoing in districts of Surendranagar and Junagadh. Entrepreneurs in Saurashtra have been roped to encourage farmers to opt for drip irrigation and bio-farming to protect their farms from further damage.

AKRSP-I latest focus is on helping the Swachchta Mission by recycling sewerage water generated by the village homes which can be used for irrigation in farms.

AgriRain Industries India Pvt Ltd

Case Study	:	Innovation in Water Technology
Area of Work	:	Understanding and harnessing water for agriculture
Project Name	:	Efficient Water Management for Sustainable Agriculture
Project Region	:	Andhra Pradesh, Bihar, Karnataka, Maharashtra, Madhya Pradesh, Rajasthan
Key Impact	:	Integrated water management, increase in agricultural productivity

About AgriRain

AgriRain is a precision irrigation systems company which deals with Hosereel irrigators. The organization was founded by Sri Malladi in 2017 to empower the farming community with modern, efficient and equitable irrigation solutions that saves water and increases productivity.

Case Study

The conventional methods of agricultural water applications usually result in excessive loss of water due to non-uniformity, over-irrigation etc. To combat such a situation, present-day application methods need to be replaced by efficient ones. Sprinkler is one of methods of irrigation water applications that can bring in more efficiency.

Initiative

AgriRain started an innovative "Irrigation as a Service (IaaS)" model using Hosereel irrigation technology that provides hassle free, pay per use, scalable, reliable, and cost effective and on demand irrigation as a complete irrigation package. It has an on-farm design agnostic irrigation model with a fully integrated irrigation system with pump, pipe and delivery syetem.

Impact

Measured and precision irrigation through Hosereel system is done for the region to meet requirements of crop rotations and cropping pattern changes and provide irrigation as a regularized service. This method is also faster than conventional method and is capable of providing critical irrigation for drought mitigation and supplemental irrigation to boost farmer's income. With regular use there is an increase in farm productivity and profitability in project areas in both kharif and rabi crops and especially in the summer season. For example, the yield data of chickpea in Rajasthan indicates that there is a yield advantage to the extent of 87.92% in Sardargarh and 19.15% in case of Suratgarh.

With increasing water use efficiency compared to traditional methods like flood irrigation, more area could be brought under productivity and there were zero crop failures due to climate change.

Conservation Measure

Hosereel, an automated micro-irrigation system, provides irrigation in the form of rain. It is a mobile, self-propelled raingun that is fitted on a cart and is integrated with a diesel pump and HDPE pipe. The inlet hosepipe can pump water from the existing water bodies like farm ponds, water tanks, lakes or pipelines. The product was re-designed for Indian conditions.

Geofencing is done of each farmer served. Crop and soil data, including moisture stored for each farmer served is mapped, as precision irrigation incorporates weather forecast for small farmers. Irrigation scheduling is done using real-time weather data and available soil moisture content on the ground.

- **Irrigation Efficiency**

  Hosereel can irrigate one acre of field at the rate of 20 mm in 4 hours. If the irrigation efficiency of Hosereel is high, and in case of irrigation efficiency, it is as high as 79.4% and the applied water is not wasted in runoff.

- **Application Efficiency**

  If the application efficiency of Hosereel is high, then the applied water is delivered at the right place on the field with an application efficiency of 76%.

- **Water Use Efficiency**

  Hosereel Sprinkler System is a precision irrigation system which uses about 250% less water than conventional flood irrigation. In Hosereel @ 15 mm rain about 4,047sqm (15/1000) is irrigated, i.e. around 80,940 liters/acre compared to conventional flood irrigation, which requires around 2,02,350 liters/acre.

Capacity Building & Project Scalability

The operational model includes rural entrepreneurship through social engineering. Rural youth and women among the community are trained to be water entrepreneurs and are responsible for precision irrigation at critical stages. Moisture sensors are installed in field for measuring soil moisture content. Weather data with historical records on air temperature, humidity, precipitation and calculated evapotranspiration is collected. All this data is tracked on the state-of-the-art android app Jal Suvidha.

Geo-fencing of the land parcel is done separately for each of the farmers. The mobile app populates irrigation schedules for a land cluster of 40-60 acres for each of the water entrepreneurs and mobile notifications are sent to respective water entrepreneurs and individual farmers in the respective irrigation clusters. The sustainable and affordable business model creates employment and reduces overall cost of cultivation by saving on labour and fuel.

Akhil Bhartiya Samaj Sewa Sansthan (ABSSS)

Case Study	:	Water Initiatives by NGO
Area of Work	:	Holistic Development for Tribals, Dalits and Deprived Sections
Project Name	:	Watershed Management
Project Region	:	Mangawan, Itwan, Patin, Manikpur Block Chitrakoot district, Bundelkhand UP
Key Impact	:	Water Conservation and Agricultural Productivity

About ABSSS

Akhil Bharatiya Samaj Sewa Sansthan (ABSSS) was founded by Gaya Prasad Gopal, now popularly known as Gopal Ji, or Gopal Bhai, in 1978. It is a voluntary organisation working in the area of upliftment of tribals, dalits and deprived sections in Bundelkhand. ABSSS is based in Chitrakoot district of Uttar Pradesh and is active all over Bundelkhand, spread in Uttar Pradesh and Madhya Pradesh.

Case Study

The Mangawan, Itwan and Patin site is in the `Patha' plateau. The Patha region frequently receives extremely poor rainfall, below the 400 mm mark, which is generally used to declare an area as drought-prone. Most lands are characterised by poor quality soil with low organic content, zinc and sulphur, average nitrogen and medium to high potash.

Initiative

An `Empowering People through Integrated Watershed Development Programme' was carried by ABSSS, with financial support from SDTT and NABARD, over a period of four years ABSSS intervention was developing micro watersheds with people's participation and sustainable approach, preventing soil erosion and increasing water availability. As per the project, a total of 27,345 ha were covered under land and water development and in-situ rainwater harvesting and 50 ha was covered under land use diversification, including forestation.

Impact

Due to concerted efforts made by the project, many households (HHs) in sites started cultivating alternative crops recommended in consultation with experts, particularly til and barley. In Mangawan, wheat production increased 10 times, the total area under cultivation increased from 472 bighas in 2007-2008 to 1481 bighas in 2011-2012 and the total production in main crops increased from 26765 kg in 2007-2008 to 294283 kg in 2011-2012.

In Patin-Itwan, wheat production increased 3 times, Paddy yield increased over 10 times from 24kg/bigha to 330kg/bigha and 68 Quint/bigha to 246 Quint/bigha. The total area under cultivation increased from 1342 bighas in 2007-2008 to 2100 bighas in 2011-2012 and the total production in main crops increased from 188926 kg in 2007-2008 to 804995 kg in 2011-2012.

Overall, number of HHs cultivating in kharif increased by over 10 times and in rabi the number doubled. Gross area under cultivation increased in sites by 3 times and area under mustard and gram increased by 2 to 2.5 times. At the end of the project, over 95% of the HHs were cultivating even in a below-normal rainfall year.

Conservation Measure

The interventions included land bunding, levelling, gully plugs, farm ponds, check dams, percolation tanks, earthen bunds, gabion structures, well construction, agriculture development techniques, vegetable cultivation, afforestation, awareness generation etc.

Rainwater Harvesting

The first strand of strategy used in this project was to arrest the rainwater as far as possible close to the plants that needed it, while following a watershed plan. Levelling lands, making field bunds and impounding rainwater in each field were the main techniques used. Complementing the in-situ approach outlined, some larger water impounding structures were planned in the lower reaches, to help capture water seeping through the ground.

In Mangawan watershed, Dist. Chitrakoot, 330.511 ha-m (33,05,110 cum) water conservation structures were constructed and repaired. 5 `SAJLA (Samekit Jalagam) samitis' were formed for O&M of watershed structures and met weekly. In Patin and Itwan watersheds, two Watershed Development Committees (WDC) were formed for project implementation.

Harness Riverine Resources

The second strand of the strategy was to harness the riverine resources in the region. Both the strategies were accompanied by crop diversification and productivity enhancement efforts. 2,605 contour trenches and earthen checkdams were built to change surface water dynamics during the lean season of the river by harnessing rain, storm ruoff water.

Land Development

More intensive land development was carried out, with both in-situ or on-farm water harvesting (through Pradan's 5% farm pond model and levelling- bunding) and ex-situ water harvesting (earthen check dams). The main activities were land development through levelling, bunding and tree plantation. Agriculture development was carried out along with capacity building in specific areas. 28,611 trees planted in sites, on structures and lands of 166 farmers. Appropriate local species planted with a survival rate was 62.5%.

Awareness Generation & Capacity Building

On-field training with input support was provided to motivate 45 farmers to adopt System of Rice Intensification (SRI) and 25 farmers to adopt System of Wheat Intensification (SWI). Local farmers participated in training programmes conducted each year on topics - Organic Fertilizers, Improved Agricultural Practices, Agriculture Yield Trends, Kharif Crop Planning.

Amalgam Biotech

Case Study	:	Innovation in Water Technology
Area of Work	:	Manufacturing & Supplying Biotechnology Products for the Environment
Project Name	:	Bioculture and Micronutrients for Wastewater
Project Region	:	M/s TASA Foods, M/s Honda Motor Cycle & Scooter India Pvt Ltd
Key Impact	:	Wastewater Management, Water Recycling

About Amalgam Biotech

Amalgam Group started it's operations in 2009 and commercial production of Bioculture and Micronutrients manufacturing was started in 2014. Amalgam Biotech is professionally engaged in manufacturing and supplying the highest quality biotechnology products for the environment.

Case Study

Organic material is present in sewage and effluent wastewater in colloidal form and also in dissolved form. This dissolved organic matter can be effectively consumed by microorganisms, primarily bacteria. While bacteria are naturally available in sewage, their concentration and efficiency is very low. This is where Bacta Cult Bioculture plays an important role.

Initiative

Amalgam Biotech manufactures and supplies the right combination of microorganisms, containing necessary floc-forming bacterial cultures for Effluent Treatment Plants (ETP), Sewage Treatment Plants (STP) and Waste Water Treatment Plants (WWTP), which are specifically designed for the client, depending on the nature of the effluent.

Impact

An average treatment plant suffers from process problems and plant shut down problems with increasing frequency. Typical industrial frequency is an average of 3 days of ETP shutdown per month due to biological system non-performance. This technology reduces the average commissioning time by 40% and reduces downtime. There is also no need to carry sludge over large distances and this saves time, equipment and transport cost.

For example, in a Mango Pulp Processing Unit of M/s Tasa Foods, on an average water saving per year due to zero downtime at the rate of 400 m^3 x 3 days/Month x 12 months per year is about 14,400 m^3 of water. Saving due to 85% treated effluent recycling is about 400 Cu.m x 150 days per year x 85%, i.e. 51,000 m^3 of water saved per yr. 150 days because, the plant operates for 5 months during fruit processing season.

In M/s Honda Motorcycles, saving due to Zero downtime was (800+200)m^3 x 3 days/month x 12 months/yr = 36,000 m^3 of water saved per year and saving due to 85%

treated effluent and sewage recycling was (800+200)m^3 x 330 days per year x 85% = 2,80,500 m^3 of water saved per year, considering 330 working days for the plant and not 365 days.

Conservation Measure

Bacta Cult™ Bioculture and Pro Bac AE 100 Micronutrients are used in STP, ETP and WWTP to remove the organic pollution caused by industrial wastewaters.

Target industries are identified. Then pure bacterial strains are collected and isolated from mixed cultures of an operating industrial plant. Trials are conducted in which four tankers of 10,000 litres per tanker, totalling 40 thousand litres of raw effluent, is tested. Multiplication and culturing of isolated strains are done in order to conduct pilot plant trials at the client factory to create adaptability and acclimatization. Following this, re-collection, re-isolation, re-culturing, spray drying, blending and formulating the composition mix is carried out to provide the final commercial product to the client. The entire process takes approximately 6 months for each industry type.

- **Bacta Cult Bioculture**

  A Bioculture is a source of concentrated bacteria and other mircorbes which have been impregnated over a carrier material. Other product manufacturers use pure bacteria strains isolated from soils, while Amalgam has developed strains through 18-month Incubation and Acclimatization cycle. Bacta Cult, when added to wastewater treatment systems, starts multiplying immediately to create higher biomass content. This helps in biodegradation to improve BOD content of the wastewater.

- **Pro Bac AE 100**

  It is a blend of essential micronutrients that nourishes the essential bacteria within a wastewater or sewage treatment system. By stimulating and strengthening these microbes, the product helps to increase the rate at which organic effluent can be broken down and improves Mixed Liquor Suspended Solids (MLSS) settling in the clarifier. It increases capability for sustaining BOD shock loads and for sustaining Flow based shock loads. It also increases the breakdown of complex compounds into simpler forms.

Project Sustainability and Scalability

Replicating the product requires technical expertise. Developing tailor-made bioculture products requires in-depth industry knowledge and plant commissioning expertise. Hence replication is a difficult proposition, but not impossible. Replicating bioculture applications has a huge potential. For example, the product Bacta Cult Pond Cleaner was replicated with a few modifications for clean river applications. Due to this, Amalgam Biotech is one of the few companies approved for Namami Gange projects. Direct replication in the same industry is easily possible as evident from the Bacta Cult: Textiles which can be used in textile industry and replicated for all textile manufacturing units in India and abroad. The same holds true for increased market of Biotoilets, which are aggressively promoted by NGOs and government organisations.

Arvind Limited

Case Study	:	Industrial Water Use Efficiency
Production Sector	:	Cotton Textile Composite Unit
Project Name	:	Water Conservation and Wastewater Recycling
Project Region	:	Santej, Gujarat
Key Impact	:	Reduction of water use during textile production

About Arvind Ltd.

Arvind Limited is a textile manufacturer and the flagship company of the Lalbhai Group. Our headquarters are in Ahmedabad in Gujarat and it has units at Santej (near Kalol). Arvind Limited is a global leader in apparel manufacturing which is also transforming water management. Arvind Limited, Santej unit was established in the year 1998 with concept of Zero Liquid Discharge plant and has a current capacity of 17,000 m^3 per day.

Case Study

To reduce water use during textile production, latest technology is adopted in order to reduce water use for every meter of textile produced. It is expected that through various water efficiency measures as well as technology up-gradation, the water consumption per meter of fabric production can come down by 30-35% over the next 5 years. Secondly, their key goal is to reduce freshwater use for textile production.

Initiative

Arvind has recently implemented foam dyeing technology, which uses 95% less water during the denim dyeing process. Arvind is trying to recycle 100% of wastewater by implementing water recycling technologies at the Effluent Treatment Plants (ETPs), or source wastewater from municipality for use in the production process. These two approaches are being used in combination, as is the case with their Santej facility.

Impact

In conventional dyeing process, the fabric web is immersed in a water bath containing a dilute dispersion of the dyes and or chemicals. The company has recently implemented foam dyeing technology, which uses 95% less water during the denim dyeing process. This process has an added advantage over other processes, as it involves treating a fabric with foam at low wet pick-ups. They have also put in place various water efficiency measures like Reverse Osmosis, desalination of brine to recover both water and salt and capturing drinking water from steam condensation and open evaporation, etc. Cooling water is reused. Installation of SCADA system to monitor all data has led to streamlining and overall the company has succeeded in reducing water use for every meter of textile produced.

Conservation Measures

Arvind is conserving water by implementing water saving technology during production, recycling wastewater and rainwater harvesting.

- **Water Saving Technology**

  Gyro Screen: In the process water is separated from fibre and fluff by the screen. This water is filtered and again used in cooling water leading to water saving of 150 M3 /day. The overflow system was designed in a way that water would only go in to the drain when the recovery pump fails. The installed recovery system to save water led to water saving in the processing system of about 50 M^3 /day.

  Karl Mayer Technology Modification: This process uses a patented pre-reduced indigo ready for use on the dyeing range. Taking help of Karl Mayer's newly developed indigo dyeing process technology, which ensures an optimum setting of the dye requiring less dye bath volume, chemicals and water in the plant has led to resource optimization and water saving by about 30% (150 M^3/day).

  High Capacity Pump: The installation of a high capacity pump of 30 kl/hr in place of 15 kl/hr at both the Singeing and Sanforising machines led to a reduction in the ion cooling losses up to zero, leading to water savings of 100 M^3/day.

- **Water Recycling**

  Cooling water used to reduce the temperature of the Rubber blanket in the Sunforising Machine is re-circulated and is reused in the same operation leading to a 100 m^3/day water saving.

  Water is recovered from the wet singeing machine (loose hairy fibres burning from cloth surface) and stored in the holding tank and used for cooling purposes saving up to 150 m^3 a day.

  The water flow was optimized by half to 6 KL /hr by controlling the valve of the Goller Soaper Machine leading to a Water Saving of 90 M^3 /day.

- **Rainwater Harvesting**

  Two groundwater recharge wells with a capacity 5700 m^3 and 9000 m^3 have been constructed to store the rainwater with a total rainwater harvesting potential of 7000 m^3. The stored rainwater is used in processing areas for humidification plant, machine cleaning as well as in Boiler plants. 70% of the water is used in plant processing whereas 30% water is used for groundwater recharging.

Awareness Generation & Capacity Building

Awareness among the employees, business partners, vendors, nearby village people is created through trainings, competitions etc. As a part of capacity building, IR/HR and safety team have organized and conducted various training and awareness programmes for their Front Line Managers (FLMs).

Asian Paints

Case Study : Industrial Water Use Efficiency

Production Sector : Painting and Home Décor Services

Project Name : Water Harvesting

Project Region : Rohtak facility

Key Impact : Water Conservation and Zero Liquid Discharge

About Asian Paints Limited

Asian Paints Limited, founded in February 1945, by four friends, Champaklal Choksey, Chimanlal Choksi, Suryakant Dani and Arvind Vakil, is an Indian multinational paint company headquartered in Mumbai, Maharashtra. It is currently the largest paint manufacturing company in India, engaged in the business of manufacturing, selling and distribution of paints, coatings, products related to home decor, bath fittings and providing of related services.

Case Study

Rohtak facility is a completely water based paint manufacturing facility established in year 2009. During the initial few years the water source was tanker water. The quality was very poor (TDS >2000). As the unit shifted to canal water in year 2013 and the quality of canal water being as good as drinking water the company invested in water saving technologies.

Initiative

Zero discharge and water recycling was adopted. The wastage of water due to backwash and rejects of water treatment plant got significantly reduced which resulted in significant drop in total water intake in the plant. Flow meters were installed on ground water recharge wells within plant to monitor groundwater recharge.

Impact

Total fresh water requirement in the plant was reduced by 8130 m3. The plant achieved 51% reduction in specific industrial effluent generation in 2016-17 with respect to baseline year of 2013-14. 100% of treated water is recycled for gardening purpose.

Conservation Measure

Asian Paints follows the '3R' strategy of Reduce, Reuse and Recycle for waste management. Water consumption and wastewater generation and treatment

monitoring at source level is done using flow meters. Wastewater is treated and reused. Water from rainwater harvesting is used in plant processes. There are advanced technologies at each step to reduce water wastage. Some major steps taken towards water conservation are:

- **Effluent Treatment**

  Asian paint Rohtak has a dedicated effluent treatment Plant (ETP) cum sewage treatment plant (STP) of capacity 75 m^3 per day. Industrial effluent is fed to the bioreactor for primary treatment. At present ETP is operated through distributed control system (DCS). Complete dosing, pumping, transfer and primary and tertiary treatment system is connected to DCS. The Bioreactor (advent integral system) coarse bubble diffuser has been replaced with the advanced silicon membrane diffuser. This increases the oxygen transfer rate thereby reactor effluent treatment efficiency is increased. Centrifuge provides consistent solid content in sludge (around 25%). The Kelly Fan in the sludge handling room improves the handling and storage of sludge. The fan helps in removing the moisture content from chemical sludge (4-5% reduction). It's a 16 feet diameter VFD operated induced and forced draft fan.

  Forbes Marshall Online Treated Effluent Characteristic System was installed. This system is very useful and displays online the effluent characteristics such as COD, BOD, pH, TSS, TDS. The Online DO Meter displays DO in aeration tank which helps plant personnel in taking immediate action for controlling the feed, blower rpm etc to prevent any negative impact on biological process of effluent treatment.

  Extensive trial of Asian Paints' effluent on newly developed technology called "Hycator", which works on the principle of "hydrocavitation", were done under the guidance of Dr Anirudha Pandit from ICT Matunga, Mumbai. It achieved 40% reduction in COD of raw effluent in lab trials. Based on the results a hycator unit which was procured at Rohtak in year 2016-17. In field trials it has resulted in an average 15% reduction of COD in raw effluent.

  The Heat Exchanger System is an air cooler system which is installed in the aeration tank blower and helps reduce the high temperature in blower air (supply to aeration reactor). Higher temperature in aeration unit (especially during summer season) impacts the microbial activities in bioreactor.

- **Reuse**

  Washwater is used as replacement to freshwater in paint manufacturing. At Rohtak there are 2 wash water streams which are currently not utilised and drained to ETP. 1 stream plant personnel is working with R&D for finalisation of reuse scheme and in other case the putting in place of new infrastructure for reuse of treated effluent for gardening purpose is in progress. Treated effluent is also used for gardening purposes. RO reject is used in cooling tower make up. DMF Backwash water is used for fire hydrant tank make up. Bioblocks are used for waterless urinals.

- **Rainwater Harvesting**

  There are 2 reservoirs constructed for collection of storm water (~7000 m^3) and roof water (~1000 m^3). Collected rainwater is further treated and used in utility (cooling tower make up) or process (paint manufacturing). Three numbers of recharge pits are also constructed for ground water recharging purpose. Complete harvested rainwater is utilised after necessary treatment in utility/processes. In year 2016-17 around 8130 m^3 rainwater was harvested, of which 2934 m^3 was utilised in product and 3660 m^3 in cooling tower make up. Remaining rainwater was used for fire hydrant tank makeup.

Project Replicability and Scalability

Bioblocks for waterless urinals is an initiative implemented by Asian Paints head office in year 2015-16 and was replicated at Rohtak. In all the plants of Asian Paints washwater is collected and reused in paint manufacturing. In some of the plants where water demand for green cover is less than the treated effluent, part of the effluent is further treated in RO and MEE and utilised in utility and paint manufacturing as replacement of fresh water. Reuse and recycling of water can be replicated at any other industry or facility with similar characteristics.

Project Update

The factories have adopted a twin-focused approach for effective effluent management - reducing the trade effluent generated at source and finding ways of reusing the treated effluent. This has been instrumental in achieving zero liquid discharge outside factory premises across all paint manufacturing units. The Company's manufacturing facilities (other than the new one at Mysuru & Vizag) are ISO 14001 certified for Environment Management System.





Axis Bank Foundation & Dhan Foundation

Case Study	:	Water Initiatives by NGO
Area of Work	:	Rural Livelihood Programs
Project Name	:	DHANA
Project Region	:	Pambar-Kottakarayar River Basin, Tamil Nadu
Key Impact	:	Watershed Management, Water Harvesting and Safe Water Access

About Axis Bank Foundation

Axis Bank Foundation (ABF) is the Corporate Social Responsibility arm of Axis Bank, one of the largest private sector banks in India. It was formed in 2006 with the aim of giving focus and structure to Bank's philanthropic activities.

Development of Humane Action (DHAN) Foundation, a professional development organisation, was initiated on October 2, 1997 with the aim of making new innovations in development to root out poverty.

Case Study

Sustainable management of water in agriculture is critical to increase agricultural production. Tamil Nadu has 3 key sources of irrigation - canals, tanks and wells. The tanks were earthen-bunded reservoirs built to take advantage of the natural depressions and mounds, particularly the undulating topography of the Deccan Plateau. The area relies heavily on tank fed agriculture and the deterioration of these water structures have impacted the livelihoods of the locals negatively.

The project was implemented in four 4 drought-prone blocks of the Pambar-Kottakarayar River Basin of Tamil Nadu State.

Initiative

Axis Bank Foundation in collaboration with the Dhan Vayalagam (Tank) Foundation initiated a project called DHANA in the four blocks of Natham, Kottampatti, S.pudur and Ponnamaravathi located within the basin for their sources of harvesting rainwater during the north east monsoon. 625 tanks and 125 village ponds were renovated.

Impact

The household income in the case of tank beneficiaries was around 65%. District wise analysis of tank beneficieries showed the highest change was observed in Madurai district (85%) followed by Pudukkottai (52.24%), Dindigul (46.15%) and Sivagangai (43.86%).

It was noticed that percentage change in the cropping intensity was the maximum in Sivagangai district (32%) and the minimum in Dindigul district (5.72%) and S. Puthur (18.53%) and Ponnamaravathy (23.74%) lying in between. Similarly, %age change in irrigation intensity was the maximum (32.65%) in Pudukkottai district and the minimum in Sivagangai (12.46%) and S. Puthur and Kottampatti blocks lying in between with 18.26% and 21.38% respectively.

Conservation Measure

Community engagement and involvement is at the core of the project model. As the approach followed under the program is to capacitate the community right at the initialization stage of the project, they are capacitated at the same time to manage the interventions.

Once the water bodies are renovated, they are handed over to these local institutions and support is provided till they are self-sustainable.

Ground Water Recharge

Some of the major interventions are recharge of wells, borewells in the farms and rise in the water table. 129200 cubic metres of space in the existing tanks was created, in which the maximum space was in Pudukkottai (36,770), followed by Madurai (31,988), Sivagngai (15,843) and Dindigul (15,380). In the first instance, supply of bore water to the villagers through common water supply system of the village panchayat improved.

While renovating the tanks, a dead storage, which is an additional storage created below the pit of the tanks is formed, and is a few meters deep than the actual depth of the tank. It is a portion of total storage capacity that is equal to the volume of water below the level of the lowest outlet. The utility of this dead storage is to enhance the capacity of the tank to store extra water during monsoons. It also helps immensely in facilitating ground water recharge and at the same time is also used for fishery.

After satisfied with the storability of water in the renovated tanks and ponds, panchayat leaders started digging borewells and fixing hand pumps/motor pumps to extract underground water.

Soil Fertility Increase

Apart from renovation, the project concentrated on catchments treatment around the water bodies as to arrest the soil erosion and deposition of the silt to the tanks. The silt that was removed from the tanks/ponds, helped saving the crops/trees from drying. Silt acted as a mulch cover to prevent the moisture loss. This innovative approach ensured that the silt, removed as dirt from tanks is not dumped and is spread across farms, helping in increased fertility.

- **Increase in Vegetation Cover**

  In the sample tanks as whole 45.86% of the soil removed was applied to the cultivated lands. In Dindigul and Pudukkottai districts, 87% and 71% of the soil was applied like that and in Sivagangai 34.4% was applied and in Madurai the figure was 22.53%.

  After renovation of tanks and ponds, green cover in the boundaries and surrounding places had increased. In a way recharge of wells in the farm lands motivated farmers to expand the area under crops, to extend the cropping season, to increase their cattle population, to produce high value crops etc. In some places lands with improved water sources, after the implementation of the project, were taken on lease for cultivation.

Capacity Building & Project Sustainability

The program has an enabling model where the community is mobilised by continuous participation in every stage. The community is further capacitated to make the interventions sustainable without the help of external stakeholders.

Once the water bodies are renovated, they are handed over to these local institutions and support is provided till they are self-sustainable. As stated in the previous section, there are federations formed at collective level, which further facilitates in creating and supporting a sustainable environment.

Project Update

In Phase II the project was expanded downstream in the Pambar Kottakariar water basin and saturated 3 sub basins - Pambar, Manimuthar and Kottaikariyar that are spread over 13 blocks and 5 districts in Tamil Nadu. This Phase covered a total of 70,000 households and around 860 tanks.



Case Studies



BAIF Institute for Sustainable Livelihoods & Development (BISLD)

Case Study	:	Water Initiatives by NGO
Area of Work	:	Skill Development & Sustainable Livelihood
Project Name	:	Sachetana - Safe Drinking Water Programme
Project Region	:	Karnataka
Key Impact	:	Safe Water Access

About BISLD

BAIF Institute for Sustainable Livelihoods and Development (BISLD) is a not-for-profit Organisation established on April 16th, 2012. BISLD is closely associated with BAIF Development Research Foundation, a reputed Non-Government Organisation founded in 1967 by Dr. Manibhai Desai, a disciple of Mahatma Gandhi. BISLD works on creating opportunities of gainful self-employment for the rural families, ensuring sustainable livelihood, enriched environment, improved quality of life and good human values. This is done through skill development, effective use of local resources, extension of climate-smart technologies, and facilitation for value chains of farm-produce and community participation.

Case Study

As per the Ministry of Health, in India, at least 132 districts in 19 states are severely affected by high fluoride content in drinking water, a leading cause of fluorosis, placing 11.5 million people of India at high risk. Karnataka, with 365 affected habitations, is the 4th worst fluoride contaminated state.

Initiative

BAIF has come out with innovative and cost-effective method of constructing the Rainwater Harvesting Structures (RWHS) for households in order to ensure clean and hygienic drinking water. In the fluoride contaminated areas, there is no surface or groundwater source which is devoid of fluoride. Rainwater being the purest form of water is being harvested hygienically and monitored for any contamination. The participants are provided training and exposure visits on Operation & Maintenance (O&M) of the RWHS.

Impact

About 20% of the population of the villages (mostly those effected by fluorosis) under the project are getting safe drinking water. Earlier, people spent 30 to 45 minutes for fetching water, whereas at present due to availability of rainwater, they do not need to fetch water. There is 100% sustainability of drinking water for the fluorosis affected families. People suffering from fluorosis and related problems have got relief after drinking rainwater continuously for more than six months and this has led to

significant reduction in dental and muscular fluorosis. Fluoride level in the groundwater has decreased significantly.

- **Conservation Measure**

  The programme focused on providing clean drinking water to the fluoride affected families and on overall recharging of groundwater table. The participants were selected by the Community Based Organisations (Gram Vikas Samithi (GVS) through Gramasabha).

- **Rainwater Harvesting**

  Innovative rainwater harvesting structures were built, wherever possible. Based on the availability of space in and around the participants' residence, the type of water harvesting structure was selected. The available roof area or the artificial catchment area (if there was no hard roof) was cleaned. Roof top rainwater is collected in tanks, normally of 5000 litre capacity to suit the requirement of the family, constructed underground or on surface. Water test was conducted to check for any contamination and corrective measures taken. The participants were then trained in O&M to maintain the Rainwater Harvesting Systems (RWHS) on their own.

Water Quality Analysis

One of the objectives of the project is to provide safe drinking water which is free from fluoride and bacterial content. Water quality test is carried out by testing the water through H2S bottle. The rainwater harvested is tested for bacterial load on quarterly basis using the bottle. If any sample reported is not potable, that water is chlorinated and the water tested again. The results are discussed with the community.

Groundwater Recharge

Groundwater recharge measures were taken up as a long-term solution for the problem through farm ponds, bore well recharge, aquifers recharge etc. Recharge of groundwater was done through excavation of percolation ponds. Recharge of existing bore wells and direct recharge of aquifers were also undertaken. Where tank de-siltation project was undertaken, toilets were also constructed to avoid water contamination.

Capacity Building & Scalability

People's organizations like Gram Vikas Samithi and Self-Help Groups were formed. The capacity building of the people's organisations was taken up to ensure maximum participation of the community and maintenance of community assets. The people's organizations played an active role in individual micro plan preparations, participation in impact monitoring and maintenance of community assets.

The success of the project has led the government to replicate it. One corporate house - HSBC - came forward to sponsor the project at two locations. Eventually, the programme may be extended to cover all affected areas in Karnataka state.

Many NGOs from the other parts of Karnataka have visited the project villages to see the activities and have interacted with the participants.

Bilt Graphic Paper Products Ltd.

Case Study	:	Industrial Water Use Efficiency
Production Sector	:	Coated paper manufacturing
Project Name	:	Wastewater Treatment and Water Recycling
Project Region	:	Unit Bhigwan, border of the Pune and Solapur districts, Maharashtra
Key Impacts	:	Water Conservation during paper production and wastewater reuse

About BILT

Ballarpur Industries Limited (BILT) is a subsidiary of the Avantha Group, and India's largest manufacturer of writing and printing (W&P) paper.

BILT has six manufacturing units across India under Bilt Graphic Paper Products Ltd., which is the largest manufacturer of coated paper in India, primarily meant for import substitution. Around 20% of its paper is exported to developed countries.

Case Study

BILT Graphic Paper products ltd. (BGPPL), Unit Bhigwan is one of the leading coated paper manufacturer in India. The water requirement of the mill is met by lifting the water from Bhima River and as the mill is situated in the rain shadow area, average rainfall being as less as 500 mm, the mill has implemented specific improvement projects to reduce overall water consumption.

Initiative

To reduce freshwater use during paper production, BILT has adopted latest technologies. RO water treatment plant is installed in the mill, to treat the effluent treatment plant (ETP) water which generates around 1100 to 1200 m^3/day water. About 10 - 15 % of this RO water is then directly reused in the main paper manufacturing process and in cooling tower. The rest is used for Green Belt Development and by farmers for agriculture. Rainwater harvesting (RWH) is done for groundwater recharge through recharge pits.

Impact

Due to the specialised treatment improvement projects the mill was able to reduce water consumption from 26 m^3/T to 11.35 m^3/Ton of Paper (achieved in May - 2016). Harvested water has led to marginal improvement in groundwater levels.

Recycled wastewater use by farmers has reduced groundwater extraction and saved about 2,400 M^3/day on irrigation.

Conservation Measures

An advanced effluent treatment plant was put in place with multiple outlet pipes. Partly treated safe sewage is provided for irrigation to nearby farmers and for Green Belt Development. The leftover is then directed to the RO plant to be directly reused in plant production.

- **Water Conservation during Production**

  The plant was installed with an advanced condensate (liquid collected by condensation) and a flash steam recovery system (low-pressure steam created when hot water is released from high pressure to lower pressure area within a steam pipeline) from vacuum pump to collecting tank. This saves about 85 to 88% of condensation water. As per report 3% condensate recovery saves about 7300 m^3/year of demineralized water and along with heat recovery of about 7800 m^3/year from steam traps.

  The water used in heat exchangers is subsequently used in the shower water and in the chemical dilution system. There is also water reduction in the dilution percentage of the coating chemicals resulting in a 25% increase in the silo water level.

  Systems are installed to prevent water overflow from cooling tower and pulpers (machine to make pulp). Vacuum pump sealing water is reused in shower water. Salvage rewinder (used to recover scrap or damaged paper rolls) cooling water is used for cooling tower top up. Ultra filtration backwash water and boiler blow down water is reused in the cooling tower. Water saving is also done from the 'deculator (de-aerator)'. Fresh water saved during production was about 450 m^3/day and total water saving was about 720 m^3/day.

- **Water Conservation inside Plant Residential Complex**

  Modifications were done to bring all overhead tanks inlet pipeline at same level. Flow meters, flow valves and alarms were put to prevent water overflow. All the wastewater was then collected.

- **Wastewater Treatment**

  All the wastewater generated in the residential area is transferred from the septic tank to a 5-stage (Primary Thickener, Cascade Aeration, Secondary Clarifier, Higher Capacity Belt Press, Centrifuge and Tertiary Clarifier) RO Effluent Treatment Plant (ETP). The ETP then treats the residential wastewater combined with industrial effluent from the plant, to reuse 10-15% wastewater directly in the plant process. The treated effluent is also used as a substitute to fresh water for floor cleaning, chemical tank cleaning, fly ash brick making, fly ash and coal dust suppression etc., leading to a total water saving of 4.92 lakh m^3/year (2015-2016). Part of the ETP Sludge is sent to paper board manufacturers and some used as fuel in the boiler for heat value.

Green Belt Development: Treated effluent from the treatment plant is used for plantation (193000 trees) and 100 hectares of green belt development.

Agricultural Production/ Irrigation: Farmers take water from the discharge pipeline of the treatment plants and use it for the irrigation of sugarcane, bajra and pomegranate crops on 200 acres of land. The secondary sludge is further used for vermicomposting and bio compost.

- **Awareness Generation & Capacity Building**

Training and awareness programs and Small Group Activities carried out for the employees, colony residents, surrounding villages and vendors during the programme led to an increased awareness on water conservation methods.

The Maharashtra Pollution Control Board has given permission to Bilt Graphic Paper Products Ltd to provide treated effluent for farming and the farming community have made a co-operative society.

The projects implemented in the paper manufacturing process can be implemented in any paper industry.



FICCI

Case Studies



Chemplast Sanmar Limited

Case Study	:	Industrial Water Use Efficiency
Production Sector	:	Chemicals, Shipping, Engineering and Metals
Project Name	:	The 4 R
Project Region	:	Plant II, PVC Division, Raman Nagar, Mettur Dam, Tamil Nadu
Key Impact	:	Fresh Water Conservation

About Chemplast

The Sanmar Group headquartered in Chennai, India is a US $1 Billion business conglomerate that has presence in Chemicals, Shipping, Engineering and metals. The Sanmar Group consists of a set of diversified manufacturing companies and has manufacturing facilities in India, Mexico and Egypt. Chemplast is Sanmar's flagship company and a major player in the chemical business for over 50 years.

Case Study

The Company has a policy of not withdrawing water from the earth. The Sanmar Group plays a responsible role in water conservation, with none of its coastal plants drawing any water from the ground. These plants depend entirely on converting seawater by means of contemporary desalination technology even though the aquifer is very close to the surface.

Initiatives

In the Mettur plant, other than the desalination process, water from PVC (polyvinyl chloride) manufacturing is recovered and recycled to the tune of 400 KL every day to be used in the cooling tower. Chemplast has also established Air Cooled Condenser in its coal power plant instead of conventional cooling towers in order to save water up to 3000 KL/day.

Recycling of water through Zero Liquid Discharge (ZLD) facilities at its Mettur plant has enabled Chemplast to avert the contamination of natural resources.

Each plant has water meters to monitor the quantum of water drawn from the nearby reservoir on a daily basis. Chemplast has also built water tanks in partnership with the Government of Tamil Nadu in the 'Namakku Naame' scheme.

Impact

Chemplast Sanmar provides 35 lakh litres of drinking water every day to villages around Mettur, targeting 12,000 families. Since Chemplast does not draw any

groundwater for its plant in accordance with its principle, the water table is maintained for the general community. This is a part of the company's environmentally conscious water-management strategy.

Conservation Measures

The 4 R (Reduce, Recover, Recycle and Reuse) principles are implemented in the production process towards the preservation of the environment. To this effect water is desalinated for intake and mixed with freshwater from the Stanley Reservoir for industrial production. The ZLD plant has adopted technology for the total recycle of wastewater and the recovery of residual salt from the evaporator.

- **Desalination for Production**

  The project comprises of a seawater desalination plant, worth Rs.20-crore, based on RO technology. The technology saves approximately 3,500 kilolitres of water a day.

- **Wastewater Recovery during Production**

  Effluent Pretreatment: After organic load removal from the waste stream of the PVC manufacturing unit, the stream is taken to the effluent treatment plant (ETP), where it is collected in two equalization tanks. From there, it is pumped to a flash mixer, goes through the Flocculator, Primary Clarifier and Secondary Clarifier and then to sand filters. The outflow of the sand filter is collected in a collection tank from where it is recycled to the cooling tower. The air-dried sludge is sold as PVC sludge for low-end applications.

  The effluent generated from the regeneration of the Demineralizer plant and cooling tower is collected in the collection tank and treated in the ETP. It is then sent to the ZLD plant for further treatment.

  ZLD Plant: Treated water from the ETP is mixed in equalization tank and further treated by clarifiers, filters, softeners and High Efficiency Reverse Osmosis (HERO) and is utilized for internal plant requirements. High TDS water rejected from RO is treated separately in evaporator centrifuge and the salt recovered. The recovered salt is used to make brine solution for caustic soda manufacturing. The entire process demonstrates the total recycle concept. Around 2000 KL per day (KLD) of water arising in both PVC and chloro-chemical plants is fully recycled and reused in the process.

- **Canteen and Colony Wastewater Recycling**

  Wash water from the canteen is collected separately in a tank. Basic facilities including septic tank and soak pit are available at various places and the outlet water is collected in sewage sumps. Both sewage and canteen water are pumped to aeration basin for biological treatment. The overflow of aeration basin is fed to a clarifier. The solids are settled at the bottom and a portion of the settled sludge is

recycled back to aeration basin. The overflow from clarifier is filtered through sand filter and used for Green Belt development. The sludge from thr clarifier spread in Sludge Drying Beds and is used as manure when dry.

- **Rainwater Harvesting**

  Rainwater is collected in sumps and is reused in place of raw water. Each section of every plant is provided with rainwater harvesting pits. Average quantity of rainwater collected and used instead of raw water at Chemplast Sanmar Limited, PVC Division is 28900 m^3/year.

Awareness Generation & Capacity Building

Chemplast organizes frequent training programs for the regular and contract employees on the "reduce, recover, recycle and reuse" of water. Awareness program of water saving, decontamination of tankers as well as mitigation measures are a regular feature during the logistics emergencies for truck drivers and cleaners. Specific water conservation programs were successfully carried out in the different plants (e.g. recycling of polymer plant effluent to the cooling towers, introduction of new effective mixing system for ethylene dichloride washing). Employees are encouraged to contribute towards awareness creation on water conservation. Water conservation awareness programs were also carried out for the residential colony of the company workers.

Using Mettur as a learning experience, all new facilities of Chemplast will use ZLD and shore based facilities would use desalinated water - for example the state-of-the-art PVC facility at Cuddalore (shore based) which is to be commissioned.





Case Studies

Coastal Salinity Prevention Cell

Case Study	:	Water Initiatives by NGO
Area of Work	:	Sustainable Approaches for Prevention and Mitigation of Salinity Ingress
Project Name	:	Safe water access and Sanitation
Project Region	:	Gujarat State
Key Impact	:	Sustainable Water Conservation

About CSPC

Coastal Salinity Prevention Cell (CSPC) was established in 2008 as a joint initiative of the Aga Khan Rural Support Program India (AKRSPI), Tata Trusts and Ambuja Cement Foundation (ACF) with the aim to improve the quality of life of the rural coastal communities of Gujarat through socio-economic development programmes which sustain the fragile environment. CSPC pioneered efforts to create a collaborative partnership of civil society organisations working with government agencies, to pilot and upscale intervention to improve quality of life indicators in coastal Gujarat.

Case Study

Imbalance between the ecology and economy in coastal regions has created serious problems for the life and livelihood of coastal population. One of these problems is ingress of salinity into land and water resources on the coast. The state of Gujarat, with its more than 1600 Km of coastline, is suffering from this problem, the Saurashtra coast being affected maximum. A major consequence of this problem is the acute shortage of potable water in this region.

Initiative

The organization provides seasonal security and conservation of water supplies with an integrated combination of pipe and local traditional water sources to 420 coastal villages; with a special focus on water resource management for strengthening of local drinking water sources.

Impact

Household tap connections have increased from 6% to 83%. Study shows that families fetching water from up to 200 m have decreased from 63% to 9% with increase in household tap connections. Also, 77% families now spend less than 30 minutes to fetch water and number of families spending 30-60 minutes to fetch water has reduced from 65% to 17%. According to a household survey, 22% families have reported decrease in occurrence of water-related diseases and corresponding savings of medical expenses (around Rs 63000/- per village per year saved).

Conservation Measure Requirement

CADP has adopted a two-pronged strategy wherein community as well as household based drinking water intervention is dovetailed with sanitation and hygiene education.

- **Household-level solution**

  Under CADP programme around 420 villages were covered by in-village water distribution system to provide effective low-cost technologies for household water treatment. This ensured safe water at the point of consumption. All these schemes were implemented with demand-responsive and community-managed approach.

- **Community-level solution**

  Village level water committees "Pani Samities" were formed, under the village panchayat, which is responsible for planning, implementation, management, operation and maintenance of the drinking water scheme. 63% villages have functional Pani Samiti. In the rest of the villages, the management of water supply has been taken over by panchayat body. The process of working through Pani Samiti was largely successful and a fair amount of community participation has been ensured in villages. The self-sufficiency provides a community level system which can ensure that safe drinking water is available for a large part of the rural communities.

- **'Samajhdar' campaign**

  One of the major interventions under CADP was to achieve Open Defecation Free villages in the project areas. A creative communication tool was developed with central theme of Nurture and Disgust or Affiliation or suitable combination of all three. The tool was called 'Samajhdaar' campaign meaning 'Wise person' who takes the wise decision of having a toilet at home and using it.

- **Direct Money transfer**

  Under SBM-G programme, the poor and the marginalized communities are being served by the Government for providing incentive amount of Rs. 12000/- post-construction of Individual Household Latrine (IHHLs). For this, Direct Benefits Transfer (DBT) was adopted as a potential solution for incorporating transparency and accountability in the system.

Capacity Building and Project Scalability

To support the village institution for robust tariff collection mechanism, household level water meter was piloted. Usage (volumetric) based tariff collection mechanism through innovative technological and economically sustainable solutions are being explored.

With water metering and regularized tariff collection by Pani Samities/Panchayats, the financial sustainability of the programme will be ensured. Pani Samitis which are active in over 70% of the villages are collecting water dues from the villagers. The operation and maintenance costs of the water supply system are met with the collected amount. In the rest of the villages, it is an added burden on Panchayats.

Project Update

CSPC is currently focused on developing sustainable models for salinity ingress prevention and mitigation to enhance livelihood resilience of 75,000 households across 525 villages in coastal Gujarat by the end of 2020.

DC Water World Supermart Pvt Ltd

Case Study	:	Innovation in Water Technology
Production Sector	:	Electronic water purifiers, purification systems; ionization apparatus
Project Name	:	ECO EWP
Project Region	:	100 units installed across Delhi
Key Impact	:	Water Conservation during Purification

About DC Water World

Water World Supermart was established in the year 2000 as a supermarket for supplying the water treatment companies with their basic requirements of components for RO (reverse osmosis) Plants and other water treatment plants. It began supplying residential RO systems, filtration equipment, and setting up residential water treatment plants and industrial RO plants. Water World has innovated on several products for both domestic and industrial use, including an economy model for residential RO system and a water cooler (hot and cold) with RO.

Water World's EWP systems are currently being tested at the offices of Airport Authority of India. The company is already in the process of developing larger industrial scale units with the target of exporting the systems to the neighbouring countries and beyond.

Case Study

Minerals are the major components of TDS (total dissolved solids) in water found in various brackish water supply sources and wastewater applications. Existing popular RO technology fully demineralizes the water treated, depleting it of several essential minerals. Despite the shortage, wastage of water is increasing with growing urbanization due to increased usage of RO technology in homes and offices. The amount of water that is wasted in RO purification systems is in the ratio of 4:1 (i.e., for every 4 liters of water, one liter gets purified).

Initiative

ECO EWP based on a patented Capacitive Deionization Technology, which means low voltage (3V DC) is a Water purification System capable of saving around 80% of water with wastage of just 20%. ECO EWP not only wastes less water than traditional RO systems but also retains the required minerals.

Impact

Electronic Water Purifier (EWP) has low operating costs, low rejection wastewater capital, no chemicals and a small footprint. It has a significantly high recovery rate of up to 80% as compared to just 20-30% in case of most RO water Purifiers in the market.

It also has a lower electricity consumption rate (0.33Unit/h) as compared to RO System (1.3 Unit/h). The system can control essential minerals retention in water without mixing raw water as RO System requires.

Conservation Measures

The Electronic Water Purifier (EWP) technology uses a hybrid electrode comprised of activated carbon, nanomaterials and a semi-permeable coating. These hybrid electrodes are electrically charged using a DC power supply and have different polarities. When water passes between the electrodes the minerals and metals in the water, which have charges, are attracted to oppositely charged electrodes, thus removing the unwanted minerals from the water.

- **Capacitive Deionization (CDI)**

  CDI is an emerging water treatment technology that uses electrophoresis as a driving force to achieve desalination. Heavy current is applied on carbon electrodes, separated by a spacer, to remove the salts (TDS) from the water allowing the naturally available minerals to be retained and give natural-tasting water. The negative electrodes attract positively charged ions such as calcium, magnesium, and sodium; simultaneously, the positive electrodes attract negatively charged ions such as chloride, nitrate and sulfate.

- **Electro Deion Module**

  All the material used for preparation of Electro Deion Module are Biodegradable and can be refurbished to reduce the cost for replacement, resulting in better life for the machine. Unlike ion exchange processes, no additional chemicals are required for regeneration of the electro sorbent in this system.

Capacity Building & Scalability

It can be used at a single Point-of-Use (POU) and scaled up to any large commercial size. The present technology has a capacity to purify a maximum TDS of 1000 ppm. Research is on-going for development of purifier which can remove up to 2000 ppm input water. The intended target is up to 5000ppm TDS/Salinity. The technology has been implemented and successfully running on more than 100 machines, 20 of which are in the Rashtrapati Bhawan (official residence of the President of India) in Delhi.

Project Update

DC Waterworld has developed a new class of EWP called X3A (patent pending), which is a hybrid combination of Capacitive Deionization (CDI) and Electro deionization (EDI) technology.

Earth Water Limited

Case Study	:	Innovation in Water Technology
Area of Work	:	Technology and Business Solutions for Water and Wastewater Management
Project Name	:	Solar Run Community Safe Drinking Water Plant & Desalination Plant
Project Region	:	Barmer, Rajasthan/ Thane Maharashtra
Key Impact	:	Water Conservation, Wastewater Treatment

About Earth Water Limited

Earth Water Limited (EWL) is an unlisted public company. It was incorporated on 21 June, 2001 and is located in New Delhi. Since its inception over a decade ago, Earth Water Limited has evolved into India's leading provider of technology and business solutions across the value chain for water and wastewater management. EWL is the holding company of the group and has 4 direct subsidiaries at present: Aventura Components Pvt. Ltd. (83.62%), Geist Research Pvt. Ltd. (100%), Fontus Water Pvt. Ltd. (100%) and Healthpoint Services Pvt. Ltd. (62.96%).

The EWG Group is a leading implementer and systems integrator of projects, products and services in the water and wastewater treatment sector, with expertise in sewage recycling, sea water desalination and industrial zero liquid discharge/recovery solutions. The Group offers various types of components, which require significant technical and engineering capabilities and know-how.

Case Study

Earth Water's community drinking water treatment facilities across the country have a strong focus on social outreach and community empowerment. The fisrt project was in Punjab where they now have over 162 plants running successfully for over 5 years. Subsequently their plants were commissioned in communities across Karnataka, Andhra Pradesh, Rajasthan, Madhya Pradesh, Uttar Pradesh and Maharashtra.

Initiative

EWG has set up drinking water treatment facility in Sewniwala, Barmer with Cairn India. Barmer has abundant sunlight throughout the year and to maximize the use of this renewable source of energy, EWL technology was used to setup a solar powered safe drinking water plant. Plants of varying capacities from 1,000 to 3,000 litres per hour capacity were planned to be installed over the next three years to provide safe drinking water to a large number of people (estimated in excess of one million) living in 800 villages.

EWL also planned Vending Machines in villages of Barmer for Cairn India under the Jeevan Amrit Project.

Impact

The solar plant has MNRE certified panels and generates 5KW power which is stored in batteries and can be used for 8-10 hours of plant operations. The water from this plant is sold at 25 paise per litre to the local community.

Conservation Measure

Recognizing the challenges of depleting water supply and the rapidly increasing demands for fresh water, Earth Water Limited is engaged in bridging these gaps in industrial, building, government and consumer segments.

- **Solar Water Purification**

  Solar water purification involves purifying water for drinking and household purposes through the use of solar energy in many different ways. Using solar energy for water treatment has become quite common as it is usually a low-technology solution that works to capture the heat and energy from the sun to make water cleaner and healthier for human use and consumption. Solar water treatment is particularly beneficial for rural communities, as they do not have other forms of water purification infrastructure and more importantly, electricity to run such structures. The most positive feature about solar water purification is that there is no requirement of fuel. It is precisely due to this that solar applications are relatively superior to conventional sources of energy as they do not cause pollution (global warming, acid rain, ozone depletion) or health hazards associated with pollution.

- **RO Technology**

  The water treatment system is a Brackish Water RO system followed by a Mixed Bed Exchanger with a pre-treatment system in place to make the raw water suitable for the RO membranes.

Capacity Building & Project Sustainability

Over the year, Earth Water has invested into sewage recycling projects in West and South India, leading to abundant recycled water for industrial clusters there. It has installed Industrial ZLD technology operations with chemical recovery from processing industry effluent. EWL has created one of the largest community drinking water initiatives in the world, with over 15,000 plants in 3 years. Most recently, EWL has invested in 2 new path-breaking technologies in Canada for electrostatic deionization and water quality sensing.

A contract has also been signed for the execution of a 20 million litres per day seawater desalination plant with Thane Municipal Corporation and construction has started.

Project Update

Around 150 red rice farmers, who will lose their land for this desalination plant, have opposed the project, claiming that it will displace them from their rightful farmlands. The corporation will be acquiring 28 hectares (70 acres) of farmland for this desalination plant which had earlier faced resistance from the opposition party.

Goverdhan Ecovillage Trust

Case Study	:	Water Initiatives by NGO
Work Area	:	Green Community
Project Name	:	Nature inspired Integrated Water Management
Project Region	:	10 tribal villages of Maharashtra
Key Impact	:	Water Harvesting, Sanitation, Safe Water Access

About GEV

Expanded over 100 acres of area, Govardhan Ecovillage is a project of the International Society for Krishna Consciousness. The project is owned and managed by ISKCON Wada. GEV is a community in rural setting with meagre infrastructural support as against cities. Thus, innovative sustainability driven water initiatives at GEV can be classified as inward bound to improve Water sustainability within and models thus developed and learnings are been shared for Water sustainability outward bound in nearby villages.

Case Study

In spite of being in an area with a decent rainfall, GEV is in a region which faces drought situation perpetually in summer. With practically insufficient water distribution support from government in the region, water extraction from Vaitarna River and extraction of the available groundwater through five bore wells had been supporting its water needs earlier.

Initiative

To address the water scarcity issue, GEV decided to launch mission for water harvesting and groundwater recharge, instead of extraction.

Impact

The Project recovers around 95% of sewage water, which comes out to be around 1Cr litres, annually supporting 50% of their agricultural needs. This recycled water irrigates a horticulture and vegetable plantation spanning over 2 acres and housing over 500 varieties of plants. Around the same amount of water is harvested annually by GEV. GEV provides safe drinking water access and irrigation for 60 tribal villages hosting 3071 families.

Conservation Measures

10 tribal villages were selected for baseline study as discussed in above sections. These villages were Galtare, Aamgaon, Gorhe, Guhir, Hamrapur, Kuntal, Kurla, Nane,

Shelate and Sange. These villages are organized into 35 hamlets and have total population of over 12,000 with 2163 households.

- **Water Harvesting**

Detailed hydrogeological survey was carried out covering 100 acres of land at GEV. Study revealed that out of 5 main water borewells, two were low yielding. The recharge in 3 main water borewells shared the same aquifer resulting in inconsistent water availability. The created central water pond capacity is 1 crore litre, with additional distributed recharge facility of 3 lakh litre with a percolation pond.

- **Water Recycling**

GEV in association with an experts' team from IIT Bombay implemented SBT (Soil Bio Technology) plants to process 100% of the sewage generated in the community in an ecological, low-energy and chemical free, way with capacity of 30 KL, 90 KL and 70 KL sewage water processing per day. The only water loss in SBT systems is due to evapo-transpiration from the plants and soil. Therefore, the treated water recovery is very high. Recovery of more than 90% has been observed under all climatic conditions.

- **Drinking Water & Irrigation**

GEV project was about ensuring access to safe drinking water resources by creating new safe water facilities (drilling bore wells, hand pumps, covering open wells etc.), repair and maintenance of existing drinking water sources (hand pump repairs, deepening of wells, fitting pulley on wells etc.), providing educational programmes for building awareness about source chlorination/ home chlorination to clean the drinking water especially during rainy seasons.

Around 60 tribal villages were provided safe drinking water access and irrigation. Participatory action and budgeting was used where the local community contributed labour for initial building and also provided support for maintenance, and they in turn were supported and monitored by GEV's team. Rain fed agriculture was being practiced in these villages. They do not have proper water resource/ irrigation facilities to fulfil agricultural needs especially during other seasons.

- **Awareness Generation & Capacity Building**

GEV is now supporting over 3071 tribal families to achieve access to safe water; a journey from dependence to independence to interdependence.

Beyond these initiatives for access to safe drinking water and sustainable irrigation measures, GEV's lessons learnt during Water Harvesting are now being transplanted in other villages, with similar water ponds being created in some villages.

Haritika

Case Study	:	Water Initiatives by NGO
Area of Work	:	Natural Resources Management and Provision of Infrastructure Facilities
Project Name	:	Pragati-Gram Project
Project Region	:	Bijawar, Chhatarpur District & Jaitpur, Mahoba District Madhya Pradesh
Key Impact	:	Safe Water Access

About Haritika

HARITIKA a non - government organization was set up in the year 1994. Since then it has been working on issues affecting the rural poor. It has made interventions on natural resources management and provision of other infrastructure facilities so as to make the villagers, living in the backward districts of Bundelkhand region, self-reliant.

Case Study

The Bundelkhand region which is spread over 70,000 sq. km of 13 districts in Uttar Pradesh and Madhya Pradesh has experienced continuous drought over several years. "Pragati-Gram II" is a project based on watershed program which was initiated in the year 2016-2017. The project covers major villages benefitting around of Kupia, Agra, Ramnagar, Jharkuwa, Meharkuwa and Bhainskhar in Bijawar of Chhatarpur district in Madhya Pradesh.

Initiative

The approach adopted was the Integrated Water Resource Management Approach in the above mentioned villages. 1173 acres of forestation was carried out. The project covers a catchment area of 210.90 km2 with a recharge potential of 22,083 m3 and a pond recharge volume of 19,408 m3. 30% of total recharge volume (after twice filling of pond/reservoir) will be used for irrigation and domestic purposes; and 20% of total recharge volume (after twice filling of pond/reservoir) will evaporate.

Impact

In 200 villages a projected population of approximately 311500 people is getting assured water supply to meet drinking and domestic water requirement. Through the activities on water and soil management, ground water level is likely to increase by 1-3 meters in these villages. According to an assessment, area under water reservoirs after the monsoon increased significantly (approximately by 468% from 0.6 sq km to 2.84 sq km) due to the construction and promotion of water harvesting structures in the watershed area. The area under rabi cultivation has increased approximately by 36%.

The expected impact includes improvement of availability of surface flow and sub-surface flow in seasonal Nalas. The project is said to increase approximately 30% of cultivation area, enhancing agriculture production by 20%. The project is expected to reduce the migration rate by 20 to 25 % in the project area. Change in cropping pattern

from food crop to cash crop has already increased. These also include diversification into vegetable cultivation, horticulture, seed production, etc.

- **Conservation Measures**

  The project is about optimization of the use of natural resources like soil and water to mitigate the adverse effects of the drought and prevent further ecological degradation and adequate availability of drinking water for human and cattle even in a drought year. Community participation of local people in water management is a crucial part of the water resource conservation programme.

- **Watershed Management**

  This is a holistic approach of development through construction of water check dams and stop dams and enabling water availability throughout the season for beneficial purposes to the villagers. Check Dams/Stop Dams were constructed to enable restraining the water flow for utilization within the boundaries of its serving/command area. Irrigation as well as domestic purposes will be fulfilled by the program. The communities were asked to contribute for labour work.

- **Participatory Approach & Community Mobilization**

  Community participation involves holding discussions and open forums between community members themselves and with local government authorities i.e. PRI to contribute ideas for inclusion in policy development and change in operation strategy. The process of community consultation will help in the planning process and may take different approaches, for example, Participatory Rural Appraisal, Participatory Livelihood Assessment, participatory water budgeting or a wider approach through village or area development. The consultation will develop mechanisms of monitoring & sustainability, agreed undertakings and their enforcement.

- **Integrated Development through Convergence**

  Apart from the funds leveraged from Coca Cola Foundation, other funding sources have been accessed for integrated development of project villages. Irrigation solar pumps have been installed with the support of Grundfos Pvt. Ltd. Drinking water supply project has been implemented with the support of Coca-Cola Foundation itself & Just a Drop, while Wadi Project for tribal development has been implemented with the support of NABARD.

- **Capacity Building & Scalability**

  HARITIKA organizes capacity building and training programs like Operation & Maintenance, System & Source sustainability, Ensuring Water Security through less water intensive cropping. Training has been provided to the members of VDC, SHG etc. The project concentrates on reconstitution and strengthening of village level institutions through a series of awareness creation and theme-based training programs with the basic objective of ensuring system sustainability.

  The interventions implemented by HARITIKA have the potential to be implemented on a larger scale. The above project was continued under Unnati-4 & Unnati-5 Projects, with the support of Coca-Cola Foundation, in 11 villages of Bijawar Block, Chhatarpur Disrtict, Madhya Pradesh through the construction of water conservation structures that resulted in approximately 8,700 acres of irrigated land in the area and thus improved income of the farmers in this region.

Himmotthan - Tata Trusts

Case Study	:	Water Initiatives by NGO
Area of Work	:	Developing Sustainable Enterprises in Rural Mountain Communities
Project Name	:	Water Security through Participatory Springshed Management
Project Region	:	312 villages Gangolihat Block Pithoragarh District Uttarakhand Himalaya
Key Impact	:	Watershed Management, Springshed Management, WASH

About Himmotthan - Tata Trusts

In 2001, Tata Trusts initiated Himmotthan Pariyojana (HMP) to target the root causes of underdevelopment in the Central Himalayan region of Uttarakhand. Himmotthan Society, an associate organization of Tata Trusts, was set up to oversee, manage and implement the Himmotthan Pariyojana's programme. The Society currently works in the state of Uttarakhand, Himachal Pradesh and Leh region of Jammu & Kashmir and is focused on working among the rural mountain communities by developing sustainable enterprises linked to livestock, agriculture and non-timber forest produce as well as interventions for better education, access to safe water, sanitation and energy.

Case Study

The water stress situation in the hills results in limited local growth and development and is also leading to severe ecological degradation. The dying of water supply sources now poses severe drinking water crisis in many parts of the Uttarakhand Himalayas.

Initiative

Tata Trusts identified the sources of springs, studied their history and diagnosed the issues impacting their discharge. By adopting comprehensive scientific methods, the trust has implemented successfully springshed management in the region of Uttarakhand through their Himmotthan Pariyojana initiative.

Impact

Over 145 springs have been augmented, and over 200 gravity flow water schemes and 7,000 sanitation units have been created in the region. The project has led to 500 million cubic meters of annual groundwater recharge. A household's waiting time every day to collect water has been reduced to 15 minutes, compared to 2-3 hrs earlier. Distance travelled to collect water has reduced from 2.5km to less than 10m and water consumption has increased from 24 to 70 litres per capita per day.

Conservation Measure

Springshed is the unit of land where rain falls (recharge area), and then emerges at discharge points of the spring. It is the natural unit for revival and management of the spring. By adopting comprehensive scientific methods such as hydrogeology and quality assessment of water, the Trusts have been successful in implementing spring-fed, gravity flow WASH programmes in the region.

The methodology followed during the study included preliminary survey/pilot survey, hydrogeological survey, preparation of hydrogeological cross section/ maps and data analysis.

Survey

Preliminary survey was conducted with participation of community. Secondary data collection and interpretation was carried out followed by mapping of all the water resources of the village, location of households, location of water tanks, water supply pipes, rivers, lakes, springs, streams, forest, cultivable land, barren land, roads and any other land mark.

- **Hydro-Geological Mapping**

  In depth collection and compilation of surface geologic data, surface and subsurface geophysical data, and well-drilling data was conducted.

- **Conceptual Layout**

  Recharge Pond, which is a rectangular dugout structure, was constructed usually in a natural depression area on sloping land. Digging pond in natural depressions will collect maximum runoff. It was realised that ponds and trenches had a greater impact on groundwater recharging and soil moisture than plantations, which lose moisture through evaporation.

  Trenches i.e. a small rectangular structure were constructed on sloping land in a staggered manner. Some trenches were dug on terraced fields instead of on sloping land. Terraced fields reduce the surface runoff as the steps help in slowing down the speed of water and increase the ground water recharge. Feeder Channels were created on both sides of the trenches and ponds to collect maximum runoff and feed into the ponds and trenches.

- **Project Implementation**

  The recharge intervention has been carried out through the User Water and Sanitation Committee (UWSC) which is a sub-committee of the Gram Panchayat.

- **Water Treatment**

  The captured water is treated through roughing filters. In case of rivulets, Slow Sand

Filters are used for water filtration. Water is then conveyed to the village, where there is a Clear Water Reservoir (CWR) and where water is chlorinated.

- **Monitoring System**

  Monitoring systems were set up for periodic spring discharge precipitation and water quality during planning, implementation and impact assessment stages. Planning of treatment measures in the recharge area is carried out with the help of community participation.

Project Sustainability & Scalability

In order to achieve the goals of the project, UWSC meetings are organized on regular basis to discuss about the protection, conservation and management of Spring-sheds. This is because community awareness regarding artificial recharging of ground water, along with its conservation and sharing mechanism, is required for future sustainability.

Project Update

A cadre of para-hydrogeologists is being created in 125 villages through training and capacity building programmes.





Case Studies

Hindustan Ecosoftt Pvt Limited (ECOSOFTT)

Case Study	:	Innovation in Water Technology
Production	:	Water, Wastewater and Environmental Services
Project Name Sector	:	Poseidon Biological Wastewater Treatment and Recovery System
Project Region	:	Xavier Institute of Development and Action Studies, Jabalpur
Key Impact	:	Wastewater Treatment and Recovery

About ECOSOFTT

Hindustan Ecosoftt Pvt Ltd or ECOSOFTT works in the field of decentralised management of water, wastewater and environmental services. They provide a comprehensive range of solutions that enables homes and communities to become water secure, and live in harmony with the environment.

Case Study

More than 95% of the water used in homes and communities is used for non-potable purposes. The conventional system processes require extra equipments and steps which are highly cumbersome and expensive. Poseidon bypasses most of the high energy consuming equipments and works on the principle of natural attached growth processes, combining three organic removal processes in one single unit.

Initiative

The Poseidon Airlift Circulating Floating-Carrier Bed is a compact wastewater treatment system specially designed for on-site treatment of wastewater within homes and residential communities. The system uses biological processes, without the use of chemicals, to ensure a safe and sustainable wastewater treatment process. Featuring a compact and modular design, various treatment sizes are available to cater to specific site requirements.

This system is extremely suitable for urban areas where the use of land and space has to be optimized, such as decentralized treatment within households, hotels, hospitals, educational institutions, offices, residential and commercial buildings and communities including ships and floating vessels.

Impacts

Using a combination of aerobic and anaerobic processes, the ACFB reactor in the Poseidon achieves high rates of nitrogen and phosphorus removal in a single treatment unit. This reduces the overall hydraulic retention time in the system, thereby resulting in a highly compact and portable wastewater system.

The core system generates no sludge, produces no odour and noise, requires no consumables, and is fully automated with minimal manual intervention required. The conventional systems process requires extra equipments and processes; but

Poseidon bypasses most of the high energy consuming equipments and works on principle of natural attached growth process, combining three organic removal processes in one single unit itself.

Conservation Measure

Poseidon is ECOSOFTT's extremely compact, packaged, robust, energy - efficient, plug - and - play natural biological wastewater treatment and recovery system. The core system generates no sludge, produces no odour and noise, requires no consumables, and is fully automated with minimal manual intervention required.

Prefabricated in stainless steel with minimum civil structures/works involved - fabrication decreases the maintenance exponentially and can be installed anywhere, e.g. on roof tops/basements, etc.

- **Homogenization tank**

  The aeration tank receives the effluent stream and treats it with an activated mass of microorganisms maintained in suspension and capable of stabilizing the substrate aerobically. The stabilization is done by breaking down and removing soluble and insoluble organic compounds from the effluent stream and converting this material into a flocculant microbial suspension, which can be separated in a settling tank.

- **ACFB Reactors**

  The Airlift Carrier Floating Bed (ACFB) reactors (three) use aerobic, anaerobic and anoxic processes together to achieve high treatment efficiency, with high levels of carbon, nitrogen and phosphorous removal in a single treatment unit. This reduces the overall hydraulic retention time in the system, thereby resulting in a highly compact and portable wastewater system.

- **OBAC reactor**

  This system includes in-built Ozone disinfection and activated carbon, making the treated effluent fit for reuse directly in car washing, gardening, landscaping, general cleaning and toilet flushing.

Capacity Building & Project Scalability

The modularity and scalability of the system from 5,000 LPD and 15,000 LPD (further multiples) with short on-site installation time is in line with the vision of green and blue building requirements. The system is based on Mother Nature, uses naturally available local material, hence reducing the overhead costs dramatically.

Project Update

Based on the principles of bio-remediation, ECOSOFTT has come up with Aerobic Biofilter without Sludge (ABWS) technology. This is a low-cost, efficient solution for single homes, as well as communities. It uses 80% less energy and requires no chemicals and does not generate sludge.

HSBC - WASH in partnership with SAFE

Case Study	:	Community Initiatives by Industry
Area of Work	:	Water Sanitation and Hygiene for Urban Slums
Project Name	:	'WASH-US'
Project Region	:	Kalikapur, Bantala, Nonadanga and Raina in Kolkata
Key Impact	:	Safe water and sanitation through solar energy

About HSBC & SAFE

HSBC Bank India is an Indian subsidiary of UK-based HSBC Holdings, with its operational head office in Mumbai. It is a foreign bank under the Banking Regulation Act, 1949.

South Asian Forum for Environment or SAFE is a registered civil society organization working at science-society interface towards environment, sustainable development and poverty alleviation in the Indian eco-region of South Asia since 2004.

Case Study

WASH is an acronym that stands for "water, sanitation and hygiene". The HSBC - SAFE partnership established the first project named 'WASH-US' ('Water Sanitation and Hygiene for Urban Slums') in 2014 in Kalikapur Slum in Kolkata with support from HSBC and furthered it in 3 more slums of Kolkata, viz. Bantala, Nonadanga and Rania. The unique innovative model has been scaled up in Northeastern India by the World Bank.

Initiative

The intervention is an integrated community based holistic plenary on 'water and sanitation' issues of urban poor, inhabiting the slums of metropolitan cities in India. The facility has an improvised Solar Power run water-treatment plant sustained on harvested surface water in ponds and supplying budgeted volume of drinking water to slum dwellers at a nominal and affordable price, along with a common hygienic sanitation unit for them.

Impact

WASH interventions were carried out in four slums with 1800 households and nearly 10,000 people. Water borne disease occurrence decreased by 68-70% in 30 months leading to a 47-55% reduction in medical expenses and 45-50% reduction in school dropouts. 40% women saved time for alternative livelihood and underwent capacity building for the same. 80% reduction in social conflicts and events of domestic violence assured societal cohesion and fraternity.

The 12 installed facilities were built to run entirely on solar power, save energy and reduce CO2 emissions. The 'zero-effluent' circular design reduces water footprints by 75-80%. An average of 37000 Lt/Yr green water was harvested, 80000 Lt/day grey water reused and equivalent blue water recharged by reclaiming 120 Hectares of urban wetlands.

The integrated system recycled nearly 1700 MT/Yr Municipal Solid Waste and revived nearly 25 sq km urban habitat with plantation and wetland conservation to leverage as a green quotient. There was a direct and positive impact on the lifestyle of the beneficiaries and the basic amenities like health education and habitat could be assured without any compromise on the livelihood.

Conservation Measure

The community enjoys the facility with a contributory 'service fee' for maintenance and earns revenue by micro-retailing the excess of potable water to urban consumers in the area. A biogas plant fed with the refuse of community toilet and other organic garbage of the area supplies to a community kitchen in the daytime and generates electricity to illuminate strategic points at night for the safety and security of women. The project promotes a sustainable revenue return model for unrestricted access to WHO-recommended safe drinking water through micro retail services for community and clean sanitation facility.

- **Renewable Energy in WASH**

  The intervention provides 24x7 safe drinking water to the beneficiaries through automated water dispenser using a chip enabled RFID touch-card. A 7.5 kVA photovoltaic solar plant runs a 100 Ltrs/hr membrane filtration unit for water treatment. The zero-effluent 'cyclic design' of the intervention enables effluent from the treatment plant to flush hygienic bio-toilets, whereas the effluents of bio-toilets generate biogas and bio-manures to earn nominal fees for these services. The excess of drinking water and solar energy is sold to urban communities and power grid respectively, for earning additional revenue.

- **Cyclic Economy: The Entrepreneurial Model**

  The intervention is run and managed through women-led Joint Liability Groups (JLGs), who are trained and initiated to the business model through capacity building. These JLGs are bank linked and share the profit for inclusive growth and extend community services and benefits too. The intervention has the business potentials for scaling up and can be credit linked to bank finances as a small-scale enterprise. The gross monthly income from sale of water and power with service fees collected from sanitation, biogas and bio-manure is used to sustainably bear the operational cost of each WASH-US unit. 80% of Cash Flow After Tax is kept as reserve for scaling up and rest 20% is distributed as profit to JLGs.

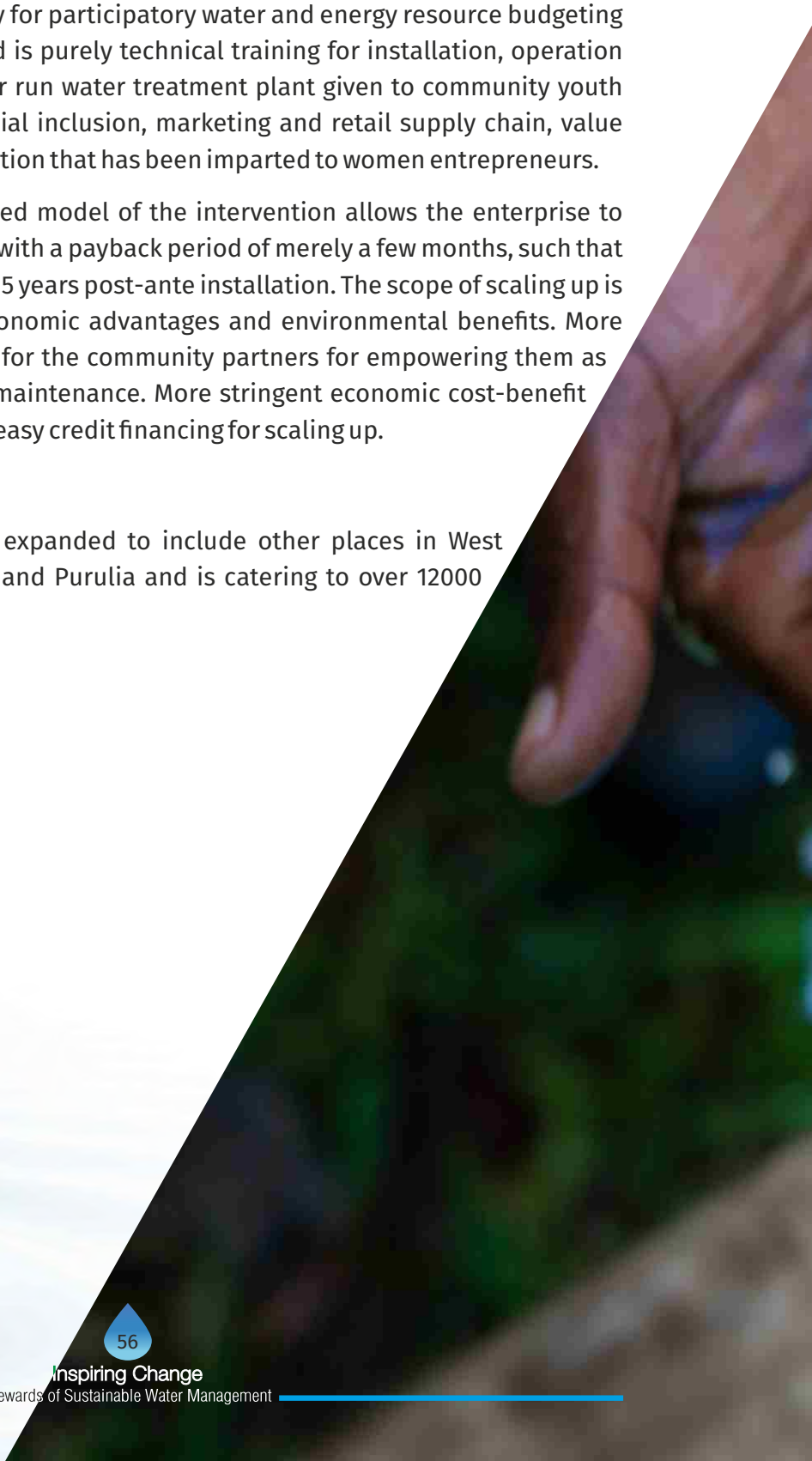
Capacity Building & Project Sustainability

While stakeholders find great prospects in showcasing it as a sustainable climate adaptive intervention in an essential service segment with a circular design, the community partners benefit from revenue returns, insurance coverages and financial inclusion for inclusive growth, sustainable development and poverty alleviation other than the facility of equitable access to water energy health and sanitation for the community. Three tiers of skill building are involved in this intervention, the first one is a community-based activity for participatory water and energy resource budgeting and its allocation; the second is purely technical training for installation, operation and maintenance of the solar run water treatment plant given to community youth and the last one is on financial inclusion, marketing and retail supply chain, value chains etc for business promotion that has been imparted to women entrepreneurs.

The sustainable revenue linked model of the intervention allows the enterprise to scale-up and grow on its own with a payback period of merely a few months, such that the facilities will triple in next 5 years post-ante installation. The scope of scaling up is very high given the socio-economic advantages and environmental benefits. More capacity building is required for the community partners for empowering them as well as reducing the cost of maintenance. More stringent economic cost-benefit analysis is also important for easy credit financing for scaling up.

Project Update

Today the project has been expanded to include other places in West Bengali like the Sunderbans and Purulia and is catering to over 12000 marginal households.





Case Studies

ITC Limited

Case Study	:	Community Initiatives by Industry
Production Sector	:	FMCG, hotels, packaging, paperboards & specialty papers, agri-business
Project Name	:	Water Stewardship Programme (WSP)
Project Region	:	Districts of Andhra Pradesh
Key Impact	:	Integrated Watershed Management, Harvesting and Rejuvenation

About ITC

ITC Limited is an Indian multinational conglomerate headquartered in Kolkata, West Bengal. Established in 1910 as the 'Imperial Tobacco Company of India Limited', the company was renamed as the 'India Tobacco Company Limited' in 1970 and later to 'I.T.C. Limited' in 1974.

ITC has a diversified presence in Fast Moving Consumer Goods (FMCG), hotels, packaging, paperboards & specialty papers and agri-business.

Case Study

The survey showed that farmers residing in ITC's catchments are smallholder farmers with limited investment capacity who practice rain-fed agriculture and are most vulnerable to impacts of climate change. ITC Social Investments Programme, Mission Sunehra Kal (MSK) designed Water Stewardship Programme (WSP) with the end objective of 'Water for All- Today and Tomorrow'. The intervention is in line with ITC's commitment to the Triple Bottom Line Performance and its implementation targets "Positive Water Balance" in those locations.

- **Initiative**

  Managing supply side augmentation and demand side management (water efficiency in agriculture) in communities in ITCs core operational catchments (agri-business and factory catchments).

- **Impact**

  The project saw enhanced water availability for irrigation, improvement in soil and moisture regime of the area (e.g. soil organic carbon) which in turn strengthened the farming system. Change in the cropping pattern and cropping intensity (shift from mono-cropping to two or more crops in a year) was also encouraged. An overall improvement was noticed in agricultural productivity and farm income for the smallholder farmers. There was also a reduction in seasonal migration of the landless and farm-labour as on-site and on-farm employment and productivity increased.

The impacts documented by various independent assurance providers have reported increase in crop yields by 20-25%, reduction in cost of cultivation by 25-30%, improvement of groundwater table by around 40% and an increase in soil organic carbon (SoC). Improved water availability has also reduced the daily drudgery of fetching water for women and boosted cattle rearing.

Conservation Measure

Supply Side Management Activities

Through construction/renovation of water harvesting structures; and promoting water efficiency in agriculture like drip irrigation/sprinkler, ring bund/mulching in coconut & banana, zero tillage method of sowing for wheat, broad bed furrow for soybean, direct seeding of rice (DSR)/mechanized paddy transplanter (MPT) method of sowing rice, composting and many more sustainable agricultural package of practices; to ensure water efficiency in agriculture for its farmer stakeholder.

Demand Side Management Activities

Promoting agronomic practices like ring bunding, mulching, zero tillage, BBF, and many more activities. Cost effective technologies to arrest soil erosion, conserve soil-moisture, recharge aquifers, and reduce excessive groundwater withdrawal were provided to promote water use efficiency in agriculture.

The project focused on agronomical and micro-irrigation practices and 95.04 million CuM water was saved during the year 2018-19, covering 1.54 lakh acres of area through various water efficient practices. Zero tillage was promoted on over 1 lakh acres of wheat and Broad Bed Furrow in more than 33 thousand acres of soybean. Over 5,800 sprinkler/drip sets are in operation to promote water use efficiency and over 40,600 compost units installed to improve soil quality.

Community Participation

Under this programme, Farmer Field Schools (FFS) and Water User Groups (WUGs) were formed from amongst the beneficiaries, who actively participated in all stages of the programme from planning, implementation, monitoring and evaluation of the intervention, to strengthen community based organizations to impart knowledge to communities on water conservation. Women self-help groups were formed and strengthened in water stewardship programme locations through which women are encouraged to be part of the water user groups and also take up livelihood activities which are women centric.

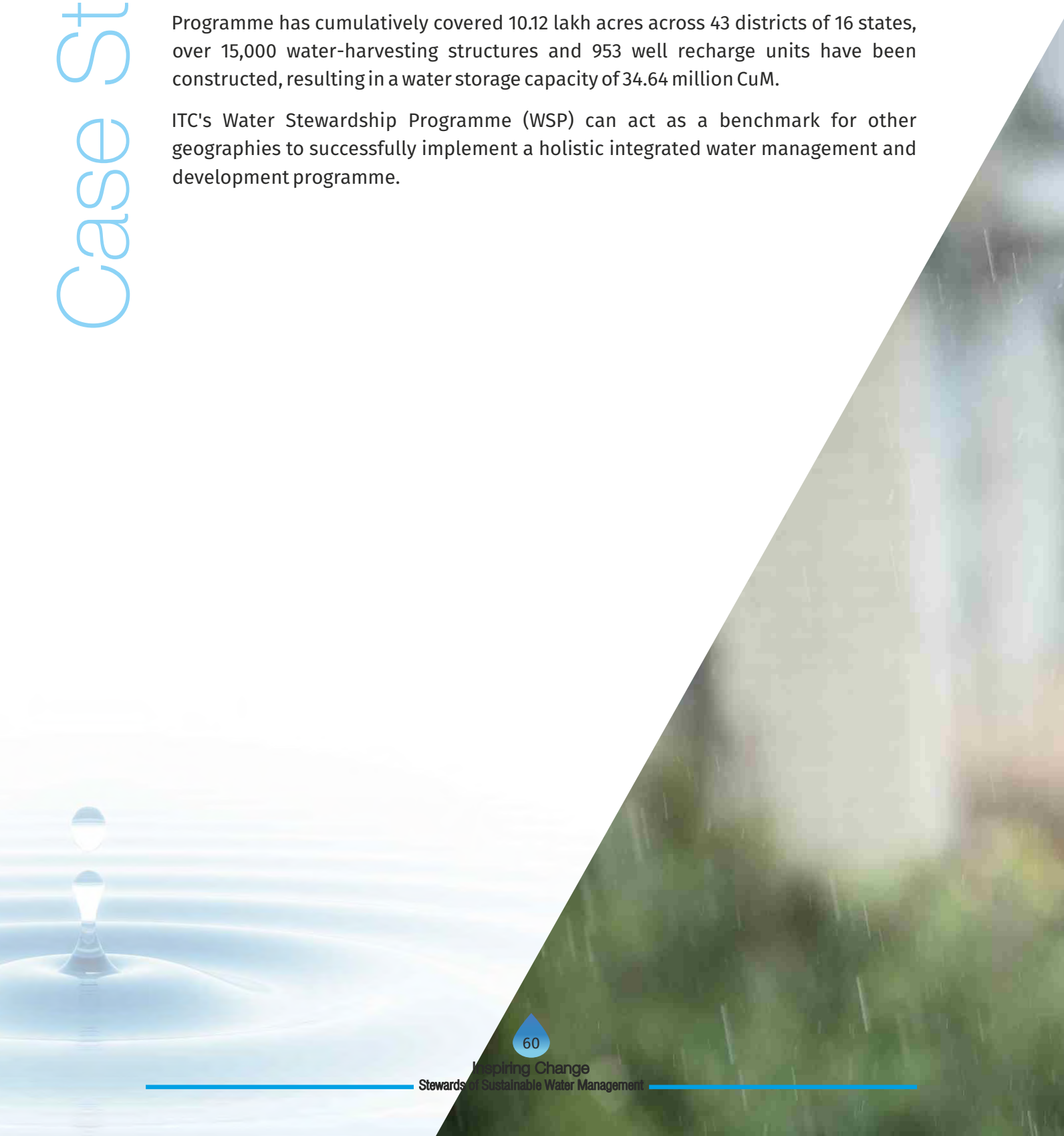
The programme strengthened over 2,700 WUGs with a membership base of over 49,000 members and impacting over 3.10 lakh beneficiaries by generating 5.9 million person-days of employment through its water stewardship activities across 43 districts of 16 states.

Capacity Building & Scalability

The programme's core thrust is on forming and strengthening community based organizations (CBOs) to drive ownership, participation and ownership, asset creation for community and multi-stakeholder partnerships for mobilisation of resources and technology. Building of strong community based organizations (CBOs) led to strengthening the local communities' capacity to leverage and channelize government funds and schemes.

Programme has cumulatively covered 10.12 lakh acres across 43 districts of 16 states, over 15,000 water-harvesting structures and 953 well recharge units have been constructed, resulting in a water storage capacity of 34.64 million CuM.

ITC's Water Stewardship Programme (WSP) can act as a benchmark for other geographies to successfully implement a holistic integrated water management and development programme.





Case Studies

ITC Maurya

Case Study	:	Industrial Water Use Efficiency
Area of Work	:	Hospitality
Project Name	:	Sustainable Water Conservation
Project Region	:	Delhi
Key Impact	:	Water Conservation, Wastewater Treatment, Rainwater Harvesting

About ITC

ITC Limited is an Indian multinational conglomerate headquartered in Kolkata, West Bengal. Established in 1910 as the 'Imperial Tobacco Company of India Limited', the company was renamed as the 'India Tobacco Company Limited' in 1970 and later to 'I.T.C. Limited' in 1974. ITC has a diversified presence in fast moving consumer goods (FMCG), hotels, packaging, paperboards and specialty papers and agri-business.

Case Study

The Triple Bottom Line approach is the driving force that defines ITC's sustainability vision and its growth path. ITC Maurya, a premier luxury hotel, is located in the heart of Delhi. The unit has contributed in Energy Efficient Dishwasher, Condensate Recovery System, Automatic Tube Cleaning System, Agni Sumukh Gas Burner, Sewage Treatment Plant etc. to reduce the water requirement and optimize the process.

Initiative

The hotel undertook a host of multi-faceted programmes to not only improve its own environment, but also to propagate environmental causes. The guiding principle is 'Triple Bottom Line Approach' which considers Socio-Economic & Environmental impact and thereby creates a Planet Positive experience for their Guests. The hotel has its own long term water sustainability programme, encompassing local participation, creating awareness among employees and internal conservation, through energy and water saving, state of the art technologies, external water audits and usage of environment friendly material.

Impact

The hotel has a benchmark of 320 litres per head total consumption per day excluding laundry, kitchen, staff and water bodies. ITC Maurya's per head water consumption in 2016-17 was 300.5 litres which has successfully reduced to 251.4 litres in 2017 - 18. ITC Maurya has reduced freshwater consumption of the plant by 10 lakh litres compared to 2016 -17 while increasing production of food and beverages.

Conservation Measure

ITC Maurya focuses on integrated water management including water conservation and harvesting initiatives at its units.

- **Efficiency in Day-to-Day Operation**

  The Dry Cleaning Machine is based on a heat exchanger cooling and distillation process. To save water the input water of the heat exchanger is used by tapping chilled water line and drain water pipeline. It improves the machine performance by 7%, saving about 6,170 litres of water. The water from the dry cleaning process is sent to the Sewage Treatment Plant (STP).

  The new energy star certified Dishwashing Station has sensors to adjust the cycles for optimum cleaning with minimum water and energy use. Its control jets allows efficient use of detergent and water through the cycle.

  The water efficient Vegetable Washer & Immersion Cleaning Machine has washing and spinning in one programme sequence without having to put the salad/vegetables into another basket self-cleaning programme. This saves water and power.

  The automatic Chiller Tube Cleaning System continuously cleans the condenser tubes of the chiller plant, eliminating water wastage from manual process and prevents fouling inside the tubes, while maintaining constant heat transfer and improvig energy performance.

  Automatic Purging Valve quickly and effectively removes the air trapped inside the chilled water pipeline. Air in the water system can cause corrosion, reduce efficiency, cool rooms inadequately and cause problems.

- **Technology Interventions**

  The Agnisumukh Gas Burner is a convection cum radiant heat burner which has infrared rays capable of penetrating the tiniest water molecules and passing heat through them. It produces uniform heat without burning while retaining the moisture of the food, therby requiring lesser water for cooking as compared to regular conduction type of cooking range.

  The Automatic Swimming Pool Robotic Cleaner is a vacuum cleaner intended to collect debris and sediments from the swimming pool with minimal human intervention. Use of robotic pool cleaner is more energy efficient than a standard main pool filter system. Saving on chemical usage - it vacuums all type of debris and removes algae and bacteria thereby substantially reducing the amount of chemicals needed and water wasted.

  Cooling Tower 3D Trasar technology platforms help to optimize scale, prevent corrosion, scaling and microbial fouling with the help of innovative chemical

sensors and control algorithms. Reduces chemical consumption and water discharge and saves substantial amount of water by raising cycles of concentration. Maximizes cooling tower performance.

- **BioAmp Wastewater Treatment System & Reuse**

  ITC Maurya has a membrane bioreactor based sewage treatment plant which is a combination of biological wastewater treatment and membrane filtration. Pollution due to biodegradable matter is reduced using bacteria and microorganisms. BioAmp is an on-site microbial fermentation and delivery system that automatically produces active, naturally occurring bacteria, every day and delivers 30 trillion live bacterial cells every 24 hours into the drains, grease traps or wastewater systems. Following biological treatment, the activated sludge is separated from the treated water by a microfiltration membrane. The unit utilizes treated wastewater within the building for gardening, air-conditioning (cooling towers), flushing toilets, road washing. Excess treated wastewater from the STP is sent to neighbouring complexes for their gardening purposes, thus reducing overall groundwater intake.

Capacity Building & Project Sustainability

ITC Maurya has a long-term water sustainability programme, encompassing local participation, creating awareness among employees and internal conservation, through energy and water saving, state of the art technologies, external water audits and usage of environment friendly material.

Since the overhauling and upgradation of the ETP there has been a significant increase in treated sewage water. The surplus treated water is used by civic bodies like NDMC to maintain the greenery along the roads, flyovers, in the parks, the Dhaula Kuan ridge area forests and other public areas in the hotel vicinity.





Case Studies

Jain Irrigation Systems Ltd. (JISL)

Case Study	:	Innovation in Water Technology
Production Sector	:	Integrated Irrigation Solutions (IIS)
Project Name	:	Ramthal Integrated Micro Irrigation Project
Project Region	:	Ramthal, Upper Krishna Project, Karnataka
Key Impact	:	Increased Water Use Efficiency, Equitable Distribution of Water

About JISL

Jain Irrigation Systems, often known as Jain Irrigation (JISL) is a multinational conglomerate organisation based in Jalgaon, India. It develops, manufactures, supports and sells diversified products, including drip and sprinkler irrigation systems and its components, integrated irrigation automation systems for monitoring and control, dosing systems, PVC and PE piping systems, plastic sheets, greenhouses, bio-fertilizers, solar power, solar water-heating systems, solar water pumps, turnkey biogas plants, photovoltaic systems and tissue culture plants. JISL also processes dehydrated vegetables, spices, concentrated & frozen fruits or pulp. It also provides turnkey projects and agronomical support services.

Case Study

Ramthal is a village located in Hungund Taluk, Bagalkot district of Karnataka in India. The area was suffering from a water crisis. Main water source is backwater of Narayanpur reservoir. Ground water table was too deep and PH very high. This backwater was being lifted and delivered to main delivery chamber provided under Marol Lift Irrigation scheme. 60% water is lost during canal irrigation due to conveyance, evaporation, percolation and seepage. Under rainfed agriculture, the farmers could only plant one crop per year. In 2005, the Karnataka government decided to combat the water crisis in the area by utilizing available water efficiently through a lift and micro irrigation project.

Initiative

Under this integrated project, water is delivered directly using HDPE / PVC piping network to irrigate 30,381 acre command area through Micro Irrigation System by providing pressurised piping network.

Impact

Integrated micro irrigation solutions consist of closed piping networks right from the source to the root zone of crops. This results in huge savings of water and substantial increase in crop yields, savings in input costs, fertilizers and energy, as well as

equitable distribution of water among farmers. This project is providing irrigation facilities to 7382 beneficiaries.

Conservation Measure

Survey, investigation, planning, designing, supply and execution of distribution system was carried out using HDPE / PVC piping network.

- **The Irrigation System**

  This backwater is lifted and delivered to main delivery chamber provided under Marol Lift Irrigation scheme. Near this main delivery chamber sump a centralised pumphouse is constructed from where water is lifted through high density polyethylene (HDPE) or Polyvinyl chloride (PVC) distribution network and used to provide irrigation to an area od 12300 ha through drip irrigation systems. Centralised self-cleaning filtration units are there at the pump house. Secondary automated filtration units have been installed at the block level (100 ha each). The disposal of back-washed water of all the filters installed in the pump house is carried out through approach channel/forebay structure where routine seasonal maintenance of silt deposition is done.

- **Fully Automated Technology Innovation**

  The SCADA system (Supervisory Control and Data Acquisition) is being used in agriculture applications and specifically in irrigation systems management. Water is distributed through pipe network with modern wireless automation system to farms. Fertigation equipment is provided at farmer level for the drip system. The farmers can regulate irrigation in their farm using technology through mobile phones. Filtrations provided under the project are fully automatic self-cleaning type filters.

Capacity Building & Project Replicability

Agronomists are available for each Block with Field Assistant provided to each Water User Association (WUA). Training is provided to the farmers and WUAs as required while monitoring of data is also done.

The Integration Irrigation Solution (IIS) technology provides for tailor made options which can be replicated in any difficult terrain as per the prevailing climatic and demographic conditions.

JS Water Energy Life Company

Case Study	:	Urban Wastewater Management
Area of Work	:	Development & Manufacturing of Integrated Nanoscale Nutrients
Project Name	:	Revival of River & Lake Sub-Eco Systems through Bioremediation
Project Region	:	Nag River, Naik Talav in Nagpur/ Centurion Lake, Bhubaneswar/ Jajmau Tannery Plant, Kanpur/ Laksar Drain
Key Impact	:	Wastewater Management, Water Quality Improvement

About JS Water

JS Water Energy Life Company is based in Udyog Vihar, Gurgaon. Incorporated in 2010, it is engaged in development and manufacturing of integrated nanoscale nutrients for Bio-remediation of polluted rivers and lakes, agriculture and aquaculture.

Case Study

Industrialization and urbanization contribute to freshwater ecosystem degradation worldwide. Urban watercourses suffer from elevated and fluctuating concentrations of nutrients and various contaminants causing changes in species assemblage composition, with increase in the number and abundance of pollution-tolerant species. JS Water Energy Life Company works to improve and sustain water quality to a very high level.

Initiative

JS Water Energy Life Company's bioremediation using nano-nutrient product 'Aquaritin' works in rivers, drains, lakes, bays and dead zones to rapidly improve water quality, enhance aquatic life, revive eco hydrology system, sequester carbon and neutralise breeding vectors. It is a cost-effective solution to revive the river and lake sub-eco systems in order to restore the aquatic foodchain leading to improvement in the water quality and livelihood of fishermen. The latest innovation is a solution through nutrient intervention rather than living micro-organisms so that the solution there is not in conflict with the native microorganisms.

Impact

Accelerated bioremediation leads to an increase in dissolved oxygen (DO), removal of nitrogen and phosphorous and reduced TSS (Total Suspended Solids) and TDS (Total Dissolved Solids). It also enhances microbial activity, controls algae, reduces odour and lowers energy costs. There is an elimination of unwanted Blue Green Algae (BGA) progressively with each dose. This reduces exposure to toxicity of the inhabitants who live near river. There is a visible reduction of mosquito larvae. BOD and COD levels fall significantly within 6-8 weeks when dosed weekly. This leads to better aquatic life in the lake, higher fish levels, higher fish biomass and fish protein levels.

Conservation Measure

Aquaritin is a breakthrough nanoscale integrated mixture containing 12 essential nutrients in a single liquid formulation prepared through a unique process using special components which does not allow interaction of cations and anions. It also contains special inhibitors for retarding growth of unwanted algae. These nutrients are utilized by diatoms to grow and divide. The population of diatoms doubles every day provided the nutrients for its growth are bio-available. Inhibitors retard growth of unwanted algae and balance the phytoplankton spectrum even in the presence of continuous inflow of untreated sewage. Aquaritin does not contain any live organisms so it does not conflict with native biodiversity. Once dosed in the water in diluted form, it disseminates into the entire water body through effective polarization.

- **Wastewater**

  Bioremediation was able to revive drains and lakes much faster and more efficiently than the STPs. In Nag River, for example, the BoD levels were brought down by 96% from 110mg/l to 3.41 mg/l in 14 days as compared to a few years by conventional wastewater treatment. The new technology pushes molecular oxygen in pico scale compared to milli or micro scale by STPs. It can reduce nutrients (N and P) which STPs cannot do to this level, unless expensive nutrient removal systems are fitted or added.

- **Aquaculture**

  Many urban and peri-urban ponds are being used for aquaculture. The fish stock harvested every year is in the range of 2000-3000 kg/Acre. The fish mortality is very high. Using Aquaritin (Aqua variant) the production can be sustained at over 20,000 kg/acre with mortality as low as 0.2%.

Project Sustainability & Scalability

Major cost savings would include capital cost of the STP plant and sewage pumping systems, as well as irrigation and drainage systems infrastructure.

The technology is readily scalable. The technology can revive major rivers in 12 months and minor rivers within 6 months using impact projections (not actually done). Water clarity will improve with regular usage of Aquaritin. Aquaritin, leading to a natural aeration of the lake, will lead to bio-dredging of the sludge from the lake. Air quality will improve as the diatoms have a tendency to absorb carbon dioxide from the atmosphere. There will be 15-20 % improvement in the air quality.

Project Update

Since the time of project inception, bio-remediation using Aquaritin has been carried out for many project in different states. One project involved two ponds Radhey Kund and Shyam Kund, located in Mathura situated in the state of Uttar Pradesh.With funding from Mathura Vrindavan Development Authority, JS Water Energy Life Co Pvt Ltd has successfully implemented the Quick Bioremediation Project using Moringa seeds and the nano-nutrient product 'Aquaritin'.

JSW Steel Ltd. (JSWSL)

Case Study	:	Industrial Water Use Efficiency
Project Name	:	Water Harvesting
Project Region	:	Toranagallu, Karnataka
Key Impact	:	Water Conservation and Zero Liquid Discharge

About JSWSL

JSW Steel Ltd. formerly known as Jindal Vijayanagar Steel ltd. (JVSL) is an Indian steel making company owned by the JSW Group based in Mumbai, Maharashtra, India. Since its merger with ISPAT Steel, JSW Steel has become India's second largest private sector steel company. It is one of the fastest growing companies in India with a footprint in over 140 countries.

Case Study

JSW has its environmental policy as a part of its Environment Management System. Preservation of environment and natural resources is included in JSW's vision statement itself which states that "Global recognition for quality & efficiency while nurturing nature and society".

Initiative

Integrated steel manufacture involves several process operations from ore processing to steel finishing requiring different quality of water in their processes. All the sewage generated from the townships is reused in plant operations and horticulture. All the townships of JSWSL are Zero Liquid Discharge units. The blow down from one unit can be used as make up in another unit using relatively lesser quality of water in its operation.

Impact

A total of 21,700 m3 of recycled industrial effluents water is reused in the plant process after treatment. Remaining sewage treated water is used for Greenery Development of 1700 acres, total area being 7860 acres. In the residential colonies, 345600 m3 of water is recovered from the V V Nagar Suspended Aerobic Fixed Film (SAFF) and 864000 m3 from Shankar Hill Town Membrane Bio Reactor (MBR), which are both reused in the factory process. The Vidyanagar STP Fluidized Aerobic Bioreactor (FAB) generates 432000 m3 of treated water and Vidyanagar STP Reed bed 288000 m3, both of which are used for Greenery Development. From sewage treatment, recycling and reuse of water, the plant JSW saves approximately 23.4 lakh m3 of water annually.

Conservation Measure

JSW being a ZLD plant does not discharge any effluents from the plant boundary. Since inlet water enters the plant boundary with salt load and some amount of salt is added to water system in the process, it becomes essential for the plant to remove the salts from the water system for the sustained recycling/ reuse practice. It follows the '3R' strategy of Reduce, Reuse and Recycle for waste management. JSW has installed flow meters to measure water drawn from source, water consumed at each departments and discharges from each department.

- **Effluent Treatment**

  JSW has an EMD RO plant and the JSW EL RO plant which anuually saves 2,48,400 m3 and 437400 m3 of water. It also has the largest installation of Ceramic Membrane for Oil and Grease removal in the world which saves 842400 m3 of water annually. The plant has a unique Biological Treatment-MBR- RO- ZLD system for its Coke Oven Effluent treatment which saves 464400 m3 of water. It also has a CO2 injection system for hardness removal in Steel Melting shop as well as GCP and Water Evaporation Retardants for evaporation control.

- **Rainwater Harvesting**

  JSW has built rainwater collection and reuse system. Five rainwater collection ponds with connecting drains have been constructed, with 4 rainwater harvesting ponds connected with the storm water drains. The rainwater harvesting structures have a capacity to collect, store and reuse 56,75,000 m3 of rainwater. It has divided its total area into 4 catchments sections and storm water drains are connected to a pond in each section. The water collected in the ponds are used in the plant process. 100 % of harvested rainwater is used for storage. However, since the harvesting ponds are not lined, it is observed that the groundwater level near the collection ponds has increased significantly.

  JSW has installed 54 numbers of piezometric stations within its plant boundary and ground water quality and groundwater levels are measured.

Capacity Building & Project Replicability

Mandatory training on Environment Management is a part of the induction program for all the new joinees. In an effort to improve the knowledge base in Environmental Facilities' Operation and Maintenance, dedicated training programs are conducted for the shop floor operators operating Air Pollution Control Equipment, Wastewater Treatment plants and Solid Waste management teams. JSW organizes mass communication through various environmental competitions and events and conducts/ hosts workshops related to water management and conservation.

Several initiatives taken by JSW for water conservation though are unique to the Indian steel industry; they are replicable in varying scales in other industries, e.g the Ceramic Membrane for Oil and Grease removal, the Biological Treatment-MBR- RO-ZLD system for Coke Oven Effluent treatment, the CO2 injection for hardness removal in Steel Melting shop GCP or the Water Evaporation Retardants for evaporation control. The basic requirement to execute these measures is the sound knowledge on the characteristics of the wastewater to be treated and preliminary knowledge of Environmental Engineering.

Project Update

JSWSL has established a Total Water Management approach; as a result the water is extensively used by cascading from one process to another, ensuring a zero discharge plant. In 2018 JSW Steel expanded its operations from 16 MTPA to 18 MTPA.Water consumption was optimised by treatment of water to the extent possible and recycling of treated water as make-up in the network. The recovery of water in 2018 from the existing seven RO Plants was 22,000 m3/d and an additional 8400 m3/d of RO permeate has been recovered since then from the ZLD plant of Coke-5 and a centralized RO plant.

FICCI

Case Studies



Kirloskar Oil Engines Limited

Case Study	:	Industrial Water Use Efficiency
Production Sector	:	Combustion engines, generating sets and parts
Project Name	:	Water Conservation and Wastewater Recycling
Project Region	:	Kagal, Kolhapur district, Maharashtra
Key Impact	:	Water Conservation

About KOEL

Kirloskar Oil Engines Limited (KOEL or the Company) incorporated in 1946, is a leading engineering conglomerate manufacturing internal combustion engines, generating sets and parts, which are used for various applications, such as agriculture, industrial, stationery power plants and construction equipment. The Company specializes in the manufacture of both air-cooled and liquid-cooled diesel engines and generating sets.

Case Study

The climate of Kolhapur district, located at the southern end of Maharashtra State, is characterized by general dryness except during the south-west monsoon season. KOEL is therefore moving from an "end-of-pipe" reactive strategy to a more holistic approach.

Initiatives

Water conservation through technology during production, effluent treatment and wastewater reuse, and rainwater harvesting is done by KOEL, in and around their plant.

Impact

Reduction in water usage has been from 35 to 61% with an average reduction of 38%. The ETP has been switched over to continuous treatment process from batch process, which has resulted in lowering fresh chemical consumption by almost 60% as well as 40% ETP sludge reduction. The reduction in effluent generation is from 22283.65 to 14269.3 m3. 100% of the generated effluent is treated in the ETP, leaving zero discharge.

Conservation Measures

KOEL has implemented various water saving projects including major rainwater harvesting initiatives at Kagal. Recycle and reuse strategies ensure zero discharge from the plant.

- Water Reduction during Production

  The water intakes for industrial purpose are from municipal fresh water supply and rainwater harvesting. Water use is minimised at impregnation plant by

modifications in water filling cycle and Fire Hydrant Line to avoid water loss. Use of Pressmatic Cocks for washing utensils in the central kitchen area and in washbasins saves water as they have a much lower flow rate that allows only a fixed quantity of water to flow with every press. Adoption of water saver nozzles is also in place wherever washing is required.

- **Rainwater Harvesting**

  Earthen Bandhara (vantale), rainwater harvesting ponds and storm water storage tanks have been constructed to put a good rainwater harvesting system in place. The total available runoff to be recharged, considering 4 rainy months in a year, is 2093 m3/day.

  Monitoring of groundwater recharge is through a mechanism which includes installation of piezometer to identify the groundwater levels and extract within permissible limits. Harvested rainwater is used for industrial cooling after filtration. Reduction in water consumption is achieved during Genset production pre-treatment by using rainwater in place of freshwater. Harvested rainwater is used in the ETP processes like washing and also for washing utensils in the central kitchen area.

- **Wastewater Recycling & Reuse**

  The ETP has activated carbon filter and pressure sand filter for better quality of treated effluent. Bioreactors are also used for wastewater treatment, followed by a comprehensive tertiary treatment. The ETP lab has been modified for analysis of effluent parameters like BOD, COD, TDS, etc. 100% of the treated effluent is reused for gardening and toilet flushing after consistent mixing with domestic effluent and all plants are reported to be ZLD compliant. More than 4 lakh m3 (almost 20%) of water was recycled and reused during 2017-18 in Kagal. Co-processing is done using alternate fuel of ETP sludge (approval from SPCB is pending). Hand washing wastewater is used for gardening, which alone saves almost 936 m3 of water per year. Harvested rainwater is used for industrial processing, cooling and landscaping.

- **Awareness Generation & Capacity Building**

  Activities carried out for awareness creation include: Training programmes; interaction with Gram Panchayats; display of Water Consumption and Water Balance at prominent locations inside the plant; organising various competitions like EnCon week etc. Awareness generation also includes visits to nearby villages to monitor groundwater levels and formulate the required actions to mitigate the impacts etc. Water audit is done through daily monitoring and reviewed through meetings.

NTPC Limited

Case Study	:	Innovation in Water Technology
Area of Work	:	Thermal Power Generation
Project Name	:	Technological Solutions for Water Conservation and Efficiency
Project Region	:	50000 + MW stations
Key Impact	:	Water Conservation and Efficiency

About NTPC

Headquartered in New Delhi, NTPC Limited, formerly known as National Thermal Power Corporation Limited, is an Indian Public Sector Undertaking, engaged in the business of generation of electricity and allied activities. NTPC's core business is generation and sale of electricity to state-owned power distribution companies and State Electricity Boards in India. The company also undertakes consultancy and turnkey project contracts that involve engineering, project management, construction management and operation and management of power plants.

Case Study

NTPC-NETRA is the Research & Development arm of NTPC, catering to the need of 50000 + MW stations, by means of offering technological solutions, validation of innovative technologies, and scientific support. Described here is an innovative and effective technology which is in operating condition and having high potential for converting waste water into good quality (distilled) water using waste heat, which is available in plenty in coal based thermal power plants.

Initiative

NTPC follows a two-pronged approach to drive water conservation and efficiency at its projects. Firstly, it is minimizing its fresh water usage and making its processes water efficient through implementation of state-of-the-art technologies and process re-engineering. Secondly, through policy intervention and capacity building NTPC is ensuring that good quality fresh water is available in and around its plant locations. It has developed the roadmap for "Zero Liquid Discharge (ZLD)" for all of its plants, 3 among which have already been declared as ZLD plants.

Impact

The technology solutions have demonstrated their capacity for water saving, heat rate improvement, water reuse and minimisation of water discharge. Widespread adoption of these technologies could lead to NTPC producing not just power but safe drinking water.

Conservation Measure

The water technology group has been active in achiving its goals in water conservation, and compiled here some of the most important and effective

technologies which are in running condition. These technologies have given NTPC the opportunity to address some long-standing problems. In total eight technologies have been highlighted, which have demonstrated their capacity for high water saving, heat rate improvement, water reuse, minimisation of water discharge, and use of sewerage water.

- **Water Saving Technology**

  Cooling towers in power plant consume the largest share of water. At NETRA a new technology chemical formulation has been developed which is able to raise cycles of concentration (COC) in its cooling water system saving 8-10 m3/ hr of water for a 500 MW unit and almost 400 m3/ hr for a typical 1.5 GW power station. The same chemical formulation is capable to mitigate corrosion potential of the system and also keep the system from biological fouling.

  Air Cooled Condensers (ACC) are in place in three projects namely Patratu, North Karanpura and Singrauli, which has led to a saving of around 77% of water compared to a typically Water Cooled Condenser (WCC).

  Condensate Polishing Units (CPU) are capable of maintaining water quality and ensuring continuous operation of units even during condenser leakages. Generally, these units are operated for 15 days and after exhaustion of the resin in the CPU, they are subjected to regeneration. NTPC uses 3 sets of resin based condensate polishing units in the water steam cycle for each stage of power plant which enables to shorten the outage period and to reduce deionized water consumption drastically.

  Molybdate Treatment in CW system reduces specific water consumption. Chloride content in cooling water at many stations exceeds the design values and the compound Molybdate reduces this corrosion and decreases fouling problems.

  Silica mitigation - Silica exists in water in mainly two forms, Reactive (easily detected) and colloidal: (non-detectable and difficult to capture through ion exchange or RO membranes). NTPC-NETRA has developed a fool-proof diagnostic method to detect these colloids by converting them to reactive silica through chemical treatment.

  The **Non-Chemical Scale Inhibition Technology** can effectively prevent the formation of calcium carbonate scales in condenser cooling water system so that it does not deposit on condenser tubes resulting in heat loss, and water blow down (water intentionally wasted from a boiler to avoid concentration of impurities).

- **Sea Water Desalination**

  This Multi Effect Distillation (MED) plant is based on flue gas-based sea water desalination plant which is divided in to two parts. First is Low Pressure (LP) Steam Generator Block and other is Desalination Block. In this LP steam generator block, the thermal energy from exhaust flue gas Induced Draft (ID) Fan is utilized to generate hot water at desired temperature through a heat exchanger. This hot water is flashed in a chamber which is maintained under vacuum to generate low pressure steam. The flash steam is then fed to the Desalination block. As a result of the LP steam piping and vacuum in the distillation chamber, part of the sprayed sea water gets evaporated. This evaporated vapour is fed to the next distillation

chamber of the MED where it acts as working steam and the above mentioned process is repeated. Last stage of MED is condenser where vapour generated from preceding stage is condensed.

- **Effluent Recycling for Water Reuse**

  At Jhanor-Gandhar which a gas power station with capacity of 657.39 MW, approx. 4500 m3 of effluent is generated and disposed per day while operating at full load. The major portion of this effluent i.e. >95% comes from cooling water blow-down and DM plant regeneration waste. The water is treated by use of an activated amorphous alumina-silicate, high surface negative electrical charge and high surface area. The system adsorbs small particles and dissolved organic molecules from water and reduces BOD, COD and organic impurities to such an extent that output water can be reused for plant process water.

Project Sustainability & Scalability

The investment made in the domestic STP water recycling to plant can be paid back in less than 2 years and can be replicated in all existing gas power stations. The cost of the innovative treatment is Rs. 70 Lakh.

NTPC decided to replicate the Non-Chemical Scale Inhibition Technology in a competitive manner.

The Sea Water Desalination plant investment can be paid back in 4.2 years and can be replicated in any plant (e.g. coal/gas based power plant, cement plant, process industry), where waste heat is available. The Multi Effect Distillation (MED) plant has the potentiality to use low grade waste heat (around > 90 0C water or > flue gas of 120 0C) of any form from any plant to desalinate high TDS water and produce vapour distilled high quality water.

Project Update

NTPC recently signed a contract with IRCTC to set up a unit to produce packaged drinking water (Rail Neer) at its Simhadri Super Thermal Power Project in Vishakhapatnam, Andhra Pradesh. The facility will utilise patented Flash Desalination Technology (FDT) developed by NTPC-NETRA.

NETRA is engaged in several key research and technology development activities, out of which the development of Geopolymeric Cementitious Blocks through use of sea sand and sea water for is expected to directly conserve water. NTPC has also raised a Japanese yen loan worth $750 million to fund its green push and acquisition of hydel units under the Indian Government's disinvestment plan.



FICCI

Case Studies

Pan Himalayan Grassroots Development Foundation

Case Study	:	Water Initiatives by NGO
Area of Work	:	Holistic Mountain Development through self-help participation
Project Name	:	Community Managed Drinking Water Program
Project Region	:	States of Uttarakhand and Himachal Pradesh
Key Impact	:	Enhancing safe water access

About Grassroots

The Pan Himalayan Grassroots Development Foundation or 'Grassroots' has been established as a non-profit voluntary organization under the Societies Registration Act (1860) in November 1992. The primary aim of Grassroots is to initiate people's action at the grassroots for restoration of languishing river basins through holistic mountain development programs in order to improve the quality of life.

Case Study

Mountains provide between 60 and 80% of the world's freshwater. The Hindu Kush Himalaya alone is the source of ten major river systems, and about 1.4 billion people depend on its ecosystem. Chronic water shortages are being felt across the Himalayas, where springs and streams have dried up. The lack of vegetation cover needed to recharge primary water resources combined with an increasing population has rendered traditional water collection systems insufficient for meeting local needs. The need for a reliable and accessible year-round water supply has led to Grassroots' implementation of infiltration wells for drinking water and rainwater-harvest systems for sanitation purposes.

- **Initiative**

  The emphasis is on self-help participation working across the integrated issues of water and sanitation. Community managed drinking water programs were put in place in 15 villages during last year by recharging primary water sources through infiltration wells and rainwater harvesting.

- **Impact**

  As a result of infiltration wells, the average number of water scarcity months reduced from about 3 months to less than half a month, mostly during May-June as compared to February through July. Benefits of this appropriate technology has reached approximately 23 thousand households with access to safe drinking water to the tune of 3.50 million litres per day, which is 30 litres per capita per day for over l lakh beneficiaries. Implementation of these drinking water systems has generated over 1.5 lakh man-days of employment and Rs 5.85 million as wages for the local youth.

Conservation Measures

Over the years, 648 infiltration wells were created in 484 villages spread over 58 Blocks in 12 Districts in the two states of Uttarakhand and Himachal Pradesh.

- **Drinking Water**

  The "infiltration wells" are created to act as protected intake structures for subterranean water capillaries, and then fitted with a hand pump or submersible pump, to enable the drawing of water. Infiltration Wells have not only provided access to enhanced quantities of safe drinking water, but communities have also been empowered to operate and maintain such facilities without dependence on government agencies. The per capita cost of the infiltration wells are Rs. 700 as compared to Rs. 7000 for conventional systems with no risk of external contamination.

- **Rainwater Harvesting**

  A rainwater harvesting unit works simply by collecting rainwater pooling or running off the roof of a house and channeling it into a tank, where it can be stored. Before entering the tank, the water passes through a chamber where solids like leaves and rocks are filtered out. The water can then be used for washing, irrigating fields, and for cooking. The stored rainwater reduces the pressure on scarce spring water used for drinking.

- **Sanitation**

  Construction of twin pit water seal shauchalayas (toilets) have been promoted as a necessary condition before implementation of water programs in order to reduce the chances of e-coli contamination. Over 5000 toilets have been constructed and some communities have also received the Nirmal Gram Puraskar for achieving 100% coverage.

Capacity Building and Scalability

Local youth were trained as barefoot engineers with necessary skills and knowledge regarding installation, operation and maintenance of Infiltration Wells as an appropriate technology option in drinking water sector. Further, they were encouraged to form themselves into guilds and some members were encouraged to take on leadership roles in order to engage with various stakeholders including state government officials and elected members of the legislative assemblies. Grassroots also forged partnerships with other interested NGOs in the region in order to share lessons learnt and also for dissemination of technology.

The state government of Uttarakhand undertook a study regarding the benefits of this Technology Initiative and thereafter requested Grassroots to assist in spearheading this process across the state.

Pratiks Enviro Foundation

Case Study	:	Innovation in Water Technology
Area of Work	:	Water Management Services
Project Name	:	Bio Sewage Treatment Technology
Project Region	:	Chennai in the Metro Rail
Key Impact	:	Cost effective sewage treatment and wastewater recovery

About Pratiks

Pratiks Enviro Foundation is a Water Management Service provider and is a leading manufacturer of Effluent Treatment Plants, Iron Removal Plant, Bio-septic Tank, RCC Precast Water Sump etc.

Case Study

Water is critical in urban centres and reusing it is important. Currently, Chennai is facing huge water scarcity. Pratiks Enviro Foundation intervention was mainly to prevent the lorry tanker pump-out (high-pressure manually operated pumps to clean out sewers) and stop pollution of nearby water bodies with untreated sewage.

- **Initiative**

  The project led to the implementation of an urban wastewater treatment technology using the Bio-Sewage treatment method, which has no electricity requirement and very low maintenance requirement. It runs and treats wastewater by Gravity Pressure.

- **Impact**

  The Bio STP recovers 90% of wastewater at low capital and operating cost. The design needs zero electricity for ongoing operation and creates almost no sludge and no odor from the core treatment process. The initial investment to set-up a Bio STP is 30% less than conventional STPs and maintenance cost is just 3% as against 15% for a normal STP.

- Conservation Measure

  The Bio Sewage treatment technology uses anaerobic and anoxic process to achieve high treatment efficiency and high levels of carbon, nitrogen and phosphorous removal in a natural way. It requires 48 hours of hydraulic retention time in the system, thereby resulting in a high-quality treated water without having external energy. The process involves Collection Tanks, Bio Reactor tanks, Soil Bio Remediation tanks,

Clarifier and Carbon Filter. The final tertiary treatment system also includes an in-built disinfection unit which disinfects by ozonation.

- **Primary Treatment**

  As the waste is accumulated in the collection pit, it flows to 20 connected reactor tanks. Anaerobic digestion is designed to substantially degrade the biological content of the sewage. The tanks are sprinkled with bio-organisms, which break down the waste. From the tanks, the residue flows through a pump where it gets filtered and stored in sumps.

- **ACF Clarifier**

  Activated Carbon Filter (ACF) is a method of filtering that uses a bed of activated carbon to remove traces of organic contaminants, chlorine etc. using chemical adsorption process Adsorption is a process whereby pollutant molecules in the water to be treated are trapped inside the surface pore structure of the carbon substrate. ACF thus improves the colour and odour of the treated water.

- **Ozonation Disinfection Unit**

  The final tertiary treatment system also includes in-built ozonation disinfection unit, making the treated effluent fit for secondary purposes like car washing, gardening, landscaping, general cleaning and toilet flushing. This unit leads to a 70% saving of fresh water.

Awareness Generation & Capacity Building

Awareness among the communities about wastewater treatment is poor. Pratiks launched Callcentre4water for free public awareness programmes to bring about behavioral change.

The Bio STP process is being used for industrial and domestic purposes to manage wastewater. The entire urban and semi-urban market is the target segment because of the imminent acute water scarcity problem. It can also be safely implemented in rural areas to enable reuse of recycled water in agriculture. The plant can be scaled from 1 KLD plant to 1000 KLD. As it is a technology easy to adopt and maintain, it can be a step towards setting new standards for green and blue buildings at a negligible implementation cost.

SFC Environmental Technologies Pvt. Ltd.

Case Study	:	Innovation in Water Technology
Production Sector	:	Environmental Technology manufacturer for Municipal Sewage & Solid Waste Treatment
Project Name	:	"C-Tech" Cyclic Activated Sludge Technology
Project Region	:	500 numbers C-Tech STPs in different areas
Key Impacts	:	sewage treatment and water recycling

About SFC

SFC Environmental Technologies Pvt. Ltd (SFC) is a global Environmental Technology Company which provides advanced technologies in the fields of Municipal Sewage & Solid Waste Treatment. "C-Tech" Cyclic Activated Sludge Technology treats sewage to recycle quality water in a single step biological process.

Case Study

SFC has done pioneering work in bringing the best biological treatment technology, C-Tech, to treat the sewage to recyclable quality at affordable price. One of the biggest recycle project where SFC is technology and engineering partner is 130 MLD STP in Nagpur for a Thermal Power Plant. The plant is in operation for the last three years.

Initiative

C-Tech is a Cyclic Activated Sludge process technology which is the latest and 4th generation of Sequential Batch Reactor (SBR) process (industrial processing tanks for the treatment of wastewater). Several such plants have been set up across India. Some examples:

A 130 MLD STP with C-Tech process in Nagpur is supplying water to power plant for cooling tower which leads to saving the fresh water for farmers and the Municipal Corporation. In 120 MLD STP with C-Tech process in Gurgaon, 30 MLD of treated sewage is being recycled after sand filtration for toilet flushing, gardening, etc. A 10 MLD STP with C-Tech process is set up in Bhilwara, Rajasthan to supply treated water.

Impact

C-Tech produces treated effluent of recyclable quality with average values of BOD < 10 mg/l, COD < 50 mg/l, TSS < 10 mg/l. Along with main pollutants it also removes nutrients to such a low level which makes the treated sewage suitable for direct use in industries and other non-potable applications. The oxygen control system helps in saving about 50% power costs compared to conventional treatment technologies.

Conservation Measures

C-Tech is a Cyclic Activated Sludge activated sludge wastewater treatment that produces a tertiary quality effluent at the price of secondary treatment including nutrient removal. No additional Settling Unit or Secondary Clarifier is required.

The complete biological treatment is divided into cycles with each Cycle is of 2-4 hours duration, during which all treatment steps take place.

- **Fill / Aeration**

  In activated sludge process wastewater containing organic matter is aerated in an aeration basin in which micro-organisms metabolize the suspended and soluble organic matter. Influent is received into the basin through an admixture (selector) reactor. Biomass from the main aeration zone is admixed with influent load in the biological selector hydrolysis reactor Part of organic matter is synthesized into new cells and part is oxidized to CO2 and water to derive energy.

- **Settling**

  This is the process by which particulates settle to the bottom of a liquid and forms sediment at the bottom. The air is turned off and influent to the reactor basin is stopped. During the first five minutes of this sequence, the residual mixing energy within the reaction basin is consumed. At this time gentle bio-flocculation takes place and a solids-liquid interface forms under partial hindered settling conditions. These particles are recovered at the bottom of the tank.

- **Decanting**

  This is an extension of the settle sequence. The sludge, which was formed in a previous process step, settles forming a sediment and is separated at the bottom of the settler, while the purified water passes through. This is done by lowering of an effluent decanter below the water surface. Then, the supernatant water flows in the decanter and the decanter is dropped with suitable velocity and height in order to discharge a given calculated amount of treated wastewater. This allows optimum removal over the decant depth without disturbing the settled solids or floating debris.

- **The C-Tech Process**

  The C-Tech system specifically refers to the use of variable volume treatment in combination with a Biological Selector (specific organisms geared to specific wastewater) and Oxygen Uptake Rate (the rate at which these organisms consume oxygen to breakdown waste) control, which is operated in a batch reactor mode. The Cyclic Activated Sludge process technology represents a certain technical development of a process philosophy over conventional SBR technology.

Capacity Building & Scalability

Due to modular design of C-Tech, it is very easy to expand the capacity of C-Tech. C-Tech technology is extensively used for treating domestic sewage and industrial effluents to the highest possible quality, at a very low cost of treatment and by using minimum space. C-Tech has installations in almost all countries in the world, Including UK, Germany, Poland, Austria, China, Russia, Australia, Vietnam, Malaysia, Korea, New Zealand and most importantly India. 392 C-Tech Plants are under construction and 237 Plants ranging from 1 MLD to 245 MLD capacities have been successfully commissioned and are under O & M.

Shroffs Foundation Trust (SFT)

Case Study	:	Water Initiatives by NGO
Area of Work	:	Community Development
Project Name	:	"Zero Waste Village" by Solid and Liquid Waste Management
Project Region	:	Khanderaopura village, Dabhasa Gram Panchayat, Padra Block, Gujarat
Key Impact	:	Watershed Development, Safe Drinking Water Program, WASH

About SFT

Shroffs Foundation Trust (SFT) was instituted in 1980 and initiated developmental activities in 1987. The Trust provides supportive services in diverse areas such as Natural Resource Management including Watershed Area Development, Safe Drinking Water Program, Water and Sanitation, Health (Curative and Preventive services), Education and Vocational Skill development, Capacity building and skill up gradation, Agriculture and Horticulture Development, Drudgery Reduction, Livestock Management, Community Development, Women Empowerment, Children Development, Disaster Management, Livelihood Security & Enhancement programs.

Case Study

It was observed that about 63% of the Families have toilet facilities while about 60% have bathroom facilities and around 37% families wanted to avail the toilet facilities. SFT observed open disposal of wastewater, grey water and solid waste practices. The local people wanted a better solution and SFT wanted to help develop a model Zero Waste Village; so that such models can be replicated in other villages. SFT joined hands with different Corporate and Industry Houses and till now constructed more than 2500 Household Sanitary Latrine (HSL) Units and contributed in declaring 5 villages (Padra block of Vadodara District, Gujarat) as Open Defecation Free (ODF) villages.

Initiative

SFT empowered 100% families with Household Sanitary Latrine (HSL) facilities Units and make the village Khanderaopura, Open Defecation Free (ODF). They established services of door to door collection of household solid waste and implemented comprehensively planned solid & liquid waste segregation and management of these collected solid waste owned by the Panchayat. The waste is disposed through Khanderaopura Gram Vikas Samiti (a community based organization) facilitated and empowered through SFT. Recycling and reuse of waste created "Zero Waste Village".

Impact

Due to toilets constructed, the village has become Open Defecation Free (ODF), which greatly helps in reduction of contamination of the surrounding environment. There are more than 80 HH which have Vermicomposting pits/ FYM pits attached to the toilets. From the prepared bio manure through vermin-compost and farm yard manure, each farmer is expected to earn equivalent to about INR 15000 per bed per annum.

Conservation Measure

SFT developed a Zero waste at farm gate model by adopting Vermi Compost, Farm Yard Manure and Vermi Wash techniques and ready farm manure to be used in 15 acres of farming. Also adopted was chemical free Bio-Technology driven wastewater treatment.

Project Planning and Conceptualization

SFT conducted village level meeting with all stakeholders and shared the outcomes and possible solutions for model village. Undertaken technical feasibility for recycling of waste water along with Bio-Filter plant and prepared Micro plan for Village Development by involvement of all the stake holders. Shared Village Development Plan was also made and activities were prioritized in village meetings.

Project Implementation

Village Swachhata Committee was formed with 11 members including 50% female members, representing equal participation from all the Mohallas and castes of the village. They were sensitized and were strengthened for the appropriate set of skills. They took a lead role in counseling of beneficiary families, resolved conflicts among Mohalla and with Gram Panchayat, ensured quality of works and timely implementation of different activities.

With the implementation of Bio-Filter plant, a wastewater treatment technology offered by Transchem Agritech Pvt. Ltd., wastewater is treated at its source so transportation and energy costs are substantially reduced. Treated water is suitable for reuse, leading to reduced stress on the groundwater/freshwater levels and less chance of contamination of natural water sources. Daily 20,000 Litres of treated grey water is available for 22 acres of farm land irrigation which in turn has led to three crops in 22 acres of land in a year.

Operation and Maintenance

Village Swachhata Committee took ownership of the O&M activities. They meet regularly month on month basis, review the status and act accordingly.

Each family pays INR 25/ month for collection of door-to-door garbage to the Village Swachhata Committee. Segregated garbage is further sold appropriately

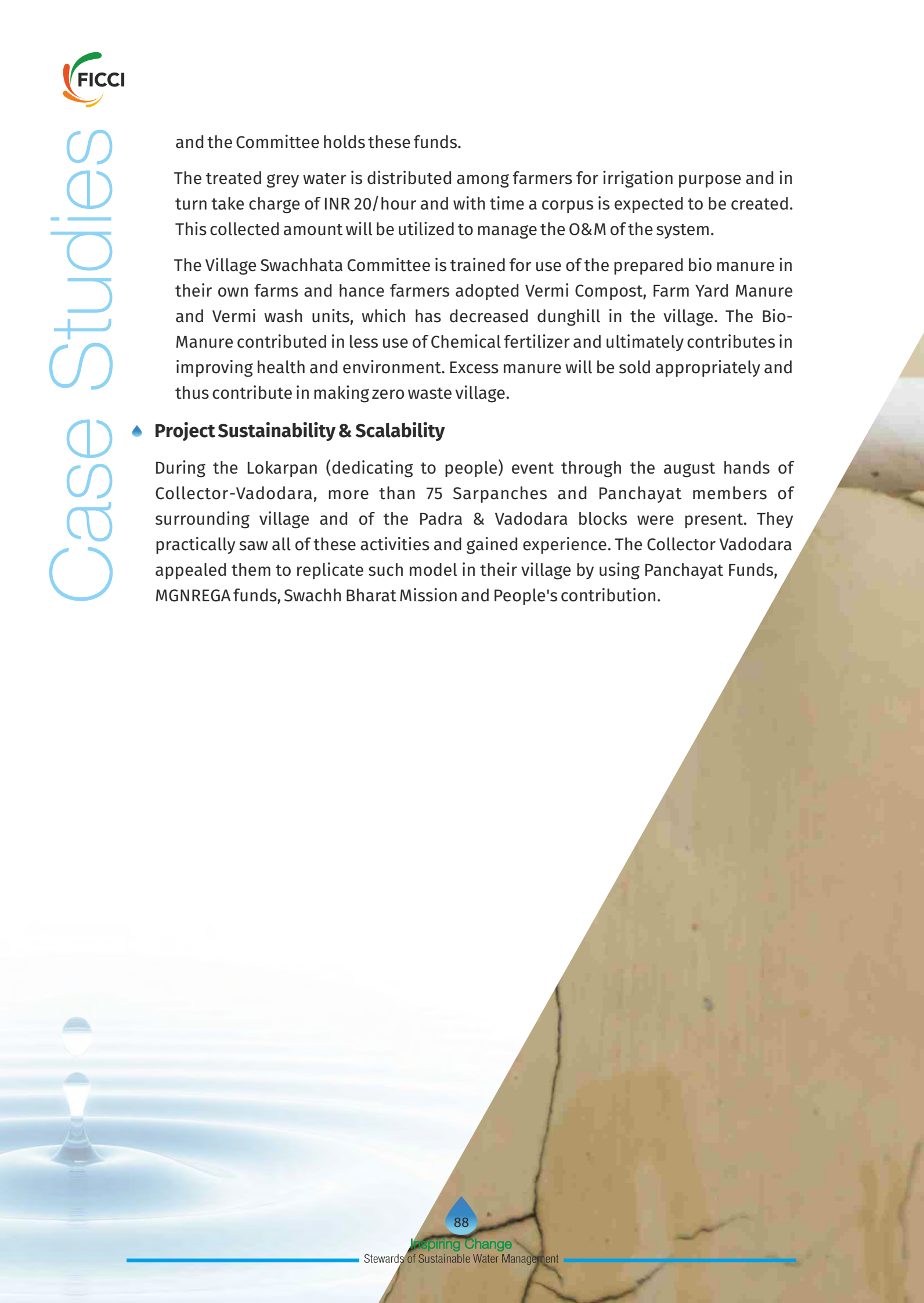
and the Committee holds these funds.

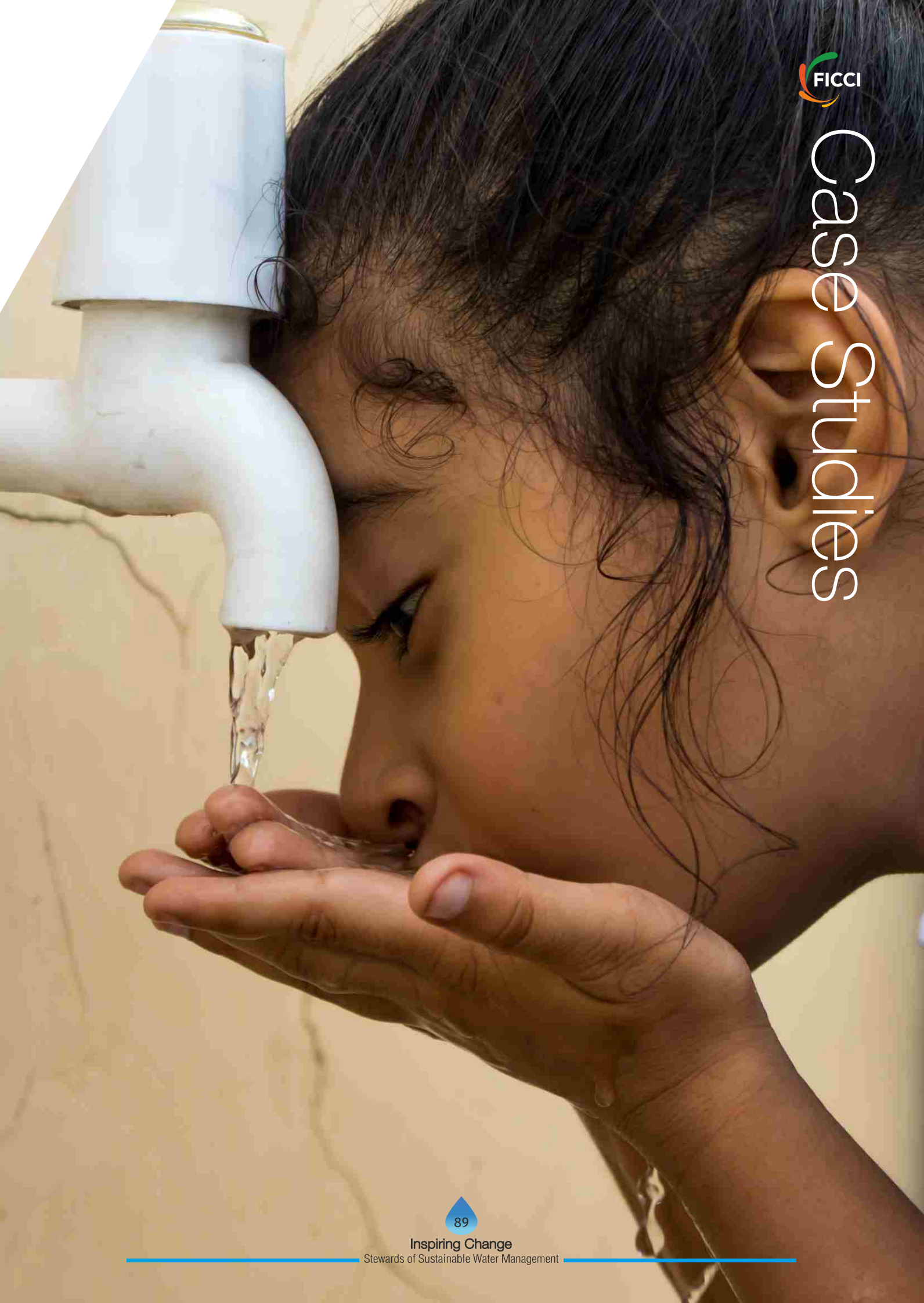
The treated grey water is distributed among farmers for irrigation purpose and in turn take charge of INR 20/hour and with time a corpus is expected to be created. This collected amount will be utilized to manage the O&M of the system.

The Village Swachhata Committee is trained for use of the prepared bio manure in their own farms and hance farmers adopted Vermi Compost, Farm Yard Manure and Vermi wash units, which has decreased dunghill in the village. The Bio-Manure contributed in less use of Chemical fertilizer and ultimately contributes in improving health and environment. Excess manure will be sold appropriately and thus contribute in making zero waste village.

- **Project Sustainability & Scalability**

During the Lokarpan (dedicating to people) event through the august hands of Collector-Vadodara, more than 75 Sarpanches and Panchayat members of surrounding village and of the Padra & Vadodara blocks were present. They practically saw all of these activities and gained experience. The Collector Vadodara appealed them to replicate such model in their village by using Panchayat Funds, MGNREGA funds, Swachh Bharat Mission and People's contribution.





Case Studies

SM Sehgal Foundation, Gurugram

Case Study : Innovation in Water Technology

Production Sector : Rural Development

Project Name : Creating Freshwater Pockets in Saline Aquifers

Project Region : Mewat, Haryana

Key Impact : Rainwater Harvesting and Groundwater Recharge

About Sehgal Foundation

SM Sehgal Foundation (Sehgal Foundation) is an NGO focused on rural development and environmental change with its main offices in Gurugram, Haryana. It was founded as a public, charitable trust registered in India since 1999, by plant geneticist Dr Surinder M Sehgal and his wife Mrs. Edda Sehgal. Their mission statement emphasizes on strengthening community-led development initiatives.

Case Study

Mewat, Haryana, a primarily groundwater-dependent district, has highly saline groundwater in 78% of its area. The average annual rainfall in the area is 594 mm spread over 31 days. The depth of water level in Mewat is between 2 to 29 metres below ground level.

Initiative

This innovation in rainwater harvesting technology enables creation of freshwater pockets in saline aquifers. The recharge well extends above and below the groundwater table. The rainwater harvested from the school rooftops creates hydrostatic pressure, enough to slowly push aside existing saline groundwater to take its place. This freshwater is extracted from underground with a hand pump, and a biosand filter is deployed to address the risk of biological contaminants, thus making the water fit for drinking.

Impact

Approximately 14,69,310 liters of water is harvested per year. For example, in the Untka School with 297 students and an annual water demand of 150,000 liters, for 200 working days per year, 322,126 litres of water was harvested annually (run-off factor as 0.85). Four government schools of Nagina block of Mewat district saved approximately 14,69,310 liters. Number of direct beneficiaries in Mewat are 29,143 people and annual harvest in KL is 14,867.

The innovation saves 3240 kWh of energy, compared to an RO plant, per year. The cost savings in terms of purchased water is about INR 60,000 and cost savings in terms of energy during water withdrawel is about INR 26,000 (calculated at Rs 7 per unit) per year.

Conservation Measures

Since project inception, over 60 demonstrations of creating freshwater pockets successfully serving households, institutions, and agricultural farms, were done since 2015. Fifteen rainwater harvesting structures specifically designed based on the technological innovation of creating freshwater pockets in saline aquifers were carried out in government schools, ensuring safe drinking water for school children and teachers.

- **Rainwater Harvesting**

  This innovation in rainwater harvesting technology enables creation of freshwater pockets in saline aquifers. The recharge well extends above and below the groundwater table. The rainwater harvested from the school rooftops creates hydrostatic pressure enough to slowly push aside existing saline groundwater to take its place. This freshwater is extracted from underground with a hand pump, and a biosand filter is deployed to address the risk of biological contaminants, making water fit for drinking.

- **Groundwater Recharge**

  In a conventional recharge well rainwater floats over the saline groundwater. In order to maintain hydraulic equilibrium this freshwater layer gradually spreads over a large area and ultimately forms a thin layer. This thin layer is difficult to extract as any attempt at pumping it out causes an influx of saline groundwater. This innovative model of recharge well is designed in a way to form a sizeable pocket of freshwater within the saline aquifer which can be exploited without getting it mixed with surrounding saline water.

  Fresh Water Pockets are created by directing the harvested rainwater into the saline aquifer through recharge well walls that extend below the groundwater table. Since the density of rainwater is less than that of saline groundwater, the former floats over the latter. Because of hydrostatic pressure, harvested rainwater pushes away the existing saline groundwater to form a pocket of freshwater within the saline aquifer. The flow of rainwater under the ground through tiny void spaces among the soil particles is a streamlined flow. There is minimal turbulence so that the harvested freshwater and existing saline water do not mix. The buoyant force exerted by the surrounding saline groundwater on the newly formed pocket of harvested water keeps the harvested water pocket intact.

- **Water Withdrawal Mechanism**

  Extraction of water from the freshwater pocket requires care to avoid disturbances in the configuration of the pocket that would mix the fresh and saline water. For this, a pipe is inserted either inside or outside the freshwater pocket. A hand pump is connected to this pipe from which harvested water is pumped out manually as per daily requirements. An electric pump with a lower discharge rate may also be installed depending upon the quantity of harvested rainwater, daily withdrawal needs, and soil characteristics. A high-capacity pump is unsuitable because the force used to extract the water will disturb the pocket and may lead to mixing with surrounding saline water

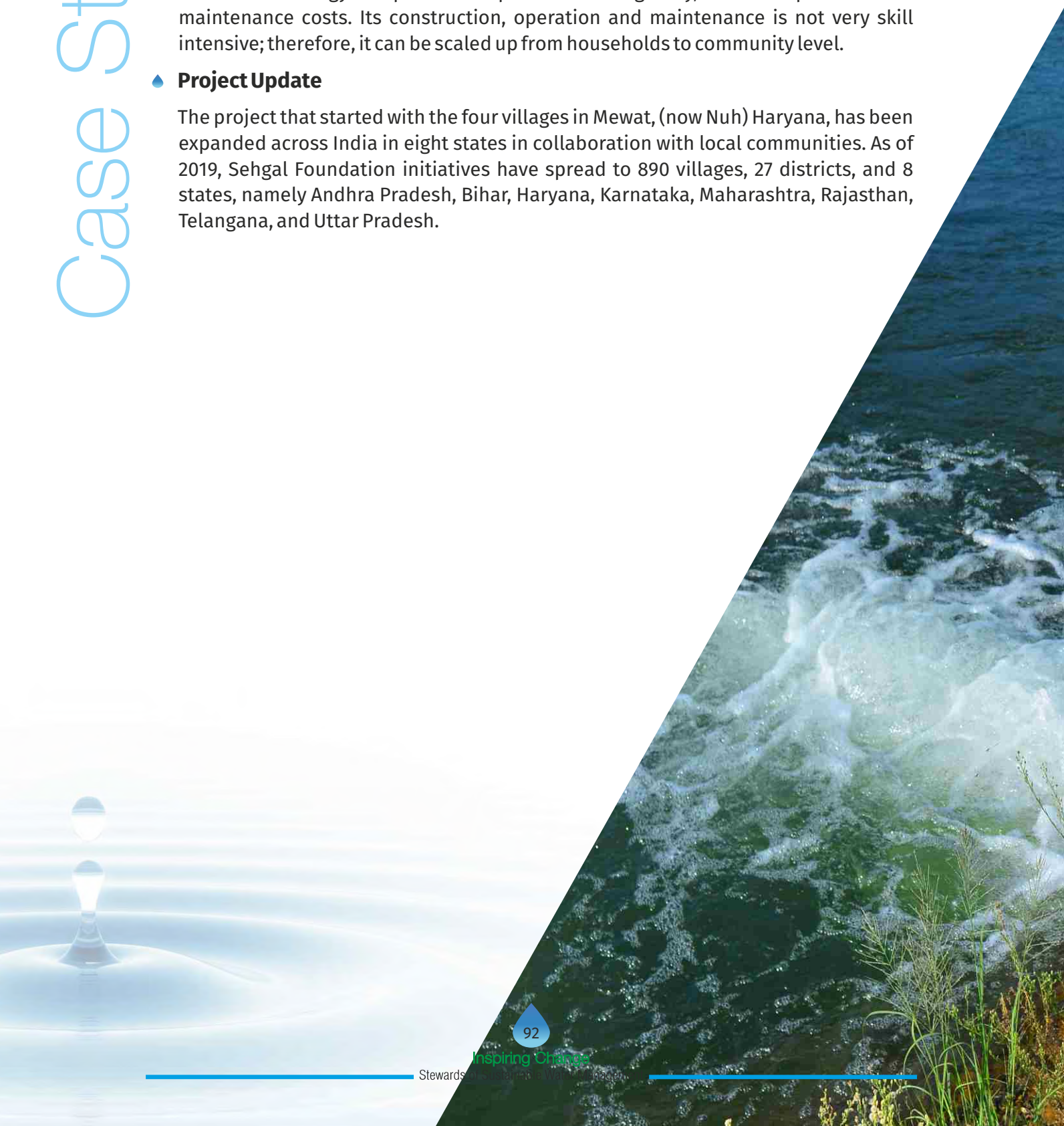
Awareness Generation & Project Scalability

Capacity Building workshops and O&M Trainings were carried out with the community in the project areas. Awareness sessions were done with both school children and community members through workshops and Community Radio Programs. Programs on water awareness and water-related health topics provided information and resources to villagers.

The model can be adapted for both inland and sea water intrusion salinity areas. As there is no energy footprint and operates under gravity, it saves operation and maintenance costs. Its construction, operation and maintenance is not very skill intensive; therefore, it can be scaled up from households to community level.

Project Update

The project that started with the four villages in Mewat, (now Nuh) Haryana, has been expanded across India in eight states in collaboration with local communities. As of 2019, Sehgal Foundation initiatives have spread to 890 villages, 27 districts, and 8 states, namely Andhra Pradesh, Bihar, Haryana, Karnataka, Maharashtra, Rajasthan, Telangana, and Uttar Pradesh.





Case Studies

SSP Private Limited

Case Study	:	Innovation in Water Technology
Production Sector	:	Technology Developer and Equipment Supplier
Project Name	:	Vacuum Salt Refinery
Project Region	:	Mombasa in M/s Kensalt Limited, Kenya
Key Impact	:	Water and Salt Recovery

About SSP

SSP Pvt Limited is a leading manufacturer, exporter, technology developer and turnkey projects and equipment supplier for Dairy Processing industry, Food and Fruit Processing Industry, Chemical Processing Industry, Herbal Extraction Plants, Gelatin Processing Plants and also provider of technology for Zero Liquid discharge for Effluent Treatment for various Industries for over forty years. SSP's well-engineered solutions have delivered over 2000 processing plants and units all over the world and touching billions of lives through reliable purity of products.

"SSP" has its own Research and Development Centre, which is recognized by DSIR, Ministry of Science and Technology, Govt. of India. Its aim is to develop new technologies of international standards and process solution to industrial problems.

After all, SSP has Innovation at its core, which makes us want to keep working continuously for the country and the society.

Case Study

SSP strives for bringing innovative technologies to the industry. for the water sector, they plan to work on drinking water and sanitation. To this end, they have 2 technologies in the pipeline that the others, including the government can adopt.

Initiative

Brine is technically a concentrated salt stream produced from Reverse Osmosis (RO) technology applications in water recovery. SSP Private Limited made innovations on Reverse Osmosis to recover portable water and desalination of brine to recover water and high-grade table salt.

Impact

Depending on composition of water the newly developed process allows separation of valuable salts like Separation of many industrial salts like Magnesium Chloride, Magnesium Sulphate, Potassium Chloride, Bromine, Potassium Sulphate (fertilizer), etc. having good market potential, apart from production of drinking water. In case of RO reject brine, with addition of SSP technology, additional by-products are drinking water and high purity table salt produced from brine reject stream.

Impact of this technology is multifold. Protection of marine life and biodiversity, increased drinking water production from RO plants while avoiding cost of brine disposal system, Production of drinking water in salt production facilities, improving salt purity and reducing land requirement for salt pans. The technology provides a Zero Liquid Discharge process for RO systems.

Conservation Measure

Worldwide drinking water production is shifting to Reverse Osmosis (RO) technology in the coastal areas. Typically, about 60% of the water pumped into a RO plant is discharged to environment as high salt laden reject brine stream. This is damaging to the environment. Also, hundreds of tons of good quality water is lost to open evaporation in the process of salt production.

Desalination Reject

This newly developed technology of producing drinking water from brine along with salt has been tested at industrial scale at the Kensalt facility in Mombasa, Kenya which had been producing salt from solar pans. The salt production facility required 7 days of solar pan evaporation for crystallization under local conditions. A salt crystallizer unit was setup that also produced quality drinking water that was locally needed. A plant for production of 120 MT of high purity salt per day was commissioned by SSP, which also produces safe potable bottled water making the entire project a highly profitable one. For every 100 m3 of raw water pumped to a RO drinking water plant, only 40 m3 drinking water quality is produced. This technology helps recover the balance 60% water also which is 140% more drinking water production over the standard capacity.

Drinking Water Saving - 310,000 L/d, Salt Production Capacity - 120 Ton/d and produces about 99.5% pure table salt (NaCl).

Capacity Building & Scalability

The technology has been in use by SSP since 1999. Depending on the scale of the plants the technology can save millions of litres per day.

Sterlite Copper Vedanta Limited

Case Study	:	Industrial Water Use Efficiency
Production Sector	:	Manufacturing - Metallurgy and Mining
Project Name	:	Zero Waste Zero Discharge
Project Region	:	Tuticorin
Key Impact	:	Wastewater Treatment, Desalination and Rainwater Harvesting

About Sterlite Copper Vedanta Limited

Sterlite Copper is a Business Unit of Vedanta Limited ('Formerly known as Sesa Sterlite Limited/Sesa Goa Limited'). Vedanta Limited was created through the amalgamation of Sterlite Industries (India) Limited, The Madras Aluminium Company Limited [MALCO], Sterlite Energy Limited [SEL] and Vedanta Aluminium Limited [VAL] with Sesa Goa Limited [SGL]. Sterlite Copper represents the Copper business of Vedanta Limited.

Case Study

Water is a key resource and with increasing global water scarcity a balance needs to be maintained. Vedanta has tried to decrease its water footprint at all their projects and operations in order to minimise the amount of freshwater consumed - by re-using as much water as possible in the processes. The ultimate aim is zero liquid discharge, an aim which Vedanta has horizontally deployed across the Vedanta group companies.

Initiative

At Tuticorin, all wastewater is treated and then reused in the operations of the plant. Sterlite Copper is focused on minimizing environmental impact by achieving zero waste and zero discharge across its operations making Sterlite Copper the world's first metal plant with zero liquid discharge. The complete storm water runoff is diverted for rainwater harvesting.

Impact

About 71493.6 m3 of storm water was harvested in 2016 and total rainwater harvesting potential (including paved/unpaved/rooftop) is about 129658 m3. Rainwater harvesting reduced fresh water intake by 20000 m3 in the year 2016. A 6.5% reduction since 2015-16 was observed in specific water consumption. Total average reduction in specific water consumption since 2013-14 was 14%. The total water use reduction through new technology since 2013 to 2016 was approximately 35%.

Conservation Measure

Sterlite copper has separate energy carbon, water, environment, biodiversity policy and also as per Vedanta guidelines sterlite copper has water technical standard to track the performance.

- **Effluent Treatment**

  100% of the generated effluent is treated in the ETP and 100% of the treated effluent is reused in the process for manufacturing Copper. The plant maintains its Zero Liquid Discharge status. The smelter's water consumption is the second lowest in the world at 6.0m3/mt of cathode, with a 20% reduction in specific water usage.

- **Rainwater Harvesting**

  The complete storm water runoff generated is diverted to rainwater harvesting ponds through a dedicated storm water network. All the rainwater harvesting ponds are HDPE lined at the bottom and side walls with brick and concrete slabs. The unit has three rainwater harvesting ponds, two of 50000 m3 storage capacity and one of 27000 m3. Rainwater harvested is reused for industrial process purposes and not for just groundwater recharge and storage. Sterlite Copper also provides rainwater harvesting, drinking water supply and improvement to pond water quality, etc. in nearby villages, as part of the water saving programme.

Awareness Generation & Capacity Building

Awareness among the employees, business partners, vendors, nearby village people is created through trainings, competitions etc. Every year, Sterlite Copper takes up improvement projects within the energy and water sectors, involving both vendors and employees. The company provides the required training to its team in order to enhance their knowledge with respect to energy, water awareness and capacity building among the team. It has conducted around 44 trainings on energy and water covering almost 600 direct employees and more than 800 indirect workers over the last three years.

Sterlite Copper also considers evaluation of supply chains for their energy and water conservation measures as part of their Green Supply Chain Management (GSCM) system. Sterlite Copper has a sustainability framework, and as a part of this effort, its vendors and business partners are audited for their adherence and compliance. Almost 113 vendors have been audited in order to track the performance improvements.

Vedanta's water conservation approach can be replicated in other large scale manufacturing plants where they have multiple sources of waste liquid generation with high solids and heavy metal generation inclusion. It can also be replicated for higher volumes of waste water.

Project Update

Since March 2018, the plant has been shut by order of the Tamil Nadu State Government. The Company challenged the closure order through an appeal before the National Green Tribunal (NGT). Following the appeal, a three-member independent committee, set up by the NGT, set aside an order for closure. The matter is currently being heard before the Madras High Court as per the directions of the Supreme court.

The Company has announced a Rs.100 crore investment in social infrastructure plans.

Surat Municipal Corporation (SMC)

Case Study	:	Urban Wastewater Management
Area of Work	:	Basic Civic Service Provider
Project Name	:	Water Conservation
Project Region	:	Surat
Key Impact	:	Sustainable Water Conservation



About SMC

Surat Municipal Corporation is the local civic body responsible for the administration of Surat, the Indian State of Gujarat, which has come into being under the Bombay Provincial Municipal Act of 1949. The Surat Municipal Corporation was established on 2 October 1966. It carries out all the obligatory functions and discretionary functions entrusted by the BPMC Act of 1949.

Case Study

The Surat City has witnessed the highest population growth in the nineties, which has imposed drastic demand for the establishment of basic amenities including water. Exponential growth has been witnessed in Surat City leading to ever rising demand for the most essential service of water supply.

Initiative

SMC through all round water security measures and integrated approach in water and waste water management, uninterrupted water supply has been ensured. SMC is reusing treated wastewater for non-industrial or non-domestic uses like gardening, irrigation in peri-urban areas etc. and distributing recycled water to industrial consumers. TTP plants are being augmented having improved the supply to the end users, i.e. mainly Textile Industries.

Impact

Zero Liquid Discharge setup is being executed through which, on a daily basis, 36 Million Litres of water are being recycled. Recycling and reuse of Tertiary Treated sewage in industrial consumers in Surat has helped saving of 40 Million Litres of fresh water. Tertiary Treatment for Industrial Use in city - 40 MLD capacity Tertiary Treatment Plant for domestic sewage treatment is implemented and successfully in operation since 2013. Secondary Treated Water - 0.3 Million Litres of secondary treated wastewater is being used in various Municipal parks and Gardens across the city. Tertiary Treatment for Pond restoration - 1 million liters per day capacity TT plant have been executed.

Conservation Measure Requirement

Surat City has a supply of 1250 Million Litres per Day (MLD) presently and for the envisaged population of 1.23 Crore in 2041, the water demand will reach to more than 2300 Million Liters per Day. Surat experienced devastating floods in August 2006 and along with other essential services, water supply system was badly affected. The only source of water supply is surface water of river Tapti with no backup / alternative source.

- **French Wells**

  French wells are designed and executed in river bed and delivers potable grade water directly which doesn't require any conventional water treatment, only chlorination being sufficient.

  This has helped in saving of precious land towards the construction of water treatment plant. Putting all French wells together, Surat Municipal Corporation is able to supply potable grade water of 145 Million Litres which doesn't require any conventional water treatment. Due to the operational French wells / infiltration wells the water supply could be restored within 36 hours during the 2006 floods. This brings out the efficacy of French wells as a technology for meeting at least the "Life Line" water demand in extreme situations.

- **Water Supply Grid Networking**

  It is important to ensure economic transmission of water from water works to water distribution station and to supply the lifeline water supply in case of any breakdown / shut down / eventuality.

  Airborne electromagnetic survey parameters are designed to map precisely top 100 m as well as deeper horizon extending down to 250 m - 500 m depths.

- **Rainwater Harvesting**

  Rainwater Harvesting structures have been made mandatory for all high-rise buildings, commercial complexes and open plots. These structures are helping in increasing the groundwater table across the city and also, since, city is near to the Arabian Sea, it helps preventing salinity intrusion. Presently, 382 Rain Water Harvesting Structures have been executed across the city in various Municipal Properties, and every year more structures are planned. A 3 ft rise in water table has been observed.

- **Recycling and Reuse of Wastewater**

  The Bamroli Sewage Treatment Plant has a two-stage biological / secondary treatment and tertiary treatment phase. The plant has Sand Filtration, Ultra-filtration (UF), Reverse Osmosis (RO) and Activated Carbon Filters (ACF) for tertiary treatment.

A ZLD system is being put in place to treat 80 MLD (2-5%) of WTP backwash water which otherwise was going wastage. Dual plumbing facilities is being provided in Housing Projects for Grey Water Recycling, which at the moment includes 6 Projects for the Economically Weaker Section (EWS) in about 3000 households.

- **Aquifer Mapping Study**

  In order to ensure that the entire city gets at least Life Line Water Supply, "aquifer mapping" was found to be necessary. Ground survey based on ERT was completed during June and July of 2017 and Helicopter based Heliborne TEM (Transient Electro Magnetics) survey was carried out in October 2017. The total geographical area covered was 270 sq.km with total 1600 line kilometer. Based on preliminary outcome of the study, exploration of subsurface water through drilling work is in process for total 5 locations.

Cpacity Building & Project Scalability

Concept of "Veljibhai" has been adopted, which is a mechanism to obtain feedback from citizens for improving service delivery. Two more tertiary treatment plants are in the pipeline. Bore wells / Tube wells are being put in place at major Water Distribution Stations supported with DG Sets, Submersible pump sets and Tanker filling stations to ensure water supply during black out / power outage.

Project Update

The tertiary treatment plant quantum has been increased to 115 Million Litres by March 2019 once additional 75 MLD capacity TTP is commissioned. SMC has started using Solar Energy in the water supply system.





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Case Studies

Swades Foundation

Case Study	:	Water Initiatives by NGO
Area of Work	:	Empowerment of Rural Communities
Project Name	:	Swades Drinking Water & Water for Irrigation Programme
Project Region	:	6 Blocks in Raigad District, Maharashtra
Key Impact	:	Water Harvesting, Drinking Water Provision, Irrigation
Key Impact	:	Water Stewardship (Addressing the management of water supply and demand through appropriate governance)

About Swades Foundation

Founded by Ronnie and Zarina Screwvala, the Swades Foundation operates with the single-minded focus of empowering rural India. It has been working in more than 2,000 villages in Maharashtra's Raigad district since 2013.

Case Study

In addition to the problems surrounding drinking water, water scarcity for agricultural and other uses causes chronic economic and social issues. Despite 3,600 mm of annual rainfall, the soil and terrain of rural Maharashtra makes water management a severe problem.

Initiative

Water harvesting was carried out in 6 blocks namely Mangaon, Mahad, Tala, Shrivardhan, Poladpur and Mhasla of Raigad district in Maharashtra covering a total area of close to 3000 sq. kms. The project has a two-pronged strategy to bring water into households and water to the fields.

Impact

The project covered 455 hamlets with 312 water schemes supplying around 200 litres per household of spring water per day throughout the year across 6 blocks of Raigad district, directly impacting 471,000 people.

Conservation Measure

Natural springs exist in the hilly areas all year round. Swades Foundation tapped this water according to its yield capacity and transported the water to villages by gravity or siphon so that only required quantity of water would come out from the spring.

- **Spring Cordoning**

  Due to excess back water pressure from springs, water comes to the mouth of. the spring and is stored underground. A continuous flow of water from the hills which accumulates to form a pool of water is termed as uncordoned spring. In order to increase the efficiency of a spring, in terms of extending its life and output, a concrete wall is built around it. This is termed as spring cordoning. This excess water is used during the scarcity period. To further extend the life of the cordoned spring, trenches are excavated on the slopes above the cordoned spring.

- **Drinking Water**

  The project brings the drinking water, primarily tap water, from springs in the hills (Western Ghat), open wells, dams and streams. Water from the cordoned springs is siphoned and carried by gravity or by lifting through a pipeline to storage tanks located in the village and from there to households. The general elevation difference from source to tank is more than 10 meters and elevation difference from tank to house (ground level of house) is around 2-5 meters. Ground Storage Reservoirs (GSR) are built with capacity commensurate with the number of households in the area with a standard of 200 litres water to every household per day.

- **Agriculture**

  The project ensured sustainable income augmentation of single crop growing farmers by enabling them to grow multi crops through water for irrigation. To bring water into the fields, infrastructure recharge-ponds, gate type check dams on streams (seasonal tributaries) of short rivers flowing into Arabian Sea along with a robust grid of drip and flood irrigation were built. Check dams have to be monitored once every year for removal and reinsertion of gates and community farmers are collectively responsible to maintain these.

Capacity Building & Project Replicability

In both these interventions, the water committees and farmers' associations play key roles. They are representatives of their community and are duly supported by the Panchayat members themselves for timely remuneration and supervision. These key stakeholders become frontrunners in mobilizing the community in their hamlets after they are fully convinced of the need for structured interventions During the construction of the project, key village representatives are empowered to supervise and report of any variation from the standard operating processes. After the project is completed, water committees are formed for each hamlet that monitors the rationing of water to their respective hamlets and are paid a basic honorarium for their volunteering by the villagers themselves. Adequate training is given to each committee by way of activities, written examination, case studies, presentations and a whole lot of interaction. Water committees have free access to reach out for field support from Swades Foundation at any time for any help or guidance.

The Project implementation model of Engage, Empower, Execute and Exit is common across all Swades programmes and has helped reach out to more and more villages in just a few years. The systematic approach for drinking water and water for irrigation right from community mobilisation, obtaining necessary permissions and community participation to overall programme design and implementation across hundreds of water projects is easily replicable in any new geography irrespective of its size, topography, and demographics.

Latest Update

The project has been extended to cover more hamlets in the existing 6 blocks and work is being done in the Sudhagad block, also in Raigad district of Maharashtra covering a total 2513 hamlets and benefiting over 500,000 people.

Technorbital Advanced Materials Pvt Ltd. (TAML)

Case Study	:	Innovation in Water Technology
Production Sector	:	Innovative Drinking Water and Wastewater Solutions
Project Name	:	Ultrafiltration Hollow Fiber Membrane
Project Region	:	100 units at different locations
Key Impact	:	Water Purification

About TAML

Established in 2011, Technorbital Advanced Materials Pvt Ltd (TAML) is focused on affordable and innovative green technologies for drinking water solutions and wastewater management. Technorbital is a R&D driven company involved extensively in research and innovation.

Case Study

A majority of Indian population still yearns to have access to basic necessities like hygienic food and water, clean air and affordable energy (electricity). In order to develop India at the grass root level, these basic necessities need to be fulfilled. TAML's primary goal is to provide most advanced indigenous technologies to Indian society and to provide pure yet economical drinking water to every Indian.

Initiative

Technorbital has developed an Ultrafiltration hollow fiber membrane spinning technology that removes particulate matter, bacteria and viruses (commonly known as pathogenic species; causing diseases such as cholera, dysentery, hepatitis, etc.) from the source water in collaboration with CSIR - NCL Pune (Central Govt's research lab). The R&D was started on this product (membranes) technology in the year 2013 and the first few Tech Jal units were installed in the year 2014.

Impacts

"Tech Jal" works without electricity, with no wastage of water and does not require any technical person to operate. It has zero maintenance and lowest operating cost, which is about 3 - 4 paisa/litre. For example, CSIR-NCL used to provide bottled drinking water to all the departments since 2004 through outside vendors. Approximate consumption of bottled water in CSIR-NCL was about 175 bottles per day and the expenditure was approximately Rs. 2 lakhs per month. The plant installation cost has been recovered within 5-6 months. Considering all recurring and operational costs, CSIR-NCL is currently saving Rs. 18 lakhs per year by establishing this inhouse "Shuddha-Jal" water purification plant using Tech Jal. Tech Jal can also remove Volatile Organic Compounds and pesticides which Sky Hydrants or other purification

devices usually don't.

Conservation Measures

The unit is perfectly suitable for rural areas because it is effortless to operate and it takes care of all water borne diseases. It is a three-stage water purification system: sediment pre - filter (5 micron), activated carbon filter (10 micron) and innovative hollow fibre ultrafiltration membranes.

- **PAN**

  PolyAcryloNitrile (PAN) is a synthetically produced organic polymer resin, which though thermoplastic, has thermal stability. The hollow fibre is made of specialty PAN polymer with average porosity size of 20 nano - meters and can remove the smallest impurities from water, like virus along with bacteria and cyst. The specialty polymer is chemically modified to work under very low pressure like gravity.

  Technorbital is one of the first companies in India to specially synthesize a PAN with a modified molecular weight and a unique formulation of copolymers that empowered the resulting PAN with some exceptional properties that could be used in the field of water filtration membrane, carbon fibres, lithium ion batteries anodes, nano fibres and create wonders.

- **Hollow Fibre Membrane**

  Technorbital in association with NCL, Pune has developed a hollow fibre ultra-filtration membrane technology using Technorbital's modified PAN. These UF hollow fibre membranes are commercially manufactured at Technorbital plant in Kanpur (UP). The UF membranes are a lot more effective than the conventional water filter membranes, whether in drinking water or wastewater treatment, as it has a 20 nano meter porosity. The membrane is a highly hydrophilic and high anti-fouling membrane. Further, these are low maintenance and affordable as compared to conventional membranes.

Capacity Building & Project Scalabiity

'Tech Jal' comes with multiple capacities (500/1000/2000 LPH) and more than 100 units (300 units are under installation) are running in different areas including remote parts of India. These membranes are also being used by a reputed Indian company TATA for their domestic water purifier TATA SwachDezire+.

Transchem Agritech Private Limited (TAPL)

Case Study	:	Innovation in Water Technology
Area of Work	:	Soil, Water and Wastewater treatment Solutions
Project Name	:	Trans Bio-Filter
Project Region	:	Several installations across Gujarat and other states
Key Impact	:	Sustainable Water Conservation

About TAPL

Transchem Agritech Pvt. Ltd. (TAPL) incorporated in 2004 is engaged in Soil, Water and Wastewater Treatment Solutions. In line with the mission statement "strive for excellence and satisfaction through reliable supply of products, project and services", TAPL is working for the last 25 years for new product innovations, applications as well as modifications.

Case Study

There are various options for wastewater treatment, from conventional Effluent Treatment Plants (ETPs) / Sewage Treatment Plants (STPs) to Bio-Filtration wastewater treatment system. A decentralized approach can help address a number of issues including transportation, reusability and costs. When treated at source, the water can be used for non-potable applications. It also leads to substantial savings in transportation costs since they build their system near the source. Energy costs are also reduced.

Initiative

Transchem has developed a Trans bio-filter for usage in waste-water treatment replacing the conventional industrial ETP (chemical industry effluent containing sulphur and chloride) with a plant capacity of 180 KLD. The nutrient-rich treated water allows farmers who use it for farming generate a yield of four times the crop in comparison to watering their crops with regular water.

Impact

The product enables 100% water recycling, a substantial reduction in ground water contamination and better agricultural produce. The power load was reduced by 82%. The retention time was reduced by 99% from 10 days to 45 minutes. The Capital Expenditure and Operations Expenditure were reduced by 75% and 65% respectively.

Conservation Measure

Trans Bio-Filter is a sustainable, green and cost-effective technology and is one of its kind in the world. The concept is "Design with Nature" using tools of modern science. Trans Bio-Filter can efficiently treat industrial effluent and domestic sewage and is ecologically and economically viable with a low environmental footprint.

Trans Bio Filter Technology

The Trans Bio-Filter is a bed of organic material which supports hybrid earthworms and microbes that breakdown solid and converts it to carbon dioxide, water and nutrients. It uses that ability of earthworms and beneficial microbes (transzyme) to reduce contaminants present in the wastewater. It involves removal of toxic matter by adsorption and filtration followed by biological degradation and oxygen supply by natural aeration to the treatment system. The requirement for space and the capital expenditure by this technology is lower than other methods that are currently being used. The product enables 100% water recycling, a substantial reduction in groundwater contamination and better agricultural produce. It reduces COD and BOD loads and other impurities like ammonia (NH_3), hydrogen sulphide (H_2S) etc. even in presence of high TDS and at varied hydraulic loads giving cost effective sustainable results. It is a natural way of recycling nutrients and removing toxins.

Project Scalability

Vermifiltration is emerging as an environmentally sustainable, economically viable and socially acceptable technology all over the world. The potential for use of this technology not just by industry to treat effluents or wastewater but more importantly, for treatment of both grey and black water from urban habitation makes this an attractive effort.

The cost of operations from Transchem plants is about Rs 63 per Kiloliter as against other plants with averages of Rs 181 per Kiloliter. It is among the lowest in the industry. The annual saving with trans-Bio-Filter system is Rs 77.52 lakh. Thus, it is one of the most cost-effective technologies and also easy to maintain as there are no skilled personnel required to operate the plant.

Udaipur Municipal Corporation

Case Study	:	Urban Wastewater Management
Area of Work	:	Municipality
Project Name	:	Hybrid Annuity Model
Project Region	:	Udaipur
Key Impact	:	Water Conservation



About UMC

The Udaipur Nagar Parishad was converted to Udaipur Municipal Corporation (UMC) in April 2013. It is governed under the Rajasthan Municipalities Act 2009.

Case Study

Udaipur is one of the most water scarce cities in India, with a national average water demand of 115 l/c/d. With a growing population and flourishing economy linked to higher industrial inputs and greater energy demand, there is a domino effect; with water demand from urban landscape and industrial bodies growing simultaneously adding to the urban water stress. The entire sewage generated in the city finds its way to Ayad River through 800mm diameter outfall sewer at Manwa Kheda village. This has caused a serious strain on the ability of Udaipur Municipal Corporation (UMC) to maintain city water supply to acceptable standards for all users.

Initiative

In harmony with Rajasthan State Water Policy, UMC has devised a PPP model for commissioning a sewage treatment plant (STP) based on MBBR Technology during 2014. Treatment capacity of the STP is 20,000 cubic metres per day.

Impact

About 11 lakh cubic metres per year is used for river recharge. 7.3 lakh cubic meters per year is used in horticulture and 3.5 lakh cubic meters per year is used for mining and industrial operations. 82% of households are covered under storm water and drainage system. In the last 4 years about 21 lakh m3 water has been saved which was then reused for industrial use and some water is discharged to the Ayad River. As a result of the recharge, freshwater abstraction at the mining complex has been reduced by 60% per day.

The project also improved ecological stability of the local lakes (Udai Sagar and Pichola Lake) and the Ahar River by reducing health-hazards from open sewage disposal and improved the tourist appeal of the area.

Conservation Measures

Udaipur has adopted Hybrid Annuity Model (HAM) for operating STP. The HAM is a mix of engineering, procurement and construction (EPC) and build-operate-transfer (BOT) formats, with the government and the private companies sharing the total project cost in the ratio of 40: 60 respectively. This model will reduce financial burden on the concessionaire during project implementation phase and also save water through reuse of treated water.

An online water quality monitoring system have been installed which records the quality of water being discharged. The STP plant is protected with boundary wall and plantations in the campus. Fire safety measures and drills for general public are also regularly undertaken. HZL have also undertaken CSR activities related to toilet construction around their unit.

Capacity Building & Scalability

The PPP model sets up an institutional framework for co-producing SDGs related projects. It will establish an innovative model for citywide sanitation services. The model developed will have a private service provider who will be able to showcase this solution and seek commercial opportunities in other cities.

Three more CSTP is being planned with a total capacity of 40 MLD with a total cost of 80 crores. 50% of the treated water would be used by HZL and 50% of the treated water will be used to make the Ayad River perennial.



United Way

Case Study	:	Water Initiatives by NGO
Area of Work	:	Community Development through Voluntary Partnerships
Project Name	:	Wake the Lake – Revival of Kawdenahalli Lake
Region	:	Ramamurthynagar, Doorvaninagar, Kawdenahalli, & KR Puram, Bengaluru
Key Impact	:	Community Ownership of Water Body Management

About United Way

United Way is a not-for-profit organization that works with communities to take local action for global impact. They partner with the people, listen to their concerns, identify the problems, and empower them to tackle these challenges head on. The Bengaluru chapter of United Way Worldwide was started in 2008, with the vision to make lasting and effective change within the city and the rural areas around it.

Case Study

'Wake the Lake' campaign was carried out under United Way Bengaluru to revive the Garden City's dying lakes in association with civic bodies, corporates and citizens. Kowdenahalli Lake revival project was undertaken to enhance the biodiversity in and around the lake and make it a thriving community managed space.

Initiative

Kowdenahalli Lake rejuvenation project is a joint effort where the Government efforts were directed towards creating basic infrastructure at the Kowdenahalli Lake, while United Way Bengaluru engaged in revival of biodiversity and community engagement to make the lake, as an example of an urban water body, a community place.

Impact

The initiative led to the restoration of quality of water in the lake. The water was free from garbage, effluents and other pollutants. The project led to the revival of the ecosystem in and around the lake by creating micro climate for aquatic flora and fauna. The lake has now been restored to its full glory with a variety of local and migratory birds, various fish species and reptiles, medicinal plants and fruit-bearing trees gracing its ecosystem. There has been an increase in groundwater level in the vicinity of the lake leading to increased availability of potable water.

Conservation Measure

A community initiated and managed plantation drive was started through formation of a Lake Association which generated financial resources from the local elected member's development fund for the lake maintenance.

- **Cleanup Drive**

  Clean-up drives were organised through active volunteerism and community involvement. The lake was cleaned by diverting sewage, cleaning it before it entered the lake. De-silting was also done. This led to a reduction of toxic elements and bad odour in the lake. The clean-up also made the lake safer for aquatic flora and fauna to flourish, which in turn attracted birds and enabled sustenance of fish life. There has also been an increase in migratory birds.

  Because of the good storage of water, the fishermen in the vicinity are able to harvest a good yield of fish which is an income both for them and the Government (Fishery Department).

- **Development & Maintenance of Lake Surroundings**

  United Way Bengaluru had planted more than 6500 saplings in the lake over the last three years. About 35% of these constitute herbal or medicinal plants. Voluntary tree plantation drives were also carried out to enhance bio-diversity. The Seed Ball technique (a seed wrapped in mixture of clay and compost) was adopted to further increase green cover in the surrounding area, which provided shelter to birds, butterflies and other organisms. The seeds were native and local forest-based, suited for planting in the area.

  Spread over 55 acres, the lake area is now filled with bio-diverse saplings that include ground cover, herbs, shrubs, flowering, creepers, tall growing/ wild leading to an eco-system that is suitable for habitat of birds, bees and butterflies.

  All the major civil work such as bunding, fencing, revetment, plantation, solar lights, benches, and toilets has been completed during the last four years. Walk paths were created for morning walkers. The lake association in collaboration with the city corporation was roped in to provide support for basic maintenance.

Capacity Building and Scalability

The locality members have been empowered and they are now extending support to neighboring lakes (Jinke Timmana Halli Lake / Varanasi Lake).

Two of their sister chapters have been replicating this model in the states of Andhra Pradesh and in Tamil Nadu.

The United Way of Bengaluru was able to create the **A Lake Score Card** (to measure the project progress and the impact of the interventions undertaken) with inputs from the Bangalore Environment Trust. The scoring guidelines are easy to follow and can be performed by a lay person, as this is a uniform baseline. The Scoring Methodology document can be used for guidance for all such projects. It is currently being successfully used in The United Way's flagship campaign **Wake the Lake.**

A Lake web portal is currently under development that captures stories of change which can further inspire other communities.

Vassar Labs IT Solutions Private Limited

Case Study	:	Innovation in Water Technology
Production Sector	:	Information Technology Solutions
Project Name	:	Andhra Pradesh Water Resources Information & Management System
Project Region	:	Krishna Delta Region, Andhra Pradesh
Key Impact	:	Water Resources Planning and Management

About Vassar Labs

Vassar Labs IT Solutions Private Limited is a technology company established in the year 2014, focusing in delivering for last mile visibility and decision support solutions into Primary sectors like Water, Agriculture, Smart City and Education, leveraging a collection of emerging technologies like IoT, GIS, Crowd Sourcing, Big Data, Machine Learning, Satellite Data, Drone Data etc.

Case Study

Information on Water resource availability, and its consumption, along with data and scientific model-based decision making is the key to planning and management of water resources towards mitigating the crisis today.

One of our key products in Water Resources Information Management System (WRIMS) gives real-time visibility into the supply & demand of water and enables our customers to make better informed decisions on water management. This system is a cloud based Realtime system, and provided information and management advisories for water resources across the whole state (http://apwrims.ap.gov.in/).

Initiative

Andhra Pradesh Water Resources Information and Management System (APWRIMS) is an implementation of our solution, a single window access point for all water resources related information of Andhra Pradesh state, assisting all stakeholders (policy makers, managers, water-users) to visualise real-time information on supply and demand of water and to take water management decisions. The system consists of Hydro-met data like Rainfall, Groundwater, Reservoirs, etc.

Impact

System provided basin level water budgeting and real-time decision support for lift scheme operation together this helped to optimize inter-basin transfer of water that provided critical and necessary water to entire Krishna Delta region impacting 1.1 million acres.

The information on APWRIMS is expected to benefit more than 60% population in the State, who are agricultural dependant. APWRIMS has helped 4500+ farms to predict and detect drought condition and advise the irrigation needs to save them. The system has raised advisories to 10000+ villages on the right crop to sow, when and

where. The data collected also helped States to submit drought relief fund on time. This initiative has helped the Groundnut farmers to increase their yield by 23%.

Conservation Measures

The System is built on Open-Source Tools and Software's which are hosted on Cloud. The Models developed are based on various scenarios and can be customized to other geographic locations. System has components/ Dashboards/ Reports that helps the stakeholders in Planning, Operations and Management.

- **Presentation Layer (UI)**

  This layer enables interaction of the Knowledge Portal with the user through various media such as Desktops, Laptops, Tablets and Mobile Phones. The presentation layer interacts with the Service Layer to render the Business Data, Analytics and Visualizations in the form of Heat Maps or Interactive Charts and Graphs. The presentation layer also enables the users to download data or upload data into the system.

- **Service Layer**

  The service layer interacts with the Database Layer to fetch the Business Data and GeoSpatial Data to perform calculations or process the data to service the Presentation Layer based on the user interaction. This layer is developed using multiple languages such as Java (using the Play and Spring Framework) and Node JS to process business data. The GeoServer processes the GeoSpatial information which is combined with the Business Data in the Presentation Layer to serve meaningful data to the user such as displaying Rainfall Data for a District on clicking a District in a State in the GeoPortal.

- **Database Layer**

  The database is designed to store different types of data in different servers to leverage the efficiencies of each type of database. Three databases are used for the respective purposes. The **MySQL Database** which is designed to store Platform data such as location data and other metadata required for generating the boundaries for states, districts and blocks in the UI. **Cassandra Database** that is designed to store temporal data for various parameters such as Precipitation and Temperature. **PostgreSQL Database** designed to process and store GeoSpatial data. The GeoServer interacts with the PostgreSQL database to serve WMS and WFS Json data to the UI.

Awareness Generation & Capacity Building

Vassar Labs works with experts in various sectors such as Agriculture Scientists, Hydrologists, Water Experts, Crop Model experts, GIS and Remote Sensing experts to bring the realistic nuances into our predictive modelling. APWRIMS has components that help the stakeholders in Planning, Operations and Management.

This system collects this information different departments and different project reports. The system has helped the state drive various initiatives and drives that has helped solving key issues. Also, the integrated platform is supporting synergistic implementation of government programmes, benefiting exchequer with optimal and efficient utilization of resources and funds.

Water, Sanitation and Hygiene (WASH) Institute

Case Study	:	Innovation in Water Technology
Area of Work	:	Water and Sanitation
Project Name	:	"The Annam" Mobile Septage Treatment Unit (MTU)
Project Region	:	Dindigul, Tamil Nadu
Key Impact	:	Onsite safe and cheap faecal sludge treatment

About WASH

The Water, Sanitation and Hygiene Institute (WASH Institute) was established in 2008 as a Non-Governmental Organization to address issues such as ground water depletion, water quality deterioration, poor sanitation coverage, poor focus on hygiene, mismanagement of solid and liquid waste, rapid urbanisation, and other emerging issues due to climate change, demand adequate human resources with necessary capacity.

Case Study

WASH Institute is engaged in action research to develop innovative products on the sanitation value chain. In general, the septage consists of higher volumes of liquid than solids and most of the truck operators must carry the entire septage (solid and liquid) to the treatment/disposal sites. This puts extra cost burden on transportation. The Mobile Treatment Units, an onsite faecal sludge treatment technology developed by the WASH Institute, have been tested in Dindigul, Madurai and Coimbatore district in Tamil Nadu and in Kerala.

Initiative

The Mobile Treatment Unit (MTU) is an onsite faecal sludge treatment technology. This mobile unit is easy to operate, and the operational and maintenance cost is also lower. The higher flow rate of MTU helps to empty and treat higher numbers of septic tanks per day. This brings down the truck operational cost, especially fuel cost, and maximizes profit. If the truck operators pass on this benefit to the households/customers, then customers end up paying less for de-sludging services. This also benefits the treatment facilities by decreasing their plant load.

Impact

The expected impact of this technology in Tamil Nadu is that it will facilitate a safer environment by preventing discharge of contaminated seepage into the open environment and water bodies, thereby reducing the sanitation related diseases. This will allow more livelihood opportunities in the desludging business.

In its efforts to improve the deteriorating sanitation situation in Kerala in the

aftermath of heavy rainfall and flood, WASH Institute in close partnership with UNICEF intervened in the districts of Alappuzha, Pathanamthitta, Thirssur and Ernakulam for a period of 50 days. Four trucks treated over 9 lakh litres of septage from the septic tanks in 156 locations across 60 camps that benefitted 34, 965 beneficiaries directly.

- **Conservation Measure**

  It is a treatment system mounted on the bed of a small truck which can treat the contents of the septic tanks. The MTU treated septage effluent thus discharged into the environment complies with the 2017 norms of CPCB.

- **Mobile Treatment Unit (MTU)**

  The on-site mobile treatment unit works with the concept of solid-liquid separation, sludge thickening and effluent treatment processes. While the liquid is separated from the solid, the effluent passes through the treatment process and the treated effluent is disposed. The sludge thickening process helps to further reduce the moisture content in the sludge. The operational capacity of the MTU varies from 3000 to 6000 litres/hr. The total cost of each mobile treatment unit is much lower than the septage emptying trucks used by the private operators.

- **Capacity Building & Scalability**

  The WASH Institute provides technical assistance to the Government of India for implementing Swachh Bharat Mission (Urban) and Swachh Bharat Mission (Gramin). Apart from the capacity building initiatives for the professionals already associated in the sector, the organization has also given prime importance towards grooming students for achieving sustainable water and sanitation solutions.

  The MTU technology is designed in such a way that it is replicable and scalable across regions due to low CapEx and Opex.



Watershed Organisation Trust (WOTR)

Case Study	:	Water Initiatives by NGO
Area of Work	:	Participatory Watershed Development & Eco-Systems Restoration
Project Name	:	Water Stewardship in Rainfed Agrarian Maharashtra & Telangana
Project Region	:	Ahmednagar, Jalna & Dhule of Maharashtra; Meheboobnagar of Telangana
Key Impact	:	Water Stewardship (Addressing the management of water supply and demand through appropriate governance)

About WOTR

Watershed Organisation Trust (WOTR) is a not-for-profit NGO founded in 1993 operating currently in the areas of Maharashtra, Telangana, Seemandhra, Madhya Pradesh, Rajasthan, Jharkhand and Odisha. It works in areas of participatory watershed development and eco-systems restoration, adaptive sustainable agriculture, integrated and efficient water management, and climate change adaptation, with a special emphasis on vulnerable communities, farmers, and women.

Case Study

Maharashtra and Telangana have experienced severe and frequent climatic events of drought and unseasonal rainfall. Erratic rainfall and drought have resulted in drastic fall in agricultural production and acute water scarcity for drinking and livelihood purposes. Traditional knowledge and local water governance practices of rural communities are unable to cope with these risks and losses. Hence, it was felt necessary to equip them with the knowledge and tools to take informed decisions at the farm, enterprise and community levels that enhance robustness of practices and adaptive capacities.

Initiative

There was a felt need to facilitate communities to evaluate their available water stocks and plan water use accordingly. This was done by sensitizing communities on how climatic and non-climatic drivers (including their water use behaviors) are adversely affecting the "water cycle" and locally available water resources. The project also evolved community mandated practices for water management by promoting water efficient technologies.

Impact

At present, communities in 106 villages approximately 1,50,000 people (20 thousand families) are effectively governing 71.61 billion litres of water available to them annually which is getting stored in different water harvesting structures. The total cultivable land impacted for food crops production was 260,944 ha. The total increase in land under agriculture for both food crop and non-food crop was 89,193 ha.

Conservation Measure

The major target groups of the project are inhabitants of 106 project villages who will be assured of drinking water resulting from water budgeting, water harvesting and water saving measures. Over 10,000 farmers are receiving crop-weather advisories in these villages. Around 1,200 "Water Stewards" from project villages participated in different stakeholder engagement workshops together with a good number of government officials.

- **Water Budgeting**

  This was the process whereby in each community an assessment was done on the following: season-wise water availability (surface and groundwater) based on the rainfall received for that year; assessing the current and projected water demand (for domestic, agriculture, livestock and livelihood purposes); choosing crops and cropping patterns in line with net water availability while prioritizing drinking water needs; adopting water conserving technologies and formulating and enforcing sustainable and fair water governance arrangements.

- **Stakeholder Engagement**

  The Stakeholder Engagement outreach was intended to also take forward the implementation and operationalization of the Groundwater Management Acts. It was a process that involved key stakeholders from the village ("stakeholder teams") block and district levels involving representatives from the state government, local administration and NGO sectors. This engagement facilitated the alignment of water use patterns with local bio-physical, hydrological and climatic conditions. It also facilitated and strengthened linkages between communities, local, regional and state level agencies and programs which can enable these communities and households to avail of existing schemes that help them realize their Water Stewardship Plans.

  In more than 60 villages, people have offered voluntary labour ("Shramdaan") to repair defunct water harvesting structures and construct new structures. Through these voluntary activities and convergence with other programs, 8.95 billion litres of additional water was impounded.

- **Water Stewardship Plans**

  Through the Water Stewardship Initiative and the Stakeholder Engagement Process, the project is developing village/ cluster level Stewardship Plans (both harvesting and water conservation) for implementing sustainable water solutions on a watershed basis, that are inclusive and equitable, reaching out to more than 10,000 households in 106 villages.

  Jal Sevaks: A total of 27 **"Jal Sevaks" (village youth water volunteers)** have been trained to mobilise rural communities in 106 villages to assess, plan for and manage their available water resources in a manner that is sustainable and equitable.

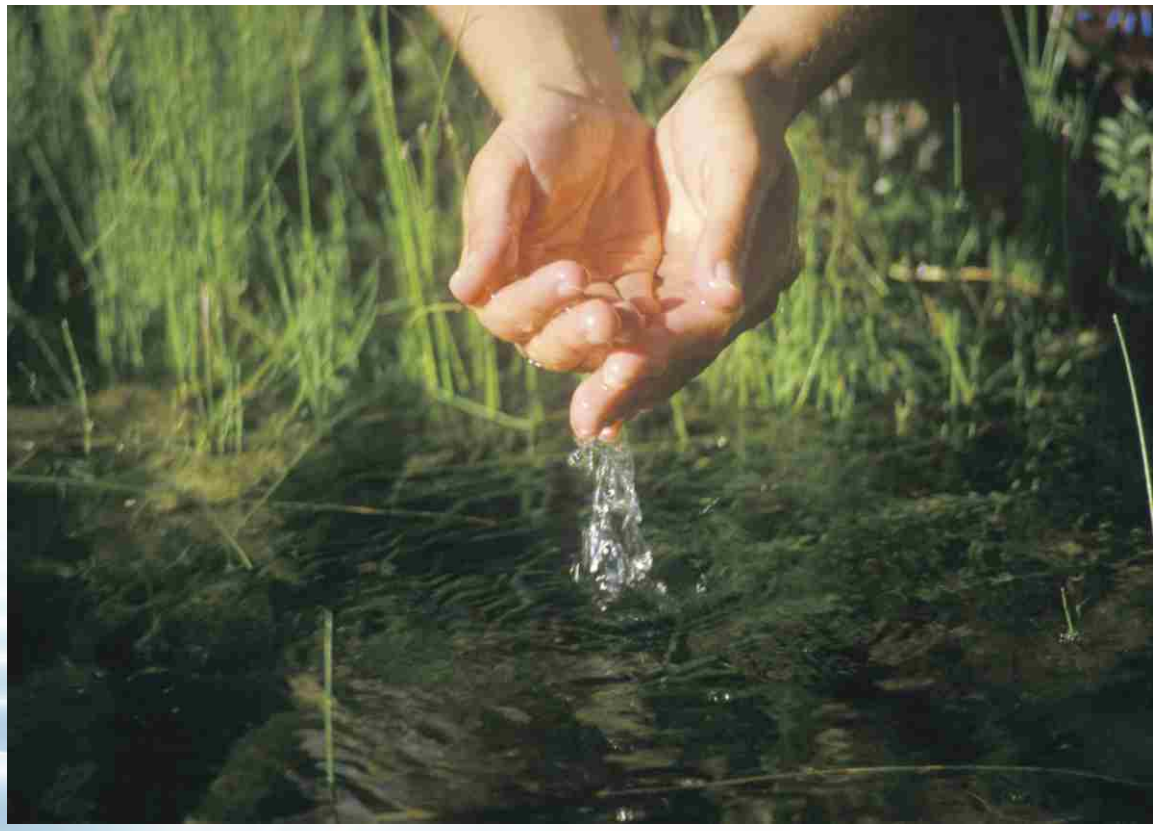
Since inception of the project, Village Water Management Teams (VWMT), comprising of 6-8 representatives of various socio-economic groups from the village, were nominated by the Gram Sabha authorized by the Gram Panchayat to support them in water management. The VWMT, with the support of Jal Sevaks, prepare Water Stewardship Plans and gets them ratified by the Gram Sabha, which they then submit to the concerned government department to seek convergence under various government programs.

These plans focus on both supply augmentation and demand management by leveraging resources from existing schemes to improve the moisture regimes in the locality; augmenting groundwater and surface water; improving water use efficiency and promoting adoption of conservation-based agricultural practices.

- **Capacity Building and Scalability**

There has been large-scale skill development and empowerment, especially of the village youth whose active involvement in village development plans has also encouraged them to take on additional responsibilities and seek out alternative livelihood opportunities. Village communities have learnt to assess water structures and repair them. They established linkages with government projects such as the Jalyukt Shivar Yojana (JSY) and the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS).

There has been increased resilience and enhanced capacity to adapt to climate change which has resulted in increased agriculture production.



Annexures I - V

Summary Tables of Case Studies by Categories

Annexure-I

Industrial Water Use Efficiency

Sl.No.	Name of Organization	Sector of use	Type of Intervention	Geographical location
1	Arvind Limited	Cotton Textiles	Water Conservation and Wastewater Recycling	Santej, Gujarat
2	Asian Paints	Paints	Water Conservation and zero liquid recharge, Rainwater Harvesting	Rohtak, haryana
3	Bilt Graphic Paper Products Ltd.	Paper	Wastewater Treatment and Water Recycling	Pune and Solapur districts, Maharashtra
4	Chemplast Sanmar Limited	Chemicals	Water recycling through zero liquid discharge and Wastewater Recycling	Mettur Dam, Tamil Nadu
5	ITC Maurya	Hospitality	Water Conservation Technologies, Rainwater Harvesting	Delhi
6	JSW Steel Ltd. (JSWSL)	Steel	Water Conservation and Zero Liquid Discharge	Toranagallu, Karnataka
7	Kirloskar Oil Engines Limited	Engineering	Water Conservation and Wastewater Recycling, Rainwater Harvesting	Kagal, Kolhapur district, Maharashtra
8	Sterlite Copper Vedanta Limited	Copper	Wastewater Treatment, Desalination and Rainwater Harvesting	Tamil Nadu

Annexure-II

Water Initiatives by NGOs

Sl.No.	Name of Organization	Type of Intervention	Geographical location
1	Adani Foundation	Participatory Groundwater Management, Water harvesting structures, groundwater recharge	Mundra Taluka, Kutch, Gujarat
2	Aga Khan Rural Support Programme (AKRSP)	Rainwater Harvesting structures	Meghal River Basin Management, Junagadh, Gujarat
3	Akhil Bhartiya Samaj Sewa Sansthan (ABSSS)	Integrated Watershed Management	Bundelkhand UP
4	Axis Bank Foundation & Dhan Foundation	Watershed Management, Water Harvesting, groundwater recharge and Safe Water Access	Pambar-Kottakarayar River Basin, Tamil Nadu
5	BAIF Institute for Sustainable Livelihoods & Development (BISLD)	Safe Water Access, Water Harvesting, groundwater recharge	Karnataka
6	Coastal Salinity Prevention Cell	Safe water access	Gujarat
7	Goverdhan Ecovillage Trust	Sewage water processing, access to safe drinking water, Water Harvesting	Maharashtra
8	Haritika	Integrated watershed management, safe water access	Chhatarpur District Madhya Pradesh
9	Himmotthan - Tata Trusts	Watershed Management, Springshed Management, WASH	Uttarakhand
10	Pan Himalayan Grassroots Development Foundation	Community Managed Drinking Water, safe water access, rainwater harvesting	Uttarakhand and Himachal Pradesh
11	Shroffs Foundation Trust (SFT)	Zero Waste Village (Solid and Liquid Waste Managemet), watershed development, safe drinking water, WASH	Vadodra district, Gujarat
12	Swades Foundation	Drinking Water, water for irrigation, water harvesting	Raigad District, Maharashtra
13	United Way	Revival of Kawdenahalli Lake	Bengaluru, Karnataka
14	Watershed Organisation Trust (WOTR)	Participatory Watershed Development & Ecosystems Restoration	Telangana & Maharashtra

Annexure-III

Community Initiatives by Industry

Sl.No.	Name of Organization	Type of Intervention	Geographical location
1	HSBC - WASH in partnership with SAFE	Safe water and sanitation for urban slums through solar powered water treatment	Kolkata, West Bengal
2	ITC Limited	Water harvesting structures, drip irrigation, direct seeding of rice, soil erosion prevention technologies, aquafier recharge	Andhra Pradesh

Annexure-IV

Urban Wastewater Management

Sl.No.	Name of Organization	Sector of use	Type of Intervention	Geographical location
1	JS Water Energy Life Company	Urban Wastewater	Revival of River & Lake Sub-Eco Systems through Bioremediation	Nag River, Naik Talav in Nagpur/ Centurion Lake, Bhubaneswar/ Jajmau Tannery Plant, Kanpur/ Laksar Drain
2	Surat Municipal Corporation (SMC)	Urban Wastewater	Reuse of treated waste water for non-industrial and non-domestic uses, distribution of recycled water to industrial consumers, zero liquid discharge for water recycling	Surat
3	Udaipur Municipal Corporation	Urban Wastewater	River recharge, sewage treatment plant on hybrid annuity model	Udaipur

Annexure-V

Innovation in Water Technology

Sl.No.	Name of Organization	Type of Intervention	Technology Application
1	AgriRain Industries India Pvt Ltd	Irrigation as a Service (IaaS)" model using Hosereel irrigation technology	Water use efficiency in Agriculture
2	Amalgam Biotech	Bioculture and Micronutrients for Wastewater in ETP, STP and WWTP	Food processing and motorcycle units
3	DC Water World Supermart Pvt Ltd	Water purification technology for residential premises and offices	Residential premises and offices
4	Earth Water Limited	Solar Run Community Safe Drinking Water Plant & Desalination Plant	Community drinking water
5	Hindustan Ecosoftt Pvt Limited (ECOSOFTT)	Poseidon Biological Wastewater Treatment and Recovery System	Homes and residential communities
6	Jain Irrigation Systems Ltd. (JISL)	Water use efficiency in agriculture	Agriculture
7	NTPC Limited	Conversion of waste water into distilled water using waste heat	Coal based thermal power plants
8	Pratiks Enviro Foundation	Bio Sewage Treatment Technology	Industrial and domestic applications, reuse of recycled water in agriculture
9	SFC Environmental Technologies Pvt. Ltd.	Cyclic activated sludge technology for sewage treatment	Reuse of treated sewage water in thermal power plants
10	SM Sehgal Foundation, Gurugram	Rainwater harvesting technology for creating freshwater pockets in saline aquifers	Groundwater
11	SSP Private Limited	Recover portable water and desalination of brine to recover water and salt	Salt Refinery

Annexure-V

Sl.No.	Name of Organization	Type of Intervention	Technology Application
12	Technorbital Advanced Materials Pvt Ltd.	Water purification through Ultrafiltration hollow fiber membrane spinning technology	Drinking water
13	Transchem Agritech Private Limited (TAPL)	Trans bio-filter technology for wastewater treatment plants	Industrial wastewater, grey and black water treatment in urban areas
14	Vassar Labs IT Solutions Private Limited	Water resources information management system	Water Resources Management and planning by State Govt.
15	Water, Sanitation and Hygiene (WASH) Institute	Mobile Septage Treatment Unit for onsite faecal sludge treatment	Urban sewage treatment

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