Impact Study Report

"Water Resource Management and Ecosystem Restoration in Valsad and Dang Districts, Gujarat."

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Acknowledgement

We are grateful to Atul Ltd. and Atul Foundation for entrusting us with an impact study of the "Water Resource Management and Ecosystem Restoration" Project. We would especially like to thank the project team members for their continued support throughout the study.

We are grateful to all the community members and school management for providing their time and input during field-level interactions.

Centre for Integrated Development, Ahmedabad
January 2025

Abbreviations

AKRSP	Aga Khan Rural Support Program
BISLD	BAIF Institute for Sustainable Livelihoods and Development
C.C.	Cement Concrete
CSR	Corporate Social Responsibility
Cu.M.	Cubic Meter
FGD	Focus Group Discussion
Ha.	Hectare
IM	Instrument Mechanic
KII	Key Informant Interviews
KL	Kilo Liter
PRI	Panchayati Raj Institution
RCC	Reinforced Cement Concrete
SDG	Sustainable Development Goal
SMC	Soil Moisture Conservation
STP	Sewage Treatment Plant
tCO2e	Ton Carbon Dioxide Equivalent
TDS	Total Dissolved Solids

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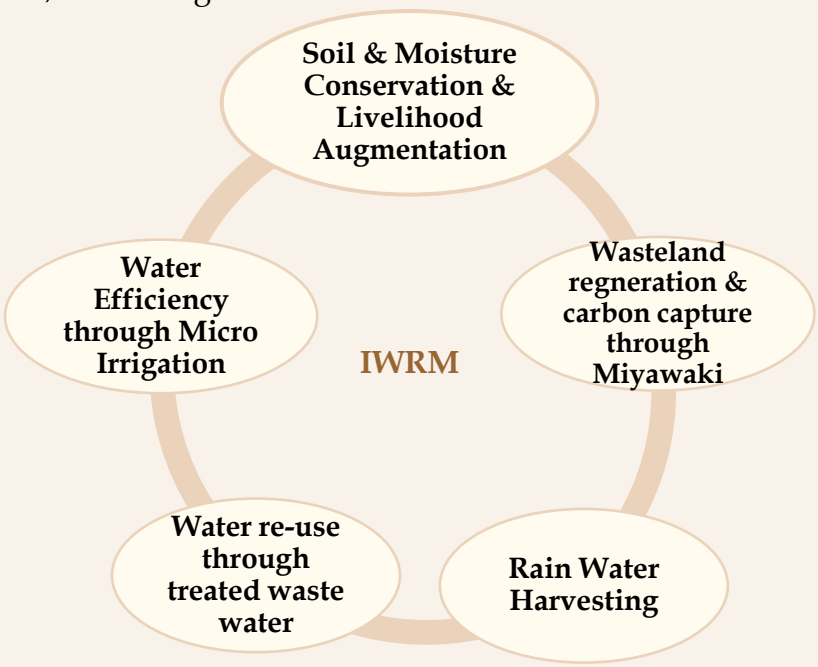
Executive Summary

Project Brief

Atul Foundation has implemented "Integrated Water Resources Management (IWRM)" project in and around Atul village as well as in 5 villages in Dang district. The project has adopted a cross-sectoral approach to managing water resources, land, and related resources with an aim to maximize social and economic welfare while maintaining the sustainability of the ecosystem. The project considers 5 thematic areas in the project:

- Natural resource management, including construction of 650 soil and water conservation from Parnera hill to Par River near Atul town of Valsad district & watershed development and livelihood enhancement interventions in 5 villages of Subir block in Dang district.
- Rainwater harvesting structures in 36 schools.
- Sewage treatment plants near Atul village, Valsad,
- Micro irrigation system (drip system) to 86 farmers for water use efficiency,
- Miyawaki plantations near Atul village.



About the Impact Study

- Impact study is aimed to understand the impact of the interventions towards the end of the project, and to measure the effectiveness of the activities undertaken. The study has undertaken a technical evaluation of physical assets created and evaluated the socio-economic and environmental impacts of interventions.
- The study adopts a mixed-methodology approach for data collection covering qualitative as well as quantitative aspects. Quantitative information is covered through CAPI-based farmer/Household (HH) level surveys and verification of physical structures. Qualitative information is captured through focus group discussion (FGD) with farmers, KII with PRIs, Atul Foundation team, and its project partners.

Key Findings

1. Watershed development, Atul

- The watershed project has been rightly conceptualized to focus on water conservation and control soil erosion. The presence of small streams and undulating topography is highly favorable for undertaking a watershed approach for soil and water conservation.
- The project supports the conservation of 316.087 million litres of water and 1321.26 cu.m of soil during the monsoons of 2021-22 and 2022-23. The project has benefited downstream immensely through control of soil erosion and reduction in water velocity. Extensive recharging of the groundwater is done upstream which has resulted in improved soil moisture
- All the structures verified have been designed appropriately, considering the watershed location and flow of the stream and are in good condition
- The project, though rightly focuses on environmental conservation, does not have a direct impact in social terms as the intervention sites are not in proximity to agricultural farms or village core habitations.

2. Livelihood enhancement through natural resource management, Subir, Dang

Considering the major challenges of irrigation water availability and high run-off, The project has been conceptualized to augment irrigation water availability, conserve soil and water, and support improved and efficient irrigation practices for augmenting farm-based incomes of small and marginal tribal farmers. The following are some of the major impacts of the project:

- 85 acres of land treated through soil-moisture conservation.
- 1.2 lakh litres of water recharge annually.
- 24 acres of land is brought under irrigation through new water harvesting structures and access to irrigation through solar/electric lift irrigation.
- Promotion of water efficiency through drip irrigation in 5.5 acres of land.
- More than 450 community members and village leaders capacitated for village governance and management of natural resources.
- 256 farmers adopted regenerative agriculture practices through crop diversification and natural farming.

3. Protecting biodiversity through Miyawaki forest in Hariya Village

- Miyawaki plantations have been promoted in 2 Ha. Land on the village wasteland of Hariya village, adjacent to Atul village. Nearly 47,000 trees with 79 varieties of native species have been planted in a span of 3 years.
- The project has been highly successful in increasing biodiversity, creating natural barriers, reducing air and sound pollution, reducing local temperature, and improving

soil organic carbon content by 30%. Locals indicate the presence of varied birds and butterflies due to these plantations.

- Upon maturity these plantations will support carbon sequestration with a potential estimate of 735 tCO2e/year[1], thus contributing to India's target of net zero emissions by 2070.
- Further, the project has provided employment of 235 person days to local tribals during the plantation phase.

4. Rainwater harvesting and recharging in government schools

- Atul Foundation has undertaken rainwater harvesting and recharging in 36 government schools in villages adjacent to Atul.
- The complete system and filter are operational in 9 schools studied.
- The project has been instrumental in the groundwater recharge of nearly 14,000 kilo-litres of water annually.

5. Micro irrigation system for water use efficiency

- Atul Foundation promoted MIS (Micro Irrigation System) in 24 villages in Kaprada and Valsad blocks of Valsad district in Gujarat in partnership with GGRC for supporting subsidies to small-marginal farmers.
- The project has supported 86 small and marginal farmers mainly with a drip irrigation system covering 85.28 acres of land area.
- Some of the major impacts are:
    - ✓ Increased rabi cultivation in 5-10% of land (avg. 0.25-0.5 acres/farmers)
    - ✓ Reduced water consumption by 20-40% (total 77600 kilo litres per year)
    - ✓ Increased crop productivity by 20-40%
    - ✓ Increased income – Rs. 17.8 lakh/year (Avg. Rs. 12,000-25,000/farmer/year)

6. Water recovery through sewage treatment plant

- In alignment with national goals, Atul Foundation has promoted the treatment and reuse of sewage water in 4 educational institutes in and around Atul village through the installation of 6 Sewage Treatment Plant (STP). The project aims to protect public health, and conserve the environment and water resources. STPs also aim to reduce pollution and make wastewater usable for other purposes.
- The treatment technology is a patented technology CAMUS SBT (Continuous Advanced Mite Utilizing System- Soil Bio-Technology). It is a low space low energy, expandable high-quality nature-based technology. The technology has been shortlisted by Atul Foundation after rigorous interaction with various technology service provider.

[1] Default values set by the IPCC Good Practice Guidance for LULUCF in urban trees in parks and streets were sink carbon stock in the plant as about 0.0033-0.0142 t C tree-1 yr-1 (IPCC, 2003)

- Treated water in all the institutes is used either for toilet flushing or gardening.
- The project has been instrumental in treating and reusing 312 KLD wastewater.

Summary

Through an integrated approach to water resource management, the project has contributed immensely to managing land and water resources and improved bio-diversity, thus contributing towards improved ecosystem sustainability. The project interventions contribute towards Sustainable Development Goal (SDG) 6- clean water & sanitation, SDG 13- climate action as well as SDG 15- land on water (through conservation of water ecosystem, reducing land degradation and preventing biodiversity loss).

Way forward

- Gram Panchayats can be linked for availing water credits under the LiFE initiative launched by the Central Government in 2023.
- The community in Subir can be supported in adopting improved cook stoves (against traditional fire-wood stoves) for fuel efficiency as well as reducing greenhouse gas emissions.
- Organizing environmental camps for children in project villages through training and exposure visits to watersheds, rainwater harvesting systems & sewage treatment plants

Background

About Atul Group

Atul Ltd. was founded in 1947 after Indian independence by Shri Kasturbhai Lalbhai. The company is a manifestation of his dream to generate large-scale employment, create wealth in rural India and make the country self-sufficient in its requirements of chemicals. At present, Atul Ltd is a chemical conglomerate specializing in the production of over 900 products. Atul is headquartered in Valsad district of Gujarat and is spread over 1,300 acres of land.

Atul Foundation was created as part of Corporate Social Responsibility (CSR) to bring all activities related to serving society under one umbrella. The Foundation undertakes projects and activities, broadly under six programs like education, empowerment, health, relief, infrastructure, and conservation.

Project Brief

Atul Foundation has implemented "Integrated Water Resources Management (IWRM)" project in and around Atul village as well as in 5 villages in Dang district. The major objectives of these interventions are to promote coordinated development and management of water, land, and related resources for improved livelihoods and ecosystem restoration.

Figure 1 Project Location

Several programs under Integrated Water Resources Management (IWRM) have been undertaken, including:

- Natural resource management
  - ✓ 650 soil and water conservation structures from Parnera hill to Par river near Atul village of Valsad district in partnership with BAIF Institute for Sustainable Livelihoods and Development
  - ✓ Watershed development and livelihood enhancement interventions in 5 villages of Subir block in Dang district.

- Rainwater harvesting structures in 36 schools.

- 6 sewage treatment plants near Atul village, Valsad.

- Micro irrigation system (drip system) benefits to 86 farmers for water use efficiency.

- Miyawaki plantations near Atul village.

Figure 2 Region Overview

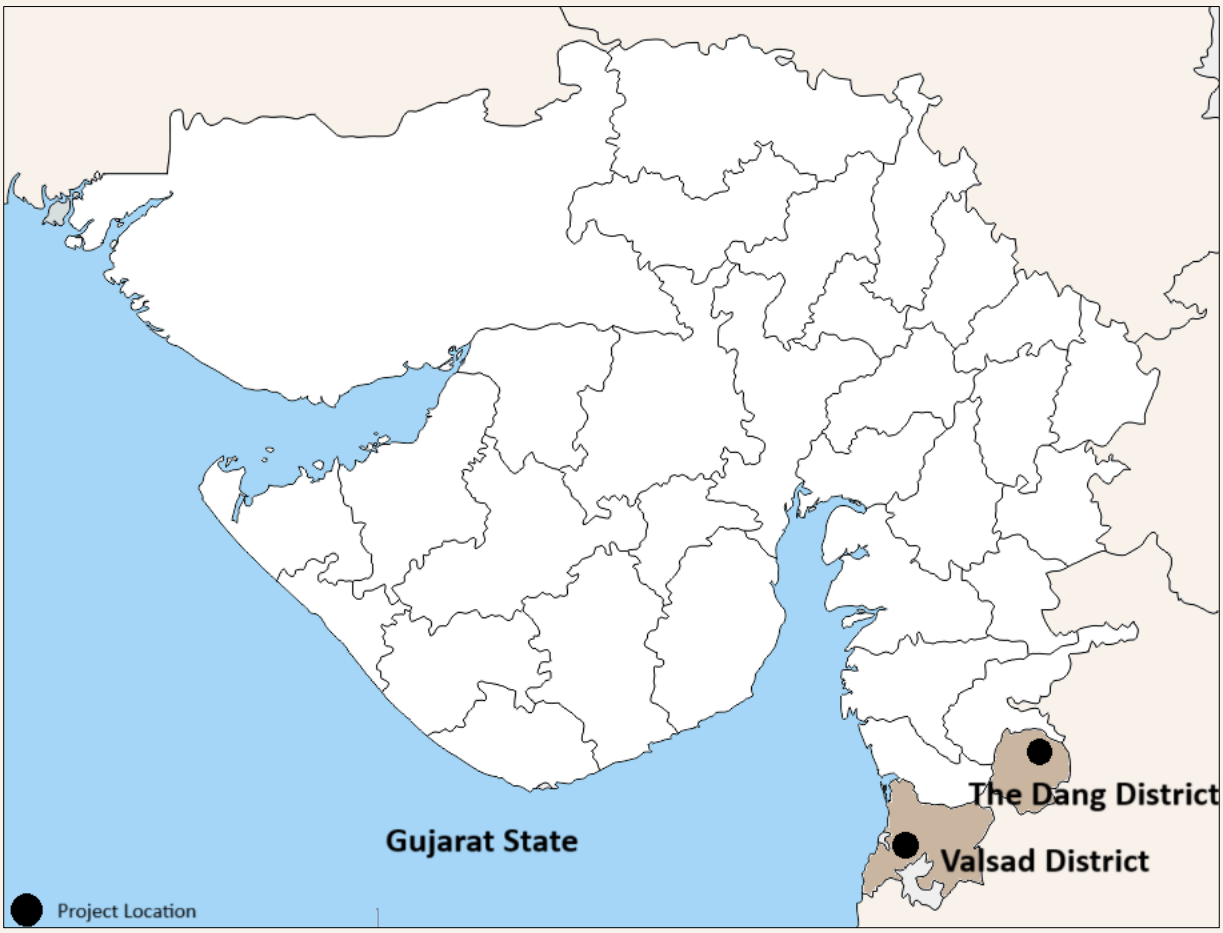


Figure 3 Project location

Brief on project geography

Atul and adjacent villages in Valsad district

Project villages including Atul and other adjacent villages like Hariya are primarily tribal dominated with a major population of Nayka Patel and Dhodiya Patel. The topography is undulated, hilly terrain. Weather is mainly hot and dry during summer with high rainfall(1750-2990mm/year)[2] during monsoon. The region has a good forest cover. Major occupation of the households in agriculture and households augment their incomes through various work in Atul factory.

Project villages in Subir Block, Dang District

Project villages in Subir block mainly comprise of scheduled tribe populations like Bhil, Konkana, Varli, Kotwalia, Kathodi and Gamit. The region has a high forest cover and is highly undulating. The economy is basically dependent on agricultural activities. Animal husbandry and bamboo cutting are other economic activities. The region has many small-medium streams. The region receives heavy rainfall (ranging from 1,440-2,800 mm/year)[3]

[2] CRIS, Indian Meteorological Department
[3] CRIS, Indian Meteorological Department

About the study

Study objectives

The impact study is aimed to understand the impact of the interventions towards the end of the project and to measure the effectiveness the activities undertaken. The study has undertaken a technical evaluation of physical assets created and evaluated the socio-economic and environmental impacts of interventions.

Research study framework/areas of inquiry

Table 1 Research framework

MIYAWAKI FOREST	RAIN WATER HARVESTING	WATER HARVESTING (NRM)	SEWAGE TREATMENT PLANT	DRIP IRRIGATION
Coverage	Status, functioning and quality of structures	Water conservation	Status, functioning and quality of structures	Command area under drip
Type of plantation	Recharge potential created annually	Status, functioning and quality of structures	Reduction in nutrient pollution-	Reduction in water consumption
Survival rate	Impact on groundwater table	Appropriateness of location	Improved water quality parameters	Changes in seasonal crop pattern
Impact on air quality & sound reduction	Alignment with national context	Annual recharge potential created	Re-usability of treated water	Improved soil moisture
Annual carbon sequestration		Impact on ground water table	Energy efficient treatment system	Yield benefit & increased farm income
Process of activities Impact on the livelihood of tribals		Livelihoods for tribals	Process of selection of technology	Water and labour saving
Impact on biodiversity		Soil conservation	Alignment with national context	Alignment with national context
Alignment with national context		Alignment		

Study Methodology

- The study adopts a mixed-methodology approach for data collection covering qualitative as well as quantitative aspects. Quantitative information is covered through CAPI-based farmer /Household(HH) level surveys. Qualitative Information is captured through focus group discussion (FGD) with farmers, KII with PRIs, Atul Foundation team, and its project partners.

Study approach

The study looks mainly at aspects like

- Study of design documents
- Visual observations on the quality of physical assets created
- Analysis of the technical impact of various interventions

Study Sample

Table 2 Study sample

Intervention	Sample
Watershed development Parnera, Valsad	Verification of complete area, more than 100 structures verified KII 3 (Senior Manager- Atul Foundation, Project engineer- Atul Foundation, Project lead- BAIF)
Livelihood enhancement through NRM, Subir, Dang	FGD and structure verification in 3 villages (total 21 members) KII 3 (Project engineer- Atul Foundation, Area manager and Block head- AKRSPI)
Miyawaki plantation near Atul	Verification of complete area, interaction with 3 villagers
Roof top water harvesting & recharging in schools, Valsad	9 schools (of total 36 schools) Structure verification and interaction with 2-3 staff in each school KII with Nee Rain- technology support partner
Drip irrigation, Valsad	KII with all 10 benefitted farmers
Sewage treatment plant	All 6 Plants- site verification KII with technology support partner (CEO, Vision Earth Care)

Watershed development

Atul, Valsad

Background

Project Outreach
Village: 1 (Atul)
Area: 450 Hectares
No. of Structures: 650

The topography near Atul village near Atul plant is highly undulated, with an average slope of 5-10%. There are various small streams in the region. High rainfall and undulating topography have led to high soil erosion in the region. Though rainfall is high, there is major issues of water scarcity specially in summers as rain water is not captured adequately.

To promote soil and water conservation and reduce high-velocity runoff in the region, Atul Foundation undertook watershed development near 2 villages (Atul & Hariya) in Pardi Block of Valsad district.

The project has been designed and implemented by the BAIF Institute for Sustainable Livelihoods and Development. The project has been implemented from April 2021 to March 2023.

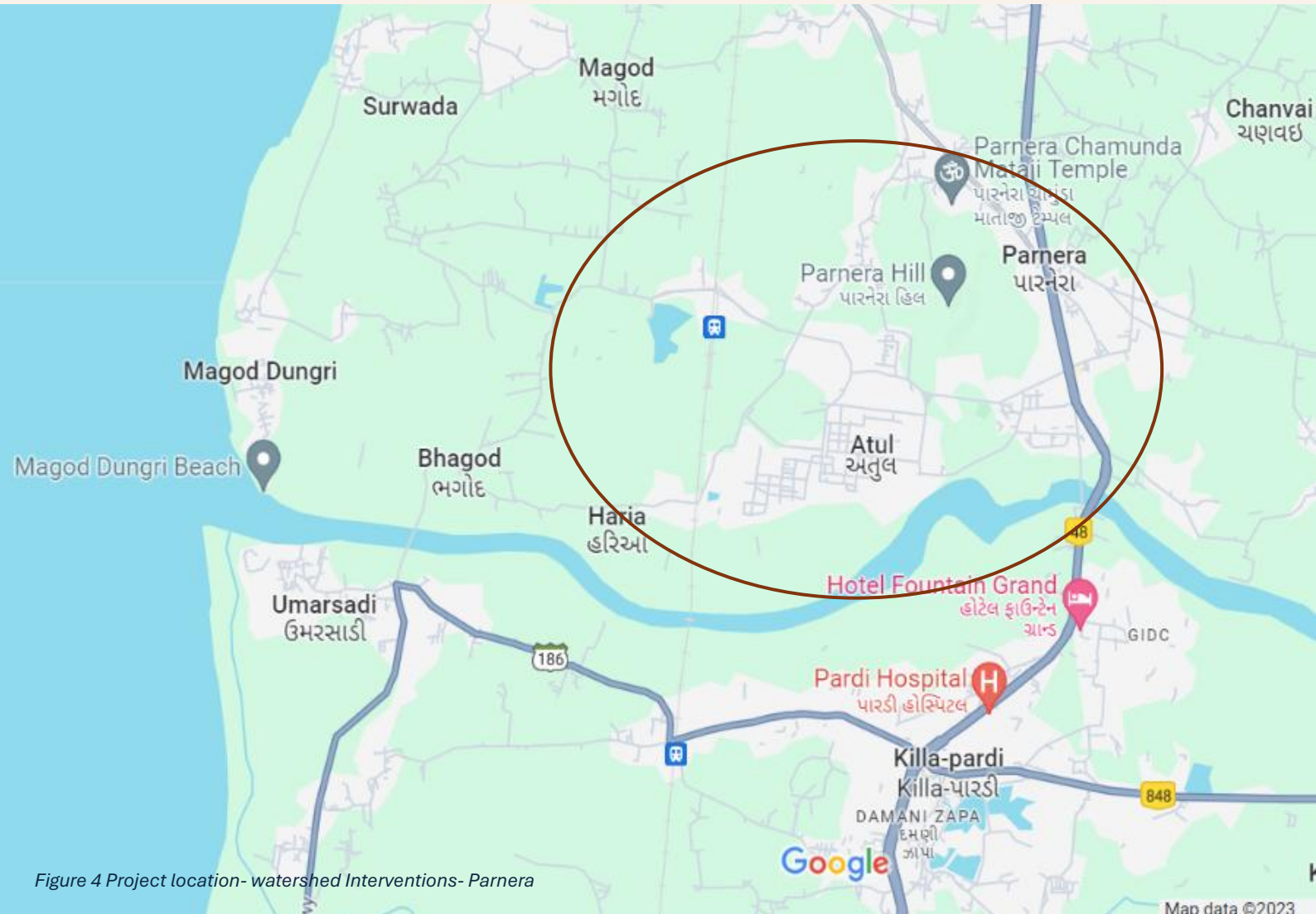


Figure 4 Project location- watershed Interventions- Parnera

Technical Interventions

Considering the undulating topography and soil conditions, a ridge-to-valley water shed approach has been adopted for the treatment of the area with the major objective of control of high run off and water recharging/conservation. Following water recharging and soil moisture conservation structures have been constructed augmenting nearly 316.087 million litres of water and conservation of nearly 1321.26 cu.m. soil during the monsoon of 2021-22 and 2022-23

Table 3 Details of water harvesting structures

Details of Water Harvesting/Recharging Interventions			
Type of Structure	**Unit**	**Qty**	**Water Conservation (cu.m.)**
Trench Cum bund/GP/Stone outlet/Stone bund	Ha.	566	222500
Nala Plug (Concrete)	No.	9	8324.75
Masonary Field Outlet	No.	1	249.425
Gabion Structure	No.	20	10409
De-Silting	No.	5	73130
Farm Pond	No.	2	760
Check Dam Repair	No.	2	714
Total			**316087.175 cu.m 316.087 million litres**

Figure 5 Farm pond with plastic lining

Table 4 Details of soil moisture conservation interventions

Details of Soil Moisture Conservation Interventions		
Activity Name	**Qty (No.)**	**Volume (Soil)**
Trench Cum bund	361	425.79
Gully plug	160	233.31
Stone Outlet	45	0.00
Nala Plug (Concrete)	9	42.88
Masonary Field Outlet	1	5.17
Gabion Structure	20	119.52
SSB+SB	36	44.02
De-Silting	5	450.57
Total Volume (Conserved)- cu.m.		**1321.26**
Tonnes (0.3518 tonne/cu.m.)		**464.82**

Figure 6 Check wall

Project implementation

Survey works have been undertaken by the Project engineer, Atul Foundation as well as BAIF Development Research Foundation to identify the type and location of various structures along with the preparation of contour maps. Post identification of potential sites, meetings have been held with the forest department and Sarpanch of relevant gram panchayats. The design for the structures has been prepared by the project engineer and BAIF. Sanctions have been given thematic programme executive. The project has been implemented by BAIF.

Key findings from field verification

All the structures verified have been designed appropriately considering the watershed location and flow of stream. The location of structures is appropriate in benefitting downstream immensely through control on soil erosion and reduction in water velocity as well as benefiting upstream through recharging of groundwater and improved soil moisture. The quality of structures is good and no major damage is seen.

Figure 7 Nala Bund

The overall impact of interventions

National context: The central government has formulated the National Water Policy (NWP) 2012, which contains provisions for rainwater harvesting like incentivizing the revival of traditional water harvesting structures, and encouraging rainwater harvesting to increase the availability of utilizable water. Launched in 2019, "Jal Shakti Abhiyan" campaign promotes rainwater harvesting in both urban and rural areas indicating "Catch the rain, where it falls, when it falls". In line with this objective, Atul Foundation has rightly focused on a sustainable solution to the global water crisis.

Contribution to SDGs: These initiatives also contribute to The Sustainable Development Goal (SDG) on water resource management (Goal 6), which aims to protect and restore water-related ecosystems.

In line with national context on Jal Shakti Abhiyan & sustainable development goal 6

2628 work days of labour generated for local tribals

Conserving nearly 316.087 million litres of water annually

Conserving nearly 1321.26 cu.m. soil annually

Improved ground water recharge and soil-moisture conservation: The project has been instrumental in conserving 316.08 million litres of water and conserving nearly 1321.26 cu.m. soil annually and treating 450 hectare area during the monsoons of 2021–22 and 2022–23.

Livelihood augmentation to locals:

The project has immensely benefited in providing employment to local tribals during the construction works of the structures.

Control of soil run off

The major impact has been in a reduction in soil erosion and a reduction in water flow velocity in downstream.

Learnings and way forward

The project interventions rightly focus on one the most pressing global challenges of water crisis and soil erosion. The project though rightly focuses on environmental conservation does not have direct impact in social terms as the intervention sites are not in proximity to agriculture farms or village core habitations.

While the focus of project is on water and soil conservation, its impact on ground water table as well as testing of soil moisture prior to and after the project would have helped in determining actual impact.

Further, there is a huge scope for connecting local gram panchayats to avail water credits under the LiFE initiative launched by the central government in 2023. Agency/Panchayats can earn tradable credits by adopting water-saving measures.

Figure 8 Trench cum bund

Livelihood enhancement through NRM

Subir, Dang

Background

The project regions in the Subir block of Dang district receive good rainfall and are blessed with rivulets and streams. The higher portion of this region is covered under reserve and protected forest. The area comprises hills with rugged topography due to which the surface run-off is high. High rainfall and undulating topography have led to high soil erosion in the region. Though rainfall is high, there is a major issue of water scarcity, especially in summer, as rain water is not captured adequately. Moreover, there is a lack of year-round irrigation water availability and access to irrigation sources, limiting agricultural incomes.

Figure 9 Project villages in Subir block, Dang

To address these issues, Atul Foundation undertook natural resource development for livelihood augmentation in 5 villages across 2 gram panchayats in Subir block of Dang district. The project has been designed & implemented by Aga Khan Rural Support Programme India (AKRSPI). The project duration spans from June 2023- March 2024.

Geographical coverage		
	Village	**Gram Panchayat**
1	Daher	Daher
2	Karanjada (Lavchalisaja)	Hanwantpada
3	Uga (Lavchali)	Daher
4	Ghana	Daher
5	Ghubadia	Hanwantpada

The objectives of this project are:

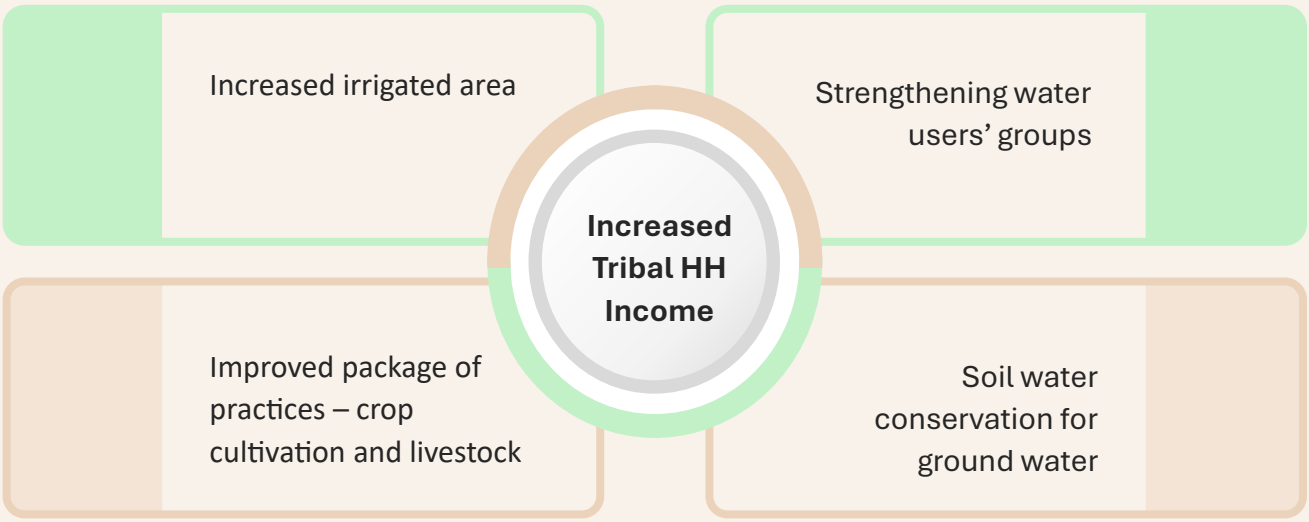


Figure 10 Gully Plug

Project Interventions

The project focuses on 6 major areas:

A. **Water resource development:** The major objective of water resource development in the project region has been to provide a sustainable solution for irrigation water through the augmentation of water resources and its access. Major interventions include:

- Farm pond: 3 farm ponds have been constructed in farmers' fields in villages Ghubadiya and Karanja to augment irrigation water availability.
- Solar base mini lift irrigation: Even after good rainfall and the availability of streams, access to irrigation is a major concern, due to lack of power supply. Farmers have been using a diesel pump, but the operational costs are very high and lead to environmental issues due to the emission of greenhouse gases. To tackle these issues, the project has introduced an efficient and green energy solution through solar-based mini lift irrigation system. 1 such system has been provided in village Ghubadiya which is used by 8 farmers.
- Electric lift irrigation: 1 electric based lift irrigation system has been installed in village Karanja village where power supply was available. This system supports 8 farmers to access irrigation water from local stream and well.

The water resource development has been undertaken in convergence with other donor agencies

B. Soil & water conservation: Major objective of SWC in the project region has been to control high run off, control soil erosion and capture water for soil moisture. Major interventions include:

- Farm bund: This support has been provided to 55 farmers for construction of earthen bunds and to 71 farmers for construction of stone bunds on the periphery of their farms to control run off and improve soil moisture.
- Nala plug/ gully plug: 96 stone ridges are constructed across streams for harvesting and storing water as well as improve soil moisture.

Figure 11 Stone bund & land levelling beneficiary

- Land levelling: The region being undulating, there is high runoff and soil erosion, hence land levelling has been supported for 226 farmers.
- Deep continuous trench: Trenches have been dug to control surface run off and support ground water percolation. 1490 running meters trenches have been dug, assisting 9 farmers.

SWC interventions have been undertaken solely with support of Atul Foundation

C. Sustainable agriculture development: Monocropping is widely practiced in the region, with paddy and millets as major crops. Monocropping has been affecting land productivity and agricultural income has been limited. The project has been instrumental in promoting multi-cropping and crop diversification through the cultivation of cash crops for improved land productivity and increased farming incomes.

Figure 12 Creeper vegetable at Ghubadiya village

Various interventions have been undertaken to promote regenerative agriculture:

- Kitchen garden support for 175 HHs.
- Micro irrigation systems (drip) for 32 farmers.
- Creeper vegetable kits for 31 farmers.
- Natural farming kit and training for 50 farmers.

All the regenerative agriculture support has been undertaken in convergence with other donor agencies.

D. Animal husbandry: Livestock rearing is one of the major occupations after agriculture in the project region. The project has been instrumental in building the capacity building of 5 Pashu Sakhis to provide preventive veterinary care for milch cattle. Further, 10 village level trainings have been conducted for awareness raising for 40 participants on better practices of rearing small ruminants (goat/sheep) and poultry. 30 HHs have also been provided with kits for the cultivation of Napier grass and nutrition kits for better fodder and feed for cattle and small ruminants. All the animal husbandry support has been undertaken in convergence with other donor agencies.

E. Capacity building of local leaders & community: The following capacity-building interventions have been undertaken for the community to improve understanding of governance and management of resources:

- Training of Village Development Committee (VDC): 10 trainings have been conducted for 172 community members with a major focus on the importance and methods of conducting gram sabha.

Figure 13 Focus Group Discussion

- Exposure visit of community leaders: in order to orient PRIs (Panchayati Raj Institutions) on development programs, government schemes, budgeting etc., 6 exposure visits have been conducted in Kutch region covering 36 village leaders.
- Workshop with PRI members: A workshop has been conducted for PRI members from 5 villages to understand the local governance structure.
- User group training & exposure visit: 10 trainings have been conducted for solar user groups for 66 farmers for the management and maintenance of group solar lift irrigation. Further 3 exposure visits have been undertaken for 24 solar lift irrigation farmers in Dang to understand the practical working of such systems

The capacity-building programs have been undertaken with the support of Atul Foundation as well as in convergence with other donor agencies.

F. Youth skill development: 19 youth (male & female), 18-25 years have been provided training on stitching and tailoring at YJ Waghai center as sewing machine operators. Of them, 12 have joined AIVE at Atul Foundation to operate an industrial sewing machine

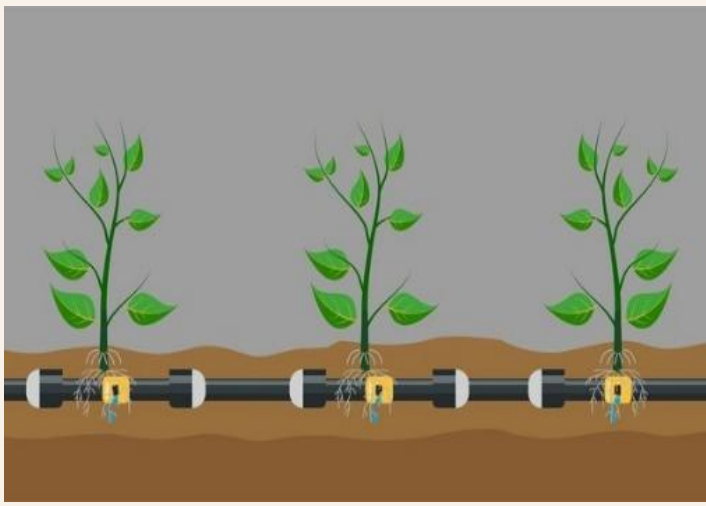
Project implementation strategy

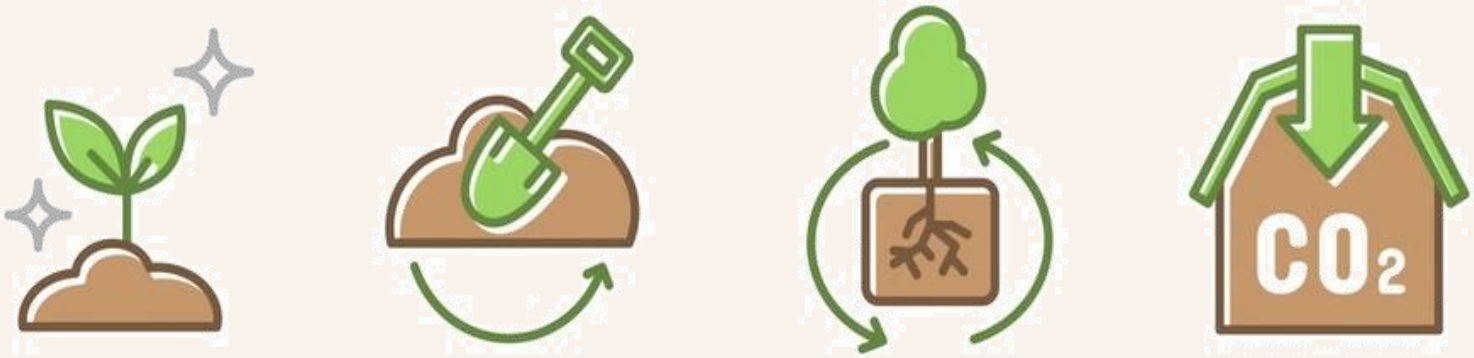
- Keeping community at the core, the project has been implemented through extensive community participation and capacitating village-level institutions.
- Gram Vikas Mandal, the apex institution at the village level has been involved right from project planning, beneficiary selection, and implementation.
- Beneficiaries have been identified through community-level meetings giving priority to vulnerable like small and marginal farmers, widows, disabled etc.
- A lot of collaborations have been pulled up in the project with government organizations (agriculture & animal husbandry department, tribal sub plan, forest department, Krishi Vigyan Kendra) which included convergence in planning, finances, and capacity building of community.
- A development organizer (social & technical) has been appointed for overall project mobilization and implementation for AKRSP(I) and Atul Foundation
- Pashu Sakhis have been trained & promoted in 5 villages for carrying out works related to animal husbandry through an entrepreneurial approach.
- Farmers' field schools have been promoted in 5 villages to provide a platform for farmers for learning and sharing.

Project impacts

Considering irrigation as a major challenge, the project rightly focuses on major interventions on water harvesting, soil water conservation, and forming user groups for effective management of water resources. Some of the major impacts of the project are:

- 24 acres of land brought under irrigation through new farm ponds and solar/electric lift irrigation benefitting 19 farmers.
- 85 acres of land treated under soil water conservation for improved soil moisture and reduction of soil erosion benefitting more than 359 farmers. 120 cu.m./ 1.2 lakh litres of water recharged annually.
- Water efficiency through drip irrigation benefitting 5.5 acres of land.
- More than 70 households benefitted from better nutrition and awareness of better practices for animal husbandry
- More than 450 community members and village leaders capacitated for village governance, and management of natural resources.
- 19 youth capacitated under skill development for augmenting livelihood.
- 256 farmers adopted regenerative agriculture practices through crop diversification and natural farming.





Learnings & way forward

The project has been instrumental in creating needed infrastructure for augmenting irrigation as well as building awareness of regenerative agriculture practices. Considering the climatic changes and anomalies, looking ahead, the following are some of the recommendations for the coming project phases:

- Extensive literacy on water efficiency in agriculture through micro irrigation systems, and better irrigation practices can be taken up.

- A detailed study on pattern of climatic anomalies and its impacts on farming needs to be taken up for guiding farmers on combating future climate-induced hazards.

- The project has been instrumental in extensive convergence and partnership. However, guidance and handholding are still needed for availing of major government schemes in the region.

- The region still has the use of traditional firewood-based cook stoves. Handholding and capacity building are needed for transitioning the community towards improved cook stoves for fuel efficiency as well as reducing greenhouse gas emissions.

Preserving biodiversity through Miyawaki Forest, Hariya village

About Miyawaki Concept

The Miyawaki method is a Japanese technique for planting forests quickly on degraded land using native plants. This dense, native-species forest enhances biodiversity, creating a habitat for various flora and fauna. It serves as a natural barrier, reducing noise and air pollution while improving air quality. The lush vegetation helps in carbon sequestration, mitigating climate change. Additionally, the forested border provides aesthetic appeal and can reduce stress and enhance the well-being of those nearby. Its rapid growth and low maintenance needs make it a practical and sustainable choice for greening urban and suburban environments effectively.

Project Details

Atul Foundation took up Miyawaki plantation on the village wasteland of Hariya village, adjacent to Atul village in about 2 Ha. Land from April 2022 phase-wise for 3 years

Project Highlights

2 Ha. dense forest

47,000 trees

79 varieties of native species

A total of 47,000 native plants were planted in three Miyawaki forests. High-intensity 79 varieties of indigenous plants (Vad, Peepal, Tulsi, Gulmahor, Ashwagandha etc) have been planted covering 2 Ha. area. To provide irrigation, 3 farm ponds (plastic lined) have also been constructed for irrigation purposes. Further, vermicompost for pit preparation has been purchased from the local women's self-help group providing them employment. The plantations and labour work have been undertaken through the support of tribals, creating employment for them. The project has been implemented by Atul Foundation and BISLD and a local caretaker is appointed for overall maintenance and watering.

Project impact

"From barren land to butterflies"

While the plants are not yet fully grown, this initiative upon its maturity in the next 1-2 years shall be highly impactful through:

- Increased biodiversity.
- Natural barriers reduce air and sound pollution and reduce local temperature (ranging from 1-1.3^{o} C).
- Improve soil organic carbon content by 30% within five years.
- The project has been instrumental in providing employment for local tribals during the plantation phase.
- Within 3 years, the average carbon sequestration of this forest of about 1 hectare is 156.53 tCO2e/year[4]. Upon maturity, these plantations will support carbon sequestration with a potential estimate of an average of 735 tCO2e/year[5], thus contributing to India's target of net zero emissions by 2070.

Discussions with few villagers nearby indicate that they have observed varied birds and butterflies nearby due to these plantations indicating improving biodiversity and habitat conservation in the region.

[4] 2022, Estimating Carbon Stock in Biomass and Soil of Young Eco-Forest in Urban City, Thailand (Volume 97, The Italian Association of Chemical Engineering)

[5] Default values set by the IPCC Good Practice Guidance for LULUCF in urban trees in parks and streets were sink carbon stock in the plant as about 0.0033-0.0142 t C tree-1 yr-1 (IPCC, 2003)

Rainwater harvesting
in Government schools

Background

India faces water stress in some areas and flooding in other parts. Ministry of Jal Shakti has thus launched the Jal Shakti Abhiyan (JSA) in the year 2019. A campaign "Catch the rain" lays stress on creating Rain Water Harvesting Structures (RWHS). In line with this, Atul Foundation has undertaken rain water harvesting & recharging in 36 government schools in villages adjacent to Atul.

Figure 14 Filter for collected rain water

Project details

Roof top rainwater harvesting and recharging systems has been installed in total of 36 schools.

The components include:

- PVC channel/ gutters to collect rain from rooftop.
- Water filter (NRU 150: NeeRainUltra rooftop).
- PVC recharging pipe (1.5 feet connected to existing borewells).

Filter Specifications

- Two stages of filtration.
- Filter element 1 – HDPE double layer filter element – 400 micron
- Filter Element 2 - Polymeric filter – 200 Micron
- Transparent lid, one can see harvesting live.
- Suitable for a roof area of 150 sq.m.

Key Findings

Water harvesting system has been studied in 9 schools of total 36 schools. The following are key findings:

- The complete system and filter are operational in 8 schools studied. In Magod Dungri primary school, the conveyance pipe from roof top had been damaged and hence system was nonfunctional. It has been repaired recently, post-field visit.
- School staff in all 9 schools acknowledged rise in borewell water depth due to recharging (perception-based, not monitored yet). The principal of Chanvai village primary school reported improved water availability in summer due to the recharging of the borewell.

Study Sample

1. Primary school Rabda
2. Primary school Chanvai
3. Sarvajanik higher secondary school Parnera village
4. Primary school Hariya
5. Primary school Meh
6. Mangod- Mangelwad primary school
7. Higher secondary school-Magod Dungri
8. Atul Vidyamandir
9. Kalyani Shala

Annual Ground Water Recharge
Schools: 36
Total catchment: 7650 sq.m.
Run off co-efficient- 0.9 (RCC slab)
Average annual rainfall: 2000 mm
Total recharge: 14,000 Kilo litres (137 lakh litres)

Impact

The project has been instrumental in groundwater recharge of nearly 14000 kilolitres (137 lakh litres) of water annually.

Micro irrigation system for water use efficiency

Project context

In the irrigation sector, the Ministry of Jal Shakti, Government of India is pushing various water-saving technologies like underground pipelines and micro-irrigation (drip irrigation and spray irrigation) as part of the Pradhan Mantri Krishi Sinchai Yojana (PMKSY) Scheme. PMKSY promotes "Har Khet Ko Pani" (assuring water to every farm through assured irrigation) and "Per drop, more crop" (ensuring greater productivity through micro irrigation).

Project objective

In alignment with national context and in order to improve water use efficiency in agriculture and augment irrigated area for better productivity, Atul Foundation promoted MIS (Micro Irrigation System) in 24 villages in Kaprada and Valsad blocks of Valsad district in Gujarat.

Project coverage

The project supported 86 small & marginal farmers mainly with a drip irrigation system covering a 77.6 acres of land area.

Project Coverage
24 villages
77.6 acres land
86 small and marginal Farmers

Project partners & implementation method

As a partner for MIS implementation, Atul Foundation has partnered with GGRC (Gujarat Green Revolution Company) for subsidized provision of drip irrigation kits to farmers. Atul Foundation technical support through supply and one-time installation has been provided by various organizations like Mahindra Epic Irrigation Ltd, AMEE, Netafim, True Value, Shreedhar etc. Depending on the landholding and category, 70-80% cost of each MIS (Rs. 0.7-1 lakh) has been provided by GGRC and the rest is contributed by farmers and Atul Foundation.

Impact

Pre-project scenario

- The project region is highly dependent on small streams (lift irrigation) for irrigation. There are no major groundwater sources.
- Kharif cultivation, mainly paddy is rainfed as rainfall is good.
- Water in streams is available till Nov-Dec. Hence farmers give critical irrigation to certain crops (mainly vegetables like bottle guard, cucumber, okra etc) and cultivate certain crops like jowar mainly through critical irrigation or through moisture.
- There is minimal water availability in summer. Hence, farmers are not able to take summer cultivation.

Post project scenario (Based on interaction with 10 farmers)

- Drip system is used for the cultivation of vegetables in the rabi season, currently on 0.5- 2 acres of land per farmer.
- While farmers indicate that though initially, they have to invest financially, and also increase labour for fixing it crop-wise, some of the major benefits of using the drip system are:
  - ✓ Increased cultivated & irrigated Land: While there is no major change in cropping pattern with the introduction of MIS, farmers have started taking up additional land in rabi under cultivation ranging from 0.25-0.5 acres/farmer.
  - ✓ Water savings: Farmers reported a reduction in water requirement by 40-50%. Hence, assuming water reduction of an average of 1000 cu.m./acre in 77.6 acres of support for MIS, the project has contributed to a total reduction of 77600 cu.m. (77600 kilo litres) water.
  - ✓ Labour Saving: Farmers reported savings in labour and time for watering to up to 60-70% due to the use of drip system.
  - ✓ Rise in crop productivity: The use of drip has resulted in optimum and uniform water and fertilizer availability to each crop even in undulating and hilly regions resulting in improved soil moisture and plant growth. This has resulted in increased crop productivity ranging from 20-40%.
  - ✓ Reduction in input cost: Farmers indicated a reduction in weeding requirement and thus savings in the cost of weeding medicine and labour. Further, there is a reduction in pumping costs due to lower irrigation requirements and a reduction in watering labour. All these have resulted in a reduction in average input cost of an average of Rs. 3000/acre.
  - ✓ Considering the rise in productivity and reduction in input costs, there is a rise in rabi income to up to Rs. 23000/acre. Considering 77.6 acres, the project has been instrumental in a rise in farm income of Rs. 17.8 lakh per year, an average of Rs. 12,000-25,000/farmer/year.

Major Impact

- ✓ Increased rabi cultivation in 5-10% of land (avg. 0.25-0.5 acres/farmers)
- ✓ Reduced water consumption by 20-40% (Total 77,600 kilo litres per year)
- ✓ Increased crop productivity 20-40%
- ✓ Increased income – Rs. 17.8 lakh/year (Avg. Rs, 12000-25000/farmer/year)

Gopalbhai Patel owns 7 acres of land in Arnai village in Kaprada. He received the support for the drip irrigation system in 2023 under this project. Major irrigation source is from a local stream. Kharif cultivation (paddy) is mainly rainfed. He used to cultivate jowar (through moisture) and vegetables through irrigation. He now cultivates rabi vegetables, mainly okra using a drip system on 1 acre of land.

With the use of a drip system, Gopalbhai has been able to save nearly 30-40% of water for okra cultivation. Due to watering in the root zone of the plant, he reported improved soil moisture and uniform watering. Further, he added the liquid fertilizer in a drip for uniform application. This resulted in increased crop productivity by 30% and a reduction in input cost (due to savings in pumping, labour, fertilizer, and weeding medicine), resulting in an increased income of Rs. 0.39 lakhs from okra cultivation per year. He has been using the system for 2nd year now. This year he has experimented with the cultivation of strawberries with the use of drip irrigation as well as mulching.

Rabi Cultivation	Land Area	Type of Irrigation	Crop Productivity (Quintal/Acre)	Input Cost Rs/Acre)	Net Income
Before project	1 acre (okra)	flooding	60	35,000	Rs. 0.85 lakh
After project	1 acre (okra)	drip	78	32,000	Rs. 1.24 lakh
	0.25 acre (strawberry)	recently cultivated.			

Water recovery through sewage treatment plant

Project context

Wastewater is increasingly recognized as a potential new source of clean water for non-potable purposes. India's National framework on "Safe reuse of treated water" released in November 2022 gives impetus to treat and reuse wastewater.

Under Swachh Bharat Mission (Grameen), grey water management is the key component in villages through community systems such as the construction of community soak pits, waste stabilization ponds, constructed wetlands, etc.

Project objective

In alignment with national goals, Atul Foundation has promoted the treatment and reuse of sewage water in educational institutes in and around Atul village through the installation of Sewage Treatment Plant (STP). The project aims to protect public health and conserve the environment, and water resources. STPs also aim to reduce pollution and make wastewater usable for other purposes.

Project Details & Impact

- Atul Foundation has partnered with Vision Earth Care Pvt Limited for the installation and annual maintenance of 6 sewage treatment plants in 4 schools/colleges with total treatment capacity of 312 KLD.

Project Features

6 STP with capacity of 312 KLD in 4 Institutes

Use of Patented nature-based, energy-efficient technology with lower land footprint

Current input of 250 KLD

Re-use of all treated water for non-potable use

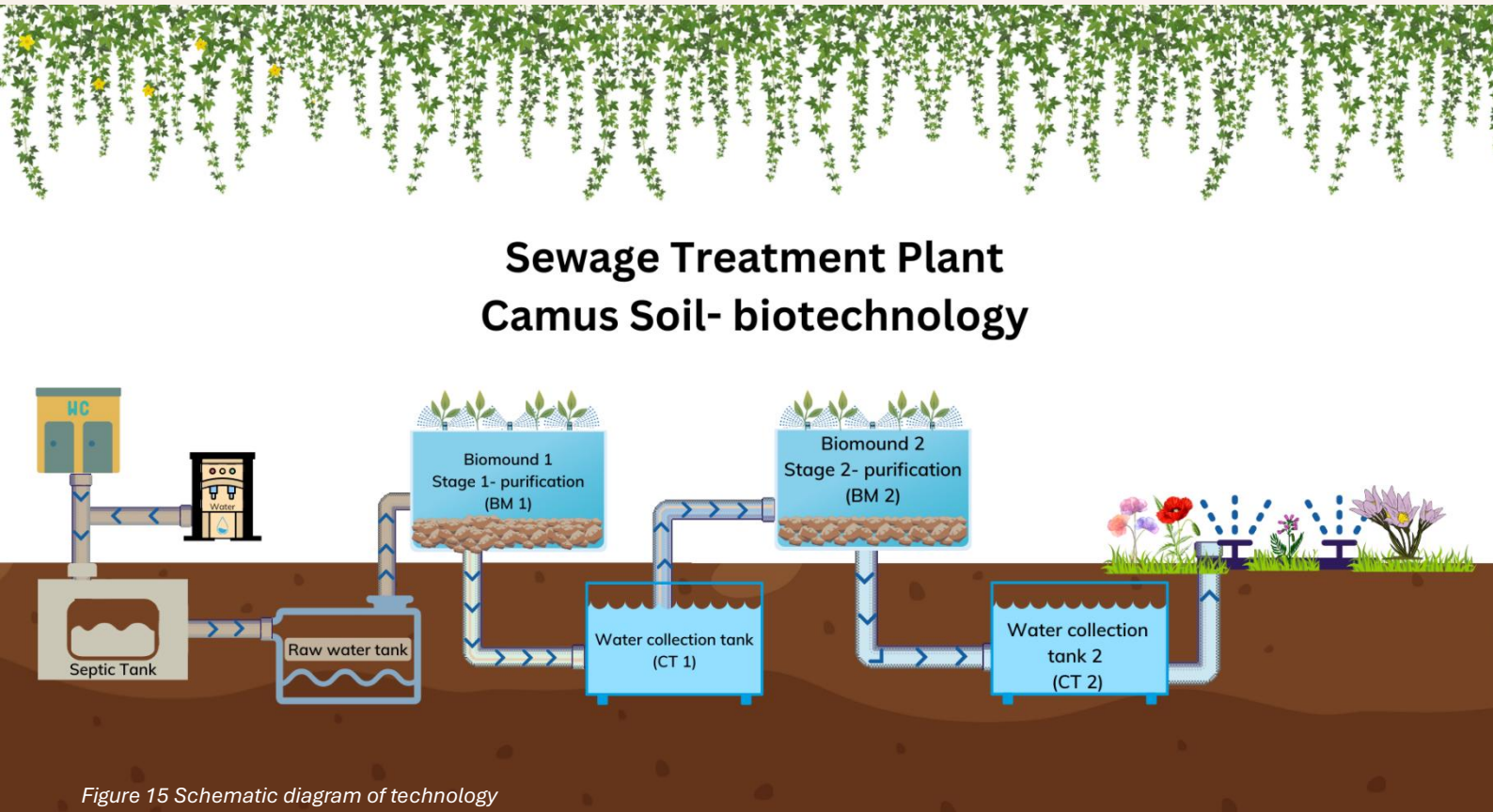


Figure 15 Schematic diagram of technology

Table 5 List of sewage treatment plants

No.	Name of Institute	Location	Design Capacity	Re-Use
1	Kalyani Shala	washrooms	70 KLD	toilet flushing
2	Kalyani Shala	waste drinking water + urinals	40 KLD	gardening
3	Atul Vidyalaya	canteen / kitchen	6 KLD	gardening
4	Eklavya Vidyalaya	hostel + kitchen	50 KLD	kitchen garden & landscape
5	Eklavya Vidyalaya	hostel	21 KLD	
6	Dolat Usha Institute of Applied Sciences	Nr. chemistry lab + urinals	125 KLD	irrigation for mango cultivator (development for re-use in campus of irrigation ongoing)

- The treatment technology is a patented technology by Professor H S Shankar of IIT Bombay termed as CAMUS SBT (Continuous Advanced Mite Utilizing System- Soil Bio-Technology). This technology is based on the principle of trickling filters. In this system, a combination of physical processes like sedimentation, infiltration, and biochemical processes are carried out to remove the suspended solids, and organic

Figure 16 STP 70 KLD Kalyani Shala

and inorganic contents of the wastewater. Suitable mineral constitutions, culture containing native micro-flora, and bio-indicator plants are the key components of the system. It is also known as a Constructed Soil Filter (CSF). SBT systems are constructed from RCC & stone masonry. It consists of a raw water tank, bioreactor containment, treated water tank, piping, and pumps. It is a low space low energy, expandable, high-quality nature-based technology. The technology has been shortlisted by Atul Foundation after rigorous interaction with various technology service providers.

- Currently all the plants are designed with the load factor for next 25 years. All pants are working with the current input load is 225-250 KLD in total. Treated water is re-used for toilet flushing, gardening and kitchen garden.
- Input and output water is treated for parameters like pH, BOD (Biological Oxygen Demand), COD (Chemical Oxygen Demand), TSS (Total Suspended Solids), ammonia nitrogen, total nitrogen, dissolved oxygen, and fecal coliform and the treated water falls within stipulated norms specified by CPCB (Central Pollution Control Board.) However, it is suggested that if re-use is planned for irrigation, additional testing for electrical conductivity should also be done.
- One trained operator is placed at all the sites, who looks after the daily operation and maintenance of the site.

Figure 17 STP 50KLD at Eklavya Model Residential School, Pardi.