

2008-2025

SEED's Water Interventions in the Sundarbans

More than a Decade of Aquatic Ecosystem Conservation



An Initiative By- SEED
(Society for socio economic & ecological development)



Supported By: World Bank, Deptt. of Environment (Govt. of WB), NABARD, BPCL and Azim Premji Foundation

Executive Summary

SEED (Society for Socio-Economic and Ecological Development), founded in 1996, has spent nearly three decades working in some of India's most climate-vulnerable geographies – with the Sundarbans delta of West Bengal at the centre of its water, livelihood and ecosystem conservation programming. This impact report documents SEED's cumulative track record of water resource interventions across Ghoramara Island, Sagar Island, and Kumarpukuria tribal village – encompassing freshwater pond rejuvenation, deep tubewell installation, community water governance and aquatic ecosystem restoration.

The numbers tell a compelling story:

- ~70 ponds restored across Sagar Island under the World Bank ICZM Programme (2012–15)
- 8 ponds rejuvenated on Ghoramara Island under the BPCL Climate Resilient Water Security Project (2022–25)
- 45 ponds re-excavated in Kumarpukuria tribal village under the Department of Environment, Government of West Bengal (2015–16)
- 1,100 tribal families supported through cage-based aquaculture in the East Kolkata Wetlands Ramsar Site under NABARD.

Together, these interventions have directly benefited over 21,000 people across some of India's most water-stressed and ecologically fragile geographies.

This report documents the cumulative impact of SEED's water resource interventions across the Sundarbans delta – spanning pond rejuvenation, deep tubewell installation, community water governance, and aquatic ecosystem restoration across multiple geographies including Ghoramara Island, Sagar Island, and Kumarpukuria tribal village. It draws on project-level data, community testimonials, and third-party validation to present a comprehensive evidence base of what SEED has built, who it has reached, and what has changed as a result.

21,000+
People
Benefited

~147
Ponds Restored

65
Water User
Groups (WUGs)

325
Trained in
Water
Governance

About SEED

Organisation Overview

SEED (Society for Socio-Economic and Ecological Development) was founded in 1996 by a group of professionals and social workers in Kolkata, West Bengal, united by a shared vision of empowering vulnerable, climate-affected communities. Originally named the Naktala Centre for Socio-Economic Reform and Environmental Conservation, the organisation was formally registered under the West Bengal Society Registration Act, 1961, and has since grown into a nationally and internationally recognised NGO working across multiple states and thematic areas.

Over nearly three decades, SEED has implemented programmes spanning climate resilience, water security, clean energy, early childhood care, non-formal education, biodiversity conservation, disaster risk reduction, livelihood development, and WASH — with a consistent focus on the most marginalised communities in India's most climate-vulnerable geographies, particularly the Sundarbans delta of West Bengal and the tribal communities of Jharkhand.

Leadership and Scientific Expertise

SEED's leadership brings world-class scientific expertise directly into its programming — a unique organisational advantage that sets it apart from most implementing NGOs in this space.

Prof. Jyoti Ranjan Naskar — President and Founding Member of SEED; Senior Zoologist and Environmentalist with decades of specialised knowledge of Sundarbans aquatic biodiversity, native freshwater species ecology, and estuarine ecosystem dynamics. Prof. Naskar has led community-level marine biodiversity conservation awareness programmes for coastal women of the Sundarbans — featured by Climate Action Network South Asia (CANSA). His expertise directly guides SEED's bioremediation and aquatic ecosystem restoration methodology.

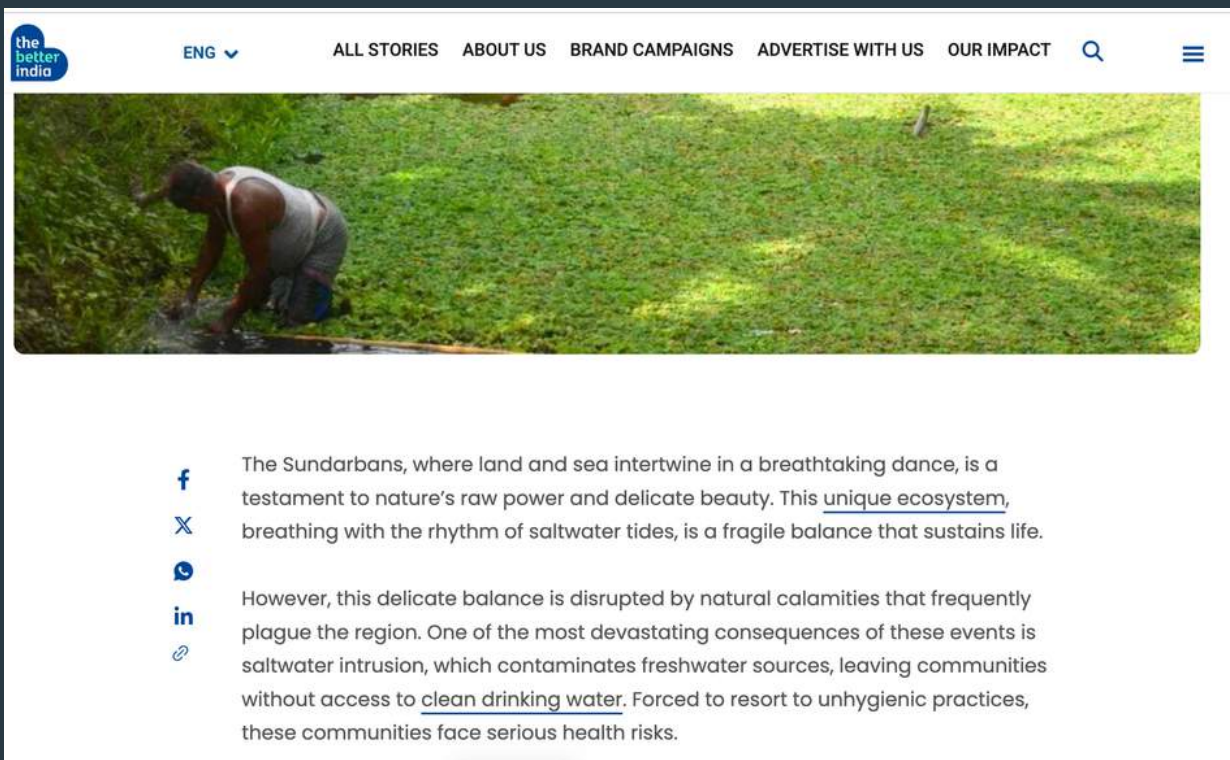


Dr. Somenath Bhattacharyya — Executive Director of SEED; affiliated with the Society of Integrated Coastal Management (SICOM), Ministry of Environment, Forest & Climate Change, Government of India. Dr. Bhattacharyya's expertise in coastal geology, water resource management, and wetland ecology underpins SEED's technical pond restoration methodology.



Recognition and Accreditation

- Recipient of the **Eastern India NGO Leadership Award (2023)**
- Coastal Biodiversity Conservation Centre showcased by **Wetland Link International (WLI)**, UK – a global network of wetland education centres supported by the Wildfowl & Wetlands Trust
- Water conservation and women's health work featured in **The Better India (December 2024)** as a nationally recognised model of community-driven freshwater conservation
- Marine biodiversity conservation and aquaculture awareness work featured by **Climate Action Network South Asia (CANSA)** – Asia's largest NGO coalition on climate
- Implementation of **World Bank supported ICZM Programme** on Sagar Island recognised by Shri Arijit Banerjee, IFS, Principal Chief Conservator of Forests & Head of Forest, Government of West Bengal, as "transformative in enhancing water security and ecological conservation"

The image is a screenshot of a webpage from 'the better india'. At the top, there is a navigation bar with the logo on the left, followed by 'ENG' with a dropdown arrow, and several menu items: 'ALL STORIES', 'ABOUT US', 'BRAND CAMPAIGNS', 'ADVERTISE WITH US', 'OUR IMPACT', a search icon, and a hamburger menu icon. Below the navigation bar is a large photograph of a person in a wetland area, possibly a mangrove, with water and dense green vegetation. Under the photo, there are social media sharing icons for Facebook, X, WhatsApp, LinkedIn, and Email. To the right of these icons is a text block. The text starts with 'The Sundarbans, where land and sea intertwine in a breathtaking dance, is a testament to nature's raw power and delicate beauty. This unique ecosystem, breathing with the rhythm of saltwater tides, is a fragile balance that sustains life.' This is followed by a paragraph: 'However, this delicate balance is disrupted by natural calamities that frequently plague the region. One of the most devastating consequences of these events is saltwater intrusion, which contaminates freshwater sources, leaving communities without access to clean drinking water. Forced to resort to unhygienic practices, these communities face serious health risks.'

the better india

ENG ▾

ALL STORIES ABOUT US BRAND CAMPAIGNS ADVERTISE WITH US OUR IMPACT 🔍 ☰



f The Sundarbans, where land and sea intertwine in a breathtaking dance, is a testament to nature's raw power and delicate beauty. This unique ecosystem, breathing with the rhythm of saltwater tides, is a fragile balance that sustains life.

X

wa

in

e

However, this delicate balance is disrupted by natural calamities that frequently plague the region. One of the most devastating consequences of these events is saltwater intrusion, which contaminates freshwater sources, leaving communities without access to clean drinking water. Forced to resort to unhygienic practices, these communities face serious health risks.

The Freshwater Crisis in the Sundarbans

The Sundarbans delta — the world's largest mangrove forest and a UNESCO World Heritage Site — is also home to some of India's most acutely water-stressed communities. Situated at the confluence of the Bay of Bengal and the Gangetic delta, the region's deltaic islands face a chronic and worsening freshwater crisis driven by four interlocking forces: saline intrusion, land subsidence, sea-level rise, and the progressive degradation of freshwater pond ecosystems.

The Salinity Crisis

Shallow aquifers across the Sundarbans are highly saline due to tidal ingress and saltwater intrusion, with potable groundwater only available at depths of 245–325 metres below ground level — far beyond the economic reach of most households. Surface water salinity during the pre-monsoon season regularly reaches 27.3 PPT on Ghoramara Island — nearly 27 times above the Bureau of Indian Standards safe threshold of 1 PPT for irrigation water. On Sagar Island, government-installed hand pump tubewells served an average of one tubewell per 70 households, leaving communities chronically underserved.

The Pond Degradation Crisis

For centuries, communities across the Sundarbans relied on freshwater ponds as their primary source of irrigation water, domestic water, and aquaculture. These ponds were not merely water infrastructure — they were the ecological and livelihood foundation of island life. However, decades of siltation, embankment erosion, saline storm surges, and neglect have rendered the majority of these ponds non-functional. On Ghoramara Island alone, 650 of 950 ponds (~68%) are non-functional, having been progressively silted, salinised, or structurally compromised by repeated cyclones.

The Climate Compounding Effect

Ghoramara Island — one of the most water-stressed geographies in SEED.s operational footprint — has been devastated by successive major cyclones: Bulbul (2018), Amphan (2020), Yaas (2021), and Remal (2024). Each cyclone breaches pond embankments, floods waterbodies with saline storm surges, and destroys in hours what communities have spent years building. The island is now classified as a Very High Damage Risk Zone-B ($V_b = 50$ m/s) with a maximum storm surge risk of 12–13 metres — making climate-resilient pond restoration not a development preference but a survival imperative.

**A compounded
freshwater crisis
in the Sundarbans**

Salinity intrusion

Freshwater sources turn saline, reducing crop and fish productivity and disrupting aquatic biodiversity

Pond degradation

Leads to loss of habitats, declining native species, and breakdown of local ecological functions

**Climate shocks
(cyclones & storm surges)**

Repeated inundation damages ecosystems, accelerates land erosion, and prevents natural ecological recovery



The Effects.....

Impact on Biodiversity, Ecology & Environment

The freshwater crisis in the Sundarbans is driving a systemic ecological decline. Rising salinity—intensified by reduced freshwater inflows and tidal intrusion—has altered the hydrological balance of this globally significant mangrove ecosystem, placing it under severe ecological stress .

As salinity increases, freshwater habitats shrink, leading to a decline in native aquatic species and disrupting breeding and nursery grounds that support over 400 fish species in the region .

Studies show that salinity intrusion reduces species fitness, growth, and survival, ultimately lowering biodiversity and altering food chains and ecosystem functions . Habitat degradation due to silted and saline ponds further accelerates the loss of ecological niches, while the decline of freshwater species weakens the overall resilience of the ecosystem.

Impact on Livelihoods

The ecological collapse directly translates into livelihood insecurity for millions dependent on the Sundarbans' natural resources. Shrinking freshwater fish habitats and declining fish diversity have already led to measurable losses—studies indicate up to 21%–59% decline in freshwater fish species in affected areas, severely impacting fishing communities and their primary source of protein and income . Increasing salinity and deteriorating water quality also make fishing more difficult and reduce fish health, further lowering yields .

With freshwater ponds becoming non-functional, agriculture suffers due to lack of irrigation, forcing households to abandon farming or shift to less stable livelihoods. This creates a cascading effect—reduced income, food insecurity, and increased competition over limited natural resources —ultimately pushing vulnerable populations toward distress migration and long-term economic instability. livelihoods.



SEED's Approach

SEED's strategy transforms degraded freshwater systems into climate-resilient ecological and livelihood assets through an integrated model of pond restoration, rainwater harvesting, aquaculture, and community governance.

SEED's strategy to curb the freshwater crisis in the Sundarbans is not a single intervention – it is an integrated ecosystem-based water security model that combines infrastructure restoration, ecological regeneration, and livelihood integration, built on over two decades of field implementation. Drawing from large-scale interventions such as the World Bank-supported ICZM programme on Sagar Island—where 70 ponds were rejuvenated and 58 deep tubewells installed benefiting ~18,000 people—SEED has evolved a replicable, climate-resilient approach that directly addresses salinity, ecological degradation, and livelihood collapse

1. Climate-Resilient Pond Rejuvenation

SEED places freshwater pond ecosystems at the center of its strategy, recognising them as both ecological assets and livelihood infrastructure. Through scientific desilting, embankment raising, and hydrological restoration, degraded ponds are transformed into multi-functional freshwater systems supporting irrigation, domestic use, and aquaculture. This approach has already restored irrigation across hundreds of acres and revived freshwater habitats, enabling the return of native fish species and aquatic biodiversity. By restoring natural recharge pathways, the model also strengthens local hydrology—critical in a region where salinity intrusion is intensifying due to reduced freshwater flows and sea-level rise

2. Rainwater Harvesting

Rather than relying solely on deep groundwater extraction, SEED strengthens decentralised rainwater harvesting through pond ecosystems. Re-excavated ponds capture monsoon runoff, store freshwater year-round, and reduce dependence on saline aquifers. This approach is particularly critical in the Sundarbans, where increasing salinity and erratic rainfall patterns are degrading both soil and water systems. By restoring ponds as rain-fed reservoirs, SEED enhances climate resilience and water availability at the community level.

3. Livelihood Integration through Aquaculture

SEED integrates freshwater aquaculture as a core livelihood strategy, converting restored ponds into productive economic assets. Through structured training, demonstration ponds, and input support, communities are enabled to adopt scientific fish farming practices. This not only increases household incomes but also reduces pressure on fragile coastal and marine ecosystems. Evidence from SEED's interventions shows revival of fish farming as a supplementary income source, while also contributing to the recovery of native species such as Rohu, Catla, and Mrigal. This is critical in a region where rising salinity is already reducing fish habitats and productivity

4. Community Water Governance (WUG Model)

A defining pillar of SEED's approach is the formation of Water User Groups (WUGs)—community institutions responsible for managing, maintaining, and governing water resources. Across previous interventions, hundreds of community members have been trained in technical maintenance, water allocation, and governance systems, ensuring long-term sustainability beyond project timelines . This shifts communities from passive beneficiaries to active custodians of freshwater ecosystems.

5. Climate-Resilient Infrastructure Design

SEED integrates climate-adaptive engineering into all interventions—such as raised embankments and elevated tubewell platforms designed to withstand cyclones and storm surges. These designs have been field-tested during major cyclones like Amphan and Yaas, where restored infrastructure remained functional when conventional systems failed . This ensures that water systems are not just restored, but future-proofed against climate shocks.

6. Ecological Restoration & Biodiversity Recovery

SEED's approach goes beyond water access—it actively restores freshwater ecosystems and biodiversity. By reversing salinity intrusion and restoring pond habitats, the interventions support the return of aquatic flora, fish, amphibians, and waterbirds, strengthening ecological resilience. This is crucial in the Sundarbans, where salinity, habitat loss, and climate change are already degrading mangroves and biodiversity at scale .



SEED's Water Intervention Snapshot

Project / Intervention	Location	Beneficiaries	Key Output
World Bank ICZM Programme	Sagar Island (2012–15)	~18,000 people	58 tubewells + 70 ponds; 30% reduction in waterborne illness; 58 WUGs formed; 870 individuals trained
BPCL Climate Resilient Water Security	Ghoramara Island (2022–25)	350+ HHs (7 villages)	7 ponds rejuvenated; 7 elevated tubewells; 30–35% crop productivity increase; functional through Cyclone Remal 2024
Dept. of Environment, GoWB	Kumarpukuria (2015–16)	165 Munda families	45 ponds re-excavated; year-round irrigation restored; community water groups formed
NABARD RKVY Aquaculture	Sagar Island (2010–2011)	145 fish farmers; 14 Lodha families	10 FPGs formed; 6 ponds excavated; Lodha community integrated into aquaculture livelihoods
NABARD Rural Innovative Fund	East Kolkata Wetlands, West Bengal (2008–2009)	1,100 Munda families	75 JLGs formed; pen culture in internationally protected wetland; ecological compatibility maintained
Azim Premji Foundation (Current)	Ghoramara Island (2025–28)	1,150 families	24 ponds + 6 handpumps; livelihood support for 50 landless families; WUG formation

Project 1: Integrated Coastal Zone Management (ICZM)

Supported by	World Bank (through ICZM Programme, Department of Environment, Government of West Bengal; SPMU: Institute of Environmental Studies and Wetland Management, Kolkata)
Duration	September 2012 – August 2015 (3 years, with extensions)
Coverage	Rudranagar and Muriganga-1 Gram Panchayats, Sagardwip Block, Sagar Island, South 24 Parganas, West Bengal
Total Beneficiaries	~18,000 people across two Gram Panchayats
Infrastructure Delivered	58 deep tubewells (depth: 245–325 metres) + 70 freshwater ponds rejuvenated across Rudranagar and Muriganga-1 GPs



Project Context and Rationale

Sagar Island, the largest island in the Sundarbans delta with a population of approximately 212,000 across 42 villages and 9 Gram Panchayats, faced an acute freshwater crisis. Shallow aquifers were highly saline, potable groundwater was only available at 245–325 metres depth, and the island's traditional freshwater ponds had been progressively degraded by rising salinity, cyclonic damage, and siltation. The Integrated Coastal Zone Management Programme – supported by the World Bank and implemented by the Department of Environment, Government of West Bengal – recognised SEED's technical capacity and community relationships as the critical implementing resource for the water security component.

Interventions Delivered

Installation of 58 Deep Tubewells

Fifty-eight deep tubewells were drilled across Rudranagar and Muriganga-1 GPs, each reaching a depth of 245–325 metres to access salinity-free confined aquifers. All tubewells were constructed on 2.5-metre elevated concrete platforms to ensure functionality during floods, tidal surges, and cyclonic events – when conventional surface-level structures are submerged or contaminated. This elevated platform design was directly inspired by SEED's understanding of Sundarbans storm surge dynamics and was field-tested during subsequent cyclones, including Amphan (2020), Yaas (2021), and Remal (2024), when these tubewells remained the only functional drinking water source across the affected villages.

Rejuvenation of 70 Freshwater Ponds

Seventy community freshwater ponds across Rudranagar and Muriganga-1 GPs were scientifically mapped, desilted, and embankment-strengthened through a community-participatory process. Each pond underwent systematic desilting, embankment raising and compaction, and embankment stabilisation – restoring water-holding capacity for both irrigation and domestic use. Hydrological pathway connectivity between ponds and groundwater recharge zones was restored. The restored ponds collectively irrigated over 280 acres of cultivated land, supporting multi-season cultivation for hundreds of smallholder farming households.

Formation of 58 Water User Groups (WUGs)

A defining feature of SEED's ICZM implementation was the formation of 58 Water User Groups (WUGs) – one per tubewell or pond cluster – with 870 individuals trained in technical skills (pump operation, water quality monitoring, infrastructure maintenance) and management skills (record-keeping, financial management, equitable water allocation, and participatory governance). Women were actively included in WUG leadership, with minimum 40% women representation achieved across most WUGs. The Lodha tribal community – previously excluded from shared water resources due to social discrimination – was formally integrated into WUG governance, ensuring equitable access for all community members regardless of caste or tribal identity.

Outcomes and Impact

Ecological Outcomes

- 70 freshwater waterbodies restored across Sagar Island – reversing the progressive loss of freshwater aquatic habitats caused by saline intrusion and siltation
- Recovery of native freshwater fish species including Rohu (*Labeo rohita*), Catla (*Catla catla*), Mrigal (*Cirrhinus mrigala*), and Mud Eel (*Monopterus albus*) documented in restored ponds
- Return of freshwater macrophytes, amphibians, and waterbirds to rejuvenated pond habitats – contributing to biodiversity conservation within the Sundarbans Biosphere Reserve
- Raised embankments remained unbreached during major cyclonic events including Amphan (2020), Yaas (2021), and Remal (2024) – demonstrating the structural resilience of the restoration methodology
- Natural groundwater recharge cycles restored through hydrological pathway connectivity – improving ambient water availability across the surrounding agricultural landscape





Socio-Economic Outcomes

- ~18,000 people gained reliable, safe freshwater access — the largest single water security intervention ever implemented on Sagar Island by an NGO
- 30% reduction in reported waterborne illnesses including diarrhoea, skin infections, and gastrointestinal diseases across beneficiary households
- Restored ponds irrigated ~280 acres of cultivated land — supporting multi-season Rabi and Kharif cultivation for hundreds of smallholder farming households
- Freshwater aquaculture revived across multiple pond clusters — with fish farming becoming a primary supplementary livelihood for fishing households, generating monthly income increases of INR 1,500–3,000 per household
- Women and children freed from long-distance water collection burden — gaining time for education, livelihood activities, and community participation
- Seasonal migration pressure significantly reduced — with improved water and livelihood security enabling families to remain in their villages year-round
- 870 individuals trained as local resource persons — creating a sustainable community cadre for long-term water infrastructure management

Government Endorsement

“SEED’s implementation of the World Bank-funded ICZM project in West Bengal has played a transformative role in enhancing livelihoods for the coastal population. Their integrated approach to sustainable agriculture, aquaculture, and community-driven initiatives has empowered vulnerable communities, ensuring long-term resilience against climate challenges.”

— *Shri Arijit Banerjee, IFS*
— *Former Principal Chief Conservator of Forests & Head of Forest, Government of West Bengal*

Voices from the Field

"Before the ponds were fixed, I would watch my paddy dry out every year by February. The pond near our cluster had not been cleaned in so many years — you could almost walk across it, the silt had come up so high. Whatever little water remained by winter was brackish, not fit even for the cattle. I had stopped attempting Rabi altogether. What was the point? When SEED came and the digging work started, I honestly did not believe it would make a difference. These ponds have been like this for decades — I thought one season of work cannot change what years of neglect has done. But when the rains came and filled those cleaned ponds, I saw with my own eyes how much water they could hold. We were irrigating into March for the first time in my memory. That year I cultivated mustard on nearly two bighas I had left fallow for three years. My wife said it felt like the land had come back to life. I think she was right."

— *Swapan Halder, 52 years, marginal farmer, Rudranagar village*



Project 2: Climate Resilient Water Security

Supported by	Bharat Petroleum Corporation Limited (BPCL) – CSR Initiative (Swachhta Pakhwada flagship campaign, continued annually since 2022)
Duration	2022–25 (ongoing Swachhta Pakhwada campaigns; cumulative 8 ponds restored to date)
Coverage	7 villages, Ghoramara Island, Sagardwip Block, South 24 Parganas, West Bengal
Total Beneficiaries	350+ households across 7 villages
Infrastructure Delivered	7 freshwater ponds rejuvenated + 7 high-raised deep tubewells installed on 2.5-metre elevated platforms



Project Context and Rationale

The BPCL Climate Resilient Water Security Project holds unique significance in SEED.s water intervention portfolio – because it was implemented on the same island, in the same 7 villages, with the same communities validating the pond rejuvenation methodology in this specific island context. This is not analogous evidence from a comparable geography – this is SEED.s own direct, site-specific field validation that SEED's pond rejuvenation and community water governance methodology delivers quantifiable results on Ghoramara Island specifically.

Interventions Delivered

Freshwater Pond Rejuvenation – 7 Ponds

Seven critically silted and saline-intruded community ponds were re-excavated to a depth of 3 metres, with embankments raised by 1–1.5 metres and reinforced with compacted soil and local vegetation. Desilting removed decades of accumulated sediment, restoring the original water-holding capacity of each pond. Embankment strengthening with compacted clay and local planting significantly reduced saline overtopping risk during tidal surges and cyclonic storm events. Community participation in physical works was integrated with MGNREGS labour convergence – with Water User Groups mobilising community members as active restoration participants rather than passive beneficiaries.

Installation of 7 High-Raised Deep Tubewells

Seven deep tubewells were drilled and installed on 2.5-metre elevated concrete platforms – the same cyclone-resilient design validated under the ICZM Programme – providing clean, salinity-free drinking water to all 7 villages. Mini water supply schemes were additionally created at school sites through piped connections from tubewells to dedicated tap points, improving health and hygiene for children and teachers.

Water User Group Formation and Swachhta Pakhwada Campaigns

Water User Groups (WUGs) with 40+ community members per pond (40% women representation) were formed for each rehabilitated pond and tubewell cluster. Annual Swachhta Pakhwada community campaigns – engaging school children, women's SHGs, and folk theatre groups – built community awareness on water conservation, pond stewardship, and household hygiene. Community members collectively pledged to keep cattle out of pond water and eliminate waste disposal near tubewells – demonstrating a genuine shift in community behaviour around water resource stewardship.

Outcomes and Impact

Ecological Outcomes

- 7 ponds restored to functional freshwater ecosystems – reversing saline intrusion and creating freshwater habitats for native aquatic species including Magur (*Clarias batrachus*), Koi (*Anabas testudineus*), and Pabda (*Ompok pabda*)
- Dissolved oxygen levels improved across restored ponds – supporting aquatic biodiversity recovery and reducing invasive weed proliferation
- Strengthened embankments prevented saline overtopping during Cyclone Remal (2024) – reducing contamination risk that had devastated pond ecosystems during previous cyclones

Institutional Outcomes

- Water User Groups (WUGs) with 40% women representation established across all 7 villages – demonstrating the institutional sustainability of community water governance on Ghoramara Island
- Successful convergence with MGNREGS and PHE Department – establishing a replicable model of public-CSR co-investment in climate-resilient water infrastructure on Ghoramara Island
- Behavioural change campaign through Swachhta Pakhwada – community pledges on pond stewardship now part of village-level water governance culture





Socio-Economic Outcomes

- 350+ households across 7 villages benefited with safe potable water and restored irrigation access
- 30–35% increase in crop productivity across approximately 100 acres of cultivated land – directly attributable to restored irrigation access from rejuvenated ponds
- 20–30% reduction in waterborne illnesses and skin infections across beneficiary households – measured through household health surveys
- Elevated tubewell platforms remained fully functional during Cyclone Remal (2024) when all other water sources on the island failed – preventing disease outbreaks and reducing the burden on post-cyclone relief operations
- Mini water supply schemes at school sites improved child and teacher health and hygiene – reducing school absenteeism due to waterborne illness

CSR Endorsement

BPCL is committed to continuing our partnership with SEED on Ghoramara Island. We are confident that SEED's model of community-embedded, technically rigorous, and ecologically sensitive freshwater restoration is the right approach for this geography – and we would readily recommend SEED as an implementation partner to any organisation looking to invest in water security and ecosystem conservation in the Sundarbans."

*Mr. Suresh Nair, Assistant Manager
– CSR & Sustainability
Bharat Petroleum Corporation
Limited (BPCL)*



Voices from the Field

"Ghoramara is not a place where things last. The river takes a little more land every year. The cyclones come and take what the river did not. I have seen handpumps get washed away, I have seen embankments that people built with their own hands disappear in one night of storm surge. So when SEED said they would fix the pond near Raypara and raise the bund, I was not sure it would survive even one monsoon season.

But that pond is still there. After Remal last year, when the salted water came over the low parts of the island and the old pond at the edge of the village turned completely brackish – our rejuvenated pond held. The bund stopped the surge water. We lost some of the grass on the slope but the structure held. Three days after the cyclone, while other parts of the island were still without any water, our Water User Group was already drawing water from that pond for the fields. My husband said – this is the first time in twenty years that a flood has not destroyed everything we depend on. For Ghoramara, that is not a small thing. That is everything."

Rekha Mondal, 44 years, farmer and Water User Group member, Raypara village, Ghoramara Island

Project 3: Participatory Environment Management Programme

Supported by	Department of Environment, Government of West Bengal
Duration	2015–16
Coverage	Kumarpukuria tribal village, Kheadaha-2 Gram Panchayat, Block Sonarpur, South 24 Parganas, West Bengal
Total Beneficiaries	165 Munda tribal families
Infrastructure Delivered	45 freshwater ponds re-excavated; embankments strengthened; community water management groups formed



Project Context and Rationale

Kumarpukuria is a tribal village home to Munda communities – among the most socially and economically marginalised groups in South 24 Parganas. The village faced acute freshwater scarcity and irrigation deficits due to the progressive degradation of its traditional freshwater pond network, leaving agricultural households entirely dependent on erratic seasonal rainfall and significantly constrained in their ability to sustain year-round cultivation.

Interventions Delivered

Freshwater Pond Rejuvenation – 45 Ponds

Under the Participatory Environment Management Programme, SEED re-excavated 45 freshwater ponds with embankment strengthening to enhance water retention capacity and prevent soil erosion. The entire process was deeply participatory – with tribal households involved in pond site selection, planning, physical works, and community water management group formation. Local water management groups were trained on pond maintenance and water conservation practices, building the institutional capacity needed for long-term stewardship of the restored waterbodies.



Outcomes and Impact

- 45 ponds re-excavated — restoring rainwater harvesting capacity and year-round irrigation access for 165 Munda tribal families.
- Restored freshwater access enabled year-round cultivation — reducing fallow land and improving crop yields and household food security for families previously dependent on erratic seasonal rainfall.
- Community water management groups formed and trained — embedding local ownership and maintenance responsibility within the tribal community's governance structures.
- Re-excavated ponds restored natural groundwater recharge cycles and created freshwater habitats for native aquatic species including Rohu (*Labeo rohita*), Catla (*Catla catla*), and Singhi (*Heteropneustes fossilis*) — reversing localised ecological degradation within the village's freshwater ecosystem.
- Demonstrated SEED's capacity to implement community-led pond restoration in tribal and socially marginalised geographies using a participatory methodology — directly applicable to Ghoramara Island's 70%+ Scheduled Caste and minority population



Voices from the Field

"After the rejuvenation work was done and the rains filled the ponds properly that year, I started a small kitchen garden next to our house for the first time. I had wanted to do this for many years but without water close by it was not possible. Now I grow spinach, red amaranth, brinjal, and green chilli – enough for our family through most of the year and some extra to sell or share with neighbours. My younger son had skin infections every summer from the old pond water. After the clean water became available that problem has not come back. My mother-in-law said it was the first time in her years of living here that the pond in our settlement looked like it had life in it – she could see small fish moving in the water, birds sitting at the edge in the mornings. She said it felt like the land was breathing again. That is what it felt like to us too – like something that had been sleeping for a long time finally woke up."

- Sushila Munda, 35 years, homemaker and kitchen garden cultivator, Kumarpukuria tribal settlement, South 24 Parganas



"We Munda people came to this area from Jhargram many years ago. When we settled here, the land was difficult – not much water, not much support. The ponds in our settlement had become shallow over the years, filled with mud and weeds. During summer, most of them would go completely dry by Chaitra month. Whatever water remained was not good for the fields. We were entirely dependent on the rains, and in a bad monsoon year, our crops would fail completely.

When the government programme came through SEED and the pond cleaning work started, there were people in the community who were unsure – we had seen programmes come to our village before that started and then stopped halfway. But SEED stayed. The digging was done properly. I remember standing at the edge of one pond after the excavation was completed and being surprised at how deep the water was already, just from the groundwater seeping in before the rains even came. That year, for the first time in many years, I cultivated vegetables on my plot through the dry season – bottle gourd, pumpkin, some mustard. My wife sold some of the vegetables at the local market. It was not a large amount but it was ours – earned from our own land, our own pond. For our community, that feeling matters more than the money."

-Mangal Munda, 47 years, marginal farmer, Kumarpukuria tribal settlement, South 24 Parganas

Project 4: Pond Restoration and Aquaculture Development

Supported by	NABARD
Duration	2010-2011
Coverage	Rudranagar GP and Radhakrishnapur village, Sagar Island, South 24 Parganas
Total Beneficiaries	145 fish farmers across 10 FPGs; 14 Lodha tribal families
Output Delivered	10 Fish Production Groups (FPGs) formed; 6 ponds excavated for Lodha tribal community



Project Context and Rationale

Progressive degradation of community freshwater ponds through siltation and saline intrusion had rendered most waterbodies unproductive — forcing fishing households into increasingly destructive dependence on tidal fisheries. Wild prawn seed collection — in which collectors drag fine-mesh nets through tidal creeks, destroying large volumes of juvenile fish and aquatic flora as bycatch — had become a primary livelihood for dozens of households, creating a cycle in which communities dependent on aquatic resources were simultaneously destroying the ecosystem sustaining them. And the Lodha tribal community in Radhakrishnapur — a Particularly Vulnerable Tribal Group with no prior aquaculture history — lacked the capital, knowledge, and institutional access needed to establish productive aquatic livelihoods.

SEED's response addressed both dimensions simultaneously — restoring degraded freshwater ponds as productive aquatic ecosystems while building the community institutions and livelihoods that would sustain them. The transition of prawn seed collectors to sustainable homestead aquaculture was identified as the highest-impact single intervention — recognising that economic incentives, not awareness alone, are the most durable mechanism for reducing ecologically destructive harvesting in coastal wetland communities.





Interventions Delivered

Formation of 10 Fish Production Groups (FPGs)

Rudranagar GP SEED formed 10 FPGs across Rudranagar GP and provided multi-session structured training covering pond preparation, water quality management for aquaculture, native fish species selection (Rohu, Catla, Mrigal, Silver Carp), fingerling stocking protocols, post-harvest handling, and market linkages. All 10 FPGs were linked to RKVY for government-backed technical support, input subsidies, and financial assistance – securing institutional sustainability beyond the project period.

Pond Excavation and Aquaculture for Lodha Tribal Community

Radhakrishnapur Village Six freshwater ponds were excavated within the Lodha settlement – removing decades of silt and restoring water-holding capacity for both aquaculture and domestic use. The 14 enrolled Lodha families received integrated training in fish cultivation (Magur, Singhi) alongside kitchen gardening – addressing both nutrition and income generation. Government entitlement facilitation including ration cards, voter IDs, and RKVY scheme linkages was simultaneously pursued – formalising Lodha access to institutional support from which they had been historically excluded.

Transition of Prawn Seed Collectors to Sustainable Homestead Aquaculture

Women prawn seed collectors were transitioned to homestead aquaculture in small managed ponds and crab fattening in tidal-fed enclosures – delivering higher and more stable income than declining wild collection yields while eliminating the most ecologically destructive harvesting practice operating on Sagar Island's tidal aquatic biodiversity. Within two seasons, participating women had completely shifted away from wild seed collection.

Ecological and Aquatic Conservation Impact:

- 6 ponds excavated in Radhakrishnapur village — restoring degraded, silted waterbodies into productive freshwater aquatic ecosystems with species-appropriate stocking and water quality management
- Scientific pond preparation and native species stocking (Rohu — *Labeo rohita*; Catla — *Catla catla*; Mrigal — *Cirrhinus mrigala*) supported the recovery of indigenous freshwater fish populations — reversing the decline of native aquatic species in community ponds across Sagar Island
- Transition of prawn seed collectors to pond-based aquaculture directly reduced pressure on wild tidal fisheries and estuarine aquatic biodiversity — protecting juvenile fish and crustacean populations in the tidal creeks and estuaries of the Sundarbans Biosphere Reserve
- Managed aquaculture in restored ponds reduced overfishing pressure on tidal ecosystems — allowing natural population recovery of commercially and ecologically important species in the broader Sundarbans estuarine environment
- Demonstrated the principle of productive conservation — that community-governed freshwater aquaculture and aquatic biodiversity restoration are complementary rather than competing objectives, and that economic incentives are the most effective mechanism for reducing ecologically destructive harvesting practices in coastal wetland geographies



Project 5: Pen Culture Programme, East Kolkata Wetlands

Supported by	NABARD (under Rural Innovative Fund Program)
Duration	2010-2011
Coverage	East Kolkata Wetlands, West Bengal (designated Ramsar Site and Internationally Important Wetland)
Total Beneficiaries	11,00 vulnerable Munda tribal community members
Output Delivered	75 Joint Liability Groups (JLGs) formed; pen culture (cage-based aquaculture) systems established



Project Context and Rationale

The East Kolkata Wetlands – a Ramsar Site and Internationally Important Wetland, it provides critical livelihood support to thousands of marginalised families, including Munda tribal communities who have historically depended on the wetland's fisheries for subsistence and income. However, these communities faced a deepening crisis – traditional capture fishing yields were declining under pressure from urban encroachment, wetland degradation, and overfishing; Munda tribal households lacked the institutional support, financial access, and technical knowledge to transition to more productive and sustainable aquaculture practices; and the absence of community-governed management institutions meant that wetland fishery resources were being accessed in an unregulated, inequitable manner that benefited the most economically powerful actors at the expense of the most marginalised.

SEED recognised that the intervention needed to simultaneously address livelihood, institutional, and ecological dimensions – introducing pen culture (cage-based aquaculture) as a scientifically validated, ecologically compatible aquaculture technique that could generate stable household income without overexploiting the wetland's wild fishery resources, while building community governance institutions strong enough to manage the programme independently beyond the project period. NABARD's Rural Innovative Fund provided the ideal financing mechanism – designed explicitly for innovative, community-led livelihood programmes in ecologically significant landscapes.





Interventions Delivered

Introduction of Pen Culture (Cage-Based Aquaculture)

SEED introduced pen culture — a technique in which fish are cultivated in defined enclosures (cages or pens) within larger water bodies, enabling controlled aquaculture without disrupting the surrounding wetland ecosystem — as the primary production system for beneficiary households. Training was provided on pen and cage construction using locally available bamboo and net materials; species selection for cage-based aquaculture compatible with East Kolkata Wetlands water quality and ecology (Rohu — *Labeo rohita*; Bhetki — *Lates calcarifer*; Parshe — *Mugil cephalus*; freshwater prawns — *Macrobrachium rosenbergii*); stocking density management; feed formulation using locally available inputs; water quality monitoring within pens; harvesting and post-harvest handling; and market linkage and collective sale.

Formation of 75 Joint Liability Groups (JLGs)

The programme's institutional centrepiece was the formation of 75 Joint Liability Groups (JLGs) — each comprising 12–15 Munda tribal households — as the primary vehicle for collective pen culture operations, shared financial responsibility, group-based credit access, and equitable benefit distribution. JLGs were trained in financial literacy, group-based record keeping, collective decision-making, and internal governance — building the institutional capacity needed to manage pen culture operations, access NABARD credit facilities, and sustain livelihoods independently after project closure. The JLG model also provided a mechanism for social accountability — with group liability creating powerful community incentives for responsible wetland resource use and ecological stewardship within the Ramsar Site.

Ecological and Aquatic Conservation Impact:

- Reduced pressure on wild fish populations within the East Kolkata Wetlands – as 1,100 tribal households shifted from capture fishing to pen culture, directly reducing harvesting pressure on native aquatic species within the Ramsar ecosystem.
- JLG governance structures created a community-level institutional mechanism for collective stewardship of wetland fishery resources – reducing unregulated access and establishing equitable, sustainability-oriented management of shared aquatic commons.
- Demonstrated ecological viability of pen culture as a low-impact aquaculture technique in sensitive wetland geographies – providing a scientifically validated and institutionally governed model directly applicable to freshwater pond ecosystem conservation across similar Ramsar and non-Ramsar wetland landscapes.
- Programme recognised by NABARD as an innovative model of community-led aquatic livelihood development in an ecologically sensitive landscape – establishing SEED's credentials as an implementing organisation capable of delivering aquaculture programming within internationally protected wetland ecosystems without ecological compromise



Lessons Learnt

As these projects were implemented and matured through 2009–2025, several lessons emerged that are guiding future efforts and ensuring the sustainability of the intervention. These lessons learned are valuable for continual improvement and for informing similar projects in other regions.

1

Pond Rejuvenation Delivers the Highest Impact

Across SEED's water interventions on Sagar Island, Ghoramara Island, and Kumarpukuria, pond rejuvenation has consistently outperformed every other single intervention in terms of breadth, sustainability, and multiplier effect. A single restored pond simultaneously serves irrigation for farming households, aquaculture for fishing households, freshwater access for kitchen gardens, domestic water for surrounding families, and habitat for native aquatic species. No other water infrastructure investment delivers this range of simultaneous benefits from a single asset. SEED's experience confirms that in deltaic island geographies where saline groundwater makes tubewell-based irrigation prohibitively expensive, freshwater ponds are not merely one option among several — they are the only viable foundation for water-secure, climate-resilient livelihoods.

2

Governance Determines Sustainability

The single most important predictor of whether a restored pond remains productive five years after project closure is not the quality of the desilting or the height of the embankment — it is the quality of the community institution governing it. SEED's post-project observation across multiple intervention sites consistently shows that ponds without functional Water User Groups progressively re-silt, accumulate weed cover, and lose embankment integrity within three to five years as maintenance responsibility diffuses and no single household or institution takes ownership. Conversely, ponds governed by trained, inclusive WUGs with clear maintenance protocols, defined contribution mechanisms, and formal linkages to government convergence schemes remain productive and structurally sound well beyond the project period. Community governance is not the soft component of pond restoration — it is the hardest and most important one.

3

Livelihoods Change Ecological Behaviour

SEED's experience transitioning prawn seed collectors on Sagar Island from wild tidal harvesting to homestead aquaculture produced a clear and replicable insight: communities engaged in ecologically harmful practices do not abandon them because they are told about biodiversity loss – they abandon them when a more economically viable alternative is placed within reach. Wild prawn seed collection declined sharply and sustainably among programme participants not because of awareness campaigns about juvenile fish mortality but because homestead aquaculture and crab fattening generated more stable income with less physical hardship. This lesson has shaped SEED's entire approach to aquatic conservation – leading with livelihood improvement as the mechanism for ecological behaviour change, rather than treating conservation as a constraint on livelihoods.

5

Government Convergence

SEED's experience across multiple project geographies demonstrates that the only financially sustainable post-project maintenance mechanism is systematic convergence with government schemes – for annual desilting and embankment repair labour, PMKSY for irrigation infrastructure, and NABARD's RIDF for larger restoration works. WUGs that are trained to access these schemes independently during the project period continue pond maintenance after project closure without donor dependence. WUGs that are not trained in government convergence – regardless of how well-trained they are in pond maintenance techniques – eventually face a maintenance funding gap that leads to gradual infrastructure deterioration. SEED now treats government convergence activation as a mandatory deliverable from the first quarter of any water project – not an optional exit strategy component added in the final year.

4

Cyclone-Resilient Design

SEED's field experience across Amphan (2020), Yaas (2021), and Remal (2024) has produced field-validated engineering knowledge that cannot be derived from desk-based guidelines. Pond embankments raised by less than 1.5 metres are regularly overtopped by cyclonic storm surges in Ghoramara and Sagar Islands – contaminating restored freshwater ponds with saline water and destroying years of restoration investment in a single night. Tubewells installed at ground level are submerged and contaminated. Embankments without deep-rooted vegetation stabilisation erode within two monsoon seasons. SEED now treats minimum embankment height of 1.5 metres, deep root stabilisation, and tubewell platforms elevated to 2.5 metres as non-negotiable design standards for all water infrastructure in Very High Damage Risk Zone-B geographies – and has the cyclone survival evidence to justify every one of these specifications.

Conclusion

SEED's water resource interventions across the Sundarbans delta — spanning nearly two decades, five major programmes, six geographies, and over 21,000 direct beneficiaries — tell a single consistent story: that freshwater pond rejuvenation, when implemented with scientific rigour, community governance, and ecological sensitivity, is the most transformative investment possible in India's climate-vulnerable coastal island communities. From the 70 ponds restored under the World Bank ICZM Programme on Sagar Island to the 7 rejuvenated ponds that survived Cyclone Remal on Ghoramara Island, from the 45 re-excavated ponds that restored year-round irrigation for Munda tribal families in Kumarpukuria to the 75 Joint Liability Groups governing cage-based aquaculture in the East Kolkata Wetlands Ramsar Site — every project in this portfolio has reinforced the same foundational truth: a restored pond does not just hold water. It holds livelihoods, health, food security and ecological balance simultaneously.

What distinguishes SEED's approach from conventional water infrastructure programming is the integration of three dimensions that are too often treated as separate. Physical restoration — desilting, embankment raising, bioremediation, hydrological pathway reconnection — creates the asset. Community governance — Water User Groups, Joint Liability Groups, cooperative registration, capacity building — sustains the asset. Ecological restoration — native species reintroduction, macrophyte recovery, biodiversity monitoring — ensures the asset delivers beyond human livelihoods into the broader ecosystem that those livelihoods depend on. SEED does not implement these as sequential phases or parallel workstreams — it implements them as a single, indivisible programme. That integration is what makes the difference between a project that delivers impact for two years and a programme that delivers impact for two decades.

The communities documented in this report — the farmer in Rudranagar who cultivated mustard on fallow land for the first time in memory, the Munda woman in Kumarpukuria who grew her first kitchen garden because a clean pond was finally within reach, Kajal Bhakta in Radhakrishnapur who went from subsistence fishing and exclusion to agricultural self-sufficiency and community leadership — are not success stories assembled for a report. They are the lived evidence of what happens when water security is treated not as an infrastructure problem to be solved but as a human and ecological right to be restored. Their transformations are SEED's most honest and accurate impact assessment.

SEED remains committed to deepening and expanding this work across the Sundarbans delta — with Ghoramara Island as the immediate priority geography where the convergence of need, community trust, institutional readiness, and scientific knowledge is strongest. The model is proven. The communities are ready. The next phase of this work begins with the next restored pond.

This report documents more than a decade of evidence that freshwater pond rejuvenation – when grounded in community governance, scientific rigour, and ecological sensitivity – is the most durable and highest-impact water security intervention available to climate-vulnerable coastal communities in the Indian Sundarbans. It is not a record of completed projects. It is a living demonstration of what sustained, place-based commitment looks like when an organisation stays long enough to see restored ponds survive cyclones, tribal families move from exclusion to self-sufficiency, and community institutions outlast the donor funding that created them.

