Application form - BSF Small Grant program

1. **Contact information**

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2. **Title**

Strategic in-stream systems: A Decentralised anticipatory approach to wastewater contamination in Bangalore

3. **Background/Motivation (300 words)**

Bengaluru is in the midst of a serious urban water crisis. Rare among major metropolitan population centres, the city isn't intersected directly by a perennial water source (such as a major river). Instead, surface water flows through a complex system of lakes and open channels (often referred to as the "Tank Cascade System") which follow the natural slopes of the landscape as they flow into one another. Once used effectively for stormwater storage and agricultural irrigation, the recent explosion of largely unregulated urban development in the past two decades has put immense pressure on these infrastructures. They now double as a defacto open sewers, receiving a daily deluge of untreated domestic and industrial effluents. This contamination hyper-accumulates as it makes its way through this interconnected system, causing a range of impacts to local ecosystems, livelihoods, and public health. These include toxic foam events and downstream impacts on human health and food systems. A 1,100MLD (Million Liters per Day) wastewater treatment capacity gap, compounded by a drastic reduction in wetlands due to encroachment leaves 90% of local water bodies directly fed by sewage.

Strategic In-stream Systems (STRAINS) proposes small-scale, low-tech, in-stream decontamination strategies to be deployed and monitored over the course of 1 year. Our interdisciplinary team is already engaged in the ongoing schematic design, lab-based material testing, and relationship building with local partners. Comprised of three basic stages aimed at 1) diverting and collecting solid waste, 2) slowing and settling sediment and suspended solids, and 3) lowering BOD, and trace metals levels through biofiltration using locally available aggregate materials. Our initial findings demonstrate that these systems can be deployed and scaled at a low cost with an immediate positive impact on localized water quality.

4. Goals/Objectives (200 words)

The ultimate aim is to use the insights of the Sowl Kere studies to develop a series of larger interventions which can be placed directly within nallahs to prevent the contamination and eutrophication of urban lakes. We call this larger approach “Strategic In-stream Systems” or “STRAINS”— decentralized, frugal, flexible, and inclusive.
We plan to deploy a small scale intervention a “model Nallah”, approximately 2M Wide and 8M long. Within this space, we will run a series of experiments with a variety of materials and treatments. The first treatment will test the removal of organic contaminants by means of Terracotta rubble material. Terracotta has properties which makes it a viable biofilter media for urban wastewater.
We intend to test the efficiency of the pilot systems at variable contaminant and hydraulic loading rates (2.4 Kilo Liters per Day (KLD) to 9.6 KLD). The aim is to optimize the design of strains system for efficient removal of contaminants. This would also help in understanding the risks associated with the scaling up the system to the catchment level. This intervention is part of an ongoing collaboration which includes diverse partners spanning Design, Engineering, Civil Society, and Science perspectives. The six-fold partnership includes input from Biome Trust, (project management, collaboration, coordination) MAPSAS (community engagement) Eco Paradigm (engineering & construction), Commonstudio (design), ATREE (monitoring), and Wipro (fiscal sponsorship). Through this proposal, we seek funds for the water quality monitoring of the STRAINS system. The overall goal is to

- Optimize the design of STRAINS for efficient removal of contaminants
- Develop an approach to enhance community participation. We plan to hand over the maintenance of systems to the communities. This will help in promoting community engagement that will lead to a greater impact.

5. Methods and plan of work, including timeline (400 words)

The project proposes to monitor two pilot systems located at Sowl Kere. The control (A) and the experimental (B) STRAINS system (see Figure 1). Both setups will be exposed to similar conditions except that experimental setup will be modified by changing the placement of the aggregate material and planting various species for effective removal of contaminants.
Both the setups will be exposed to variable hydraulic (2.4 to 9.6 KLD) and contaminants loading rate (8 – 112 $g/m^2/day$). We will monitor the flow and water quality at the inlet and the outlet of the systems weekly. Flow meters will be installed and the water samples will be tested for various physical, biological and chemical parameters. We will monitor the systems over the course of one year while developing a robust community engagement protocol in partnership with local experts and stakeholders.

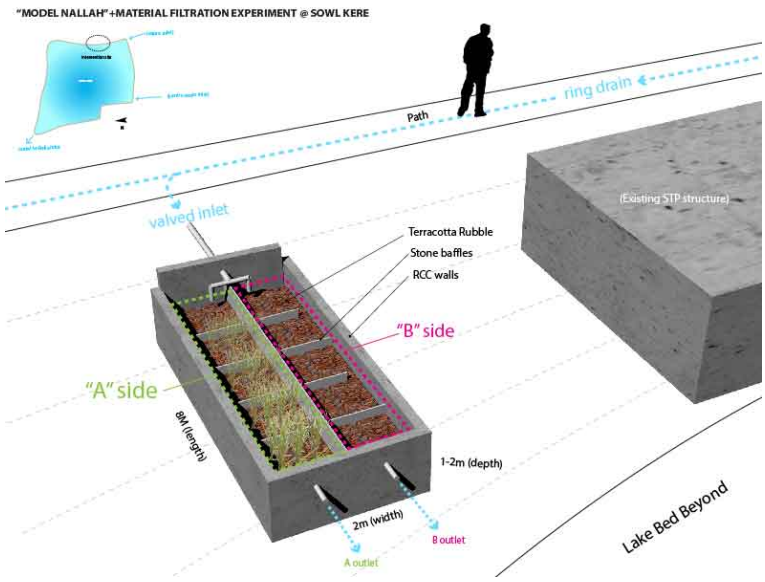

Figure 1- Strains intervention at Sowl Kere

Table 1- Timeline

	Year 2019-2020											
Activities	April	May	June	July	August	September	October	November	December	January	February	March
Literature review												
System stabilization												
Sample collection /Water quality testing												
Stakeholders engagement												
Data analysis and report writing												

6. Expected Outcome/Impact (400 words)

Our proposed intervention will impact on several levels

- At the local level, we aim to test the efficiency of the system to optimize the design for effective removal of contaminant. If successful, this technology could then be replicated and deployed for wastewater treatment in any body of water in the urban area of Bangalore.
- The successful trial would allow us to expand this to catchment scale/rural area with the aim to provide an effective system for the treatment of greywater in villages.

- After testing in a local area the technology could be scaled up on the global level anywhere with similar water quality issues.
- The proposed platform will constitute a pivot tool for the citizen dashboard initiatives by ATREE (http://www.atree.org/lakesdashboard). The proposed solutions if successful could be linked to the citizen dashboard as one of the possible solutions to address water quality issues of Urban lakes.

7. **Budget plan**

Table 2: Budget Plan

Staff	**Cost(INR)/month**		**Duration (months)**	**Total Budget (INR)**
RA	23000		11	253000
Research cost	**Cost/unit**	**Frequency/month**		
Water quality tests	500	20	11	110000
Travel cost	1200	4	11	52800
				415800
Overheads @10%				83160
Total budget				**498960**