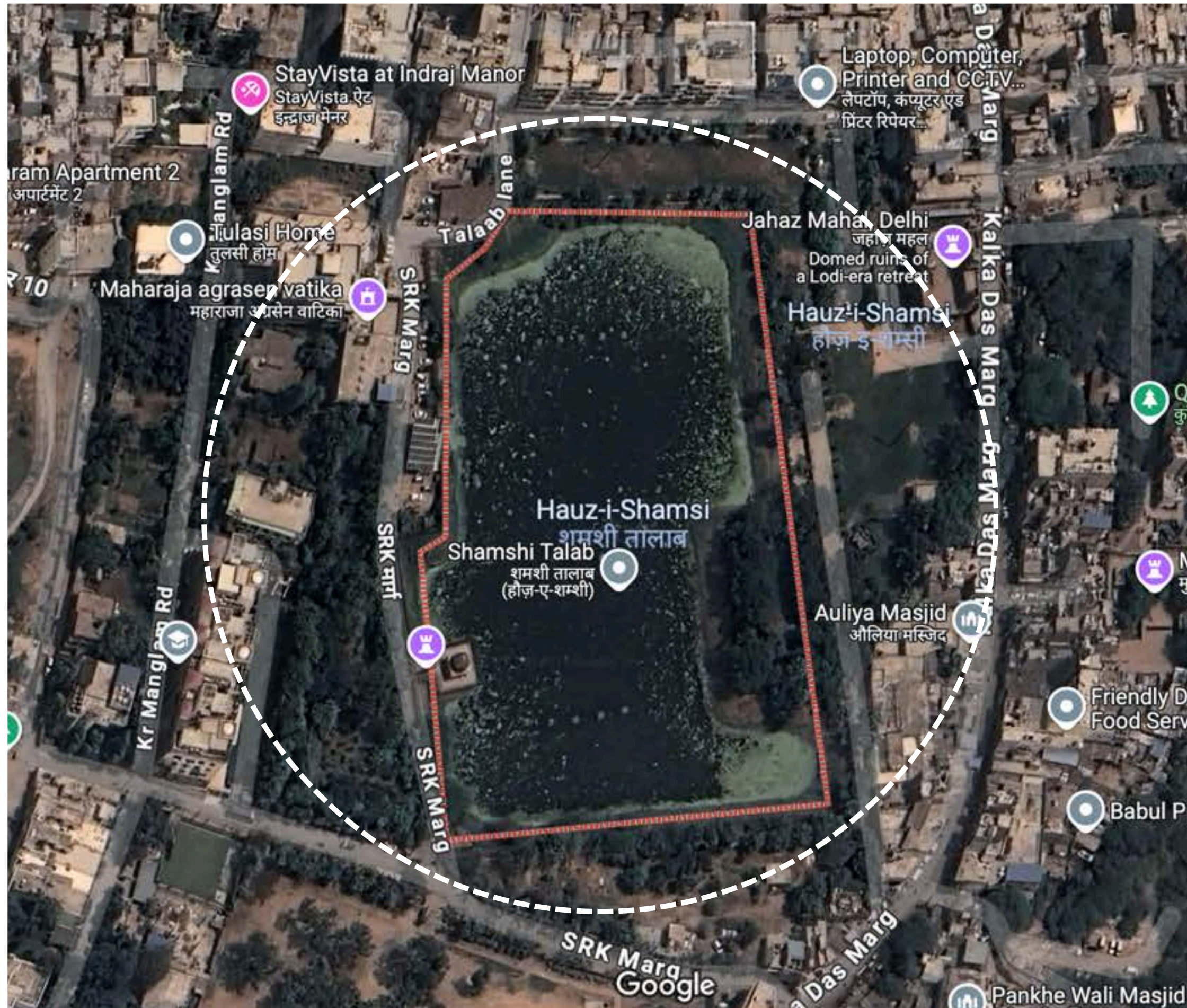# HAUZ - I - SHAMSI

PROJECT REPORT

BY CLEAN WATER

CLEAN WATER

ABOUT HAUZ - i - SHAMSI

Hauz-i-Shamsi is a historic reservoir in Mehrauli, Delhi, built in 1230 by Sultan Iltutmish of the Delhi Sultanate. Once a vital water source for the surrounding area, the reservoir was sustained by rainwater and natural springs. The original complex included elegant pavilions and gardens, and remnants of its historic architecture still echo Delhi's medieval past, underscoring the reservoir's cultural and architectural significance.

However, due to years of neglect, the lake has developed a thick layer of algal bloom, and various pollutants have contributed to unpleasant odors, impacting the water quality and diminishing the lake's natural beauty.

ABOUT CLEAN WATER

Clean-Water is a startup based out of Indore specializing in building nature based solutions for rejuvenating water bodies and restoring their ecosystems.

The company was founded in 2017 by visionary founder and IIT-Bombay Alumnus, Priyanshu Kumath with the aim to indigenously produce bioremediation solutions for restoring India's polluted water bodies.

The company has pioneered the use of durable and high efficiency floating islands that can be deployed on all types of water bodies for water quality management, beautification and biodiversity enhancement.

By leveraging the power of wetland plants and friendly bacteria, these islands continuously remove pollutants while providing habitats for local flora and fauna. Clean-Water supplements these islands with aerators for increasing the amount of dissolved oxygen in the water and microbial solutions that quickly remove nutrients and reduce accumulated sludge in water bodies.

ABOUT CLEAN WATER

Clean-Water's mission is to restore 1,00,000 water bodies across India in a responsible and sustainable way that benefits the environment and people.

Clean Water has worked on 25 water bodies across India in places including Delhi, Ahmedabad and Bangalore. For its efforts, Clean Water has been awarded the title of **"Water Hero"** and recognised as **"Jal Prahari"** by Jal Shakti Mantralaya, Government of India.

Towards Sustainable Water Body Management

Clean Water is committed to rejuvenating water bodies in India, including Hauz-i-Shamsi

We deliver nature-based solutions to restore ecosystems, integrating advanced cleantech to make our efforts enduring and sustainable. At Annapurna Lake, we are applying these approaches to reduce pollutant accumulation, tackle eutrophication, and enhance water quality, creating a thriving ecosystem that supports essential biodiversity.

To rejuvenate the lake's ecosystem, Clean-Water has deployed five floating islands, working in harmony with four floating aerators, regular applications of beneficial microbial cultures, and a lotus-shaped floating solar aerator. These bioremediation methods have allowed us to eliminate contaminants and transform Piplyahana Lake into a robust, vibrant ecosystem that serves the community.

Our goal is not only to restore Hauz-i-Shamsi but also to raise awareness about the importance of water conservation and management in India.

PROBLEM AT HAND

Hauz-i-Shamsi reservoir faces several significant issues that threaten its historical and ecological value:

1. Pollution and Algal Blooms: The reservoir suffers from pollution, with waste disposal and runoff from nearby areas leading to the buildup of contaminants. This pollution encourages algal blooms, which form a green layer over the water and reduce oxygen levels, harming aquatic life.

2. Odor and Water Quality Deterioration: Due to accumulated pollutants, the reservoir emits unpleasant odors. Poor water quality has made the reservoir less suitable as a natural water source and diminished its appeal as a public space.

3. Loss of Biodiversity: Poor water quality and pollution have negatively impacted local biodiversity, with fewer aquatic species and a reduced presence of native flora and fauna

Clean-Water aimed to restore Hauz-i-Shamsi, revitalizing it as a valuable asset for both the community and the environment, far beyond its role as a simple water body.

PROBLEM AT HAND

Why is SUSTAINABLE WATER Important?

It is crucial for preserving ecosystems, community well-being, water security, and economic benefits.
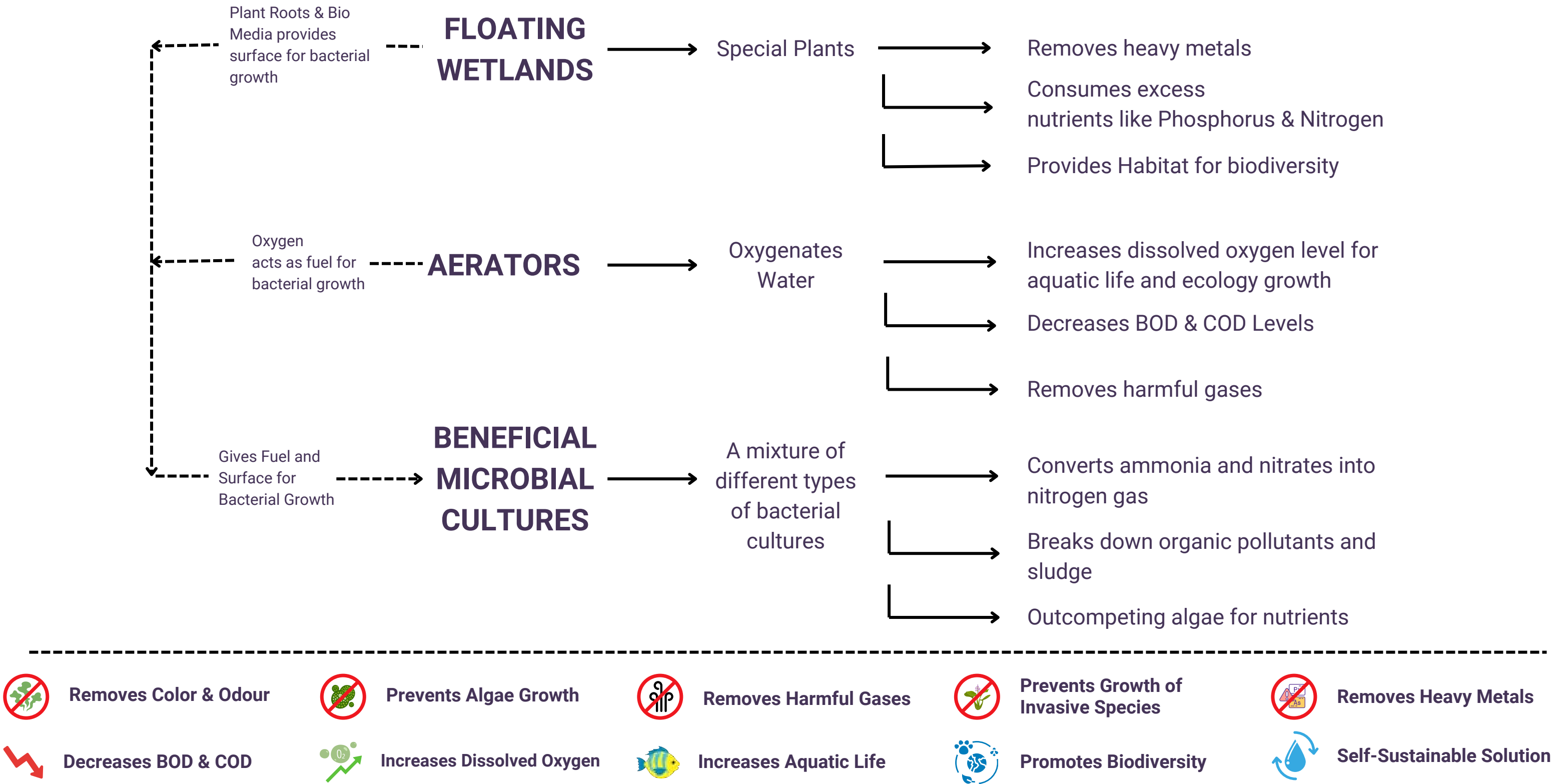
It ensures long-term viability and climate resilience.

Sustainable water management isn't just about preserving water;

it's about safeguarding ecosystems, enhancing community life, and securing our future.

HOW OUR PRODUCTS CREATED IMPACT

Plant Roots & Bio Media provides surface for bacterial growth

FLOATING WETLANDS → Special Plants →
- Removes heavy metals
- Consumes excess nutrients like Phosphorus & Nitrogen
- Provides Habitat for biodiversity

Oxygen acts as fuel for bacterial growth

AERATORS → Oxygenates Water →
- Increases dissolved oxygen level for aquatic life and ecology growth
- Decreases BOD & COD Levels
- Removes harmful gases

Gives Fuel and Surface for Bacterial Growth

BENEFICIAL MICROBIAL CULTURES → A mixture of different types of bacterial cultures →
- Converts ammonia and nitrates into nitrogen gas
- Breaks down organic pollutants and sludge
- Outcompeting algae for nutrients

- Removes Color & Odour
- Prevents Algae Growth
- Removes Harmful Gases
- Prevents Growth of Invasive Species
- Removes Heavy Metals
- Decreases BOD & COD
- Increases Dissolved Oxygen
- Increases Aquatic Life
- Promotes Biodiversity
- Self-Sustainable Solution

OUR INNOVATIVE PRODUCTS HELP US TO DELIVER & SCALE QUICKLY

Floating Wetlands

Mimic nature's process and provide wetland effect to waterbodies to clean the water.

- Improve water quality, reduce algal blooms and remove pollutants
- Produces Value (fish yield, oil, etc).
- Beautification tool for water-bodies
- Provide habitat to all life-forms

Floating Aerators

Aeration/Oxygenation helps in improving water quality and increasing Oxygen for sustenance & growth of aquatic life

Beneficial Microbial Cultures

Friendly bacteria work in tandem with wetlands to help devour nutrients and other unwanted pollutants to reduce algal blooms

WHAT ARE FLOATING WETLANDS AND HOW DO THEY WORK?

Floating islands are innovative ecological solutions for water bodies pioneered in India by Clean-Water. They consist of buoyant structures supporting wetland vegetation and biomedia, creating a sustainable ecosystem. The plants' roots extend into the water, absorbing nutrients and promoting biological filtration, improving water quality. The biomedia also help in the formation of colonies of helpful bacteria (biofilms) that improve the water treatment efficiency of the islands 4-5 times!

This process mitigates issues like algae blooms, removes pollutants such as heavy metals from the water and provides habitats for above water and underwater species. This makes floating islands an effective and environmentally friendly tool for water quality management, ecological restoration and beautification

FLOATING WETLANDS

FLOATING WETLANDS

Floating Islands are innovative structures designed to enhance water quality and provide ecological habitats. They mimic wetland effects, promoting microbial activity that helps settle sediments and absorb pollutants like phosphorus, nitrogen, and heavy metals. Ideal for lakes, ponds, and rivers, they also contribute to biodiversity and beautification of water bodies.

TECHNICAL SPECIFICATIONS

- **Build:** Hybrid - 7 Layered
- **Anchoring & Fixing:** Anchored to Bottom or from Side
- **Sizes:** 2m x 2m x 0.4m
- **Island Height:** 12 inches
- **Max Load:** 800 Kgs
- **Operational Design Load:** 400 kgs
- **Finish:** FRP
- **Frame:** FRP
- **Ideal For:** Lakes , Rivers , Drains & Ponds
- **Expected Life** > 10 years

Benefits
- Artificial bio-media provides maximum pollutant removal
- Natural wastewater treatment without use of chemicals
- Can be camouflaged in a natural environment

FLOATING AERATORS

To aerate the lake, Clean-Water deployed sub-surface floating aerators, dispersing them over the lake to target most affected areas. Since Annapurna Lake's water supply is limited to sewage discharge and seasonal rainfall, choosing an aeration method that preserved water levels was essential. Therefore, sub-surface aerators were selected over fountain or paddle-wheel types, which could otherwise contribute to water loss.

These sub-surface aerators release oxygen a few feet below the water surface, effectively reaching critical areas of the lake's water column that lack direct air exposure. Clean-Water also carefully adjusted the aeration flow to avoid disturbing the lakebed, thereby preventing sediment and sludge agitation, which could harm fish and other aquatic life.

FLOATING AERATORS (2 HP)

CLEAN WATER

Floating aerators enhance oxygen transfer in water bodies via high-velocity jets, improving water quality and preventing algae blooms. Ideal for lakes, ponds, and treatment facilities, they support aquatic life and ecosystem health.

TECHNICAL SPECIFICATIONS

- **Horse Power:** 2 HP
- **Voltage Range:** 230V (Single Phase)
  420V (Three Phase)
- **Frequency Range:** 50 Hz/60 Hz
- **Ampere Range:** 11A (Single Phase)
  3.3A (Three Phase)
- **Water Flow Range:** 100-110 feet
- **Oxygen Generation (kg/hr) :** 3.8 Kg/hr
- **Power Consumption (unit/hr) :** 1.5-1.8 unit
- **Installation Depth (in feet) :** 5 feet from the surface level

Benefits

- Boosts oxygen levels to support healthy aquatic life and enhance water quality.
- Minimizes stratification for uniform temperature and oxygen distribution throughout the water body.
- Prevents harmful algae blooms for a clearer, healthier aquatic environment.

BENEFICIAL MICROBIAL CULTURES

Beneficial Microbial Cultures are dormant colonies of specialised friendly bacteria. These bacteria are introduced in the water either by sprinkling them directly on the surface of the water or by diluting them with lake water in a separate drum and then allowing gradual dosing through a tap.

The bacteria consume excess nutrients and accumulated sludge quickly and safely. Through this, they starve out infestations and algal blooms and thereby stop their spread in the water. In this way, the bacteria improve water quality and help restore balance in the ecoystem

The bacteria start showing results within a few days' time and need to be dosed based on the amount of pollutants entering the lake regularly.
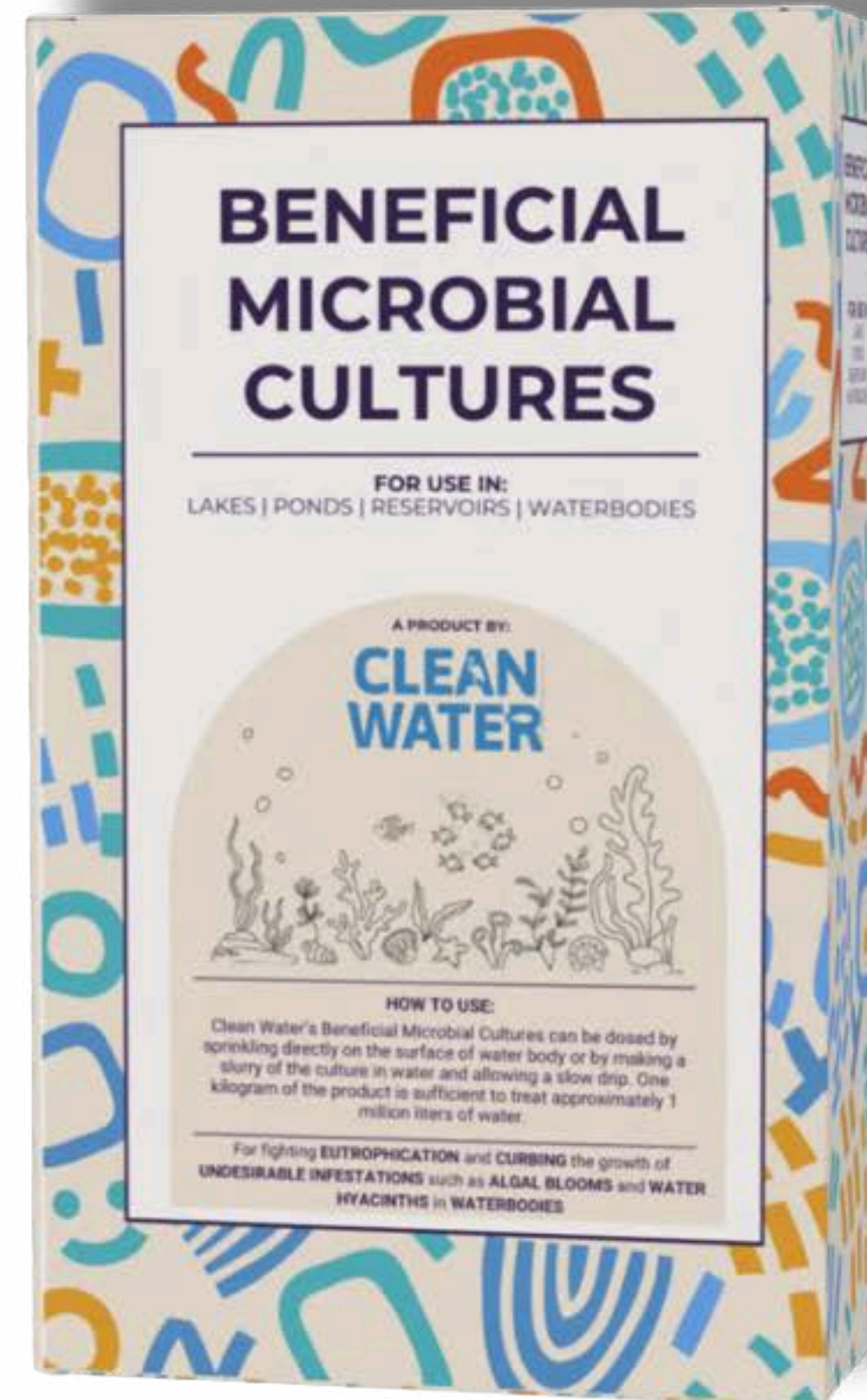
BENEFICIAL MICROBIAL CULTURE

Microbial cultures, consisting of beneficial bacteria consortia, combat eutrophication by improving water clarity, reducing sludge, and removing excess nutrients. This low-cost solution prevents algae infestations in diverse water environments.

Benefits
- Quickly tackles eutrophication in water bodies.
- Improves water clarity and odour within a few days.
- Biologically removes excess nutrients, reducing sludge and silt.
- Safely stops undesirable infestations of algae and water hyacinth.
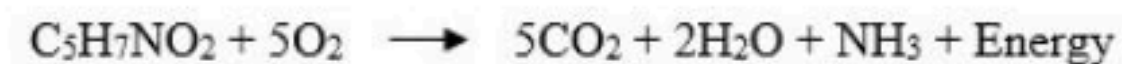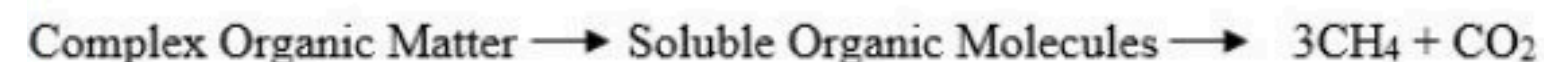
BIOLOGICAL NUTRIENT REMOVAL PROCESS

1) Oxidation

$$COHNS + O_2 + bacteria \longrightarrow CO_2 + NH_3 + \text{other end products} + energy$$
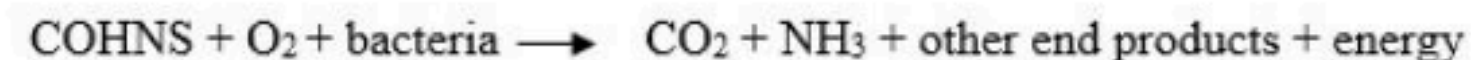
2) Synthesis of new cell tissue

$$COHNS + O_2 + bacteria \longrightarrow C_5H_7NO_2 \text{ (new cell tissue)}$$

3) Endogenous decay or respiration

$$C_5H_7NO_2 + 5O_2 \longrightarrow 5CO_2 + 2H_2O + NH_3 + Energy$$

4) Anaerobic Fermentation

$$\text{Complex Organic Matter} \longrightarrow \text{Soluble Organic Molecules} \longrightarrow 3CH_4 + CO_2$$

5) Biological Nitrogen Removal in the form of Nitrogen gas

(i) Nitrification $\quad NH_3 + O_2 \longrightarrow NO_2^- + 3H^+ + 2e^-$

$$NO_2^- + H_2O \longrightarrow NO_3^- + 2H^+ + 2e^-$$
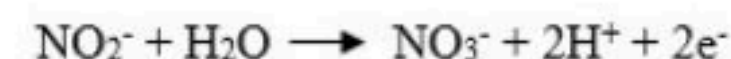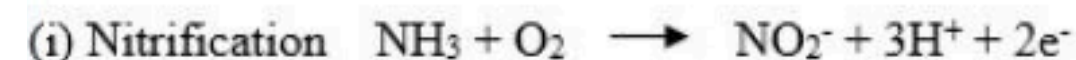
(ii) Denitrification in this process NO_3^- is converted to nitrogen gas (N_2) by denitrifying bacteria These are heterotrophic bacteria which need organic matter as a source for carbon.

$$2NO_3^- + 10e^- + 10H^+ \longrightarrow N_2 + 6H_2O$$
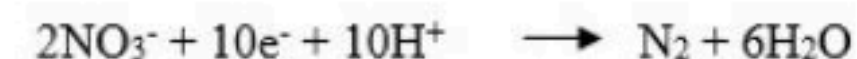
IMPACT

CLEAN WATER

The impact of Clean-Water's treatment on Hauz-i-Shamsi has been substantial, yielding notable improvements in water quality, ecosystem health, and community value. The use of floating wetlands has enhanced water filtration, absorbing excess nutrients and contaminants, which has helped reduce algal blooms and improve clarity. Floating aerators have played a key role in increasing dissolved oxygen levels, supporting healthier aquatic life and reducing foul odors caused by low-oxygen conditions. Additionally, regular applications of beneficial microbial cultures have accelerated the breakdown of organic matter, lowering BOD (Biological Oxygen Demand) and COD (Chemical Oxygen Demand) levels and addressing eutrophication issues.

Together, these products have revitalized Hauz-i-Shamsi, transforming it into a cleaner, more balanced ecosystem that supports biodiversity and reduces pollution-related issues. This successful treatment has not only restored the reservoir's ecological health but has also enhanced its value as a cultural and community asset, fostering a sustainable environment for the future.

BEFORE:

AFTER:

WATER QUALITY ASSESSMENT

CLEAN WATER

PARAMETER	Safe Limits	Test Results
Nitrate as NO3	<45	5.91
Total Suspended Solid(TSS)	<500	19
Biochemical Oxygen Demand (BOD)	<10	BDL
Chemical Oxygen Demand (COD)	<250	BDL
Nitrite as NO2	<30	BDL
Phosphorous as PO4	<4.5	1.19
Turbidity	<5	<1

BDL = Below Detection Level
Test Results dated approx 2 months after installation

SUCCESSFUL IMPLEMENTATION
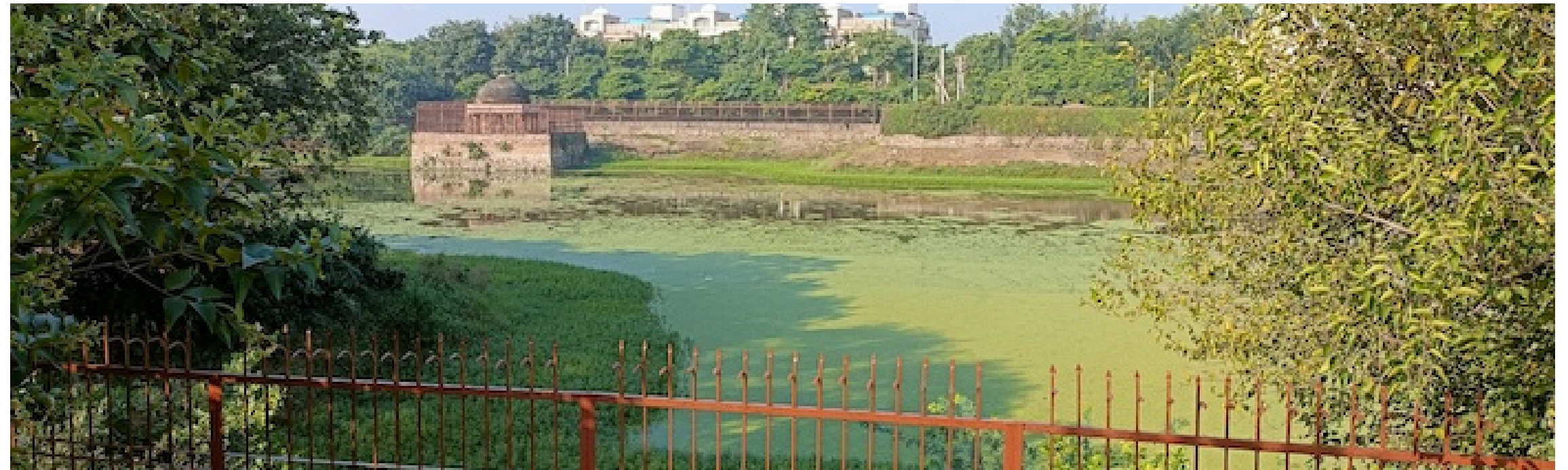
CLEAN WATER

BEFORE:

AFTER:

SUCCESSFUL IMPLEMENTATION

CLEAN WATER
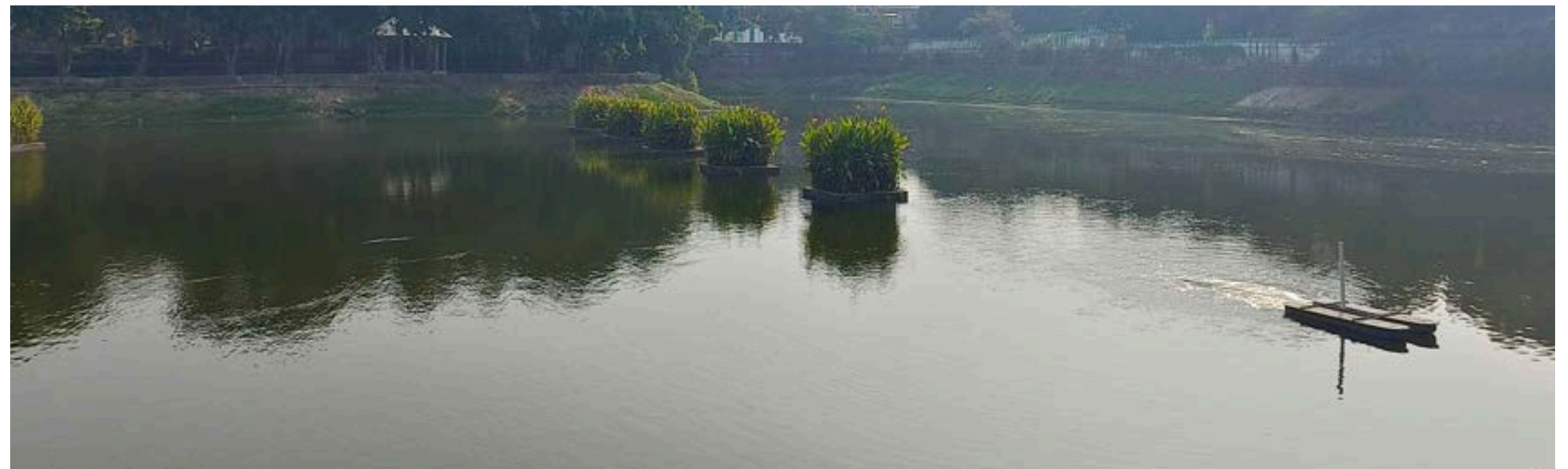
BEFORE:

AFTER:

SUCCESSFUL IMPLEMENTATION

CLEAN WATER

BEFORE:

AFTER:

THANK YOU!

www.clean-water.co.in

priyanshu@clean-water.co.in

+91 7999454226, 9769302930