

FSM *for* Leh

At an altitude of 12,000 feet, Leh town in Ladakh with population of about 45,000 is one of the highest cities in the world with amongst the harshest climates—minimum temperature of -30°C , low air pressure and very little rain or snow. Roads to Ladakh remain closed for 6 months of the year, making access difficult. Increasingly erratic weather patterns caused by global warming are affecting water supply (causing floods) and agricultural production, affecting the safety and self-sufficiency of the region.

Due to its geographic isolation, Ladakh's traditional way of life is incredibly sustainable and self-sufficient. But modern habits and an influx of tourists over the past 10 years (270,000 expected in 2017) are wreaking havoc on the ecology. Plastic waste, traffic jams, flush toilets, massive amounts of construction—all are threatening the fragile ecosystem and polluting natural resources.

About 60% of water supply is drawn from the pure underground water table and even drunk without filtering. But as flush toilets become increasingly popular, they discharge sewage into underground septic tanks and pits, which release toxic overflow into the soil which can easily reach and contaminate the underground water. A sewer system is under construction and in due course, may cover 40-50% of the city. This could be too little, too late as ground water contamination would have disastrous effect on public health and tourism. Many other Indian cities, including Shimla, have seen cholera or jaundice outbreaks due to similar pollution of water sources.

Due to this situation, the Ladakh Autonomous Hill Development Council (LAH-DC) visited Devanahalli (near Bangalore) in February 2017 to understand Faecal Sludge Management (FSM) and realized that it was critical to protect the environment and water supply in Leh. In May 2017, BORDA visited Leh to conceptualize a FSM system for the city that can complement the sewerage system that is under development. FSM involves multiple operations:

1. Scheduling and planning the cleaning of septic tanks in an efficient manner
2. Using suction trucks to clean septic tanks and soak pits
3. Safely transport the faecal sludge to a treatment plant
4. Operate a Faecal Sludge Treatment Plant to meet effluent standards
5. Sell and reuse the effluents



A Familiar Problem



Officials from LAHDC and the Municipal Committee of Leh (MCL) had two concerns:

1. How will the municipality manage the FSM project? FSM requires proper planning, customer service, operations management, developing and maintaining infrastructure etc. Given the shortage of government staff and lack of technical understanding about FSM, who can design, implement and operate the system such that the end goals are met?

2. How will the municipality pay for it? While public funds can be identified, it takes time to allocate budgets, and government tendering process delay implementation with no guarantee of finding the right contractor who will implement the system properly. This will work against the urgency of the situation.

These are common problems facing urban local bodies interested in implementing good quality FSM services. Many cities divide the process into separate components undertaken by separate parties, but this reduces accountability and increases chances of errors and failure.

Therefore, BORDA decided to invite the Blue Water Company (BWC) to set up India's first Public Private Partnership in FSM to design, finance, build and operate the entire system, and thereby solve both problems facing LMC.



A Solution in PPP



A five-year contract between the Leh Municipal Committee (LMC) and Blue Water Company (BWC) outlines operating responsibilities, payment terms and revenue models:

Municipal Committee of Leh	Blue Water Company (BWC)
Will provide the land for the FSTP	Will invest capital to construct the FSTP
Will provide 2 suction trucks for cleaning services	Will create a monthly schedule and clean septic tanks- large ones each year, smaller ones every two years
Will charge and collect a fee from every household, hotel and guesthouse for compulsory FSM services	Will be paid a part of the fees collected from customers, after the septic tank is cleaned
Will send customers a notice of cleaning 20 days in advance, based on a schedule created by BWC	Will train all employees, ensure use of proper safety gear and provide periodic health checks to operators
	Will develop a plant nursery where the treated water and compost will be used for greenification projects.

This structure aligns the interests of MCL and BWC perfectly. As BWC has invested in the project, it is committed to providing high quality service for the duration of the contract. BWC has an incentive to build the FSTP quickly and start services so as to start earning a return on its capital as quickly as possible. Risks of work stoppage and delays are minimized.

As the MCL will pay BWC a fee based on collections from customers, FSM will always be a financially profitable service which can be sustained in the long-term.



Notable Features

1. Speed—implementation in 3 months: In May 2017, BORDA visited Ladakh and submitted a preliminary proposal. In June, an agreement was signed, land was allocated for the FSTP, design completed and construction started. In August the FSM system will become operational—3 months from first discussion. This clearly shows that political will along with a turn-key PPP approach can be implemented very quickly, particularly if land can be quickly identified and cleared.

2. No cost to Government: The ULB has invested zero money and will pay only when services are successfully delivered. This prevents investment of funds into projects that never achieve their goals, as is common in India.

3. Accountability and Simplicity: As BWC is responsible for designing, building and operating the entire system, it has to take full accountability for any problems or failures. Accountability falls when multiple players are involved in a fragmented manner or when the process is very complicated.

4. New Technology: Given the unpredictable weather which can disrupt scheduled cleaning services and thus daily volume of faecal sludge collected, BORDA and CDD decided to deploy the Planted Drying Bed (PDB) technology for the first time in India. A DEWATS module is used to treat the water which will keep operations simple and costs very low.

5. Respect for Operators: While sanitation workers do one of the most hazardous and difficult jobs to keep our city clean, they receive low pay and face inhumane work conditions. The FSTP will have a comfortable office and rest area to provide them a positive work environment and dignity.

Potential to Improve

The system allows for incremental improvements, if needed, to further improve performance.

1. Greenhouses to improve treatment quality: The PDBs can be converted into greenhouses if needed.

2. Capacity increase: Building more PDB will double the capacity of the treatment easily—within 4 weeks.

3. Mobile Gulper: Many roads in Leh are too small for trucks. BORDA is developing a small device that can reach such areas and clean septic tanks—today, manual scavengers are still illegally used for such work.



Project implementation partners:

- Ladakh Autonomous Hill Development Council (HDC)
- Municipal Committee of Leh
- Leh Development Authority (LDA)
- Bremen Overseas Research & Development Association (BORDA)
- CDD Society
- Blue Water Company

Faecal Sludge Treatment Plant (FSTP), Leh



BACKGROUND

Leh, a high altitude cold desert at 12,000 feet in Jammu & Kashmir, India, has become a popular tourist destination with 250,000 visitors annually. The city is building a sewerage system that in the near future will connect about 40% of the city, but today, households, hotels and guesthouses use septic tanks and soak pits for on-site containment of sewage.

As most of the septic tanks are poorly designed and the underground water table is high (only 30 feet in some places), the risk of water contamination is very high. Borewells are extensively used for drinking water, therefore water pollution can have serious health and economic consequences.

Therefore, the Municipal Committee of Leh (MCL) has ordered that septic tanks are to be made water tight and mandatorily desludged every year. The town needs a FSTP to safely treat and reuse the sludge.

The FSTP must handle both the challenges of high altitude and extreme climatic conditions, as well as highly variable sludge inflow as activities will be minimal in the winter.

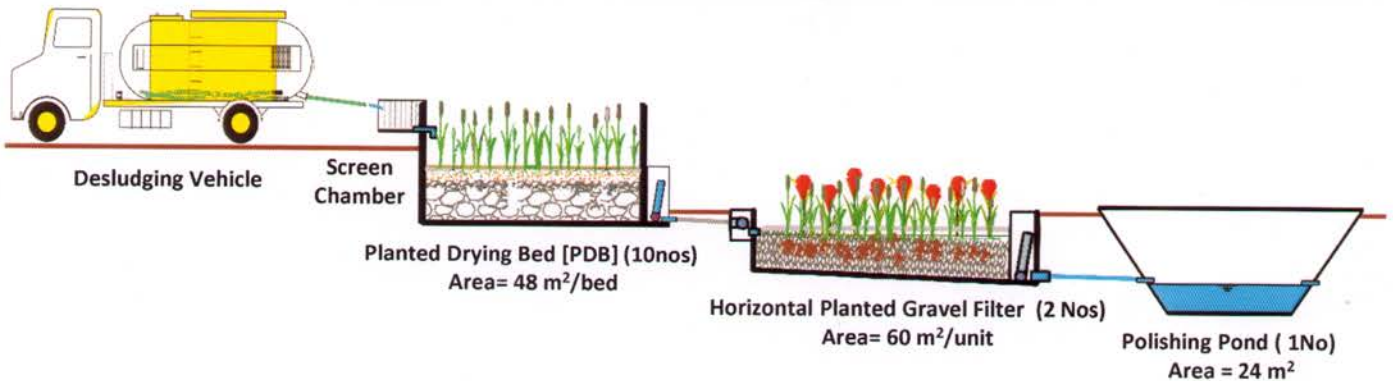
This plant is designed by BORDA and CDD Society and executed by MCL and Blue Water Company, a sanitation service company that will provide end-to-end Faecal Sludge Management Services to make Leh the first ODF++ city in India.

FEATURES AND BENEFITS

- Planted Drying Bed Technology used in India for first time—robust and flexible for extreme conditions
- No direct human contact with faecal sludge
- Minimal odour during entire process and aesthetically designed to locate it near habitation
- Gravity-based system, based on natural and biological treatment with no use of chemicals or electricity – green and ecofriendly system
- Minimal and simple operations with no skilled operator required – minimizing O&M costs
- Greening of Leh as a nursery will be set-up and operated using the treated wastewater and sludge

SPECIFICATIONS

Construction Period	7 weeks
Construction Cost	Rs. 52 lakhs (Rs. 4.33 lakhs/m ³)
Total Area	~ 60 m ² /m ³
Population served	~30,000
Design capacity	12 m ³ /day
Sludge Loading Rate	100 kgTS/m ² /Yr
Effluent quality	BOD < 30 mg/l



PRIMARY MODULES

The system is designed for simple and robust O&M.

1. Planted Drying Bed (10 units)

Solid-liquid separation and digestion of solid fraction

Capacity : 12 m³/day/bed | Area : 48 m²/bed

2. Horizontal Planted Gravel Filter (2 units)

Treat liquid fraction using plants and controlled flow

Area : 60 m²/unit

3. Polishing Pond (1 unit)

Ultraviolet disinfection of water and storage

Area : 24 m²

Filter material used : Graded Gravel, Sand

Plants used : *Phragmites karka*, *Canna indica* 1

SUITABILITY AND OPTIONS TO IMPROVE

The FSTP is designed to operate optimally in Leh's climatic conditions—low temperatures, dry climate with strong sunshine through the year.

The capacity can be increased easily by building PDB modules.

Greenhouses can be built on the PDBs to further improve and speed up the treatment process.

OPERATIONS AND MAINTENANCE

Operations: Each day, one bed of the PDB is filled with sludge and allowed to dry. The excess water percolates and is treated as it flows through the HGPF, and is collected in the polishing pond where sunlight provides further disinfection. The plants and direct sunlight assist in the digestion and disinfection. Once the sludge accumulates to a height of about 0.9m in the PDB (in 3-4 years), it is removed and can be used as an organic soil conditioner.

Maintenance: Weekly maintenance involves checking pipes and clearing blockages, trimming plants and cleaning the screen chamber.

REUSE OPTIONS

A plant nursery will be developed on-site where the treated percolate water will be used to grow plants, which can be sold to help make Leh more green. The dried and treated compost will also be used as a soil conditioner for the nursery.

Supporting Agencies :

NFFSM Alliance; Bill and Melinda Gates Foundation; Ladakh Autonomous Hill Development Council (LAHDC); Federal Ministry for Economic Cooperation and Development, Germany (BMZ); Tourism Development Authority, J&K Govt.; All Ladakh Hotel and Guest House Association; Public Works Department, Leh; J&K Bank; Ladakh Ecological Development Group; LhaRiSa Resorts

Executing Agencies :

Municipal Committee of Leh; Ladakh Development Authority; Blue Water Company; Ladakh Environment and Health Organisation; Dorje Tsering Construction Company; CDD Society; BORDA