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**Operation and Maintenance policy for Liquid Waste Management facilities in Kerala**

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**Thiruvananthapuram**

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# **Glossary**

| Liquid Waste Management (LWM) | Management of liquid waste, including greywater and faecal sludge, to minimize environmental and health risks. |
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| Public Toilets | Sanitation facilities located in public spaces such as bus stands and parks for use by the general population. |
| Greywater | Wastewater from domestic activities such as dishwashing, bathing, and laundry, excluding sewage. |
| Community Greywater Treatment Facility (GWTF) | A system for treating greywater from households in communities that lack space for individual management systems. |
| Faecal Sludge Treatment Plant (FSTP) | A facility designed to treat sewage and faecal sludge from septic tanks and other sanitation systems. |
| Sewage Treatment Plant (STP) | A facility for treating sewage from households and commercial establishments to meet environmental and health standards. |
| Preventive Maintenance | Scheduled maintenance activities to prevent breakdowns or failures in infrastructure and equipment. |
| Circular Economy | An economic system aimed at minimizing waste and making the most of resources by reusing and recycling. |
| Capacity Building | Initiatives to enhance the knowledge and skills of stakeholders for improved operation and maintenance of LWM facilities. |

# **Abbreviations**

| BOD | Biochemical Oxygen Demand |
| --- | --- |
| COD | Chemical Oxygen Demand |
| CSR | Corporate Social Responsibility |
| FSTP | Faecal Sludge Treatment Plant |
| GWTF | Greywater Treatment Facility |
| KSPCB | Kerala State Pollution Control Board |
| LSG | Local Self Government |
| LWM | Liquid Waste management |
| O&M | Operation & Maintenance |
| PFAS | Perfluoroalkyl Substances |
| STP | Sewage Treatment Plant |
| TSS | Total Suspended Solids |

# **Introduction**

Effective liquid waste management is pivotal for addressing Kerala’s pressing environmental challenges and safeguarding public health. With its high population density, varied topography, and intricate hydrological systems, Kerala faces unique hurdles in managing liquid waste effectively. While the state has made significant progress in establishing centralized and decentralized treatment facilities for sewage and faecal sludge, greywater mismanagement remains a persistent issue. Greywater, generated from domestic activities like dishwashing, bathing, and laundry, contributes significantly to water pollution, public health risks, and ecosystem degradation when inadequately treated.

The development of a comprehensive Operation and Maintenance (O&M) policy is essential to ensure that Liquid Waste Management (LWM) facilities function effectively and sustainably. This policy aims to bridge operational gaps, address infrastructure deficits, and mitigate environmental risks by standardizing procedures and promoting accountability. By doing so, Kerala can optimize its sanitation value chain, promote resource efficiency, and foster a healthier environment for its residents.

### 1.1 Need for the Policy

The absence of a dedicated O&M framework has led to inefficiencies in the management and upkeep of LWM facilities across Kerala. Key challenges include:

1. Lack of ownership by LSGs: There are usually gaps in the maintenance, which is from allocation of finances for O&M to regular monitoring of the infrastructure or having updated data on the infrastructure after the commissioning
2. Operational Inefficiencies: Inconsistent maintenance, insufficient technical expertise, and lack of capacity-building initiatives contribute to the suboptimal performance of existing systems.
3. Environmental Risks: Inefficient liquid waste treatment and discharge practices exacerbate water pollution, public health hazards, and ecological degradation.
4. Resource Constraints and gaps in monitoring: Financial and technical limitations often hinder timely repairs, upgrades, and expansions of existing facilities. The absence of standardized monitoring protocols and enforcement mechanisms leads to non-compliance with treatment and discharge standards.

To address these challenges, the O&M policy will provide a structured framework to ensure the sustainable and reliable functioning of LWM facilities, enabling Kerala to achieve its sanitation and environmental goals effectively.

### 1.2 Objectives of the Policy

The primary objectives of the O&M policy are:

1. Ensuring Infrastructure Sustainability: Establish guidelines for routine maintenance, periodic inspections, and timely repairs to enhance the longevity and reliability of LWM facilities.
2. Enhancing Operational Efficiency: Introduce capacity-building programs, adopt innovative technologies, and promote efficient resource utilization to improve facility performance.
3. Mitigating Environmental Risks: Ensure compliance with treatment and discharge standards to minimize pollution and protect natural ecosystems.
4. Promoting Accountability and Transparency: Establish clear roles and responsibilities for stakeholders involved in the operation and maintenance of LWM facilities.
5. Facilitating Resource Optimization: Encourage the reuse of treated greywater and faecal sludge, contributing to water conservation and circular economy principles.

# **2. Facility Specific O&M requirements**

### 2.1 Public Toilets

Public toilets are the convenience facilities available in the villages, public spaces like bus stands, parks or streets. These sanitation facilities are used majorly by the floating population of a town or LSG as well as travellers.

### 2.1.1 Responsibility

The responsibility of the public toilet shall be under the Local Self Body where it is located. The operation and maintenance can be carried out by the Local Body/Private Agency/ Kudumbashree Unit.

### 2.2.2 Maintenance standards

**Cleanliness and Hygiene**

**Frequency of Cleaning:** Public toilets must be cleaned a minimum of [insert frequency, e.g., every 4 hours], including weekends and holidays. The display of the cleaning cycle as notice board shall be done in all the public toilets.

**Cleaning Procedure:** Routine cleaning should involve the scrubbing of floors, walls, basins, toilets, urinals, and mirrors. Disinfectants must be used to reduce the spread of bacteria, viruses, and odors.

**Sanitization of High-touch Areas:** High-touch surfaces such as door handles, faucets, toilet flushers, and handrails must be sanitized regularly.

**Restocking of Toiletries**: Toilet paper, hand soap, hand sanitizers, and disposable towels (if applicable) should be checked and restocked regularly, ensuring continuous availability.

**Waste Disposal**: Waste should be removed from waste bins at regular intervals (at least twice daily) to prevent overflow and unpleasant odors.

### 2.2.3 Funding for O&M

**Preventive maintenance:** A preventive maintenance schedule should be created for all plumbing, electrical, and ventilation systems. This includes regular checks for leaks, blockages, and electrical malfunctions.

**Emergency Repairs**: Procedures for handling urgent repairs (e.g., toilet malfunctions, plumbing issues) should be defined, ensuring that such issues are addressed promptly to minimize disruption to public service.

* All the funding related to minor and major repairs like change of taps, lights or exhaust fans and change of plumbing lines are to be undertaken by the operation & maintenance contractor or agency. All bills related to repairs are to be submitted to the owner of the public toilets.
* LSGs owning the toilets shall allocate a specific amount for O&M of the toilets in their area. The data on the lease and agreement with all the public toilets under the LSGs shall be maintained by the Sanitary Inspector and the same shall be extended before the date of expiry of the agreement.
* The operation and maintenance agency shall ensure the disposal of faecal waste from the septic tank through the licensed agency of the LSG and the emptying fee shall be undertaken by the LSG. This shall be initiated by the Sanitary Inspector or the competent authority fixed by the Secretary of the LSG.
* In sensitive areas, the climate resilient aspect and preventive measures like stopping use of toilets in case of floods.

### 2.2 Community Greywater Management Facility (GWTF)

Community Greywater Management facilities are generally constructed by the LSG with state or central government funds to households who lack space for greywater management or for households discharging the greywater into the drains. Generally, community greywater management facilities are percolation based systems or nature based systems like soak pits or leach pits or DEWATS systems for 5 to 20 households.

### 2.2.1 Responsibilities

* The beneficiary households shall be responsible for the operation and maintenance of the community GWTF. This beneficiary household group may be created for ease of functioning and allotment of responsibilities
* The contractor shall capacitate the community to use the GWTF properly and efficiently without hampering the function of the system.

### 2.2.2 Maintenance aspects

* **Frequency of Inspection**: The soak pit should be inspected regularly—at least once every 6 months—by trained personnel or a community member assigned as the caretaker.
* **Visual Inspection**: Check for visible signs of overflow, slow absorption of water, or any unpleasant odors. Ensure the surrounding area is not becoming overly saturated with water.
* **Water Level Monitoring**: Check for signs of high water levels within the soak pit that may indicate blockage or inefficient percolation.
* **Sediment Removal**: Over time, silt, grease, and other particles can accumulate in the soak pit, which may clog the system. It is essential to clean out any built-up sediment at least once a year, or more frequently depending on usage.
* **Inlet and Outlet Pipes**: Ensure that the pipes leading into and out of the soak pit are clear of debris, blockages, and damage. Clean the pipes at least once every 6 months.
* **Gravel and Sand Maintenance**: The effectiveness of the soak pit depends on the proper filtration of greywater through layers of gravel and sand. These layers should be inspected for degradation, and replenishment may be required if the filter becomes less effective.
* **Capacitation of the beneficiaries:** LSGs shall capacitate the beneficiaries on the do’s and don’ts for the efficient and proper functioning of GW TF
* The pit covers shall be designed to prevent entry of debris, rodents, and other contaminants while ensuring adequate ventilation to prevent harmful gas buildup.
* O&M funds for the GWTF shall be mobilized by the community itself and in case if they require the support of LSG, LSG may employ a cleaner at the cost of the community or the cost may be sponsored through CSR funds or funds of the LSG.
* In case of non-cooperation by a community member who is discharging the greywater without any treatment or reuse, penalization may be undertaken by the LSG on the non-cooperative members.
* In the event of a system failure or overflow by heavy rain, ensure the community has a plan to divert excess greywater safely. This may involve temporary storage or rerouting the water to prevent contamination of the local environment. During periods of heavy rainfall, monitor the soak pit for signs of over-saturation or overflow. Ensure drainage systems are in place to handle excess water.

### 2.3 Faecal Sludge Treatment Plants

Faecal Sludge Treatment Plants (FSTP) are a facility that treats sewage and faecal sludge from toilets, septic tanks, and other sanitation systems. The treatment involves solid-liquid separation followed by treatment of solids and liquids in a separate stream through physico-chemical or nature based systems depending on the end-use of treated solids and liquid portions.

### 2.3.1 Responsibilities

* LSG shall give the O&M of the FSTP to a private operator, particularly to the agency who commissioned the FSTP for at least 5 years or the LSG engage other agencies for O&M through a transparent bidding process.
* All the cost of O&M shall be borne by the LSG through its own funds or CFC funds or any other available fund. Funds shall be allocated for O&M of all the available UWM infrastructure to ensure its proper functioning.
* In case of any major repairs or maintenance works, the O&M agency may undertake it instantly and funds for the works shall be cleared by the LSG within 20 working days or mutually agreed time.
* The human resource cost for workers in FSTP shall be paid by the agency itself. The training cost for personnel in the FSTP shall also be borne by the operator.

### 2.3.2 Maintenance aspects

* Operational Parameters Monitoring:
	+ Sludge Inflow: Monitor the volume and characteristics of incoming fecal sludge to ensure the plant is receiving sludge within the designed specifications (e.g., solids content, pH levels).
	+ Treatment Efficiency: Regularly check the treatment stages for optimal performance. This includes checking chemical dosing, aeration, biological treatment efficiency (if applicable), and sedimentation efficiency.
	+ Sludge Quality: Ensure that treated sludge meets environmental and health standards before disposal or reuse. Parameters like moisture content, pathogen levels, and chemical composition should be regularly monitored.
	+ Effluent Quality: Check the quality of the treated effluent to ensure it meets discharge or reuse standards, including parameters like BOD, COD, pH, turbidity, and coliform levels. The treated effluent shall comply with the KSPCB treated effluent standards.
	+ Operational safety and environmental health: All the protocols issued by the concerned department shall be complied to ensure the operational safety and health of the personnel working in the FSTP.

**Routine Inspection and Maintenance of Equipment**

* Mechanical and Electrical Systems:

	+ Pumps and Motors: Check pumps used for sludge transfer, water supply, or aeration to ensure they are functioning efficiently. Routine lubrication, cleaning, and electrical inspection are essential.
	+ Aeration System: If the FSTP includes an aerobic treatment component, inspect and maintain aerators (e.g., blowers, diffusers) to ensure proper oxygenation levels.
	+ Conveyor Belts/Chutes: For systems that use mechanical conveyance, inspect belts or chutes for wear and tear, and ensure they are free from blockages.
	+ Valves and Pipes: Inspect and clean valves and pipes regularly to ensure smooth flow and prevent blockages. Damaged or leaking pipes should be replaced promptly.
	+ Electrical Panels: Regular inspection and maintenance of electrical control panels, ensuring all switches, fuses, and breakers are functional and safe.
* Sludge Drying Beds (if applicable):

	+ Inspect drying beds for adequate drainage and airflow. Clean and remove any dried sludge, ensuring that the beds remain functional.
	+ Monitor the quality of the dried sludge to ensure it is safe for disposal or reuse.

**Sedimentation Tanks and Digestion Units**

* Cleaning and Desludging:

	+ Clean and desludge sedimentation tanks and anaerobic digesters as per the recommended guidelines to prevent the accumulation of solids that could impair treatment efficiency.
	+ Desludging Frequency: Desludging frequencies should be based on the flow rates and solids retention time of the tanks. Typically, sedimentation tanks may need to be desludged every 6 to 12 months.
	+ Check for any signs of gas buildup or odor, which could indicate improper functioning of the digestion process or potential blockages.
* Tank Inspections: Inspect the interior of the tanks periodically for structural integrity. Look for cracks, corrosion, or erosion, particularly in anaerobic digesters and settling tanks.
* Odor Management: Ensure adequate venting of anaerobic tanks to minimize odors. If odors persist, assess the performance of the odor control systems, such as bio-filters or scrubbers, and perform necessary maintenance.

**Sludge Dewatering and Disposal Systems**

* Dewatering Equipment:

	+ Maintain mechanical dewatering units such as centrifuges, belt filter presses, or drying beds, depending on the technology used. Regular checks for clogging, wear and tear, and routine lubrication should be performed.
	+ Sludge Cake Quality: Monitor the quality of the dewatered sludge to ensure it is ready for safe disposal or beneficial reuse, such as composting, land application, or landfill.
* Disposal Systems: Ensure the final disposal systems (e.g., transport vehicles, incineration, or landfills) are functioning properly, and that the end-product complies with local environmental standards.

### 2.4 Sewage Treatment Plants (STPs)

Sewage Treatment Plants are treatment facilities that treat the used water or sewage from households and commercial establishments conveyed through sewers and pumping stations. STPs are operated by the respective institutions or LSGs or the utility of the state.

### 2.4.1 Responsibilities

* LSG shall give the O&M of the STP to a private operator, particularly to the agency who commissioned the STP for at least 5 years or mutually agreed period by the two parties.
* All the cost of O&M shall be borne by the LSG through its own funds or CFC funds. Funds shall be allocated for O&M of all the available UWM infrastructure to ensure its proper functioning.
* In case of any major repairs or maintenance works, the O&M agency may undertake it instantly and funds for the works shall be cleared by the LSG within 20 working days or mutually agreed time.
* The human resource cost for workers in STP shall be paid by the agency itself. The training cost for personnel in the STP shall also be borne by the operator.

### **2.4.2 Maintenance Standards**

**Routine Operational Monitoring**

* Monitoring of Influent and Effluent Quality:

	+ Influent Quality: Regularly monitor the quality and quantity of incoming sewage (influent), including parameters such as BOD (Biochemical Oxygen Demand), COD (Chemical Oxygen Demand), TSS (Total Suspended Solids), pH, and ammonia levels.
	+ Effluent Quality: Ensure that the treated effluent meets the required discharge or reuse standards. Regular testing should include parameters such as BOD, COD, TSS, fecal coliform, pH, and heavy metals, if applicable.
* Performance Efficiency: Monitor and document the operational efficiency of each treatment unit, including screening, sedimentation, biological treatment, and disinfection (if applicable). This includes verifying the correct functioning of pumps, aerators, clarifiers, and other mechanical systems.
* Chemical Dosage and Sludge Management: Ensure proper chemical dosing for coagulation, flocculation, disinfection, or pH control as per system requirements. Monitor and manage sludge generated during treatment processes, ensuring proper handling, dewatering, and disposal.
* The antibiotics and PFAS presence in the treated effluent shall be checked by building collaboration with the research organizations

**Routine Inspection and Maintenance of Equipment**

* Mechanical and Electrical Systems:
	+ Pumps and Motors: Regular inspection of all pumps and motors to ensure proper functionality, cleaning, and lubrication. Identify signs of wear and tear, overheating, or malfunction.
	+ Aeration Systems: Inspect aerators (diffusers, blowers, compressors) for proper airflow and oxygenation levels. Clean and maintain these components regularly to avoid clogging or inefficiency.
	+ Valves, Pipes, and Flow Meters: Check and maintain valves, flow meters, pipes, and fittings to ensure there are no leaks, blockages, or malfunctions. Ensure proper calibration of flow meters for accurate monitoring.
* Clarifiers and Sedimentation Tanks:
	+ Sedimentation Efficiency: Inspect primary and secondary clarifiers for accumulation of sludge, proper scum removal, and efficient settling of solids. Ensure sludge levels are within acceptable limits.
	+ Cleaning and Desludging: Perform desludging of sedimentation tanks and clarifiers periodically, based on operational needs, to maintain efficiency.
* Filtration and Disinfection:
	+ Filters: For tertiary treatment, regularly inspect and clean filtration units (e.g., sand filters, membrane filters) to prevent clogging and maintain filtration efficiency.
	+ Disinfection Units: If the STP includes disinfection (chlorination, UV treatment, ozonation), ensure that these systems are functioning correctly, with proper chemical dosing and monitoring of disinfection effectiveness.

Sludge Management and Dewatering Systems

* Sludge Dewatering: Regularly monitor sludge dewatering equipment (e.g., centrifuges, belt filter presses) to ensure proper functioning. Ensure proper disposal of dewatered sludge in an environmentally safe manner, whether through landfilling, incineration, or beneficial reuse (e.g., composting, biogas production).
* Sludge Treatment: If sludge digestion is part of the process, inspect anaerobic digesters for gas production, temperature control, and sludge mixing. Ensure the safe storage of digested sludge until it is removed for disposal or reuse.

# 3. Conclusion

Implementing this policy framework for STP operation and maintenance will ensure that sewage treatment plants function efficiently, meet regulatory standards, and contribute positively to public health and environmental sustainability. With the right strategies for training, performance monitoring, technology integration, and stakeholder collaboration, STPs can be maintained effectively for the long term, while also embracing innovation and sustainability.