Desludging Practices in Urban Areas in India

From Reactive Emptying to a Regulated, Scheduled Municipal Service

Presented by
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Country Profile: India

Most urban homes rely on septic tanks, and only 28% of urban sewage is treated

1.46 bn
Population (2025 est.)

3.29 M km²
Geographical area

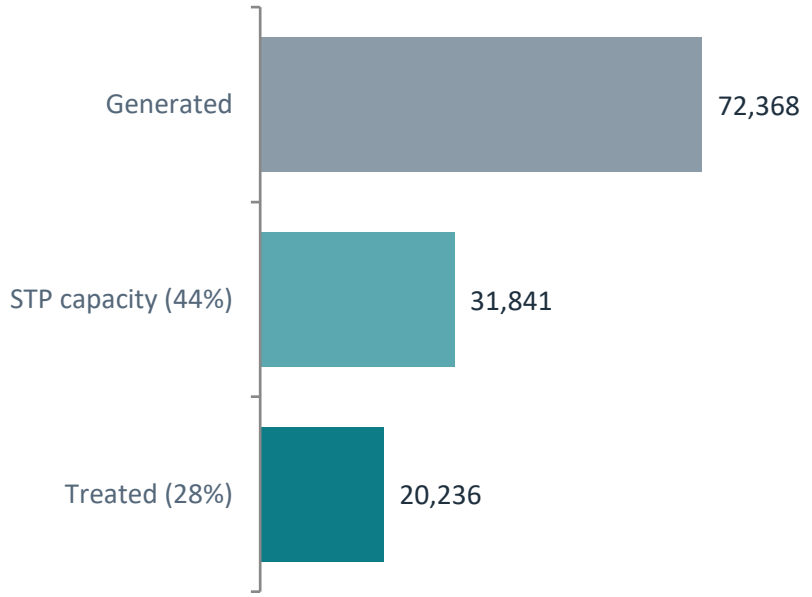
~37%
Population in urban areas

~30%
Urban households sewered

~4.5 crore
Urban homes on septic tanks

~1,131
FSTPs operational

Urban sewage (MLD per day)



Treatment Gap
Smaller towns and north-eastern states lag most in treatment.

Domestic Wastewater

- **Black water:** about half the urban population uses septic tanks
- **Rural toilets:** mostly twin leach pits built under SBM-G
- **Grey water:** the bulk of domestic flow; open drains in towns, soak pits and ponds in villages

Urban vs Rural

- **Urban:** ULBs declared ODF; SBM-U 2.0 and AMRUT 2.0 fund sewerage, FSSM and used-water reuse
- **Rural:** villages ODF since 2019; ~96% ODF Plus by March 2025 with grey-water systems

Sources: CPCB National Inventory of STPs (2021)

Currnet Practices of Decentralised Wastewater Treatment in India

Many on-site and small systems exist, but desludging and O&M decide how well they work

Floating aerators

STP with UASB technology

Key gaps

- Low plant use; irregular desludging
- Weak O&M and few skilled staff
- Few norms for small and on-site systems
- Weak monitoring and enforcement

Facility type	Key features	Treatment performance	Where in India
Septic Tank + Soak Pit	Two-chamber tank (IS 2470); settling and anaerobic digestion; desludge every 2–3 years	30–50% BOD removal; effluent needs further treatment	Most common urban on-site system
Twin Leach Pit	Alternating pits; liquid infiltrates, sludge dries in place	Pathogen die-off after 1–2 year rest; groundwater risk where water tables are high	Standard rural household toilet (SBM-G)
FSTP / Co-treatment	Screening, drying beds or screw press, ABR + planted filter, solar or lime drying	Designed to BOD ≤30 mg/L; field compliance varies	~1,131 operational; more under SBM-U 2.0
DEWATS / Community STP	Settler + ABR + anaerobic filter + planted gravel filter; gravity-fed, low energy	80–90% BOD/COD removal if maintained	Colonies, campuses; villages >5,000 pop.
Package / In-building STP	SBR, MBBR, MBR; required for large buildings by state byelaws	BOD <10–20 mg/L; reused for flushing, gardens	Hundreds in metro cities
Nature-Based Systems	Stabilisation ponds, constructed wetlands, Phytorid, soil bio-technology	70–90% BOD removal; land-intensive, low O&M	Widely used for rural grey water

Sources: Indian practice and literature; FSTP count per CSE (2025)

Desludging Processes

The service is moving from reactive emptying to regulated, mechanised and scheduled desludging

Private operators desludging in Warangal

Who performs it?

ULB-owned vehicles in some towns; licensed or registered private operators are common.

How often?

Every 2–3 years per national guidance; Telangana runs city-wise scheduled desludging in a few cities.

How is it monitored?

Warangal pioneered licensing, GPS tracking and chain of custody; digital workflows are now national.

Service maturity

1 Reactive
Empty when full or overflowing

2 Regulated
Licensed operators and vehicle records

3 Scheduled
Property database and a 2–year cycle

4 Digital
Request → Trip → FSTP entry → dashboard

What is desludging?
Removing accumulated sludge or septage from the containment unit, following the guidelines.

Practice gaps to close

- **Universal property and containment registry**
- **Mandatory service-request records**
- **Proof of receipt at treatment**
- **Enforcement against illegal discharge**

Sources: MoHUA SBM sewage-management advisory; Warangal FSM case studies; NUDM Desludging Service

Desludging Service Flow

The full sanitation value chain must be visible and traceable

01 → 02 → 03 → 04 → 05

Containment

Septic tank or pit, properly accessible

Source: property and tank ID

Emptying

Mechanised desludging by vacuum tanker

Authorised operator and crew

Transport

Licensed vehicle with GPS and trip record

Transport record for the trip

Treatment

FSTP or approved STP co-treatment

Receiving-facility entry

Reuse / disposal

Treated water and stabilised solids

Final treatment or reuse record

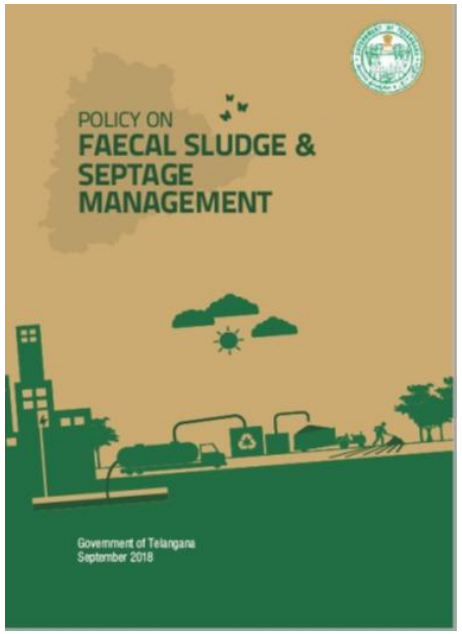
Telangana operating principle: no "last-mile blind spot"

Every desludging trip should have a source, an authorised operator, a transport record, a receiving-facility entry and a final treatment or reuse record.

Sources: FSSM service-chain guidance; NUDM digital desludging workflow

Legal and Institutional Framework

National laws set the rules; states and ULBs license operators and enforce standards



Telangana Policy on Faecal Sludge & Septage Management
Government of Telangana, September 2018

Laws and policies

1974	1986	1992	2013	2017	2018
Water Act	**Environment (Protection) Act**	**74th Amendment**	**Manual Scavengers Act**	**National FSSM Policy**	**Telangana FSSM Policy**
Pollution control	Pollution control and discharge norms	Urban sanitation is a local-body function	Bans hazardous manual sewer and septic tank cleaning	Safe septage management in all cities	State policy for faecal sludge and septage

Licensing

- Operators register with the ULB under state rules or bye-laws
- Only registered vehicles and trained, equipped workers
- Fees and penalties set in notified bye-laws

Standards

- Septic tanks: BIS IS 2470 and the National Building Code
- Discharge norms under the Environment (Protection) Act
- Service and vehicles: MoHUA SOP and state operator rules

Sources: National Policy on FSSM (2017); Manual Scavengers Act 2013; BIS IS 2470; Telangana FSSM Policy (2018); Odisha and UP model bye-laws

Who Does What in FSSM

Authorities at three levels, and the mechanisms they use to enforce

Centre

MoHUA / CPHEEO
National FSSM Policy 2017, SBM-U 2.0, SOPs, manuals, ODF++ protocol

CPCB
Water Act 1974: national baselines, monitoring, directions to SPCBs

MoSJE
NAMASTE scheme for sanitation-worker safety

MoEFCC
EP Act 1986: effluent and STP discharge standards

NGT
NGT Act 2010: binding STP norms (30 Apr 2019) and directions

State

Urban development depts
State FSSM policies, regulations and model bye-laws

Water & sewerage boards
Sewerage, STPs, septage co-treatment, tanker regulation (DJB, HMWSSB, BWSSB)

SPCBs / PCCs
Consent to establish and operate STPs and FSTPs; inspection and sampling

City (ULB)

Urban local bodies
Run desludging, license operators, own or contract FSTPs, STPs and decentralised treatment, enforce bye-laws

Enforcement mechanisms

- Consent to establish and operate, with conditions and renewal
- Closure, utility disconnection and penalties under the Water Act
- NGT directions and environmental compensation
- Scheme funding and ODF++ certification tied to safe FSM
- Desludger licences and manifests; MS Act 2013 and NAMASTE for worker safety

Sources: Water Act 1974; EP Act 1986; NGT Act 2010; National FSSM Policy 2017

Inlet and Outlet Standards: STPs and FSTPs

Septage arrives far stronger than sewage, but treated effluent must meet the same norms

mg/L unless stated	STP inlet (indicative design)	FSTP inlet: septage (indicative)	Treated outlet (NGT 2019)	MoEFCC 2017 / CPCB
pH	6.5 to 8.5	Variable	**5.5 to 9.0**	6.5 to 9.0
BOD (mg/L)	150 to 300	1,500 to 7,000	**< 10**	20 (metros), 30 (others)
COD (mg/L)	250 to 500	5,000 to 15,000	**< 50**	–
TSS (mg/L)	200 to 350	Several thousand	**< 20**	< 50 (metros), < 100 (others)
Faecal coliform (MPN/100 ml)	Very high	Very high	**< 100 desirable, < 230 permissible**	< 1,000
Total N / total P	Not specified	Not specified	**N < 10; P < 1.0 if released to ponds and lakes**	Prescribed limits

FSTP liquid outlet
No separate national statutory limit. SPCB consent usually applies the STP norms above; reuse follows CPHEEO guidance.

Biosolids (dried sludge, co-compost)
FCO city-compost limits (mg/kg): As 10, Cd 5, Cr 50, Cu 300, Pb 100, Hg 0.15, Ni 50, Zn 1,000; C:N below 20. Pathogens: helminth eggs below 1 per g TS (WHO/USEPA).

Sources: NGT order 30 Apr 2019; MoEFCC notification 13 Oct 2017; FCO 1985 as amended

Business Model and Financing

A regulated private-service model works when the ULB controls standards, access and disposal

Private operator

- Vehicle capex and crew
- User-fee revenue
- Licensed by the ULB

ULB

- Licensing and tariff
- Service standards
- Monitoring and enforcement

FSTP / STP

- Receiving fee and O&M
- Treatment and records
- Reuse or disposal

Warangal lesson

Operators finance their own vehicles and recover costs through user fees. Licensing and GPS tracking improve accountability and protect the treatment chain.

Recommended model

- Standard tariff bands
- Digital payment
- Annual operator licence
- Receiving-facility fee
- Targeted subsidy for vulnerable households
- Performance-linked O&M contracts

Financial control point

The ULB should always know:

- Number of trips
- Litres / KL collected
- Revenue
- Treatment receipts
- O&M cost per KL

Sources: IWMI Resource Recovery & Reuse: Warangal business model; NITI Aayog FSSM service and business models

The Hybrid Annuity Model (HAM)

Government and the private partner co-finance the plant; payments are tied to performance

Under HAM, the government pays a fixed share of the project cost (usually 40%) during construction. The private partner finances the rest and recovers it through annuity payments over a fixed period after completion.

40%
Capex, in milestone instalments

60% Annuity payments: semi-annual or annual, linked to performance and availability

Years 1–3 · construction

Years 4–18 · operation

Origin and context

- Introduced in India's highway sector (2016)
- A response to BOT project failures
- Ministry of Road Transport adopted it first
- Now expanding to water and sanitation

Why HAM?

- Reduces private-sector demand risk
- Attracts more bidders and competition
- Lowers the cost of capital
- Keeps a government stake in quality

Key features

- Private partner finances 60% through equity and debt
- Government repays over 15 years, easing the upfront fiscal burden
- Private partner runs O&M for the whole concession
- Construction risk with private; demand risk with government

FSTPs Built on the PPP-HAM Model in Telangana

Four plants with a combined capacity of 80 KLD

Sludge Treatment and Disposal

Treatment capacity is growing, but dumping continues where monitoring is weak

Septage dumped on open land

Kamareddy FSTP · 25 KLD

Warangal FSTP · 10 KLD

Illegal dumping

- Private tankers discharge septage into drains, open land and lakes to save trips and fees
- Delhi (May 2025): probe ordered into septage dumping polluting the Yamuna
- Lack of operator licensing, GPS tracking, scheduled desludging, penalties
- **Limited treatment and monitoring of private desludging pollutes water and harms health**

Transition required

Treatment facilities

- STP sludge: thickening, anaerobic digestion at large plants, then centrifuge, belt press or drying beds
- ~1,131 FSTPs: screening, drying beds, screw press, geo-bags, pyrolysis
- Co-treatment of septage at STPs with spare capacity

Disposal and reuse

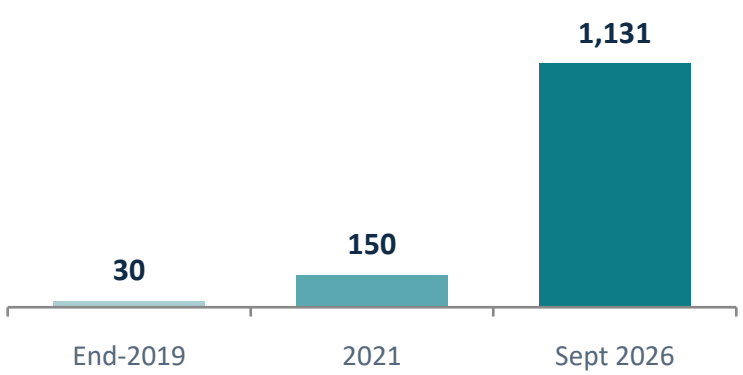
- Dried sludge and co-compost as soil conditioner in farms, horticulture and parks
- Biogas from digesters powers and heats STPs
- Emerging: biochar from pyrolysis; sale of FS compost

Sources: NFSSM Alliance; DPCC report to NGT (2025)

From Sludge to Sustainability: India's FSTP Journey

Plants have multiplied since the 2017 policy; keeping them supplied is the next test

FSTPs operating



First FSTP: Devanahalli, Karnataka, after the 2017 National FSSM Policy

Standalone FSTP

A dedicated plant where tankers unload and sludge is separated, dried and treated. Common in towns without sewers.

Co-treatment at STP

Septage is dewatered and the liquid goes to an existing sewage plant with spare capacity.

How an FSTP works

1 Receive
Tankers unload into a receiving chamber

2 Separate
Solids and liquid are split and screened

3 Dry and treat
Solids dry on beds; liquid is treated

4 Reuse
Dried sludge is co-composted or safely disposed

18 of 55

Uttar Pradesh plants run at about 20% of capacity, largely because private trucks dump sludge instead of delivering it. Plants need licensed trucks, scheduled desludging and monitoring.

Sources: NITI Aayog NFSSM Alliance; Down To Earth and CSE (UP studies); SBM-U dashboard via PIB, Sept 2026. Counts use different definitions.

Occupational Risks for Sanitation Workers

Evidence from the Reckitt–ASCI partnership

907+
sanitation-work deaths reported, 2013–2025 (SM-AID)

11.4 years
shorter life expectancy than other professions

1.03%
of GDP lost, per the Reckitt–IIPS study

Accidents in sewer and desludging work

Unsafe handling: workers handle faecal sludge in extremely unsafe ways, with inadequate safety equipment and training.

DELHI · 21 FEBRUARY 2025
Sewer line: two workers died and one survived after entering a sewer.

DELHI · 16 MARCH 2025
Sewer line: one worker died and two survived; a private contractor did the work and compensation remains unresolved.

Root causes

- No air-quality check or gas detection
- No PPE
- No trained supervisor
- No emergency plan
- Improvised rescues put more workers at risk

ASCI groups these as system, operational, tool, human and information failures.

Stigma: their work is among the most hazardous and least paid.

Sources: SM-AID (ASCI); Reckitt–IIPS study

Measures for Prevention and Avoidance

PPE, training, health monitoring and safety regulation

Protective equipment

- Breathing apparatus or gas mask, gloves, boots, helmet, harness
- Gas detector checked before anyone enters
- Machines preferred over manual entry

In India: NAMASTE supplies PPE kits to profiled workers

Information and training

- Safe entry: permit, supervisor, standby person, rescue plan
- Hazard briefings in the worker's own language
- Emergency drills so no one improvises a rescue

In India: MoHUA cleaning SOP and NAMASTE safety training

Health monitoring

- Regular check-ups for sewer and septic tank workers
- Vaccinations such as hepatitis B and tetanus
- Early treatment for infection, skin and breathing problems

In India: NAMASTE links workers to Ayushman Bharat PM-JAY

Safety regulation

- Hazardous manual cleaning of sewers and septic tanks is prohibited
- Employers must provide protective gear and safety devices
- ₹30 lakh compensation for sewer deaths

In India: MS Act 2013 and Supreme Court ruling, 2023

Goal: no worker enters a sewer or tank without gear, training and a rescue plan.

Sources: Manual Scavengers Act 2013; MoHUA cleaning SOP (2018); NAMASTE scheme; Supreme Court of India (2023)

Obstacles to Safe and Scheduled Desludging

What makes emptying unsafe today, and what stops scheduled desludging from scaling

Barriers to safe desludging

Technical

Non-standard containment

Unlined or poorly sealed tanks without access covers leak, overfill or cannot be emptied fully.

Physical

Access constraints

Narrow lanes stop large trucks reaching tanks, pushing households to manual emptying.

Social and health

Worker safety and stigma

Toxic gas, infection and injury, often without protective gear; low pay and social stigma.

Market

Unregulated service market

Unstandardised prices; many operators lack licences, records or vehicle norms.

Environmental

Illegal dumping

Where treatment is distant or underused, sludge goes into drains, water bodies and open land.

Institutional

Institutional gaps

Responsibility is spread across agencies; ULBs lack staff to run desludging as a service.

Barriers to scaling

No containment data
No register of tanks, location, type or last emptying, so a cycle cannot be planned.

Low household demand
Households wait for overflow and resist paying for a service they do not feel is due.

Financing and cost recovery
Truck, routing and notice costs are hard to recover; sanitation charges are rarely set.

Weak ULB capacity
Few towns have an FSSM cell, trained staff or enough vehicles.

Core problem: desludging is treated as an ad-hoc private task, not a regulated, funded municipal service.

Sources: National FSSM Policy (2017); PEMSR Act (2013); SBM-U 2.0 guidelines; state FSSM policies and city experience

Recommendations for Scaling Scheduled Desludging (1/2)

Plan, fund and contract desludging as a scheduled municipal service

01 **Build a containment register**
Lead: ULB

- Record every tank and pit (type, size, access, last emptied) against its property-tax ID
- Update it at tax assessment, building approval and every desludging visit
- Require IS 2470 tanks with an access cover in new building approvals

02 **Fund it through a sanitation charge**
Lead: ULB, State UDD

- Annual charge with property tax or water bill pays for emptying every 2–3 years
- Paid on-demand service as backup, at a notified tariff band
- Exempt or subsidise vulnerable households from the same pool

03 **Contract operators for performance**
Lead: ULB, State FSSM cell

- Zone-wise contracts: paid per tank emptied and per load delivered to the FSTP
- ULB sets schedule, tariff and standards; operator brings vehicles and crew
- Small towns pool contracts through a district or state FSSM cell

04 **Make dumping uneconomic**
Lead: ULB, SPCB

- Pay only on proof of treatment: GPS track plus FSTP gate entry for every load
- Low receiving fees; transfer stations where treatment plants are far away
- Escalating penalties up to licence cancellation; act on citizen reports

Scheduled desludging works only when **data, finance, operators and treatment** start together.

Recommendations for Scaling Scheduled Desludging (2/2)

Reach every tank, protect every worker, and measure every litre

05 **Reach the last mile**
Lead: ULB

- Mini-tankers and portable pumps for narrow lanes, relaying to a larger tanker
- Retrofit drive (access covers, outlet repairs, lining) with the first desludging round
- Use SBM-U 2.0 funds for retrofits in poor households

06 **Make safety non-negotiable**
Lead: ULB, MoSJE

- No licence or contract without mechanised equipment, PPE and gas detectors
- Only NAMASTE-trained crews; zero tank entry, audited on every trip
- Register crews as sanitation workers with health cover through PM-JAY

07 **State cell, city delivery**
Lead: State UDD, MoHUA

- State FSSM cell: standard bid documents, tariff guidance, one digital platform (NUDM)
- An FSSM nodal officer and a simple service-level plan in every ULB
- Tie SBM-U 2.0 / AMRUT 2.0 incentives to coverage and plant use, not plants built

08 **Measure and publish**
Lead: State UDD, ULB

- Public dashboard per ULB: share of properties desludged within the cycle
- KL collected vs KL received at the plant: the gap is the dumping estimate
- FSTP capacity use, cost per KL and worker incidents

Year 1 · Pilot 2–3 Telangana towns with FSTPs → **Years 2–3 · State roll-out** All ULBs with FSTPs → **Years 4–5 · Scale** Small towns, transfer stations

Thank you

Safe sanitation is achieved only when every litre and every worker can be accounted for across the full value chain.

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