LIQUID WASTE MANAGEMENT IN RURAL AREAS

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Aim

This Directed Research Project explores **Liquid waste management strategies and solutions for rural contexts.**

Objectives

To identify the existing Liquid waste management practices in rural areas.

To review various Liquid waste management case studies for rural context.

To Prepare a Liquid waste management plan for selected villages based upon site assessment.

To prepare a toolkit for GWM implementation for scaling up.

Research Methodology

Jan 10 – Jan 31, 2022 [3 weeks]

Research Methodology setup

To review
- Case studies,
- Various GWM technologies
- Policies,
- Guidelines,
- Strategy documents,
- Assessment frameworks

across the different Household-level, community levels, village levels, state level, and National level.

And documenting the literature reviews that support the Liquid waste management research.

Feb 1 – Feb 28, 2022 [4 weeks]

Field Assessment

Understanding challenges and problems via
- Field surveys,
- Community opinion surveys,

And building a counter solution strategy over practical challenges.

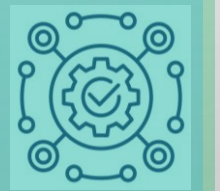
Exploring the assessment of the parameters that influence Liquid waste management practices.

March 1 – April 5, 2022 [5 weeks]

Solution Framework Documentation

Preparation of toolkit based upon Liquid waste value chain.
Based upon
- Technology selection
- Operation
- Business Model
- Financing & Monitoring

Strategizing an adequate framework with which the least skilled communities could adapt to the developments.



April 6 – May 3, 2022 [4 weeks]

Report Preparation

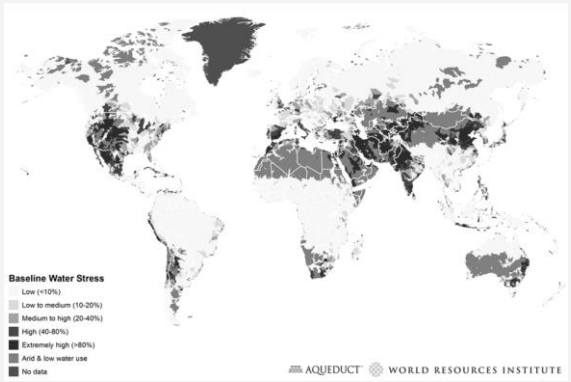
To prepare a detailed research conclusion report based on all risk assessments, challenges, and counter solutions for the most vulnerable areas i.e. rural regions.

The handbook that delivers Grameen solutions.
Liquid waste management guideline for SBM 2.0 (G)

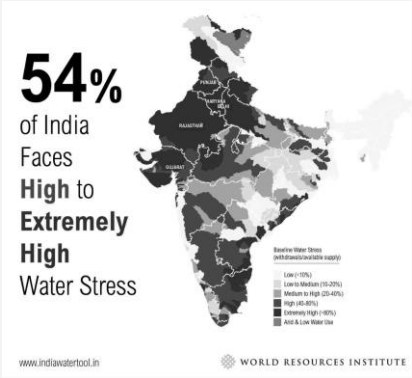
Table of Content

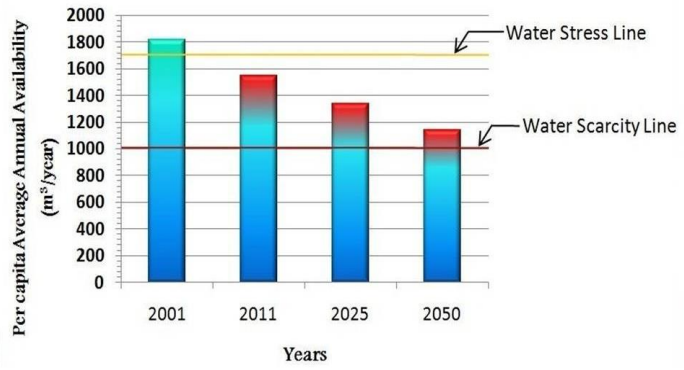
Introduction to Scope & Background

Liquid Waste Reuse Can Help Reduce Water Scarcity



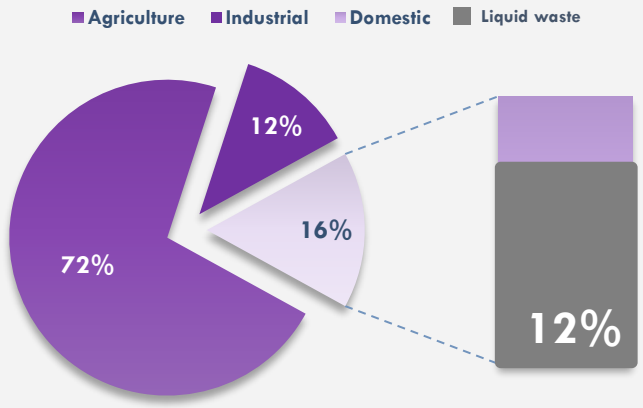
India world's 13th most water-stressed country and may face water stress above 50% by 2040: WRI 2021





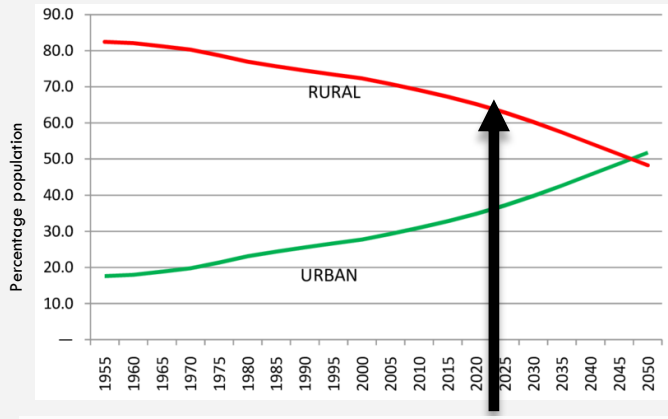
- Per Capita Water availability in India has fallen below **1300m^3/year**

Global Daily Water Consumption = 10,000B Liters



TARGET 6·3

- Globally, **44%** of Household wastewater is not safely treated.
- Globally, **1,120 Billion liters** of Liquid waste goes unused daily
- Only **2%** is Liquid waste is reused globally
- In India, **73%** of Wastewater is unsafely disposed of.
- **70%** of surface water in India is contaminated;
- India ranks **120**/**122** contrived in the water quality index.

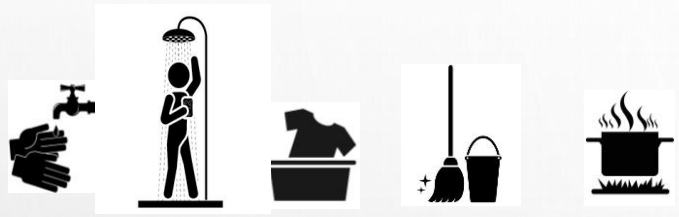


India's population trend highlights, **65%** population lives in rural areas. And are vulnerable to extreme water scarcity.

Source: www.wri.org | Average Daily Water Usage (theworldcounts.com) | (UN-Water 2021) | Population Trends of Urban India

Liquid Waste Characteristics in Rural India

Ministry of Drinking Water & Sanitation defines grey water as **"wastewater not contaminated with fecal or urinal matter."**



The rural context of Liquid waste also contains:

- **Animal/cattle wastes like goat pebbles, cow dung/urine**
- **Pesticides & Chemicals**
- **Leaked/ inadequate conveyance/containment system (poor FSSM) exposes it to black water.**

Elemental Characteristics of Liquid waste in Rural Context

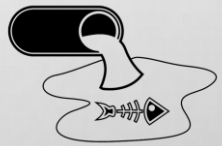
Elements	Unit	Kitchen Sink	Laundry	Wash Basin	Bathing	Cattle/Farm	Mixed
BOD5	mg/L	998	260	252	215	304	603
COD	mg/L	1038	1590	424	366	807	1045
Alkanity (pH)		7.1	8.55	8.1	7.4	8.5	7.93
Turbidity	NTU	298	247	102	209	304	232
TSS	mg/L	717	266	181	256	164	216
Chlorine	mg/L	43	9	5	5.4	60	90.5

Vulnerabilities with direct use of Liquid waste

High alkalinity

Spreads Pathogens

High metal absorption over edible crops if irrigated without treatment

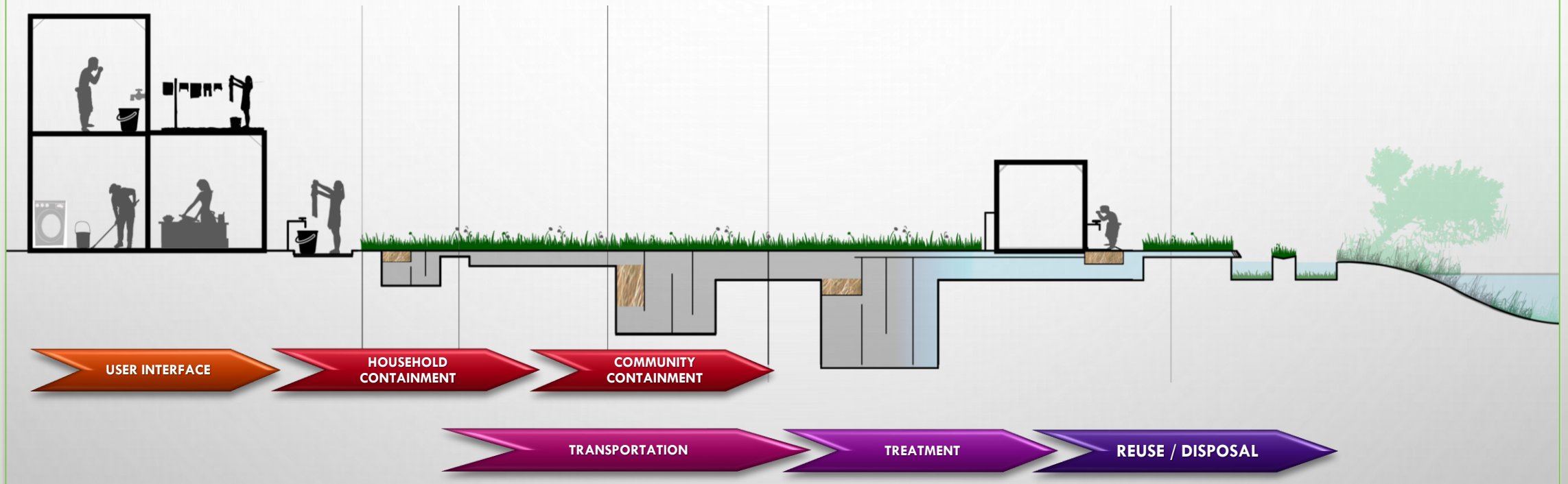


Depletion of Aquatic & biotic life

Source: Pravin D. Patil et al.; | SS Rakesh et al. https://doi.org/10.22271/chemi.2020.v8.i1a.8316 | 8-1-66-149.pdf (chemijournal.com)

DEFINING THE SECTOR: LIQUID WASTE SERVICE CHAIN

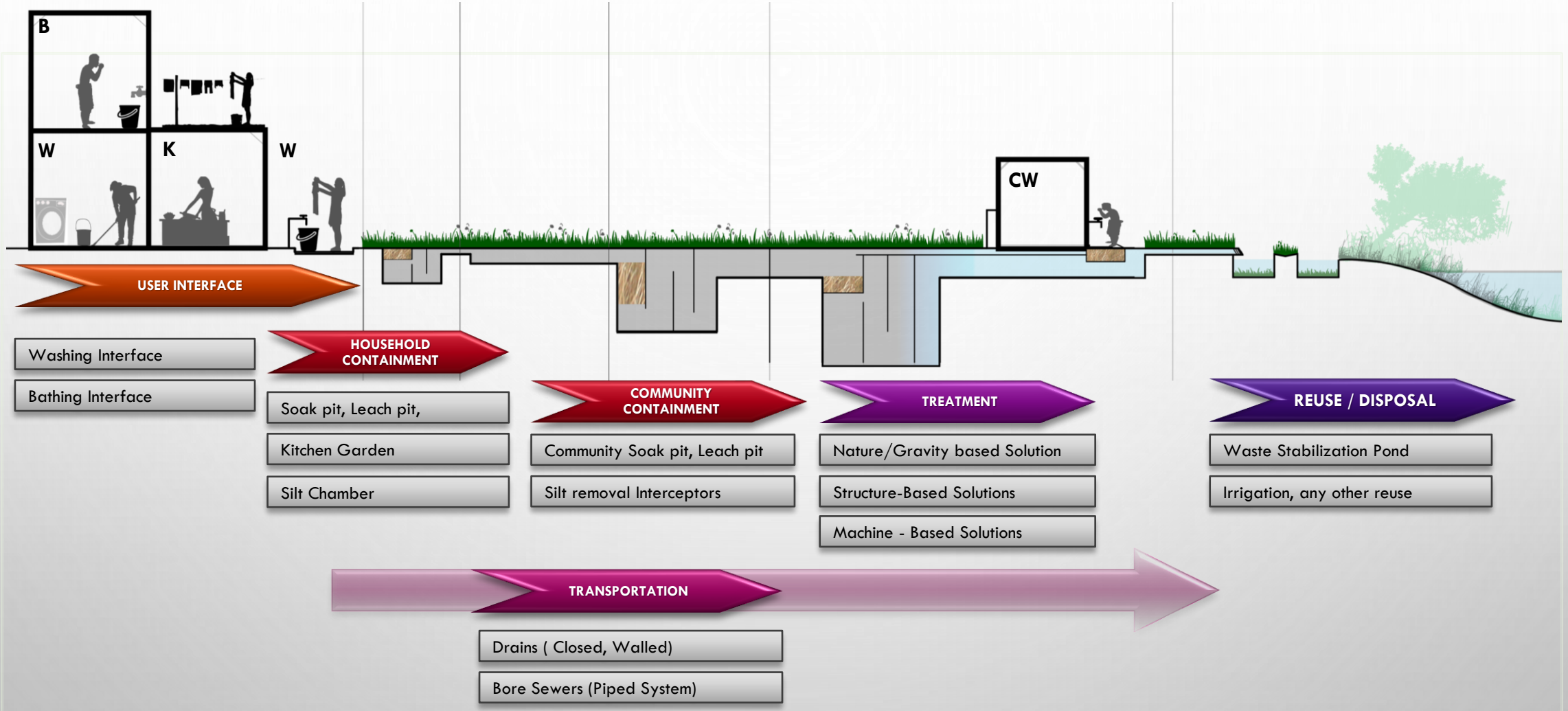
The Liquid waste service chain can define the assessment of Liquid waste management in any settlement. It has five components into a journey cycle, from generation (consumption) to safe disposal (treatment / Reuse). Its sequence follows as mentioned below:



The evolution of these components can be catered with technology, nature-based solutions, or adaptation of both together.

Source: Concept Adapted from SFD manual- Susana.org | Graphics redefined for LWSC by Pushpak Sahu

SBM-G 2.0 Suggestions across the service chain



Source: Concept Adapted from SFD manual- Susana.org | Graphics redefined for LWSC by Pushpak Sahu |

Liquid waste Norms

There is a handbook of the Government of India for Liquid waste management,
But no such mandatory policies are yet explored for rural India.

Exploration of Liquid waste management in India is still grey by 2022.

There are guidelines for discharge standards by CPCB, as mentioned in the table.
CPHEEO, CGWB, Ministry of Environment, Forest & Climate change has also issued water reuse policies with discharge standards.
National Green Tribunal is also preparing guidelines for Liquid waste management.

Treated Used water discharge standards as per CPCB norms

S. No.	Parameter	Required Standards
1	pH	6.5-8.5
2	BOD(5th day)	<10mg/l
3	COD	<50mg/l
4	Suspended Solids	<10mg/l
5	Ammonical Nitrogen	<5mg/l
6	Total Nitrogen	<5mg/l
7	Fecal Coliform	<100 MPN/100 ml

American Liquid waste Discharge Norms

Sno.	Parameter	Standards
1	pH	6.5-8.0
2	BOD (5th Day)	<10 mg/l
3	COD	< 10mg/l
4	Suspended Solids	< 10 mg/l
5	Ammoniacal Nitrogen	< 5 mg/l
6	Total Nitrogen	< 5 mg/l
7	Fecal Coliform	< 70 MPN /100ML

Japan Liquid waste Discharge Norms

Sno.	Parameter	Standards
1	pH	5.8-8.6
2	BOD (5th Day)	< 5 mg/l
3	COD	< 5mg/l
4	Suspended Solids	< 10 mg/l
5	Ammoniacal Nitrogen	< 3 mg/l
6	Total Nitrogen	< 3 mg/l
7	Fecal Coliform	< 45 MPN /100ML

Source: Handbook of the Government of India for Liquid waste management by MoDWS | CBCP | American Oregon Liquid waste Guidelines | Water Pollution Control Law: Effluent Pollution Control and Standards (Japan) (wepa-db.net)

Liquid waste Management Policy Practicing States

Punjab: 10396 villages to revive ponds;
Ex-situ Treatment Technologies for Grey Water Management Guidelines

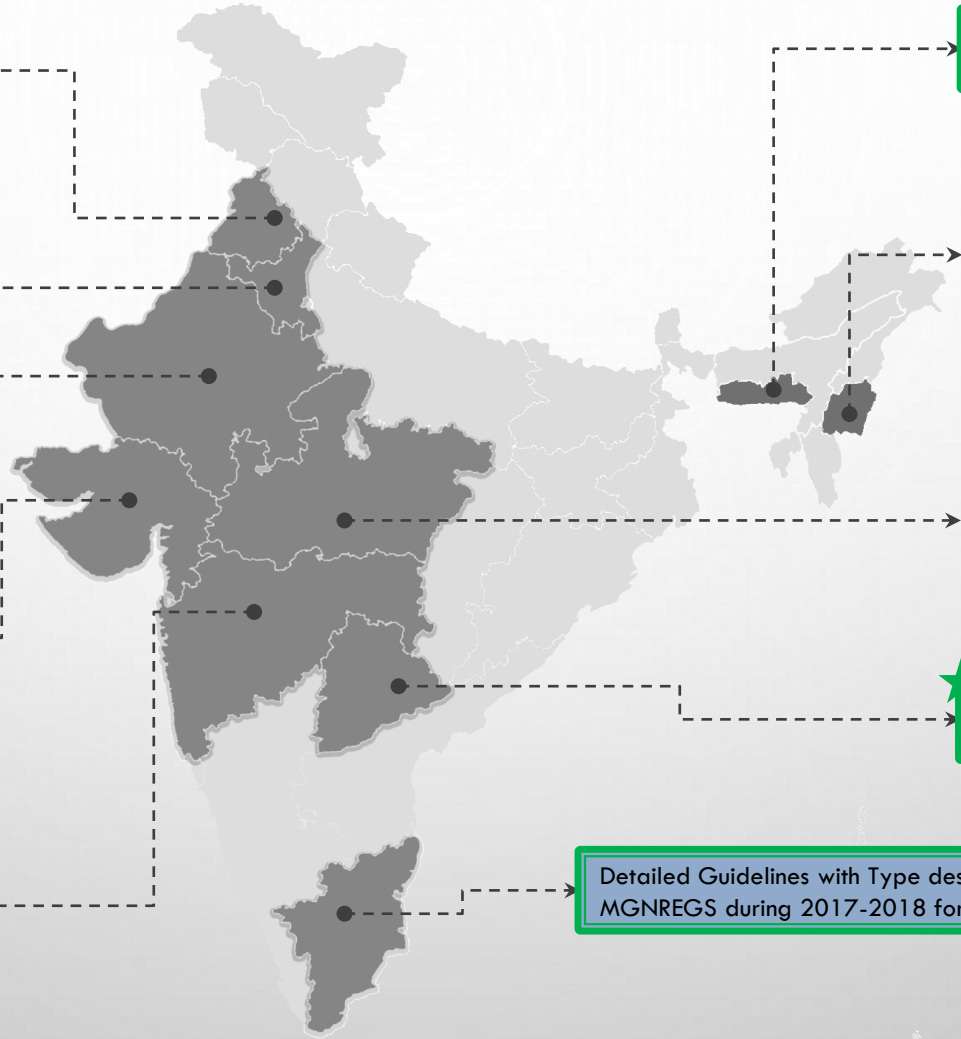
The Haryana Pond and Wastewater Management Authority Act, 2018.

RAJASTHAN STATE SEWERAGE & WASTEWATER POLICY- 2016

Govt. of Gujarat policy for reuse of treated wastewater (May 2018)
Dual plumbing system & recycling of Liquid waste in homes, guidelines Gujarat

Need of Rural Focused actions distinctly

Maharashtra Water Reuse Policy and Wastewater Reuse Certificates Platform Regulations 2019



Meghalaya,
Rural Liquid waste Management Guidelines

The concept of wastewater reuse is acknowledged in the state water policy, Committee for JJM, and concern for GWM were formulated in 2020.

Govt. of Madhya Pradesh State Level Policy (2017)
for Wastewater Recycle & Reuse and Fecal Sludge Management (FSM)

"Magic Pits" of Telangana.
Approved GWM guidelines.

Detailed Guidelines with Type designs were issued by the Government of Tamil Nadu MGNREGS during 2017-2018 for Liquid waste Management for Rural Areas

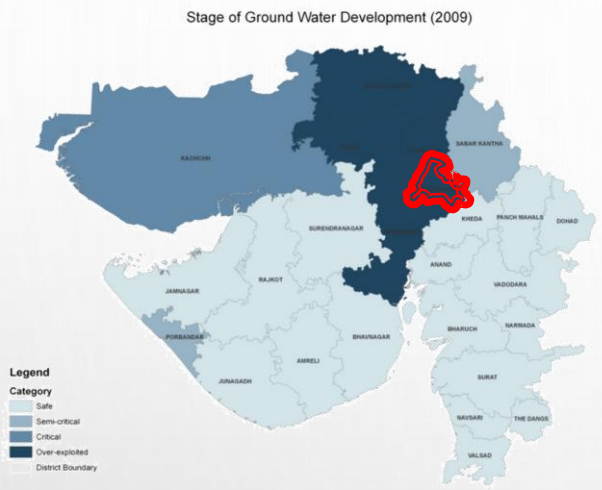
Legend
- *Taking Active Actions for Rural*
- *Have Policy advisory for Rural*
- *Have Policy for Urban Only*

Source: (mwrra.org) | SBM Website | Rajasthan Govt. Website | MP Gov. Website | Haryana Govt. Website

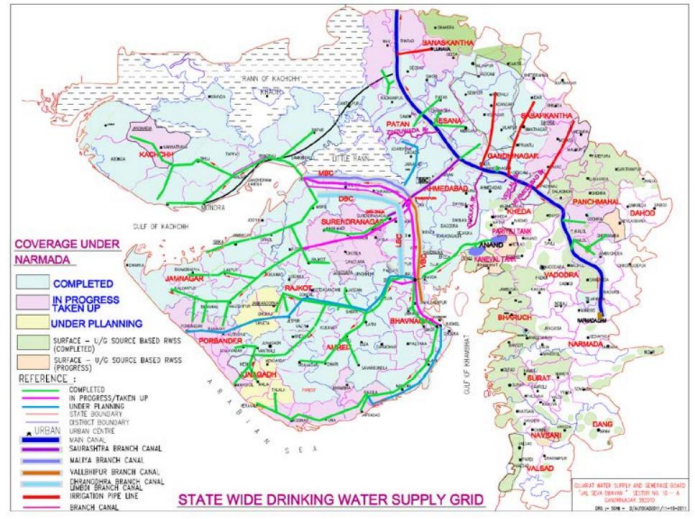
Need of different approach for Rural than Urban for LWM

Elements	Scalability	Decentralization	Economy	Management
Urban	**Scalability is dominantly restricted towards centralized management.** *Building/community scale plumbing systems can not be scaled up for all localities, it' not a fundamental practice for Retrofitting Urban India*	**Huge investment needs in pivoting towards decentralized approaches.** *Urban Settlements are dense and have lack space, management or Decentralized approaches do not achieve even 10% of the urban coverage and collection*	**Limited economic resources for ever-growing challenges.** *Due to the Lack of decentralization, centralized systems have various barriers, it's a great challenge to manage a huge quantity of wastewater within discharge standard qualities with limited economic opportunities.*	**Centralized systems have high O&M costs.** *There is always an inadequate output efficiency. Urban technology solutions need high skilled workforce system and ever innovating technology and management to cater to the problems due to huge quantity.*
Rural	**Villages replicate learnings and developments easily.** *Villages have a controllable quantity of waste generation that can be easily managed into quantum and can match the growth pace for its scalability.* *100 villages do not have 100 problems, they have countable similar problems that can be solved in a unified manner.*	**Building new infrastructure at decentralized habitations is to be taken in action.** *Villages have available open lands that can be adapted with adequate solutions to bring climate resilience and sustainability*	**Huge money is being pumped for rural infrastructure developments.** *Capital investments into adequate fundamentals would provide enhanced urban facilities to rural areas via more space for sustainability and resilience*	**Clusters perform better than cities in quality output and reuse efficiency.** *Small-scale solutions can be easily adapted and managed in villages with fewer workforce requirements.*

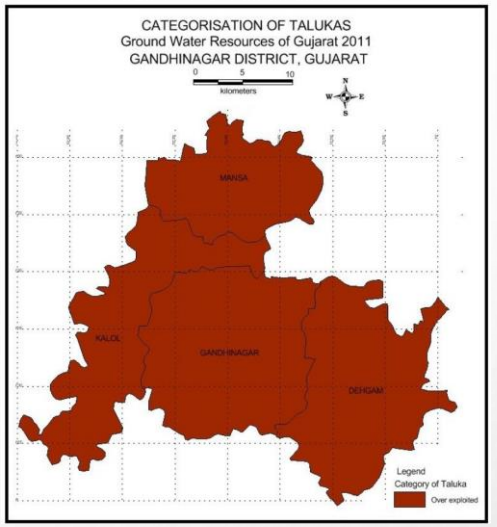
Gandhinagar District

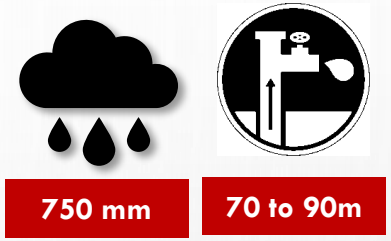


Groundwater status of Gujarat districts in 2009



Water Supply- Narmada Canal Grid





Gandhinagar has extremely high water stress due to lack of sufficient rainfall and exploited groundwater extraction.

The Gandhinagar district is the second smallest district of Gujarat still has the most exploited groundwater condition. Being the Administrative capital of Gujarat, it has the most upcoming growth potential in the due influence of Ahmedabad and Mehsana, and studies regarding Liquid waste management are not yet explored here.

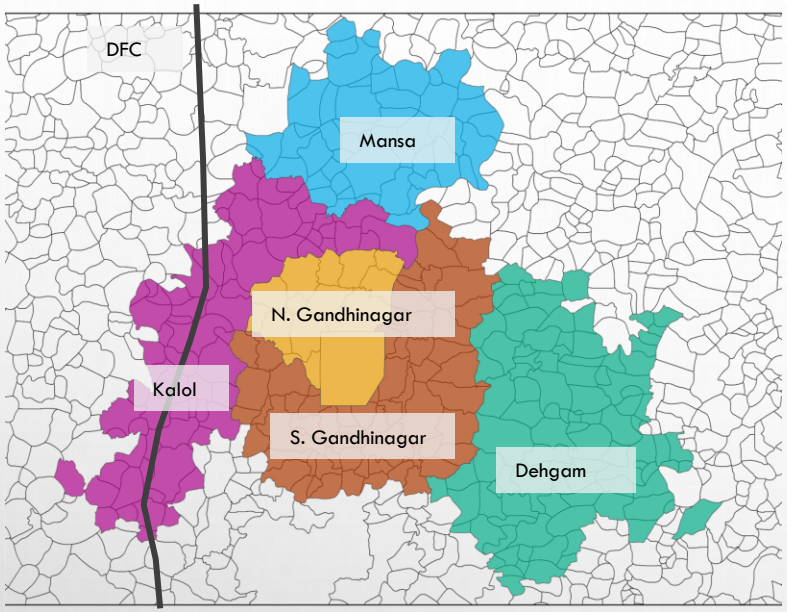
Among most exploited GW districts, Gandhinagar gets its water supplies before Mehsana, Palan, Banas-Kantha from the Narmada canal grid, Adequate liquid waste management in Gandhinagar villages would spread higher awareness and willingness for wastewater reuse and conservation.

(in ha m)

Sr. No.	Assessment Unit/ Taluka	Net Annual Ground Water Avail-ability	Existing Gross Ground Water Draft for irrigation	Existing Gross Ground Water Draft for All uses (4+5)	Allocation for domestic and industrial require-ment supply upto next 25 years	Net Ground Water Availability for future irrigation developme nt (3-4-7)	Stage of Ground Water Development {(6/3)*100} (%)	Categorization for future ground water develop-ment
1	2	3	4	6	7	8	9	
1	**Dahegam**	13408.31	13043.50	13800.50	1015.00	0	102.93	Over Exploited
2	**Gandhinagar**	12165.73	13250.80	14077.80	1159.00	0	115.72	Over Exploited
3	**Kalol**	10873.29	12424.00	13363.00	1258.00	0	122.90	Over Exploited
4	**Mansa**	8852.73	12553.70	13142.70	825.00	0	148.46	Over Exploited
	TOTAL	**45300.05**	**51272.00**	**54384.00**	**4257.00**	**0**	**120.05**	**Over Exploited**

Source: water.pdf (gujenvis.nic.in) | CGWB report Gandhi nagar (cgwb.gov.in)

Gandhinagar Sampling



Out of 5 sub-districts of Gandhinagar,
The sampling methodology was adapted based upon the following Categorizations:

Categories (Population)	Number of Villages	Population	Number of samples	Kalol	S. GandhiNagar
0-1000	44	29539	0	0	0
1001-2500	85	104562	3	1	2
2501-5000	77	194959	8	5	3
5001-10000	42	75328	9	4	5
10000<	4	47266	0	0	0
TOTAL	252	451654	20	10	10

Area	2,163 Km2
Number of Sub-districts:	4
Number of Villages:	252
Total Rural Population:	791126
Total Rural Household:	161994

Urban	57% Rural Population

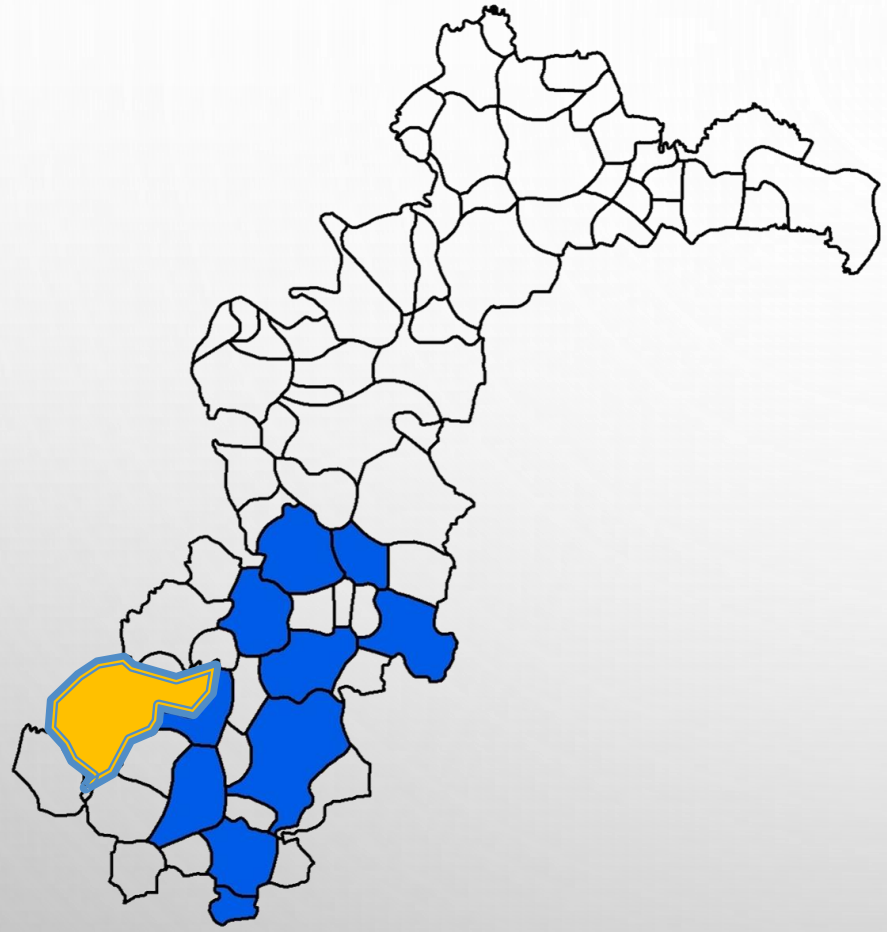
Sub-districts of Gandhinagar

Source: https://forests.gujarat.gov.in/gis-eng.htm | Census Hand book 2011

Two Sub-districts were chosen for sample surveying.

- **Kalol** **(10/73 Villages)**
  - Kalol subdistrict is directly catering for the National Dedicated freight corridor and its agglomerations towards industrial settlements.
- **South Gandhinagar** **(10/65 Villages)**
  - The south Gandhinagar region is sandwiched between Gandhinagar and Ahmedabad, facing intense pressure of aggressive urbanization. But lack of infrastructures is hindering the growth of these regions.

Survey Samplings – Kalol Sub-district



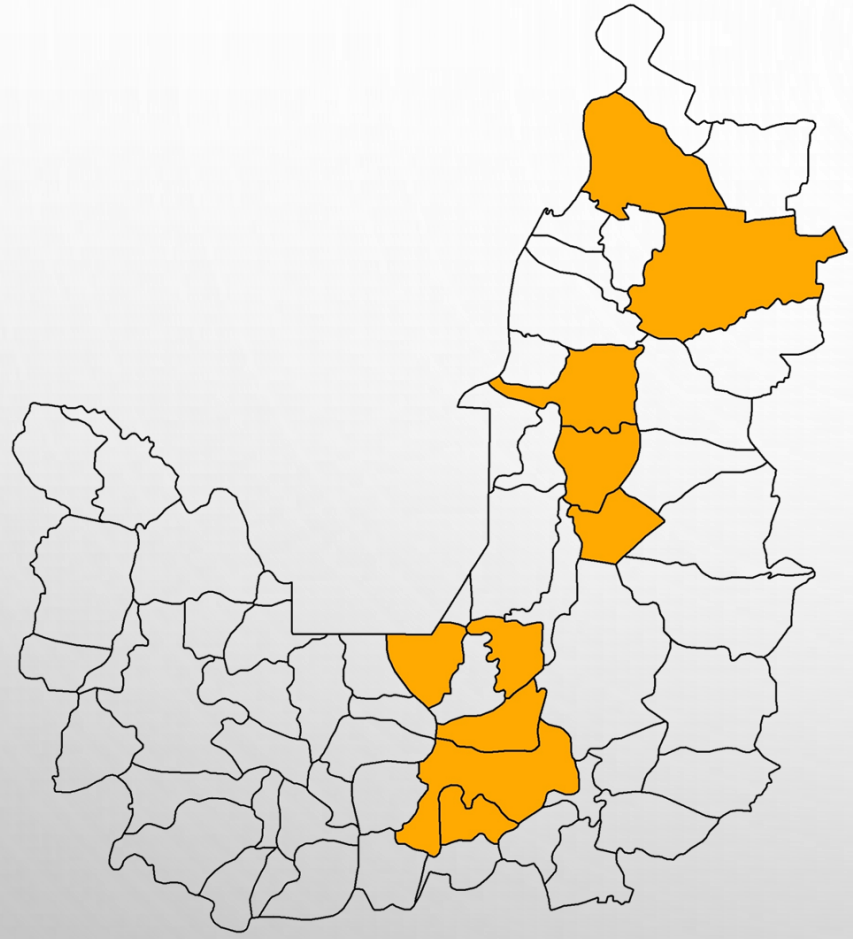
Kalol Sub District Sampling 1						
Sno.	Selected Village	Population Census 2011	Household	Water Supply	Sewer Drains	LWM
1	Vadsar	9,506	1,590	62.17 LPCD	80-95%	N.A
2	Sherisa	6,785	1,420	61.91 LPCD	85-95%	N.A
3	Bhoyan Moti	6,602	1,653	63.62 LPCD	85-90%	N.A
4	Palsana	4,599	1,241	62.42 LPCD	80-85%	N.A
5	Jaspur	3,557	1,043	61.01 LPCD	75-90%	N.A

Kalol Sub District Sampling 2						
Sno.	Selected Village	Population Census 2011	Household	Water Supply	Sewer Drains	LWM
1	Santej	7493	1683	63.45 LPCD	85-95%	N.A
2	Rancharda	4318	940	61.6 LPCD	55-60%	N.A
3	Nasmed	3824	1170	54.33 LPCD	60-70%	N.A
4	Jethalaj	3669	885	63.61 LPCD	50-60%	N.A
5	Palodia	1498	584	62.7 LPCD	60-80%	N.A

One sample survey of village Thol, Mehsana was also conducted for trend identification

Source: https://forests.gujarat.gov.in/gis-eng.htm | Census Hand book 2011 | JJM Portal | Primary Survey Data | Telephonic Conversations with the Village Sarpanch

Survey Samplings – South Gandhinagar Sub-district



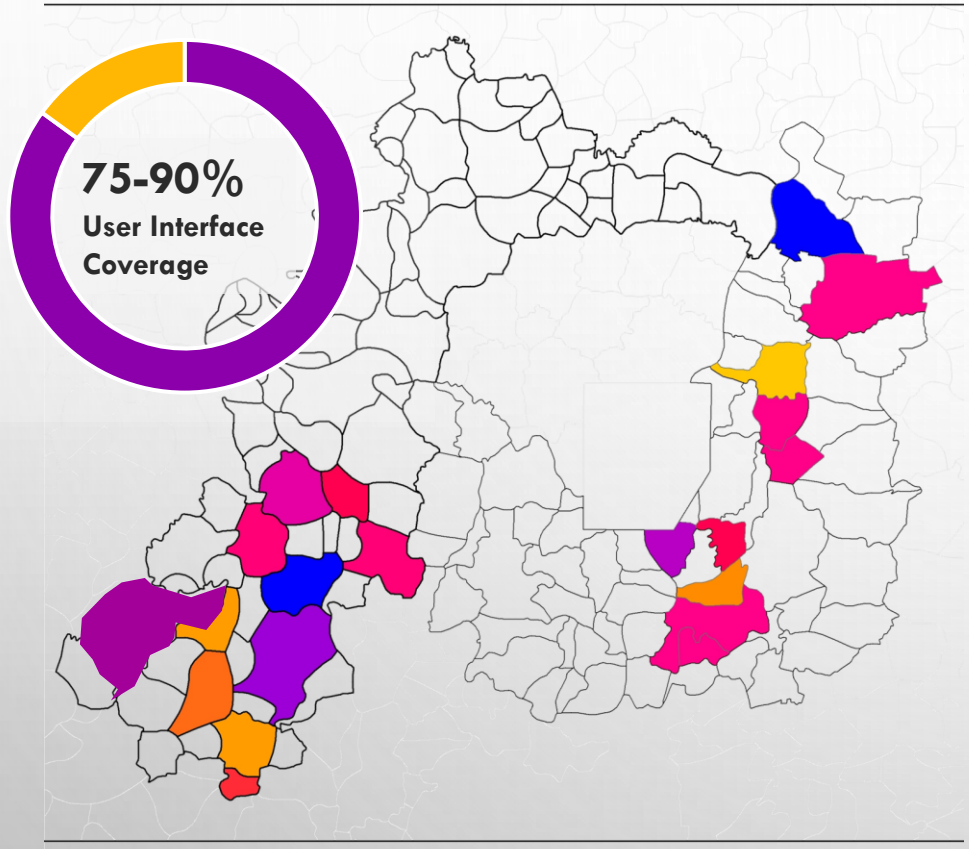
South Gandhi Nagar Sub District Sampling - 1						
Sno.	Selected Village	Population Census 2011	Household	Water Supply	Sewer Drains	LWM
1	Chhala	9,691	1,762	56.03 LPCD	75-95%	N.A.
2	Chiloda Mota	8,092	1,590	56.85 LPCD	80-95%	N.A.
3	Sadra	5989	1,205	56.15 LPCD	60-85%	N.A.
4	Shiholi Moti	5953	2,022	65.51 LPCD	60-95%	N.A.
5	Dashela	4111	1,088	58.38 LPCD	60-80%	N.A.

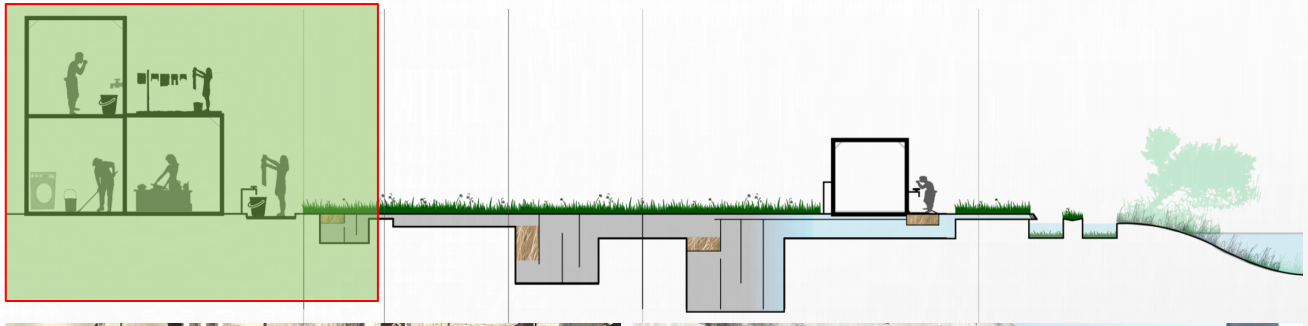
South Gandhi Nagar Sub District Sampling - 2						
Sno.	Selected Village	Population Census 2011	Household	Water Supply	Sewer Drains	LWM
1	Valad	9399	2,478	57.29 LPCD	80-95%	N.A.
2	Lavarpur	3584	573	56.03 LPCD	85-95%	N.A.
3	Shahpur	3525	1,191	65.44 LPCD	40-65%	N.A.
4	Pirojpur	2041	745	64.58 LPCD	40-60%	N.A.
5	Limbadiya	1467	752	58.09 LPCD	75-95%	N.A.

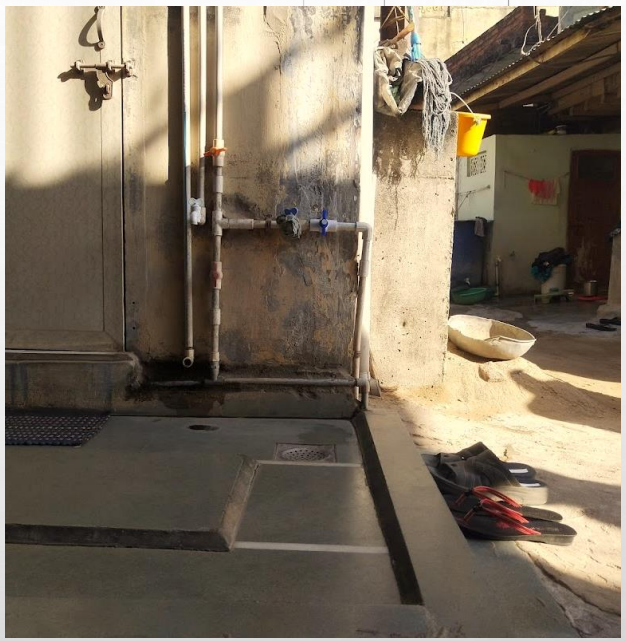
Source: https://forests.gujarat.gov.in/gis-eng.htm | Census Handbook 2011 | JJM Portal | Primary Survey Data | Telephonic Conversations with the Village Sarpanch

Existing Situation Documentation

Villages and their User interface coverage







Toilet / Washroom Coverage needs to be explored into various villages.
But the primary survey found Gandhinagar villages have about 75-90% of user interface coverages i.e. upgraded sanitation practices at the household level.

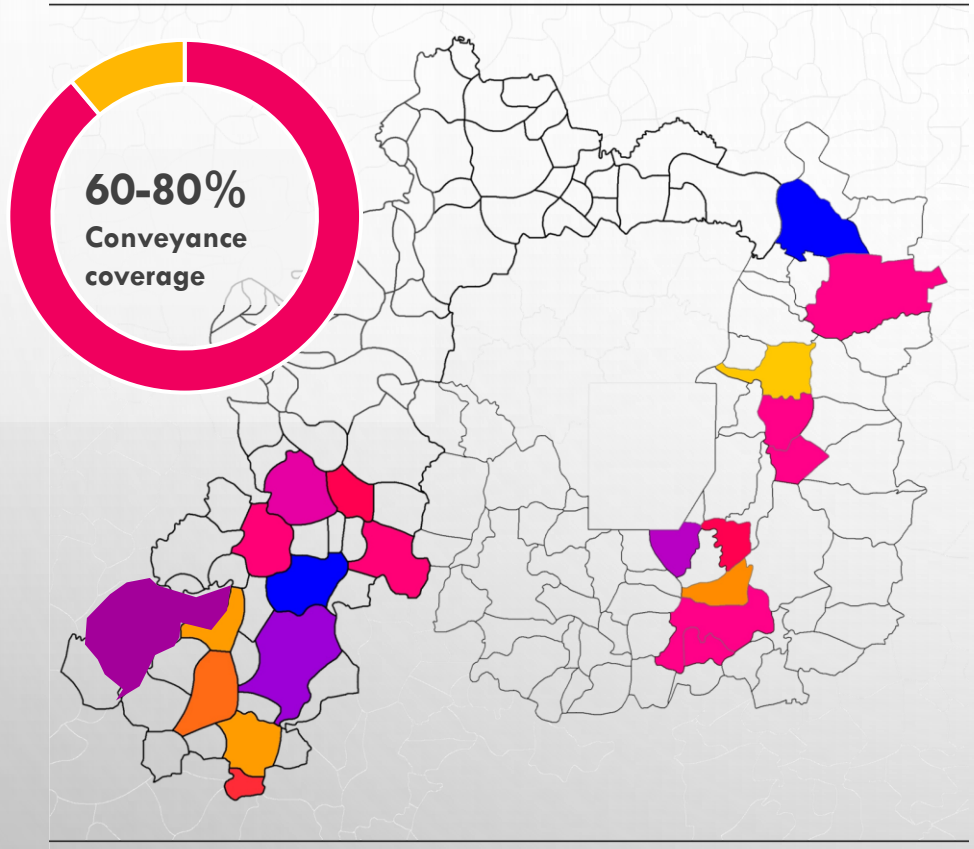
Source: Primary Survey

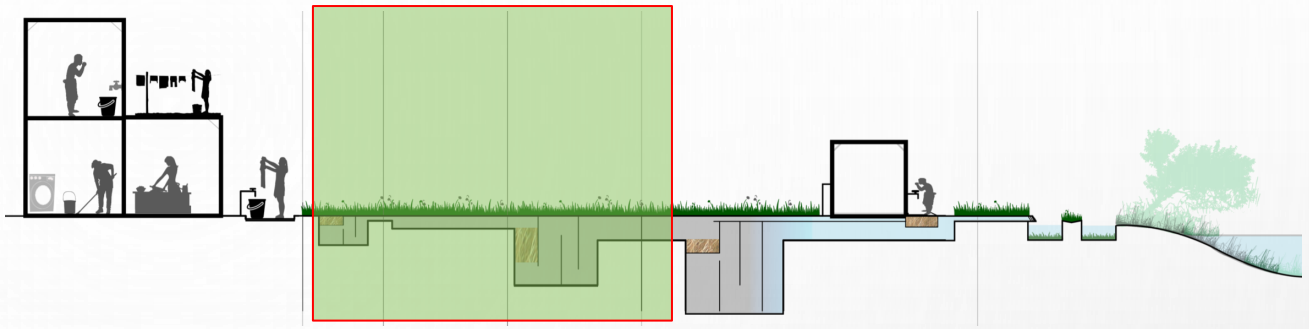
Community water tank

User interfaces can be improved for efficient water usage and liquid waste management

The remaining 15-25% of coverage is from the liquid waste that litters from the user interface at community taps, public wash, and common Household wash areas that need to be addressed.

Villages have Conveyance Network





Villages need to set up regular maintenance and realignment of their conveyance network, but many villages still lack full coverage of sewers.

Source: Primary Survey | Swachh Bharat Mission(G)- MIS (sbm.gov.in)

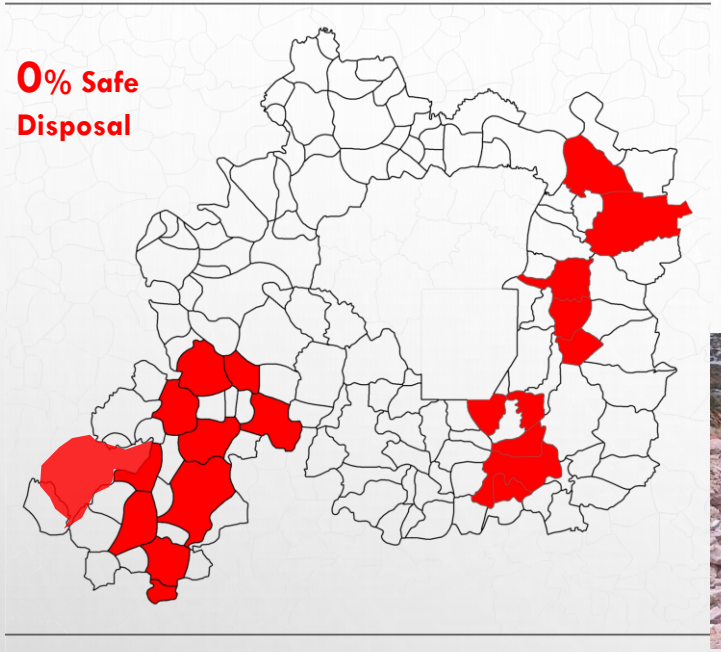
Desludging chambers are misaligned.

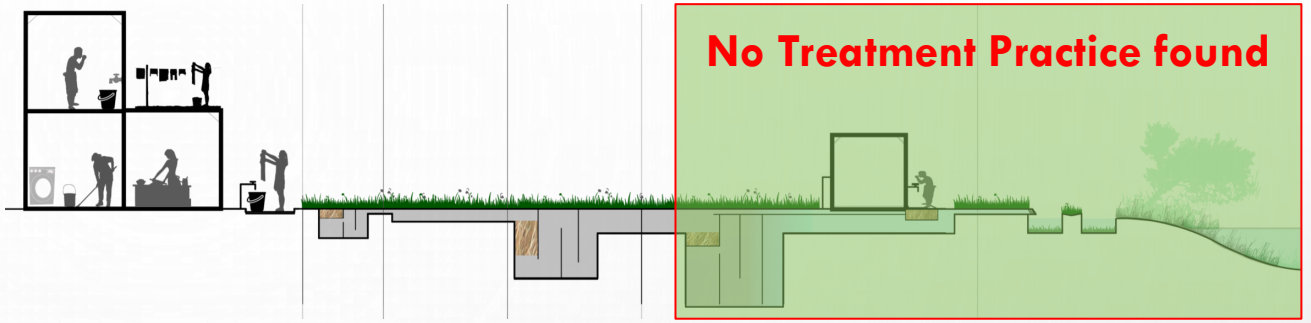
Maintenance and realignment of sewer pipes can increase the efficiency of the coverage..

Spillover can be prevented by regular timed maintenance.

Villages need to refurbish their existing network; basic realignment activities can improve their collection network.
The collection chambers can be enhanced via interceptor chambers to perform during peak hours.

Villages that require ex-situ Treatment solutions





No pond was found safe for potable purposes during surveys.

Source: Primary Survey

The wastewater disposal ponds have been impacted to extreme solid waste disposal.

Eutrophicated ponds can never heal themselves, it needs manual abatement for its revival.

Water bodies and local rain catchments are waste disposal sites in the villages also many ponds are getting eutrophicated due to silt decomposition.

Summary of key issues identified for Liquid Waste Management

SBM-G's outlook towards greywater management for Gandhinagar seems unique. Gandhinagar villages are more developed as compared to other states.

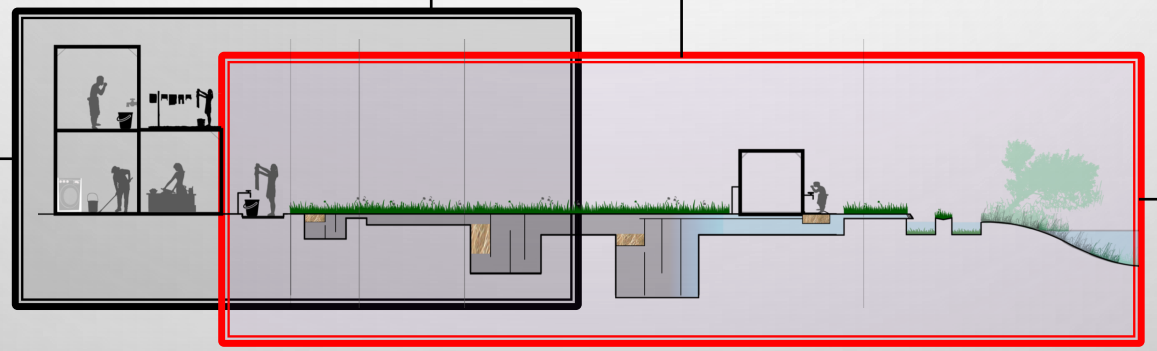
About **85%** coverage of user interface for WASH

On average **80%** Coverage of sewer drains already exists in the rural areas.

Villages with coverage systems of sewer drain need to explore their adequate treatment system for sustainable disposal and reuse to bring efficient water management and building water security.

Uncovered 15-25% area of villages needs adequate infrastructures for LWM

Untreated disposal practices are bringing extreme pollution that impacts groundwater.



Unsustainable disposal of used water as waste into water bodies causing water scarcity

Source: Primary Survey

Case Studies

User Interface Case Studies

The adequate infrastructure of water consumption interface could be categorized into various components for rural India as follows:

- Kitchen and dishwashing interface
- Bathroom and laundry interface
- Asset washing: House cleansing, car washing, or animal cleansing activities

Water supply tap as the source of Liquid waste generation, Increased water consumption with extreme water scarcity due to poor sanitation facilities.

Images from Telangana LWM

Providing an adequate User interface can make a difference in water consumption efficiency, management, women's privacy, and hygiene.

Source: : Primary Survey (Pushpak Sahu); Rancharda Feb 2021 | SLWM - Liquid waste Management Tamil Nadu PPT

Containment Case Studies

After users consume water,

Liquid waste should get collected with preliminary filtration screening.

It would contain the Liquid waste for further reuse and adequate management.

Containment of Liquid waste should ideally be free from contact with black water.

The spillover and open spreading of liquid pollution in the locality cause the breeding of germs, diseases, mosquitoes, flees, and unhygienic conditions.

Before and after representative photograph due to lack of User interface and Containment.

Meghalaya Rural Liquid waste Management

Biofilter for oil/ silt removal directed to soak pit or locality drain

Before and after representative photograph with an adequate containment chamber after the user interface

Image source: Primary Survey (Pushpak Sahu); Rancharda Feb 2021 |

Safe Transportation or Conveyance of Liquid waste- Case Studies

For proper reuse of Liquid waste, transporting the resource with efficiency is much of need as much of its treatment.

- Inadequate closed piped drainage systems,
- open-drain,
- or lack of systems in rural areas

Lead to mixing various kinds of wastewater (black and grey), contamination of water resources, and the spread of pathogens.

Representative image of common sewage transportation practices in rural India

Adequate sewage transportation practices in rural Chhattisgarh

Source: Primary Survey (Pushpak Sahu);

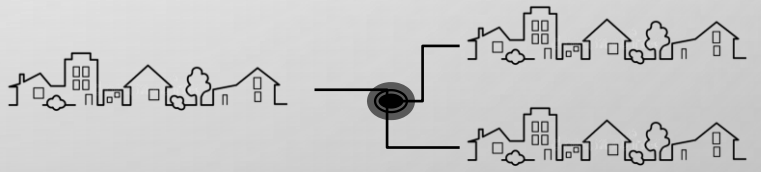
Case Studies for Treatment of Collected Liquid waste

Kolhapur

Household Chennai

Baran-Patiala

Treatment & reuse of Liquid waste should step with four sequential categories:

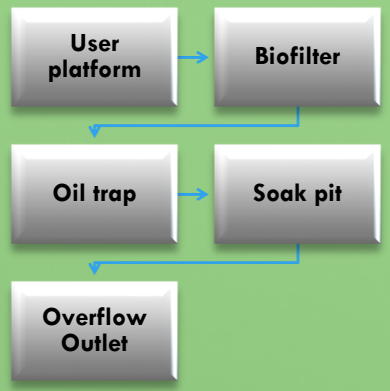
- Household Phase 
- Community Phase 
- Village Phase 
- Inter Village Cluster Network 

Source: SBM Garmin Punjab | SLWM/Kolhapur_Maharashtra_GWM_PPT.pdf | https://www.thebetterindia.com/135718/Liquid waste-recycling-home-guide-India

Liquid waste treatment Practices in Rural India

MEGHALAYA- EAST GARO HILLS

Project timeline: 2013-18
Methodology: Biofilter + Containment
Scale: Households

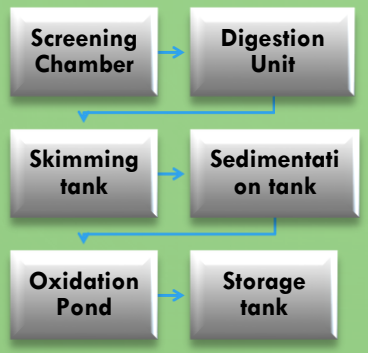


Key takeaway:

- Biofilter at the containment chamber played a crucial role.
- The improved soak pit is a test of behavior change for the people

PUNJAB - PATIALA

Project timeline: 2013-18
Methodology: Waste Stabilization Pond
Scale: Village of population 7000

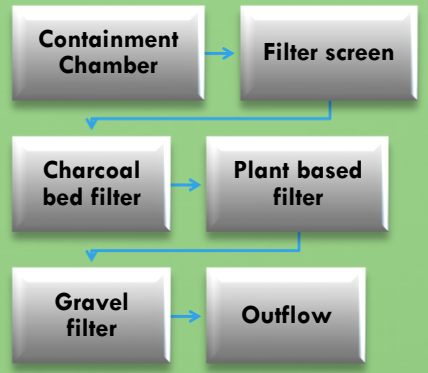


Key takeaway:

- Enables water stock and capacity building at the village scale.
- Good source of irrigation with rich nutrients BOD content.

TAMIL NADU- T.PUDUPATTI GP

Project timeline: 2016-17
Methodology: Community soak pit
Scale: Village of Population 2700

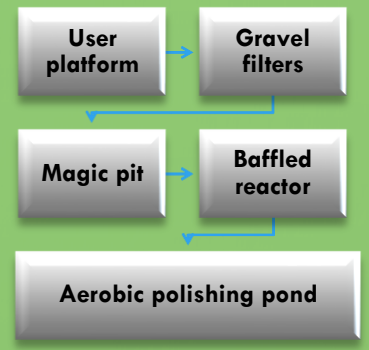


Key takeaway:

- Community soak pit with plant-based vertical gravel filter for safe disposal.
- Can flood easily due to lack of containment chambers.

TELANGANA - MENTAPALLY GP

Project timeline: 2015-20
Methodology: Onsite & offsite DEWATS
Scale: Village Of Population 6500



Key takeaway:

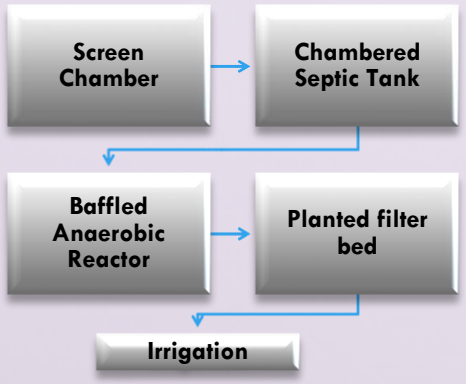
- Adequate containment management led to drain-free villages via magic pits.
- Aerated lagoon enables a safe disposal system.

Source: https://swachhbharatmission.gov.in/

Conventional Treatment Practices at Rural areas

KACHPURA VILLAGE, AGRA

Project timeline: 2010
Methodology: DEWATS
Scale: Community

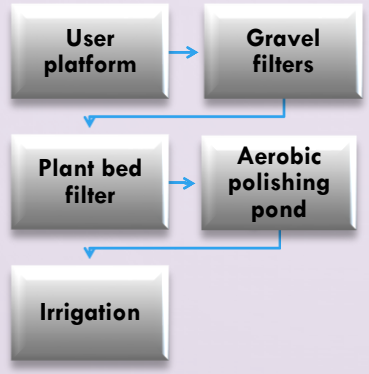


Key takeaway:

- The bed is filled with three different types of filter media (white river pebbles, red stones, and gravels) and planted with Canna indica.

TIRUNIVELLI, TN

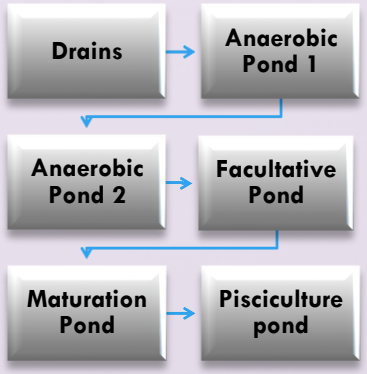
Project timeline: 2014
Methodology: Aerobic Constructed Pond
Scale: Village



Key takeaway:
The system is very low cost and maintenance based upon gravity flow via contours.

KURAK JAGIR VILLAGE, HARYANA

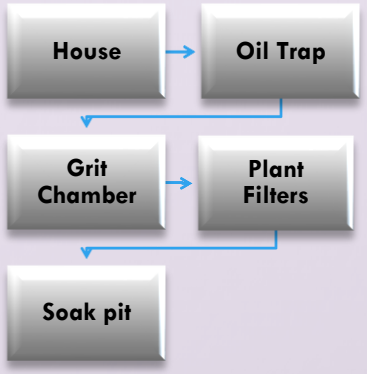
Project timeline: 2010-14
Methodology: Aquaculture
Scale: Village



Key takeaway:
The final pond is used for Pisciculture
And generates a good economy for the local community.

KOREGAON, MAHARASHTRA

Project timeline: 2013-18
Methodology: Plant-based filter Soak pit
Scale: Household



Key takeaway:
Canna Indica is a good water treatment plant for a household wetland system.

Source: https://swachhbharatmission.gov.in/

Innovative Technological Treatment Practices

ROADSIDE NBS via LIQUID WASTE

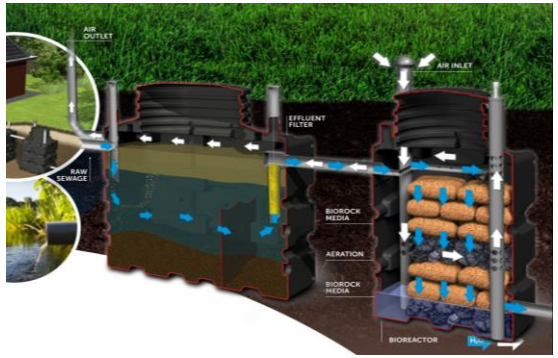
LOCATION: GLASGOW UK

For small communities with adequate electricity and collection system availability. Electrolytic treatment is a feasible option to get an immediate reusable source of water.

This technique only deals with COD and TSS does not deal with BOD.

Reuse of output can be adapted for cleaning & irrigation purposes.

HOUSEHOLD CONTAINMENT PREFILTERATION SYSTEM



LOCATION: DEXTER UK

This is the ideal solution that every household must apply before discharging their Liquid waste to the main collection line.
With very low maintenance, it removes all dirt, oil, and TSS via gravity.

Reuse can be adapted from the system for all non-potable purposes in the household except bathing and kitchen.

ELECTROLYTIC GREY WATER TREATMENT

LOCATION: CHENNAI, TN

For small communities with adequate electricity and collection system availability. Electrolytic treatment is a feasible option to get an immediate reusable source of water.

This technique only deals with COD and TSS does not deal with BOD.

Reuse of output can be adapted for cleaning & irrigation purposes.

NANOBUBBLE AERATION TECHNOLOGY

LOCATION: ROPAR PUNJAB

This is an adequate technology for multi pond aerated lagoon system to adapt to water stabilization.

This aerates water at a very rapid rate taking care of BOD and COD to an high extent.

Reuse of Water is potable after further osmosis. And all kinds of non-potable purposes can be adapted.

Source: https://biorock.com/_files/file/products/ecorock/ecorock_brochure_en.pdf | https://www.cleantechwater.co.in/ | Green Loo - Grey Water | https://swachhbharatmission.gov.in/

Urban Technological Treatment Practices - International

MABR (Membrane aerated Biofilm Reactor)

LOCATION: FLUENUSCE

For Urban cities with adequate electricity and collection system availability.

High End treatment for black water to irrigation reuse & non potable purposes.

Can attain discharge norm of BOD 10 mg/l

NANOFILTERATION MEMBRANE PROCESS

LOCATION: NEWYORK

This is the ideal solution that can attain the most cleanest water that can be adopted for drinking purposes.

Can attain BOD with precise quality as 3mg/l.

SEQUENCING BATCH REACTOR (SBR)

LOCATION: MORLEY, ALBERTA

This Technology is adequate for decentralized system for townships in urban settlements.

This system contains 2 days of discharge capacity and treats black water via aeration and pressure filter suction.

MOVING BED MEMBRANE BIOREACTOR

LOCATION: BUGOLOBI, UGANDA

This Plant comprises two inlet screw pumping stations, mechanical pre-treatment with coarse and fine screens and aerated grit removal, primary sedimentation, aerobic treatment in high-performance trickling filters, secondary clarifiers, mechanical sludge thickening, anaerobic mesophilic sludge stabilization, biogas multi-ponder rapidly, taking care of all BOD/COD & odor treatments.

Source:

Reuse and Disposal of Treated Liquid waste

Various Reuse and disposal practices in Rural Areas

Batour village was facing the problem of drainage. Residents recognized an opportunity even in the wastewater. The panchayat started filtering dirty water coming from the village after collecting it at a spot. The filtered water is now being used by farmers for irrigation purposes.

- recognized by **Narendra Modi, Prime Minister**

Building treatment plants is not enough; good reuse and disposal of treated water are to be practiced to bring sustainability.

Reuse can be done at any phase of the service chain and any scale, from household flushing to community toilets or dual plumbing systems.

Source: Liquid waste-guidelines-presentation-for-Gauteng-workshop.pdf |

Punjab moving ahead to Gujarat.

Punjab Government Incurs Rs. 3.40 Crore On Cleaning Of 413 Ponds In Ferozepur District Amid Lockdown

MOVE AIMED TO ALLEVIATE RURAL DISTRESS BY ENSURING JOB OPPORTUNITIES WITH 79324 MAN-DAYS UNDER MGNREGS DURING COVID-19 CRISIS

Technology options adapted by Punjab for rural GWM

- **Magic Pits for HH/communities**
- **Various combinations of WSP**
- **Mechanically Nano-bubble aerated WSP**

Source: Punjab Government Incurs Rs. 3.40 Crore On Cleaning Of 413 Ponds In Ferozepur District Amid Lockdown (5dariyanews.com) | Punjab LWM SBM G

Various Locally Available Biofilters / Screening Fillers

Various Natural local Ingredients for primary Biofiltration	Purpose of the ingredient	Usage Scale	Efficient consumption period	End Sludge Reuse
Moringa Seeds	• Moringa seeds are good coagulating agents for enhancing Settlement,	• Community Scale - Sedimentation Chamber • Household scale into Oil trap chamber	• Hourly/Daily flow-dependent	• Composting • Land filling
Moringa husk (Drumstick husk)	• Silt and oil trap biofilter media only • Sugarcane husk has coagulating properties too for the first day of its use.	• Can be used at all scales for increasing screening efficiency	• Needs to be replace and grinded weekly	
Sugarcane Husk				
Paddy / Coconut Husk				
Sponge Gourd	• Silt and oil trap biofilter	• Household screening chamber • Community screening chamber/Sedimentation/aeration chamber inlet	• Needs to be replaced weekly	

Various screening biofiltration ingredients only reduce the silt and oil components from the liquid waste.
Liquid waste would need further treatment measures after sedimentation and coagulation.

Comparison of Various Treatment Technologies post screening

Sno.	Technology	Source of WW	Size	Costing	Inflow [mg/L]	Outflow [mg/L]	Durability	End Reuse	Cons
1	Multi-soil-layering technique for waste water treatment in rural areas	Dometic Grey Water, Storm Water	100 sqm x 1.5 m for 100 KLD	10 Lac Rs for 100 KLD	BOD5 - 314 ± 5.359 / COD- 504 ± 21.014	BOD5- 43.20± 3.102 / COD -91.21±12.231	90% for 60 Days of Operation	Irrigation, retention ponds, GW recharge, flushing community toilets	Feasible for small scales clogs easily.
2	Aqua Plantation								
	A. Floating plantation Treatment	Dometic Grey Water, Storm Water	Any Pond scale	500rs per sqm per year [could be planted for 75% coverage into pond surface]	intial BOD 175 mg/L	BOD5 of 24 day treatment - 30 mg/L	Achieves 90% efficiency into 3 years of estabilishment cycle	Irrigation, GW recharge	Only could be applied to water bod remediation
	B. Constructed Wetland Treatment	Domestic Grey Water, Storm Water	10 Sqm for 1 KLD	Estabilishment costing: 1000rs per sqm; 500rs per sqm per year {excluding land costing}	500mg/L BOD5	9.5mg/L - BOD5	90% efficiency after 3 months of regular maintenance	Irrigation, non potable purpose, pond & GW recharge	consumes huge area but effective for rural regions
3	Aerobic Brickbat Grit Sand Filter	Dometic Grey Water, Storm Water	5 Sqm for 1 KLD	50,000 for 1 KLD system one time cost	BOD5 - 140mg/L	10mg/L – BOD5	60% efficiency after 3 months of regular maintenance	Irrigation, non potable purpose, pond & GW recharge	cheap but inefficient for larger scales or capacity building
4	Mooringa Seed Based Water Treatment								
	A. Mooringa Seed Based Baffle Reactor	Domestic Black Water	30 m3 for 100KLD	15000 per 100 KLD recurrring cost annually ; capital cost 30-50 lac equilization tank system	1000 mg/L -BOD5	10 mg/L- BOD 5	90% withstanding 180 Days of Operation efficiency	All non potable reuse; potable reuse after tertiary treatment	cheap but needs more maintenance
	B. Mooringa Seed based filter system	Domestic Grey Water	0.5 m3 / household	1500 Rs; one time cost; 30 Rs weekly filter replacement	100 mg/L - BOD5	30 - 60 mg/L BOD5	60% Efficiency with weekly maintenence	Gardening and GW recharge	cheap but needs more maintenance
			20 sqm for community system capacity per 100 KLD	5-20 lac Rs capital cost; 800 Rs weekly monthly filter replacements and pumping cost,	100 mg/L - BOD5	60 mg/L – BOD5	60% for weekly maintenence	Irrigation, retention ponds, GW recharge, flushing community toilets	cheap but needs more maintenance
5	Electrolytic Sewage Treatment Plant	Commercial Waste Water, Municipal Sewage, Industrial Effluent, Hazardous Effluents	15x3x3 m3 \ unit	2-3 Lacs / Unit for 50KLD - 300KLD system; daily O&M costing rise up for electricity consumption of 5KW/day	COD- 500mg/L	COD- 50mg/L	95% efficiency with daily operation measures	Irrigation, retention ponds, GW recharge, flushing community toilets	Expensive with linear capacity building
6	Nano Membrane Filteration System	Commercial Waste Water, Municipal Sewage, Industrial Effluent, Hazardous Effluents	5 sqm / unit	5 Lacs for 1 KLD; 15000-20000 annual O&M	Any	Required needs	95% Efficiency with daily operation measures	Can achieve potable output	Expensive and have huge discharge water output loop

Solution Strategy

Vision

Achieve clean and green habitation in all villages via completing the water loop by 2030.

State SPV to SBM-G Mission → **State Swatch Jal Yojna**

- Data Collection
- Performance Assessment
- Financing and Monitoring Channel
- Implementation and Campaigning

Short Term Strategy (5 Year Goals)

1. Providing Adequate User Interface services equitable for all
2. Fixing and Realignment of conveyance system of respective villages
3. Providing soak pits and Magic Pit to isolated small habitations
4. IEC Campaigns for Water Awareness

Long Term Strategy (10 Year Goals)

1. Water Security Data Management Portal
2. Village Liquid Waste Management Plan
3. Pilots and Replications of Treatment Plants
4. Water Reuse & Production Industries

Swatch Jal Yojna Planning into Timeline

Sno.	Components	Pilot : Phase 1			Replication : Phase 2						
		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
1	Legal framework formation and Approvals										
2	Official Portal based Village Registration										
3	Data Collection										
4	Gram Panchayat Sewage Committee formation										
5	PMC / Advisory Body Agreements										
6	Village Technology Plans Preparation										
7	Village Action Plan Approvals										
8	Implementation works										
9	Operation & Monitoring Setup										
10	Reuse And Revenue Infrastructure Setup										
11	IEC Campaigning: Training & Awareness										

SDG Targets seeking our solution

Water Security Building

Food Security building

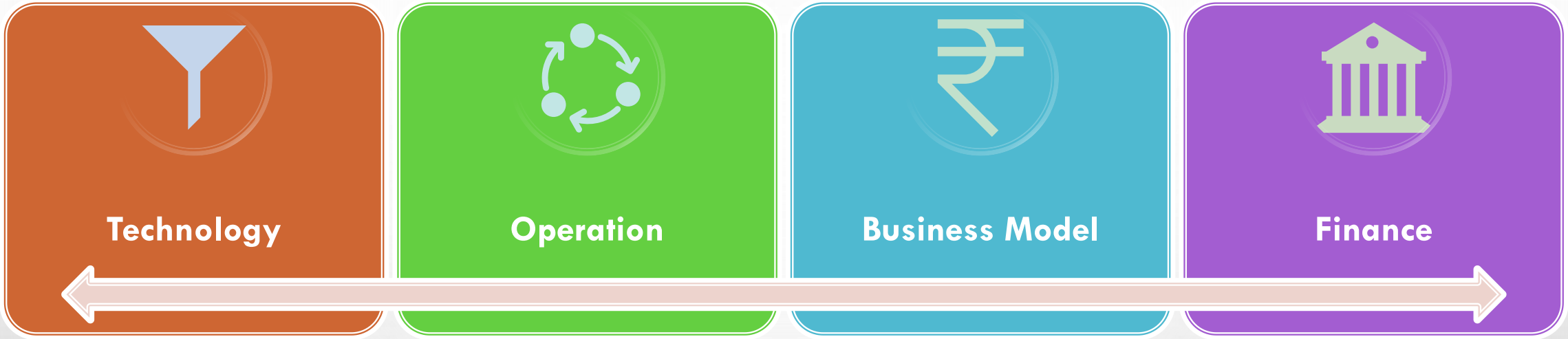
Hygienic Habitation for all

Industry, Innovation & Infrastructures

SDG's with Business Opportunities

Controlled water quality of our local habitation can lead to better hygiene, better food production, and building economic & industrial growth with water security

Fundamental Pillars of Strategy to achieve LWM



- Bringing all solutions for LWM into one stage.
- Connecting all stakeholders together.
- Selection of technology for solution for LWM.
- Volumetric Design Suggestion based upon selection.

- Operation strategies can be explored with various PPP models or a Tender basis locally by GP/Block.

- Business strategies need to be set up for effective scaling up of the solution.
- Adequate reuse infrastructures could be adapted for various drip, sprinkle farming techniques, aquaculture and pisciculture.

- Rural villages need to depend on grants, loans & CSRs until the revenue generation comes from water reuse businesses.

Improve water quality and increase regional water security.

Involvement of communities and inclusion of local private players.

Revenue generation via production using treated water.

Transparent route for villages to take benefits of grants and schemes.

Treatment chain-based technology selection

- Treatment sequence solution can be selected from the menu as per the feasible requirement of the village.
- For village-scale management all three phases of treatment are required for impactful results, their technologies can be selected and evolved.

Primary

Secondary

Tertiary

Primary Treatment

Key Challenges:

1. Silt
2. Overflooding
3. Velocity & Turbulence

Primary Screening → Velocity Equalization Tank & Flow Laminator → Silt Removal Sedimentation Tank → Oil Removal Flocculation Tank

Household Scale
Soak pit, Kitchen garden

Village Scale
Secondary Treatment

In situ Concrete Structure

Modular System for the quantity up to 100 KLD

Secondary Treatment

Key Challenges:

1. BOD
2. COD
3. pH
4. TSS
5. Chlorine

Gravel Filter (TSS Removal)

- Sandbed filter
- Pressurized Sandbed Filter
- Charcoal bed gravel filter
- Biofilter Media
  - Moringa Seed Based Filter media Screen
  - Dry Bushes
  - Sponge Guard
  - Paddy Leaves
  - Sugarcane

Digestor System

- Batch Reactor
  - up to 100 KLD
- Baffled Reactor
  - For more than 100 KLD
- Anaerobic Baffled Reactor + Aerobic Filter
- MBR, MMBR etc

Digestion filter (Gravity/pressurized)

- Sand Filter Constructed Gravel bed Wetland
- Gravel & Charcoal Bed filtration

In situ Concrete Structure

Modular System for the quantity up to 100 KLD

Tertiary Treatment

Key Challenges:

1. Pathogen Removal
2. Salt Stabilization
3. Non-Potable Reuse
4. Potable Reuse

Disinfection & Stabilization

- Ultraviolet Disinfection
- Chlorination
- Electrolysis

Pond Aeration Systems after abatement

- Micro bubbling
- Sprinklers
- Floating wetlands

Non-potable Reuse

- Sprinkler Irrigation
- Drip Irrigation
- Dual plumbing systems
- Community Wash & Toilet usage
- Industrial use

Potable Reuse

- Osmosis
- Pressurized Nanomembrane Filters

In situ Concrete Structure

Modular System for the quantity up to 100 KLD

Revenue generation via reuse of liquid waste for production.

Tata Steel Meramandali organizes training for farmers on Pisciculture

Water spinach cultivation in a drainage ditch (Dili)
Image Credit: Tatoli Ba Kultura (2013)

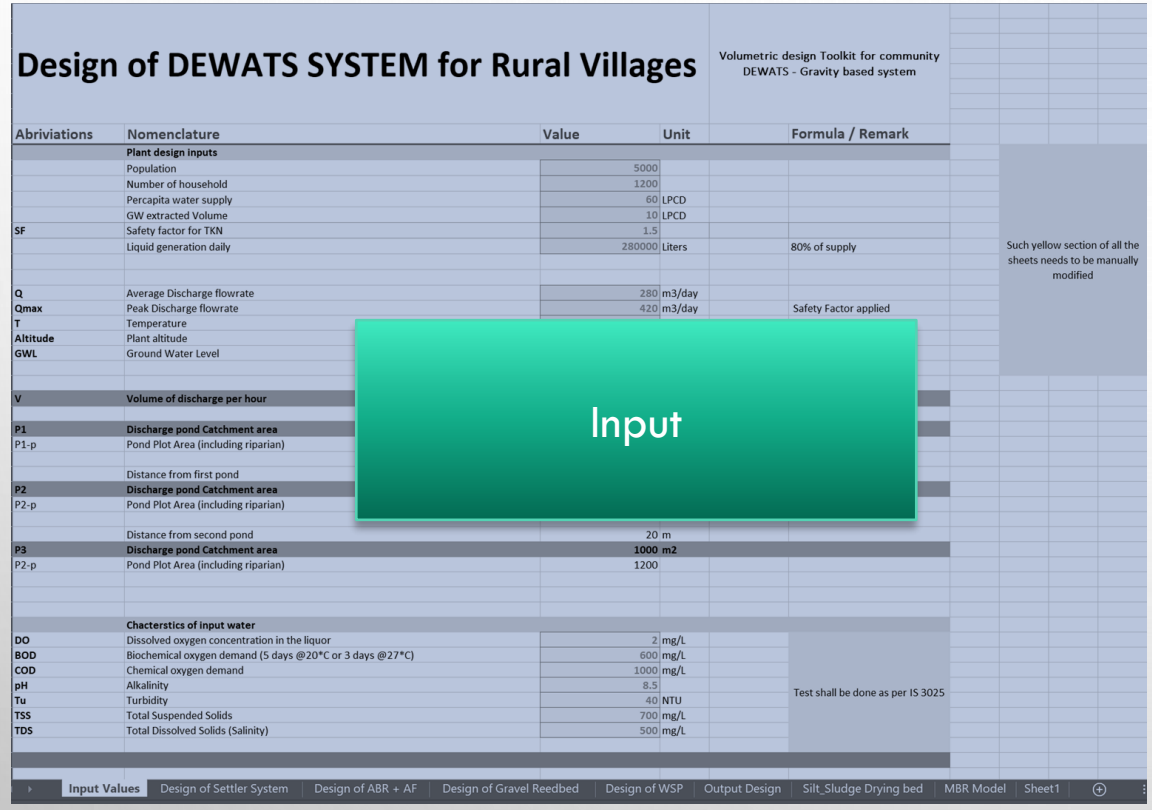
Drip irrigated permaculture

Pisciculture → Aquaculture → Permaculture → Industrial use

Source: Tata Steel Meramandali organizes training for farmers on Pisciculture- CSRBOX | vikalpsangam.org | Wastewater reuse for aquaculture - from traditional knowledge to modern techniques • Department of Earth Sciences (fu-berlin.de)

Technology Toolkit

Treatment System Volumetric Design Toolkit for DEWATS



Design of DEWATS SYSTEM for Rural Villages

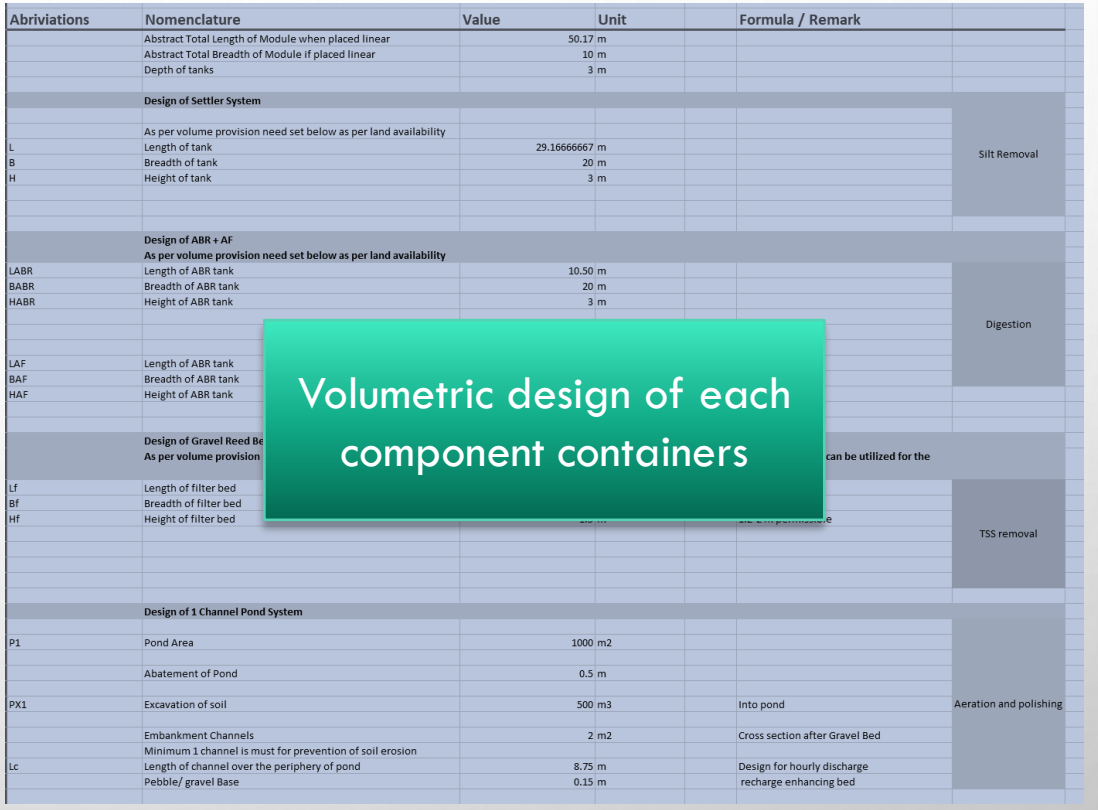
Volumetric design Toolkit for community DEWATS - Gravity based system

Abriviations	Nomenclature	Value	Unit	Formula / Remark
	Plant design inputs			
	Population	5000		
	Number of household	1200		
	Percapita water supply	60	LPCD	
	GW extracted Volume	10	LPCD	
SF	Safety factor for TKN	1.5		
	Liquid generation daily	280000	Liters	80% of supply
Q	Average Discharge flowrate	280	m3/day	
Qmax	Peak Discharge flowrate	420	m3/day	Safety Factor applied
T	Temperature			
Altitude	Plant altitude			
GWL	Ground Water Level			
V	**Volume of discharge per hour**			
P1	**Discharge pond Catchment area**			
P1-p	Pond Plot Area (including riparian)			
	Distance from first pond			
P2	**Discharge pond Catchment area**			
P2-p	Pond Plot Area (including riparian)			
	Distance from second pond	20	m	
P3	**Discharge pond Catchment area**	1000	m2	
P2-p	Pond Plot Area (including riparian)	1200		
	Chacterstics of input water			
DO	Dissolved oxygen concentration in the liquor	2	mg/L	
BOD	Biochemical oxygen demand (5 days @20*C or 3 days @27*C)	600	mg/L	
COD	Chemical oxygen demand	1000	mg/L	
pH	Alkalinity	8.5		
Tu	Turbidity	40	NTU	Test shall be done as per IS 3025
TSS	Total Suspended Solids	700	mg/L	
TDS	Total Dissolved Solids (Salinity)	500	mg/L	

Such yellow section of all the sheets needs to be manually modified

Input

Input Values | Design of Settler System | Design of ABR + AF | Design of Gravel Reedbed | Design of WSP | Output Design | Silt_Sludge Drying bed | MBR Model | Sheet1

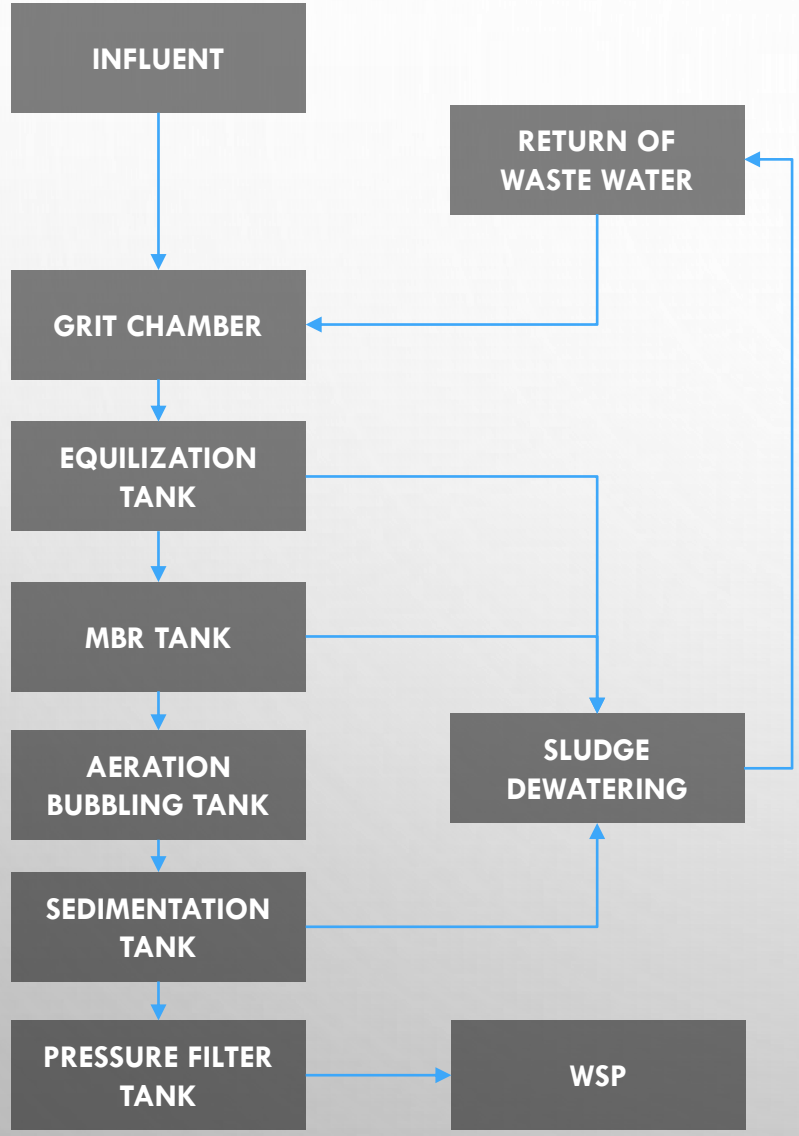


Abriviations	Nomenclature	Value	Unit	Formula / Remark	
	Abstract Total Length of Module when placed linear	50.17	m		
	Abstract Total Breadth of Module if placed linear	10	m		
	Depth of tanks	3	m		
	Design of Settler System				
	As per volume provision need set below as per land availability				Silt Removal
L	Length of tank	29.16666667	m		
B	Breadth of tank	20	m		
H	Height of tank	3	m		
	Design of ABR + AF				
	As per volume provision need set below as per land availability				
LABR	Length of ABR tank	10.50	m		
BABR	Breadth of ABR tank	20	m		
HABR	Height of ABR tank	3	m		Digestion
LAF	Length of ABR tank				
BAF	Breadth of ABR tank				
HAF	Height of ABR tank				
	Design of Gravel Reed Be				
	As per volume provision			**can be utilized for the**	
Lf	Length of filter bed				
Bf	Breadth of filter bed				TSS removal
Hf	Height of filter bed				
	Design of 1 Channel Pond System				
P1	Pond Area	1000	m2		
	Abatement of Pond	0.5	m		
PX1	Excavation of soil	500	m3	Into pond	Aeration and polishing
	Embankment Channels	2	m2	Cross section after Gravel Bed	
	Minimum 1 channel is must for prevention of soil erosion				
Lc	Length of channel over the periphery of pond	8.75	m	Design for hourly discharge	
	Pebble/ gravel Base	0.15	m	recharge enhancing bed	

Volumetric design of each component containers

Source: SBM- G- MIS App Screenshot for Greywater management section.

MBR TREATMENT PROCESS FLOW

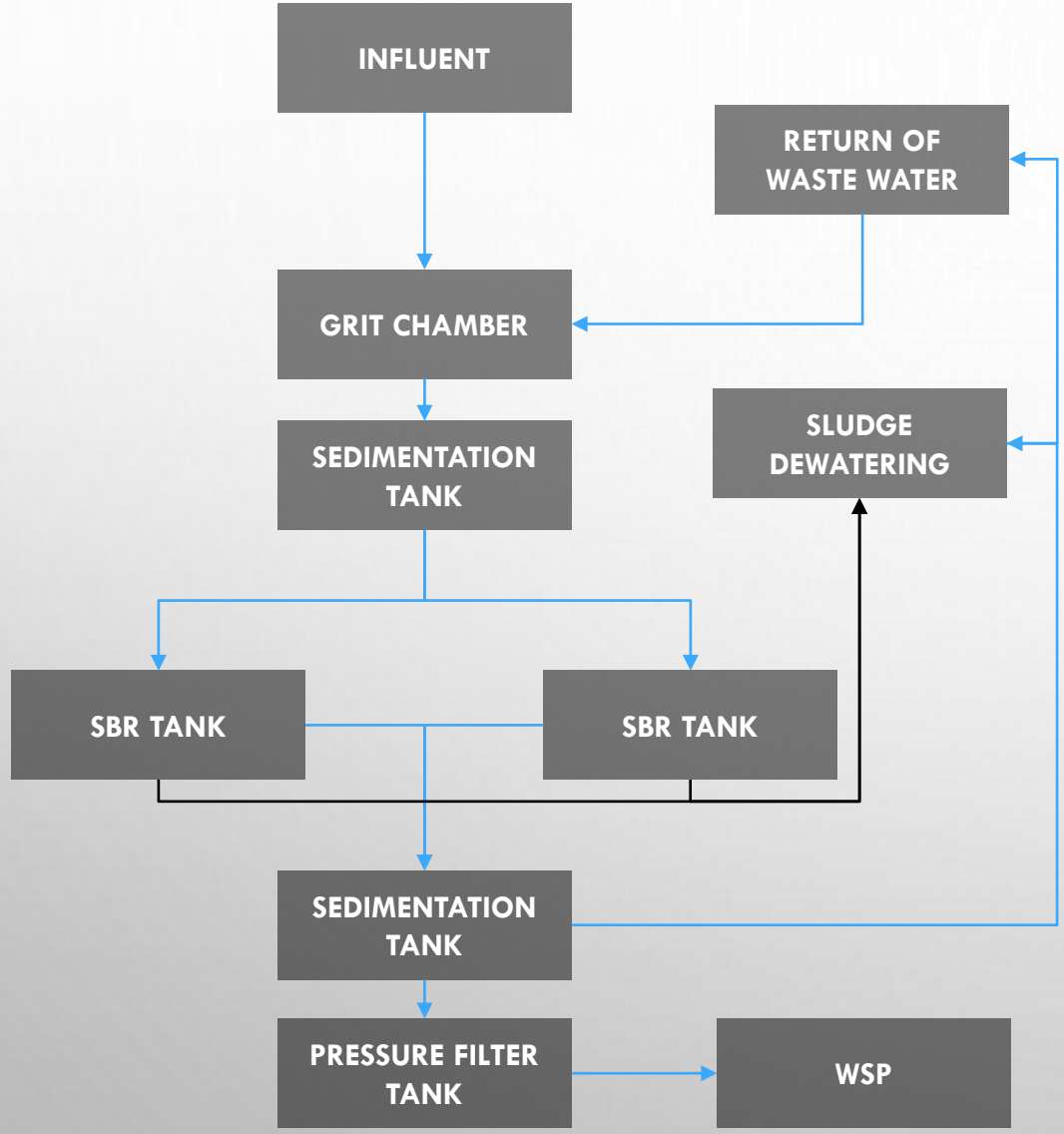


Abriviations	Nomenclature	Value	Unit	Formula / Remark
V	Design flow rate	55	m3/h	
DF	Design Flux	0.38	$m^3/m^2/h$	
Ma	Required Area of Membrane	144.737	m2	
Mau	Membrane Area per unit	12	m2	
	Required number of Membrane unit with FOS (1.25) oper basin	20		
	Number of Basins required	2		2 minimum
	Total Number of Membrane Required	40		
	Membrane unit size			
	Membrane Length	1.8	mm	
	Membrane Breadth	2.5	mm	
	Membrane Height	4	mm	Take as per influx
	Membrane Tank size			
	Length	25	m3	
	Width	9	m3	
	Depth	5	m3	1 M air flow
	Number Of membranes for spacing	40		Spacing factor 1.5
	Membrane Tank Volume per Unit	1136.54	m3	
	Total Tank Required	2		2 minimum
	Total Discharge From MBR Tank	55	m3/h	
	Sluge Water Extraction from MBR	11	m3/h	0.5 of pump capacity from MBR Tank Base + 0.5 from Sedimentation tank

Process FLow | Input Values | Grit Chamber+ Equilization Tank | MBR Tank | Aeration & Sedimentation Tank | Pressure Filter Tank | Sludge Dewatering Tank | Design of WSP

Toolkit for Membrane Biofiltration Reactor

SBR TREATMENT PROCESS FLOW



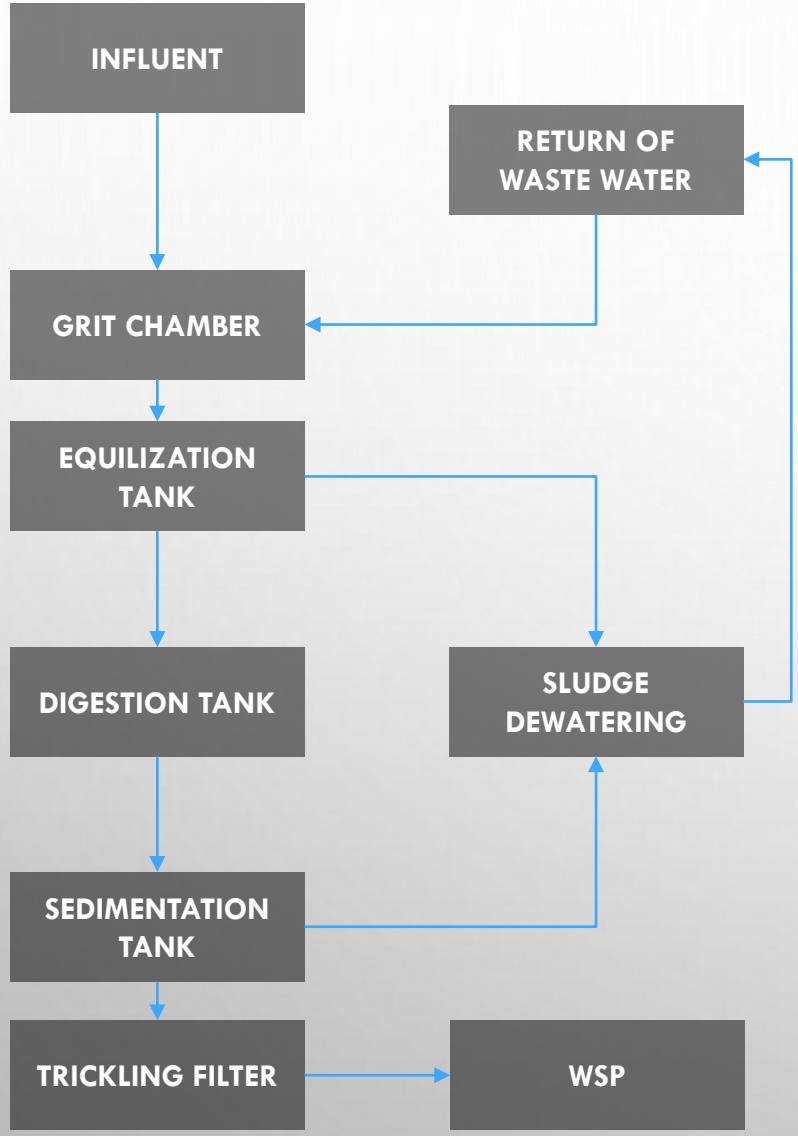
Design of circular tank (Central Upflow towards outer circumference)

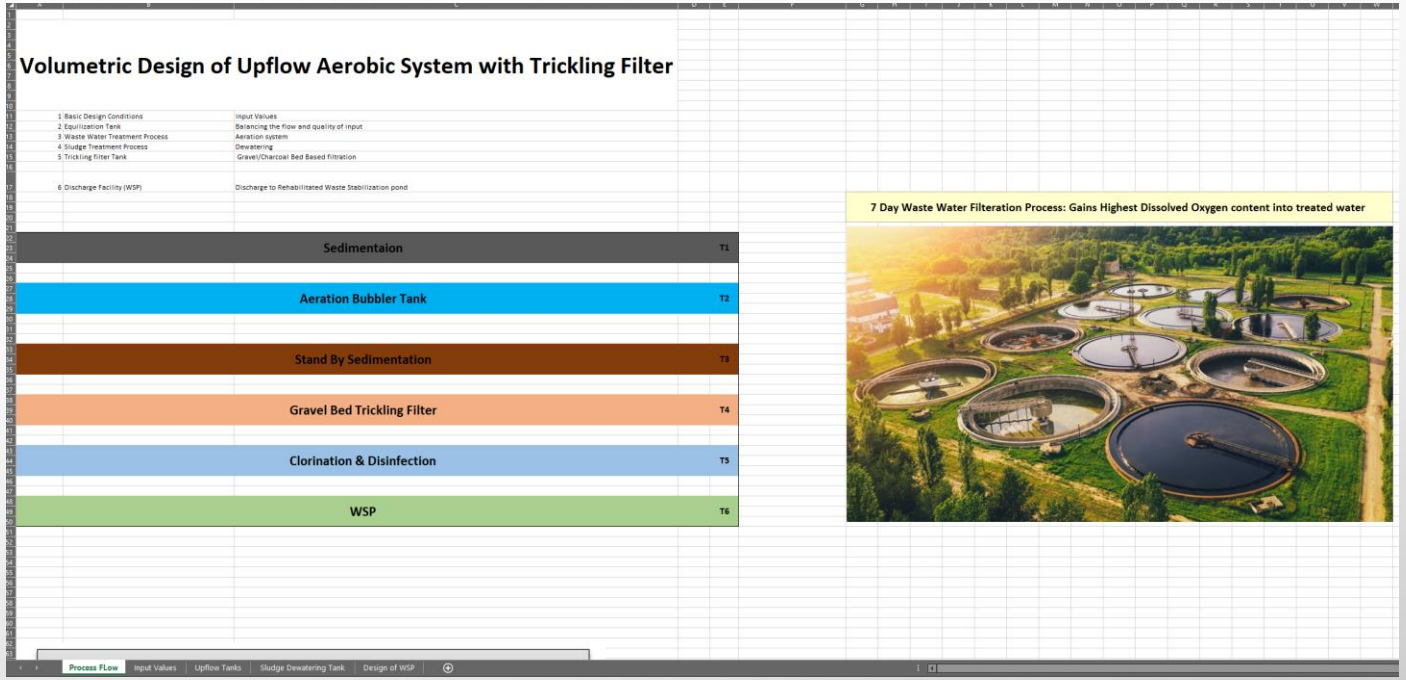
Abriviations	Nomenclature	Value	Unit	Formula / Remark
	Design of Settler System with screening net			**Formula / Remark**
V_t	Volume of collection & equalization Tank with halfway separator	330	m3	4-hour settlement + 2 Hour return
	Permissible Minimunm Buffer height from bottom of the tank	1.5	m	
V_s	Volume of Settlement Tank (Hour Storage)	1320	m3	24 hour settlement
	Permissible Minimunm Buffer height from bottom of the tank	1.5	m	
	Permissible Maximum Buffer height from bottom of the tank	7.5	m	
	Tank Details			
FOS1	Factor of safety for over loading	1		
V_t'	Volume of Equilization tank provision	1650		
				40:12:05
	Permissible Minimunm Buffer height from bottom of the tank	1.5	m	
P_1	Interconnecting Pipe Depth	1.5		8:10 H
	As per volume provision need set below as per land availability			
R	Length of tank	16	m	
H	Height of tank	2	m	
H2	Air Reach Height Additional Needed	0.5	m	
	Additional Height for parapet as overflow safety	0.5	m	
H1	Total height of Tank Provision	3	m	
	Lift Pump Design - Vertical shaft Volute type mixed flow pump			
	Design Flow Rate	55	m3/h	
	Pump Capacity			
	Number of Pump	5		
	Capacity of each Pump	55	m3/h	1 Stand By
				2 for SBR Pumping
				1 Pump for sludge unloading from MBR / Sedimentation Tank
				1 Pump for Pressure filteration

Process FLow | Input Values | Grit Chamber+ Equilization Tank | SBR Tank with Aerators | Pressure Filter Tank | Sludge Dewatering Tank | Design of WSP

Toolkit for Sequential Batch Reactor

Up flow Aerobic Sedimentation Biofiltration + TRICKLING FILTER TREATMENT PROCESS FLOW



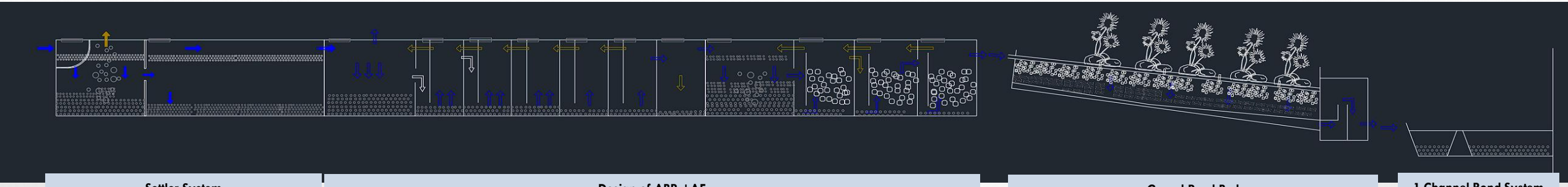


Toolkit for Up-flow Aerobic Biofiltration & Trickling filters

DEWATS as the Primary Fundamental setup : Suggestion

Treatment System Volumetric Design Toolkit for DEWATS

Toolkit comes with a CAD NTS file that can be universally modified with ease as per volumetric results of the toolkit



Settler System | Design of ABR +AF | Gravel Reed Bed | 1 Channel Pond System

The benefit of having DEWATS as a universal primary system for a block/district:

DEWATS is the most fundamental treatment procedure mandate every habitation should adopt. It is a basic first-phase treatment process for non-potable output.

- Complete Gravity Based Design with zero power consumption
- Can be evolved with pressurized plumbing and pumping filtrations for capacity building and high-end treatment results
- Replicability: Ease of Scaling up via pilot replication into villages
- Universal guidelines can be adapted by governing authorities for design approvals.
- Similar systems would ease up monitoring the quality index quarterly,
- and immediate solutions could be planned if quality reduces

A common technology suggestion would reduce the burden of training the villages/blocks for technology into implementation and operation.

The geotagged implementation phase approval system for releasing grants would be easier for scaling up at block/state level with a unified fundamental approach

Example - Design strategy for Rancharda - Palodia Cluster

Rancharda - Palodia

Projected Population to cater: 10,000

WSP Pond area available: 16 Ha

Needed collection coverage line: 5 Km

Input Variables for selected cluster into the toolkit

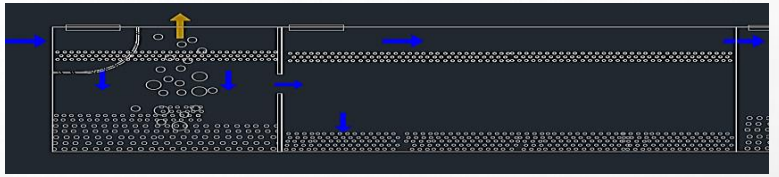
Abriviations	Nomenclature	Value	Unit	Formula / Remark
	Plant design inputs			
	Population	10000		
	Number of household	1200		
	Percapita water supply	60	LPCD	
	GW extracted Volume	50	LPCD	
SF	Safety factor for TKN	1.5		
	Liquid generation daily	880000	Liters	80% of supply
Q	Average Discharge flowrate	880	m3/day	
Qmax	Peak Discharge flowrate	1320	m3/day	Safety Factor applied
T	Temperature	27	C	
Altitude	Plant altitude	500	m	
GWL	Ground Water Level	100	m	
V	**Volume of discharge per hour**	**55**	**m3/hr**	
P1	**Discharge pond Catchment area**	**16000**	**m2**	
P1-p	Pond Plot Area (including riparian)	1200	m2	
	Distance from first pond	20	m	
P2	**Discharge pond Catchment area**	**1000**	**m2**	
P2-p	Pond Plot Area (including riparian)	1200	m2	
	Distance from second pond	20	m	
P3	**Discharge pond Catchment area**	**1000**	**m2**	
P2-p	Pond Plot Area (including riparian)	1200		
	Chacterstics of input water			
DO	Dissolved oxygen concentration in the liquor	2	mg/L	Test shall be done as per IS 3025
BOD	Biochemical oxygen demand (5 days @20*C or 3 days @27*C)	600	mg/L	
COD	Chemical oxygen demand	1000	mg/L	
pH	Alkalinity	8.5		
Tu	Turbidity	40	NTU	
TSS	Total Suspended Solids	700	mg/L	
TDS	Total Dissolved Solids (Salinity)	500	mg/L	

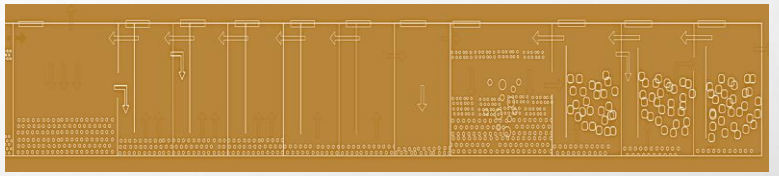
Volumetric Design for Rancharda - Palodia Cluster

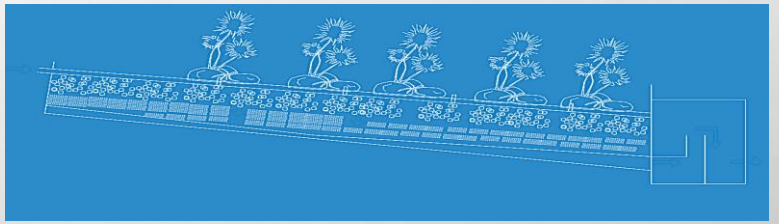
Output Design

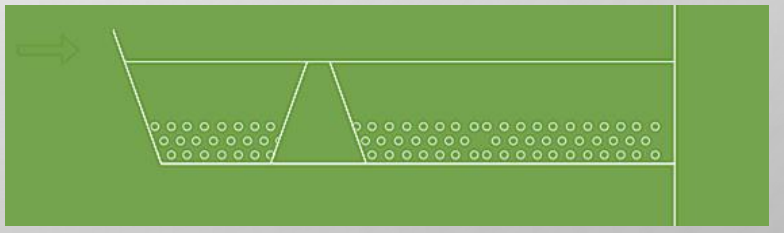
Abriviations	Nomenclature	Value	Unit	Formula / Remark	
	Design of Settler System				
	As per volume provision need set below as per land availability				
L	Length of tank	19.25	m		Silt Removal
B	Breadth of tank	20	m		
H	Height of tank	4	m		
	Design of ABR + AF				
	As per volume provision need set below as per land availability				
LABR	Length of ABR tank	24.75	m		
BABR	Breadth of ABR tank	20	m		
HABR	Height of ABR tank	4	m		Digestion
LAF	Length of ABR tank	8.25	m		
BAF	Breadth of ABR tank	20	m		
HAF	Height of ABR tank	4	m		
	Design of Gravel Reed Bed				
	As per volume provision need set below as per land availability			**Pond riparian bed can be utilized for the following activity.**	
Lf	Length of filter bed	22.00	m		
Bf	Breadth of filter bed	20	m		
Hf	Height of filter bed	1.5	m	1.2-2 m permissible	TSS removal
	Design of 1 Channel Pond System				
P1	Pond Area	16000	m2		
	Abatement of Pond	0.5	m		
PX1	Excavation of soil	8000	m3	Into pond	Aeration and polishing
	Embankment Channels	2	m2	Cross section after Gravel Bed	
	Minimum 1 channel is must for prevention of soil erosion				
Lc	Length of channel over the periphery of pond	27.50	m	Design for hourly discharge	
	Pebble/ gravel Base	0.15	m	recharge enhancing bed	

Complete gravity-based DEWATS system









Gujarat still does not have started data collection for LWM

SBM 2.0 IMIS Mobile App - Data Entry Status

Current State assessment of ODF Plus assets to be completed in **all villages by 31st October 2020** through SBM 2.0 IMIS app launched on 1st Sep 2020. Currently entry has started in ~ 10450 villages only

Downloads and user registration

- **69,855** app downloads
- **66,294** villages allocated to 23,965 **users**

Data Entry

- 20 States have started data entry
- Data entry started in **10,450 villages**

Training and team Formation

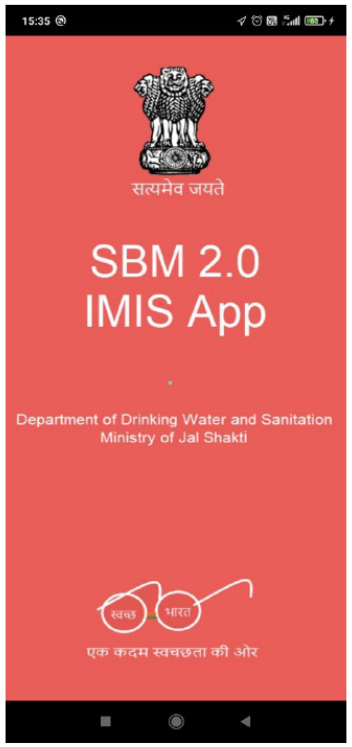
- 20 States have completed District trainings
- 17 States have formed District resource pool

Data Entry Status Of SBM 2.0 Mobile App

S.No.	State Name	No. of users allocated to villages for data entry	No. of villages allocated to users	No. of villages – Data entry started
1	Andhra Pradesh	11,240	17,749	6,243
2	Himachal Pradesh	370	2,275	1,186
3	Karnataka	1,412	4,344	780
4	Rajasthan	1,419	5,516	695
5	Arunachal Pradesh	198	1,177	327
6	Assam	675	2,682	247
7	Uttarakhand	888	5,171	214
8	Haryana	751	2,684	163
9	Maharashtra	1,972	5,360	137
10	Meghalaya	94	456	126
11	Tripura	241	965	122
12	Sikkim	25	108	66
13	A & N Islands	91	254	59
14	Punjab	90	573	36
15	Bihar	456	1,751	24
16	Goa	189	356	11
17	Uttar Pradesh	956	5,487	5
18	Daman & Diu	5	6	4
19	Kerala	188	269	4
20	Madhya Pradesh	604	1,429	1
	Total	**23,965**	**66,294**	**10,450**

Source: SBM- G- MIS App Screenshot for Greywater management section. | https://swachhbharatmission.gov.in/IECMaterial/FileManager/IECMaterialReadonly.aspx

SBM G 2.0 IMIS app for Data collection & finance monitoring



Prepared by
National Informatics Centre
Ministry of Electronics and Information Technology
Government of India

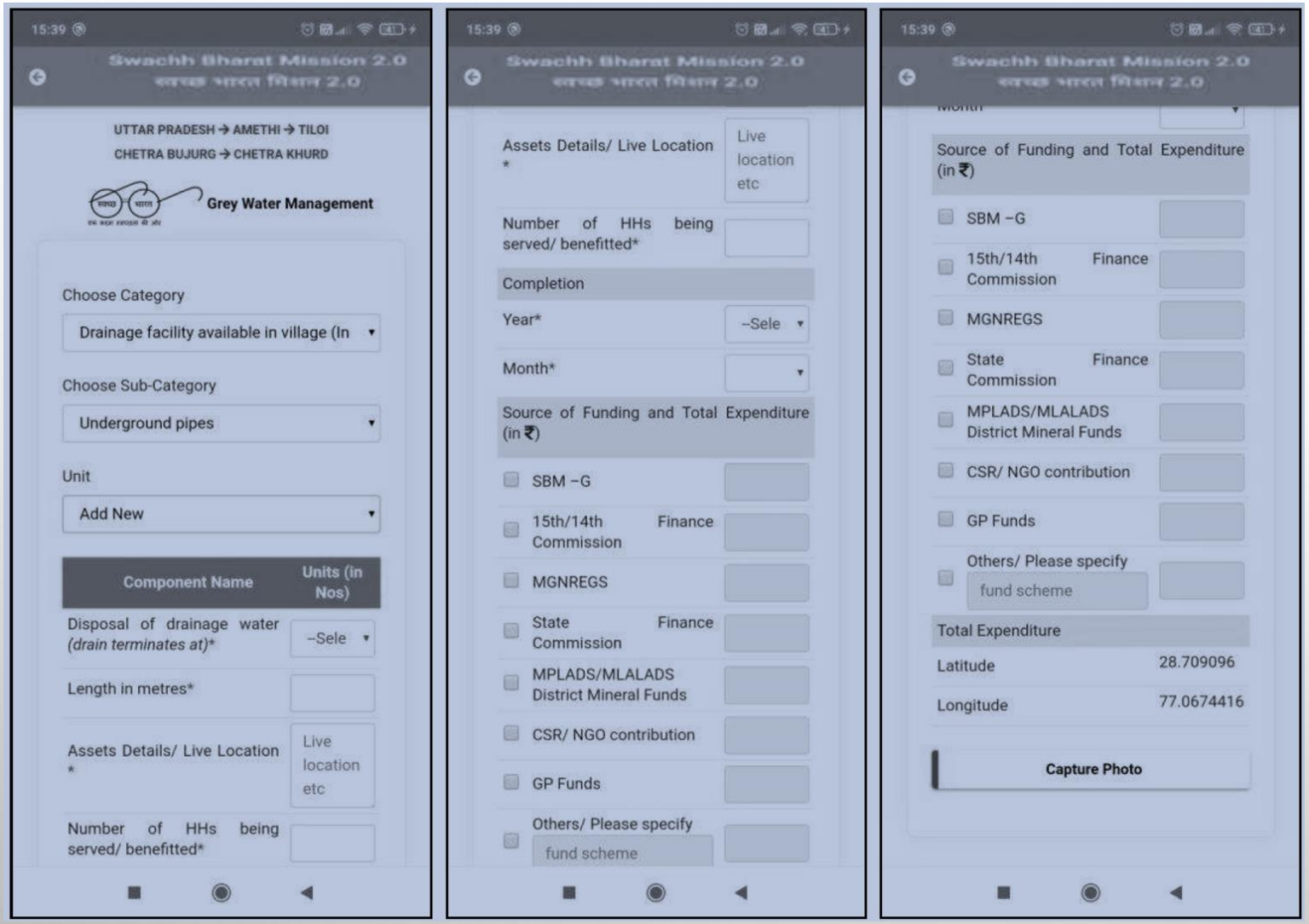
The **Village level** user can make an entry for the following listed as follows:

- Village Basic Information
- Institutional Toilet Status
- Physical Progress Reporting
- Community assets
- Visual Cleanliness and ODF Plus Certificates
- Number of Schools, Anganvadi and Panchayat Toilets

Component Unit	Validation Rule
No. of HHs in the village	The number of Household cannot be zero or more than X. (Where X = **Total no. of HHs**. If **Total No. of HHs** < 500, then the value can be **Total no. of HHs** times 2 otherwise the value will be **Total no. of HHs** times 1.5)
Population in the village	The population in the village cannot be zero and more than six times of **Total no. of HHs.**
Total no. of Hamlet	If the **Total No of HHs** is less than equal to 50, then the value cannot be more than **Total No of HHs**. If the **Total No of HHs** is more than 50, then the value cannot be more than 99.
No. of SC/ST dominated Hamlet	The value cannot be negative or more than **Total no. of Hamlet**.
Avg. total quantity of the solid waste generated in the village per day	The value cannot be negative and or more than 999.
Avg. total quantity of the grey water generated in the village per day	The value cannot be negative and or more than 999.
No. of HHs having access to door-to-door waste collections	The value cannot be less than zero or more than **Total number of Households** entered by the user
No. of Schools in the Village	The value cannot be greater than 9.
No. of Anganwadis in the Village	The value cannot be greater than 9.
Upload Signed certificate for self-declaration	The file can be either in the image format, word file or PDF document and max size of the file can be 200 KB.

Source: SBM- G- MIS App Screenshot for Greywater management section.

Grey Water Management Component in IMIS SBM-G 2.0 app



Information to be filled for drainage facility available in Village are:

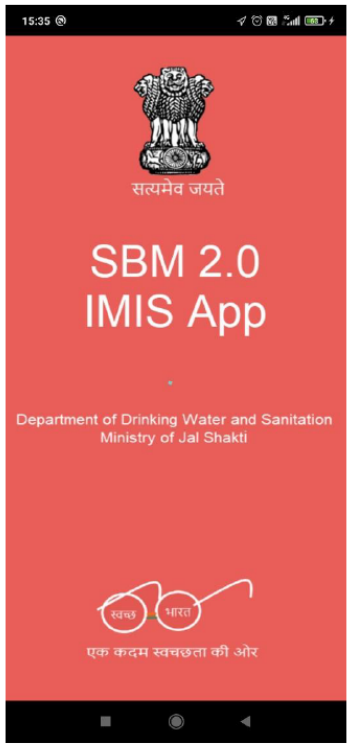
- ❑ Disposal of drainage water
  - Open land areas
  - Ponds
  - Nearby Rivers
  - Agricultural fields
  - Treatment systems
- ❑ Length in meters (conveyance)
- ❑ Assets Details/ Live Location
- ❑ Number of HHs being served/benefitted
- ❑ Completion Date

Things that should be included:

- ❑ Uncovered conveyance details
- ❑ Length of needed Maintenance and realignment of conveyance network
- ❑ Per capita water supply
- ❑ Total outfall discharge

Source: SBM- G- MIS App Screenshot for Greywater management section.

Scaling up implementations via IMIS portal



Prepared by
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Ministry of Electronics and Information Technology
Government of India

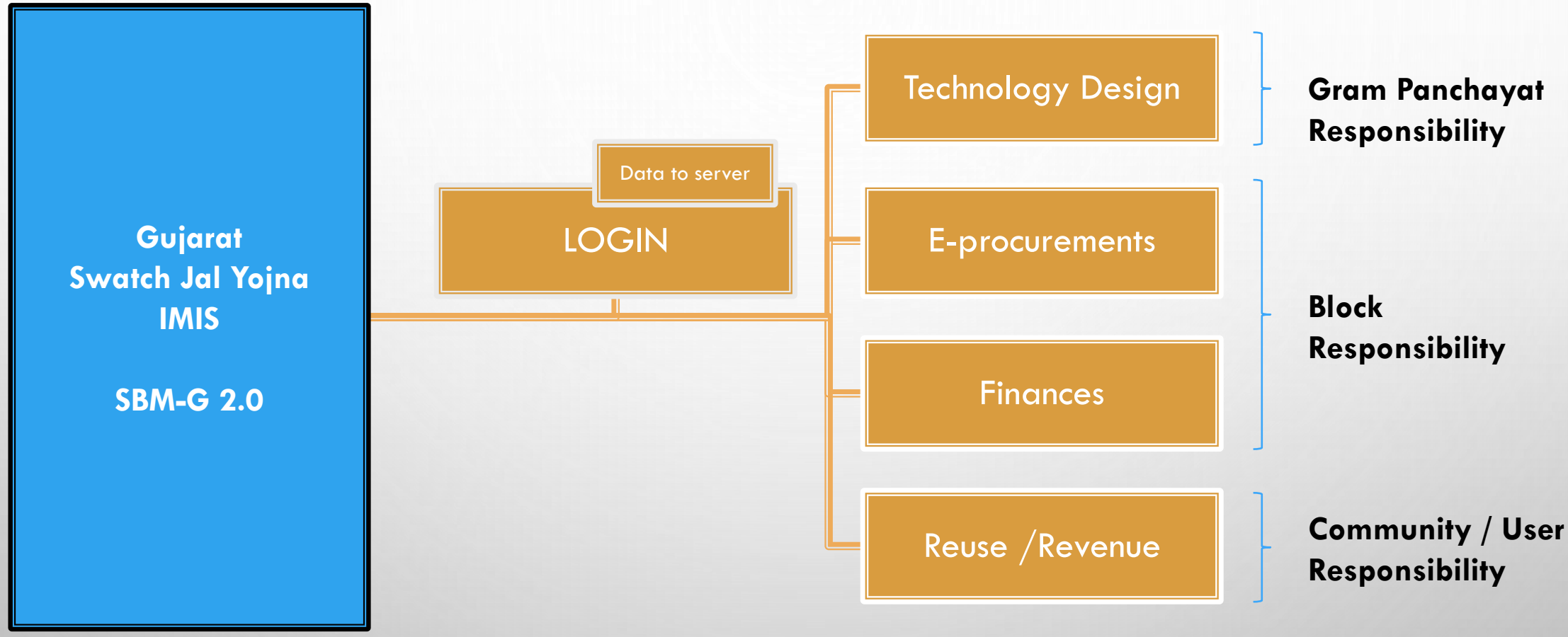
Gujarat
Swatch Jal Yojna
IMIS

SBM-G 2.0

Integrated Water resource platform

Source: SBM- G- MIS App Screenshot for Greywater management section.

Toolkit integration into SBM IMIS app addon: E-Governance

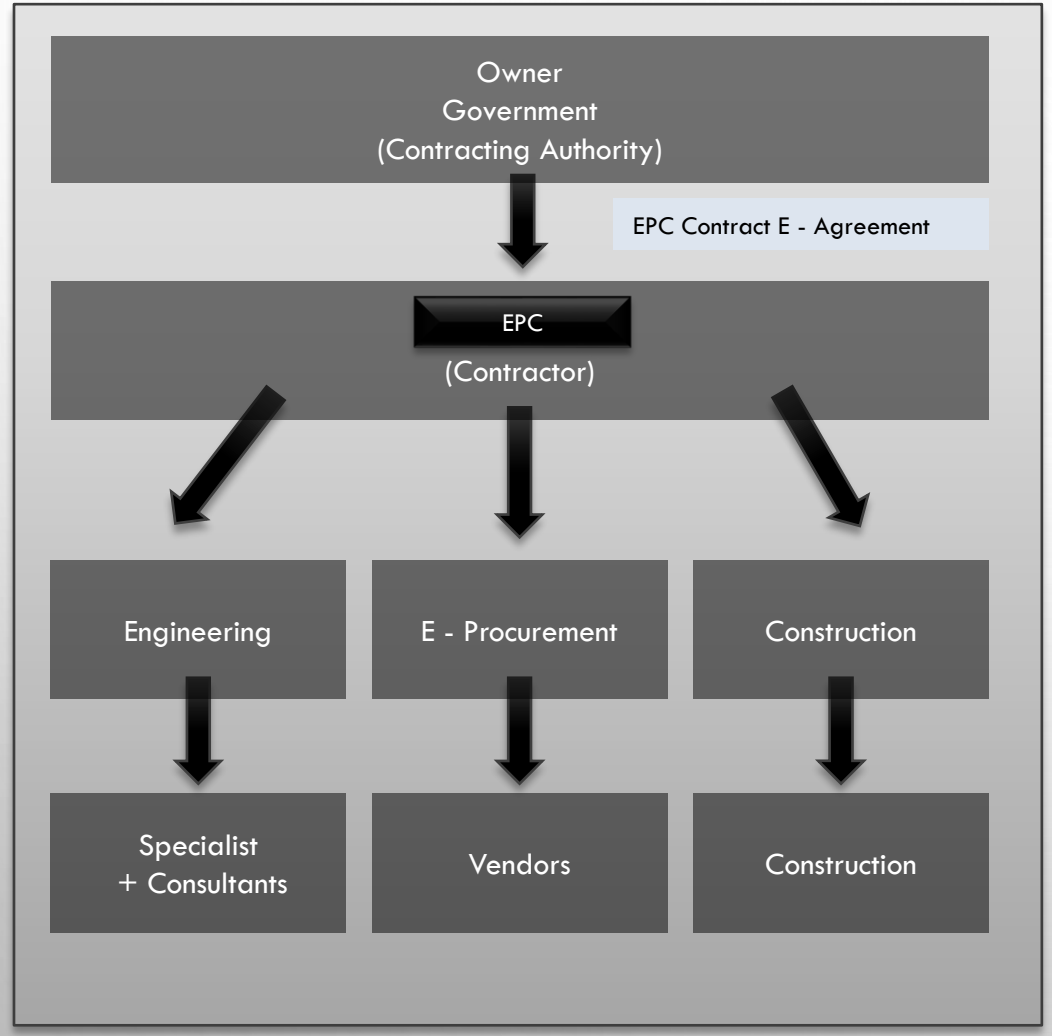


Data Collection App

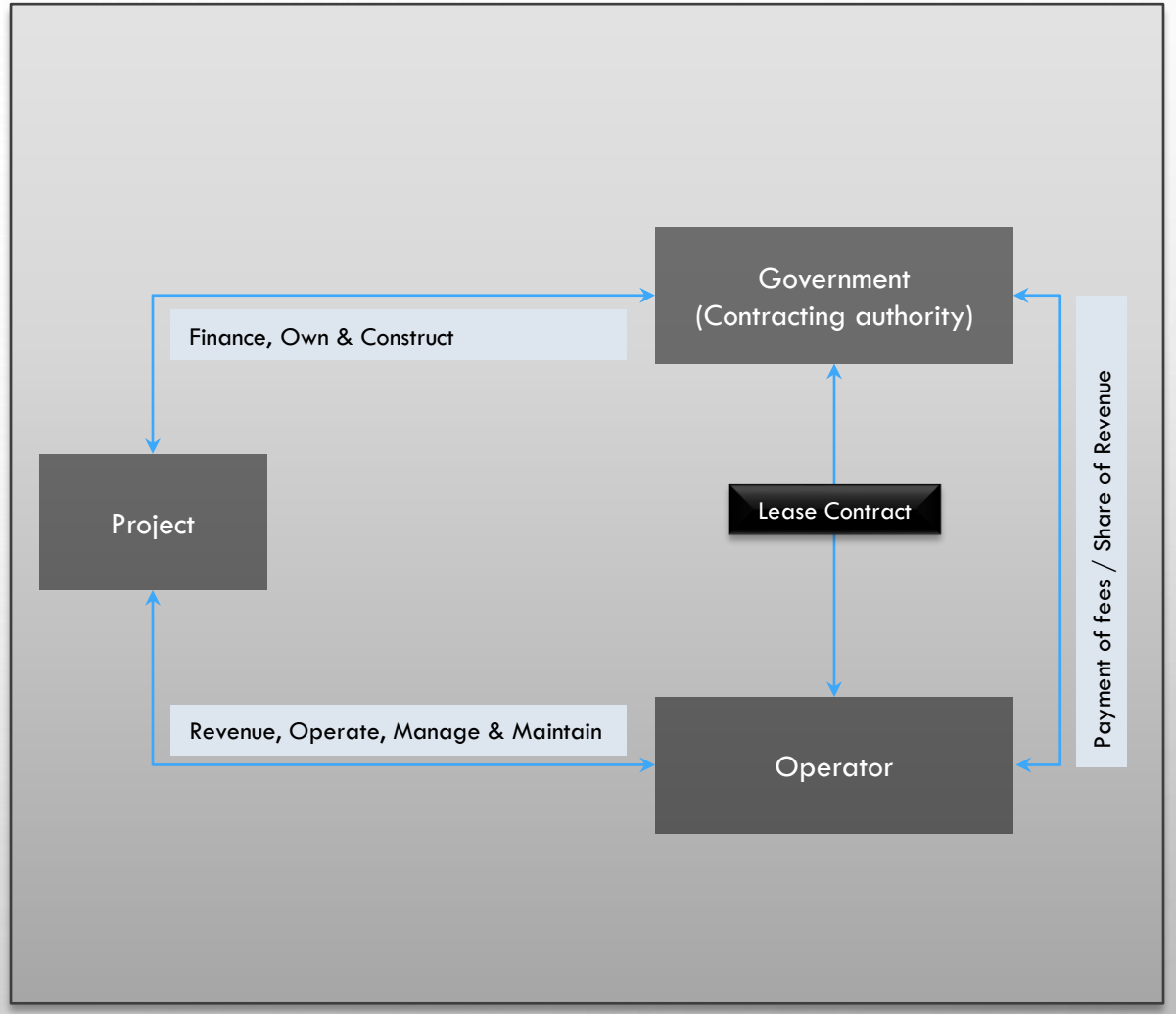
Strategic development solution via collected data

Implementation and O&M Model

Implementation

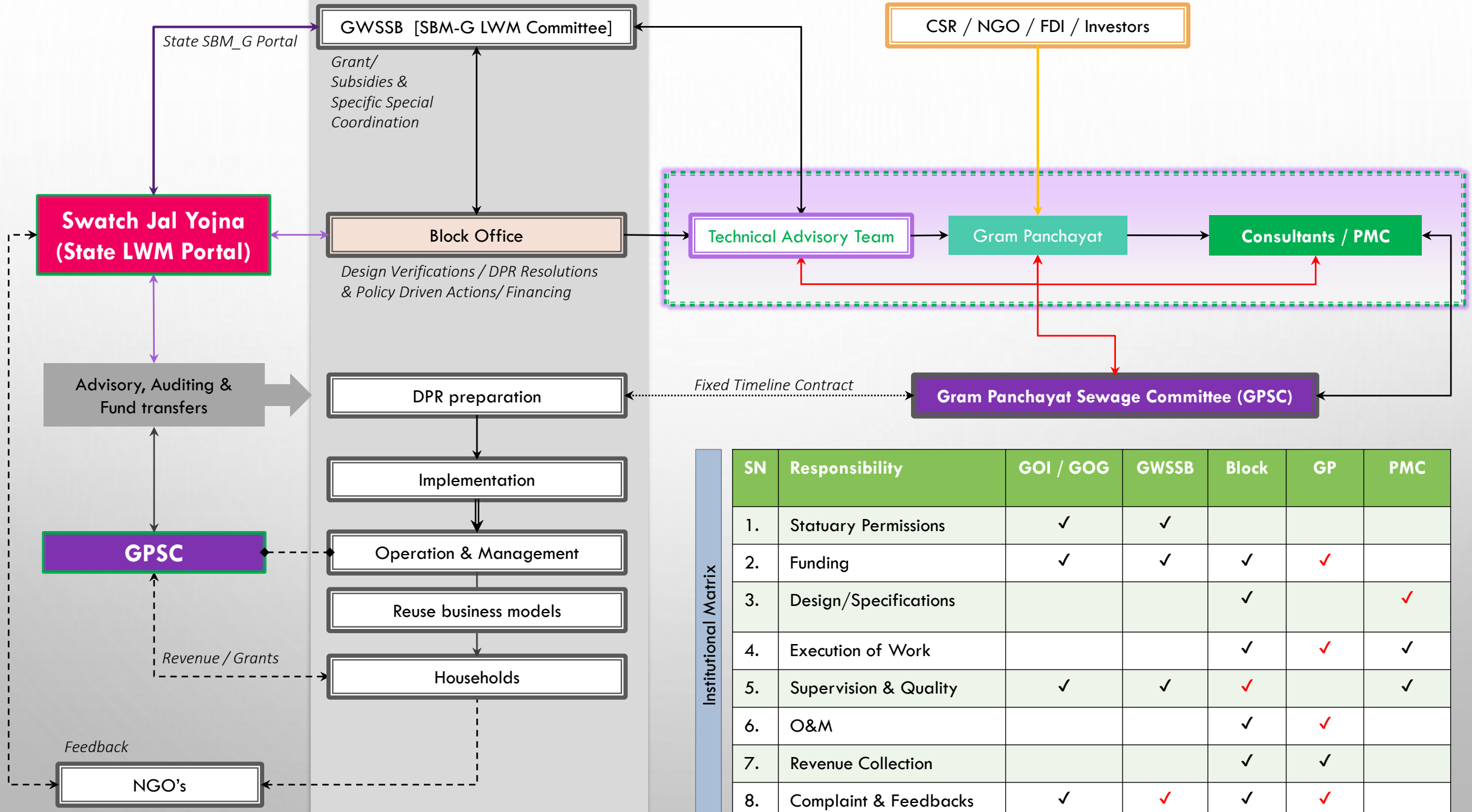


Operation



Institution and Finance Analysis

INSTITUTIONAL FRAMEWORK



Institutional Matrix

SN	Responsibility	GOI / GOG	GWSSB	Block	GP	PMC
1.	Statuary Permissions	✓	✓			
2.	Funding	✓	✓	✓	✓	
3.	Design/Specifications			✓		✓
4.	Execution of Work			✓	✓	✓
5.	Supervision & Quality	✓	✓	✓		✓
6.	O&M			✓	✓	
7.	Revenue Collection			✓	✓	
8.	Complaint & Feedbacks	✓	✓	✓	✓	

SBM-G's15th FC provisions for national

The government of India has approved,

Swachh Bharat Mission (Grameen) Phase-II.

To support villages with the sustainability of ODF outcomes and arrangement for solid and liquid waste management by 2024-25.

The 15th Finance Commission has recommended an allocation of Rs.2,36,805 Crore to rural local bodies (RLBs) for the period 2021-22 to 2025-26,

Year-wise allocation of tied grant for water supply & sanitation services

(Amount in Rs. Crore)

Year	Tied grant		
	Water	Sanitation	Total
2021-22	13,470	13,470	26,940
2022-23	13,954	13,954	27,908
2023-24	14,106	14,106	28,212
2024-25	14,940	14,940	29,880
2025-26	14,572	14,572	29,144
	71,042	**71,042**	**1,42,084**

Indicative list for Liquid waste management activities for the source of funding:

Components	Source of fundings				
	SBM2.0	15th FC	MGNREGS	CSR/Business Models	Beneficiary
Creation of Silt, Oil & Grease chamber for pre-treatment of Liquid waste before channelizing into community Liquid waste management system	✓	✓	✓		
Soak pits	✓	✓	✓		
Liquid waste Management Systems (WSP)	✓	✓			
Liquid waste management systems such as Waste Stabilisation Ponds, Constructed Wetlands, DEWATS, or any other technology suitable for local conditions	✓	✓		✓	
Drainage Channels		✓	✓		
O&M for GWM		✓		✓	

Allotments for Liquid waste Management into villages under 15th FC

Components		Financial Assistance	
Liquid waste Management Activities		Village Size - population	Financial Support
	Village Level	Up to <5000	Up to Rs. 280 per capita
		5000< above	Up to Rs. 660 per capita
		• 30% of this amount will be borne by GP's from 15th FC grants. • Every village can utilize about Rs. 1 Lakh for GWM as per their requirements	
IEC and capacity building	Up to 5% of the total funding for programmatic components (up to 3% to be used at state/district levels and up to 2% at central level)		
Flexi funds	States can use Flexi funds as per Ministry of Finance guidelines issued in this regard, from time to time for innovations/technology options at the state level to meet the local needs and requirements within the The overall objective of the scheme		

Source: SBM(G)2.0 Manual | Manual for the utilization of the 15 Finance Commission tied grants to Rural Local Bodies/ PRIs for water & sanitation (2021-22 to 2025-26) | https://pib.gov.in/PressReleasePage.aspx?PRID=1603628

SBM-G & 15th FC allocations for Gujarat for SLWM

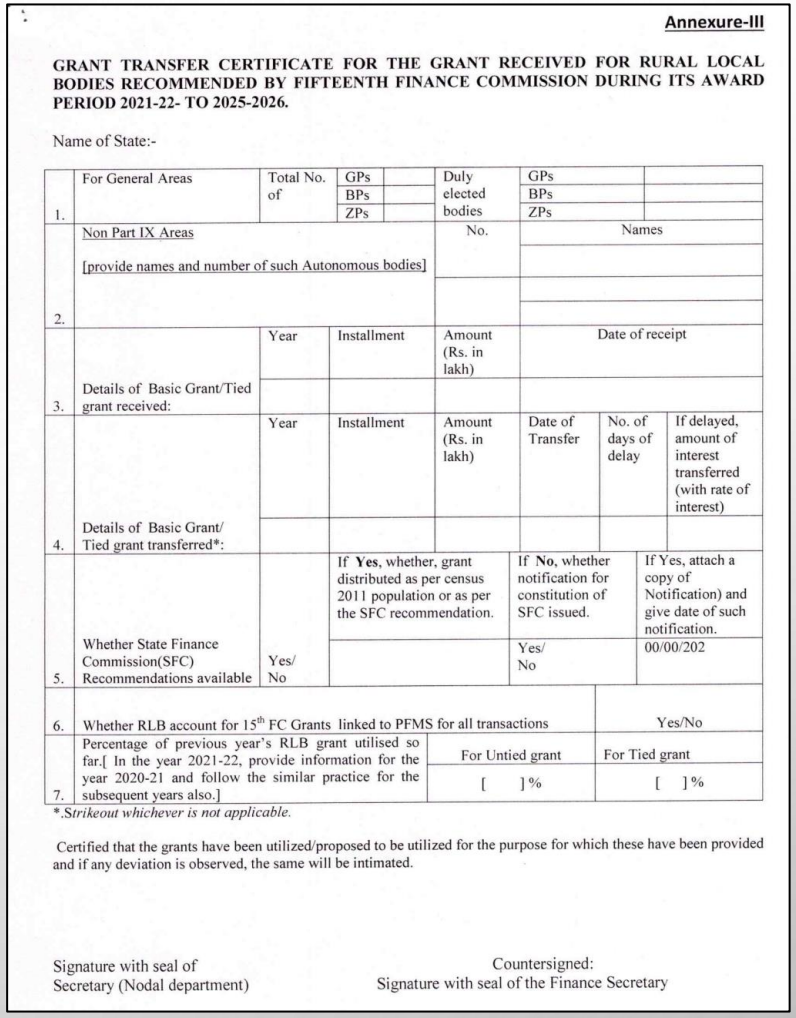
15th FC basic grants for Rural Local Bodies of Gujarat (40% of RLB grants) (Rs. In crore)

Sno	State	2021-22	2022-23	2023-24	2024-25	2025-26	Total
1.	Gujarat	944.8	978.4	989.2	1047.6	1022	4982

15th FC Tied grants for Rural Local Bodies of Gujarat (60% of RLB grants) (Rs. In crore)

Sno	State	2021-22	2022-23	2023-24	2024-25	2025-26	Total
1.	Gujarat	1417.2	1467.6	1482.8	1571.4	1533	7473

A huge allocation of funds is in the pipeline, an adequate portal for its utilization towards SLWM can bring a great change.



Annexure-III

GRANT TRANSFER CERTIFICATE FOR THE GRANT RECEIVED FOR RURAL LOCAL BODIES RECOMMENDED BY FIFTEENTH FINANCE COMMISSION DURING ITS AWARD PERIOD 2021-22- TO 2025-2026.

Name of State:-

1.	For General Areas	Total No. of	GPs / BPs / ZPs	Duly elected bodies	GPs / BPs / ZPs		
2.	Non Part IX Areas [provide names and number of such Autonomous bodies]			No.	Names		
3.	Details of Basic Grant/Tied grant received:	Year	Installment	Amount (Rs. in lakh)	Date of receipt		
4.	Details of Basic Grant/ Tied grant transferred*:	Year	Installment	Amount (Rs. in lakh)	Date of Transfer	No. of days of delay	If delayed, amount of interest transferred (with rate of interest)
5.	Whether State Finance Commission(SFC) Recommendations available	Yes/ No	If **Yes**, whether, grant distributed as per census 2011 population or as per the SFC recommendation.	If **No**, whether notification for constitution of SFC issued.	If Yes, attach a copy of Notification) and give date of such notification.		
				Yes/ No	00/00/202		
6.	Whether RLB account for 15th FC Grants linked to PFMS for all transactions				Yes/No		
7.	Percentage of previous year's RLB grant utilised so far.[In the year 2021-22, provide information for the year 2020-21 and follow the similar practice for the subsequent years also.]			For Untied grant [ ]%	For Tied grant [ ]%		

**.Strikeout whichever is not applicable.*

Certified that the grants have been utilized/proposed to be utilized for the purpose for which these have been provided and if any deviation is observed, the same will be intimated.

Signature with seal of Secretary (Nodal department)

Countersigned: Signature with seal of the Finance Secretary

Source: SBM(G)2.0 Manual | Manual for the utilization of the 15 Finance Commission tied grants to Rural Local Bodies/ PRIs for water & sanitation (2021-22 to 2025-26)

Design & verification guidelines for Gram Panchayat

The volumetric result to design preparation generated via the LWM app toolkit

Toolkit App results would be directed to both the Block and Village for verification

Design-based Survey, Structural detailing, Geotechnical, and Cost Estimation report to be prepared as per DPR procedures following the latest SOR.

Via a Systematic universal Template has to be adapted as per the yearly Schedule of the rate of that time.

Financing request audit request to be put to block via the app

Geotagging must be done only via allocated bonafide surveyor of the block

Gram Panchayat Sewage Committee (GPSC)

Data to be immediately uploaded to IMIS to avail the village certification report of ongoing sequential phase

Design & verification guidelines for Block

Volumetric Assessment of various components as per App Toolkit results generated at block end:

Toolkit App results would be directed to both the Block and Village for verification

Structural, Geotechnical, and Cost Estimation report to be analyzed as per DPR procedures.

Via a Systematic universal Template has to be adapted as per the yearly Schedule of the rate of that time.

Financing release to be verified only via Audit Geotagging of each phase, and approval of IMIS

Geotagging must be done only via allocated bonafide surveyor of the block

Gram Panchayat Sewage Committee (GPSC)

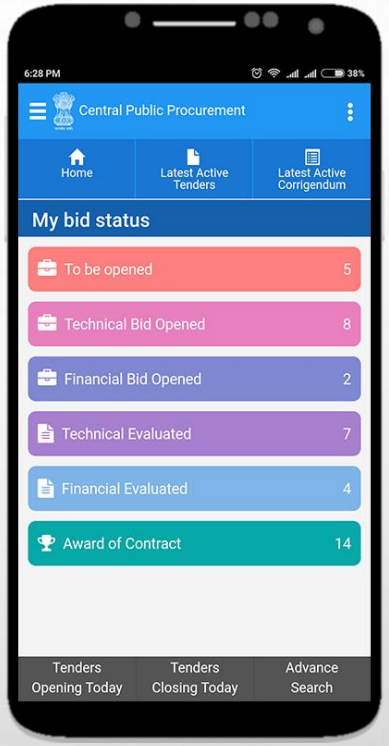
Approval from the Chief officer's Office of the block

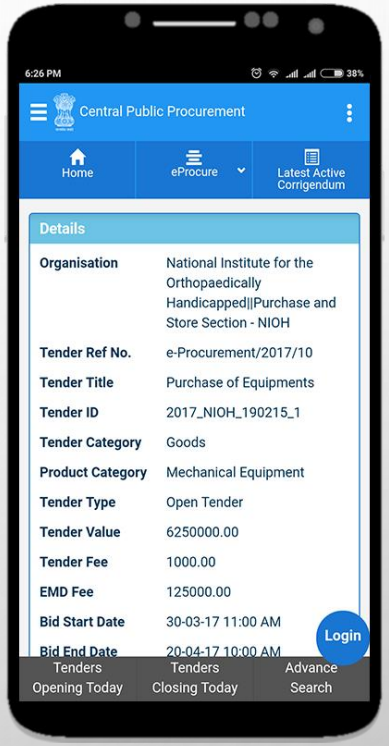
Data to be immediately uploaded to IMIS to avail the village certification report of ongoing sequential phase

E-procurement gateway via LWM app

Towards working for Atma Nirbhar Bharat,
Our scaling up would need its own smoother & adequate user-friendly e-procurements

1. Consultant Verification and Registration
2. Tender Notice
3. Tender Application
4. Verification
5. Bid Management

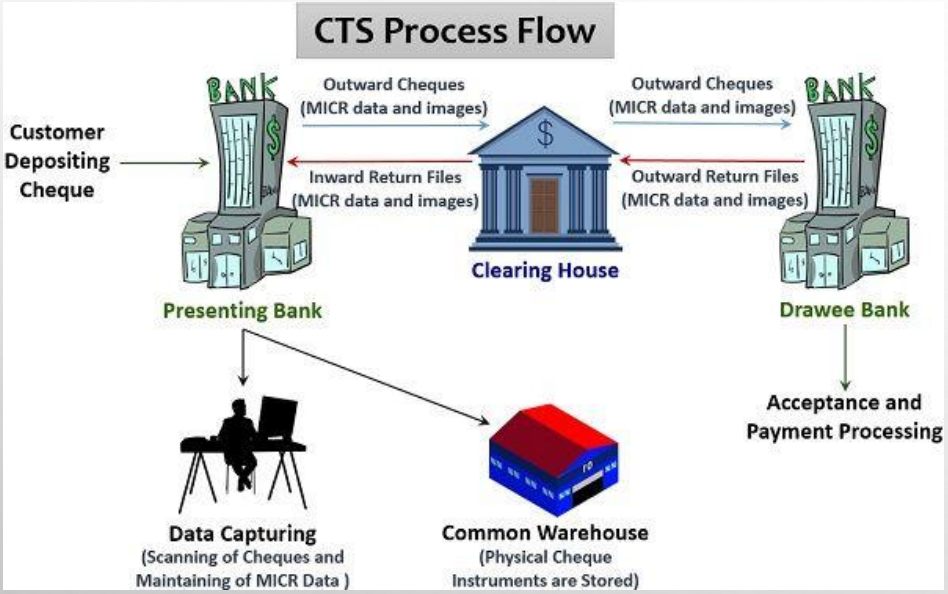




Source: Government eProcurement System of National Informatics center

UPI based Payment gateway & Phase wise finance monitoring

Towards working for Atma Nirbhar Bharat,
Our scaling up would need a smoother transaction portal for easing up the e-procurements & implementation.



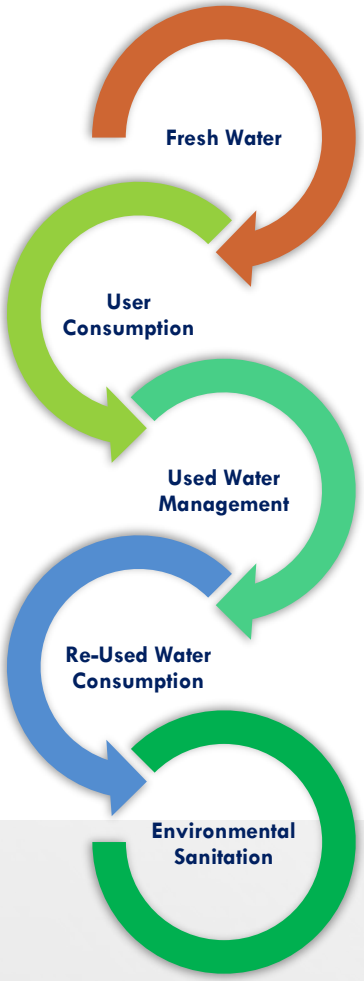
Old & Slow process, have multiple barriers of issues

Faster Transactions and speed up in scaling up and revenue collection

Next Steps in the To-do list for Implementation

1. Formation of Technical Advisory team as per suggested Implementation framework
2. Preparation of Swatch Jal Yojna IMIS portal app
3. Registration of app into all Villages & their profile updating works
4. Collaboration of GPSC within the portal
5. Preparation of DPR
6. Verification of DPR via block & technical advisory team
7. Implementation of the projects
8. IMIS monitoring of phases of the projects
9. Funding and phase-wise certification of villages as within the portal line
10. Monitoring and operation regulation functioning within controlled policies
11. Revenue model project preparations and implementations
12. Revenue and resources generation
13. Monitoring of water quality, quantity, and stock quantum per quarter

Swatch Jal Yojna



Wealth from Waste: The Tribune India

Villages in Karnal learn the five-pond system to reuse the dirty village pond water for farm and fisheries. The traditional 'johad' is giving way to cleanliness as well as confidence among villagers

Facelift: The area around a pond of untreated and accumulated water now has a park, open gym and other recreational facilities at Kurak Jagir Village in Karnal. Tribune photos: Sayeed Ahmed

The holistic approach aims to achieve equitable habitation and complete environmental sanitation by safely managing the used water loop toward sustainable rural development.

CWAS CENTER FOR WATER AND SANITATION | CRDF | CEPT UNIVERSITY | FP FACULTY OF PLANNING

THANK YOU

PUSHPAK SAHU | PUI200022
LIQUID WASTE MANAGEMENT IN RURAL AREAS

Figure 6. Microfinance Value Chain

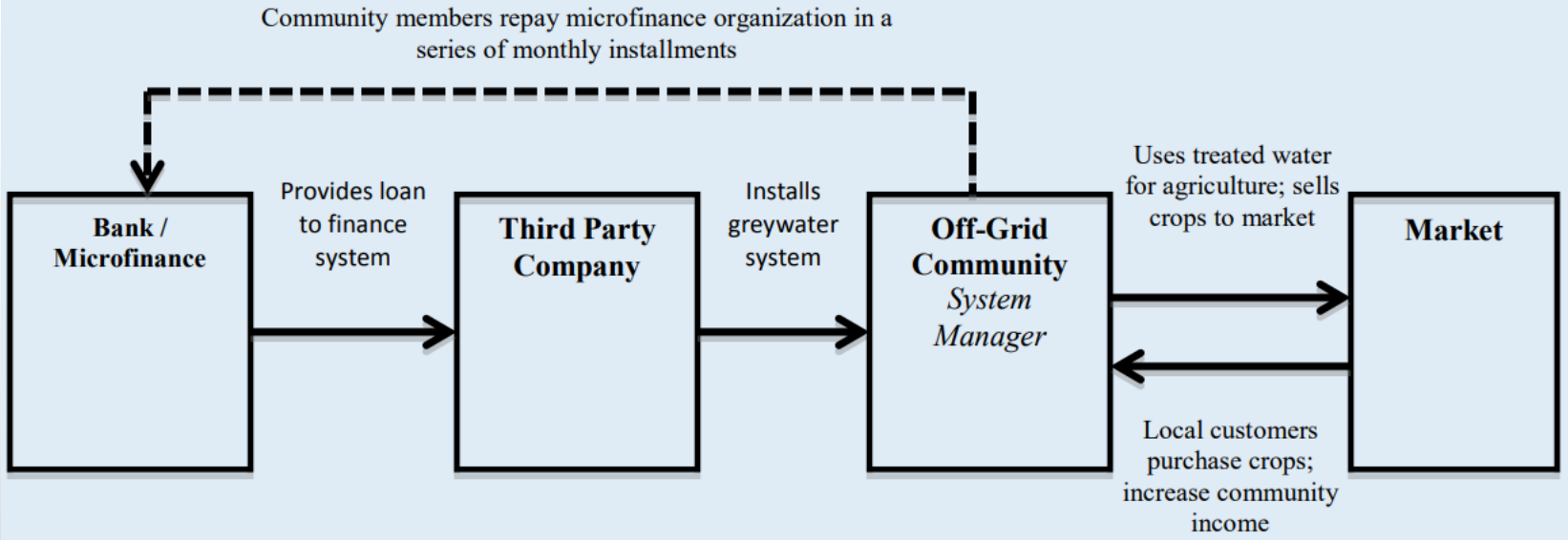


Figure 7. Third Party Management Value Chain

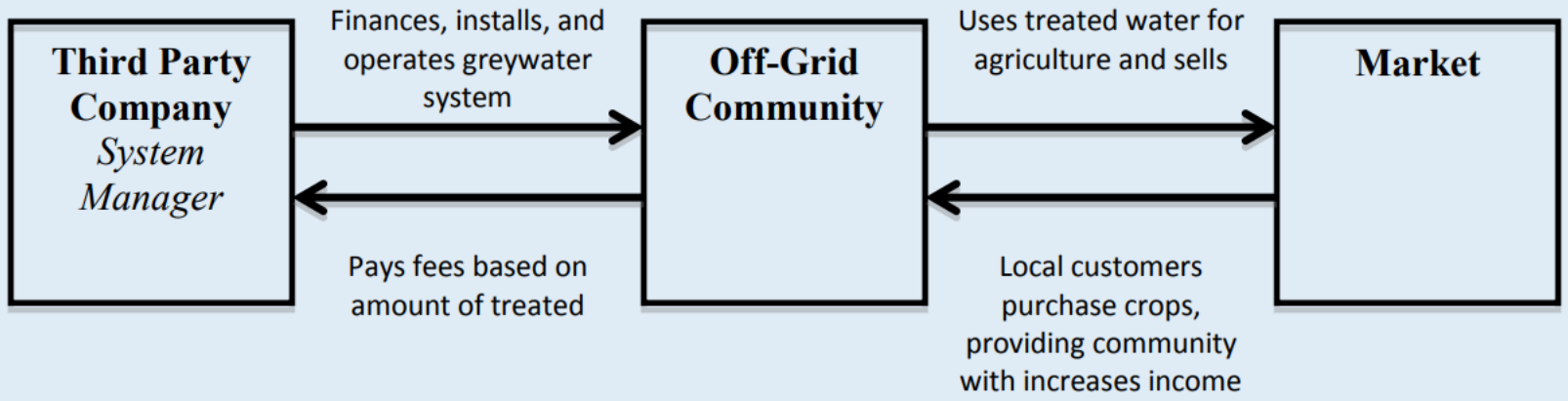
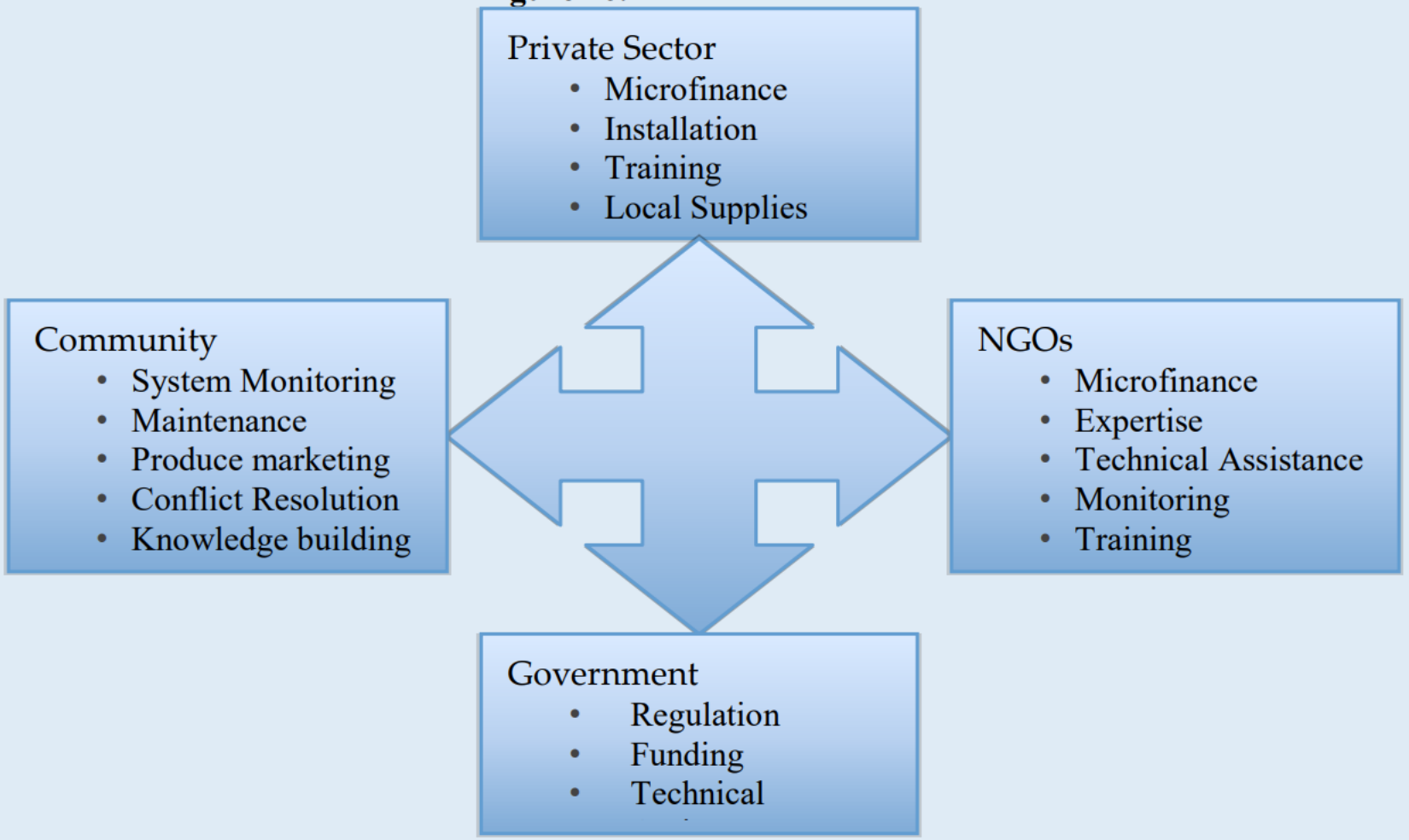


Figure 16. Stakeholder Network



Appendix B. Decentralized Systems Cost Analysis

										O&M Estimation				
Project	Area	Capacity (m3/d)	Capacity (m3/yr)	Population Served	Households (estimate)[6]	Total Investment Cost ($)	Investment Cost ($/m3/d)	Investment Cost ($/person)	Investment Cost ($/household)	Estimated O&M Total ($/year)[5]	O&M ($/person/year)	O&M ($/m3)	O&M ($/household/year)	Components
Hal Hull Project[1]	WB	1	365	7	1	4,408	$4,408	$629.71	$4,408.00	$661.20	$94.46	$1.81	$661.20	Household Greywater System
Beit Hasan[1]	WB	100	36,500	8,000	1143	310,000	$3,100	$38.75	$271.25	$46,500.00	$5.81	$1.27	$40.69	Village level WWTP
ARIJ System[2]	WB	1	365	10	1	4,000	$4,000	$400.00	$2,800.00	$600.00	$60.00	$1.64	$420.00	Small Scale Onsite WWTP (treats blackwater water)
AIES Schoolhouse[3]	Israel	1.5	548	10	1	10,000	$6,667	$1,000.00	$7,000.00	$1,500.00	$150.00	$2.74	$1,050.00	Household Greywater System
Nuba Project[4]	WB	120	43,800	2000	500	$125,000	$1,041.67	$62.50	$250.00	$7,500.00	$3.75	$0.17	$26.25	Village level WWTP, Wetland
Hajja[4]	WB	40	14,600	1500	375	$30,000	$750.00	$20.00	$80.00	$4,725.00	$3.15	$0.32	$22.05	Village level, Constructed Wetland
Nahhalin Project[4]	WB	50	18,250	1300	325	$135,000	$2,700.00	$103.85	$415.38	$27,000.00	$20.77	$1.48	$145.38	Village Level WWTP, Activated Sludge
					Avg	$88,344.00	$3,238.05	$322.12	$2,174.95	$12,640.89	$48.28	$1.35	$337.94	
					stdev	$112,807.21	$2,042.38	$375.68	$2,691.74	$17,579.95	$56.56	$0.88	$395.94	
					median	$30,000.00	$3,100.00	$103.85	$415.38	$4,725.00	$20.77	$1.48	$145.38	

Notes:

1- Data obtained from PWA Annual Status Report, 2011

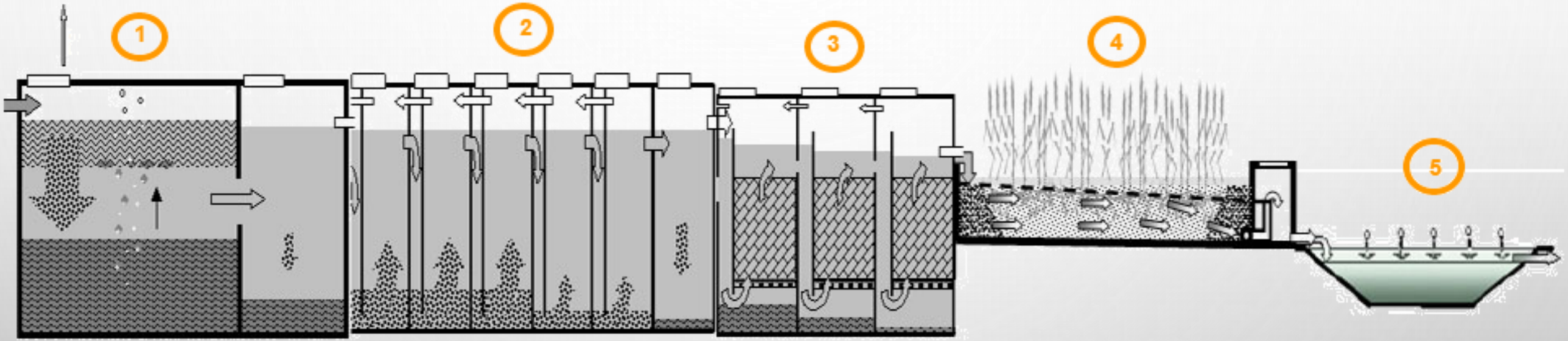
2- Data obtained from Spanish Agency for International Development Cooperation, 2011

3- Estimates based on data provided by AIES

4- Data obtained from Spanish Agency for International Development and Cooperation

5- Assumes 15% of investment cost when data not known

6- Assumes 7 people per house


1
2
3
4
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Vision

1. **Integrate Schedule of Rates with the toolkit for abstract block costing**
2. **Building Institutional Matrix that may work for the solution**
3. **Design the app flow formations as much possible and conclude as report for the DRP**

Grey Water Management Component of IMIS SBM-G 2.0

Grey Water Management

Main components are (Including MNREGA):

- Community Soak Pits/Leach Pits/Magic Pits (including MGNREGS)
- Drainage Facility available in Village(other than MGNREGS)
- Community Grey Water Management Systems

Department of Drinking Water & Sanitation

Monitoring development and finances via the mobile app into MIS

Source: SBM- G- MIS App Screenshot for Greywater management section.