

GREY WATER TREATMENT

A Brand of Adhunika Enterprises

Abstract

- Grey water is defined as effluent from potable water used in the household and commercial establishments for all purposes other than toilet flushing.
- Hence the term Grey Water. Water containing sewage is called black water.
- Grey water typically consists of water for used for cleaning, bathing, laundry, dish washing & floor washing.
- Grey Water typically constitutes about 65 % of the total water used for domestic consumption.
- Per Capita consumption of water ranges from 160 liters to 170 liters.



About Vasudha Aqua

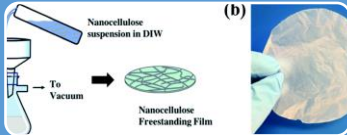
Early Research, Unique Value Proposition, Current Status

Vasudha Aqua



Sponsored research with ERI institute at Loyola College , Chennai

- Research Commenced in 2018.



Developed the process and a prototype for treatment of grey water

- Tested the prototype for over a year for repeatability, ruggedness and reliability of the process



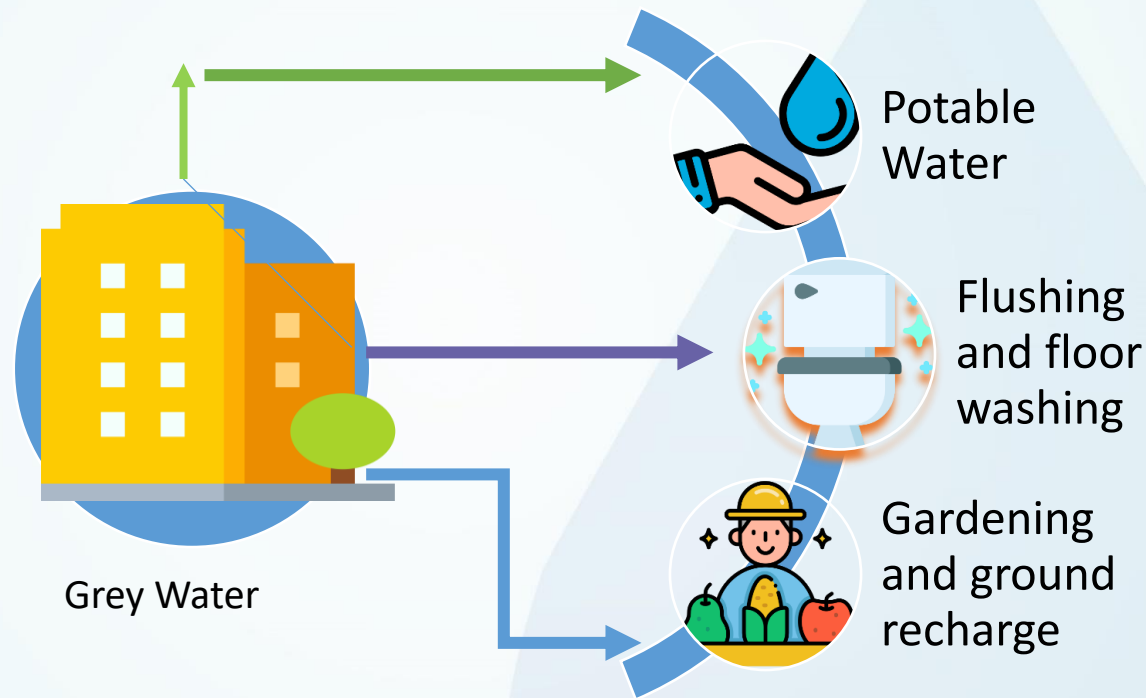
Patent Applied - Process Patent granted on March 15, 2023 . Method for treatment of grey water.

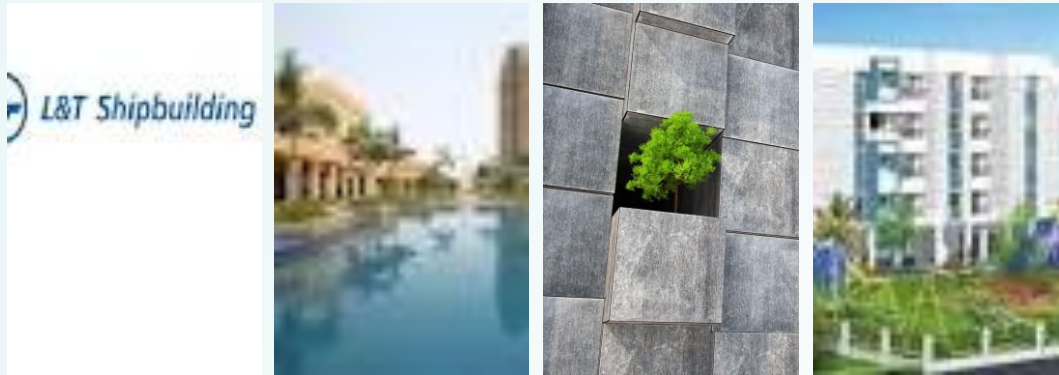


Focus on real time, online treatment of grey water using physical unit operations rather than unit processes. Treated Grey Water tested on Marine Life, and Plants.

Technologies for Grey Water Treatment

Today we have the process for treatment of grey water for different end uses.





Fast Forward to 2022

- Installed Plants ranging from 1500 liters per day to 190 KL per day.
- Pilot plant for conversion of grey water to potable water standards.
- Installations working for over two and half years now.
- Some Marquee customers
- L&T Shipbuilding, DABC Apartments, Shobha City , Shreeyas

What is unique about our system



Only system that treats the grey water online on a real time basis.



Our system works on a gravity feed and does not rely on any prime movers for the treatment .



The process does not use any chemicals for treatment or processing the grey water.



Can be retrofit into the existing drainage system and does not occupy any floor area nor does it require additional space.



The treated water can be used for recharging the ground water or used for gardening or recycled for flushing the toilets. We can if necessary provide a process for reusing the water for all household and commercial purposes other than drinking and cooking



The treated water meets the standards of Land for Irrigation as laid down by the Central Pollution Control Board.



The system is designed to prolong the life of the filters by a simple system of back washing.

Why Grey Water Treatment

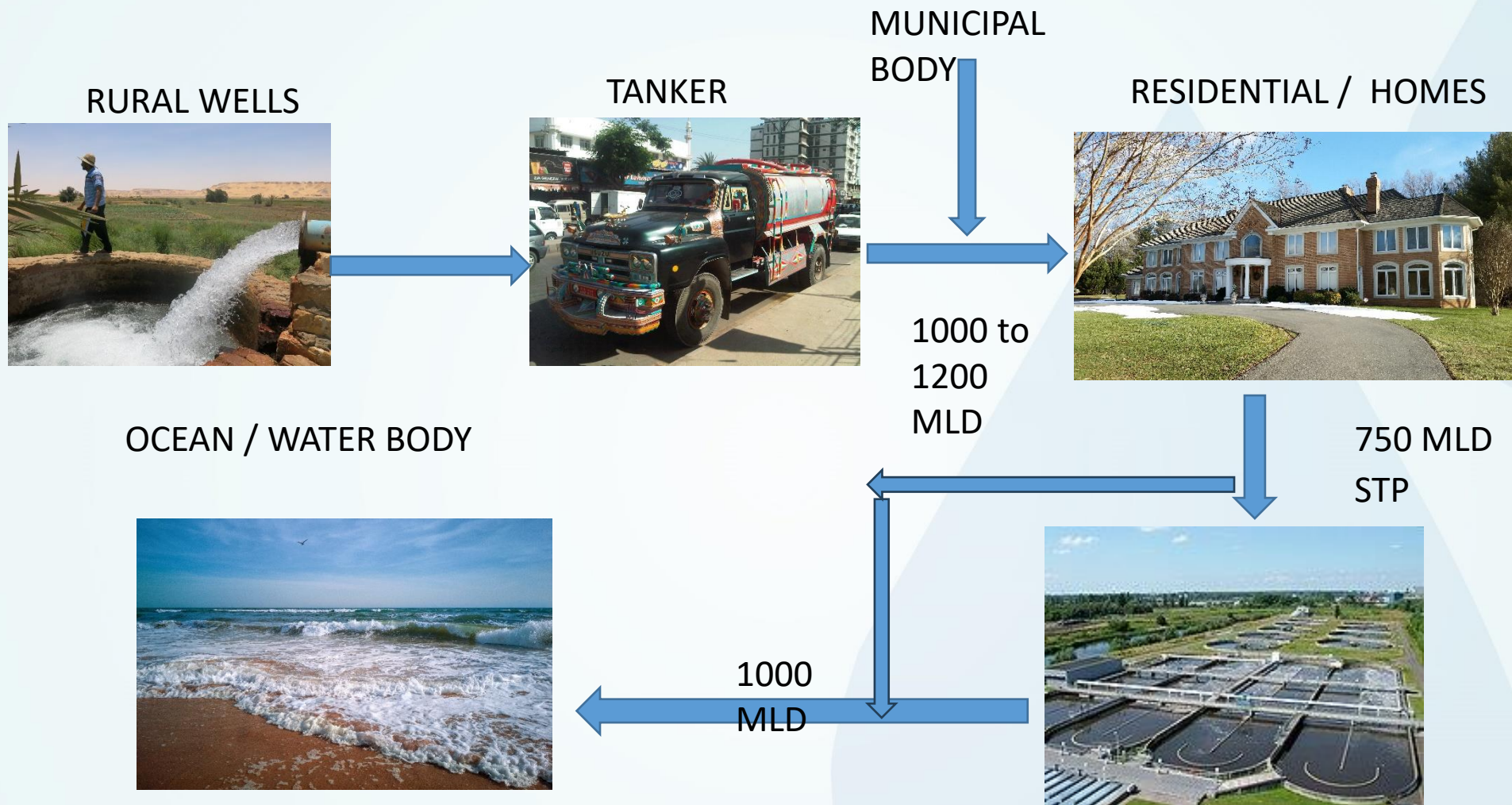
Grey Water constitutes about 65 % of the total domestic effluent.

Has 10% of the pathogen and bacterial load of black water.

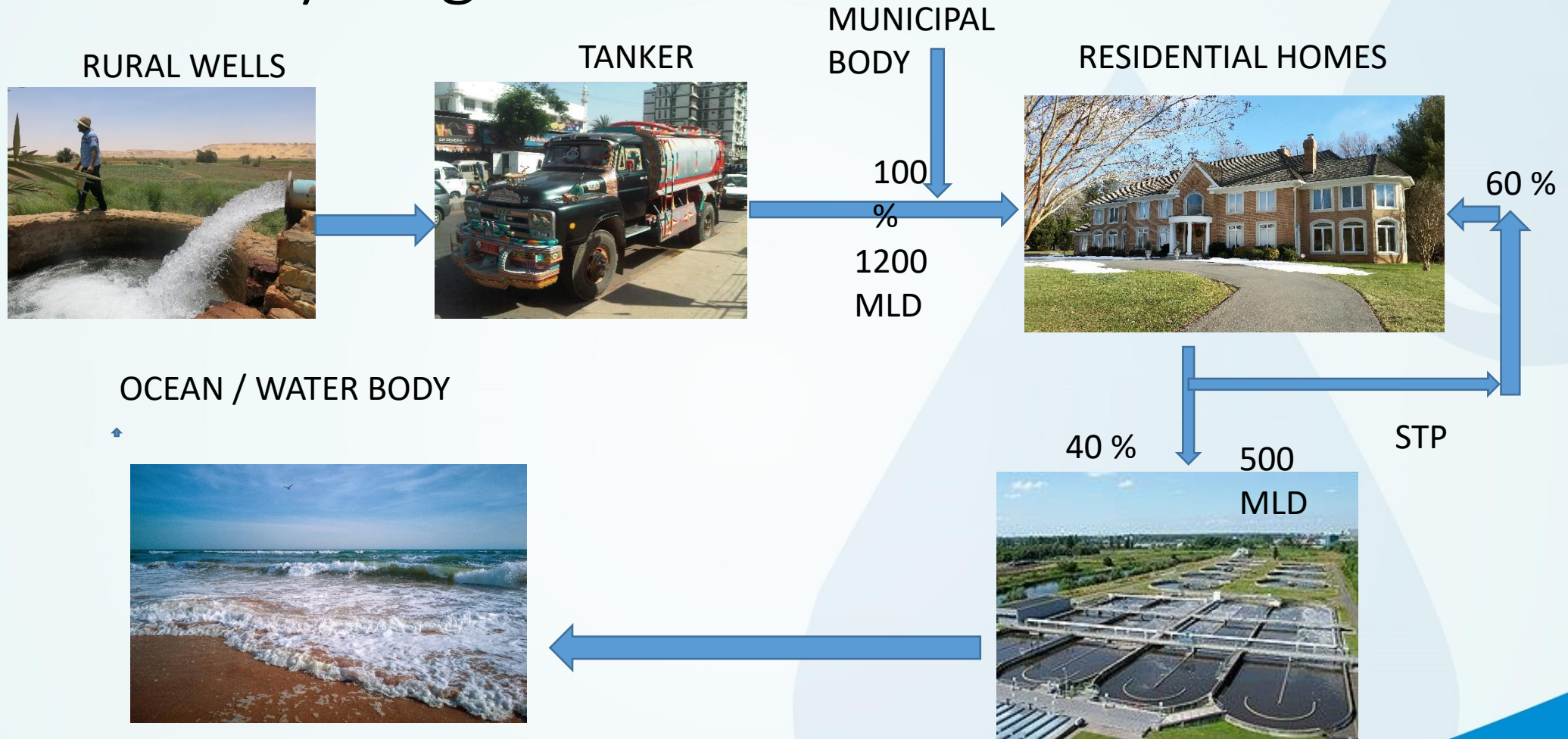
Has a BOD that is $1/4^{\text{th}}$ of the black water.

Real time treatment of grey water lends itself to simpler methods of treatment.

Current scenario – Chennai Case Study



CHENNAI - With Grey Water Treatment and Recycling.



Typical Analysis of Grey Water

Based on Laboratory Analysis of Different types of Grey Water

	PARAMETER	VALUE
1	PH	7.0 TO 9.0
2	Dissolved Oxygen	1.5 to 2.0 ppm
3	Oil and Grease	1.15 to 2.20 grams / litre
4	BOD	50 to 75 ppm
5	COD	250 to 450 ppm
6	Phosphates as PO ₄	2.0 to 4 ppm
7	TDS	1100 to 2100 ppm

Installed grey water systems



IMPACT ON THE PUBLIC UTILITY SYSTEMS

- Water to be processed by the municipal sewage treatment boards can potentially reduce by at least 50 % of the present volume.
- Can shift to a decentralised model of dealing with waste water.
- Will help in improving the quality of ground water.
- Dependence on tanker water supply will reduce substantially in cities and towns.
- Equitable distribution of water across the society is possible.



Grey Water Characteristics

- Grey Water Generally contains the following impurities

S no	Impurities	Details
1	Organoleptic and Physical Parameters	Colour, Odour, PH , Taste and Turbidity, TDS
2	General Parameters Concerning Undesirable Substances	Heavy Metals, Calcium and magnesium Salts present in the form of Sulphates, Nitrates and Carbonates . Reflected in COD
3	Bacteriological Impurities	BOD, E – Coli and Thermotolerant Coliform Bacteria and Total Coliform.

Typical Analysis of Grey Water and Sewage Water

Based on Laboratory Analysis of Different types of Grey Water

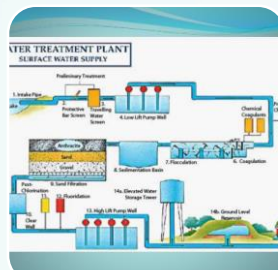
	PARAMETER	VALUE for GREY WATER	VALUE for BLACK (SEWAGE WATER)
1	PH	7.0 TO 9.0	6.5 TO 8.0
2	Dissolved Oxygen	1.5 to 2.0 ppm	0.15 TO 0.20 PPM
3	Oil and Grease	1.15 to 2.20 grams / litre	0.5 TO 0.75 grams /litre
4	BOD	50 to 75 ppm	300 – 350 ppm
5	COD	250 to 450 ppm	400 to 600 ppm
6	Phosphates as PO ₄	2.0 to 4 ppm	30-40 ppm
7	TDS	1100 to 2100 ppm	1000 to 2100 ppm
8	Pathogens and TTB	< 200 MPN/100 ml	>5000 MPN/100 ml

Grey Water to Potable Water

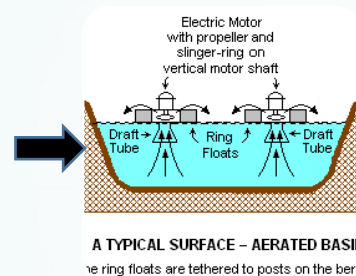
S NO	Treated Grey Water Application	Method Of Treatment	Remarks
1	Recharging Ground Water and Gardening	Sediment Removal, Oil and Grease removal, particulate matter removal and Odour removal perfunctory.	Meets Land For Irrigation Standards
2	Toilet Flushing and Floor Washing etc.	All steps outlined above plus Aeration for complete odour removal	
3	Bathing and Clothes washing.	All steps outlined above plus mineral filter and disinfection by UV or Ozonisation.	Will meet standards for Bathing Water Designated Class B water usage.
4	Complete Potability to include drinking and Cooking.	All steps outlined above plus softening.	Meets BIS 10500 standards subject to input raw water analysis.

SCHEMATIC FLOW DIAGRAM

PROCESS STEPS OPTIONS DEPENDING ON END USE

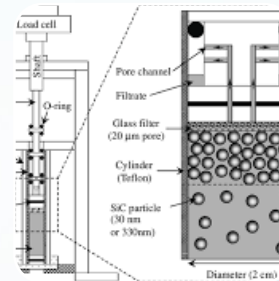


SEDIMENT , AND OIL AND GREASE SEPARATION



AERATION

Increase in DO content. Odour Elimination



MINERAL AND CARBON FILTER AND OR SOFTENER

- Removes heavy metals, Reduces BOD and COD.



UV TREATMENT OR OZONATION
ELIMINATION OF BACTERIA

LABORATORY ANALYSIS OF TREATED GREY WATER

VASUDHA AQUA



S. No.	Sample	Date	pH	BOD (ppm)	COD (ppm)	PO ₄ ²⁻ (ppm)	TDS (ppm)	Colour and odour	DO (ppm)	Oil and grease (ppm)
1	TAP WATER FRESH FOR POTABLE USE	25.06.19	7.27	11.8	89.3	0.1	1890	No	4.7	0.09
2	TREATED GREY WATER FOR GROUND RECHARGE		7.23	32.5	121.4	0.04	1680	Negligible	3.6	1.4
3	TREATED GREY WATER FOR POTABLE USE		WILL	MEET	BIS	10500	STANDARDS			

📍 1A, Chella Villa, 19, East Road, West CIT Nagar, Chennai - 35

☎ +91 9384095796 ✉ sales@vasudhaaqua.com

Laboratory Analysis of STP Upgraded Water.

Report No.	GCS/W/ 2184 /2020-2021			Report Date	10.08.2020
Company Name & Address	M/s. Larsen & Toubro Limited, L&T Shipbuilding Kattupalli Village, Ponneri Taluk, Thiruvallur District Pin – 600 120				
Sample Description	Labor Colony STP Treated Water Reuse System Outlet	Sample Received on			03.08.2020
Sample Collected by	GCSPL	Test Commenced on			03.08.2020
Sample Collected Date	03.08.2020	Test Completed on			08.08.2020
Sl.No	PARAMETER	UNITS	RESULTS	REFERENCE METHOD	Tolerance Limits for discharge of Sewage into Inland Surface Water
1	Odour	-	Unobjectionable	IS 3025 /P 5 /1983 Reaff.2006	--
2	pH@ 25 ^o C	-	7.42	IS:3025/P11/1983 Reaff 2006	6.5 to 9.0
3	BOD (for 3 days at 27 ^o C)	mg/l	9.0	IS:3025/P44/1993 Reaff 2009	20
4	Total Suspended Solids	mg/l	6.0	IS:3025/P17/1984 Reaff 2006	50
5	Total Hardness as CaCO ₃	mg/L	185	IS 3025 /P 21/1983 Reaff.2006	--
6	Total Alkalinity as CaCO ₃	mg/L	127	IS:3025/P23/1986 Reaff 2009	--
7	Iron as Fe	mg/L	0.07	IS: 3025/ P 53/2003(Reaff.2009)	--
Bacteriological Parameters					
8	E. coli	MPN/100ml	Absence	IS:1622-1981 Amd.4 RA 2009	--
9	Total Coliform	MPN/100ml	Absence	IS:1622-1981 Amd.4 RA 2009	--
10	Fecal Coliform	MPN/100ml	Absence	IS:1622-1981 Amd.4 RA 2009	1000

For Green Chem Solutions Pvt.Ltd
(Laboratory Division)

Treated STP Water vs Treated Grey Water

PARAMETER	STP TREATED WATER	TREATED GREY WATER
END USE – POTABLE PURPOSES OTHER THAN DRINKING AND COOKING	Reuse for Potable purposes is a challenge owing to user aversion	Reuse for potable purposes is less of challenge for uses other than drinking and cooking. User acceptance is better.
CAPITAL COST	For gardening and Flushing the Capital cost is at least 3 times higher than Grey Water treatment	Capital Cost is 3 times lower than STP capital costs if end use is gardening and flushing
PLANT CAPACITY	As built does not any flexibility to treat harvested rain water.	Plant would have sufficient capacity to process harvested rain water as well and use it for all potable purposes other than cooking and drinking.

Treated STP Water vs Treated Grey Water

PARAMETER	STP TREATED WATER	TREATED GREY WATER
PROCESSING COST	At least 3 times higher than for grey water treatment	At least 30 % of the cost of STP water.
MAINTENANCE COSTS	Higher than for Grey Water plants	Lower than for STP plants.

Grey Water – Treatment and Recharge – Impact



INDICATOR	DATA	REMARKS
Quantity of Water recharged per day from Grey Water Treatment.	9 mm of rain per day	Calculation based on a plot of 9600 sq. ft having 18 flats with 72 residents. Per capita Consumption is 160 litres with 70% grey water.
Grey Water plus Rain water harvested (RWH) contribution to total water usage	This can be equal to 87 % of the total water used by the complex.	Assumes that all Grey Water is recharged and rain water collection systems are in place for a typical residential apartment. Assumes a rain fall of 1000 mm per annum for a city like Bangalore.
Combined effect of Grey water and RWH.	This is equivalent to 11.4 mm of rain per day.	

Grey Water Treatment – Capital Cost

CAPITAL COST	INVESTMENT PER APARTMENT	REMARKS
One time Capital Cost for each apartment for treating and Recharging Grey Water	Rs 5500 to Rs 6000/ Apartment.	This is an indicative figure for 10 to 15 numbers of 3 BHK apartments who have segregated the grey water lines and have a common collection point. Does not include RWH costs.
One time Capital Cost for each apartment for treating and Reusing Grey Water.	Rs 6500 to 7000/ Apartment	This is an indicative figure for 10 to 15 numbers of 3 BHK apartments who have segregated the grey water lines and have a common collection point. Water can be used for all potable purposes other than drinking and cooking.

Cost of Grey Water Treatment – Price Comparison



SOURCE	COST PER KL	REMARKS
Treated Grey Water for Gardening .	Rs 6 (0.006/litre)	Assuming 20% of Capital Cost as Interest and Depreciation cost and Rs 600/ apartment as annual maintenance cost.
Treated Grey Water for Potable purposes	Rs 19 (0.019/litre)	With Ozonation and Ultrafiltration .
Piped Corporation Water Bangalore	Rs 7 (0.007/litre)	As published by BMC
Tanker Water as supplied by Bangalore Corporation	Rs 90 (0.09/Litre)	As Published by BMC.
Private Tanker Water	Rs 75 – 150 (0.075 to 0.16/litre)	Trade Data

Capital and Processing Cost Indications

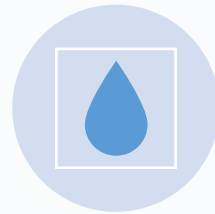
- GREY WATER TREATED TO POTABLE WATER STANDARDS – 250 KL/DAY



CAPITAL COST -
5.25 RS /KL



PROCESSING COST
14.25 RS / KL



TREATED WATER
COST 19.50 RS/KL



CAPITAL COST – 33
LAKHS



COMPONENT COSTS
AS OF JULY 2021

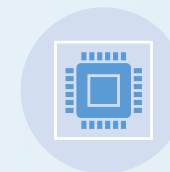
Capital and Processing Cost Indications Grey Water for Non-Potable Purposes



GREY WATER TREATED FOR
NON-POTABLE STANDARDS
– 250 KL/DAY



Capital Cost – 4.40 Rs/kl



Processing Cost – 14.00 Rs
/kl



Treated Water Cost – 18.40
Rs/kl



Capital Cost – 30 Lakhs



Component Costs as of July
2021

Capital Cost Considerations – STP vs Grey Water

CASE STUDY - 500 KLD STP

STP PLANT FOR 500 KLD – 68 LAKHS

CIVIL WORK COSTS – 40 LAKHS

TOTAL COST – 108 LAKHS

COSTS AS OF SEP 2021

300 KLD GREY WATER PLANT PLUS 200 KLD STP

300 KLD GREY WATER PLANT – 32 LAKHS

200 KLD STP – 28.17 LAKHS

CIVIL WORK FOR 200 KLD STP-17.00 LAKHS

TOTAL COST – 78 LAKHS

SAVINGS – 27 %

COSTS AS OF SEP 2021

Reduce. Reuse. Recycle.



Grey Water System & Rainwater Harvesting System

www.vasudhaaqua.com