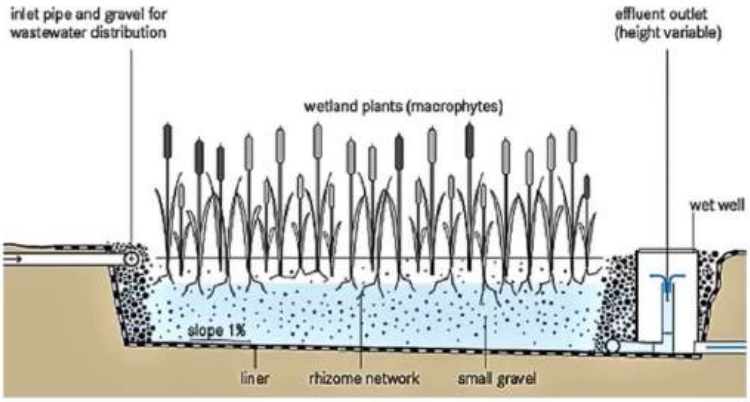
Horizontal subsurface flow Constructed

Introduction

Horizontal flow Constructed Wetlands are human-made systems with Natural Based sustainable solutions that utilise natural processes involving soil, vegetation, and microbial communities for wastewater treatment. Constructed wetlands are relatively inexpensive to build and can be easily operated and maintained even by the community. These systems are filled with gravel or metal chips and planted with wetland vegetation. Wastewater passes through the system, and solids are trapped in filtering materials and digested by microorganisms. Constructed wetlands closely resemble natural wetlands in their treatment processes.

Functions of Constructed Wetland and Filter Bed



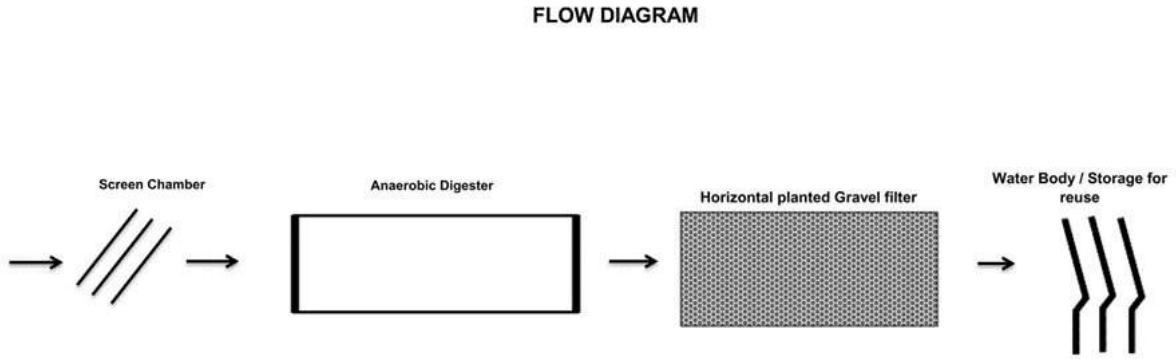
The filter bed serves several functions, including:

- Removing solids by acting as a filter
- Providing a stable surface for bacteria to attach to
- Serving as a foundation for vegetation and cultivation.

Microbial action in the root zone among atmospheric oxygen, plant roots and org

Technical Details

Components of Horizontal subsurface flow constructed Wetland
Anaerobic reactor



Horizontal flow Constructed Wetlands with Anaerobic baffled reactor

The constructed Wetland is designed to remove a BOD of up to 100 mg/L from the wastewater with the prerequisite of sedimentation.
The maximum organic loading rate on the cross-sectional area should be less than 150 gm/COD/m2/d for coarse sand and 20g COD/m2/d for fine sand.

Pollutant Removal Mechanisms in Horizontal subsurface flow constructed wetlands

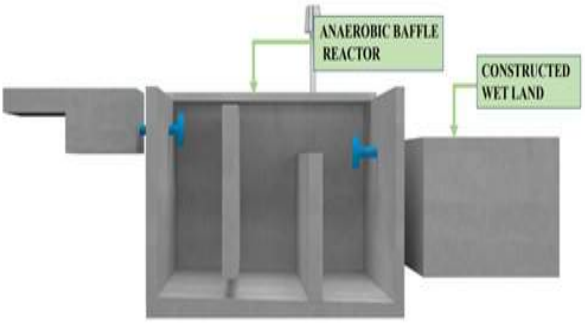
WASTEWATER CONSTITUENTS	REMOVAL MECHANISM
Suspended Solids	Sedimentation Filtration
Soluble organics	Aerobic microbial degradation Anaerobic microbial degradation
Phosphorous	Plant uptake Adsorption by filler materials

Nitrogen	Ammonification followed by microbial nitrification Nitrification and Denitrification Plant uptake Adsorption by filler materials Ammonia volatilisation (mainly in the SF system)
Pathogens	Sedimentation Filtration Natural die–off UV radiation Excretion of antibiotics from roots of macrophytes

Microbial action in Constructed Wetland: Plantation on top of the filter bed promotes microbial action between the greywater plant roots and atmospheric oxygen. The vegetation helps transfer a small amount of oxygen to the root zone, enabling aerobic bacteria to colonise the roots and degrade organic matter. The plant roots also play a crucial role in maintaining permeability in the filter layer and facilitating the passage of atmospheric oxygen into the filter bed. Any native plant with deep and broad roots that can thrive in a wet, nutrient-rich environment can be suitable for planting. Phragmites Australis (reed) is a common choice due to its ability to form horizontal rhizomes that penetrate the entire depth of the filter bed.

Debris Screen chamber: To prevent unwanted floating materials, such as dry leaves and plastics, from entering the downstream treatment units, a vertical bar screen is typically installed in the lead drain. Placing the bar screen at a 45-degree angle makes it easier to remove the floating materials.

Anaerobic Baffled reactor: Primary treatment separates the suspended matter by physical operations, mainly sedimentation. Raw wastewater contains suspended particulates heavier than water; these particles tend to settle by gravity under quiescent conditions. Primary treatment reduces suspended solids and organic load to the Wetland and also equalises raw wastewater quality and flow to a limited degree. Heavy inorganic particles, such as sand, grit, gravel and other solid materials, have much greater gravities than organic solids in the wastewater.



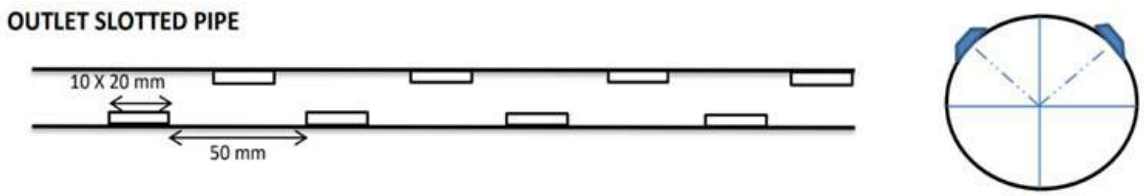
· **Inlet pipe:** It is recommended to use a perforated PVC pipe of 110mm in outer diameter for uniform distribution of greywater over the filter bed. The pipe should be fixed from 0.10m to 0.15m above the filter bed. The perforations on the pipe should be 10mm in diameter and spaced at 50mm intervals. To prevent sagging of the inlet pipe due to the weight of the pipe and the greywater collected inside,

the vertical supports should be provided at intervals of 1.5m to ensure that the pipe remains stable and maintains its proper height for effective distribution of greywater over the filter bed. The pipe ends should be capped for the periodic removal of algae.

Planted horizontal Filter bed: Planted Horizontal Filter bed consists of the following components:

- An inlet pipe made of 110mm OD PVC with perforations that span the entire width of the filter bed, designed for uniform distribution of greywater
- A filter bed chamber should have a depth of 90cm, constructed with a brick wall of 20 cm thickness and a concrete bottom. The length and breadth of the chamber will vary depending on the volume of greywater to be treated.
- The filter media height should be 0.6m with a minimum freeboard of 15cm.
- The bottom of the chamber should have a slope of 1 in 100
- Sieved broken stones of 20mm size are placed at both ends of the filter bed, with broken stones of 4mm to 8mm size filled in the middle
- Wetland vegetation, such as cattails, reed, and bulrush, are planted in gravel/metal chips of 4-8mm size at a density of 16-20 plants per square metre of the filter bed
- An outlet pipe of 110mm diameter PVC slotted pipe is used, extended outside the filter bed and vertically extended up to a height of approximately 15 cm below the top level of the filter bed, allowing the treated water to bubble out from the vertical pipe

- **Slotted Pipe Collector and Outlet pipe:** It is recommended to use a PVC perforated or slotted pipe with an outer diameter of 110mm as the treated wastewater collection pipe at the bottom of the filter bed for collecting and discharging the treated greywater to the reuse points. The collector pipe should have rectangular slots of 50mm x 25mm at 50mm spacing and should be wrapped with netting to prevent blockages. To maintain moisture in the filter bed for plant growth and to increase the retention time of the greywater in the filter bed, the outlet pipe should be extended outside the filter bed and further extended vertically up to a height of about 15 cm below the top level of the filter bed, allowing the excess treated greywater to overflow. Depending on site requirements, a collection chamber may also be constructed at the end of the outlet pipe for pathogens destruction such as chlorination, before discharging the treated water for recharge or reuse purposes. The pipe ends should be capped with detachable caps for the periodic removal of algae.



Operation and Maintenance

Do's:

- Install a bypass system to redirect stormwater during rainy seasons to prevent filter bed overload. The specific location for stormwater escape should be determined based on site conditions and local knowledge.
- Wait until a mature vegetation cover has been established before removing weeds during the first year.
- Regularly desludging the settler/anaerobic baffled reactor.
- Cut, weed, remove plants, and compost the wetland vegetation cover as necessary.
- Periodically clean and maintain the inlet and outlet structures to ensure subsurface flows.
- Inspect flow regulation and organic loadings to prevent clogging and take corrective action when necessary. Clean the filter media periodically based on performance.
- Use appropriate filter media with proper grain size and quality.
- Construct inlet and outlet structures and plumbing as necessary.

- For vertical flow constructed wetlands, ensure the distance between inlets is around 5m for uniform distribution over the filter media.
- Provide outlet structures that can control up to 15 cm flooding to promote desirable plant growth.
- Periodically clear any blockages that may occur.
- Yearly removal of end caps from the inlet pipe and distribution network for flushing out and to be cleaned thoroughly to remove slimes and blockages
- Check logging of substrate cleaning and replacing the same if necessary
- By monthly visual inspection of primary upstream treatment for structural integrity, quantity and quality of effluent.
- Visual inspection for adequate and uniform inflow and identification of blockages, damages, and maintenance as required.
- Removal of unwanted vegetation from the beds and cleaning of the inlet/ outlet systems (2 to 3 times per year)
- Desludging of settling tanks at the interval of 3 to 4 months
- The parts of the Wetland, like manhole covers, pipes, etc., must be protected from theft.

Don'ts

- Overloading horizontal filters should be avoided as it may lead to mosquito and insect problems.
- Garbage dumping on the filter bed should be prohibited.
- Discharging septic tank effluent through the lead drain should be avoided.

Monitoring

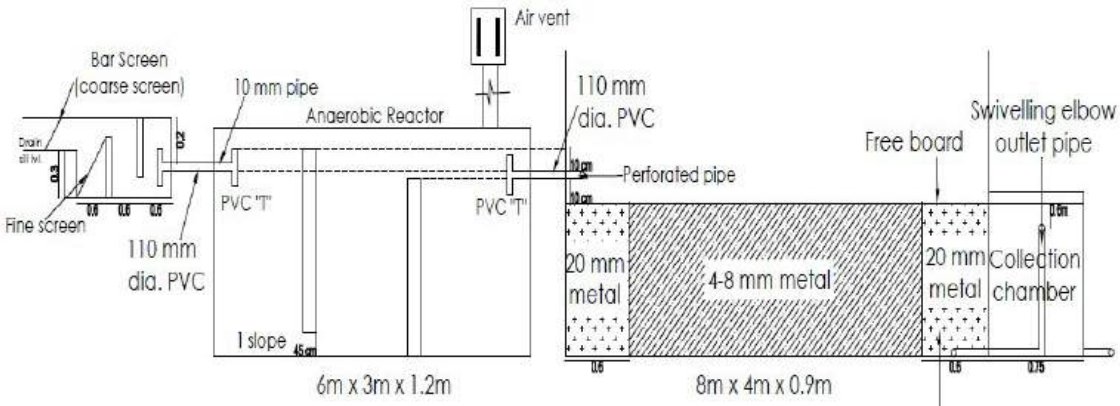
Checklist for inspection

- Make sure the vertical screen bar is at an angle.
- Ensure an oil and grease trap chamber for a low volume of settleable solids and an anaerobic chamber for a high volume of settleable solids.
- There should be a gradient of at least 1% between each component.

- Anaerobic Chamber should have an air vent and manhole for periodical sludge removal.
- Check if the crown of the outlet pipe is fixed at the same level as the inlet pipe's bottom.
- Install clamp support for the inlet pipe to avoid sagging.
- The filter bed should have a width of 0.6m on both sides with 20 mm metal and 4 to 8 mm metal at the centre.
- The filter bed should be planted with suitable plant species.
- There should be a freeboard of at least 10 cm between the inlet pipe and filter material.
- The outlet of the filter bed should have an adjustable standpipe that is not higher than 45cm to avoid backflow stagnation in the bed.
- Ensure a reuse collection chamber with a cover slab to avoid algae.
- Make sure there is a revenue model in all possible cases.

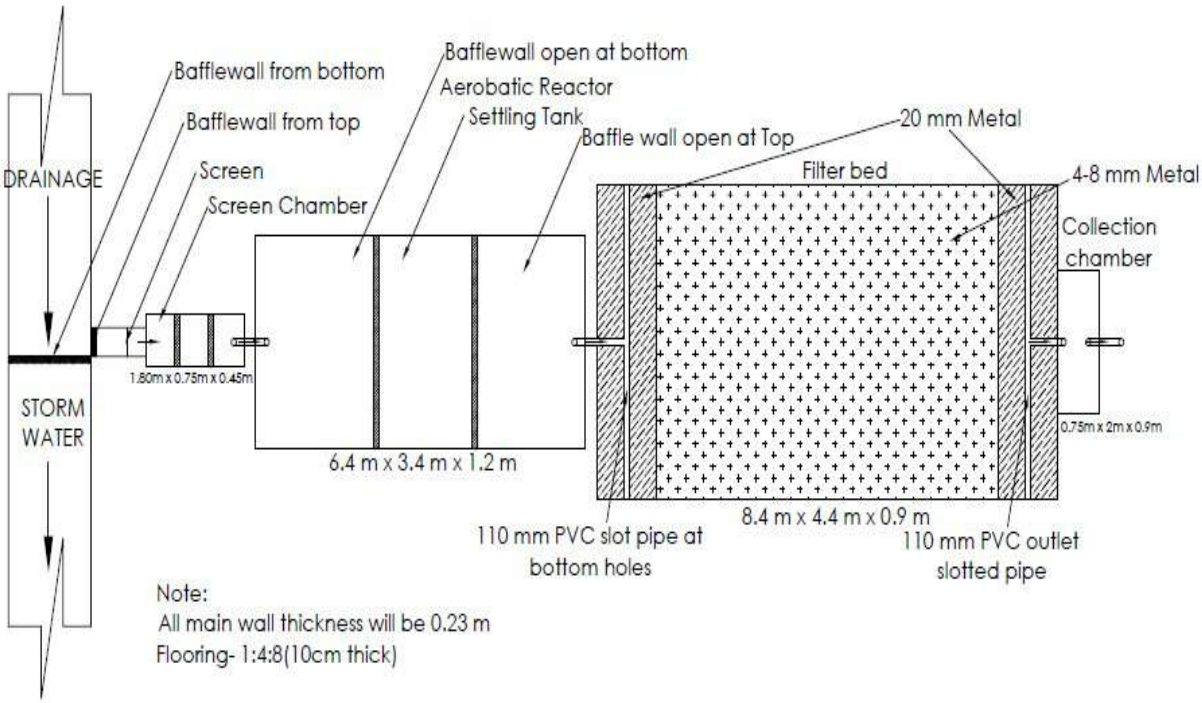
S.NO	Flow (KLD)	Filter Dimensions			Grease Trap	Size of Anaerobic Reactor			Amount
		L (m)	B (m)	H (m)		L (m)	B (m)	H (m)	
1	5	4.5	2.25	0.60	0.9X0.75X0.45	3.2	1.6	1.0	
2	10	6.0	3.0	0.60	1.2X0.75X0.45	4.5	2.25	1.0	
3	15	7.0	3.5	0.60	1.5X0.75X0.45	5.5	2.75	1.0	
4	20	8.0	4.0	0.60	1.8X0.75X0.45	6.0	3.0	1.0	

HORIZONTAL SUBSURFACE CONSTRUCTED WETLAND WITH ANAEROBIC DIGESTER FOR HIGH VOLUME OF SETTLABLE SOLIDS - SECTION VIEW- 20 KLD



Note:
All main wall thickness will be 0.23 m
Flooring- 1:4:8(10cm thick)

HORIZONTAL SUBSURFACE CONSTRUCTED WETLAND WITH ANAEROBIC DIGESTER FOR HIGH VOLUME OF SETTLABLE SOLIDS - PLAN VIEW- 20 KLD



Note:
All main wall thickness will be 0.23 m
Flooring- 1:4:8(10cm thick)

ANNEXURE

Estimate for GWMS

Dsor year: 2018, Cost Index Applied for this estimate is 36.44%)

	Sl.No.	Description	No.	L	B	D	Quantity	Amount
2.31	1	Clearing jungle including uprooting of rank vegetation, grass, brush wood, trees and saplings of girth up to 30 cm measured at a height of 1 m above level and removal of rubbish up to a distance of 50 m outside the periphery of the area cleared.						
		plan	1	20.55	6.4		131.52	
		Say 132m2@ Rs.13.9/m2		132	13.9			1834.8
2.1.1	2	Earth work in surface excavation not exceeding 30 cm in depth but exceeding 1.5 m in width as well as 10 Sq.m on plan including disposal of excavated earth up to 50 m and lift up to 1.5 m, disposed soil to be levelled and neatly dressed : All kind of soil						
		plan	1	20.55	6.4		131.52	
		Say 132m2@ Rs.102.48/m2		132	102.48			13527.36

2.8.1	3	Earth work in excavation by mechanical means Hydraulic excavator/manual means in foundation trenches or drain (not exceeding 1.5m in width or 10 Sq.m on plan) including dressing of sides and ramming of bottom, lift up to 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed with in a lead of 50 m. All kinds of soil						
		BSC	1	3.2	1.95	0.65	4.056	
		ART	1	7.4	4.2	1.4	43.512	
		FB	1	9.2	5.2	1.1	52.624	
		CC	1	1.95	3.2	1.1	6.864	
		Total					107.056	
		Say 108 m3 @ Rs.279.32/m3		108	279.32			30166.56
5.9.1	4	Centering and shuttering including strutting etc. and removal of form for : Foundations, footings, bases of columns, etc for mass concrete						
		BSC 1:4:8	2	3.75		0.1	0.75	
		ART	2	10.4		0.1	2.084	
		FB	2	13.2		0.1	2.64	
		CC	2	3.95		0.1	0.795	
		BSC For 1:3:6	2	3.55		0.1	0.715	
		ART	2	10.2		0.1	2.04	
		FB	2	13		0.1	2.68	
		CC	2	3.75		0.1	0.75	
		Total					12.454	
		Say 12.5m2@ Rs.315.41/m2		12.5	315.41			3942.625

4.1.8	5	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level 1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate 40mm nominal size) using 40mm nominal size.						
		BSC	1	2.6	1.35	0.1	0.351	
		ART	1	6.8	3.6	0.1	2.448	
		FB	1	8.6	4.6	0.1	3.956	
		CC	1	1.35	2.6	0.1	0.351	
		Total					7.106	
		Say 7.20m3 @ Rs.6410.38/m3		7.2	6410.38			46154.736
4.1.6	6	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 40mm nominal size) using 40mm nominal size.						
		BSC	1	2.4	1.15	0.1	0.276	
		ART	1	6.6	3.4	0.1	2.244	
		FB	1	8.4	4.4	0.1	3.696	
		CC	1	1.15	2.4	0.1	0.276	
		Total					6.492	
		Say 7.20m3 @ Rs.6783.12/m3		7.2	6783.12			48838.464
50.6.1.8	7	Solid block masonry using pre cast solid blocks (Factory made) of size 40 x 20 x 15 cm or nearest available size confirming to IS 2185 part 1 of 1979 for super structure up to floor two level with thickness 15 cm in CM 1:6 (1 cement : 6 coarse sand etc complete.						
		BSC WALL	2	3.15	0.2	0.45	0.567	
		BSC BAFFLE WALL	2	0.75	0.1	0.3	0.045	
		ART WALL	2	9.6	0.2	1.2	4.608	
		ART BAFFLE WALL	2	3	0.1	0.65	0.39	

		FB WALL	2	12.4	0.2	0.9	4.464	
		CC WALL	2	3.15	0.2	0.9	1.134	
		Total					11.208	
		Say 12m3 @ Rs.6538.08/m3		12	6538.08			78456.96
13.7.1	8	12 mm cement plaster finished with a floating coat of neat cement of mix 1 : 3 (1 cement : 3 fine sand)						
		BSC FLOOR	3	0.6	0.75		1.35	
		BSC WALL	2	2.55	0.45		2.295	
		BSC BAFFLE WALL	2	0.75	0.45		9	
		BSC BAFFLE WALL 2 SIDE	2	0.75	0.45		0.675	
		ART WALL	2	9	1.2		21.6	
		ART BASE FLOOR	1	6	3		18	
		ART BAFFLE WALL	2	3	0.65		3.9	
		ART BAFFLE WALL 2 SIDE	2	3	0.65		3.9	
		FB WALL	2	12	0.9		21.6	
		FB BASE FLOOR	1	8	4		32	
		CC WALL	2	2.75	0.9		4.95	
		CC BASE FLOOR	1	0.75	2		1.5	
		Total					120.77	
		Say 121 m2 @ Rs.377.4/m2		121	377.4			45665.4
5.9.3	9	Centering and shuttering including strutting etc. and removal of form for : suspended floors, roofs, landings, balconies and access platform.						
		Anerobic Tank Slab	1	9.2		0.2	1.84	
		Say 1.9 m2 @ Rs.767.35/m2		1.9	767.35			1457.965
5.2.2	10	Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. up to floor five level excluding cost of centering, shuttering, finishing and reinforcement : 1:1.5:3 (1 cement : 1.5 coarse sand : 3						

		aggregate 20 mm nominal size)						
		Anerobic Tank Slab	1	6.6	3.4	0.2	4.488	
		Total						
		Say 5 m3 @ Rs.10303.84/m3		5	10303.84			51519.2
13.7.2	11	12 mm cement plaster finished with a floating coat of neat cement of mix 1 : 4 (1 cement : 4 fine sand)						
		B.S.C followed by GREESE TRAP Length	2	3.55	0.65		4.615	
		Anerobic reactor tank Length	2	10	1.4		28	
		Filter Bed Length	2	12.8	1.1		28.16	
		Collection Chamber Length	2	2.95	1.1		6.49	
		Total					67.265	
		Say 68 m2 @ Rs.245.34/m2		68	245.34			16683.12
13.18	12	Neat cement punning						
		BSC FLOOR	3	0.6	0.75		1.35	
		BSC WALL	2	2.55	0.45		2.295	
		BSC BAFFLE WALL	2	0.75	0.45		9	
		BSC BAFFLE WALL 2 SIDE	2	0.75	0.45		0.675	
		ART WALL	2	9	1.2		21.6	
		ART BASE FLOOR	1	6	3		18	
		ART BAFFLE WALL	2	3	0.65		3.9	
		ART BAFFLE WALL 2 SIDE	2	3	0.65		3.9	
		FB WALL	2	12	0.9		21.6	
		FB BASE FLOOR	1	8	4		32	
		CC WALL	2	2.75	0.9		4.95	
		CC BASE FLOOR	1	0.75	2		1.5	
		Total					120.77	
		Say 121 m2 @ Rs.363.43/m2		121	363.43			43975.03

2.25	13	Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundation etc. in layers not exceeding 20 cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift up to 1.5 m						
		BSC	2	3.95	0.4	0.65	2.054	
		ART	2	10.6	0.4	1.4	11.872	
		FB	2	13.2	0.4	1.1	11.616	
		CC	2	3.95	0.4	0.4	1.264	
		Total					26.91	
		Say 27 m2@ Rs.243.22/m2		27	243.22			6566.94
50.18.8.9.2	14	Providing and fixing PVC pipes, fittings including fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes with one step PVC Solvent cement and testing of joints complete as per direction of Engineer-in-Charge. Concealed work, including cutting chases and making good the wall etc. 110 mm pipe 4 kgf/cm2						
		110 MM	1				20	
		Total						
		Say 20m@ Rs.631.75/m		20	631.75			12635
CODE 298	15	Stone Aggregate(single size): 06 mm nominal size						
		FB	1	6.8	4	0.6	16.32	
		Total					16.32	
		Say 17 m3@ Rs.1910.16/m3		17	1910.16			32472.72
	16	Stone Aggregate(single size): 20 mm nominal size						

		FB	2	0.6	4	0.6	2.88	
		Total					2.88	
		Say 3 m3@ Rs.1841.94/m3		3	1841.94			5525.82
	17	Supply,erection,testing and commissioning of Bar screen and GI 15 mm sheet						
	a	SS Bar Screen 20 mm & 10 mm	2				15000	**30000**
	b	GI Sheet of 15 mm holes	1				15000	**15000**
		Total						**464428.82**

Estimate for GWMS 15 KLD

Dsor year: 2018, Cost Index Applied for this estimate is 36.44%)

	Sl.No.	Description	No.	L	B	D	Quantity	Amount
2.31	1	Clearing jungle including uprooting of rank vegetation, grass, brush wood, trees and saplings of girth up to 30 cm measured at a height of 1 m above level and removal of rubbish up to a distance of 50 m outside the periphery of the area cleared.						
		plan	1	18.75	5.9		110.625	
		Say 111m2@ Rs.13.9/m2		111	13.9			1542.9

2.1.1	2	Earth work in surface excavation not exceeding 30 cm in depth but exceeding 1.5 m in width as well as 10 Sq.m on plan including disposal of excavated earth up to 50 m and lift up to 1.5 m, disposed soil to be levelled and neatly dressed : All kind of soil						
		plan	1	20.55	6.4		131.52	
		Say 132m2@ Rs.102.48/m2		132	102.48			13527.36
2.8.1	3	Earth work in excavation by mechanical means Hydraulic excavator/manual means in foundation trenches or drain (not exceeding 1.5m in width or 10 Sq.m on plan) including dressing of sides and ramming of bottom, lift up to 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed with in a lead of 50 m. All kinds of soil						
		BSC	1	2.9	1.95	0.65	4.056	
		ART	1	6.9	3.95	1.4	43.512	
		FB	1	8.2	4.7	1.1	42.394	
		CC	1	1.95	3.2	1.1	6.864	
		Total					96.826	
		Say 97 m3 @ Rs.279.32/m3		97	279.32			27094.04
5.9.1	4	Centering and shuttering including strutting etc. and removal of form for : Foundations, footings, bases of columns, etc for mass concrete						
		BSC 1:4:8	2	3.45		0.1	0.75	

		ART	2	9.65		0.1	2.084	
		FB	2	11.7		0.1	2.64	
		CC	2	3.95		0.1	0.795	
		BSC For 1:3:6	2	3.35		0.1	0.715	
		ART	2	9.45		0.1	2.04	
		FB	2	11.5		0.1	2.68	
		CC	2	3.75		0.1	0.75	
		Total					12.454	
		Say 12.5m2@ Rs.315.41/m2		12.5	315.41			3942.625
4.1.8	5	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level 1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate 40mm nominal size) using 40mm nominal size.						
		BSC	1	2.3	1.35	0.1	0.351	
		ART	1	6.3	2.85	0.1	2.448	
		FB	1	7.6	4.1	0.1	3.956	
		CC	1	1.35	2.6	0.1	0.351	
		Total					7.106	
		Say 7.20m3 @ Rs.6410.38/m3		7.2	6410.38			46154.736
4.1.6	6	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 40mm nominal size) using 40mm nominal size.						
		BSC	1	2.1	1.15	0.1	0.276	
		ART	1	6.1	2.65	0.1	2.244	

		FB	1	7.4	3.9	0.1	3.696	
		CC	1	1.15	2.4	0.1	0.276	
		Total					6.492	
		Say 6.50m3 @ Rs.6783.12/m3		6.5	6783.12			44090.28
50.6.1.8	7	Solid block masonry using pre cast solid blocks (Factory made) of size 40 x 20 x 15 cm or nearest available size confirming to IS 2185 part 1 of 1979 for super structure up to floor two level with thickness 15 cm in CM 1:6 (1 cement : 6 coarse sand etc complete.						
		BSC WALL	2	2.85	0.2	0.45	0.567	
		BSC BAFFLE WALL	2	0.75	0.1	0.3	0.045	
		ART WALL	2	8.85	0.2	1.2	4.608	
		ART BAFFLE WALL	2	2.75	0.1	0.65	0.39	
		FB WALL	2	10.9	0.2	0.9	4.464	
		CC WALL	2	3.15	0.2	0.9	1.134	
		Total					11.208	
		Say 11.3m3 @ Rs.6538.08/m3		11.3	6538.08			73880.304
13.7.1	8	12 mm cement plaster finished with a floating coat of neat cement of mix 1 : 3 (1 cement : 3 fine sand)						
		BSC FLOOR	3	0.5	0.75		1.125	
		BSC WALL	2	2.25	0.45		2.025	
		BSC BAFFLE WALL	2	0.75	0.45		0.675	
		BSC BAFFLE WALL 2 SIDE	2	0.75	0.45		0.675	
		ART WALL	2	8.25	1.2		19.8	
		ART BASE FLOOR	1	5.5	2.75		15.125	
		ART BAFFLE WALL	2	2.75	0.65		3.575	
		ART BAFFLE WALL 2 SIDE	2	2.75	0.65		3.575	
		FB WALL	2	10.5	0.9		18.9	

		FB BASE FLOOR	1	7	3.5		24.5	
		CC WALL	2	2.75	0.9		4.95	
		CC BASE FLOOR	1	0.75	2		1.5	
		Total					96.425	
		Say 97 m2 @ Rs.377.4/m2		97	377.4			36607.8
5.9.3	9	Centering and shuttering including strutting etc. and removal of form for : suspended floors, roofs, landings, balconies and access platform.						
		Anerobic Tank Slab	1	8.45		0.2	1.69	
		Say 1.7 m2 @ Rs.767.35/m2		1.7	767.35			1304.495
5.2.2	10	Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. up to floor five level excluding cost of centering, shuttering, finishing and reinforcement : 1:1.5:3 (1 cement : 1.5 coarse sand : 3 aggregate 20 mm nominal size)						
		Anerobic Tank Slab	1	6.1	3.15	0.2	3.843	
		Total						
		Say3.9 m3 @ Rs.10303.84/m3		3.9	10303.84			40184.976
13.7.2	11	12 mm cement plaster finished with a floating coat of neat cement of mix 1 : 4 (1 cement :						

		4 fine sand)						
		B.S.C followed by GREESE TRAP Length	2	3.25	0.65		4.225	
		Anerobic reactor tank Length	2	9.25	1.4		25.9	
		Filter Bed Length	2	11.3	1.1		24.86	
		Collection Chamber Length	2	2.95	1.1		6.49	
		Total					61.475	
		Say 62 m2 @ Rs.245.34/m2		62	245.34			15211.08
13.18	12	Neat cement punning						
		BSC FLOOR	3	0.5	0.75		1.125	
		BSC WALL	2	2.25	0.45		2.025	
		BSC BAFFLE WALL	2	0.75	0.45		0.675	
		BSC BAFFLE WALL 2 SIDE	2	0.75	0.45		0.675	
		ART WALL	2	8.25	1.2		19.8	
		ART BASE FLOOR	1	5.5	2.75		15.125	
		ART BAFFLE WALL	2	2.75	0.65		3.575	
		ART BAFFLE WALL 2 SIDE	2	2.75	0.65		3.575	
		FB WALL	2	10.5	0.9		18.9	
		FB BASE FLOOR	1	7	3.5		24.5	
		CC WALL	2	2.75	0.9		4.95	
		CC BASE FLOOR	1	0.75	2		1.5	
		Total					96.425	
		Say 97 m2 @ Rs.363.43/m2		97	363.43			35252.71
2.25	13	Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundation etc. in layers not exceeding 20 cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift up to 1.5 m						

		BSC	2	3.45	0.4	0.65	2.054	
		ART	2	9.45	0.4	1.4	11.872	
		FB	2	11.1	0.4	1.1	11.616	
		CC	2	3.95	0.4	0.4	1.264	
		Total					26.91	
		Say 27 m2@ Rs.243.22/m2		27	243.22			6566.94
50.18.8.9.2	14	Providing and fixing PVC pipes, fittings including fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes with one step PVC Solvent cement and testing of joints complete as per direction of Engineer-in-Charge. Concealed work, including cutting chases and making good the wall etc. 110 mm pipe 4 kgf/cm2						
		110 MM	1				20	
		Total						
		Say 20m@ Rs.631.75/m		20	631.75			12635
CODE 298	15	Stone Aggregate(single size): 06 mm nominal size						
		FB	1	6.8	4	0.6	16.32	
		Total					16.32	
		Say 17 m3@ Rs.1910.16/m3		17	1910.16			32472.72

	16	Stone Aggregate(single size): 20 mm nominal size						
		FB	2	0.6	4	0.6	2.88	
		Total					2.88	
		Say 3 m3@ Rs.1841.94/m3		3	1841.94			5525.82
	17	Supply,erection,testing and commissioning of Bar screen and GI 15 mm sheet						
	a	SS Bar Screen 20 mm & 10 mm	2				15000	30000
	b	GI Sheet of 15 mm holes	1				15000	15000
		Total						**440993.786**

Estimate for GWMS10 KLD

Dsor year: 2018, Cost Index Applied for this estimate is 36.44%)

	Sl.No.	Description	No.	L	B	D	Quantity	Amount
2.31	1	Clearing jungle including uprooting of rank vegetation, grass, brush wood, trees and saplings of girth up to 30 cm measured at a height of 1 m above level and removal of rubbish up to a distance of 50 m outside the periphery of the area cleared.						
		plan	1	16.45	5.4		88.83	

		Say 89 m2@ Rs.13.9/m2		89	13.9			1237.1
2.1.1	2	Earth work in surface excavation not exceeding 30 cm in depth but exceeding 1.5 m in width as well as 10 Sq.m on plan including disposal of excavated earth up to 50 m and lift up to 1.5 m, disposed soil to be levelled and neatly dressed : All kind of soil				9		
		plan	1	16.45	5.4		88.83	
		Say 89 m2@ Rs.102.48/m2		89	102.48			9120.72
2.8.1	3	Earth work in excavation by mechanical means Hydraulic excavator/manual means in foundation trenches or drain (not exceeding 1.5m in width or 10 Sq.m on plan) including dressing of sides and ramming of bottom, lift up to 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed with in a lead of 50 m. All kinds of soil						
		BSC	1	2.4	1.95	0.65	3.042	
		ART	1	5.9	3.45	1.4	28.497	
		FB	1	7.2	4.2	1.1	33.264	
		CC	1	1.95	3.2	1.1	6.864	
		Total					71.667	
		Say 49 m3 @ Rs.279.32/m3		49	279.32			13686.68
5.9.1	4	Centering and shuttering including strutting etc. and removal of form for : Foundations, footings, bases of columns, etc for mass concrete						
		BSC 1:4:8	2	3.35		0.1	0.67	

		ART	2	9.95		0.1	1.99	
		FB	2	13.2		0.1	2.64	
		CC	2	3.95		0.1	0.79	
		BSC For 1:3:6	2	3.15		0.1	0.63	
		ART	2	9.75		0.1	1.95	
		FB	2	13		0.1	2.6	
		CC	2	3.75		0.1	0.75	
		Total					12.02	
		Say 12 m2@ Rs.315.41/m2		12	315.41			3784.92
4.1.8	5	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level 1:4:8 (1 cement : 4 coarse						
		BSC	1	2	1.35	0.1	0.351	
		ART	1	5.3	2.85	0.1	2.448	
		FB	1	6.6	3.6	0.1	3.956	
		CC	1	1.35	2.6	0.1	0.351	
		Total					7.106	
		Say 7.20m3 @ Rs.6410.38/m3		7.2	6410.38			46154.736
4.1.6	6	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 40mm nominal size) using 40mm nominal size.						
		BSC	1	1.8	1.15	0.1	0.276	
		ART	1	5.1	2.65	0.1	2.244	
		FB	1	6.4	3.4	0.1	3.696	
		CC	1	1.15	2.4	0.1	0.276	
		Total					6.492	
		Say 6.5 m3 @ Rs.6783.12/m3		6.5	6783.12			44090.28

50.6.1.8	7	Solid block mansonry using pre cast solid blocks (Factory made) of size 40 x 20 x 15 cm or nearest available size confirming to IS 2185 part 1 of 1979 for super structure up to floor two level with thickness 15 cm in CM 1:6 (1 cement : 6 coarse sand etc complete.						
		BSC WALL	2	1.95	0.2	0.45	0.351	
		BSC BAFFLE WALL	2	0.75	0.1	0.3	0.045	
		ART WALL	2	7.35	0.2	1.2	3.528	
		ART BAFFLE WALL	2	1.6	0.1	0.65	0.208	
		FB WALL	2	9.4	0.2	0.9	3.384	
		CC WALL	2	3.15	0.2	0.9	1.134	
		Total					8.65	
		Say 8.8m3 @ Rs.6538.08/m3		8.8	6538.08			57535.104
13.7.1	8	12 mm cement plaster finished with a floating coat of neat cement of mix 1 : 3 (1 cement : 3 fine sand)						
		BSC FLOOR	3	0.4	0.75		0.9	
		BSC WALL	2	1.65	0.45		1.485	
		BSC BAFFLE WALL	2	0.75	0.45		0.675	
		BSC BAFFLE WALL 2 SIDE	2	0.75	0.45		0.675	
		ART WALL	2	6.75	1.2		16.2	
		ART BASE FLOOR	1	4.5	2.25		10.125	
		ART BAFFLE WALL	2	2.25	0.65		2.925	
		ART BAFFLE WALL 2 SIDE	2	2.25	0.65		2.925	
		FB WALL	2	9	0.9		16.2	
		FB BASE FLOOR	1	6	3		18	
		CC WALL	2	2.75	0.9		4.95	
		CC BASE FLOOR	1	0.75	2		1.5	
		Total					76.56	
		Say 77m2 @ Rs.377.4/m2		77	377.4			29059.8

5.9.3	9	Centering and shuttering including strutting etc. and removal of form for : suspended floors, roofs, landings, balconies and access platform.						
		Anerobic Tank Slab	1	4.7	2.25	0.2		
		Total					2.115	
		Say2.1 m2 @ Rs.767.35/m2		2.1	767.35			1611.435
5.2.2	10	Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. up to floor five level excluding cost of centering, shuttering, finishing and reinforcement : 1:1.5:3 (1 cement : 1.5 coarse sand : 3 aggregate 20 mm nominal size)						
		Anerobic Tank Slab	1	5.1	2.65	0.2	2.703	
		Total						
		Say 2.8m3 @ Rs.10303.84/m3		2.8	10303.84			28850.752
13.7.2	11	12 mm cement plaster finished with a floating coat of neat cement of mix 1 : 4 (1 cement : 4 fine sand)						
		B.S.C followed by GREESE TRAP Length	2	2.95	0.65		3.835	
		Anerobic reactor tank Length	2	7.75	1.4		21.7	
		Filter Bed Length	2	9.8	1.1		21.56	
		Collection Chamber Length	2	2.95	1.1		6.49	
		Total					53.585	

		Say 54 m2 @ Rs.245.34/m2		54	245.34			13248.36
13.18	12	Neat cement punning						
		BSC FLOOR	3	0.4	0.75		0.9	
		BSC WALL	2	1.65	0.45		1.485	
		BSC BAFFLE WALL	2	0.75	0.45		0.675	
		BSC BAFFLE WALL 2 SIDE	2	0.75	0.45		0.675	
		ART WALL	2	6.75	1.2		16.2	
		ART BASE FLOOR	1	4.5	2.25		10.125	
		ART BAFFLE WALL	2	2.25	0.65		2.925	
		ART BAFFLE WALL 2 SIDE	2	2.25	0.65		2.925	
		FB WALL	2	9	0.9		16.2	
		FB BASE FLOOR	1	6	3		18	
		CC WALL	2	2.75	0.9		4.95	
		CC BASE FLOOR	1	0.75	2		1.5	
		Total					76.56	
		Say 77 m2 @ Rs.363.43/m2		77	363.43			27984.11
2.25	13	Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundation etc. in layers not exceeding 20 cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift up to 1.5 m						
		BSC	2	3.05	0.4	0.65	1.586	
		ART	2	6.2	0.4	1.4	6.944	
		FB	2	7.95	0.4	1.1	6.996	
		CC	2	3.95	0.4	0.4	1.264	
		Total					26.91	
		Say 27 m2@ Rs.243.22/m2		27	243.22			6566.94

50.18.8.9.2	14	Providing and fixing PVC pipes, fittings including fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes with one step PVC Solvent cement and testing of joints complete as per direction of Engineer-in-Charge. Concealed work, including cutting chases and making good the wall etc. 110 mm pipe 4 kgf/cm2						
		110 MM	1				20	
		Total						
		Say 20m@ Rs.631.75/m		20	631.75			12635
CODE 298	15	Stone Aggregate(single size): 06 mm nominal size						
		FB	1	6.8	4	0.6	16.32	
		Total					16.32	
		Say 17 m3@ Rs.1910.16/m3		17	1910.16			32472.72
	16	Stone Aggregate(single size): 20 mm nominal size						
		FB	2	0.6	4	0.6	2.88	
		Total					2.88	
		Say 3 m3@ Rs.1841.94/m3		3	1841.94			5525.82
	17	Supply,erection,testing and commissioning of Bar screen and GI 15 mm sheet						
	a	SS Bar Screen 20 mm & 10 mm	2				15000	**30000**

	b	GI Sheet of 15 mm holes	1				15000	**15000**
		Total						**378564.477**

Estimate for GWMS 5 KLD

	Dsor year: 2018, Cost Index Applied for this estimate is 36.44%)							
	Sl.No.	Description	No.	L	B	D	Quantity	Amount
2.31	1	Clearing jungle including uprooting of rank vegetation, grass, brush wood, trees and saplings of girth up to 30 cm measured at a height of 1 m above level and removal of rubbish up to a distance of 50 m outside the periphery of the area cleared.						
		plan	1	15.65	4.65		72.7725	
		Say 73 m2@ Rs.13.9/m2		73	13.9			1014.7
2.1.1	2	Earth work in surface excavation not exceeding 30 cm in depth but exceeding 1.5 m in width as well as 10 Sq.m on plan including disposal of excavated earth up to 50 m and lift up to 1.5 m, disposed soil to be levelled and neatly dressed : All kind of soil						
		plan	1	15.65	4.65		72.7725	
		Say 73 m2@ Rs.102.48/m2		73	102.48			7481.04

2.8.1	3	Earth work in excavation by mechanical means Hydraulic excavator/manual means in foundation trenches or drain (not exceeding 1.5m in width or 10 Sq.m on plan) including dressing of sides and ramming of bottom, lift up to 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed with in a lead of 50 m. All kinds of soil						
		BSC	1	2.3	1.95	0.65	2.91525	
		ART	1	4.6	2.8	1.4	18.032	
		FB	1	5.5	3.45	1.1	20.8725	
		CC	1	1.95	3.2	1.1	6.864	
		Total					48.68375	
		Say 49 m3 @ Rs.279.32/m3		49	279.32			13686.68
5.9.1	4	Centering and shuttering including strutting etc. and removal of form for : Foundations, footings, bases of columns, etc for mass concrete						
		BSC 1:4:8	2	2.85		0.1	0.57	
		ART	2	6.2		0.1	1.24	
		FB	2	7.95		0.1	1.59	
		CC	2	3.95		0.1	0.79	
		BSC For 1:3:6	2	2.65		0.1	0.53	
		ART	2	6		0.1	1.2	
		FB	2	7.75		0.1	1.55	
		CC	2	3.75		0.1	0.75	
		Total					8.22	
		Say 8.3 m2@ Rs.315.41/m2		5.9	315.41			1860.919

4.1.8	5	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level 1:4:8 (1 cement : 4 coarse						
		BSC	1	1.7	1.35	0.1	0.351	
		ART	1	3.9	2.2	0.1	2.448	
		FB	1	5.1	2.85	0.1	3.956	
		CC	1	1.35	2.6	0.1	0.351	
		Total					7.106	
		Say 7.20m3 @ Rs.6410.38/m3		7.2	6410.38			46154.736
4.1.6	6	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 40mm nominal size) using 40mm nominal size.						
		BSC	1	1.5	1.15	0.1	0.276	
		ART	1	3.7	2	0.1	2.244	
		FB	1	4.9	2.65	0.1	3.696	
		CC	1	1.15	2.4	0.1	0.276	
		Total					6.492	
		Say 6.5 m3 @ Rs.6783.12/m3		6.5	6783.12			44090.28
50.6.1.8	7	Solid block mansonry using pre cast solid blocks (Factory made) of size 40 x 20 x 15 cm or nearest available size confirming to IS 2185 part 1 of 1979 for super structure up to floor two level with thickness 15 cm in CM 1:6 (1 cement : 6 coarse sand etc complete.						
		BSC WALL	2	2.25	0.2	0.45	0.405	

		BSC BAFFLE WALL	2	0.75	0.1	0.3	0.045	
		ART WALL	2	5.4	0.2	1.2	2.592	
		ART BAFFLE WALL	2	1.6	0.1	0.65	0.208	
		FB WALL	2	7.15	0.2	0.9	2.574	
		CC WALL	2	3.15	0.2	0.9	1.134	
		Total					11.598	
		Say 12m3 @ Rs.6538.08/m3		12	6538.08			78456.96
13.7.1	8	12 mm cement plaster finished with a floating coat of neat cement of mix 1 : 3 (1 cement : 3 fine sand)						
		BSC FLOOR	3	0.3	0.75		0.675	
		BSC WALL	2	1.65	0.45		1.485	
		BSC BAFFLE WALL	2	0.75	0.45		0.675	
		BSC BAFFLE WALL 2 SIDE	2	0.75	0.45		0.675	
		ART WALL	2	4.8	1.2		11.52	
		ART BASE FLOOR	1	3.2	1.6		5.12	
		ART BAFFLE WALL	2	1.6	0.65		2.08	
		ART BAFFLE WALL 2 SIDE	2	1.6	0.65		2.08	
		FB WALL	2	6.75	0.9		12.15	
		FB BASE FLOOR	1	4.5	2.25		10.125	
		CC WALL	2	2.75	0.9		4.95	
		CC BASE FLOOR	1	0.75	2		1.5	
		Total					53.035	
		Say 54 m2 @ Rs.377.4/m2		54	377.4			20379.6
5.9.3	9	Centering and shuttering including strutting etc. and removal of form for : suspended floors, roofs, landings, balconies and access platform.						
		Anerobic Tank Slab	1	3.4	1.6	0.2	1.088	
		Say1.1 m2 @ Rs.767.35/m2		1.1	767.35			844.085

5.2.2	10	Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. up to floor five level excluding cost of centering, shuttering, finishing and reinforcement : 1:1.5:3 (1 cement : 1.5 coarse sand : 3 aggregate 20 mm nominal size)						
		Anerobic Tank Slab	1	3.4	2	0.2	1.36	
		Total						
		Say 1.4 m3 @ Rs.10303.84/m3		1.4	10303.84			14425.376
13.7.2	11	12 mm cement plaster finished with a floating coat of neat cement of mix 1 : 4 (1 cement : 4 fine sand)						
		B.S.C followed by GREESE TRAP Length	2	3.15	0.65		4.095	
		Anerobic reactor tank Length	2	10	1.4		28	
		Filter Bed Length	2	12.8	1.1		28.16	
		Collection Chamber Length	2	2.95	1.1		6.49	
		Total					66.745	
		Say 67 m2 @ Rs.245.34/m2		67	245.34			16437.78
13.18	12	Neat cement punning						
		BSC FLOOR	3	0.3	0.75		0.675	
		BSC WALL	2	1.65	0.45		1.485	
		BSC BAFFLE WALL	2	0.75	0.45		0.675	
		BSC BAFFLE WALL 2 SIDE	2	0.75	0.45		0.675	
		ART WALL	2	4.8	1.2		11.52	
		ART BASE FLOOR	1	3.2	1.6		5.12	
		ART BAFFLE WALL	2	1.6	0.65		2.08	

		ART BAFFLE WALL 2 SIDE	2	1.6	0.65		2.08	
		FB WALL	2	6.75	0.9		12.15	
		FB BASE FLOOR	1	4.5	2.25		10.125	
		CC WALL	2	2.75	0.9		4.95	
		CC BASE FLOOR	1	0.75	2		1.5	
		Total					53.035	
		Say 54 m2 @ Rs.363.43/m2		54	363.43			19625.22
2.25	13	Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundation etc. in layers not exceeding 20 cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift up to 1.5 m						
		BSC	2	3.05	0.4	0.65	1.586	
		ART	2	6.2	0.4	1.4	6.944	
		FB	2	7.95	0.4	1.1	6.996	
		CC	2	3.95	0.4	0.4	1.264	
		Total					26.91	
		Say 27 m2@ Rs.243.22/m2		27	243.22			6566.94
50.18.8.9.2	14	Providing and fixing PVC pipes, fittings including fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes with one step PVC Solvent cement and testing of joints complete as per direction of Engineer-in-Charge. Concealed work, including cutting chases and making good the wall etc. 110 mm pipe 4 kgf/cm2						

		110 MM	1				20	
		Total						
		Say 20m@ Rs.631.75/m		20	631.75			12635
CODE 298	15	Stone Aggregate(single size): 06 mm nominal size						
		FB	1	6.8	4	0.6	16.32	
		Total					16.32	
		Say 17 m3@ Rs.1910.16/m3		17	1910.16			32472.72
	16	Stone Aggregate(single size): 20 mm nominal size						
		FB	2	0.6	4	0.6	2.88	
		Total					2.88	
		Say 3 m3@ Rs.1841.94/m3		3	1841.94			5525.82
	17	Supply,erection,testing and commissioning of Bar screen and GI 15 mm sheet						
	a	SS Bar Screen 20 mm & 10 mm	2				15000	**30000**
	b	GI Sheet of 15 mm holes	1				15000	**15000**
		Total						**366657.856**