K H A R O U D I VILLAGE IN PUNJAB

MODEL OF CLEANLINESS

CAN THIS MODEL MEET

THE TOTAL SANITATION CHALLENGE IN INDIA?

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By

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Abbreviations and Acronyms

BOD	Biochemical oxygen demand
BDO	Block Development Officer
CRSP	Central Rural Sanitation Programme
lpcd	Liter per capita per day
NRI	Non Resident Indian
RGNDWM	Rajiv Gandhi National Drinking Water Mission
SDO	Sub Divisional Officer
SWTP	Sewerage Water Treatment Plant
UV	Ultra Violet
VLIB	Village life Improvement Board

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Introduction

The wastewater generated from various household and other activities in rural areas overflows into open surface drains and is ultimately disposed off into village ponds thereby contaminating it. Seepage from pit latrines may also be affecting the underground water. His Excellency, Dr. A.P.J Abdul Kalam, President of India while distributing the 1st Nirmal Gram Puraskars on 24th of February 2005 in Vigyan Bhawan referred to Kharoudi village in Hoshiarpur district of Punjab as a "model" that understood the necessity of clean drinking water, sanitation, solid and liquid waste management and hygiene as a method to foster public health of the village community. The NRIs of the village have done enough in bringing about dramatic improvement in its sewage disposal system, the maintenance of roads, computers, schools, parks, libraries in Kharoudi village of Punjab to attract the attention of His Excellency, Dr. A.P.J Abdul Kalam, President of India in March 2003 to inaugurate the project, the first of its kind not only in Punjab but also in India.

Department of Drinking Water Supply, Ministry of Rural Development vide their letter No.W-11037/8/2005-crsp (part) launched a one-member study team as desired by His Excellency, Dr. A.P.J Abdul Kalam, President of India to study the model village and look at the replication potential. Ms Shipra Saxena, Consultant (CRSP), RGNDWM, Government of India, was appointed to study the Kharaudi model and present the report.

Methodology Adopted during Field Visit

In Kharodi village, Hoshiapur district of Punjab, NRI along with the help of state government has laid the underground sewerage system with a stabilization tank and activated sludge system. With the availability of this underground sewerage system the whole village has been able to have household toilets and toilets in schools, hospitals and other public places. Kharoudi village also boasts of concrete paved roads along with primary schools with computer education. Four new parks have been added and one exclusively for children. Solar street lights, a new cementery, Internet kiosk, and an ultra modern Panchayat Ghar with residential facilities are the other highlights. Kharoudi has changed the face of the archetypal Indian village largely due to an efficient system of sanitation and wastewater management. Henceforth it required a detailed study whether it can be replicated and propagated by the Ministry of Rural Development in other parts of the country. The team visited the Kharoudi village and met the villagers[1] and Dr. R.S Bassi, NRI and one of the brain behind the project, Mr M.P Singh, the engineer associated with the project, officials from water supply and sanitation department. A detailed in-depth discussion took place in the village along with the on-site visit and feedback from villagers about the functionality of the project. The team later visited Brahmpura village, to analyse the replication potential, because the Kharoudi project has been replicated there due to the initiative of the NRI of that village. Later the team has also seen the wastewater management in Sangole village in Ludhiana district and Ulhana village in Patiala district to understand the variations possible in the Kharoudi project. The entire visit has helped to come up with different models/options suiting the local conditions, availability of water, funds, land etc.

[1] The list of persons met during the visit has been enclosed as annexure.

Objective of the Study

This study of the Kharoudi model of sanitation of underground sewerage system and proper treatment of wastewater is set to answer the follower points

- Profile, Background and factors involved in the project
- Details of the sanitation scheme
- Cost economics
- Benefits verses Limitations
- Different models/Options
- Use and Maintenance
- Government Support
- Factors contributing towards such success
- Sustainability and Replicability
- Way Forward

Profile and Background - Kharoudi Village

Kharoudi has a population of 800 persons living in 150 households. The village has a large NRI population. **Dr Raghbir Singh Bassi** and **Dr Gurdev Singh Gill** of Canada decided to take things in their own hands. Both of them on one of their trips back home, were appalled at the squalor and filth around the village. The village practically floats in sewage. During the monsoons, it was impossible to cross the street. Stagnant water, overflowing drains and waste piling up ankle deep, made the village a health hazard. Back in Canada, they approached all NRIs who hailed form Kharaudi and told them their plan to change the total life style of the village. Within no time Rs.50 lakh was collected and out of its nearly Rs. 20 lakh was donated by the families of Dr Bassi and Dr Gill. Those contributing Rs. 1 lakh for more were promised an inscription of their names on the pillar of appreciation in the village square. So far, the pillar carries the name of 30 NRIs, including Gill and Bassi.

The leadership and the initial funds for the development of this village came from the Chairman (Dr. Basi) and Vice Chairman (Dr. Gill) who belonged to this village.

A board –**Village life Improvement Board (VLIB)**[2] comprising NRIs and representatives from the panchayat was also constituted to monitor the progress of the project. was initiated. Dr. R.S Bassi was chosen as the chairperson and Dr Gill and Dr Sukhdev Singh Bassi were elected as Vice Chairman and treasurer, respectively. Dr. R.S Bassi professor of economic development administration at Alaska Pacific University and Dr Gill, on the other hand is the first doctor of Indian origin to start a private practice. The one crore project began in 1999 with sanitation as its focus. Almost immediately, it received a boost when the then Chief Minister Parkash Singh Badal promised a “”dollar for dollar” matching grant. On CMs instructions, they further met the Deputy Commissioner of Hosiarpur, Iqbal Singh Sidhu. He too turned out to be extremely promising and inspiring. Impressed by the NRI’s zeal, the district administration provided the necessary back up for the implementation of the project. The locals too pitched in with labour and machinery. While the panchayats was involved in the execution, the

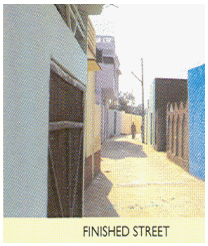
[2] The brochure is enclosed as annex

project funds were kept out of its ambit in a bid to prevent corruption. Since VLIB got a lot of work themselves, the work was completed on time but also at a cost lesson than envisaged. Dr Gill and Dr. S Bassi began working on the project from September 1999 and within 3 years the village has got transformed astonishingly. The practice of open defecation was totally eliminated and all the schools, households, hospitals, public places have toilets and are being put to use. In addition, all the toilets have functional water supply as the village has a 1,50,000 ltr capacity 27.43 mtr Over Head Service Reservoir with 8 hours of daily pumping. A 30-foot deep pond that overflowed every monsoon has now been converted into an open space. In addition, the marshy land has been converted into beautiful parks, concrete lanes have replaced the muddy and dirty roads with open drains, solar lights at common places lit the entire village. Room have been added to the primary schools, computer have added to the curriculum and 5 computer shave been installed along with a dedicated teacher. The entire village looks clean as well as aware as though urban facilities have come right in the village.

The sanitation scheme in Kharoudi Village

OPEN SEWER

Today, the entire village has concrete streets connecting each house. The sewerage line[3] flows through the village with a concrete cover on it. Each house has an outlet into it. The wastewater flows through sewers by gravity, with sewers designed with sufficient gradient to provide for a minimum of 2 to 3 feet/sec flow velocity (scour velocity) to avoid settling of solids. Stoneware pipes[4] have been used. The sewerage water has been treated till the last point where it can be reused for fish tank or for irrigation.


FINISHED STREET

The entire sewage of the village is made to flow into a large covered septic tank outside the village. Manholes have been provided at a suitable distance, which permit access to sewer lines for inspection, cleaning and repair. The septic tank has been designed keeping in mind the volume of sewer produced. The calculations are done with the assumption that there is a consumption of 100 lpcd out of which 70 percent of the water used ends up as sewage. In Kharodi village there are 2 septic tanks. In a septic tank there are partitions. In this tank, anaerobic bacterial are produced on their own and thrive on the chemicals in the sewerage. This bacterium does not need oxygen but feeds only on solids. It thus cleans the water up to 85 percent. From this tank, the water is made to flow into a smaller tank, which is laid with perforated pipes covered with nylon filters and three feet of rubble. It is further covered with three inches of sand and three inches of mud and finally taken into a pond for UV treatment, which takes care of pathogens. In the middle of the pond there is a fountain,

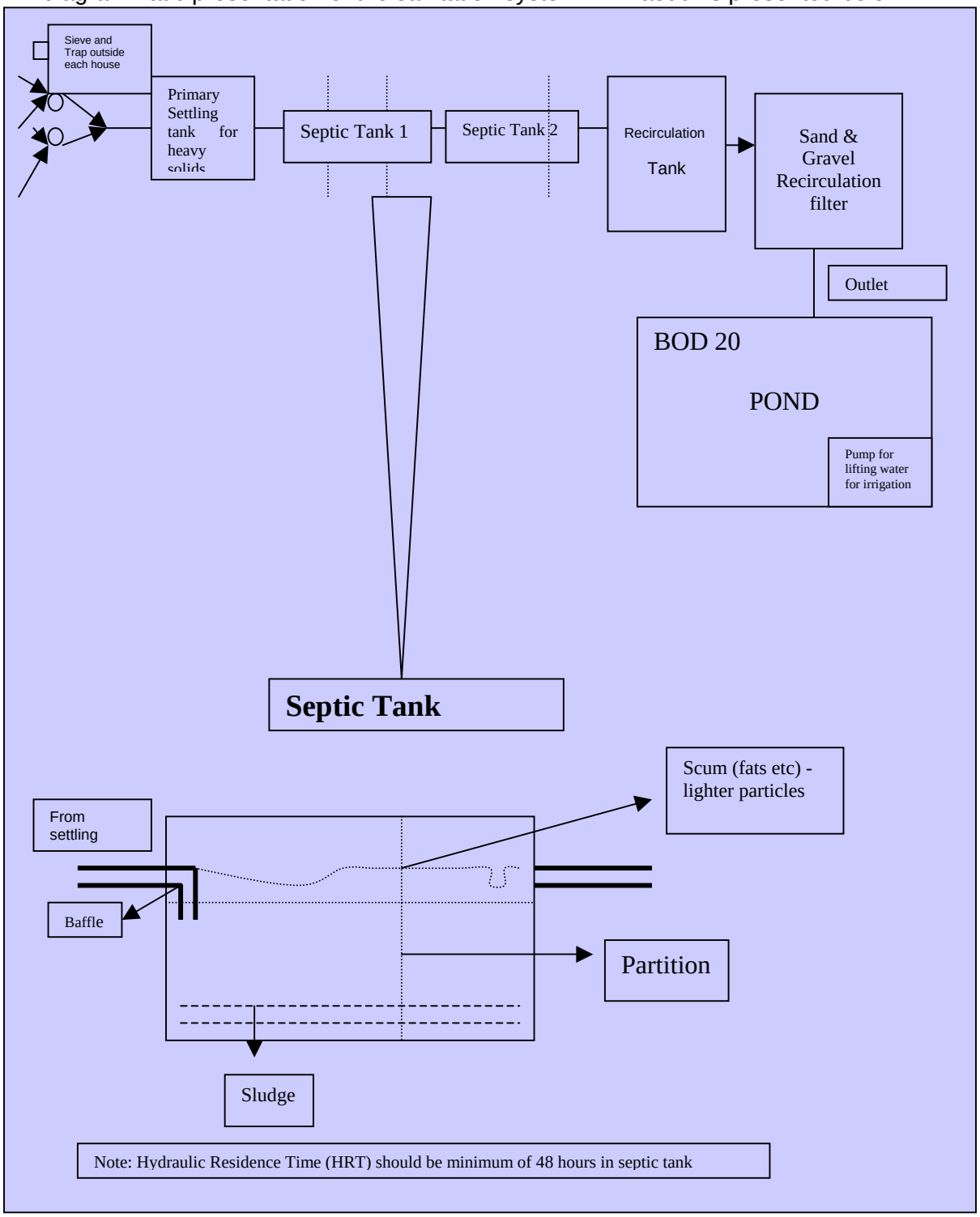

FISH TANK SEC. TREATMENT POND

[3] Sewer lines are the most expensive part of any sewer system. Great care must be taken in design and construction.

[4] Other pipe materials can be Vitrified clay pipe (for home connections and laterals), Reinforced concrete pipe, Plastic PVC pipe, Asbestos – concrete pipe, Ductile iron pipe

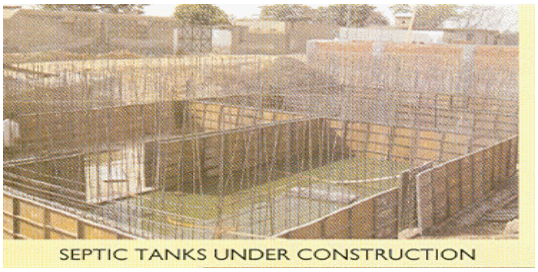
which provides aeration.

The project includes the "**Sewerage Water Treatment Plant" (SWTP),** which will enable the villagers to reuse this water for fishery and irrigation of fields. Initial sewage has a BOD^5 of 100-250mg/l and removal of at least 80 percent is required. The income generated will be given to the panchayat and the maintenance committee. The diagrammatic presentation of the sanitation system in Khaoudi is presented below.

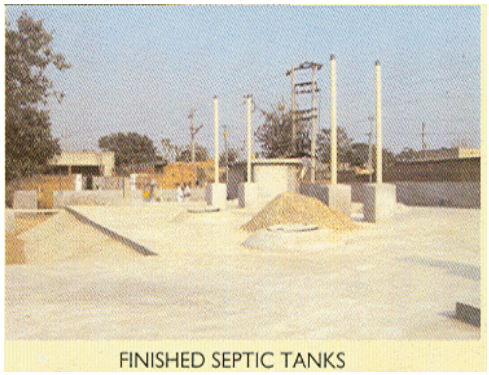


Waste Water Treatment

Primary Settling Tanks - removes organic solids by simple gravity settling in quite water. There is usually 2 hours of detention time. Settled solids (sludge) are removed from the bottom of the unit and can be pumped to a digester.

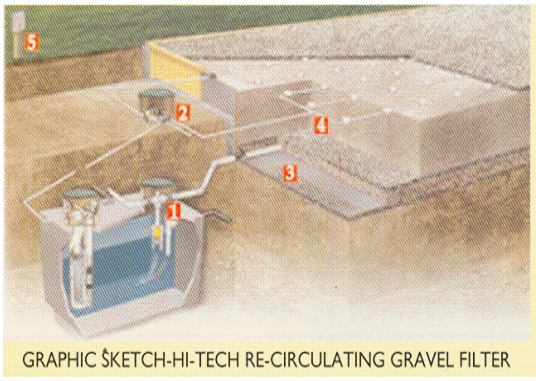


SEPTIC TANKS UNDER CONSTRUCTION



FINISHED SEPTIC TANKS

Septic Tank – A septic tank provides preliminary wastewater treatment wherein solid separates from the liquid. Then tank must be sized to handle the wastewater. Some solids such as soap or fat will float to the top of the tank to form a scum layer. The heavier solids such as human and kitchen waste settle to the bottom of the tank as sludge. Self-forming bacteria in the tank help the system digest these solids or sludge. The remaining liquid flow out of the tank. The baffles built into the tank hold back the floating scum from moving past the outlet of the tank. It is generally recommended that septic tanks be pumped out annually. The tank must have two to three partitions. With a two-compartment tank, the first compartment must hold at least one half, but not more than two thirds of the total volume. Compartments must have baffles between them to improve settling. There should be a vent pipe to vent gases that rise from the sludge to atmosphere. The effluent from the septic tank still contains about 75% of the polluted matter in the sewage and hence there is a need for further treatment of the liquid from the tank. The retention time is 48 hours.



GRAPHIC SKETCH-HI-TECH RE-CIRCULATING GRAVEL FILTER

Recirculating Sand and Gravel Filters - An excellent method for bringing wastewater that varies in volume and strength up to tertiary treatment levels: BOD levels below 20 mg/L and total nitrogen reductions of 40-50%. Wastewater first flows into a septic tank for primary treatment. The partially clarified effluent then flows into a recirculation tank, which is equipped with a pump, alarm, a timing mechanism, and float switches. The volume of the recirculation tank should be equivalent to at least one day's design flows. In the recirculation tank, effluent from the septic tank and the sand filter filtrate are mixed and pumped back to the sand filter bed. The dosing frequency is controlled by a programmable timer in the control panel. However this is very costly.

Aerobic Treatment

This is done through duck weeding, aeration tanks, and reeds to reduce the BOD thereby reducing the odour.

Ultra Violet Treatment

This is required for treatment of pathogens

SANITATION COST ECONOMICS IN KHAROUDI VILLAGE

Population	Existing	800
	Perspective	
Sewerage	Starting Depth (m)	0.5
	Final Depth (m)	1.7
	Slopes	1 in 100 to 1 in 250
Material		RCC and Stoneware
Sewer line in meters		3518 (m)
Cost		13.77 lakh
Manholes		Included
Septic Tank		4 lakh
Other		Included
Total cost		**17.77 lakh**

Replication of Kharoudi model of Sanitation in Brahampur Village in Ludhiana district of Punjab

Brahampur Village in Ludhiana district of Punjab has also become a model village and it has followed the same pattern as Kharaudi. The village has a population of 3500 persons with a few NRIs. Anantpal, an NRI from this village wanted to replicate the good work in Kharoudi. Anantpal gave $60,000 and the village received a matching grant from Canadian International Development Agency. Unlike Kharaudi, each household deposited Rs. 300 to get sewerage connection which has given a sense of participation and ownership. In addition the Punjab government sanctioned Rs.40 lakh for Brahampur. The work has been completed in less than a years time

Comparative Cost Structure			
Parameters		**Kharoudi**	**Brahampur**
Population	Existing	800	3500
	Perspective	3000	5000
Sewerage	Starting Depth (m)	0.5	0.5
	Final Depth (m)	1.7	2.3
	Slopes	1 in 100 to 1 in 250	1 in 150 to 1 in 250
Material		RCC and Stoneware	SW
Sewer line in		3518 (m)	5450 (m)

meters			
Cost		13.77 lakh	24.28 lakh
Manholes		Included	Included
Septic Tank		4 lakh	8.96 lakh
Other		Included	Included
Total cost		**17.77 lakh**	**33 lakh**

COST PER HEAD

Note: *Calculated on the data collected from Brahampur Village which is in the same patter as Kharaudi but with a population of 2450). The particulars of project are enclosed as annexure.*

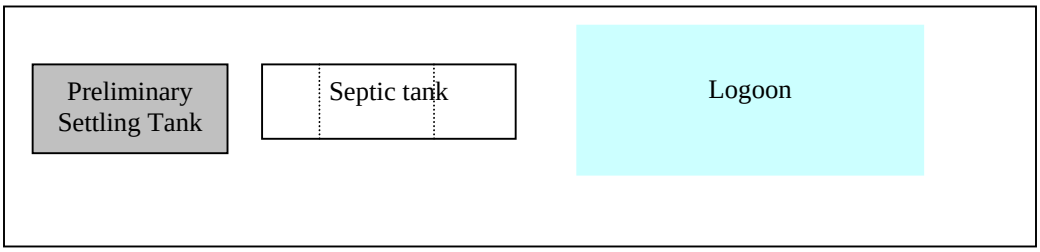
S.No	Item	Cost in lakh
1	Septic tank -1	5.3
2	Recirculation Tank	2.75
3	Septic tank -2	3.00
4	Sand and Gravel Filter	8.65
5	Collection tank and Control room	1.25
6	Pumps etc	1.50
7	Sewer line with manholes	24.50
8	Concrete streets (3")	2.17
9	Concrete streets (5")	37.28
TOTAL		**86.4**
Cost/per capita		Rs. 2,468
Cost/per capita without recirculation tank, sand and gravel filter including paccka streets		Rs.2, 142
Cost/per capita without recirculation tank, sand and gravel filter and concrete streets		Rs. 1,015

Benefits verses Limitations

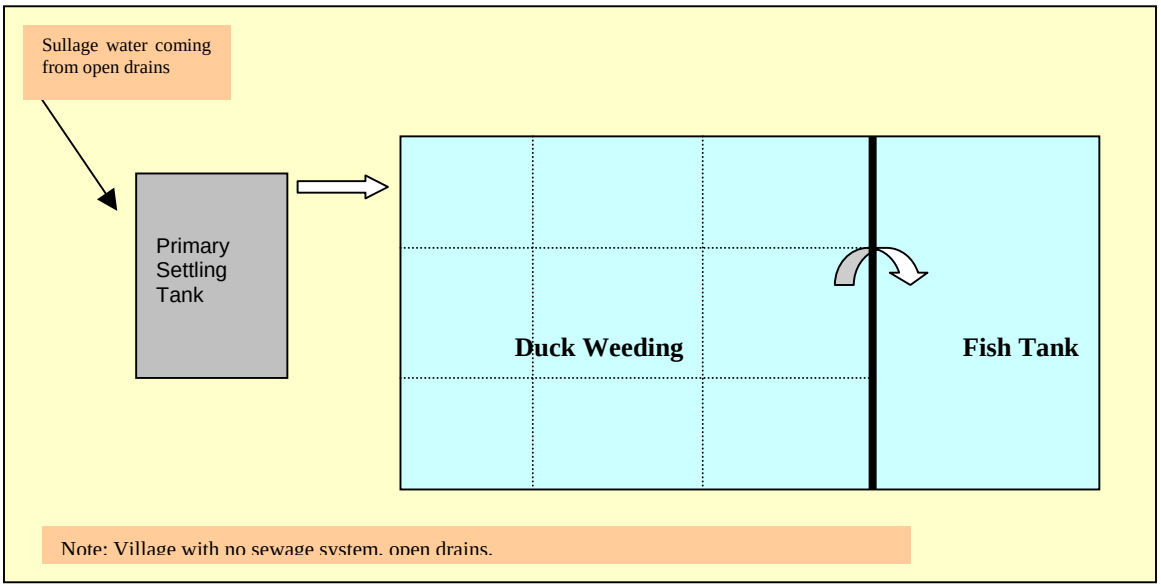
Benefits of the Technology	Limitations of the Technology
1. The open drains have been eliminated and the streets are absolutely dry and clean **2.** Ladies and children are spared the embarrassment of open defecation in fields 3. Distinct hygienic quality of life visible even in weaker sections 4. People have become aware about the possible benefits of safe wastewater disposal 5. General well being and health benefits being realized and reported	1. Huge capital investment 2. Consumes lot of water 3. Requirement of Land and Pond

Replication Potential: Different Models/ Options

1. Limited funds and land then one can eliminate recirculation filter and take water directly into a logoon[6]. This was done in part of Brahmpura village. They did away with recirculation tank and sand and gravel filter and the water was directly taken from preliminary settling tank to septic tank and to lagoon. The waster was free from any odour.



2. The Sangole village of Ludhiana district of Punjab had lot of common land and large ponds, but limited financial resources. They did away with recirculation tank and directly collected the wastewater coming from houses in the open drains to the primary settling tank and introduce duckweeding. Here pathogens also get treated due to UV rays. From here the water is fit to be taken into a fish tank. The finally treated water was free from any odour.



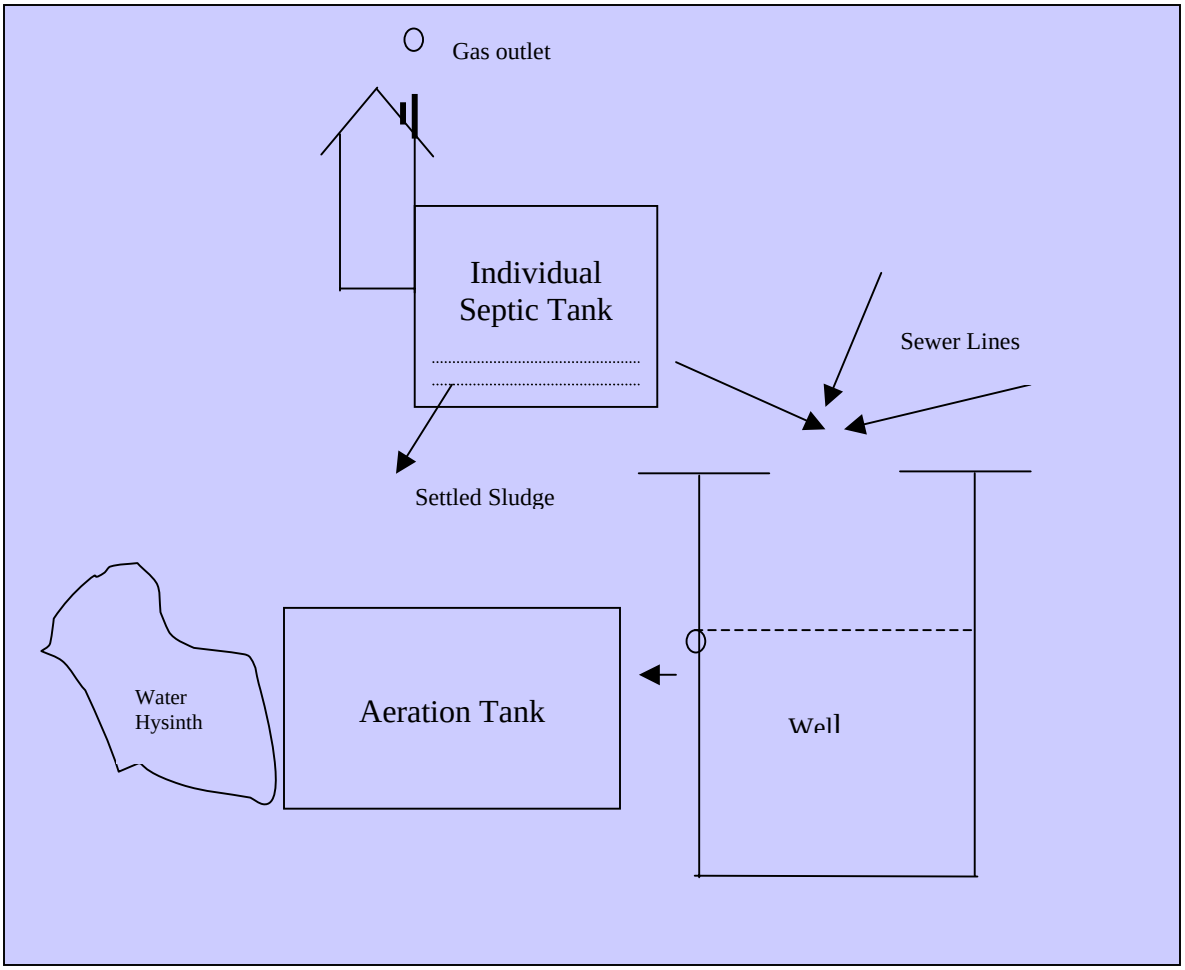
3. The 'Small Bore Sized Sewerage System' has been used in Ulana, where a separate septic tank has been provided in each house. This tank retains most of the solids and allows the water to overflow. Thus, there is a **saving in the size of the sewer pipe as well as in the cost of laying** due to lesser slope required to carry the water to the treatment plant. Ulana village sanitation project only deals in separating solids from the effluent and collecting the sullage in a well and then giving it the treatment aerobically through lagoons. No existing drains have been covered and no streets have

[6] Large open pond where pathogens get treatment by UV rays

been concreted. **THIS TECHNOLGY LOOKS CHEAPER.** It has not been developed by the Village Life Improvement Board.

The small-bore technology is fit for sparsely located houses. In clusters of houses close to each other some norm of locating a septic tank is bound to be violated. The following table gives the desired distances of septic tanks that need to be maintained:

Item	**Distance from Septic Tank**
Surface Water	50 ft
Private drinking water well	50 ft
Public drinking water wells	
Non-community system	50 ft
Community System	500 ft
All other water wells	50 ft
Water Lines	
Pressure main	10 ft
Pressure service connection	10 ft
Property Lines	5 ft
Foundations (except neighbors')	
All foundations	10 ft
Neighbors' foundations	
All foundations	20 ft.
It is obvious that in small houses located next to each other it can be tricky job maintaining all these distances.	



Therefore, the comparable part of the Brahmpur project[7] (on the same lines as Kharaudi) can be compared cost wise, with the Ulana system.

Sr.No.	Description	Ulana Details	Brahmpura Details
1.	Projected Design Population	2478	3500
2.	Waste Generated/ Capita	80 litres	80 litres
3.	Treatment Scheme Provided	Aerobic followed by floculative lagoon	Anaerobic, followed by recirculation filter and then lagoon
4.	Green House Gases	Let out at 210 different places	*Let out at one place and can be harnessed as biogas.*
5.	Per Capita Cost of Sewage collection System including manholes etc.	**Rs. 1455/-** (High due to 210 individual septic tanks)	(24,50,000/3500) **Rs.700/-**
6.	Per Capita Cost of Treatment Plant	**Rs. 638/-**	(21,45000/3500) **Rs. 641/-**
7.	Total Per Capita cost before pucca streets	**Rs. 2093**	**Rs. 1341**
Thus the per capita cost of Brahmpur/Kharaudi technology is actually less by nearly 30%			
8.	Total per capita Sanitation cost including street concreting	**Not done**	**Rs. 2468**

Usage and Maintenance

All the households, schools, hospitals and public places have toilets were put to **use** in Kharaudi and Brahampur village[8]. The reasons being NRI's have a habit of using toilet, people in the villages are literate and are aware about the good hygiene practices. The water supply is adequate. However the entire system is not optimally utilized because only mostly people reside abroad. In Brahampur village the NRIs also invested in water supply scheme because the government water supply was dysfunctional.

Kharaudi project is more than a year old and people and using it. However the issue of **repair and maintenance** has still not come up. Dr. Bassi and Dr. Gill have jointly deposited an amount of Rs.10 lakh for its maintenance. However, the Brahampur village is betterment in this front. There the villagers regularly deposit Rs. 90 as water chargers for the maintenance of water and sanitation facilities including the electricity bill.

Government Support in Implementation of the Scheme

In Punjab there are two ways to implement the programme. (A) Firstly Through the Village life Improvement Board- The board hires an engineer to prepare the proposal of the village which is directly submitted to the NRI commissioner. The NRI commissioner

[7] Data for available for Brahmpura project
[8] The team has asked them to apply for Nirmal Gram Puraskar

can send a panel of his own engineers at least 3 times in a village and the villagers have to pay a maximum of Rs. 5000. The foundation gets 5 percent of the project cost. (B) Secondly through the District Collector which goes upto Secretary Rural development. In both the case State Government earlier used to provide a matching grant of 50%, which has gone up to 90%. The Village life Improvement Board has got finalized the proposals of 10 more villager and the work is on.

Factors Contributing Towards Success of Kharaudi, Brahmpura villages

Kharaudi and Brahmpura villages Like Kharaudi and Brahmpura villages, many more villages in Punjab have a NRI population. Seeing the deplorable living conditions in their *pinds (*villages) they wanted to contribute in the development process. The contribution by the NRIs and the timely financial support by the State Government have helped changed the face of Indian villages like Kharaudi. However the question arises whether such projects can be sustainable and can be scaled up.

Sustainability and Reliability

Overall, thought the benefits from Kharaudi and Brahmpura projects are many and looks very attractive, high initial capital for the basic infrastructure, consumption of water is high for the functionality of the system and recurring maintenance cost are areas of concern specially looking at the conditions of rural areas of the country. Firstly all the villages do not have NRI support and water, which is the essential thing for this project, is a scarce product and operation and maintenance is a difficult thing. **But the village life improvement board has come up with alternate ways to deal with the problem. (a) There are lot of funding agencies like Canadian CIDA and other bilateral and multilateral organizations from where funds can be chanalized; (b) secondly this project can be promoted in water abundant states. And (c) Lastly, in all the sanitation project harnessing the emitted gases and using them to produce energy will make these systems self-sustaining. However it will be possible only in case of community septic tank rather than individual septic tank.**

Way Forward

No technology is good or bad. Modules can be designed looking at the availability of funds, depending on various conditions of the individual village, availability of water, land space. Keeping in mind the diverse conditions in India small steps which can be taken have been listed below:

- The NRIs have formed a board and their idea is not to stop at their own village but to spread it to more villages then to the whole of Punjab and even in other parts of India. Individual NRI have done remarkable work for the welfare of their villages but the board would like to make a collective effort to optimize the improvement in village lifestyle. According to the board, the funds is not a problem but what they require is willingness from the villages. **The board is willing to facilitate the process.**
- A committee of experts can be formed which can include engineers, sanitation experts, social development expert to decide what module to fit in where. The

different options as discussed above can be availed and further more can be worked out.

- In the villages, which have received Nirmal Gram Puraskar, with their award money can move towards wastewater management and GoI can provide technical and programmatic support.
- The Government can involve other NGOs and private organizations to take up projects in similar pattern.

The team received wholehearted support and cooperation from Shri D.K.Bhasin, SE, Department of Water Supply & Sanitation, Patiala, Punjab, officers and field staff of Hoshiarpur, Ludhiana and Patiala districts, Shri Dr. R.S Bassi, Chairman, VLIB, Kharodi and Shri M.P.Singh, Earthizenz Systems, bio-energy cycles.