



Case Study:



Honduras

U R B A N S A N I T A T I O N

THE CONSTRUCTION OF LOW-COST SEWERAGE SYSTEMS IN TEGUCIGALPA. A FEASIBLE SOLUTION FOR THE URBAN POOR?

Abstract

'The Tegucigalpa Model' peri-urban water programme built its reputation on **community participation, cost sharing and use of a rotating fund**. In 1995, it added a sanitation component. The case study describes the **low-cost technology** used and the **influence of sanitary solutions** on health, behaviour, costs and environment. Emphasis is given to constraints and points needing attention, in the context of the question of whether low-cost sewage systems are a feasible solution for the poor in Tegucigalpa.

Peri-urban communities quickly appreciate health benefits of infrastructure improvement and are motivated to use opportunities offered. Criteria are set to select eligible communities for the sewerage programme. Construction, administration, maintenance and operation of the sewage systems are organised through the Community Water Board. The community owns the system and takes decisions on technology, tariffs, maintenance, operation and speed of repayment of the cost-recovery Rotating Fund. In communities where sewage systems are constructed, there is a commitment to implement a hygiene education programme - *Healthy School and Home*. **Constraints** included: that even with education some misuse led to partial failure of the system; that for some the connection costs are too high; that huge investment needs to be made to expand the city's sewage collectors capacity before being able to use the proposed technology on a large scale; and that none of the wastewater discharged by the sewage systems receives treatment before being discharged into the river. Thus UNICEF will **focus on**: intensified education on rational use and maintenance of sewage systems; exploring means to stimulate connection to the system at low costs; exploring the viability of constructing small-scale off-site wastewater treatment facilities; and developing political awareness about the water and sanitation problems of the poor in Tegucigalpa. From a micro-financial and health perspective it seems that low-cost sewage systems are a feasible solution for the poor in Tegucigalpa. However, from an overall environmental impact and macro-financial perspective, a detailed impact and cost study is proposed. Thus **currently the answer to whether low-cost sewage systems are a feasible solution for Tegucigalpa's poor is 'possibly'**. Meanwhile, UNICEF will continue with small-scale implementation of low-cost sewerage and support research on larger scale solutions.

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LOW-COST SEWERAGE SYSTEMS IN TEGUCIGALPA

1. INTRODUCTION

In 1987, UNICEF together with the National Autonomous Water and Sewage Authorities, SANAA, started a water programme for the provision of safe drinking water to peri-urban communities in Tegucigalpa, the capital of Honduras. At the time, most inhabitants of peri-urban communities lacked access to a water system. Except during the wet season when some rain water could be collected, water had to be bought from private vendors at high commercial prices. For 80% of the families this represented that 11.6% of their monthly income was used just for the purchase of water, which besides could be of questionable quality (Espejo, 1994).

SANITATION:

A Process whereby people demand, effect, and sustain a hygienic and healthy environment for themselves by erecting barriers to prevent the transmission of disease agents (UNICEF/USAID, 1997).

For the execution of the Programme, the Executive Unit for Settlements in Development or UEBD was created. Since then, the UEBD has been institutionalized within the formal structure of SANAA and forms part of the Metropolitan Division of SANAA. By the end of 1997, more than 150,000 persons in 95 communities had benefited from the water supply programme, leaving only 20 urban communities without a water system. Funds have been allocated by the Government of Sweden to cover those 20 communities before the year 2000.

During the eleven years of its existence the Tegucigalpa water programme has been documented on several occasions as a successful peri-urban water programme. At international level, it is generally referred to as '*The Tegucigalpa Model*'. The Programme's reputation is mainly due to its Community Participation, Cost Sharing and Rotating Fund components. We refer to previous publications for more information on the water component (e.g. Torres/Mooijman, 1996).

In 1995, the programme was expanded with a sanitation component. Based on the experiences, this article describes the technology used and the actual influence of the sanitary solutions on health, behavior, costs and environment. In addition emphasis is given to its constraints and points that need special attention. The overall focus of the article is the answer on the question '**Are Low-cost Sewage Systems a Feasible Solution for the Poor in Tegucigalpa?**'

2. EXISTING SANITARY CONDITIONS

According to official statistics, 86% of the Honduran urban population has access to some kind of sanitary facility¹. For the poor in Tegucigalpa, sanitary facility generally means a ventilated-improved-pit latrine because connection to a sewage system is mainly restricted to middle and higher income neighborhoods only. Latrines and sewage systems are the only sanitary facilities used in Tegucigalpa. The limited infiltration capacity of the soil does not allow for the construction of septic tanks. In 1995, 150 peri-urban communities (or 279,000 persons) in Tegucigalpa lacked access to a sewage system². This represented about 30% of the city's population and 70% of the city's peri-urban population.

At the moment, 13,127 latrines³ have been constructed in the peri-urban areas of Tegucigalpa through the Honduran Fund for Social Investment, FHIS. FHIS was established in 1990 to alleviate the impact of the, World Bank stimulated, Structural Adjustment Programme on the poorest sector of society. Because of the rapid implementation of the FHIS programme, especially in its first years of existence, little attention was given to the sustainability of the projects. Also, no participation or contribution was requested from the community. Latrines were constructed by contractors and given at no cost to the beneficiaries. The average cost of the prefabricated FHIS latrines constructed so far has been US\$ 104.36. At this moment the costs of a FHIS latrine has risen to US\$ 140.

During the first years of the FHIS latrine programme, no hygiene education component was included. As a probable effect, it was reported that many of the beneficiaries did not or improperly use their latrine. For this reason, in 1995 a hygiene education component emphasizing on use and maintenance was developed. This has increased the rate of use of the latrines but still too many are without proper use.

When no sewerage exists, generally no healthy solution for the discharge of grey water has been developed. Water discharged from sinks and stand pipes runs from the patio on the street where it searches its way to the lowest point, causing insanitary situations due to smelly and polluted water standing on streets and, among others, allowing mosquitoes to breed.

For the communities with a sewage system it is important to note that none of the wastewater collectors in Tegucigalpa has been connected to a sewage treatment plant. All

¹ source: Division de Desarrollo-SANAA, projection made by SECPLAN

² Inventory of situation in marginal communities of Tegucigalpa, by UEBD, 1995

³ Information received from FHIS II, 16 March 1998

wastewater is directly discharged into the Choluteca river. The collectors are used up to their maximum capacity if not overcharged and in addition often leak.

In recent years, it was more and more being recognized that the use of latrines on a large scale in a peri-urban context could cause a future environmental problem for its local pollution, through infiltration of contamination in the soil or from filling up. The lots in peri-urban areas are normally quite small so there is few space to build a latrine in the patio of a peri-urban house, especially when is considered that a latrine should be transferred once it is filled up (another option is emptying of a latrine but that is not common in Honduras). Latrines are in general quite useful for the removal of pathogens and parasites from faeces but a latrine does not solve the grey water problem. As demonstrated in the text box, almost half of the organic pollution, measured as BOD5, is caused by grey water. Organic pollution is in the case of Tegucigalpa the main source of contamination.

Average breakdown figures for daily per capita BOD5 contributions in the Tropics (g/hd.d)

Personal washing	5
Dishwashing	8
Laundry	5
Toilet - faeces	11
- urine	10
- paper	1
TOTAL	40

source: Sewage treatment in hot climates,
Duncan Mara, 1978

Mainly because of the inconveniences of traditional latrines (such as; smell, mosquitos, location, etc.), communities started asking the UEBD to support in the construction of a sewage system. Their additional argument was the higher health benefits of flush toilets in comparison with latrines. In 1995, the UEBD constructed its first sewage project; a traditional design sewage construction. Because of its high investment costs per capita this was not considered as an appropriate strategy to be used on a large scale for the urban poor. In 1996, the UEBD started to develop a different approach through the construction of low-cost, non-conventional sewage systems. Due to the high necessity for sanitation solutions and because the need for water supply projects is nearing its end, a gradual shift of the key activities of the programme has been planned for the coming years from the construction of water projects to sanitation projects.

By the end of 1997, 4 sewage projects based on simplified design had been constructed, benefiting almost 3,500 people. For 1998 and 1999, 19 sewage projects are planned to benefit 25,000 people.

3. COMMUNITY DEMAND AND PARTICIPATION

The general impression about peri-urban areas is that since the population comes from different parts of the country, they do not feel such a strong link with their neighbors, as do rural people. This may be true, but practice has shown that this does not directly imply

that it is difficult to organize and motivate the urban poor for a programme to improve their community. The situation as described by Maggie Black (see box next page) is certainly more true for Tegucigalpa: the people in the peri-urban communities quickly appreciate the health benefits of infrastructure improvement. The reason why they came to the capital was the search for a better living and this makes them very motivated to use the opportunities offered by institutions such as SANAA/UEBD or FHIS.

Evidence from 'urban basic services' programmes indicate that **slum and shantytown populations are quick to appreciate health and economic benefits of infrastructural improvement** - usually quicker than rural folk. The impulse to better their lot which took them to town in the first place needs only to be channeled and supported with technical advice and small levels of investment. (from M. Black, 1994)

At this time approximately 150 peri-urban communities in Tegucigalpa do not have a sewage system. It is not difficult to imagine that as soon as it became known that the UEBD, in addition to water systems, was also constructing sewage systems, communities started applying for such a system. Because the UEBD's capacity to construct sewage systems is much smaller than the demand, fair selection criteria had to be set. The criteria can roughly be divided in physical and financial criteria. Since all systems, so far, have been connected to the existing sewage network, there has to be collector capacity available at a reasonable distance from the community. Another criteria is related to the financial status of the community's water project. A community can only apply for a sewage project once it has (almost) completely paid its contribution due to the Rotating Fund (more about the RF can be found under point 5). This criteria has two aims: first it ensures that only communities are selected that already have proven to be competent in the organizational and financial areas and secondly, once the Rotating Fund has been paid completely, the costs paid for water tariffs will be lower and the population will have funds available to pay their monthly sewage contribution.

The construction, administration, maintenance and operation of the sewage systems is organized through the same entity as the water systems: the *Junta de Agua* or Community Water Board. The community is the owner of the system and as much as possible takes independent decisions on the technology of the system to be constructed, the tariffs, maintenance, operation and speed of repayment of the Rotating Fund. In 1998, the UEBD will for the first time organize a course on operation and maintenance of low-cost sewage systems for Community Water Boards. In future, similar courses will be held every six months.

In all communities where sewage systems are constructed, the UEBD has the commitment to implement a hygiene education programme for all beneficiaries and finalize it within three months after the sewage system has been put into operation. The time frame has been established with the philosophy that it is easier to teach something correctly right away than to change an inappropriate behavior once people have gotten used to it. Except for the evident arguments in favor of hygiene education, in this case we

have to focus additionally on the rational use and maintenance of the system, because most people have never lived before in places that had access to sewerage. For example: what can be thrown in the toilet and what cannot; how often do you have to clean it; what to do when the pipes are blocked; etc.

The hygiene education programme of the UEBD is called: *Escuela y Casa Saludable* (or in English, *Healthy School and Home*). Access to the community is roughly through two channels: the schools and the homes. Voluntaries from the community are trained by UEBD social workers to make visits to the houses of approximately ten of their neighbors. During these visits the volunteers explain to their neighbors, with the help of theme posters, the treatment, storage and handling of drinking water, sanitary facility use, garbage and personal hygiene. School teachers are trained and given educational material to teach the children of the community on the same subjects.

4. LOW-COST TECHNOLOGIES USED

The technologies used and planned are known as 'small-bore sewage systems' and 'simplified sewage systems', which have been implemented successfully in e.g. United States, Brazil and Australia. This is the first project using these technologies in Central America.

'Small-bore' or 'solids-free' sewerage refers to the transport of domestic sewage which is settled on-site in a septic tank, so that only fluids are discharged through the sewage pipes to the main collectors. 'Simplified sewerage' is for the conveyance of raw unsettled sewage in flat, shallow sewers (it is a conventional sewage stripped down to its hydraulic basics, and with simple inspection boxes replacing expensive manholes)⁴. The main reason why these technologies were developed was to reduce construction costs in comparison with traditional sewage designs. Cost reduction is mainly due to a optimization of the capacity available in the system leading to the use of less material. Cost reduction factors are: gradient reduction, smaller pipe diameters and smaller collectors.

One of the strengths of the UEBD Programme is its emphasis on community participation. The community is very involved in the selection of the technology to be used. In this particular case it has led to a situation that communities can not be convinced to construct small-bore systems but rather choose for a simplified design because it is more conventional and 'known'. And even when using a simplified design it is sometimes quite difficult to convince the beneficiaries that a low-cost sewage system as offered can work as well as conventional sewerage. The UEBD engineers have to answer many questions from worried community members when they make their daily inspection visits to the construction sites. People question whether it will be possible to discharge all their waste water through pipes of only 4 inch diameter. Sometimes the

⁴ Definition as provided by The Low Cost Sewerage Network, University of Leeds, United Kingdom

engineers discover that an inspection box has been constructed 'overnight' with traditional dimensions rather than with the proposed design. After having implemented some good working infrastructure in other communities, people slowly discover that the solution offered to them indeed is a 'real solution' for their sanitary problems. This year, the UEBD engineers are working hard to promote the small-bore technology because in the peri-urban setting it would even be more appropriate than a simplified design.

5. COSTS AND FINANCING

As in the water supply projects, the community commits itself to provide manual labor, and some of the local construction materials and PVC accessories. In general, each household has to excavate 15 meters of trench. This is not an easy task considering that due to irregular topography excavations are sometimes as deep as 4 meters. All work is done manually in very rocky soil. In addition, every family pays an initial financial contribution of 500 Lempiras (approx. US\$ 38) in order to be allowed to connect to the system.

Alternative Waste Disposal Systems the costs per household (1990 prices)

VIP latrine	68-175 US\$
Shallow Sewerage	100-325 US\$
Small-bore Sewerage	150-500 US\$
Conventional Septic Tanks	200-600 US\$
Conventional Sewerage	600-1200 US\$

source: The Poor Die Young, Earthscan 1990

The sewage systems are being administered by the Community Water Boards and monthly sewage tariffs of approximately 5-10 Lempiras (US\$ 0.38-0.76) are included in the water bill. Except for the monthly sewage contribution to be made to SANAA and costs for operation and maintenance, the tariffs go to repay investment costs. A similar cost recovery policy is applied as for the construction of water systems; through monthly payments to a Rotating Fund. At the end of the construction of the system the UEBD calculates the investment costs (without incorporating inflation or interest) financed by UNICEF and SANAA (materials and technical assistance respectively). This makes the total amount to be repaid by the community to the Rotating Fund. Every community can decide at what speed it pays back to the Rotating Fund, with a maximum recovery period of seven years. The Rotating Fund enables the UEBD to develop water and sewage systems in other communities and to expand the programme's coverage.

Initial calculations show that the investment costs for simplified sewage systems are US\$ 35.45 per person (including a community contribution of US\$ 19, a UNICEF contribution of US\$ 14 and a Government contribution of only US\$ 2.45)⁵. By comparison, the per capita investments costs of a Dry Composting Latrine in El Salvador is US\$ 26.70⁶, of a FHIS latrine is US\$ 23.33 and a traditional sewerage system in Tegucigalpa is US\$

⁵ Calculations by UEBD/SANAA on basis on actual construction costs, August 1997

⁶ Source: Evaluation of UNICEF's Programme for Water and Sanitation in Central America, 1996

66.72. In case of sewerage, additional expenses have to be made to link up the households to the system.

6. SUPPORT IN LINKING-UP TO THE SYSTEM

The first UEBD (conventional) sewage system was constructed in 1995 in a community called La Canada. One year after the system was put into operation, 80% of the 352 houses had still not linked up to the sewage system. Some reasons were given for this: in contrast to other communities, this community did not have to sacrifice as much as other communities because all the investment costs for their water and sewage system had been donated by the Canadian Government. No repayment had to be made to the Rotating Fund. Does this mean that the community was less motivated? The UEBD-staff thinks this is partly the case. The community itself indicated that many families lacked the funds to link their existing facilities to the sewerage or to invest in the construction of appropriate sanitary services.

To support families that were not able to make investments for the construction of sanitary services, UNICEF decided to reinstate a micro-credit programme with the US-based NGO, Cooperative Housing Foundation (CHF). In April 1997, an agreement was signed for the initial provision of 85 credits to families in the urban community of La Canada. At the same time as the micro-credit programme started, the UEBD entered the same community with its hygiene education programme.

The CHF programme provides the families with near-market-rate credit for the construction of household sanitary services, i.e. toilet, shower and *pila* (a combination water storage tank and washboard). The families benefiting from the programme would never have had access to credit from commercial banks because of their relatively low or unstable earnings. The maximum credit given is 10,000 Lempiras (approx. US\$ 750). In most cases, families contribute materials or personal funds to complement the money they

"When potable water and sewage services arrive, everything changes"

These are the words with which the family of Antonio Ramon Escoto, his wife Marta and their small daughter Bessy Lorena, 5, stated their joy at the availability in their house of basic services such as potable water and sewage. Antonio and his family form part of the population living in developing neighborhoods of Tegucigalpa, such as the Altos de Loarque Community.

"To have potable water service is our home is good, but now that we have sewage service is even much better. My wife is very happy now we have a shower and a toilet in the house. We know that these things will help us improve hygiene conditions in our home and we will work hard on it."

"It is nice to know that we now have water, bath and pour-flush toilets in our house"

Delmis Palma is a single mother with two young daughters. She also lives in Altos de Loarque Community along with her father and brothers and sisters. I still remember when fifteen years ago we arrived here, said Delmis, we had to go get water at a far well, o do our necessities in the open air. Thank God and the organizations that have supported us that all that is behind us. We are proud of what we have done, and each week a member of the family has the assigned task of keeping the latrine and bath clean, and in general, the whole house.

borrow, and often provide some labor as well. The repaid funds go back into a capital fund which can provide credit to another 108 families within the same community, without decapitalization. (Ocasio, et al., 1995) Due to the programme, conditions in the community have improved rapidly. Where one year ago, most houses discharged grey water, this is now a rarity.

For the sewage systems that were constructed after the La Canada system, selection criteria as explained under point 3 were used. This made that the community was more motivated to struggle to get a sewerage constructed. This motivation can immediately be noticed in the connection rate in those communities. For example in community Altos de Loarque (see text box), more than 80% of the people had linked up to the sewerage within the first year of getting into operation. In those communities in order to overcome the problems and delays with the connection to the sewage systems, UEBD/UNICEF provided the opportunity for Community Water Boards to purchase pour-flush toilets at cost price and repay it in several payments to the Rotating Fund. Also a design was made to rebuilt the FHIS-latrine in a pour-flush toilet by using the same superstructure. Costs to install toilet and connect black and grey water to the sewerage are in this case as low as 500 lempiras (approx. US\$ 38).

7. CONSTRAINTS

- * Even though all inhabitants of communities where sewerage is constructed received hygiene education and education on its rational use, some misuse leading to partial failure of the system occurred. For example, because of cross-connection of rain water drains to the sewerage, flushing of cloth in toilets, garbage in the inspection boxes (due to lack of garbage collection) etc.
- * For some of the beneficiaries the costs to connect their house to the sewage system are too high. Without stimulation or help, many households stay disconnected for a long time, not taking advantage of the improve hygiene situation available in their community.
- * As mentioned earlier, the sewage systems constructed so far have all been connected to existing sewage collectors. Knowing that the available capacity of the existing collectors is nearing its end, huge investment should be made to expand the city's sewage collectors capacity before being able to use the proposed technology on a large scale.
- * At the moment, none of the wastewater discharged by any of Tegucigalpa's sewage systems receives treatment before being discharged to the river Choluteca. Where local, dispersed pollution and no grey water treatment are disadvantage of latrines, we could from an environmental point of view question whether it is a better solution to collect the pollution and to discharge it to a point downstream of the city as is currently the case.



8. POINTS OF SPECIAL ATTENTION

As a result of the constraints mentioned before, UNICEF will for the next two years try to focus on the following points.

- * *Education on rational use and maintenance of sewage systems:* Even though this activity is already part of the programme, problems have shown that education should be intensified. From 1998, more emphasis will be given to this theme.
- * *Linking-up to the system:* Considerations are made to continue the programme with CHF. Unfortunately due to the relative high costs and UNICEF's limited budget, the CHF programme will only cover part of the communities where sewerage is being constructed. Also the provision of pour-flush toilets for low-cost connection will continue. During 1998, other possibilities to stimulate connection at low costs will be studied.
- * *Small-scale off-site wastewater treatment:* Because the existing collectors do not have sufficient capacity for the connection of many additional sewage systems and because no wastewater treatment is taking place, a solution considered for some communities is the construction of small-scale off-site wastewater treatment facilities. Taking into consideration that Tegucigalpa is located in a mountainous setting and that in the peri-urban area few land is still available for construction, few technologies can be applied and only under certain circumstances which avoids use on a large scale. The UEBD with technical support from Delft University of Technology, the Netherlands, will execute a feasibility study on the subject from May till August 1998. If considered feasible, a pilot plant will be constructed during 1999.
- * *Developing political awareness:* As in many big cities in developing countries, the peri-urban population of Tegucigalpa has virtually been left out of all urban planning. Why? Because they illegally occupied land? Because they believe the communities are just temporary? Because the land they occupy is worthless and not very appropriate for settlement? Because constructing systems would be too expensive? Because constructing services with even attract more people to migrate to the city? It is difficult to tell but too many excuses have been given for not providing services to the urban poor. One of UNICEF's challenges will be to create more political awareness about the water and sanitation problems of the poor in Tegucigalpa.

9. CONCLUSIONS

The answer to the question: '**Are Low-cost Sewage Systems a Feasible Solution for the Poor in Tegucigalpa?**', is very complex. When implemented on a large scale for the approximately 150 communities actually lacking a sewage system, we would have to

consider several points. From a micro-financial and health perspective we would say yes, go ahead and try to find financing for low-cost sewage systems in all the communities of Tegucigalpa. When also considering the overall environmental impact and the macro-financial perspective, we propose that a detailed impact and overall cost study should be executed first. So for now we unfortunately have to answer with 'Possibly'.

Meanwhile, UNICEF-Honduras will continue with small-scale implementation of low-cost sewerage and support research for finding as soon as possible an answer to the question. Because a good sanitary solution for people living in difficult circumstances in peri-urban areas has to be found, **All Children have the right to have access to proper Sanitation.**

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