Health care and sanitation in Peru — developing appropriate technologies

by Steve Maber

The previous issue of *Waterlines* carried Part 1 of the author's work in Peru dealing with water supply. In Part 2 he describes a successful latrine-building programme using local building materials and community labour.

FREAK FLOODS devastated the north-eastern desert region of Peru in 1983 when the warm-water sea current 'El Niño' altered course and reversed the local climate. The coastal fishing village of Sechura was particularly badly affected and its water supply system was destroyed. Thereafter, the villagers were forced to buy contaminated water from water-sellers using open wells several kilometres away. The lack of adequate clean water and consequent poor hygiene led to alarming increases in the population's morbidity and mortality rates owing to the proliferation of gastro-intestinal diseases.

Poor communications and geographical isolation had limited the emergency relief that Sechura received after the floods. Yet the community had also failed to organize their own improvements to the quantity and quality of their water supplies. The author recognized the opportunity to generate development from *within* the community by using local materials and techniques in the construction of appropriate engineering solutions. Hence, the project *Agua Para Sechura* began. This approach attracted interest from the international funding community, and co-funding for the project was obtained from the Catholic Fund for Overseas Development (CAFOD), the Overseas Development Administration (ODA) and the European Economic Community (EEC).

Construction work began immediately to rehabilitate the destroyed well system and pumping main. Simultaneously, the emergency open wells were also studied in detail and many improvements were made to increase the efficiency and water quality of this temporary system. Raised-level handpumps and low-cost domestic solar distillers emerged as the appropriate solutions in this case. The story of their development appeared in the October 1988 issue of *Waterlines*.

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Health education

Valuable information about local customs and beliefs was obtained by carrying out a comprehensive survey in the town. The results revealed a desperate situation: levels of water usage were very low, with almost one-fifth of the population surviving on under 10 litres per person per day and only 7 per cent able to afford the recommended minimum of 30 l/p/d. There was also a wholly inadequate understanding of the causes of the treatments for common diseases. The majority of the families suffered from diarrhoea, sickness and fevers, and many children died needlessly because of the parents' superstition — they invariably withheld fluids from a child in this condition.

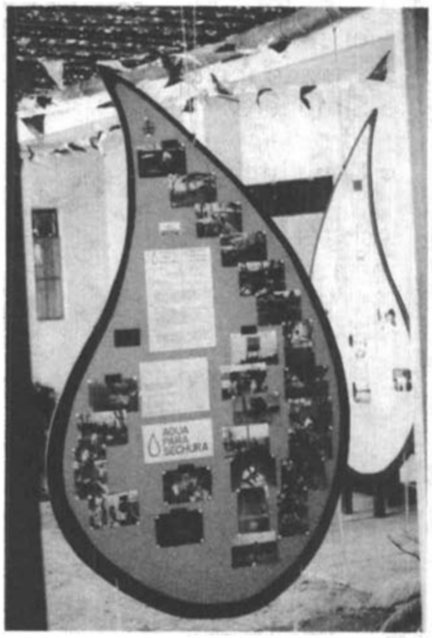
The survey results demonstrated the importance of providing better accessibility to drinking-water in greater quantities and at lower prices. But it was also clear that this response alone would not be enough to solve the community's endemic health problems. Accordingly, it was decided to include health care and hygiene education in the programme of works to provide adequate coverage for the vast majority of the community, who relied solely on remedial herbs and folklore.

The lack of medical facilities in the town restricted the treatment of illnesses to the few who could afford the trip and the fees of the doctors in Piura (an arduous journey of some 57 kilometres). So, a central community centre was designed and built in collaboration with the townspeople and many volunteers. This building now serves as the focal point for the project's activities and includes a meeting hall, workshop, laboratory, store rooms, accommodation and a complete medical facility.

Community centre

The medical wing was donated to the Peruvian Institute for Social Security on the condition that they provide a free medical service to all of the townspeople. The resident medical team now comprises a doctor, obstetrician, nurse and auxiliary but specialists such as dentists and paediatricians also make regular visits. Most importantly, the centre is concentrating on the prevention of diseases and has hosted a series of regional campaigns and workshops on inoculations, nutrition and child care etc.

The community centre successfully united engineers and doctors in a combined effort with the residents of Sechura to combat the



A poster display about the project at the community centre.

Reinforced concrete columns were cast inside hollow bamboo poles for the building supports.

ignorance about health care and hygiene matters. It has also provided a unique opportunity for education programmes that teach by demonstration and give instruction on preventive medicine and practices. For instance, considerable impact was achieved by inviting the leading Peruvian expert to conduct a parasitological study in the town. He found dangerously high levels of skin and stomach infections as a direct result of poor hygiene. So a very effective campaign which used information posters started, aimed particularly at women and children. These encouraged hygienic practices such as boiling water before drinking it, washing hands before eating, and burying domestic rubbish. This important work drew attention to the need for sanitation and provoked open discussion on this sensitive issue.

Sanitation

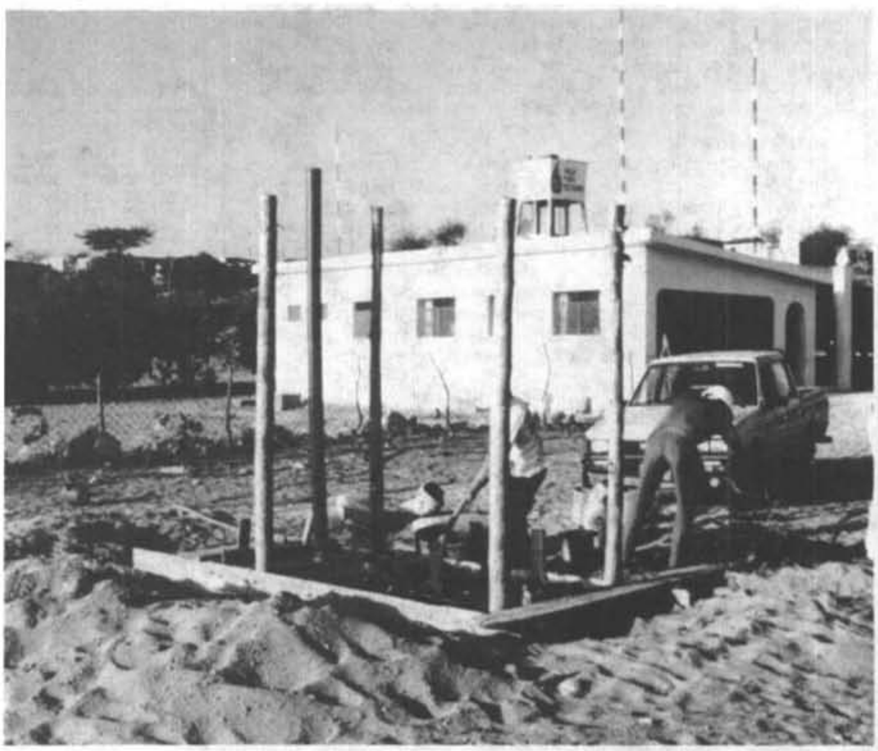
There had never been a system for the disposal of human waste in Sechura. Faeces littered the town, especially around the market-place, and few people seemed to be aware of the dangers of this practice. The survey had also shown that very few people had a bathroom, there were no public toilets and most people walked long distances to defecate (particularly women), usually on open land or behind distant sand dunes.

Hygiene education was a vital element in the perception of the problem and the need to do something about sanitation. But the solution proved to be a critical balance between the choice of technology and the level of service. On the one hand, there were demands for a full sewerage system and flush toilets installed in every house. On the other hand, there was an urgent need for a simple, efficient and low-cost system that could be installed and maintained by the townspeople themselves. It was difficult at first to convince some sectors of the community to accept something that they considered to be 'inferior'. But it was clearly inappropriate in a small desert town to install expensive house connections for water and sewerage as well as trunk mains, pumping stations, treatment works, maintenance and cost-recovery systems when there could never be enough water to supply a modern flush-system. In addition, only a small minority of the population actually have permanent homes in which a bathroom could feasibly be installed.

Latrine design

A solution finally emerged whereby public latrines would be built first and then credit would be made available for self-help groups to construct domestic models afterwards. Wide acceptance was subsequently obtained for a design which could go into service immediately but with an in-built facility for upgrading in the future. Accordingly, *Agua Para Sechura* experimented with a number of designs based on the traditional pit latrine in order to make best use of local building materials and techniques. A system of latrines was eventually developed that won the community's approval in a series of demonstration projects. Their design and installation methods are a novel and genuinely appropriate application of the available technologies. Close involvement of local craftsmen at all stages of production has also ensured their acceptance and replicability within the community.

A detailed description of the Sechuran pit latrine appears in the boxes. However, there was a complex evolutionary process that led to this final design. An overriding concern was the retention of liquids (however small in quantity) to provide favourable conditions for the breakdown of organic solids by microbial activity. This prevents the build-up of sludge, and maintenance is only required when non-biodegradable solids accumulate (for example, plastics, cloth, sand, etc.). So, while an 'aqua privy' seal was impractical, it was decided to provide a watertight treatment pit. The treated liquids filter out through open-jointed blockwork walls and quickly



The latrine's superstructure is a simple building which provides shelter and privacy for the user. Its design must be sturdy enough to withstand the strong coastal winds.

Design criteria for the Sechuran pit latrine

Treatment pit
The sands in Sechura require a submerged treatment pit built of blocks. The simplest method involves digging a 1.5m-deep hole (approximately 2m by 1.5m plan area for the family unit) and pour lean-mix concrete over compacted hardcore to form a base. Concrete blocks (formed by hand in wooden moulds) are used to build up the walls of the treatment pit. Coursework above the first 0.5m is left with 0.5cm vertical gaps between each block to act as a filter. The pit floor is built up to slope away from the entry point to avoid congestion at one end. The ramp is rendered smooth, as is the lower 0.5m of coursework to create a watertight tank. The excavation around the tank is filled to the top with stones and rubble to ensure rapid dispersal of the treated liquids.

Floor slab
Pre-cast, reinforced concrete beams can be installed over the pit to build up the suspended floor slab. However, it was found to be quicker and cheaper to pour the concrete for the slab on the site. The need for reinforcing steel is obviated by the use of permanent, split bamboo shuttering, laid side-by-side across the pit. Heavy paper placed over the upturned bamboo-halves prevents the concrete seeping through the gaps. Two courses of brickwork along three edges of the slab form a sturdy base for the walls and prevent damage from erosive wind-blown sand and flowing surface-water. This brickwork also protects the walls when cleaning the inside.

Bamboo-crete
All of the nodal platforms are knocked out of freshly-cut bamboo (at least 15cm diameter) with round bars of increasing size. A steel reinforcing bar is then inserted down the centre of the hollow wooden cylinder and concrete is poured in. The mix is critical; it must have high workability and strength with finely graded aggregate to flow well and avoid blockages. Steel bars can be 'cast-in' at this stage to form connectors, hooks and door-hinges as required by the design.

***Quincha* panels**
Flexible sheets of woven reeds (called *estera*) are cut to fit the wall sizes and are tied on to vertical cane supports (*caña brava*). These locate into holes in a split bamboo, cast into the low wall on the floor slab, and into horizontal bamboo roof-beams. Rigidity is increased by tying thin laths of bamboo on to the other side of the panel, sandwiching the *estera* matting between opposing grids of canes and laths. Strings tied diagonally across each wall and roof panel provide strong resistance to shear and torsion and effectively 'lock' the structure against all deflection. The best paste mixture for workability, economy, strength and durability was found to be in this ratio: Sand(8) : Gypsum(4) : Cement(2) : Lime(1).

The paste can be applied rapidly to the *estera* panels in thickly trowelled layers that set in three minutes. The sand controls cracking and the lime protects the plaster against the corrosive sea air. Three or four layers can be built up to a completed wall thickness of 5cm in just one day. Steel-floating the surface leaves a smooth finish ready for painting. Furthermore, only the outside face needs to be plastered, leaving the attractive *estera* fascia exposed on the inside.

Seat and bowl
The oval concrete pedestal is cast in a split wooden (or fibreglass) mould. A specially designed fibreglass insert forms an integral seat, bowl and discharge pipe. The inclusion of a ring of flexible 2cm tubing beneath the rim allows for a flush action to be added in the future. Holes drilled into the tube through the fibreglass rim provide a rinsing action when connected to a water source. The discharge pipe is also compatible with standard 10cm plastic pipes so a U-bend can be connected to provide a complete water seal when there is sufficient water.

Ventilation
Painting the vent pipe black was found to have no effect on ventilation, and devices with moving parts invariably became blocked with sand. So an 'omni-directional' ventilator was developed by installing a plastic half-sphere (approximately 30cm diameter) with a central hole over the vent pipe. An inverted hemisphere fixed above the first one, so that they almost touch, completes the device. Wind from any direction is then forced to accelerate as it passes through the 360° constricted 'venturi' and creates a vacuum over the vent pipe (the Bernoulli Effect). This in turn draws air, and smells, out of the treatment pit as fresh air is drawn down through the bowl to replace it; this also keeps out flies.

Cost
The total cost of the materials for the latrine is about US$80. Labour costs are similar when craftsmen are used and they can complete the latrine within five days. However, most families prefer to purchase the building elements and assemble the latrine themselves.