Nicaragua: rural water quality surveillance and improvement

by Katherine Wedgwood

Poverty coupled with war have left 86 per cent of Nicaragua's population without a safe water supply. CIIR, with funds from Oxfam and Christian Aid, has been helping the national water authority to set up a National Programme for safe water supply.

UP TO 1987, only 13.5 per cent of Nicaragua's rural population had been provided with a water supply (see Table 1). However, at the present time, there are several water supply construction programmes financed by such organizations as CARE (Canada), COSUDE of Switzerland and UNICEF. The majority of these supplies are hand-dug wells fitted with a handpump. There are some boreholes with electric pumps but the national water authority, INAA, discourages their construction because of their costly and difficult maintenance requirements. In the mountainous Regions I and VI there are some gravity-fed water supplies which have both spring and surface sources.

Starting a pilot project

In February 1986, a pilot project was initiated in the Department of Boaco with the aim of introducing the concepts of routine water quality control and improving the rural water supplies in the area. Until then only in the capital, Managua, had routine water quality surveillance been carried out by INAA in accordance with WHO's *Guidelines*. In other urban centres sporadic water quality checks were made. Some rural water quality analyses were carried out in Region I but these excluded determination of faecal contamination.

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Water-quality analysis was done using DelAgua kits.

The pilot project began by training a small team of INAA community promoters and a Ministry of Health (Minsa) worker in how to carry out sanitary inspections of the water supplies, and how to use the Oxfam DelAgua portable water-quality testing kit. Six such kits had been donated along with some essential equipment for INAA's central water quality laboratory as part of purchases made with funds provided by several UK non-governmental agencies including Christian Aid and Oxfam. The kit enabled a number of parameters to be determined: pH, turbidity, temperature, conductivity, and number of faecal coliforms (i.e. the most important bacteria of sanitary significance).

Diagnostic survey

A diagnostic survey of all known water systems in the department was subsequently carried out by the team. Table 2 gives the results of the sanitary inspection and water quality analyses of the 63 communities with installed supplies.

The survey revealed that preventive and corrective maintenance was totally inadequate, resulting in poor water quality. Users lacked the basic organization, training and resources necessary to undertake rudimentary repairs and preventive maintenance: many also lacked a clear understanding of the relationship between water and health and the measures necessary to prevent contamination of drinking-water.

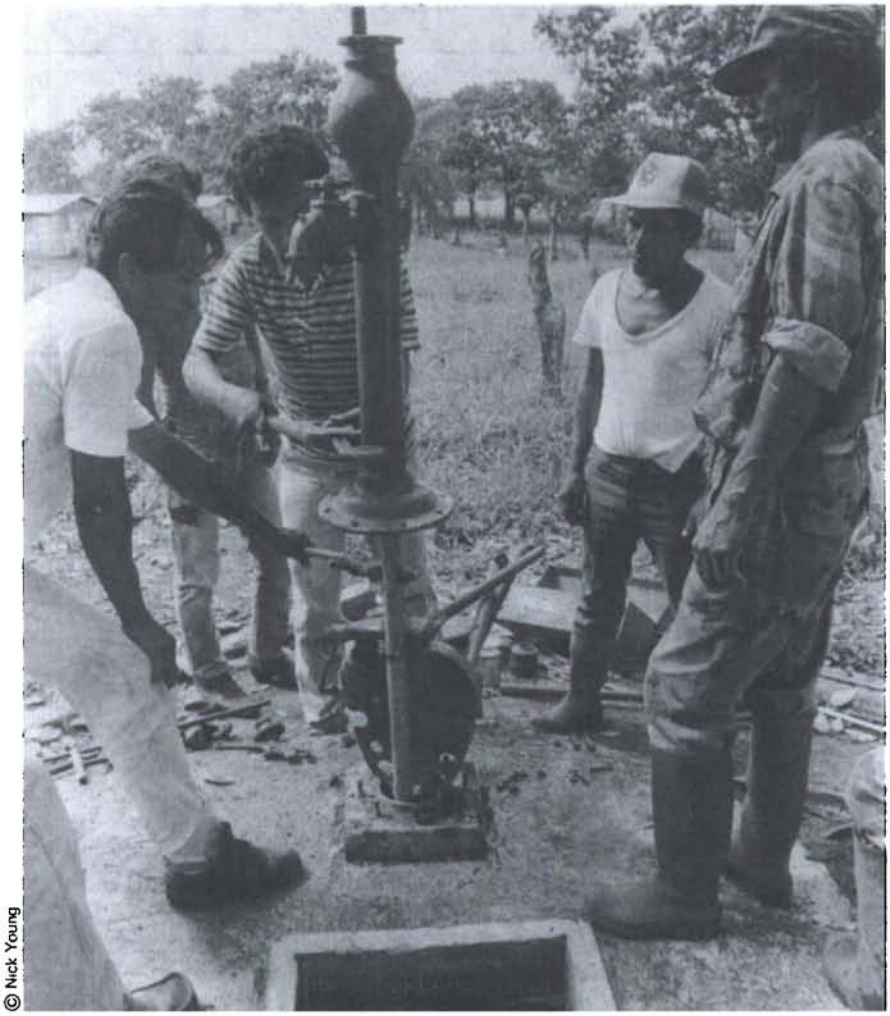
Given the general level of development in Nicaragua and an economic crisis exacerbated by war, it was felt that the INAA could not be expected to provide comprehensive maintenance of all rural supplies. Part of the burden of preventive and corrective maintenance should be placed upon the users themselves.

The pilot project set about attempting to improve this situation. First it sought to rehabilitate water supplies where there was sufficient commitment demonstrated by local people in a series of meetings held in the community. Secondly it began to develop a model of self-help operation and maintenance in the rural sector of INAA, combining within the model routine water quality monitoring, sanitary inspection and corrective action.

Rehabilitation

Every community visited in the initial survey was sent a report of the results of the analyses, pointing out the likely causes of contamination and recommending necessary repairs and improvements. Public meetings were held in each community to discuss the reports, to promote the rehabilitation and to encourage the re-establishment of elected drinking-water committees (CAPs). Such committees had been formed during the construction phase in order to organize the work carried out by the community. Sadly, most had subsequently disbanded instead of going on to assume maintenance responsibilities. Community response was mixed. Wherever the users were receptive, rehabilitative work went ahead. A CAP was formed and remedial work began.

In the pilot project it was decided that wherever possible users should provide local materials and pay for spare parts, cement and reinforcing steel. This policy was adopted for three reasons: to be less paternalistic; to overcome INAA's lack of available funds; and to try to



Water committee members re-threading the pump rising main of their well.

deepen a sense of community ownership and responsibility for the water supply.

The CAP organized the collection of sand, gravel and stones by the community, and the project transported the cement and steel purchased from the town council. Spare parts and handpumps were obtained from the stock left over from a previous programme. The rehabilitation was carried out by the users under the technical supervision of the community promoters, who simultaneously carried out a programme of basic, sanitary education involving both adults and children. To aid this educational work a video recorder was purchased along with appropriate educational videos. Illustrative posters were developed. This was particularly useful in communities without electricity.

Typically, the rehabilitation of a well includes the installation of a new handpump or the repair of a broken pump, repair of the well lining and platform, improvement of drainage, construction of a stock-proof fence and a sanitary inspection cover, and repair of existing bathing and clothes-washing facilities. In the spring-fed gravity water supplies the rehabilitation typically consists of repairing inspection covers, leaky valves and taps, covering air vents and overflow pipes with fine mesh and improving the construction of the public standpipes. Upon completion of work the supplies are disinfected using a 50 mg/l solution of nationally produced sodium hypochlorite. The final requirement is that the CAP and any other interested users attend a workshop on operation, maintenance and administration of the supply. The importance of basic sanitation and water quality are once again emphasized in these workshops.

Operation and maintenance

During the rehabilitation stage it became clear that to keep those systems in working order needed continuing attention from INAA. Recognizing this, INAA created a Unit of Operation and Maintenance (UNOM). In Boaco, this had comprised one community liaison officer, called a promoter who was part of the pilot project from its inception. Subsequently, two further promoters were appointed, so each was responsible for about 20 systems.

A community promoter is responsible for 'promoting' community action with respect to water supply. INAA tries to select promoters from the area in which they will work who have completed both secondary education and military service. In theory, a promoter, having completed initial, intensive training, must work for a minimum of two years as a construction promoter, (i.e. promoting when the water supply is being constructed), before being eligible to work for UNOM. INAA has recognized that ensuring on-going maintenance is a difficult task, made even more so in communities which did not meet their responsibilities right from the start. It is easier to interest a community in constructing a new water supply than in contributing to its subsequent routine maintenance.

The pilot project has sought to achieve the inclusion of one extra responsibility within the work of UNOM: that of routine water quality control and sanitary inspection. The other areas of responsibility are: operation and maintenance, administration, promotion and education. To enable them to carry out their work, the UNOM promoters are provided with motor bikes which they are able to buy from INAA over a three-year period. The project also has the use of a four-wheel-drive pick-up for transporting materials and equipment.

Once the CAP in a community has participated in the training workshop, s/he is expected to be able to carry out basic preventive maintenance and minor repairs unaided by the promoters. Regular cleaning, greasing and repair of pipe and tap leaks figure among their responsibilities. To do this a CAP has to collect a monthly tariff, an amount which is decided by the users themselves in public meetings. The fund is kept and controlled by the treasurer of the CAP, who is accountable to the community. The UNOM team also has some entertainment films which are loaned to CAPs for fund-raising events on condition that the water and sanitation videos are also shown.

The Boaco team has produced a simple manual on the basic operation and maintenance of hand-dug wells and handpumps to be

distributed to all CAP members. The UNOM promoter, who plans the monthly visit to each community, has access to more sophisticated tools should they be required — for example, pipe threading and cutting equipment and large wrenches. The CAPs will contact the UNOM office if they have a problem at any other time.

The promoter supervises the treasurer of the water committee, who keeps a record of the accounts in a simple system recommended by INAA. To try to keep up community participation and interest, the promoter and CAP organize user meetings to report and discuss changes, problems, tariff increases and the like. Periodically the promoter also carries out educational activities in house-to-house visits, in the school, or in public meetings, using the audio-visual aids.

Monitoring and inspection

Routine water quality monitoring and sanitary inspection are carried out in accordance with WHO's *Guidelines for Drinking Water Quality*. Every three months the promoters conduct a full sanitary inspection of the systems under their control. Appropriate inspection forms have been developed for the three most common kinds of supply. At the same time the water quality is determined using the portable testing kit. The promoter uses the results to make recommendations for corrective action. A report of results and recommendations is given to the CAP with copies being made for regional and central INAA offices. Copies are also given to local schools and health centres, so that teachers and nurses can encourage implementation of the recommendations.

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Installing a handpump.

INAA's water quality control division has decided that in the short term, the target for rural water supplies will be less than 10 faecal coliforms per 100ml. Promoters carry out a disinfection of the system should the results exceed this level, having first eliminated potential sources of contamination. Within seven days of disinfection the promoter checks the water quality again. Sometimes it is necessary to carry out a series of disinfections. On other occasions it is necessary to relocate wells because of poor siting.

The INAA, as it is interested in chlorination of small rural supplies, has encouraged the team to experiment with continuous chlorination. There are now four wells in communities which did not want to move them, or where there was no obvious alternative site, which are being continuously chlorinated. Public meetings were first held in these communities to explain why and how chlorination would be carried out, and to gain the approval of the users, at least in principle. Implementation has proved more difficult. Many people do not like the taste of chlorine. However, with time and constant education about its importance, users are gradually coming to accept chlorination. The person responsible for chlorinating is provided with a stock of 1 per cent sodium hypochlorite solution, DPD 1 tablets and a simple comparator (pool tester). S/he is taught by the promoter how to measure the chlorine concentration every evening.

Another landmark was passed in July 1988 when the water treatment plant for the town of Boaco was inaugurated. Previously the town had used untreated river water. The incidence of diarrhoeal disease was correspondingly high: in April 1988 over 900 cases were reported to Minsa in a town with a population of 19,000. The treatment processes now being used are flocculation,

Table 1. Growth and target growth of water supplies 1980-90 (Source: INAA)

Year	*Number of urban people served*	*Percentage of urban pop.*	*Number of rural people served*	*Percentage of rural pop.*
1980	913,418	35%	77,449	6%
1987	1,581,087	77%	196,397	13.5%
1990	2,100,000	100%	750,000	50%

Table 2. Results of the 1986 diagnostic survey

System		*Physical state*			*Water quality***			
	Number	*Abandoned*	*In need of major repair*	*In need of minor repair*	*A*	*B*	*C*	*D*
Hand-dug well with handpump*	46	16	8	14	7	6	12	4
Borehole with electric pump or windmill	9		2	3	8		1	
Spring-fed supply	7		3	3	3	2		2
Surface water	1						1	
Total	63	16	13	20	18	6	16	6

*In the case of the hand-dug wells water quality analyses were only carried out when there was sufficient water in the well. If the well was dry analyses were carried out, where possible, in alternative sources.

**Water quality classification key

A = less than 10 faecal coliforms/100ml
B = 10-50 faecal coliforms/100ml
C = 50-500 faecal coliforms/100ml
D = more than 500 faecal coliforms/100ml

sedimentation, filtration and chlorination.

Within the plant there is a small laboratory for monitoring the treatment processes. This laboratory has the equipment necessary to prepare material needed in the portable testing kits.

National Programme

In late 1986 a course was held in INAA's central laboratory for all UNOM promoters in the country. It introduced the concept of water quality control and field testing. Four of the six portable test kits were distributed to UNOMs in Regions I, IV, VI and Special Zone III. Regular follow-up training and supervision has been given.

It became clear that a more clearly defined strategy was required, so in May 1987, INAA produced a 'National Programme for Water Quality Control and Rural Supply Maintenance'. This five-year programme is based on the experiences of the pilot project in Boaco. In each region similar laboratories will be constructed and equipped. UNOM offices and workshops will have tools and spares. Extra staff will be employed and trained to ensure that the Programme fulfils its objective of monitoring all INAA water supplies, urban and rural, in accordance with WHO *Guidelines*.

Twice yearly, samples will be sent to the central laboratory for extensive physical and chemical analysis. All records of analyses carried out in the regional and central laboratories will be kept in a central data bank. It is hoped that over time the most important parameters to be controlled in each region can be determined. Financial resources permitting, the regional laboratories would then be equipped to carry out such analyses.

The National Programme is ambitious and as yet not all the necessary funding has been approved. The original pilot project funders, Oxfam and Christian Aid, have already agreed to supply part of the funds. It is to be hoped that the Programme will achieve success in a country whose government has clearly demonstrated its commitment to the prevention of disease and the promotion of public health.

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