



WATER, SANITATION, ENVIRONMENT and DEVELOPMENT

Pipeline extensions spread benefits

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Abstract

Many of the water supply schemes built in Senegal in recent years are operating below capacity (Smith, 1991), partly due to poorly developed distribution systems. In a small scale, ODA funded project, an extra 25,000 rural people have been connected to existing supply schemes by construction of a large number of short extensions from the original distribution networks.

Background

Senegal was severely affected by regional droughts in the 1970's and early 80's, and even in normal years there is low annual rainfall, (typically 200 - 700 mm), and a long dry season. The country is very flat, and groundwater is the principal source of water. During the droughts many shallow wells dried up, and so a policy decision to develop deep, motor driven, pumped boreholes was made. With the support of a range of donors and funding institutions, over 500 new such schemes have been constructed since 1980.

Among these schemes were 18 which were funded by a subvention from Britain and constructed during 1985-87 (Horsfield, 1988). These were typical of many projects, each comprising a borehole 100 - 300m deep, with a vertical shaft pump driven by a diesel engine. Water is pumped to a 100 - 200 cu m water tower, and supplied to villages up to 6 km away by gravity pressure, through a number of pipelines radiating from the water tower.

It did not prove possible to complete all the intended distribution lines from the water towers during the project period. Following requests from the un-served villages for the pipelines to be built, the first phase of a programme of self-help extensions to the original schemes was carried out in 1989/90. Further phases were undertaken in subsequent construction seasons, and the fourth phase has just been completed, bringing the number of extensions built to 50, totalling about 100 km. The first two phases of construction were entirely at boreholes funded by ODA in the earlier project. The third phase included several schemes originally funded by other donor institutions, and all fourth phase extensions are at 'non-ODA' schemes. A fifth phase is planned.

Experience gained each year has led to developments and improvements in the way that the extensions are imple-

mented. The intention of this paper is to illustrate the working methods employed, and to bring out aspects which have contributed to the success of the project.

Funding has been on a limited scale, more often associated with an NGO than a major bilateral donor. This has highlighted the need for efficient working practices, to minimise costs, and to maximise the number of beneficiaries.

The time taken to discuss and approve proposals has been reduced as a result of the good working relations developed between the various parties over a period of years. Bureaucratic procedures sometimes associated with donor funded projects have been kept to a minimum. This has enabled a flexible approach to be adopted, with rapid response times at all stages.

Getting going

Agreement in principle to fund an extensions programme has to be reached by ODA, and a firm programme within this sum can then be developed and proposed.

As a starting-off point for an extension to be considered, a request for an improved water supply has to be received from the village, with some indication of their willingness to be involved in its construction.

A preliminary assessment of the viability of a request is carried out at the Rural Water Department HQ. Data are available on the existing borehole schemes which would serve the villages, including populations, type and capacity of pumps and water tower, distances etc. This allows an initial 'weeding out' of obviously unsuitable proposals. The basis used in the first place to assess proposals is the cost per capita. As a guideline, a maximum cost of about £25/person is looked for, and as a rule of thumb, this translates to a population of 200 at a distance of 2 km, 300 at 3 km, etc.

Village assessment

A visit is made to each of the potential villages in order to verify technical and social aspects of the proposal, and to cross-check the data available in the office. Points which are given attention during this visit include:-

- Feasibility. To ensure adequate pressure will be available at the village to be served, the existing water tower

height, and intervening terrain have to be checked. In the past, different projects have used varying design criteria, and the water tower height may be too low. Water towers should generally be 15 m high, and the distance to the village less than 5 km. The very low relief topography of Senegal means that a full survey is not normally required. Distances involved are measured to the nearest 100m using the vehicle speedometer. This information helps to determine whether an extension or some other form of water supply is the most appropriate.

- Spare capacity. The extensions are intended to make use of underused boreholes, where existing use of the motor is less than say 4 - 5 hours/ day. The operators log book is inspected to find out the current and recent useage.
- Mechanical condition. The pump and motor should be in good working order and have a reasonably trouble-free recent history, also seen from the log book. The general appearance and condition of the equipment is a good guide to the interest and capability of the operator, and to the likely future operating record.
- Village population. A very approximate check on the village size can be made on the basis of the number of houses. This acts as a cross check on the possibility of recent population changes and guards against census errors.
- Other Parties. Water-using projects such as agro-forestry or cattle developments may be under preparation. Information on such projects is sought in discussion with the village headman who should be aware of such plans. At the same time the possibility that other funding agencies may be planning a well or other water supply can be looked into. A visit is also made to the local administrative officer to check on these matters and advise of the project. It may be very helpful to consult religious or other community leaders who can assist in community organisation.
- Village co-operation. Villagers will be expected to host the artisan labour and to dig trenches to their village without pay. A general meeting is held with the population to confirm this aspect. At the same time the number and location of standpipes can be agreed, with villagers taking the lead in this decision.
- Inter-village co-operation. Villagers will manage the scheme on completion, and the long-term success of an extension depends on there being a harmonious relationship between the villages to be linked. The existing water committee at the borehole must agree with the idea of the extension, and if possible the new village should be represented on the committee. There should be no ethnic difficulties between the villages.

Design

Design is kept simple and standard wherever possible. Trenches are dug 350 mm wide and 800 mm deep. Pipes, in the range 63 - 150 mm, are sized on the basis of informed experience depending on distance, population, and topography. The extensions are normally intended to provide for domestic consumption only.

A robust and economic 4-tap standpipe design - a square pillar 1.20 m high by 0.4 m set in a 3.0 m square apron - was used. Each needs about 2 cu m (5 tons) of concrete, reinforced with weldmesh. Cement is purchased in nearby towns, and sand and aggregates obtained from local sources. Graded laterite is used for aggregate, and may have to be transported some distance by horse and cart.

Four locally obtained taps are fitted, and although these may be of lower quality than specially designed imported models, they are more readily available when the time comes for replacement. A perimeter drain leads waste water to a nearby soakaway. As a guide, one standpipe per 200 - 250 people is built, but this may be varied to suit village structure and customs.

Project preparation

Once a potential extension has been assessed on the ground and the pipe lengths, diameters, etc. determined, the estimated cost of each can be worked out. All viable extensions can be ranked on a cost/capita basis to help determine the most effective use of funds. A proposed programme of work is drawn up by the Ministry Engineer and ODA co-ordinator.

This information is incorporated in a project framework document, and submitted for confirmation of funding. Recent phases have benefitted from past experience, reducing delay at this stage. Where funding has been previously agreed in principle, extensions assessed in October have been started December, and completed by February.

Implementation

An implementation programme is drawn up and pipework deliveries are co-ordinated with the supplier to suit this. Galvanized pipework for the standpipes is pre-assembled as far as possible. All pipework is delivered to site by the supplier. Several sets of re-useable timber shutters are made up for the standpipes.

Villagers are provided with hand tools to do the unskilled work - excavating, pipelaying, and backfilling trenches. A small group of artisans comprising a joiner and a mason (who concentrate on the standpipe construction), and a plumber and foreman to supervise PVC pipelaying and

jointing and to set up the standpipe pipework travel to the village. This group moves from site to site, and are paid for their work.

Progress of trenching in sandy soils may be as rapid as 2 km/week. Trenching is generally done by young men from the villages, and women and children are also sometimes involved. Standpipes are built at the rate of one every six days or so, again with village assistance to grade aggregates, mix cement, transport materials etc.

At each village, a supervisory visit by the Ministry Engineer is made at the start and finish of construction, and at least one intermediate visit. He is available to sort out any problems which may arise, as required, and may draw on Ministry equipment eg transport.

Financial

The principal costs are for supply of pipes and materials, and artisan labour for the standpipes. The cost of each standpipe including labour and materials is about £400. Pipes vary in price from £1.7/m for 63 mm dia to £6 for 150 mm dia. In overall terms, a budget of around £120,000 allows construction of 35 - 40 standpipes and 35 km of extensions, which can be completed in a 9 month working period. This would provide piped water to around 7,000 people in say 15 villages, at a cost per capita of around £17. A typical breakdown of expenditure is as below.

Pipework	84%
Artisan wages	6%
Standpipe materials	6%
Fuel, Supervision, Tools,etc	4%

Benefits

The obvious benefit is to the village served by piped water for the first time. Follow up visits have indicated that a range of benefits do in fact materialize. Incidence of gastro-enteric disease is reported to drop. Women have more time for productive activities and marketing. Commercial activities such as vegetable growing begin. Some villages where population was in decline due to water problems have seen this reversed, and populations have increased again. The involvement of the community in the construction has led to a better stewardship of the water supply once in regular use. The success of the completed schemes has encouraged other villages to seek assistance in the same way.

There are also gains resulting from the increased use of a borehole by more people. Low cost extensions are far more cost-effective than complete new schemes, and also cheaper than wells and handpumps in most cases. Better utilization of existing infrastructure means that the return

on the original investment, whether paid for by donor or by loan to the Government, is improved. A larger population can more easily support the running costs of the borehole, and is more likely to make good use of the installation.

Conclusion

The project successfully combines the particular strengths that each party involved can contribute to it. The active involvement and co-operation of the communities, the Ministry, and the donor have resulted in an efficient and effective programme. A large number of people have been served with improved water at low cost.

There is considerable potential for this type of project, and in particular for funding agencies to take on such work at schemes originally funded by others to the overall benefit of the population. The success in Senegal has encouraged the Government to seek larger scale funding from other agencies for a much larger programme of extensions.

References

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