

Greater expectations. Technology choices for community-managed water supply in the new South Africa

by Martin Rall and Jamie de Jager

Poor South Africans have elected *their* representatives, and expect to see changes fast. Access to clean water is a government priority; is it a realistic goal? And what are the technological options?

'We have triumphed in the effort to implant hope in the breasts of the millions of our people. We enter into a covenant that we shall build the society in which all South Africans, both black and white, will be ... assured of their inalienable right to human dignity'

President Mandela, 10 May 1994

'In a country with nuclear power, cellular telephones and vast inter-catchment water transfer schemes, more than 12 million people do not have access to an adequate supply of potable water ... Public action is needed ... but it must be action based on a clear policy which is premised on the rights of all people to determine their own future. The goal of Government is thus to ensure that all South Africans have access to essential basic water supply and sanitation services at a cost which is affordable both to the household and to the country as a whole.'

1994 South African Government White Paper on Water Supply and Sanitation

SOUTH AFRICA FACES enormous challenges in addressing the legacy of apartheid, and nowhere more so than in

attempting to provide basic services to all its citizens. Even more challenging is trying to provide them quickly and cost-effectively — yet cheap enough for the poorest — and sustainably. In the area of water supply and sanitation, given high priority by the new government, the Mvula Trust is facing these challenges head-on, and is applying a number of innovative approaches to all aspects of delivery, including a demand-led approach, structured financing, emphasis on community empowerment and, last but by no means least, the use of low-maintenance technologies.

Wherever possible, the Mvula Trust (Mvula means 'rain' in Zulu and Xhosa) works with communities that are fairly small, relatively isolated, and for whom the most cost-effective water-supply solutions are stand-alone schemes, which — for the next five years at least — they will

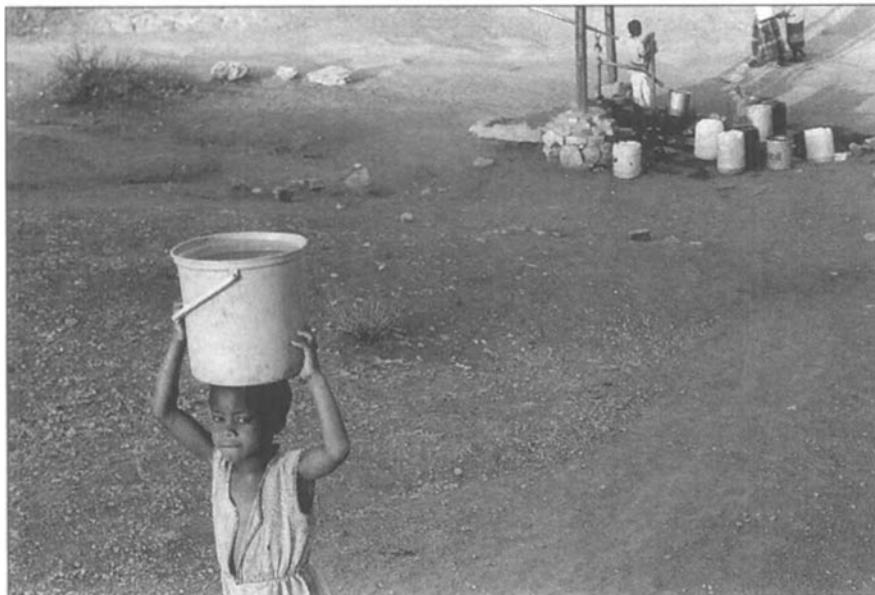
have to manage themselves, without effective support from local government or other institutions. For these communities, the issue of sustainability is even more crucial than for most.¹

As part of its integrated approach to the development of sustainable supplies, the Trust believes that the promotion of appropriate technologies has a pivotal role to play. There are a number of factors, however — some of which are unique to South Africa — which can determine the selection of



Eric Miller/Panos Pictures

'The goal of Government is to ensure that all South Africans have access to essential basic water supply and sanitation services.' A shanty dweller (above); villagers collect water (left).



Brett Eloff/Panos Pictures

technical options which are not entirely appropriate in terms of cost, and simplicity of operation and maintenance — thus adversely affecting long-term sustainability.

Limitations on choice

The generally poor level of water supply on which the majority of South Africa's 20 million rural people are forced to rely, reflects not only the general inequalities which were the foundation of the apartheid system, but also wide differences

In 1993, South Africa was redivided into nine provinces. The Mvula Trust works in five:

Eastern Cape/Ex-Ciskei

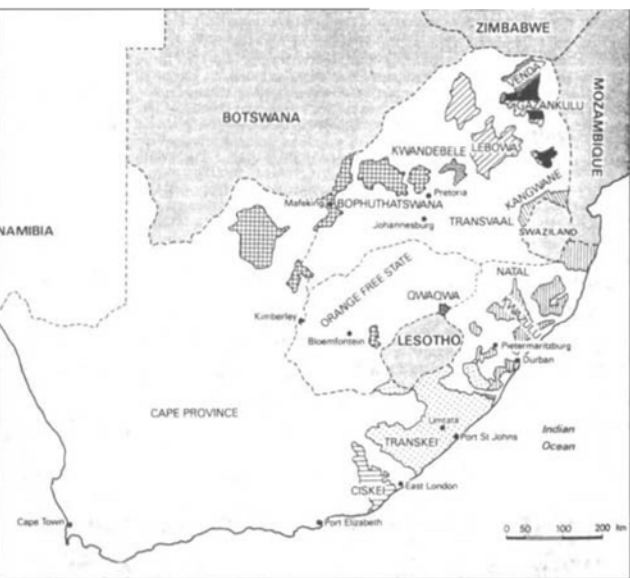
Also covers southern part of former Transkei. Close to East London, with its employment opportunities, so relatively better off than former Transkei, but still one of poorest areas of South Africa. Like former Transkei, former Ciskei governed by succession of corrupt and ineffectual regimes, so level of service provision in rural areas very low. Few large water-supply schemes developed outside urban areas. Rainfall relatively high—natural-surfaced water sources abundant. Compared to other areas, people's expectations much lower; community cohesion better; chances of sustainability more likely. Affordability of current level of service, however, less certain.

Eastern Cape/Ex-Transkei

One of poorest parts of country; few, except migrant workers and pensioners, have regular incomes. But climate and relatively high rainfall mean some subsistence agriculture possible. Climate also means relative abundance of natural surface-water sources and, in north, particularly around Kokstad, numerous reliable springs supply water to villages. History of maladministration and corrupt governments; hence very poor level of service provision in rural areas, but, as in Eastern Cape, can be advantageous for current efforts to provide sustainable, appropriate supplies.



KwaZulu-Natal benefits from good rainfall.



KwaZulu-Natal

Former KwaZulu homeland one of most fragmented, so wide differences in levels of economic development, service

provision, expectations, social cohesion etc. from one area to another. As a result, responsibility for water-supply provision in some areas taken on by Joint Service Boards, serving mainly 'white' areas; coverage here somewhat better. Former homeland government only marginally better than in Eastern Cape, however, but stronger culture of self-reliance and willingness to share costs. Influence of traditional (tribal) leadership stronger than in most areas, and political conflict a problem. Generally, relatively high rainfall, and plentiful surface water. Groundwater not difficult to find, and springs in number of areas.

Mpumalanga and Northern Province

Generally drier. Economically, relatively better off; proximity to industrial areas in and around Gauteng Province. High incidence of men working away. Former homeland governments tend to be more serious about providing services, although mostly expensive and fully subsidized water supplies. Relatively large number of people served by extensive regional piped water schemes drawing water from larger rivers and dams, now mostly semi-defunct and poorly maintained, although still at government expense. Affordability less of problem than willingness to pay, due to culture of free services, and culture of entitlement, high expectations, and greater income disparities. Generally better access (road network and electricity grid coverage).

North-West Province

Possibly unique in terms of water supply. Relatively effective 'homeland' government water-supply authority achieved high coverage to basic (standpipe) level of service, and offered individual yard connections to those who could pay full cost. Hence few applications received from this province, but Trust is trying to put together loan-finance facility for families, via local government structures, for higher levels of service.

between the former homelands (see box). Such variations include the availability of naturally occurring traditional water sources; the proportion of the population reached by government water schemes, the type of water-supply system constructed; the level of service provided; and the approach to payment for water by consumers.

There are a number of other constraints, also influenced by the country's political past, on the range of

technical options available. Chief amongst them is the level of expectation of the previously oppressed and marginalized majority; Third World communities living within a First World society. Most of these people aspire to, at the very least, a communal piped-water supply, while many expect, and can afford, water piped direct to their homes. Simpler technologies such as handpumps are sometimes simply unacceptable.

In addition, government policy defines the basic minimum level of service to be provided through grant financing as one which provides 25 litres of potable water within 200m of every home. The distance criterion, in a country where most villagers live in areas receiving less than 500mm of rain a year, and where geological conditions and settlement patterns can make groundwater abstraction

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untenable, means that a piped-water scheme is usually the only option.

In some rural areas, particularly in the drier Northern and Mpumalanga provinces, large bulk water schemes supplied by dams and/or boreholes have been constructed. Further development of water supplies in such areas — to cope with population growth and to supply unserved areas — are limited to a similar type of service by the people's expectations.

The Mvula approach

Within these limitations, and in the context of severe and widespread poverty and a lack of skills, the challenge faced by the engineers is to come up with schemes which will be as simple as possible to manage, and which will cost the consumer as little as possible in terms of operation and maintenance (O&M). The Mvula Trust focuses on three key areas: the water source, the pumping technology and its power supply; and the design of civil works.²

Groundwater

The choice of water source, where different options are available, has a



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Digging trenches — community constructed and community managed.

preferred — mainly because surface water requires treatment, which is often costly, and usually requires a more sophisticated level of management. In addition, poor management of treatment can have serious health repercussions, since such deficiencies are not obvious. Poor management of a groundwater scheme rarely affects water quality: it is normally manifested in reduced or erratic supply, which is immediately obvious.

of these, the source is a borehole, while for the rest it is a spring. Where available, the most cost-effective form of groundwater is what can be accessed from springs, without any pumping being required and, where pumping is required, it is relatively inexpensive because of lower pumping-heads and simpler equipment. The Trust has initiated a study of the O&M costs on completed projects, and a comparison of the costs of over 200 projects — predicted at the design stage — suggests that costs on borehole schemes vary from R5 (US\$1) to R20 (\$4)/household/month, while those of gravity schemes from springs range between R1 and R8.

Only 29 of the stand-alone schemes funded by the Trust (12 per cent of the total) use surface water (59 per cent are in KwaZulu-Natal), and these use exclusively slow sand filters and chlorination (see Table 1). On some of the schemes, it remains to be seen whether this will be sufficient during the rainy season when the water supply is very turbid but, on most, the water is abstracted from clear upland streams. Clearly, follow-up monitoring will be important. The Trust will only go ahead and use surface water where groundwater is insufficient or does not meet the required quality standards; or where the size of the community necessitates numerous boreholes, thus increasing O&M complexity and costs, in comparative terms.

Table 1. Sources of water in Mvula Trust projects

Province	Number of projects	Main source of water			
		Borehole	Spring	River	Regional scheme
E. Cape/Ex-Ciskei	40	29	6	1	4
E. Cape/Ex-Transkei	45	6	35	3	1
KwaZulu-Natal	38	15	3	17	3
Mpumalanga	22	21	0	0	1
Northern Province	117	94	1	8	14
Other	5	5	0	0	0
TOTAL	267	170	45	29	23

Table 2. Energy sources in Mvula Trust projects

Province	Number of projects	Main source of energy			
		Diesel	Grid	Gravity	Solar electricity
E. Cape/Ex-Ciskei	36	18	9	7	2
E. Cape/Ex-Transkei	44	5	1	36	2
KwaZulu-Natal	35	11	20	4	0
Mpumalanga	21	9	11	0	1
Northern Province	103	56	39	6	2
Other	5	5	0	0	0
TOTAL	244	104	80	53	7

significant impact on its user-friendliness. The use of groundwater has a number of advantages, and only in rare cases should surface water be

Over 70 per cent of the Trust's projects are based entirely on groundwater, and a further 10 per cent rely mainly on groundwater. In 80 per cent

Energy choices

For schemes requiring pumping, the most community-friendly and practical source of energy is grid electricity.

Tariffs are comparable or lower than diesel costs, and maintenance is simpler and cheaper. Equally importantly, the logistical difficulties of ensuring a regular supply of fuel are avoided.

It is Trust policy to connect to the grid wherever possible, even if capital costs are higher than for diesel. But, of course, most projects are out of range of the grid and, as a result, 37 per cent of projects rely solely or mainly on diesel, and only 30 per cent run on grid electricity (see Table 2). In order to keep tariffs as low as possible, and in line with the principle of subsidizing the full investment cost of basic services, the Trust funds the full costs of connecting to the grid, including line and transformer costs.³

The relatively low overall number of projects which can take advantage of grid electricity is a further reflection of the disparities in development inherited from apartheid, while the figures for Mpumalanga and KwaZulu-Natal reflect, once again, considerable regional differences.

Pumping technology

Mvula promotes simple, manually or mechanically controlled systems; schemes which avoid 'staged' pumping, (more than one pumping station), and pumping into distribution lines; crank-started engines where feasible, and pump and engine makes available relatively locally.

without pumping, but such an option is only available in a few areas; 72 per cent of these projects are in the former Transkei.

The Trust is also experimenting with a number of other energy options, notably solar energy and, to a lesser extent, handpumps, hydraulic rams, and water-powered turbines. Solar energy is particularly relevant in the case of very small communities reliant on boreholes; the use of diesel-pump sets in such cases results in O&M costs of over R25/household/month, making them too expensive. Much has still to be learned about the practical problems of maintaining solar-powered systems, however, and problems arising from vandalism and theft of panels, and unreliable and/or costly service back-up are anticipated.

Low-maintenance civil works and reticulation

Other important components of water-supply schemes that have to be designed with O&M costs and management requirements in mind, are reservoirs and standpipes and, to a lesser extent, reticulation networks. The Trust promotes the use of robust, simple designs which are durable and require little maintenance.

In the case of reservoirs, the use of plastic or steel is not advisable, as the initial cost/benefit is offset by a shorter lifespan and/or the need for more

than 6kPa [kiloPascals]) as wastage from leaks is much greater than from pipes under lower pressure. Even at greater cost, break-pressure tanks or reservoirs are preferred. User-friendly pipe materials and couplings are used, which facilitate repair work. Couplings which require specialized equipment to prepare are avoided. Accessories which are readily available in the nearest big town also make maintenance easier.

Standpipes are the points of contact between the user and the scheme, and are the most susceptible to rough treatment and misuse. Standpipes are built as sturdily as possible, within the limits of cost-effectiveness — and incorporate a robust support for the riser pipe. The pipe can be concreted into a well-buried length of large diameter pipe, or into a short supporting wall. Provision is also made for a resting place for drums and buckets, at waist height, otherwise they are likely to be placed temporarily on top of the tap, before being lifted onto the head, thus damaging the tap. Spillage aprons and drains are provided, not only to maintain hygienic conditions, but also to prevent soil erosion and eventual damage to the standpipe.⁴

While the principal factors affecting the sustainability of rural water-supply schemes are undoubtedly those which come under the heading of 'soft' issues, the appropriateness of the 'hardware' also has a direct and significant impact. The Mvula Trust continues to address this question, within the constraints imposed by history, politics and climate.

Notes and references

1. The Trust works primarily with communities of less than 5000 people; but also supports some which are considerably larger. Its smallest projects involve communities of between 500 and 600 people. Criteria include: degree of need, level of community organization, and willingness to contribute to costs.
2. The community is fully involved in the process. One of the most important elements of the initial visit to appraise a community's funding request and project proposal is ascertaining the extent to which the water committee and the community participated in the design of their scheme, and their understanding of the technical proposals and their implications.
3. The Trust receives, annually, about R50m from the Government; R5m from Australian Aid (for two years), and R10m from the EU (also for two years), plus some minor private donations.
4. Detailed guidelines on all these design aspects are currently being prepared.

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Mvula Trust

The Trust promotes robust, simple designs which require little maintenance.

Wherever possible, as emphasized above, pumping is avoided, even if this implies higher investment costs, such as might be occasioned by a very long bulk pipeline from a suitable spring or stream far from the village to be served. The Trust has been happy to fund pipelines up to 10km long. Forty-seven (18 per cent) of the projects supported by the Trust are gravity-fed,

frequent maintenance. Lower O&M costs can be ensured, for example, by the use of reinforced concrete reservoirs, preferably built with the use of permanent brick shuttering, a technique which is more labour-intensive and amenable to community-managed construction.

Reticulation networks should avoid excessive pressure (pressures greater