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SANITATION AND WATER FOR ALL

Quetta — growing water demand from declining resources

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THE QUETTA VALLEY in Northern Balochistan is an arid mountainous valley. Over the past 15 years the demand for water has increased significantly as cheap electricity has made pumping from groundwater for the irrigation of high value deciduous fruit a major economic activity and the population of Quetta has expanded, largely as a result of the expansion of high value agriculture.

The availability of low cost electricity together with a culture that has historically considered water as being free to all, has led to huge demands for groundwater. From the information available it is clear however, that groundwater in the Quetta valley is being mined, with groundwater levels falling at 1m a year, which is a cause for concern that demands immediate attention.

This paper looks at the problem and potential mitigation measures. These include control of abstraction for agriculture through legislation and pricing, institutional measures to monitor and control abstraction, alternative surface water development options, artificial groundwater recharge and reducing urban demand.

The setting

The Quetta valley in North-Western Pakistan is an arid mountainous region receiving an average annual rainfall of 200 mm. The valley lies at an altitude of about 1,600m. As a result of the valleys altitude the summers are warm, but the winters are cold, with night time temperatures falling below zero for much of the mid-winter months.

Over the past 15 years the population of Quetta has increased significantly. From a small town in the early 1980's the population has been estimated to have been increasing by 6 per cent per annum and to have reached about one million by 1995. This rise has been due to natural growth due to rural to urban migration and due to an influx of Afghan refugees which took place during the Afghan war.

Over the same period, the area under irrigation has also increased significantly, due to the high profit margins which can be obtained from the production of deciduous fruit in the region, and the availability of cheap electricity for pumping groundwater for irrigation.

Irrigated agriculture

Almost the only source of perennial water in the valley is groundwater. Traditionally this was tapped using karezes (known as ganats in Iran). These are near horizontal tunnels which have one end intersecting the groundwater table, often near the valley sides where water flows from the adjacent limestone formations. The tunnels then convey this flow at a grade of less than the slope of the ground above, to a point where the tunnel intersects the surface and the water flows into irrigation channels to be used for agriculture.

Up to the 1970s, the valley was quite isolated and the supply and distribution of electricity was limited. The flow from the karezes was therefore used to irrigate winter wheat and limited areas of grapes, summer vegetables and deciduous fruit crops.

The climate in the Quetta valley is highly conducive to the cultivation of deciduous fruit crops including grapes, apples, cherries and peaches. As there are limited areas in Pakistan and neighbouring countries which have the right agro-climatic conditions and water available for irrigation, these crops attract a high price and are highly profitable. Farmers report that they are able to make returns in excess of Rs 300,000 per hectare (US$ 10,000 per hectare).

Since the late 1970s the electrical distribution network has been extended to all areas within the valley. This together with the improvement of transport links with the rest of the country and overseas markets and the profitability of agriculture has resulted in a huge increase in the area of production of these crops, based on irrigation from pumped water from groundwater wells.

The increase in the number of wells abstracting groundwater has resulted in mining of the groundwater and the water table falling by an average of 1 m per year over the last decade. The communally owned karezes have, as a result, all ceased to operate and all abstraction for agriculture is now from individually owned wells.

Groundwater balance

A recent study (Halcrow Rural Management, 1996) has estimated the ground-water balance for the Quetta sub-basin (of the Pishin Lora Basin) and found the following to be the best estimate currently available (see Table 1).

The study further estimated that the total groundwater stored in the top 100m of saturated aquifer is 2710 million m3 and that 50 per cent of this may be safely assumed to be available. The above levels of abstraction will increase due to population rise assumed to be 5 per cent in the 1990's falling to 2.5 per cent by the 2020's, increased demand per capita from 50 to 80 l/cap/day from 2005 onwards and agricultural and industrial use increasing in proportion to the population increase.

Taking the above assumptions, the study calculated that the remaining groundwater will be exhausted by 2016.

Table 1.

This would be extended to 2022 if the agricultural demand were kept constant at 1995 levels.

The situation is therefore critical with, if abstraction continues as forecast in accordance with current trends, only 18 years of safe water supply available.

Mitigation measures

Possible measures to mitigate the above situation include policy, pricing, legal and institutional measures to monitor, reduce and control abstraction, particularly for agriculture, the development of surface water resources, artificial groundwater recharge and reducing urban demand. These are discussed in turn below.

Control of abstraction for agriculture through policy and legislation

Such plans and laws to protect resources and the environment as there are have been developed from a top down approach, with no input from the local populations. In a social environment such as exists in the Province, where it is extremely difficult to enforce any law which individuals or tribal groups judge not in their immediate best interest, the only way to ensure that policies and laws are implementable is through consensus building and mass education and communication programmes. These programmes should ensure that the population are fully informed as to the nature and magnitude of the problem and the potential solutions which exist and are involved in deciding which policies to adopt. In this way communities will adopt these solutions as their own and make them self-policing. There is a need to promote institutions capable of developing and implementing plans along these lines.

Reducing abstraction through pricing

For many years the electricity tariff for agricultural wells in Pakistan has been based on a flat rate according to the horsepower of the motor installed. This was originally introduced to encourage agricultural production. In Balochistan farmers have traditionally avoided paying these charges anyway and little has been done to force them to. This has not promoted efficient water management. Farmers use the same wells for domestic and agricultural supply and thus tend to keep the wells running 24 hours a day, whatever the requirement for agriculture, in order to have domestic water available. In the last couple of years this situation has begun to change, as financial necessity is requiring the federal government to recover the costs of generating and supplying power. The Government has therefore made significant increases in tariffs, introduced tariffs proportional to utilization and increased pressure for payment of dues. This combination being imposed at the same time is however meeting resistance from the farmers, which has resulted in power being cut off to some areas for extended periods.

Effective introduction of the new tariffs should encourage farmers to save water. Extension advise will be required to promote more efficient methods of water management which could provide significant savings in water use over the flood irrigation methods currently used.

Institutional measures to monitor and control abstraction

At present a large number of federal and provincial government institutions have responsibility for studying, monitoring, protecting and developing the water resources of the Province and the Quetta valley. There are seven different agencies responsible for the supply of domestic water to Quetta city alone.

One agency, the Bureau of Water Resources has been made responsible for monitoring water resources, but the Bureau has yet to develop the capability to fulfil it's duties, particularly in respect of groundwater resources. There is a need to support the Bureau to collect data on the groundwater resources, recharge mechanisms and to pre-

pare an inventory of the abstraction points and to monitor these.

There is need to implement existing legislation to control the drilling of new boreholes.

In the Quetta valley there is the need for a Valley Development Board to coordinate the activities of all the existing line Departments. The Board should be Chaired by the Deputy Commissioner Quetta (who is responsible for the licensing of new wells) and should comprise representatives of all concerned Departments and users.

Alternative surface water development options

There are no perennial surface water sources available within a reasonable distance or altitude which could be used as an alternative to groundwater development. The construction of dams at a number of locations has been considered; the most favourable being the construction of the Burj Aziz Khan Dam on the Pishin Lora. However, this dam site is over 100 km from Quetta and the water is known to be saline, requiring desalination before it could be used for domestic or agricultural purposes. The effects of siltation will mean that any dam is likely to have a short life expectancy and thus not provide a permanent solution to the problem. The Halcrow Groundwater Reassessment study quoted above estimated that Burj Aziz Khan Dam would only extend the life expectancy of the groundwater resource by 4 to 13 years depending on the scenario envisaged.

Consideration has been given to lifting water from the Indus, through a static head of over 3,000 m. The capital and operational cost of this would be enormous and would certainly not be a viable source of water for agricultural production.

Artificial groundwater recharge

Over the past 20 years various Government Departments have attempted artificial groundwater recharge projects in the Province, including delay action dams, offline recharge areas and catchment management approaches. More recently proposals have been made for using infiltration wells fed by desilted diverted river flood flows.

Artificial groundwater recharge has been cited as a solution to the problem of falling groundwater tables. However, analysis has shown (Halcrow, 1990) that if all potential sites in the Quetta valley were to be exploited for groundwater recharge, the effect on the magnitude of the problem would only be slight. Due to siltation, the life of any civil engineering based scheme is also short and hence cannot add to the long term sustainability of the current levels of abstraction.

There is an argument however for increasing research into the effects of improved catchment management on recharge, possibly in conjunction with further research into engineering solutions. The former usually results in an increase in the longevity and effectiveness of the latter.

Reducing urban demand

Urban water is also currently supplied for a nominal monthly fee per household. Moreover the service to most parts of the Quetta conurbation is very poor. Water charges need to be increased to reflect the cost of supplying the water. However, a working and extensive distribution system also needs to be put in place before such charges are introduced. Consumers cannot be expected to pay for an irregular and mis-managed service. Water quality standards need to be set and maintained.

Whilst the above is likely to result in an improved service and one which is self financing and sustaining, it will also result in increased water utilisation. An awareness campaign also has to be established using all facets of the media to ensure that people understand that water wastage is a crime against the community. The Valley Development Board should be set targets on improvements to the supply and reductions in water wasted.

Conclusions

- A single authority should be made for controlling the groundwater resources of the Quetta valley, this must enforce the existing rules on new wells. Policies should be developed in a participative manner in order to be self policing;
- Assistance needs to be given to the Bureau of Water Resources to survey and monitor the abstraction points, the ground water resources and to refine present analysis of the resources;
- The present change to a tariff based on power utilization for agricultural wells needs to be completed and enforced for reasons of equity, ability to pay (power costs are only 3 per cent of net returns to agriculture for high value deciduous fruit crops), fiscal prudence and in order to promote efficient utilisation of water. Indeed there is an argument for charges to be significantly higher to reflect the long term cost of mining the water;
- An extension campaign should be carried out to promote efficient water management;
- A policy of controlled groundwater mining must be acknowledged. The controlled mining of the aquifer storage would allow a limited period in which the limits of the resource may be better defined and longer term planning for sustainable supplies may take place; and
- Further research should be carried out into the benefits of improved catchment management on recharge.

References

HALCROW RURAL MANAGEMENT, 1996, Balochistan Groundwater Reassessment, Final Report, for the Asian Development Bank.

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