Comprehensive Options Assessment: The Pongolo

Matthew McCartney
International Water Management Institute
Private Bag X813
0127
Silverton
Pretoria
South Africa
Email: m.mccartney@cgiar.org

Joan Janganyi
Centre for Environment and Development
University of Natal
Private Bag X01
Scottsville
3209
South Africa
Email: jaganyijn@nu.ac.za

Sizwe Mkhize
Water Research Commission
Private Bag X03
Pretoria
South Africa
Email: sizwe@wrc.org.za

Key words: irrigation, environmental flows, cooperative management, stakeholder participation, South Africa

Geographical and socio-economic background

The Pongolopoort dam, which impounds the water of the Ponogolo River in KwaZulu Natal, South Africa, was built in the 1970s to provide water for irrigation. The dam is located where the river flows through a narrow gorge between the Lebombo and Ubombo mountain ranges, close to the border with Swaziland. Immediately downstream of the dam, a broad alluvial plain, known as the Pongolo Floodplain, extends from the dam to the confluence of the Pongolo and Usutu Rivers, close to the border with Mozambique. Within Mozambique, the river is known as the Rio del Maputo. The river gradient through the Pongolo Floodplain, which is approximately 130 km^2 in extent, is just 0.033 m km^{-1}. The floodplain is one of the most biologically diverse ecosystems in South Africa (Coke and Pott, 1970). It comprises the meandering river and a highly heterogeneous complex of lagoons, ox-bow lakes, abandoned river channels, marshes, levees and floodplain grassland, which provide habitat for a wide range of birds and animals.

Under natural conditions, the floodplain was inundated to varying extents in the summer season (December to April) every year. As water levels rose during floods, the disparate floodplain depressions (known locally as pans) became reconnected with each other and with the main river channel, creating a highly a productive environment for fish and other aquatic organisms (Coke, 1970). During periods of maximum flooding, between 90 and 100 pans, with a collective area of approximately 26km^2, were filled with water (Heeg and Breen, 1982). As water levels fell during the recession, the connectivity between pans decreased and different pans retained water for different lengths of time.

Traditionally, people have utilized the natural resources of the floodplain in a wide variety of ways, for both commercial and subsistence purposes. It is estimated that approximately 40,000 people are resident in the area around the floodplain and have close links to it (Heeg and Breen, 1982). The pans provide an important source of fish and fishing activities are valuable to the culture of many communities on the floodplain. Floodplain areas, their fertility enriched through intermittent inundation, are used for both recession cultivation and for grazing during the dry winter. In addition, plants on the floodplain and the forest adjoining it provide a variety of products for food, fuel, construction and traditional medicines.

The Pongolopoort dam was built during the apartheid period to provide water for white farmer upliftment through sugar cane irrigation. The intention was to "stabilize" the frontier bordering Mozambique and Swaziland through the creation of 40,000-50,000 ha of irrigation on the Makatini Flats, a highly fertile area adjacent to the floodplain on both sides of the river (Breen *et al.*, 1998). At the time, it was believed that development would automatically follow impoundment, and so no consideration was given to alternative development options. However, subsequent changes in political and socio-economic circumstances (e.g. the drop in the price of sugar) have meant that the expected development did not occur and to date, only about 3,000 ha of irrigation has been created.

The dam provides storage of 2,500 Mm^3, which is 2.3 times the long-term mean annual flow into the reservoir (i.e. 1,086 Mm^3).[3] Consequently, the dam affords considerable control over water resources. Although no

3 The large storage is required to assure supply on a river of extremely variable flow, which can be less than 690 Mm3 in one year in every four.

consideration was given to alternative development options prior to construction of the dam, the fact that the expansion of irrigation has been much less than anticipated has enabled post-construction assessment of alternative water use options.

Institutional framework

The Pongolopoort dam was planned and constructed by what was the forerunner of the current Department of Water Affairs and Forestry (DWAF), and it has subsequently remained under the jurisdiction of this department. Hence, for the purpose of this paper the organization responsible for the operation of the dam since its construction will be referred to as DWAF. There are a number of other stakeholders with an interest in how the dam is operated. These include:

- the people utilizing the natural resources of the floodplain, the Tembe-Thonga;
- commercial farmers on the Makatini Flats and in recent years on the floodplain;
- KwaZulu Natal Wildlife who manage the Ndumu National Park at the eastern end of the floodplain;
- local fishing clubs who utilize the reservoir for recreational fishing;
- KwaZulu Natal Department of Health which is responsible for all health matters, including malaria, on the floodplain;
- Department of Agriculture & Environmental Affairs which is responsible for agricultural extension and environmental conservation on the floodplain and the Makatini Flats;
- South Africa security forces who are responsible for national security, which is particularly an issue in the border region where the dam is located;
- Mozambiquans living close to the Rio del Maputo.

The Tembe-Thonga people are divided into a number of clans or chieftainships. Clan chiefs usually appoint members of their own family as district chiefs (i.e. *Izinduna*) and choose sub-district headmen from among the families living in a sub-district. Until recently, the sub-district headmen controlled access to all natural resources, including land and fish, in the areas under their jurisdiction. However, in recent years growing population pressures, commercialization of floodplain activities, and uncertainty over the role of tribal authority have undermined this institutional arrangement, and have led to an increasingly individualistic approach and increasing "private" ownership of resources (Breen *et al*., 1998).

Planning level and scope of options assessment

In most circumstances an options assessment should be implemented before the construction of a dam. However, the history of the Pongolopoort dam means that the scope of the options assessment conducted to date has been limited to how the dam is operated to optimise the benefits to be gained from the water stored in the reservoir. Specifically each year consideration is given to different options for managed flood releases. It is this process which is described in following sections of this paper.

There is currently no integrated strategy for the long-term development of the floodplain or elsewhere in the catchment. Indeed, in recent years, aforestation and increased upstream abstraction has reduced inflows into the reservoir. Consideration is now being given to increasing the size of formal irrigation schemes adjacent to the floodplain and to developing tourism related activities (e.g. houseboats) in and around the reservoir. Furthermore, Mozambique wants to limit the magnitude of flood releases from the dam.[4] Consequently, a wide range of development options must now be considered in increasingly complex circumstances, but at present there is no formal process of options assessment.

Assessment of development goals, sectoral demands, regional and local needs

At the time the dam was built, an analysis of development opportunities concluded that sustaining the productivity of the floodplain was justified in social, economic and environmental terms. In particular, this meant realizing the economic potential of the two traditional practices of floodplain fishery and flood dependent agriculture (Breen *et al*., 1998), but it was envisaged that as irrigation-based agriculture increased on the Makatini Flats, cultivation on the floodplain would decrease. However, as reported in section 1, the anticipated large-scale irrigation development has not occurred to any significant extent.

4 There is a tripartite agreement between South Africa, Mozambique and Swaziland for utilization of the water resources of the Incomati and Maputo watercourses (which includes the Pongolo). However, at present, there is no comprehensive agreement on dam operation. Nevertheless, Mozambique has made an informal request to keep maximum flow in the Rio del Maputo at less than 450 m3s-1 and since the devastating floods of 2000 there has been a request by Mozambique to limit flood releases further.

The construction of the dam, in conjunction with changes brought about by other socio-economic adjustments, has led to a shift in sectoral demands and local needs. The much more predictable flooding regime has reduced the risk of losing crops through unexpected flooding. This has led to a marked increase in investment in cultivation on the floodplain. Institutional controls over cultivation have been reduced, and areas not previously farmed because of the high risk of inundation have been cleared and are now cultivated. Furthermore, the local subsistence economy has increasingly come under the influence of external factors; the need for contemporary goods and services (i.e. in addition to those traditionally available) has generated a requirement for money. This has led to a commercialization of the exploitation of the floodplain resources and the adoption of new technologies. For example, cotton farming, using genetically modified hybrids (which cut insecticide costs and increase yields), spread across the floodplain in the 1990s. The water requirements of the cotton farmers differ significantly from those of other floodplain activities, in particular fisheries.

Identification and characterization of options

A participatory approach has been developed to identify and decide upon options for managed flood releases. Water committees established within different tribal regions consider all viable options as determined by DWAF and, through a complex and iterative process of negotiation and conflict resolution, develop a consensus on the preferred timing and magnitude of a managed flood. On the basis of this agreement, the water committees negotiate with other stakeholders at a "liaison committee" meeting at which a decision is made about the timing and magnitude of the managed flood release.

In theory the characterization of options attempts to balance four primary needs:

- to maintain environmental processes on the floodplain, both for livelihood support and for wildlife in the Ndumu National Park
- to support agriculture and minimize flood damage to crops
- to support the irrigation agriculture that has developed on the floodplain and on the Mkatini Flats
- to meet the concerns of Mozambique

Assessment of alternative options

Assessment of the impacts of alternative release options is undertaken by DWAF. Since the first managed flood release in 1984,[5] DWAF has experimented and monitored the hydrological impact of more than 20 flood releases (EnviroAfrica, 2000). On the basis of insight gained from this monitoring, DWAF is able to advise on the hydrological implications (i.e. the spatial extent and duration of inundation) of different release regimes. However, there has been almost no monitoring of the floodplain ecology since the dam was built, and so the ecological implications of different flood releases remain largely unknown.

DWAF plans releases when requested by a stakeholder. Through the participatory process established, DWAF attempts to get a consensus on the need and optimum timing of a managed flood. However, in all cases, DWAF makes the final decisions (i.e. on timing, magnitude and duration of the release) and plans and manages all the operational arrangements.

Stakeholder participation

Between 1973 (when the dam closed) and 1987, DWAF operated the dam without any consultation of stakeholders and without communication with downstream communities. In the late 1970s, research conducted by social scientists found that local communities perceived the dam as an emblem of the apartheid regime that caused them many problems, particularly through badly timed inundation of crops and grazing land.

This research, in conjunction with the realization that the irrigation was not developing to the extent anticipated, led to a re-evaluation of the way DWAF was operating the dam. In 1987, DWAF, in collaboration with local tribal authorities, established the first Water Committees. Initially eight committees were formed (this was later extended to 15) with each one representing a different tribal region. Each committee comprised five members representing fisherfolk, agriculturalists, livestock keepers, domestic water users and the community health services. The committees were supported by local development initiatives and NGOs who championed the process and provided logistical support (i.e. transport etc.) to enable the committees to meet.

5 In 1984 there was insufficient water stored in the reservoir to make flood releases.

The committees provided a conduit for information transfer between DWAF and the communities, and also a forum for negotiation both within and between different community groups. In addition, the water committees negotiated with other stakeholders on the different release options. Initially, the water committees were very effective in reconciling differences and reaching consensus. Furthermore, the committees were perceived by the communities to be successful in negotiating with other stakeholders (Bruwer and Jordan, 1994). However, since the mid-1990s the effectiveness of the committees has declined and, in recent years, the participatory process has to a large extent broken down.

The failure of the water committees has been attributed to a number of factors, but is principally due to the lack of planning of natural resource use and development on the floodplain (Breen *et al.*, 1998). In particular, during the 1990s, the Department of Agriculture made no attempt to divert commercial farming off the floodplain by promoting small-scale irrigation on the Makatini Flats. As a result, cotton farming spread throughout the floodplain and, by the mid-90s, the floodplain cotton farmers represented a strong political force. In 1997, they threatened to initiate legal proceedings against DWAF if flood releases were made at a time inappropriate for their cotton crop. In the face of such belligerence, DWAF was forced to acquiesce and no managed flood release was made despite the needs of other stakeholders (EnviroAfrica, 2000). In subsequent years, the planning process has become increasingly complex as new stakeholders, including those upstream of the dam, have wanted to become involved in the decision-making process. At the present time, DWAF continues to attempt to involve all interested and affected groups. Research is presently being conducted by the University of Natal, in conjunction with the Water Research Commission and the International Water Management Institute, to develop a pragmatic cooperative management approach that supports equitable distribution of water between different stakeholder groups (Jaganyi, *et al.*, 2003; and Jaganyi, *et al.*, *in prep*).

Acknowledgements

This research was funded by a grant from the Water Research Commission of South Africa. It is also a contribution to the comprehensive Assessment of Water Management in Agriculture (www.iwmi.org\assessment) which is funded in part through a grant from the Government of Netherlands.

References

Breen, C.M., Dent, M.C. and Mander, M. 1998. The Pongolo River floodplain and its people: past, present and future. Paper presented at the Salzberg Seminar, 12 February 1998.

Bruwer, C.A. and Jordaan, J.M. 1994. The Pongolo Floodplain Pans: inundation by programmed seasonal releases of water from Pongolapoort Dam. In: *Proceedings 18th Congress: International Commission on Large Dams*. 649-657. Durban.

Coke, M. 1970. The status of the Pongolo floodplain pans and the effect of a 1000 cusec flood in December, 1970. Unpublished Report, Natal Parks, Game and Fish Preservation Board, Pietermaritzburg.

Coke, M. and Pott, R. 1970. The Pongolo Floodplain Pans: a plan for conservation. Unpublished Report, Natal Parks Board, Pietermritzburg. 34pp.

EnviroAfrica, 2000. Guidelines for artificial releases from reservoirs to maintain downstream wetland ecosystems and dependent livelihoods: Phongolo Case Study.

Heeg, J. and Breen, C.M. 1982. Man and the Pongolo floodplain. South African National Scientific Programmes Report, No. 56. A report of the committee for Inland Water Ecosystems, National Programme for Environmental Sciences.

Jaganyi, J., Kotze, D. and McCartney, M. 2003. Developing a stakeholder shared understanding of the driving forces of the current state of the Pongolo River floodplain through vision building. Report of the first stakeholder workshop. 'Understanding Stakeholder Perceptions'. Makhatini Agricultural Research Station. October 16th, 17th & 18th 2002. Centre for Environment & Development, University of Natal, Pietermaritzburg.

Jaganyi J., Kotze, D., Salagae, T., Matiwane, N., Mvuse, M., and Fincham, R. (in prep.) An ecosytem approach to resolving conflicting values on the Pongolo river and floodplain, South Africa. Conservation Biology.