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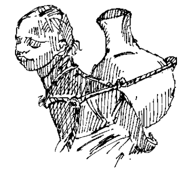
INTEGRATED DEVELOPMENT FOR WATER SUPPLY AND SANITATION



Arresting the runoff: the final choice

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MEKET, AS WITH many Woreda of North Wollo, has great variation in altitude (ranging from 1700 in Tekeze river gorge to over 3400 m a s l.). As a result the opportunities and constraints for developing protected water varies greatly. In the highland and midland areas, capped springs and hand-dug wells represent appropriate technical protection measures for the great majority of populations. Being relatively straight forward and "user-friendly", such technologies allow development and use of methodologies for promoting community participation, ownership and management. However; the lowland (*Kola)* present a more challenging technical problem to water development. Natural springs are very scarce, the water table is often to deep for hand dug wells and the prevalent geology is dominated by hard pan and rock outcrops.

This paper describes the experiences of an alternative solution in one of the villages (called *Cherkos)* located in the *Kola* agro-climatic zone, namely damming the existing gully to collect seasonal run-off and looks at both the technical and social implications involved.

Problem identification, analysis and solution

SOS Sahel's / UK / Wollo Agricultural Support Project (WASP) team spent three days in Cherkos village to help the people identify and analyze the potential constraints for better livelihood using the PAPI (Participatory Action Planning and Implementation) technique. During this session shortage of water was recognized as a major problem and prioritized for Solution.

The people of Cherkos village identified their two current water resources;

- An intermittent spring at the center of a nearby seasonal stream.
- A river 2 to 3 hours walk from the village.

The village with technical support from SOS Sahel, then explored the options open to them to access clean water.

Wells and boreholes

The village has no culture of digging wells probably because of the difficulties in doing so. When SOS Sahel first came to the village some three years before several attempts to reach underground water using handdug wells failed, impenetrable hard pans being encountered at only a depth of 2 to 6 meters. The inaccessibility of the area also seemed to rule out the use of deep boreholes. Recognizing all these difficulties , a conclusion was reached by the village that tapping underground water sources did not represent a viable option to their problem.

Spring capping

The second alternative discussed was capping the local spring, despite promising discharge rates observed immediately after the rains, the local people revealed that the spring Completely dries up from February/ March onwards and is prone to violent flooding.

Roof run-off

House hold roof water harvesting was also considered for discussion, the yield from thatch roof is not appreciable and will not satisfy the demand. Due to this it is realized that roof water harvesting is untenable option.

Gully run-off

Finally, a visit was made to a number of the seasonal streams and gullies identified by the people discharging large amounts of runoff . The WASP technical team identified the feasibility of the construction of a small dam to arrest and store this runoff. The amount of work and inputs needed, and the technical difficulties in water treatment and maintenance, were seen as a constraint. However, after considerable discussion with the village and further site analysis, it was finally concluded that such an option presented the "final choice" for the people of *Cherkos* to obtain clean and plentiful supplies of water.

Project design and preparation

Preparing proposal

So many rural water supply projects in Ethiopia sooner or later suffers failures- very often due to social issues rather than technical problems. We recognized that if our "Final Choice" was to provide sustainable benefits, good community management would be essential. To ensure communities manage and maintain any protected water source, considerable effort was made in Cherkos to maximize the sense of responsibility and from the beginning therefore WASP clearly identified its role as a facilitator to help the people themselves plan and design their own project. To what extent we were successful in this respect will be discussed later.

Using the guideline presented during the PAPI exercise, the community came up with its initial project proposal defining objectives, anticipated benefits, indicators of achievement and means of verification. The Technical team went again to the village to discuss each point in the proposal and to undertake suitable site investigation. The result of the investigation and the overall technical feature of the project explained to the people. At this stage valuable technical suggestions were gained from the community (ex. Women suggested to change the dam site).The proposal was then submitted to the Woreda Rural Development (RDC) Committee requesting funding support from the RDC's Community Development Fund.

Technical design

The following parameters were considered at this stage, investigation was undertaken at field and the final design prepared.

c) Site Selection b) Water Demand c) Hydrological analysis d) Dam design e) Water treatment.

Site selection

The dam site was selected on the following merits of the area;

- Availability of suitable foundation (exposed bed rock with no visible fissures).
- Relatively narrow width (short crest length).
- Availability of construction material nearby.

A detailed survey was made on the catchement area (about 100 ha) and topographical map was produced to assist correct yield estimation and dam design.

Water demand

Unlike other conventional water supply projects the design period of this particular project is reduced to 15 years, owing to the inaccessibility and major maintenance capacity of the community. As a result the demand is estimated for the population that may be served at the 15th year. Geometric progression was employed to forecast the population and a growth rate of 2.23 per cent was adopted. Using the domestic water consumption norm and livestock consumption a demand of 0.38 liters/second is expected at the year 2012 G.C. in Cherkos village.

Hydrological analysis

There is no meteorological data in the site nor in the nearby places, to fill this gap rainfall data of different places in the basin and adjacent basins were collected to synthesize rainfall data of the site. Knowing two quantifiable parameters in Cherkos (altitude and temperature) and observing other pertinent features a linear regression analysis was carried out relating rainfall with the above parameters. The regression output was fairly representative with a correlation coefficient of 0.65, Aerial reduction factor of 0.8 was adopted to estimate the catchement catchement yield was estimated using the rational formula (Q=CiA). From the observed land use land cover pattern of the catchement a runoff coefficient of 0.25 was adopted and 80 per cent dependable rainfall is assumed to generate the runoff from 1 km^2 catchement area. A total of 332082m^3 runoff will be generated. Demand supply analysis was also done based on the yield and a deficit was observed during the months of April, May, June.

Dam design

The type of dam to be constructed in a given site should fulfill the criterion set during site selection, based on that a masonry dam was selected which can also serve as an overflow during high flood. However the problem of using the dam for an open reservoir system has its own difficulties in an isolated area like Cherkos. Among the difficulties encountered at the planning stage were;

- Absence of any established sediment norms of local sediment flow, this causes difficulties in forecasting the sediment which may fill the reservoir and contribute to annual increments in dead volume.(provision of scouring sluice would have been an easier solution for such small dam despite the fact that loosing runoff and maintaining gates in such isolated area).
- Difficulties in water treatment, since the open water surface is easily liable to contamination, the problem is exacerbated by distant health service, technical supervision etc.
- Water losses from the reservoir is very high due to high temperature in the area (max. 35^{0}C).

Stability analysis was carried out to determine the safe dam geometry during all worst conditions and To facilitate collection of water during any damage to the outlet pipe a collection sump surrounded by graded backfill material is provided. The purpose of the graded backfill is two fold- one to serve as a filter material and the other to occupy space that would have been meant for fine silt coming with the runoff.

Water treatment

The graded back fill around the sump was supposed to act as a filter, however during water quality test it proved unsatisfactory (see table) and the option was later changed with slow sand filter.

Project implementation

Community organizations and inputs

Due to the failure of the 1996 crop, the amount of out migration was significantly higher than anticipated. It thus proved very difficult to commence the project as per the original thought. In the proposal the community had planned to supply locally available materials and all necessary unskilled labour free. However with no food in the village following the disastrous harvest, this no longer seemed a viable plan. After intensive discussion, the project agreed to cover wages at 4 Birr a day for some activities during the construction phase.

Monitoring and evaluation

Results

- The collection of runoff in the dammed reservoir has been more or less as predicted, following some 10 weeks

Table 1. Status of Faecal Coliform Units (FCU)

No. of FCU in the reservoir	No. of FCU in the sump	No. of FCU in the treatment plant
Uncountable	250	10

Table 2. Work and Time Frame

Activities	*No. People*	*Duration (days)*	*Person days*
Site selection and surveying	17	12	114
Foundation investigation	5	3	15
Transporting of 450 Quintals of cement	900	1	900
Stone dressing	3 masons	60	180
Dam Construction (inc. sand/stone collection)	55	60	3300
Construction of u/s check dams,and bund	100	6	600
Collection of materials for backfill and backfill	20	4	80

Table 3. Quantity and Expenditures

Inputs	*Quantity*	*Unit cost*	*Total Cost*
Cement	450 Quintals	90	40500
Sand	70 m³	70	4900
Pipes	138 pieces (2" diameter)	105	14490
Stone	610 m³	10	6100
Labour (skilled)	3 masons for 60 days	30	5400
Labour (unskilled)	2500 person days	4	10000
Total			81390 ETB*

Out of the total cost the community contribution (labour and local material) equals 12140 ETB
* 1 US Dollar = app. 7 ETB (September 1997)

of sporadic rain nearly the three fifth of the estimated run off collected.

- The community took responsibility for the maintenance of the system e.g. They sealed leaking pipes to conserve the reservoir water on their initiative without outside encouragement.
- Neighboring villages request to undertake similar project in their village.
- The slow sand filter provide not only clean water, but also cold water.

Problems encountered

Conceptual understanding:- community members could not really envisage how the system would work. Despite initial explanation and discussion throughout the planning and implementation stage.

Health education:- The community seem to be more interested in the quantity of water that may be obtained than the quality.

Labour Contribution:- Due to the labour intensive nature of the project and severe crop failure in the area and pressure for out migration, it was agreed to use cash for work to assist the community in construction.

Because this contradicted the first agreement in the original project proposal , it probably encourages an attitude of " get-what-we-can-now" that resulted in poor work outputs for unpaid activities (such as back filling and catchement protection) and could undermine the sense of ownership and self reliance that the project was trying to promote.

Integration of water Development with Soil and Water Conservation :- The high degree of silt trapped by check dams upstream of the reservoir demonstrates not only their effectiveness but also the need for a more systematic approach in the reservoir catchement.

Womens Involvement in the management system :- Despite initial encouragement to focus on the end users, Cherkos elected a male dominated water committee to manage the project.

Participatory evaluation

Participatory evaluation was conducted during the inauguration of the project using the villages original indicators of achievement in the proposal the following points are the few among the identified strengths and weaknesses of the project:

- Encouraging the community to participate starting from the inception of the project to the implementation stage (This built the confidence of farmers as their knowledge is respected).
- The Site selection was biased towards economical criterion , it doesn't consider end-users / Women interest during water collection (Out of the three potential dam sites the nearby site with small catchemnet was considered least due to less volume of water and far quarry/sand site).
- The project planning was flexible in that the original community plan to provide labour and local material free was later changed in cash for work by recognizing the season's production.
- No visual explanation was given on how the system will function and resulted in confusion at the beginning of the implementation.
- Fencing the reservoir area should have been considered during the planning stage as a part of the activities in the project.

Conclusion and recommendation

This project may demonstrate the use of small dams as technical alternatives in areas where ground water is not easily accessible. The project is not yet complete, further catchement protection works are needed every year, water filtration needs attention and community management still has to be put to test. However, even at this stage it is possible to offer the following recommendations based on the experience of Cherkos dam.

- In assisting communities to design their own projects, great care has to be taken to ensure that they fully understand their responsibilities and roles. It is better to start from the beginning with a realistic work plan than have to change once implementation is started.
- Even in communities where both sexes are reluctant to promote women decision making for water projects, facilitators should be more courageous in challenging accepted norms.
- If new technologies are going to be introduced, verbal animation and explanation should be reinforced with audio-visual techniques to ensure full understanding before finalizing plans.
- In areas of known food-insecurity and unpredictable rainfall, the facilitating agency must carefully design its strategy before initiating discussions with the community. Cash/food work need not undermine self reliance and sense of ownership. *If it has* to be introduced, the important factor is that the project identification and plans must still be the responsibility of the community and that some Contribution and investment must still be clearly defined in their proposal.

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