DEVELOPMENT AND TESTING OF GROUNDWATER DROUGHT MANAGEMENT STRATEGIES IN THE LIMPOPO BASIN PILOT AREAS

FINAL REPORT

October 2011

Submitted

by

a Consortium comprising

WELLFIELD CONSULTING SERVICES

Groundwater and Engineering Consultants

British Geological Survey

NATURAL ENVIRONMENT RESEARCH COUNCIL

CSIR

our future through science

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

AP	Awareness Programme
BAC	Botswana Agricultural College
CBO	Community Based Organisation
CWMC	Community Water Management Committee
DWA	Department of Water Affairs
EPP	Emergency Plant Protection
FMD	Foot and Mouth Disease
MO	Monitoring Operative
MoA	Ministry of Agriculture
MoLG	Ministry of Local Government
PTA	Parent Teacher Association
RCWMP	Rural Community Water Management Plan
SADC	Southern Africa Development Community
TDS	Total Dissolved Solids
VDC	Village Development Committee
WMC	Water Management Committee
WUC	Water Utilities Corporation

1. INTRODUCTION

The Southern African Development Community (SADC) has the goal of fostering co-operation and mutual benefit from the resources of the region amongst its member countries – Angola, Botswana, DRC, Lesotho, Mauritius, Malawi, Mozambique, Namibia, Madagascar, South Africa, Swaziland, Tanzania, Zambia, and Zimbabwe. Through this mutual goal SADC has identified water as a key resource that can benefit from such cooperation.

Significantly, SADC prepared its Regional Strategic Action Plan on Integrated Water Resources Development and Management (RSAP–IWRM) in 1998. By 2003 SADC also had its Regional Indicative Strategic Development Plan (RISDP) which is designed to provide strategic guidance to SADC Programmes, especially on poverty reduction issues. The RISDP exercise identifies most priorities in the RSAP–IWRM, indicating the need to develop and implement a regional strategic water infrastructure to:

- promote development and integration – regional economic integration is at the heart of the RISDP and SADC objectives,
- reduce poverty,
- increase food security,
- fight diseases,
- mitigate the effects of floods and droughts.

The development and management of water resources in SADC Member States has traditionally focused on surface waters. However, limited surface resources coupled with increasing demand and the threat of climate change have resulted in increasing dependency among SADC Member States on groundwater for both domestic and commercial water needs. Recognizing this increasing dependency, SADC developed its Groundwater Management Programme (GMP). The overall objective of the GMP is to promote the sustainable development of groundwater resources at a regional level, incorporating research, assessment, exploitation and protection, and focussing particularly on groundwater drought management.

Regional groundwater resources face a number of threats from increasing population pressures, industrial development, mining, point and non-point sources of pollution and agricultural practices resulting in over-exploitation, contamination, and degradation. These factors are compounded by the affects of both meteorological and social drought which is impacting the security and sustainability of water resources and resulting in the degradation of Groundwater Dependant Eco-systems (GDEs). The lack of detailed information pertaining to regional groundwater resources along with the transboundary nature of some of the aquifers is currently hindering the sustainable management and allocation of groundwater.

To start to address these challenges SADC has secured a grant (TF 055090 SADC) from The Global Environmental Facility (GEF) to implement one of the ten sub-projects under the Groundwater Management Programme: The SADC Groundwater and Drought Management Project. This Project's objective is defined as *The development of consensus on a SADC regional strategic approach to support and enhance the capacity of its member States in the definition of drought management policies, specifically in relation to the role, availability and supply potential of groundwater resources.*

The project included four components:

- Testing of practical local groundwater drought management strategies at pilot level.
- The development of groundwater drought management tools and guidelines.
- Research into GDEs, their occurrence, vulnerability, value and protection.
- Establishment of a Groundwater Management Institute of Southern Africa (GMISA) to continue long term groundwater and drought monitoring and the promotion of better management and awareness in the SADC region and at national levels.

The current project addressed Component 1 of the project *Testing of practical local groundwater drought management strategies at pilot level*. The current project was scoped into five phases over a period of three years:

Phase 1 -Inception

- Review of groundwater related information in the Pilot Areas

Phase 2 - Pilot programme definition

- Stakeholder analysis and engagement within the Pilot Areas
- Delineation of Pilot Areas
- Institutional and regulatory analysis of groundwater management in Pilot Areas
- Representative pilot 'Nodes' selected

Phase 3 - Drought mitigation planning

- Drought intervention and groundwater management plans for Pilot Areas.
- Prepare design for drought interventions structures and develop ToRs for construction contractors

Phase 4 – Physical drought intervention construction

- Supervision of drought intervention activities

Phase 5 - Monitoring and evaluation

- Monitoring and evaluation of pilot 'Nodes'
- Strategy for sustainability of drought intervention measures
- Lessons learnt

The ultimate outcome of the work is to better inform implementers of drought proofing schemes. The process of consultation, dialogue, need and choice recommended from the experience gained in this pilot project will inform a proposed major upscaling roll out across the SADC Region within the Proposed Phase 2 Programme. With the Phase 2 Programme working alongside NGOs and others, the anticipation is that all implementers will adopt the scheme of work outlined here in order to select cost effective drought proofing interventions appropriate to and owned by the community.

1.1 Background

Whereas drought was once perceived as the exception it is now considered to be the norm for many arid areas of the world including the Limpopo region. The key components of any drought mitigation strategy are:

- Drought proofing (including developing existing coping measures).
- Structured development rather than relief.
- Early warning: monitoring and forecasting to trigger actions.
- Early response.
- Drought preparedness.

Previous experience of drought in parts of the SADC region shows that all facets of drought must be taken into account in designing a mitigation strategy. Timeliness of intervention is the key to protecting livelihoods. Drought planning strategies are essential if effective protection is to take place. The precursor to any drought crisis is failure of the rains, causing crop failure and subsequent loss of animals. Pre-drought management may include food imports such as grain, movement of livestock to distant range and replacement of dry surface water sources with groundwater.

Usually the first area to be affected by drought is agriculture which may suffer crop failure, and animal deaths may occur later, perhaps in the second and subsequent years of a drought episode. Water for drinking and domestic use is commonly derived from a separate source than water that is used to sustain agriculture. For example, the soil moisture deficit may reach the wilt point and surface water sources used for irrigation may dry up, whereas water wells for domestic supply are likely to be drawing on groundwater reserves for a longer time thereafter and will maintain domestic needs until each source dries up or the

pumping equipment fails under increased stress. Some groundwater may also be used for irrigation of community gardens and other smallholdings.

The key impact of drought on livestock is lack of fodder. At the beginning of drought, pastoralists and other livestock owners try to sell animals to boost their purchasing power as food prices rise. There is an urgency to sell before the condition of the animals deteriorates and they become worthless. Inevitably livestock mortality increases and forced sales take place. Although a complex network of socio-economic, demographic and environmental factors come into play, the availability of groundwater after surface water sources have expired has the most important effect on the severity of drought impact on a community.

The timely and well organised provision of emergency water, generally groundwater, can greatly assist to mitigate the effects of drought by opening up emergency grazing areas with the provision of emergency boreholes. However, this may have a longer term impact on rangeland ecosystems. It also requires a properly defined trigger mechanism to access the emergency procedures. Similarly the provision of community gardens watered from, for example, a sand dam may provide a community with food well into a drought situation. In some places straightforward community empowerment through training and awareness may enhance resilience to drought.

Other issues that need to be tackled are the identification of effective indicators that can be monitored on the ground to measure the effectiveness of drought proofing measures. These can include livestock numbers, well and borehole status, distance travelled to collect water, the occurrence of stomach illness at rural clinics, all of which require a dialogue with village representatives.

Food transport is an obvious and effective form of short-term agricultural drought relief. But it is not a sustainable strategy, and it removes livelihoods from the receiving community. Water tankering may be equally effective on a short-term basis, for example in Northern Province, South Africa, in the early 1990s, but it is expensive and it is not a substitute for the provision of permanent and sustainable supply. Additional forms of relief are required to lessen the impact of socio-economic drought and to combat the longer-term effects of agricultural drought. Effectiveness needs to be measured both with regard to short-term humanitarian relief and more critically to longer term sustainability in post-drought years.

Specific data gathering is essential to guide the forms of drought proofing and drought preparedness, that are best suited to the sociological and environmental frameworks within the Pilot Areas (Figure 1) and in any subsequent upscaling project. In addition it is essential that actions are taken in collaboration with communities and their leaders so that their effectiveness at the onset of drought and community ownership are assured.

The key to the success of the Limpopo project was specific knowledge of the Pilot Areas. To attain this understanding a raft of social, economic, environmental and engineering data were gathered and fed into a Planning Process which was developed into a Rural Community Water Management Plan with each community to identify bespoke, best and cost effective drought proofing measures for each village. The outcome of the process was the specific Rural Community Water Management Plan (RCWMP) under which agreed measures could be implemented, while structures were later designed and constructed. Appropriate dissemination and educational work was carried out through community leaders and a network of community mobilizers established. The community mobilizers role is to inform communities of early warnings of the likelihood of impending drought so that agreed emergency actions can be implemented. Indicators were selected and monitoring commenced before the fabric was put in place to observe the baseline and post-intervention situations. However, care was taken to identify both factors that are specific to the Pilot Areas and those that can be exported generically to almost any region within SADC.

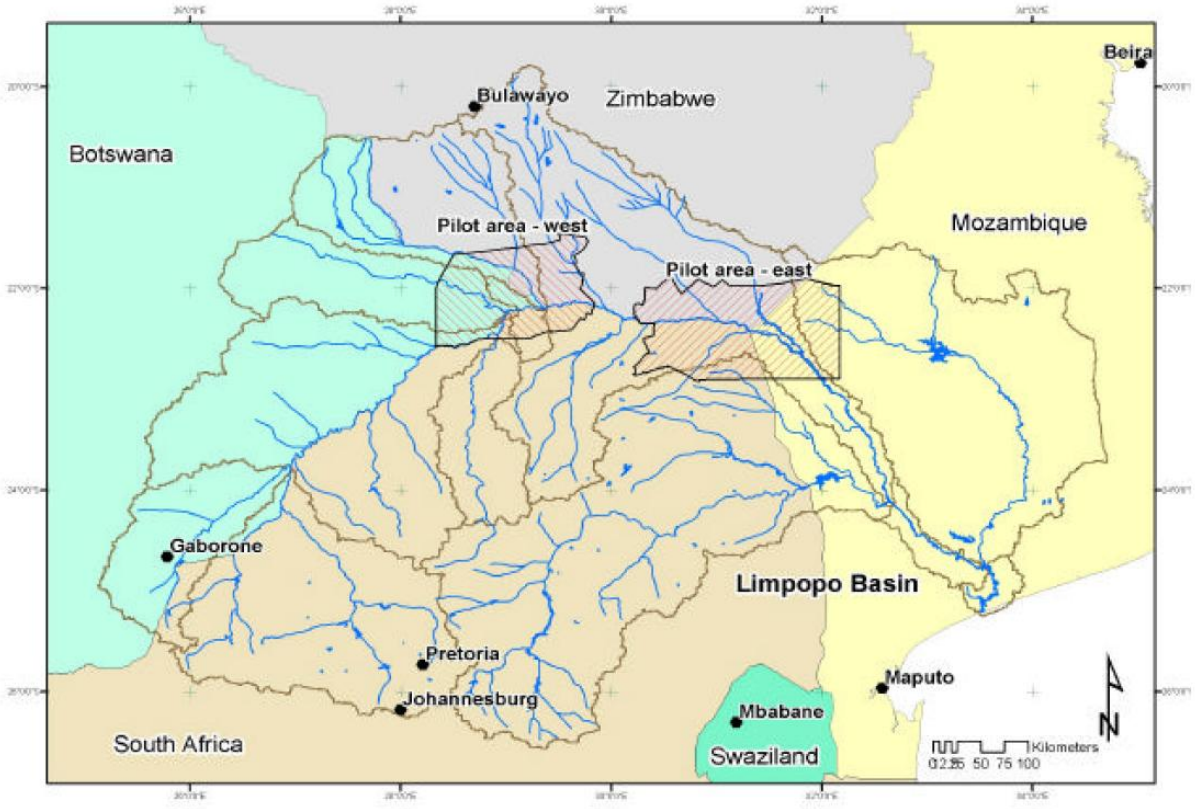

Figure 1 Pilot Areas in the Limpopo catchment identified in previous project (see Section 1.3)

1.2 Objectives and strategy

The Groundwater and Drought Management Project addressed the need for the SADC Member States to co-operatively develop a strategic regional approach to support their capacity in the definition of groundwater drought management policies, specifically in relation to the role, availability (magnitude and recharge) and supply potential of groundwater resources (as a portion of the overall water resource). This assists in reconciling the demands for socioeconomic development as well as those of the principal groundwater-dependent ecosystems. The Pilot Project addressed a number of activities at three different scales: regional, national and river basin. It is envisaged that the methodologies established and lessons learnt from these activities will be replicated in other areas of SADC to expand the knowledge and management of groundwater resources regionally (Figure 2). This will be done within an upscaling Phase 2 Project during which it is anticipated that the lessons learnt in this Pilot Project will be transferred to other implementers working in the SADC Region.

The current project addressed Component 1 of the overall project under the title *Testing of practical local groundwater drought management strategies at pilot level*.

The overall objectives were to:

1: Develop and test specific community groundwater drought management plans and associated interventions within the Limpopo Basin pilot area to obtain empirical information that can be replicated and rolled out in the SADC region.

2: Design and pilot physical and social interventions for mitigation against groundwater drought within the Limpopo Basin (i.e. drought-proof an area by addressing poverty while still considering bio-physical environmental groundwater needs).

3: Derive and develop approaches, methodologies, and lessons learnt to input into the development of generic decision support guidelines and the region's knowledge base regarding groundwater drought mitigation.

The project structure is summarised in the flowchart below.

1.3. Previous work

Work related to the objectives of the project has previously been undertaken in the Limpopo River basin, both under the preparatory GEF programme as well as by national and international studies and organisations. The primary document

which underpins the current project programme is the study, completed by CSIR, South Africa in 2003 on behalf of WB/SADC Water Division under the GEF programme, entitled *Protection and Strategic Uses of Groundwater Resources in Drought Prone Areas of The SADC Region: Groundwater Situation Analysis of the Limpopo River Basin.*

The basin-wide study produced an assessment of the occurrence of groundwater within the Limpopo Basin at a regional scale. However, that scale is too broad to be effective at Pilot Area level and provides only background information. Nevertheless, sufficient understanding was presented to provide a way forward for the present project. It was also realised that much of the required detailed information would need to be gathered from primary observation in the Nodal Areas and specifically at community level. In addition the study identified two project pilot areas, namely the Western Pilot Area and the Eastern Pilot Area

- The Western Pilot Area covers approximately 17 000 km^2 centred on the junction between the Limpopo and Shashe rivers which form the boundary between South Africa, Botswana and Zimbabwe.
- The Eastern Pilot Area is centred roughly on the intersection of the borders of Mozambique, South Africa and Zimbabwe Major tributaries include the Bubye from Zimbabwe, Levubu from South Africa and Munezi from Zimbabwe via Mozambique.

The identified pilot areas formed the basis to define the regions in which the current project would identify communities in which to pilot community based groundwater drought management activities.

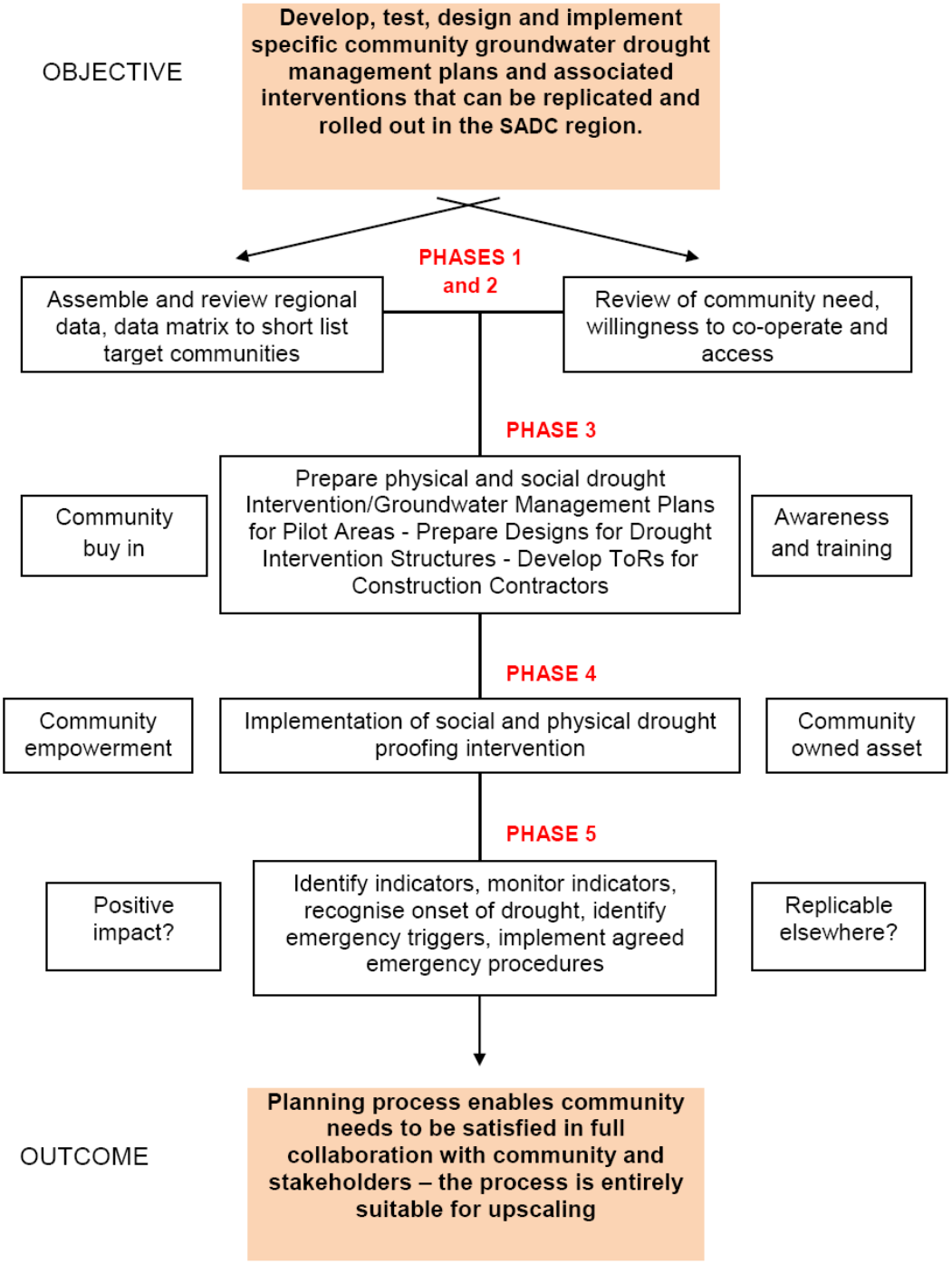

Figure 2 Flow chart showing Project structure

2. SUMMARY OF PROJECT ACTIVITIES

2.1 Phase 1 - Inception Phase

At an initial Project Inception Meeting in March 2008 the Project Supervisor outlined the background to the project and discussion followed on the process of identifying Nodal Areas on which to focus. These in turn would become the focus of the subsequent stages of intervention and observation in Pilot Areas.

Information on the impact of drought on groundwater resources within the Central Limpopo area within the context of the SADC region as a whole were gathered and assimilated (See Box 1).

A gross baseline study was conducted and identified the key socio-economic, policy and institutional dimensions, with regard to impacts of drought, and the likely responses of those impacted. While concentrating at river basin level the study was focussed also on the two defined project pilot areas, with the aim of identifying Nodal Points/communities in which to focus the project activities.

Geographical information was compiled at river basin scale again focussing on the pre-defined Pilot Areas (Tables 1 & 2).

The Limpopo River basin is one of the most densely populated in Africa with over half the people living below the poverty line. The Limpopo River Basin is predominantly semi-arid, dry and hot. It is a region of summer rainfall, generally with low precipitation. The mean annual precipitation decreases westwards. Rainfall varies from a low of 200 mm in the hot dry areas to 1 500 mm in the high rainfall areas. The majority of the catchment receives less than 500 mm of rainfall per year. The Eastern Pilot Area generally has a higher rainfall than the Western Pilot Area, with a mean annual potential evaporation of 1450-1500 mm per year, the maximum being 1500-1550 in Mozambique in the north-eastern part of the Eastern Pilot Area.

Much of the Limpopo basin is too dry even for dry land agriculture and there are limited surface water resources to support irrigation. Land use is, therefore, dominated by stock farming (mostly cattle) while there is an increasing tendency to replace this with game farming. Much of the area is covered by natural vegetation.

BOX 1 Regional data – gathered and assimilated

- Archived information and data held at BGS Wallingford, CSIR in Pretoria and Wellfield Consultants in Gaborone.
- Papers and information from the international literature – several thousand items from the SADC region and 500 items from the Limpopo Basin listed within an EndNote bibliographic archiving systems.
- Reports and maps from government departments and others in Zimbabwe, South Africa, Botswana and Mozambique – collected during earlier research studies undertaken in these countries.
- Information held at the SADC Water Sector offices and related sectors based in Gaborone.
- Information and records held at the Ratcliff Science and Rhodes Institute libraries at the University of Oxford and at the BGS Library in Keyworth.
- Additional research information from the universities of Pretoria and the Western Cape.

In addition the availability of hydrogeological and related information, maps and digitised databases, are available within the country reports compiled during the preparation of the SADC Hydrogeological Map.

A series of databases for georeferenced sites was prepared for the region.

In South Africa, available digital data sets are available within the DWA Groundwater Resource Assessment II Project (GRA2) of 2004, including:

- Situation Assessment of the Needs of Rural Communities
- G.R.II.P. (Limpopo Province) Groundwater Database
    - Rainfall
    - Baseflow per quaternary catchment
    - Surface topography
    - Soil cover
    - Vegetation
    - Geology (lithology and structural data)
    - Groundwater quality
- Depth to groundwater data are obtainable from DWA through the Geo-request Service Depth to Groundwater.

In Botswana a range of data types required for the formulation of the National Water Master Plan are available, including rainfall and river flow data within eastern Botswana. The National Borehole Archive includes hydrogeological data derived from the departments of Water Affairs and Geological Survey. Digital data are also available from the national groundwater monitoring system, selected aquifer testing data, and from project sources.

In Mozambique the situation is less clear, although digitised borehole records are maintained at the offices of the Direccao Nacional De Aguas (D.N.A.) in Maputo.

In Zimbabwe digitised borehole records have been maintained at the offices of the District Development Fund (DDF) in the main provincial towns, and detailed databases maintained also at government departments in Harare.

Table 1 The Limpopo River Basin

Country	Area of country within basin (km^2)	As % of total country area (%)	Population in basin (million)	As % of country population (%)	Population density in basin (persons /(km^2)	Population of country (million)
Botswana	80 118	14	1.0	59	12.5	1.6
Mozambique	84 981	11	1.3	7	15.3	16.5
South Africa	185 298	15	10.7	24	57.5	42.1
Zimbabwe	62 451	16	1.0	9	16.0	11.4
Total	**412 938**		**14.0**		**33.9**	**71.6**

Table 2 Areas (km^2) of the two Pilot Areas within the four riparian countries

	Botswana	South Africa	Zimbabwe	Mozambique
Eastern Nodal Area	-	6452	5639	7491
Western Nodal Area	6485	2483	5092	-

Urban centres, mostly in Botswana and South Africa, are major water users supplying industries, power stations and municipalities. Water is also vital in rural areas for domestic, livestock watering and irrigation purposes. While irrigated agricultural activities are largely concentrated in South Africa and Zimbabwe, the majority of rural populations engage in rain-fed agriculture. This does not guarantee secure livelihoods with broadly only two out of every five agricultural seasons producing reasonable crop yields. These climatic conditions emphasize the need for effective management of transboundary water resources and effective governance structures, delivery and control mechanisms. The Human Development Index (HDI) is a useful indicator of wellbeing and ranks countries according to progress in human development beyond a simple gross national product figure. The index ranges from 0 to 1, i.e. rural population of about 8 million people living in the Limpopo River Basin faces special challenges to make a living. The broad Human Development Index for the four countries in the Limpopo Basin is reflected in Table 3.

Table 3 Human Development Index for the Limpopo River Basin Countries (Source: UNICEF)

Country	Global HDI (2004)	Life expectancy 2006	Adult literacy rate, 2000-2005 (%)	Population using improved drinking sources (%)	Under 5 mortality rate 2006	Population aged 15-49 living with HIV/AIDS (%) end 2005
Botswana	**0.57**	**49**	**81**	**95**	**124**	**24**
Mozambique	**0.39**	**42**	**39**	**43**	**138**	**16**
South Africa	**0.65**	**50**	**82**	**88**	**69**	**19**
Zimbabwe	**0.49**	**42**	**89**	**81**	**105**	**20**

A number of regional institutional activities relate to the current project. The most important of these is the SADC *Drought Monitoring Centre*. This is charged with monitoring climate extremes, especially drought, and contributes towards minimizing the negative impacts of drought to the socio economic environment.

2.1.1 Procedure for the selection of Pilot Nodal Points

A series of matrices were designed to categorise potential nodal points, identified in the gross survey. Three matrices dealing with the groundwater and water supply situation in the Pilot Areas were applied. These were the Groundwater Potential Matrix, the Data Availability Matrix and the Water Supply Matrix. Each matrix contains a series of attributes that are rated on a scale of 1 to 5 according to their significance or the magnitude of their quantitative value. The final rating score for each matrix was combined, with each matrix total again being weighted, to provide a final combined rating score from which potential Nodal Points could be ranked and selected. They included:

Groundwater Potential Matrix:

- Aquifer thickness
- Aquifer properties
- Aquifer type
- Borehole
- Water
- Recharge potential

Data Availability Matrix

- Geological
- Water Quality
- Geophysical data
- Overall groundwater or knowledge

Current Water Supply Matrix

- Supply coverage
- Type of extraction
- Distance of extraction points from demand

Socio Economic Matrices

- Decision Matrix
- Community mapping
- Opportunity Ranking
    - sustainability (can the community keep the project interventions running by itself after outside assistance has gone?)
    - productivity (will intervention substantially increase the availability of needed resources (water)
    - equitability (will the intervention benefit a broad cross section of the community?)
    - cost (will large amounts of external funding be needed?)
    - technical feasibility (does the intervention require specialised expertise both to start and maintain?)
    - social/cultural acceptability (does the intervention fit within the community's norms and values)
    - time needed (will it take a long time for the community to reap the benefits of the intervention – i.e. will the community reap benefits during the next drought?)
- Problem Census

Although the populated matrices were important to the selection of representative Pilot Nodal Points as 'test sites' for physical and/or community interventions and monitoring, other practical logistical and operational factors such as general access were equally important. Similarly, community and local authority acceptance and willingness to be involved, practicality and estimated cost of specific construction interventions and overall Member State political climate and support all impacted the final selection.

Specific questions were asked at community level to inform choice of intervention and appropriate sites. These included:

- water availability, accessibility, affordability and acceptability,
- impacts of drought on community water supplies and coping strategies deployed,
- socio-economic and socio-cultural constraints and opportunities for improved water management,
- identification of human actions and capacity-building methods to improve understanding of drought management.

The following additional activities pursued:

- Identify existing administrative structures important for the implementation of the project.
- Explain project objectives to the relevant authorities and leaders of the communities as well as participating household members.
- Discuss with government departments (i.e. Department of Health, Department of Water Affairs, Department of Agriculture) at national and local level, policies and strategies in relation to water, drought management and sustainable livelihoods.
- Talk with NGOs, community leaders and clinic staff in the selected pilot study areas to obtain more information and to gain further insights.
- Promote participation / ensure information exchange between the project (field) workers and identified stakeholders.
- Use questionnaires for validity (falsification).
- Use structured interviews and focus group meetings.
- Provide opportunities for stakeholders to propose acceptable intervention methods.
- Manage community expectations concerning interventions / benefits of the project.
- Obtain concerns of the most vulnerable groups (women, the elderly etc).
- Discuss with local, district and national government representatives in the health, social services and water/sanitation sectors the support provided to households.
- Discuss levels of water supply and livelihood coverage in the pilot areas.
- Meet with local entrepreneurs in the selected pilot areas involved in water and agricultural/livestock activities to ascertain their role in service provision and discuss the strengths and weaknesses.

2.2 Phase 2 – Pilot Programme Definition

The Phase 2 programme was initiated with a study which comprised:

- Stakeholder Analysis and Engagement within the Pilot Areas
- Delineation of the Pilot Areas
- Institutional/Regulatory Analysis of Groundwater Management in the Pilot Areas
- Representative Pilot 'Nodes' Selected

The legislative and institutional frameworks within Botswana, South Africa, Zimbabwe and Mozambique reveal some marked contrasts. The rigid framework of service provision to rural communities in Botswana and South Africa contrasts with the chaotic lack of service provision, monitoring and maintenance currently offered in Zimbabwe and Mozambique.

The institutional and legislative framework had a direct bearing on the types of intervention that can be effective in the respective countries, for example, rehabilitation of existing and broken infrastructure in Zimbabwe provides a direct example of the value of maintenance of existing assets rather than provision of new ones. Subsequent monitoring of livelihood and livelihood diversification then provides useful data on a community empowered with the status quo in terms of water security compared with adjacent villages which remain water insecure. This would help to overcome the belief that it is easier to drill a new borehole rather than maintain an old pump - certainly a belief held by many NGOs.

Preferred interventions in Botswana and South Africa would likely comprise enhancement of livelihood by physical intervention in Botswana and social intervention in South Africa. In Botswana water is virtually guaranteed by government at times of drought. However, little support is given towards stock watering and the provision of fodder. Nor is there a culture of small scale irrigation and community gardens (interestingly domestic plots are often left bare when they could be used for vegetable growing using waste domestic water). It is, therefore, likely that intervention here will take the form of the promotion of community gardens as demonstration plots. Enhancement of cattle holding is constrained by the disallowing of use of allocated agricultural 'lands' for stock, so that any activity in this respect would need to be distant from a stock-owning community and situated on communal (tribal) land.

The proposed South African intervention would take the form of empowering a community to manage its water issues with particular focus on drought preparedness. This needs careful management and implementation to ensure that all the relevant stakeholders are taken aboard and the community is informed of the benefits of liaison with the water undertaking and others. This

will allow the community to be responsible for preparing itself for drought and drought-proofing its respective livelihoods as best it is able. As happened in the 1991/92 drought it is assumed that government would maintain rural community water supplies in future droughts even if it has to resort to tankering.

Droughts affect livelihoods in a number of different ways, cutting across sector perspectives and disciplines. In many countries in SADC, however, drought management, or more typically relief, focuses almost exclusively on food needs. Other dimensions of vulnerability, including water availability, access and use constraints, which determine household water security, receive much less attention. This reflects the organisation and remit of the respective governments and not the realities of community and household livelihoods.

Food and water security are interwoven. Food security is an outcome of a set of vulnerabilities, each dependent on how people access production and exchange opportunities. This is influenced by the broad expenditure in time, labour or money, invested by individual households in gaining access to water. In many rural environments domestic water is a production input, i.e. in garden and other small scale irrigation, livestock watering, brewing and brick making. Therefore, water insecurity can effect wider household production and income as well as just the quality and quantity of water for human consumption.

2.2.1 Representative Pilot 'Nodes' Selected

Criteria for the selection of individual recipient communities or Nodal Points focus on the livelihoods aspect of a respective community. However two other social criteria are weighted strongly:

- The first criterion is evidence that a strong community group exists that can take ownership and which can manage any new facility or social empowerment.
- The second criterion is the availability of water to source interventions, although in the case of Zimbabwe it is the repair of existing but broken structures that will be implemented in order to allow renewed access to the existing resource.

The key to the success of the project is monitoring the impact of the respective intervention on livelihoods. This is best done by a local technician or community facilitator working to a prescribed monitoring regime, which is dependent on criterion one. However, the choice of monitoring indicators is also critical to success. Indicators include health (visit statistics for the local clinic), community wealth (total head of cattle owned by the community) and individual household statistics taken as samples. Other indicators can be incorporated into the programme to suit each community and each type of intervention. For example, in the South African case of community empowerment towards water management some measure of satisfaction both on the part of the community

and of the stakeholders will need to be made. Physical indicators can be measured directly, e.g. depth to water level in borehole or well, number of buckets of water withdrawn, daily rainfall, number of vegetables produced, etc.

Individual interventions and monitoring programmes at each Pilot Nodal Point must not be so site specific that they cannot be replicated elsewhere during a future upscaling programme – as a key project issue is upscaling and dissemination. For the former the interventions must be suitable for upscaling, for example, the Zimbabwe case of rehabilitation lends itself to being upscaled throughout rural Zimbabwe and other countries in SADC where equipment status is poor. The South African empowerment intervention, however, can best suit only those areas of SADC which already have a prescriptive institutional framework for the provision of services to rural communities. The Botswana intervention is importing successful physical structures to an area where they have not previously been adopted. The intervention and the monitoring data and subsequent analyses need to be well documented in order to underpin dissemination of the more successful actions to promote upscaling programmes through external agencies and NGOs.

The selection procedure revealed the following potential communities for intervention:

WESTERN PILOT AREA

- Botswana: Gobojango, Semolale, Bobonong, Molalatau, Mathathane and Tsetsebjwe
- Zimbabwe: Hwali, Dendele, Mamatuturi, Whunga, Siyoka and Shashe
- South Arica: No obvious village communities in Pilot Area

EASTERN PILOT AREA

- Zimbabwe: Gota, Diti and Chabile
- South Africa: Segole, Shakudza, Tshivaloni and Maaheni
- Mozambque: Chassanga, Mugugugo, Mahatlane, Tchale, Salane and Lisenga

The process of matching intervention with community eventually provided the scope of the work shown in Table 4.

Table 4 Likely interventions

Objective of pilot intervention	Social and institutional sustainability requirements	Technical sustainability requirements	Environmental issues and drought preparedness	Upscaling potential
BOTSWANA [Water for vegetables, water for livestock]	Buy in MoA support at national and regional level. No NGO culture Strong community structure linked to local government. Focus on small communities (women important). No tradition of gardening.	Sand rivers for dams and trenches. Needs hydrogeological assessment.	Trees along river banks could be a GDE issue. Impact of livestock watering around sand dam. Community management plan needed.	Well documented pre- and post-intervention situation. Identify likely success and constraints. Institutional linkages. Upscaling and dissemination.
ZIMBABWE [Water for domestic, gardening and livestock to return communities to the status quo]	Provision of basic water needs. Establish community water user and management organisation. Secure involvement of World Vision. Linkage to government	Sand rivers. Groundwater hydrogeological assessment needed. Upgrade former infrastructure	GDE issues? Community management plan. Implementation arrangements.	Well documented pre-and post-implementation Identify success factors and constraints. Upscaling and dissemination.
SOUTH AFRICA [Secure water for drinking and livestock at times of drought[	Introduce community management of water supply and focus on drought preparedness. Need support from DWAF/LG at various levels and agree on responsibilities and mandates between parties	No technical intervention. Concentrate on social intervention.	GDE issues? Community management plan Implementation arrangements	Well documented pre-and post-implementation. Identify success factors and constraints. Upscaling and dissemination.
MOZAMBIQUE [To be determined}			Community management plan Implementation arrangements	Well documented pre- and post-implementation. Identify success factors and constraints Upscaling and dissemination

All the physical interventions are designed specifically to increase the sustainability of water supplies and could have included:

- Ensuring that service options offered to a community are sensitive to the prevailing hydrogeological conditions, and that they can provide a reliable source of supply during drought. The perception and anecdotal reports for north-east Botswana suggest that this has to a large extent been attained by government provision of domestic water. However, there remains the provision of additional water supplies specifically for sustaining livelihoods – stock watering, small scale irrigation, brewing, brick making etc.
- Ensuring that wells and boreholes are situated in the most productive part of an aquifer, i.e. in basement terrain they should be sited in the deeper zones of weathering.
- Constructing an adequate number of water points to supply a village and ensuring proper maintenance of these water points – it is better (and cheaper) to maintain what you have than to develop anew.
- Sinking deep relief boreholes away from villages that might be opened up at times of stress. These could be used to sustain all villages within an enlarged catchment. There are sensitivities with this option: it is both an expensive option and one that needs policing as the temptation to open up the borehole in normal conditions for stock watering purposes may be overwhelming and the resource may be exhausted by the time the surrounding communities need to turn to it for their domestic supply. In the event this option was not applied in the pilot nodal areas.

Intervention may also take place on a social basis and could have included:

- Education – the role and value of groundwater, or the uses to which water can increase livelihood potential.
- Empowerment of the community - to carry out either components of monitoring or of demand management.

These interventions need to focus on recognised community needs which the community can readily identify as an issue and which the community is prepared to buy into, undertake and report. A common example is inadequate and unworkable reporting systems for the need for spare parts to maintain hand pumps. Pumps may be broken not because local mechanics are incapable of repair but simply because they and their communities cannot access the spares.

Having now determined the Nodal Points and likely interventions the next action is to gather additional, but limited, field data in order to sharpen interventions and ensure that the baseline information is adequate. Most importantly, further discussion with the communities is necessary to ensure that there is a definite need for, and to attain their buy in to, the proposed intervention.

2.3 Phase 3 – Drought Mitigation Planning

Phase 3 comprised:

- Drought Intervention/Groundwater Management Plans for Pilot Areas
- Prepare Designs for Drought Intervention Structures
- Develop ToRs for Construction Contractors.

An important part of this phase was the preparation of detailed Groundwater Intervention Management Plans. These include five basic components:

1. Village description including present groundwater resource status, infrastructure, livelihoods – cash economy or agricultural economy, community health and community aspirations.
2. Detailed baseline analysis of the community status in terms of groundwater resources and livelihoods - essential information with which to judge subsequent impact created by intervention of whatever kind.
3. Proposed and justified groundwater (drought-orientated) intervention accompanied by description of the dialogue with the community and other stakeholders – i.e. community buy-in.
4. Description of the agreed intervention and expected impact on the community.
5. Identification of appropriate indicators with which to monitor the impact of the intervention on groundwater resource usage and overall wellbeing, i.e. community or sample household wealth (number of cattle), livelihood diversification, number of visits to clinic, water point usage, abstraction equipment maintenance actions, etc.

However, in order to make the process of preparing the plan completely overt and in concert with each community a set of Process Plan documents, one for each of seven villages was first prepared. This outlined the procedure that was to be adopted in order to arrive at the Plan. An example of a Process plan is given in Annex A and of the Rural Community Water Management Plan in Annex B both for the village of Tsetsebjwe in Botswana.

The process plan also identifies the form of monitoring that is required to parallel the intervention. Monitoring commences once agreement is made with the community so that baseline information is gathered.

The Planning Process and Plan reports were compiled in collaboration with the respective communities for the following finally agreed intervention sites:

Botswana: Tsetsebjwe and Gobojango

Zimbabwe: Diti and Whunga

South Africa: Segole, Shakudza and Maheni

In addition a series of posters and manuals were prepared to help inform community representatives and other stakeholders about each proposed intervention. The manual was designed as an Awareness and Training Manual containing sufficient information to impart to villagers either by technical or sociological members of the project. An example from the Technical Awareness and Training Manual is provided in Annex C. While not designed to be prescriptive, the manual aims to support training activities at village level.

The preparation of TORs for each physical intervention followed dialogue at community level to ensure that the proposed intervention was both needed and appropriate. The interventions that were finally undertaken are listed in Annex 4.

2.4 Phase 4 – Physical Drought Intervention

Phase 4 comprised:

- Supervision of drought intervention activated

Although physical interventions had been prepared for Nodal Points in Mozambique, it was found that the logistics of implementing the physical interventions were beyond the resources of the Project. The key factor was the considerable distances to towns where suitable engineering contractors were based. Although potential sub-contractors were clearly very capable, the cost of mobilisation, due to the distances involved, was prohibitive and the implementation phase was not carried through as originally planned.

Figure 3 Storage tanks supplied by windmill pump at Tsetsetjbwe, Botswana

Figure 4 Part of the intervention at Sagole, South Africa, included spring protection and discharge measurement over a V-notch weir

Figure 5 Construction of a sand dam at Diti, Zimbabwe

This physical phase of the work was carried out under project supervision according to the TOR (Annex 4). See figures 3 to 5 for examples, and Annex D.

The social interventions, notably in South Africa were instituted by the project sociologists. These were aimed at introducing the community to the principles of the management of water supply with specific regard to drought preparedness. In addition various training and awareness sessions were undertaken with the respective communities. These activities were aimed at gaining community support and ownership of project elements that were being provided to the community. These activities ensured the sustainability of the interventions which in turn are designed to assist in securing successful community based groundwater management.

2.5 Phase 5 – Monitoring and evaluation

Phase 5 was intended to encompass:

- Monitoring and evaluation of pilot 'Nodes'
- Strategy for sustainability of drought intervention measures
- Lessons learnt

In terms of overall poverty, it is the marginal and undiversified resource-poor farmers (including female-head households, landless labourers, pastoralists and displaced people) that are at risk and indicators needed to be found which measure change to their overall wellbeing and livelihoods base. However, the manifestation of livelihood insecurity is likely to vary between groups but it must include aspects of both food security and water security. To assess food security information needs to be gathered on production and exchange capability in a given household and the impact this has on access to food. To assess water security, information needs to be gathered about water availability, access and use.

Normal monitoring systems at village level that are emplaced by government concentrate almost entirely on food security indicators and follow narrow agendas. These systems, if they are in place at all, can readily be extended to include water security, e.g. status of water points (as currently compiled monthly by the Department of Water in Malawi) to provide a better indication of livelihood security. Consequently the effort in this Pilot Project concentrates almost entirely on water security, but takes note of the food security indicators available at national level to provide an overall measure of livelihood security. More importantly it is essential that this Pilot Project links the monitoring of specific indicators with interventions introduced by the project, while also acknowledging the importance of livelihoods indicators as an overall measure of the impact of a specific intervention.

Although monitoring at national or even regional level is feasible using available data held at national level, monitoring at community level is, by contrast, fraught by choice of appropriate indicators. However, physical monitoring of water points and water point status and the conversion of the monitored data to useable information is relatively straightforward.

In the context of the project there are two essential aspects to monitoring, namely:

- Monitoring relating to the success or otherwise of the implemented interventions with respect to achieving the objectives of the project, especially the maintenance or enhancement of community livelihoods during drought by improved utilisation of groundwater.
- Monitoring relating to any potential environmental (social and physical) impacts created by the implemented interventions.

The selection of indicators that measure livelihood and wellbeing are not easy to identify and may not be simple to interpret. Care is needed to ensure that indicators are chosen that are simple to measure, meaningful and straightforward to interpret (see detail in Annex A for Tsetsebjwe, Botswana). Examples could include visit statistics to local clinics, community awareness of drought preparedness, and even the head of cattle owned by a community, while the

picture will be completed given knowledge of the status of the water supply system, perhaps even physical detail such as the water level in the local well.

Although baseline monitoring was undertaken, time delays in procuring the physical interventions prevented any useful post-intervention monitoring from being undertaken (see Chapter 3). However, it is anticipated that communities will continue their own monitoring protocols until such time as SADC is again in position to hold a dialogue with them to provide assistance in identifying triggers for emergency action at the onset of drought.

Following the phases a process was identified that can act as a guide to community based groundwater management with a view to drought mitigation. The schematic (Figure 6) outlines the key steps required for an effective pilot testing project. The same scheme could be followed to upscale community based groundwater management in other areas and other Member States.

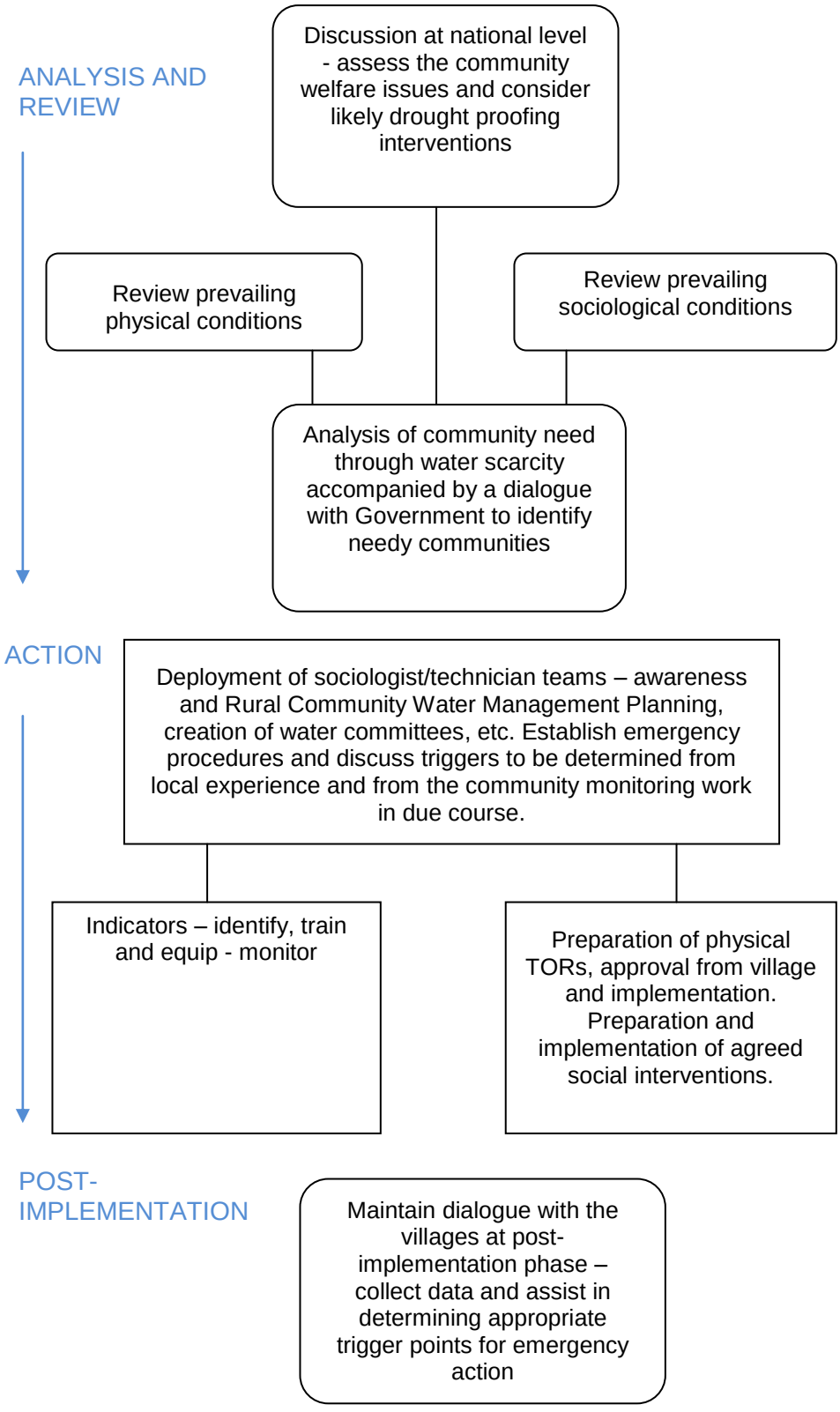

Figure 6 Process for community based groundwater management

3. LESSONS LEARNT

The project team was issued with a questionnaire in July 2011 in order to gather thoughts/ideas/experiences gained during the course of the project in order to inform future work. The lessons learnt questionnaire was divided between five separate themes, and these are retained as the most suitable way of reporting those lessons:

- Overall project approach
- Specific programme issues
- Overall programme
- Project management
- Alternative ideas

3.1 Overall Project Approach

3.1.1. Applicability of the project approach within the existing water supply sector

The main aim of the Pilot Project i.e. that of mitigation of the impact of drought, is entirely valid. The central Limpopo Region, where the Pilot Project intervention sites are located is climatically within arid to semi-arid Savanna regions where climatic drought is almost endemic. Nevertheless, drought is a cyclic phenomenon occurring every ten to twenty years. At the present time the Limpopo area seems to be experiencing a relatively wet period when communities are interested in issues other than drought. The water conservation measures proposed by the project are best demonstrated during periods of water shortage approaching drought extremes. These will become more prevalent as the impacts of climate change increase.

Lesson Learnt:

- The best time to demonstrate water supply drought mitigation measures is during a dry period.

3.1.2. Applicability of the particular physical interventions

The emphasis of the project is to introduce types of physical interventions that are in common use in one set of countries into another set of countries which have similar issues. Such systems need to be capable of being operated and maintained within the community and existing local government structure.

3.1.2.1. Domestic water supply

The emphasis is on piped domestic water supply from a surface water source in South Africa and a well-field in Botswana. The introducing of hand-pumped wells that are common in Zimbabwe and Mozambique into Botswana and South Africa, and sand-dams that are common on Zimbabwe and Mozambique sand rivers into South Africa and Botswana, where sand rivers are equally common, as sources of domestic water supply is difficult. However, when the piped water supply to Tsetsebjwe in Botswana failed the community was quick to appreciate the overflowing storage tanks on the pilot scheme as an alternate source of village water.

3.1.2.2. Livestock Water Supply

In Botswana and Zimbabwe, where wealth is largely judged by the number of cattle owned, livestock are watered from shallow pits in sand-rivers and from shallow wells. Grazing for animals assumes a greater degree of urgency during prolonged drought, and there may be a tendency for communities in Zimbabwe and Botswana to use the new water sources as livestock watering points. The full benefits of crop cultivation in the gardens during periods of drought, as a vital source of human food, will only then become apparent.

3.1.2.3. Small-scale Irrigation of Gardens

In all countries there is a tradition of small scale cultivation of garden crops usually by rain-fed methods. However, there has been a move in the location of such garden plots towards adjacent sources of water, wells and boreholes in Zimbabwe and Botswana, and stand pipes within garden compounds in South Africa. In Zimbabwe, the need for gardens as backup sources of community food during drought periods became apparent during the 1991-92 drought.

Lesson Learnt:

- *It is difficult to change the water supply practices of communities unless these are demonstrated in a positive and practical way that shows a distinct benefit.*

3.1.3. Likely acceptance and utilisation of interventions

The degree of acceptance of the physical interventions constructed by the project is dependent upon the successful demonstration of their utility during periods of low rainfall and drought. Some communities were reticent about the use of the interventions especially during the construction phase when contractors failed to communicate what they were doing for the community. Besides, they did not

employ local labour. The project team also let the community down by not keeping the community fully informed of what was being done on their behalf.

3.1.3.1. Tsetsejbwe, Botswana

Towards the end of the construction phase the Tsetsebjwe Water Development Committee (WDC) was largely ignorant of the nature of the site until the hydrogeology of the site had been explained and a technical site visit made. The community Chief remarked on the overflowing storage tanks and the nature of the soil stating that he wanted to be allocated a plot for gardening. The people were, however, concerned about the depth of the well feeling that it should have been 2 m deeper. It was explained that during periods of drought there would be scope for well deepening as water levels would then be depressed. Following in-depth discussions at site the WDC felt much more accepting of the interventions and could see how the garden and the interventions could be used for the benefit of the community. However, they needed the site to be officially handed over to them by the project before they could plan crop production.

3.1.3.2. Gobojango, Botswana

Towards the end of the construction phase the Gobojango Water Development Committee was largely ignorant of the nature of the site until the hydrogeology of the site had been explained and a site visit made. However, the collector well that had been installed had not been dug deep enough by the time the upper part of the well had been lined with concrete rings. In addition, no rain had fallen within the upstream catchment during the wet season. Following a brief survey of wells downstream of the sand-dam site, an alternative well site was located between the original well and the sand dam. This well was installed to provide some water from the bedrock so that cultivation at the designated garden could begin. The local community were advised that this well needed to be at least 10 m deep to encounter water. The final depth needs to be at least 12 m but to achieve that depth blasting and jack-hammering had to be employed. In addition, inspection of the downstream wells indicated that some of these wells were regularly over-topped by flood-waters that deposited quantities of sand and other debris into them. The community was in acceptance of the scheme once the difficulties involved with water supply were explained.

Lessons learnt:

- *Keep the community informed of intervention construction progress.*
- *Ensure the contractor involves local people in intervention construction.*
- *The WDC should visit site regularly to monitor progress.*
- *Ensure a reliable supply of groundwater is available before hand-over so that cultivation can begin.*

3.1.4. Sustainability of interventions into the future

The long term sustainability of the interventions will depend upon their utilisation by communities during the forthcoming periods be they wet or dry. Systems of garden division and crop rotations need to be established with the leadership of the local Agricultural Department Representative (ADR). Much with depend upon his enthusiasm for the project. The ADR at Gobojango, in Botswana, advised that he would be able to offer services such as soil testing, seed provision, cropping patterns and provision of small scale irrigation equipment and training. This support will be needed to ensure sustainable cultivation during periods of prolonged drought. The ADR at Tsetsebjwe, in Botswana, was not as supportive of the project, but the new enthusiasm of the community for the project ought to show him that his support will be needed. At both communities the schools undertook recording of daily rainfall amounts as part of the national Meteorological Office rainfall gauging system. The communities were informed that well deepening could be undertaken by the Department of Water Affairs.

The termination of the project before significant monitoring could take place disqualified the chance of project and community together identifying suitable triggers to release emergency procedures. Although the selection of triggers is described in the Planning Process documents it would have been valuable to gather the triggers and actions into a single review that could be used as an additional Awareness and Training Manual for future work.

Lessons Learnt:

- *Need to have the support of the local ADR to ensure successful cultivation.*
- *Need to have rainfall and groundwater monitoring systems in place.*
- *Need to inform the Department of Water Affairs of the well deepening needs.*
- *Long term monitoring of community activities need to be undertaken with advice on interpretation of data collected.*

3.2 Specific Programme Issues

3.2.1. Working with Communities

3.2.1.1. Readiness/ willingness to be involved

Communities and local government representatives usually show great willingness to participate initially. Unfortunately this willingness tends to wane if

there are any prolonged delays in the planned programme, e.g. due to extended procurement problems.

3.2.1.2. Organisational capabilities

Since the advent of the World Water Decade in the 1980s most communities have been sensitised to the need to establish health and water supply development committees. The kgotla system in Botswana is particularly useful in this sense. The leaders of the community, including the Chief, school heads and government department local officers can be co-opted onto committees with members from the wider community.

3.2.1.3. Future aspirations for project interventions

The community appears to want to ensure successful use of the interventions before considering further upgrading or replication of the interventions. This will ensure that interventions are successful and hopefully that the community will sustain them.

3.2.1.4. Community/project team interaction

There has been insufficient interaction between the community and the project team particularly with regard to the physical interventions. The main contact point was normally between the sociologist and the community with only occasional visits from hydrogeologists and engineers. However, the sociologist was not always best placed to fully explain the technical aspects of the project. Meanwhile, the consultant engineers and contractors limited their inputs to site works with only very limited contact with the communities. This led to a lack of understanding by the community about the nature and reason for the types of physical interventions installed, thus leading to an element of mistrust on the part of the community. This was, hopefully, rectified during the end of construction workshops. In hindsight each Project visit to the community should have been made by both a sociologist and a technician / hydrogeologist.

A significant issue was timing and preparation of the Rural Community Water Management Planning Process documents and the Rural Community Water Management Plan documents, the former, of course, needed first to inform the Plan after full consultation with the Community. This order of documentation was not possible during the project because the planning process evolved with the preparation of the plans. When the intervention programme is upscaled and rolled out on a wider scale, it is imperative that the Planning Process documents are drawn up first in collaboration with each community. This will ensure that the Plan that derives from these documents satisfies both the need and application of the village. (Note that the existing process planning and RCWM Plan documents can be used as a template.)

3.2.1.5. Sustainability of future monitoring

Unfortunately, the project has to close on completion of the construction phase. Monitoring of the use of the interventions and the interaction between the communities and government support institutions could not, therefore, take place. This also means that triggers cannot readily be identified as only a programme of monitored indicators recorded as a drought event approaches will enable the triggers for emergency action to be determined.

Lessons Learnt:

- *The pace of the intervention process needs to be maintained without extensive and disappointing delays.*
- *Technical information needs to be imparted to the community not just the social interaction between Project and Community.*
- *Support is needed during the post-Project phase of monitoring.*

3.2.2. Water Management Committees

3.2.2.1. Difficulties encountered

Water Development Committees have been successfully constituted in both Tsetsebjwe and Gobojango under the leadership of the Community Chairman and Chief. Both include school heads and officers of government departments.

3.2.2.2. Successes Achieved

The Water Development Committees in Tsetsebjwe and Gobojango were fully functioning by the end of the intervention construction phase. Responsible people for the monitoring of rainfall and groundwater levels and water quality were appointed. Responsibilities regarding water apportionment, garden plot allotment and crop cultivation will be made after the official hand over of the site to the community by the SADC PMU.

3.2.2.3. Composition within community structure

The Water Development Committee forms an effective element within the community structure.

Lesson Learnt:

- *Collaboration with an active community 'Water Development Committee' or its equivalent, is vital to the success of any intervention*

3.2.3. Other Stakeholders

3.2.3.1. In Botswana:

In Botswana other stakeholders include:

- The Bobirwa District Council Development Committee – access to local government funds and other services.
- Department of Agriculture – access to soil testing, training in crop cultivation and investment in small scale irrigation systems
- Department of Water Affairs – access to funds and equipment for future well deepening during drought periods.
- Department of Education – monitoring of rainfall records
- Meteorological Office – analysis of rainfall information and forecasting.

3.2.3.2. Interest/willingness to be involved

The stakeholders all express willingness to participate in the project. However, delays in implementation do not help relationships with the community.

Lesson Learnt:

- *Stakeholder collaboration is essential to successful implementation of any intervention*

3.2.4. Physical Interventions

3.2.4.1. Appropriateness and community acceptance

The physical intervention elements are robust, simple to use and require minimal maintenance. The communities have accepted the physical interventions to a degree but the true acceptance will only be established during the onset of the next drought period when the true value of them will be appreciated.

3.2.4.2. Community involvement in planning and/or construction

Although the community was involved in the location of the test sites it was not sufficiently involved in the design and installation of the interventions. It should have been directly involved by the contractor during the construction phase through the employment of community members, but this did not take place. In addition the WDC members should have been taken to site during construction to review progress. However, disappointment by some villagers in Whunga meant last minute on site changes in specification had to be made, e.g. change in height of a fence.

3.2.4.3. Long term sustainability issues

The suppliers of the pumping equipment and windmills have undertaken to train community members in the operation and maintenance of the windmill and pumping systems. With the untimely end of the project and the PMU the sustainability of the interventions cannot be guaranteed.

3.2.4.4. Monitoring abilities and interest

The monitoring equipment that has been supplied is simple to use and robust or cheap to replace. The community has experience in monitoring rainfall, at the schools. The Agricultural Officer and school heads have limited experience in handing chemical measurement equipment and tape measures. Some instruction was given on site in the use of water quality and water level measuring equipment. To ensure the maintenance of interest the data need to be collected at regular intervals but this is unlikely to happen post-project. The analyses can then be sent back to the community. Such visits to the site would enable checking of equipment and replacement of batteries thus avoiding breakdown.

Monitoring of the community awareness programme should not have been carried out by the project. This task should have been carried out externally from the project in order to provide a more balanced review.

Lessons Learnt:

- *Full acceptance of the value of the interventions will only be forthcoming during the onset of the next drought period.*
- *The community must be involved in choice and design of physical interventions.*

3.3 Overall Programme

3.3.1. Project schedule and timing – significant delays – impacts

The project proceeded at a slower than scheduled until mid-2009 when the procurement of contracting services for the installation of physical interventions was due to start. Due to procedural problems encountered with the letting of the sub-contracts the whole project was delayed by about a year resulting in abandonment of the monitoring phase of the project.

There was an issue with duplication of effort in Zimbabwe. The region was suffering water scarcity along with a greatly increased occurrence of cholera at the time the intervention structures were finally being built. As a consequence a number of NGOs were active in the region with World Vision drilling boreholes for

community schools. On site changes to the ToRs had to be made in order to avoid replication of tasks, although one borehole sited and drilled by World Vision was unproductive. This competition was caused by the significant delay in procurement and implementation so that with a much shorter time interval between consultation / planning and actual implementation friction with NGOs will be avoided.

Lesson Learnt:

- *Collaboration with active local NGOs is vital to avoid duplication of effort.*

3.3.2. Procurement for interventions – institutional bureaucracy/rules. UNOPS/SADC roles.

The IBRD procurement guidelines required to be employed by the project and implemented by UNOPS did not seem to fit the criteria required for the employment of contractors and consultants of small sub-projects involving small sums of money. Small contractors building sand dams and wells should cannot be expected to understand the complex forms they were provided with. Larger contractors that would be able to cope with the paperwork are, however, not interested in such small scale work.

Lesson Learnt:

- *Efficient letting of sub-contracts is needed.*

3.3.3. Physical interventions – contracting approach

Needs to be simple in approach as required for the construction of small scale cost units such as wells and sand-dams. The project PMU would have been better adopting a turn-key approach to this phase of the project, allowing the main consultant to appoint contractors thus avoiding unnecessary delay. The extensive delays in construction were a great disappointment for villagers.

Lesson Learnt:

- *Efficient letting of sub-contracts is needed.*

3.4 Project Management

Adequacy of management structure – support, logistics etc

The management structure worked well despite it being recognised from the outset that there ‘is more than one way to cut the cake’. The common problem of

a project team dispersed geographically between different centres meant that communication was at times difficult within some areas of the project work. Availability of specialist inputs also required careful timetabling, but the tasks were, nevertheless, progressed even though the optimum critical path could not always be pursued.

Client support in procuring small sub-contracts was fraught by UNOPS rules. However, client support in all other areas was substantial and fundamental to steering the project forward.

The logistics of working in four quite different Member States was interesting. Lessons learnt include a considerable understanding in the different approaches to governance at District and village level in each country and the different attitudes of the respective Central Government strategies towards support for village communities. By way of example, Botswana and South Africa supply water to villages whereas Zimbabwe and Mozambique have a more bottom up approach to supply. As a consequence community respect for developing additional water supplies for community gardens or stock watering is quite different in Zimbabwe and Botswana, and attitudes at village level also differ between South Africa, Mozambique and elsewhere in the region.

There was an initial reluctance, particularly from the South African communities, to become involved. In addition, all the communities expected the project to bring some form of employment and were let down. Care is needed in contact with communities to avoid any division of interest between VDC and RCWMC. There is a need to come up with some incentives for communities to see the benefits of monitoring. In any case monitoring needs to start pre-intervention to engage the community in this activity. Although no interventions were pursued in Mozambique it is noted that sub-contractor costs may be high due to distances needed to mobilize.

Lessons Learnt:

- *Management of what is a dispersed team with varied skills must be rigid and thorough.*
- *Care is needed to work within the constraints of each Member State.*

3.5 Alternative Ideas

What we could have done differently, and what better outcomes could we have achieved?

A major strength of the Pilot Project was the partnership and dialogue that was necessary between SADC PMU and the Contractor. The development and steer of the project was essential as the initial contract specification could not adequately describe the eventual needs of the client which evolved as the work

progressed. This evolution ensured that the consultant was himself a stakeholder in the work and ensured that a best possible outcome was achieved.

In hindsight it would appear that dialogue between project and community was not always perfect. This was partly because of the emphasis in fielding socio-economic experts who could not always satisfactorily describe technical aspects of proposed interventions and partly because some technical dialogue can be difficult at village level. That being so, technical visits to communities were made and every opportunity was taken to ensure that adequate information was passed on to community heads and other stakeholder so that discussion could take place to ensure that the proposed physical interventions were seen as both positive and beneficial to all.

The main weakness of the Pilot Project was that the future monitoring of the interventions is not currently assured. It was anticipated that the monitoring work would be handed over to the SADC Groundwater Management Institute at the end of the project. It appears that the Groundwater Management Institute will not be ready to assume such responsibility and the future monitoring and hence the outcome from the project could be lost. This problem is exacerbated by the delay in implementing the interventions caused by the imposed procurement procedures for the physical interventions so that monitoring became impossible during the tenure of the project.

The monitoring of the interventions does need to be put in place. It is important that continuity is maintained and that monitoring is commenced otherwise much of the purpose of the project could be lost and the benefits of which interventions to roll out and where within the SADC region will remain unknown.

Lesson Learnt:

- *Dialogue and consultation at community level must include both social and physical inputs.*
- *Post-Project monitoring may be lost through lack of continuity within SADC.*

4. THE WAY FORWARD

Of the issues raised in Chapter 3, Lessons Learnt, the most significant is the premature termination of the project which precludes any monitoring of the post-intervention phase. This could mean that a number of the intended outcomes of the project may not be achieved, not least help with the determination of triggers from the monitoring indicators that define when emergency action might be necessary. The respective communities need to be encouraged to continue monitoring as they have agreed, in anticipation of the new Groundwater Management Institute being able to pick up the reigns of the dialogue with them in due course. It is important that this information is gathered from the communities in due course so that it can be used to inform the eventual roll-out of the interventions throughout SADC.

4.1 The Project legacy

The obvious success of the physical interventions in Zimbabwe demonstrates that raising the status of water availability to the status quo, in an area where equipment and facilities are in a state of disrepair, is extremely valuable and of direct benefit to the community. The success of other physical interventions, notably the provision of water for community gardens, will only be judged, by the community at the onset of drought when vegetables and fruit should remain in supply. However, that at Sagole in South Africa was deemed successful when the community noticed a decrease in the yield from the spring while DWA were pumping a nearby borehole. The social interventions will be less easy to judge but any empowerment of the community to manage its own water resources must be beneficial to those communities.

The main legacy of the project is the documentation that is left in place. The key documents are:

- Inception Report
- Phase 2 Report – February 2009
- Awareness and Training Manual, including posters etc.
- Rural Community Water Management Planning Process
    - Tsetsetjbwe, Botswana
    - Gobojango, Botswana
    - Dite, Zimbabwe
    - Whunga, Zimbabwe
    - Shakadza, South Africa
    - Sagole, South Africa

    - Maheni, South Africa
- Rural Community Water Management Plan
    - Tsetsetjbwe, Botswana
    - Gobojango, Botswana
    - Dite, Zimbabwe
    - Whunga, Zimbabwe
    - Shakadza, South Africa
    - Sagole, South Africa
    - Maheni, South Africa
- Physical Intervention Completion Report – September 2011
- Final Report – October 2011

Of these the Process Planning and Plan documents provide the template for future work. They will ensure that interventions that are made during the proposed Phase 2 programme will be carried out within the spirit of this project for the ultimate benefit of the communities involved. These documents also instruct how the Plan should be prepared, direct what essential consultation should be made and with whom, indicate when and how a Rural Water Management Committee should be formed and indicate what awareness and training might be required as well as inform which indicators should be monitored. The Awareness and Training Manual is also important but should not be used as a prescriptive document but rather one that should be drawn upon as required.

A great deal of experience has been gained by the Project Team during this evolving exercise of Nodal Point selection through to community identification and finally to type of intervention and implementation (with monitoring still to follow post-Project). This experience is encapsulated in Chapter 3 and these lessons learnt should be drawn on during the Phase 2 Programme to ensure smooth running of future drought proofing intervention projects in SADC Region.

4.2 The Road Map for the Future – the Phase 2 Programme

Armed with the documentation produced in the current project it should be easy in the Phase 2 Programme to pick up the thread. In the meantime ongoing indicator monitoring at community level will produce a considerable volume of new experience and hopefully hard data. This needs to be gathered and assessed. At the same time the current project documentation needs to be reviewed and assimilated so that a new team, without the current team experience, can grasp the planning processes that have been developed and vary those processes to fit any changes that may have occurred, e.g. perhaps in the light of post-Project drought experience which may indicate ways of

improving or even streamlining some of the actions developed in the current project.

The design of a roll-out Phase 2 Project needs to follow the objectives laid down in this project, and that it should achieve, at village level:

- Drought proofing (including developing existing coping measures).
- Structured development rather than relief.
- Early warning: monitoring and forecasting to trigger actions.
- Early response.
- Drought preparedness.

At the regional level the roll out of drought proofing interventions needs to transfer experience gained in one country into another. Each country has its own discrete governance, experience and knowledge as well as its own traditional coping strategies. Exchange of ideas can be brought about within the Phase 2 project. For example, Botswana and South Africa tend to provide piped water to villages, whether it be groundwater or river intake, whereas Zimbabwe and Mozambique have a more bottom up approach with each community supplied by boreholes or wells commonly equipped with hand pumps. Sand dams are a common feature of supplementary water for livestock and for watering gardens in Zimbabwe but are rarely deployed in Botswana. Elsewhere in the SADC Region vegetable and fruit gardens in Malawi and Zambia are sufficiently productive that villagers tend to have a surplus of produce with which to trade. Their experience may well help villagers in Zimbabwe and South Africa. There are many other examples.

The phase 2 roll out also needs to make some decisions regarding procedure. One of the issues with informing the community was the use of outside contractors who brought their own labour with them. Although a convenient way to progress it did not allow any room for community involvement and, therefore, complete community ownership. It might be preferable to use technical leaders and local labour rather than a formal contractor. Indeed it may be that one method suits this country, while the other method suits that country. A third alternative might be to work with NGOs that are active in a particular area. This is an attractive option as it would prevent duplication of effort and would allow deployment of technical staff familiar with the local social and physical conditions.

4.2.1 The Phase 2 Roll Out

The proposed Phase 2 roll out of interventions needs to be carried out at project level and should be based on the procedures and types of interventions trialled in the current project. Upscaling from the present pilot project is not seen as a problem provided sufficient resources are available. The project would be wise to work at sub-catchment scale moving from one area to the next rather than

attempting blanket coverage throughout the SADC Region. The roll out shall comprise the following key stages:

1. Discussion at national level to determine what the community welfare issues are and to consider likely drought proofing interventions.
2. Review of prevailing physical conditions (geology, groundwater and surface water availability, water supply coverage, climate, land use, physical access, etc.).
3. Review of prevailing sociological conditions (governance, stakeholder analysis, existing drought coping strategies, etc).
4. Analysis of need – water scarcity in villages, for livestock for agriculture/horticulture, equipment status, knowledge and understanding (including experience from previous drought episodes).
5. Dialogue with Government (through national level to local level) to determine a list of communities that are poorly drought proofed which would benefit from either physical or social intervention.
6. Deployment of paired sociologist/technician teams working with selected communities on awareness and Rural Community Water Management Plan preparation, creation of water committees, etc.
7. Establish emergency procedures to be implemented at the onset of a drought period. Note that the triggers will be determined from local experience and from the community monitoring work in due course.
8. Identification of indicators that can be monitored by the village (and school children) and help appoint responsible community members. Provide training and provision of equipment plus a protocol for recording and reporting. Commence monitoring at the pre-intervention stage to acquire baseline data.
9. Preparation of TORs for physical interventions, approval from village and implementation with a technician present at the intervention stage to keep villagers informed.
10. Preparation and implementation of agreed social interventions and implementation, ensuring that not only are Community heads, stakeholders and government informed through any existing committee, but so too is the wider community.
11. Maintain periodic dialogue with the village at the post implementation phase – collect data and assist in determining appropriate trigger points for emergency action.

The Phase 2 roll out project may chose to streamline some of the procedures adopted in the Planning Process. This is not recommended as this process evolved during the pilot project as the best framework with which to achieve the project aims while keeping the community and its stakeholders within the

decision making procedure. The existing Planning Process templates (e.g. Tsetsebjwe for physical intervention, Shakadza for social intervention) can be used to produce draft documents rapidly for use with community leaders while drawing up the subsequent Rural Community Water Management Plan.

An important issue that the Phase 2 Project needs to address at an early stage is how to select and prioritise sub-catchment areas where it is to operate and then how to select communities in need of drought proofing. Neither of these issues was completely resolved within the Pilot Project. The former because the operating areas were given by a previous study which did not strictly adhere to the question of rural community need and the selection of villages, which although drawn from a shortlist were chosen partly because of access and partly because cost effective schemes of workable interventions could be drawn up within those villages. It is recommended that village selection is carried out using an overall matrix based decision system but that final community selection should be based as much on the recognition of a needed and cost effective intervention as well as the perceived effectiveness of each community's existing drought proofing strategy and willingness for collaboration. Other factors such as access, of course need also to be considered.

Another important issue that the Phase 2 Project needs to recognise is that in the drought proofing issues will be broadly similar for many of the villages at sub-catchment scale. For example, if one village would benefit from a sand dam and a community garden, many of the neighbouring villages would also. If a social empowerment type intervention would benefit one village the chances are that it would benefit most of the surrounding villages as well. This means that during the upscaling process, rather than dealing with different types of intervention as was the case at pilot scale, similar interventions can be processed and implemented at the same time across any number of villages during the upscaling. This should not mean that short cuts can be made at the Planning Process stage as the key to successful implementation and community involvement is through detailed and comprehensive dialogue with, and approval from, the community itself.

The ultimate outcome of the upscaling during the proposed Phase 2 Project is to inform existing community drought proofing implementers of the benefits of adopting the Rural Community Water Management Planning Process and Plan procedures. (The secondary outcome, of course, is that selected communities receive a higher level of drought proofing.) All too often an NGO will go into an area with a drilling rig providing communities with a new borehole and hand pump. Little thought is given either to sustainability of its intervention or of the real need of the community. The process recommended to the Phase 2 project will demonstrate on the ground to these implementers that there may well be more cost effective and robust interventions: awareness and training, hand dug wells, sand dams, community empowerment, triggers for emergency and emergency procedures etc.

5. CONCLUDING STATEMENT

Experience from the Pilot Project has shown that the processes developed in the Pilot Project are entirely suitable for the subsequent upscaling roll out proposed at Phase 2. The Pilot Project has demonstrated the value of the comprehensive Rural Community Water Management Planning Process complete with awareness and training at community and stakeholder level. Although this process may seem cumbersome to an upscaled regional scale project it is vital to the success of any drought proofing intervention project. It is recommended that the existing documentation for Process Planning and Plans be used as a template for future work; the Botswana and Zimbabwe examples where a physical intervention is undertaken and the South African examples where social intervention is predominant.

Intervention site selection remains difficult as the developed decision support matrix was only partly contributory to final community selection. Emphasis will need to be given to factors such as need, willingness of the community and access.

It has been unfortunate that the Pilot Project has been unable to continue sufficiently into a post-intervention monitoring period for two reasons:

- Assistance to communities in selecting emergency implementation triggers cannot be provided.
- Experience of monitored data into a drought event will not be gathered.

It is essential that a means be found to continue the dialogue with the intervention communities in order to ensure that the monitoring phase is not lost altogether. Loss of this experience would be detrimental to the larger regional scale work envisaged at Phase 2. In any event, the villages must be visited at the start of Phase 2 so that lessons can be learnt from the post intervention monitoring work that the communities are themselves charged with.

It is hoped that the work reported here will ultimately lead to a process that can be adopted by all implementers in the SADC Region, government and NGOs alike. The common practice of drilling and equipping a borehole with a hand pump may seem to be the panacea to many NGOs, but the villagers themselves may have other more beneficial ideas for drought proofing what, is after all, their community. Let it be hoped that future drought proofing interventions will increasingly involve a Planning Process that will be shared between the community and the implementer throughout the SADC Region.

The project has achieved a proof of concept that can be upscaled and rolled out at member state level. This can be done by demonstration to both Government and member NGOs of perhaps five or six different community type interventions

per country whilst still working at a catchment scale. The original Pilot Project objectives comprised:

1. Develop and test specific community groundwater drought management plans and associated interventions within the Limpopo Basin pilot area to obtain empirical information that can be replicated and rolled out in the SADC region.
2: Design and pilot physical and social interventions for mitigation against groundwater drought within the Limpopo Basin (i.e. drought-proof an area by addressing poverty while still considering bio-physical environmental groundwater needs).
3: Derive and develop approaches, methodologies, and lessons learnt to input into the development of generic decision support guidelines and the region's knowledge base regarding groundwater drought mitigation.

Whilst objectives 1 and 2 have been successfully carried out within the Pilot Project, the overall goal stated in Objective 3 has also been achieved. The drought intervention Planning Process procedure will, without doubt, be taken forward and used for the benefit of rural communities throughout the SADC region in the proposed Phase 2 Programme.

ANNEX A Excerpts from Community Water Management Plan - Tsetsebjwe

4. Baseline Information

4.1 Location

- Site location –Tsetsebjwe Village, Bobirwa Sub District, Central District, Botswana.
- Georeference - 22° 24’ 49.4”S 28° 23’ 54.1”E
- Topographic map - 1:50 000 scale sheet 2228B4
- Elevation - 804 m above mean sea level

4.2. Climate

- Environment - sub-tropical to semi-arid with summer rainfall
- Rainfall – The Bobonong area receives annual rainfall of 200-400 mm/year with an average of 380 mm/year, decreasing from NW to SE (Figure 2). Most rainfall occurs during the wet season between October and April (Figure 3). Droughts occur periodically as in 1979-1980, 1981-83 and 1991-94; heavy rainfall occurred in 1980-81 and 1999-2000.
- Rainfall type - Orographic; thunder showers with falls of short duration and high intensity, much rainfall is lost as runoff.
- Summer - moist SE trade winds along the Limpopo valley from the Indian Ocean during wet season (Nov to April).
- Winter - dry (April to Sept). Rainfall erratic.
- Temperatures - Cold nights June – July; hot afternoons with > 30°C in summer.
- Evaporation rate – 2530 mm per annum at the Limpopo-Maclautse junction -greatly exceeds rainfall.

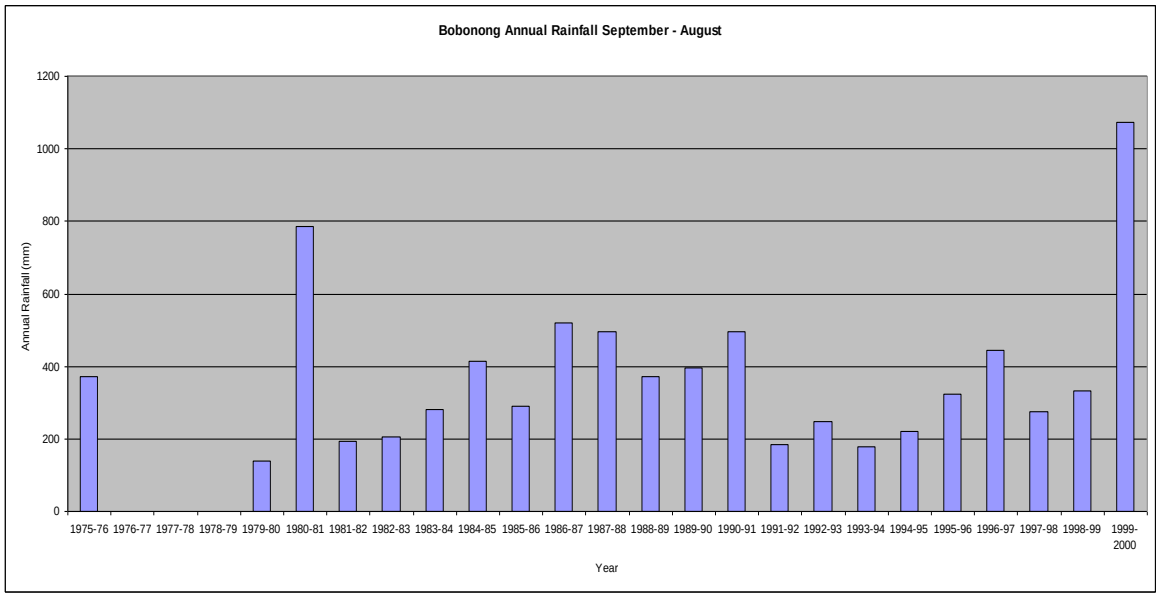

Figure 2 Annual Rainfall Plot – Bobonong, Botswana

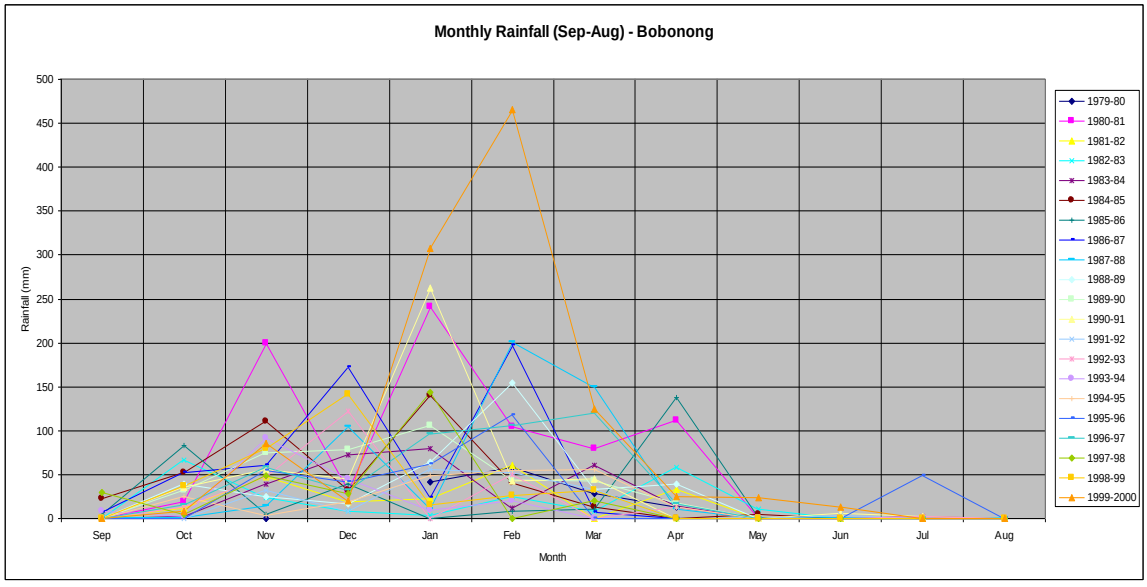

Figure 3 Monthly Rainfall Plot – Bobonong, Botswana

4.2.4 Drainage

- Drainage – An ephemeral stream bed / runoff channel flows SE from the area of the community towards the easterly flowing Limpopo River
- Catchment - part Limpopo River basin.
- Surface flow - short duration after storms
- Sub-surface flow - unknown but all year round.

4.2.5 Geology

- Bedrock - The village of Tsetsebjwe is located on the south side of a prominent Precambrian granitic-gneiss inselberg (elevation 917 m above mean sea level) on the watershed between the Limpopo River catchment to the south and the Thune River catchment to the north. The village is underlain by Mahalapye Formation migmatites of the Limpopo Schist Belt.
- Structure – Bedrock strata have been intruded by ENE-WSW trending dolerite dykes
- Weathering – moderate within the vicinity of the inselberg and east-west fracture zone to unweathered elsewhere
- Report – Aldis, D.T. 1983. The geology of the Tsetsebjwe area. Bulletin of the Geological Survey of Botswana, No 24, 86 pp.

4.2.6 Geomorphology

- Landsurface - undulating to flat with isolated kopjes
- Erosion surface - junction of Pliocene and post African surfaces
- Land-forms - moderately dissected, gneiss hills and granite inselbergs.
- Weathered thickness - shallow.
- Groundwater targets - fracture zones; weathered granitic gneiss in valleys.
- Regolith – near surface calcrete underlain by quartz sand, mica and clays.

4.2.7 Soils

- Soil types – predominantly G1a very shallow to shallow, moderately well to somewhat excessively drained, grayish brown to yellowish red coarse sands to coarse sandy loams on undulating to hilly land; some G2e moderately deep , moderately well to well drained, strong brown to red coarse sandy loams to sandy clayloam, on flat to almost flat land; and some G8a moderately deep to very deep moderately well to well drained, yellowish red to red coarse sandy loams to sandy clay on almost flat to undulating land.
- Soil class – G1a-2e-8a - rocky soils support limited crop farming.

4.2.8 Natural Vegetation and Fauna

- Natural region – mophane and shrub woodland with low and erratic rainfall
- Natural vegetation - dry land mophane savannah with dominant Mophane (Colophospermum mophane) and varieties of acacia.

4.2.9 Agriculture

- Agricultural potential - too poor for drought resistant fodder and grain crops. Recommended use the veldt for cattle or game ranching.

- Natural region - mophane and shrub woodland with low and erratic rainfall.
- Agriculture present - combination crop and livestock; main cereals are maize, sorghum and pearl millet; main livestock are cattle, goats, donkeys and poultry. Legumes - groundnut, bambaranut and cowpea grown.

There will be a need during the RCWMP process to construct a Seasonal Calendar to illustrate which crops are planted, when they are planted and harvested, when people work on their garden or field, when water is required and when is the period of water stress

4.3 Current Water Supply Situation.

4.3.1. General Situation

Groundwater obtained from boreholes in weathered Precambrian Basement Complex rocks supplements groundwater from boreholes in Karoo-age basalt and sandstone at Mathathane, 20 km away, and transferred to the Tsetsebjwe area by pipeline. By 2021 the expected water demand should reach 276 m3/day.

Domestic Supply: Attempts by the Ministry of Local Government / Water Department to drill boreholes for water at Tsetsebjwe have produced mixed results. Most boreholes drilled were either dry or low yielding hence a decision to pipe water to Tsetsebjwe from Mathathane.

Other sources: Water for livestock is obtained from hand dug wells dug along a NW-SE trending linear fracture trending through the village, recharged during the rainy season. The depth to the water table in the hand dug wells is 3 – 5 m below ground level. Most of hand dug wells close to the village are no longer in use due to contamination from pit latrines. This water is used for road maintenance and brick production.

4.3.2 Groundwater

Groundwater potential is low due to local geology, geomorphology, and climate conditions. Groundwater occurs within weathered regolith, and fractured bedrock. Baseflow through the regolith can contribute to surface flow. When the water table falls to the base of the regolith groundwater flow occurs from the low storage fractured zone. Baseflow and groundwater recharge is limited to 2-5% of effective rainfall. Specific capacities reflect this distribution with 0.067 l/sec/m in gneiss regolith, 0.072 l/sec/m in weathered gneiss and 0.156 l/sec/m in fissured gneiss. Groundwater yields are low, between 0.1 to 2 l/sec as obtained from aquifers of low primary and fractured permeability. Water levels are shallow at < 10 m. and boreholes are < 20m deep.

4.3.3 Water Quality

Water from the Basement Complex aquifer has been found to contain high levels of bacteria.

During the RCWMP community participation the above information will be updated/verified with respect to what resources exist, how are these resources managed (committee members etc) what problems exist, water quality, and how resources are used.

4.4 Current Status of Community Structure and Sociological Issues

4.4.1 Community Structure

- Population groups - The major languages spoken are Sebirwa and Setswapong with limited Sepedi (Northern Sotho). Setswana is spoken widely being the official language used at the Kgotla.
- Population - (2001); total: 4396 (male: 2,031; female: 2,365); plus surrounding villages: total: 3,467 (male: 1,502; female: 1,965).
- Chief: Kgosi Motsamai and Mr Ketlhalefile Gabanamotse; headmen overseeing seven wards.
- Partners in the management plan include:
  - at District level the District Development Committee as well as Council; the Senior Tribal Authority in Bobonong;
  - at Bobirwa sub-District level the District Officer Development, Physical Planning, Water Unit, Social and Community Development as well as the District Agricultural Office will need to be further engaged in subsequent;
  - at community level the partners in the plan will involve the Village Development Committee and the Village Extension Team. In view of the fact that no community-based Water Management structures exist, these two entities will be the initial partners in the plan.
- The potential for structures such as the Village Disaster Management Committee to become the main partner in the management plan was futher explored. The option of supporting the creation of a completely new water management entity was also explored.

4.4.2. Community Based Organizations (CBOs).

- Kgotla - the important and respected traditional Setswana village assembly in Botswana where community issues, concerns, plans are discussed
- Village Development Committee (VDC): Planning and implementation of Community development programmes in collaboration with District Council; The VDC is made up of a Chairperson, Vice-Chairperson, Treasurer, Vice Treasurer, Secretary and five ordinary members. The Village Chief is an ex-officio member of the VDC. The VDC provides leadership and oversight to community development projects. Thee are no NGOs in the village.

- Community Water Management Committee (TCWMC): established in 2010 the TCWMC includes: Chairperson, Vice chairperson, Secretary, Vice Secretary, Treasurer and five ordinary members. Ex-officio members provide expertise in water management, agricultural development and community social and community development. The four ex-officio members are members of the Village Extension Team.
- Village Extension Team (VET) – village level government extension workers work in closely with the community, village based organisations and the chief to prepare and implement Village Development Plans. The VET also monitors and evaluates Village Development Plans providing communication between community and the Bobirwa Sub- District Council. VET members include: the Agricultural Demonstrator, Veterinary Officer, Social Welfare Officer and Pump Operator all co-opted into the Tsetsebjwe Community Water Management Committee.
- Tribal Administration, Customary Court: Mediation and trial of civil cases, public consultations, coordination of traditional activities and culture preservation.
- Crime Prevention Committee: Community based awareness building and strategies for crime prevention at community level.
- Parent Teachers Association: Links and communication between teachers and parents.
- Farmers' Association: Agricultural development.
- Village Health Committee: Health care plans, public health education.
- Community Home Based Care: HIV and AIDS prevention, treatment, care and support provided by the National Strategic Framework for HIV and AIDS (2003-2009).
- Limpopo-Lepadi Game and Wilderness Safaris: community support within the Community based natural resources Management Programme. Lodges in the area employ a few youth from Tsetsebjwe.

4.4.3. Community Livelihoods.

The main livelihoods are in cattle ranching, on surrounding cattle posts, and the cultivation of rainfed crops, on lands areas. Increasingly employment is found in Bobonong and Selibe Phikwe. Baseline data gathered during earlier visits indicate the following specific activities:

- arable farming, livestock farming, piece jobs and permanent paid activities are key sources of livelihood (Florian ERM Masters thesis 2009) Informal sector businesses such as vending, tailoring, brick moulding, sale of veld products such as mophane and brewing are also important.
- Remittances are not significant in the livelihoods of residents
- agricultural activities include subsistence arable and livestock farming. Arable agriculture is rainfed with limited irrigation in the nearby Tuli Block commercial farms.
- Main crops grown are sorghum, maize, millet, groundnuts, sweet reeds, beans and water melons.

- Crop yields are low as a result of low rainfall, poor husbandry, farming methods and low level of technology use.
- Stocking levels in the Tsetsebjwe Extension Area are significant and growing as depicted in the cattle crush data for 2008/2009 (Table 1).

Table 1 2008/2009 Tsetsebjwe Extension Area Livestock Census Data

Livestock Type	2008 Census	2009 Census
Cattle	9,960	13,388
Donkeys	1,340	1,477
Sheep	846	642
Goats	3,324	3656
Horses	33	41

Source: Tsetsebjwe Veterinary Office 2009

- Livestock ownership is highly skewed; most residents own less than ten cattle.
- Women and female headed households own small herds of goats and sheep, reared for household consumption, milk and income generation. Community perceptions are that small stock are more beneficial as they are more resilient to drought than cattle. Donkeys are the main source of draught power.
- Livestock problems include diseases such as Foot and Mouth Disease, lack of water, straying, stock theft and lack of grazing land.
- Poverty is severe in the Bobirwa sub-district where half of the residents cannot provide three meals a day for household members.
- Drought Relief is important to the livelihoods of unemployed rural community members. Through the labour intensive Ipelegeng project VDCs channel government support funds to communities. This helps reduce the number of people living in absolute poverty by providing income for rural people on a temporary and rotational basis.
- A backyard gardening project provides poor, rural households with seeds to improve household food security and nutrition.
- The Integrated Support for Arable Agriculture Development (ISPAAD) – supports farmers through the provision of draught power. The programme also provides free seeds and fertiliser. Cluster fencing is also implemented for illegible farmers.
- Livestock Management and Infrastructure Development (LIMID) assists poor farmers with livestock inputs by promoting food security through improved productivity of livestock. This includes animal husbandry and fodder support; water development, co-operative poultry abattoirs for small scale poultry producers, small stock, guinea fowls and Setswana chickens. The TCWMC is working with agricultural extension officers to assess the scope for co-operation and benefits to the community of the LIMID programme.

4.4.5 Principal Community Sociological Issues.

Earlier visits and community discussions show the following sociological issues in Tsetsebjwe:

- The severe health and employment situation are the main problems in the village
- Drought is a major development and livelihood constraint
- Water quality is a major concern as groundwater is brackish with a bad taste and brings dryness to the body when bathed in.
- Livestock water is a major constraint being got from unreliable hand dug wells.
- During drought; livestock perishes or productivity is significantly reduced during drought, livestock die and there is crop failure which causes food shortages, harvests do not meet household needs.
- Land resources in the Tsetsebjwe area are scarce as a significant proportion of the land in the entire sub-district is privately owned (ranches, private reserves and game farms).
- Land use conflicts (wildlife-arable and livestock farming) are another challenge experienced in the community. Resource use conflicts serve to undermine arable and livestock productivity with adverse impacts on positive community livelihood outcomes.

In addition, drought related issues are noted as follows:

- During drought - livestock perish, productivity is markedly reduced, crop failure causes food shortages, harvests fail to meet household needs.

4.5. Current Community Status with Respect to Other Stakeholders

4.5.1 Rural Water Supply Stakeholders.

- Department of Water Affairs (DWA) sets overall nationwide regulations and guidelines. DWA representatives at District Council level collaborate closely with representatives from the Ministry of Agriculture (MoA) and Ministry of local Government (MoLG) at offices in Bobonong. Representatives of the MoLG at District Council level responsible for rural water supply ensure that interventions lie within the legal water framework and enhance livelihoods through better water provision. The DWA representative at the Bobirwa sub-District Council ensures communal access to water and equipment maintenance.
- The MoA advises communities on crop production, animal health and reproduction, drought relief programmes, small scale irrigation schemes and dams and livestock water provision. The MoA are represented at district level by agricultural and veterinary extension officers.
- The National Water Master Plan recommended separation of water resources planning and management from water service delivery.

- The Water Utilities Corporation (WUC) is responsible for water service delivery. The DWA is responsible for water resources planning and management.
- District Councils formerly responsible for the operation and maintenance of village water supply will hand this responsibility to WUC. Pump Operators at village level ensure water supply and repair and maintenance of equipment.
- Community institutions focus on the Kgotla, a village forum which adjudicates on water related disputes.

Other stakeholders include livestock owners, arable farmers, safari companies and mining companies with groundwater rights.

Information given above will be updated and configured into a Venn diagram to analyse cooperation/communication with other stakeholders following community participation in the RCWMP development. This will inform what the communication mechanism looks like, what is communicated, where cooperation exists, where the deficit is and where there is a need to improve.

4.6 Existing Drought Coping Strategies

Sociological baseline survey analysis indicates that the main impacts of major droughts on communities are:

- lack of food,
- to non-existent crop yields,
- lack of fodder,
- disease and death of livestock,
- lack of water.

These are more intense versions of the general sociological community issues felt during normal periods.

4.6.1 Community Perception of Drought.

- Community perception - relates to Hydrological Drought seen as the following outcomes:
  - reduced rainfall,
  - pursuance of livelihoods becomes constrained,
  - lack of food for people and livestock,
  - livestock becomes thin, grossly undermined productivity,
  - low crop yields to total crop failure,
  - reduced water for livestock,
  - reduced income from agriculture and livestock leads to aggravated poverty
- Rainfall drought is made worse by land degradation, deforestation and global warming resulting in the erosion of cultural practices developed during

years of good rainfall. Cultural mitigation activities include prayers, offerings such as libation to the ancestors and rain making ceremonies. Traditionally, widows and women who had miscarriages were cleansed to prevent drought.

- Community definition - Traditional beliefs associated with drought are mainly based on the increasing lack of adherence to traditional practices with the advent of modernisation. Loss of traditional values such as praying to the ancestors for rain and lack of adherence to cultural taboos, especially those associated with widowhood, miscarriages and death are believed also to contribute to drought occurrence.

4.6.2 Current Coping Mechanisms

- Perception - last drought was 2004; it occurs every four to five years.
- Adaptations to environment - minimalistic lifestyle for existence in a marginal environment that can cope with 'short-term drought'.
- Strategies for Long Term Drought - normal coping mechanisms collapse; impacts of water and food shortages lead to livestock mortalities. Strategies include:
    - Two main components: control of pests of national importance at government expense and the provision of support to farmers to recover from droughts in the form of ploughing and planting as well as the provision of free seeds. Labour intensive projects are identified and community members are employed on a rotational basis to augment loss of income from agriculture.
    - Sale of livestock – cattle herd size is viewed much more as a store of wealth and as a symbol of status.
    - Relocation of livestock - move cattle to areas that have been least affected by the drought (difficult due to the restrictions in cattle movements during outbreaks of the Foot and Mouth Disease (FMD)).
    - Some income to sustain households is derived from beer brewing even during drought.
    - Migration to major towns and villages in search of employment is an option for the younger, more able-bodied members of the community.
    - Piece working, as labourers and maids for civil servants and lodge owners in the area, becomes more important during drought periods
    - Government projects include:
        - supplementary feeding and subsidized food for work programmes.
        - Drought Relief Emergency Plant Protection (EPP) programme to reduce pre- and post-harvest losses of field and horticultural crops. There are two components: control of pests and drought recovery support to farmers with ploughing, planting and seed provision.
- Labour intensive projects identified for community members - employment on rotation to augment loss of income.

Actions that can improve drought preparedness and management
Growing fodder for supplementary livestock feeding.
Producing, preserving and storing food for household consumption (beans, groundnuts, jugo beans, dried green leafy vegetables)
Sale of livestock to reduce the herd to manageable numbers when drought sets in
Supplementary feeding of livestock
Collection and storage of veld food as a drought coping strategy
To plough during the first rains (September/October)
Drying and storing meat for consumption when the drought sets in
Fencing of arable fields to prevent arable farming-livestock conflicts and crop raids by wildlife as well as enable regeneration of grazing resources in fields after the harvest
Establish borehole syndicates to pool water resources
Building of dams to enable livestock watering throughout the year and promote irrigated agriculture
Awareness building and support to commercial farming practices
Conservation of groundwater
Re-introduce bartering of products
To promote good eating habits in households i.e. avoid over-eating so that during droughts, thin years people are not in the habit of over-indulgence but cope with the reduced availability of food.
Development of backyard gardens

4.6.3 Future Drought Mitigation Measures

The supplementary water sources developed during the current programme together with the community monitoring process will enable the Tsetsebjwe community to more effectively anticipate the onset of drought induced water shortages. The necessary tools have been provided to enable better water resource management to minimise the impact of a prolonged period of reduced water supply. As detailed in this RCWMP, this community management may involve a selective reduction of water usage, the prioritisation of water users, a change in water application for agricultural purposes and for some other methods.

During RCWMP development with the community more community information relating to drought perception and coping strategies will be gathered to refine the plan.

5. Proposed Interventions

5.1 Community Aspirations

The community in Tsetsebjwe suffers from lack of water for its livestock and agriculture almost every dry season and is especially vulnerable during extended drought periods.

Since discussion began with the community in 2008, the Tsetsebjwe village leadership has been the focal point of follow-on discussions. The village leadership constituted by the Chief, Headmen of seven wards and members of the Village Development Committee has shown a keen interest in the development of a comprehensive plan and implementation of the groundwater drought management interventions. The general feeling is that the project compliments government efforts at livelihood improvement, reducing vulnerability to drought and increasing social protection.

The community needs are:

- To provide alternative water sources for household consumption during the breakdowns and shortages that are regularly experienced in the village.
- To provide water for new initiatives/projects that could increase the range of the sources of livelihood (food and income) for the most vulnerable sections of the community (particularly People Living with HIV/AIDS, youth, female-headed households).
- To provide alternative source of livestock water during periods of drought particularly for resource poor farmers.
- To enhance community awareness on groundwater resources.
- To enhance the capacity of the Tsetsebjwe community to manage its groundwater resources in a sustainable way.

5.2 Community ‘Buy In’ to Intervention and Community Training

5.2.1 Community Ownership.

Community ownership appears to is illustrated by the following factors:

- Considerable enthusiasm has been shown by the community and community leaders for the possible interventions described during a number of information gathering visits. There is a willingness to be involved in monitoring of the intervention scheme.
- A Community Water Committee would form the nucleus of the community management of the intervention scheme and would be the ‘owner’ and implementer of the Community Water Management Plan
- All essential key informants and representatives of the different official institutions have been involved in the planning process and have been informed about the project and developments.
- The TCWMC has agreed to manage and monitor the interventions. The TCWMC had a fundraising strategy to meet the costs of maintenance,

security at the project site, day-to-day management and the envisaged start up food production and income generating activities.

The RCWMP will contain an agreement with the community/committee members regarding their continued involvement in order to ensure community 'buy in' and sustainability of the interventions.

5.2.2 Community Empowerment

Any intervention implemented in the community will require that certain individuals, or groups of individuals, are given training in both operation and maintenance of the scheme and in the subsequent monitoring to ensure sustainability (See Section 6.2).

The community will receive groundwater and drought awareness training to understand the resource available to them and help their management of the resource.

Although the members of the TCWMC have all been exposed to basic management of a community based organisation, capacity strengthening is required in the following key areas: Project Management; Leadership Development; Conflict Management, Fundraising Skills, Community Mobilisation and Partnership Building. The different extension officers in the community have responsibility for capacity building of village institutions and will consider these needs in their annual community training plans.

An assessment of training needs will be determined. The training requirements will then be incorporated into the final awareness/training programme to be undertaken once the interventions are in place.

5.3 Details of Proposed Interventions

The planned physical interventions are summarised in Table 2. Their locations are shown on Figure 2.

Table 2 Summary of Physical Interventions.

Intervention Site No.	Physical Intervention	Other engineering input
T01	Sink new large diameter well	O&M well,
T02	Equip well with windmill	O&M wind mill,
T03	Provide reticulation to storage tank	O&M reticulation system
T04	Provide storage tank adjacent to well	O&M tank
T05	Provide reticulation from tank to livestock water points and gardens	O&M reticulation system
T06	Fence Water Source and Gardens	

ANNEX B Excerpts from Community Water Management Planning Process - Tsetsebjwe

5. Community Water Management Plan

5.1 Plan Administration

The RCWMP is managed and was implemented within a new community management structure. This structure was developed through a number of sociological interventions undertaken with the Tsetsebjwe community. These interventions progressed from baseline data collection through needs assessment and awareness training to the formation of a community management structure. The structure is specifically designed for the management of the community water supply and the implementation of this Water Management Plan [this process is fully described in the Planning Process Manual].

This water management structure, namely the Tsetsebjwe Community Water Management Committee (TCWMC) was established in 2010. It consists of members of the community and key government officers with interests in village water supply, veterinary services, crop development, education and community development. Office bearers include Chairperson; Vice Chairperson; Treasurer; Secretary; vice-Secretary and ordinary members.

The key role of the TCWMC is leadership and oversight of the community water supply management and drought mitigation initiative. The TCWMC will:

- Ensure the efficient and effective management of the water infrastructure.
- Ensure regular communication with the community regarding the use of project facilities.
- Be responsible for developing a listing of water users.
- Collect the user fees as appropriate.
- Ensure the proper operation and maintenance of the interventions.

Quarterly TCWMC meetings shall be held to assess progress, resolve problems that emerge and make decisions as required. Community meetings will also be held to share information on progress, challenges that may be arising and the overall direction of the initiative.

5.2 Plan Implementation and Monitoring

The RCWMP for Tsetsebjwe was implemented by the community and is managed by the Community Water Management Committee.

In the context of the RCWMP there are two essential aspects to monitoring, namely:

- Monitoring the success or otherwise of the implemented interventions to the maintenance or enhancement of community livelihoods during drought through better use of groundwater

- Monitoring of any environmental (social and physical) impacts resulting from the interventions that have been implemented.

Existing socio-economic conditions are documented [Planning Process Manual] to provide a baseline measure that enables assessment of the impacts of the interventions using future monitoring information.

5.2.1 Physical Monitoring

Physical monitoring measures the indicators of groundwater availability and quality. These in turn provide indications on impending water shortages or issues of the suitability of water for use. The availability of local, shallow groundwater during the dry season, and especially during periods of drought, may well be critical in maintenance of community livelihoods and wellbeing (health, food supply etc).

The physical indicators monitor the physical impacts of the intervention on the availability and use of groundwater resources are summarised in Table 5.1 below:

Table 5.1 Physical Monitoring Indicators

Physical Monitoring Indicators			
Component	**Parameter**	**Method**	**Where; by Whom**
Groundwater	Groundwater level	Electrical Water level Dipper	Well; Community
	Groundwater Abstraction	Water Meter	Well; Community
Climate	Rainfall	Simple Rain Gauge	School; Pupils
Water Quality	Total Dissolved Solids	Hand held TDS meter	Well; Community

5.2.2 Social Monitoring

Sociological monitoring will be used to assess the impact of the additional water supply provision and the RCWSMP implementation on community development, wellbeing and livelihoods. It will also indicate the viability of rural community water management and empowerment.

Sociological monitoring builds on existing processes such as on-going data collection and other data sources as well as the work of the community. It requires the application of the following fundamental principles:

- Use both qualitative and quantitative methods.
- Apply community-based, simple, understandable participatory measurement tools.
- Invest in community capacity development and training in monitoring approaches.
- Incorporate action that informs TCWMC decision making.
- Share the monitoring results with the community.

The social monitoring indicators are divided between population welfare, food production and agriculture that are monitored by the TCWMC (see Tables 5.2, 5.3)

Table 5.2 Monitoring of Population Welfare Indicators

Population Welfare Indicators	Monitored through	Means of Verification
Health: Number of diarrhoea occurrences	Periods of illness and numbers of people affected	Tsetsebjwe Clinic Records
Health: Occurrence of malnutrition and stunting	Nutritional status of children under five years of age	District Health Team Statistics
Destitutes: number of people registered as destitutes	Destitute records	VDC Destitute Lists; S&CD Destitute records and Reports from the Destitute graduation programme
Water: Need for emergency water supply	Frequency and period of water tankering to village	CWMC records
Food: Number of emergency feeding programmes	Frequency and period of supplementary feeding/distribution programmes	Tsetsebjwe Clinic Records School Supplementary feeding programmes

Table 5.3 Monitoring of Food Production and Agriculture Indicators

Food Production and Agriculture Indicators	Monitored Through	Means of Verification
The number of gardens	Number of new gardens established	Observation; community records
Period of working on garden	Number of months working on garden	
Number of months harvesting crops from garden	Number of months living from garden	
Number of locally produced vegetables	Local vegetable production rates	
Nutritional levels	Number of underweight children Number of underweight adults	Tsetsebjwe Clinic Records Community Home Based Care Records
Water available for domestic use	Daily litres abstracted for domestic consumption	Community monitoring records/reports Observations
	Weekly observations (documented in diary)	
	Document special happening	
	Discussion in regular village meeting	
	Village observation	
Water available for livestock during drought spells	Daily litres abstracted for livestock consumption	Community monitoring records/reports Observations
	Weekly observations (documented in diary)	
	Document special happening	
	Discussion in regular village meeting	
	Count cattle/livestock	
Water quality	Test water quality, TDS	Community monitoring records/reports Observations
	Observation smell, taste, colour	

Tables 5.2 and 5.3, monitoring indicators for population welfare and for food production and agriculture are closely linked. The welfare indicators in Table 5.2, health, destitutes, water and food, are closely dependent on the food and agriculture indicators listed in Table 5.3 which assess the availability of food production and the wellbeing of livestock. The food and agriculture indicators are very important because in many ways these are easier to measure than the population welfare indicators and are a good secondary or indirect measure of the welfare of the community. The specific welfare indicators in Table 5.2 will reflect the same status of wellbeing but these are a direct measurement from the community.

This linkage between the indicators is the reason why all the different measurements need to be made. The depth to water level in the well, the quality of the water, the amount of water being taken from the well to the tanks all contribute to the overall evaluation of the community wellbeing and allow it to assess whether it is at risk from a shortage of water and food and how this is reflected in health and poverty. These measurements, coupled with of all the other social and physical observations, contribute to the overall assessment of community wellbeing.

5.2.3 Awareness

The awareness programme for the Plan builds upon activities undertaken during the course of the plan development. This continues to impact upon raising community awareness of the importance of groundwater resources, the impact of certain practices on its pollution as well as the benefits of drought preparedness. Discussion of all these concepts with community members provided a useful basis for developing the indicators for the results to be obtained from the awareness programme. In future the outcome of the awareness programmes (AP) and training should be externally monitored. The following indicators can be used for this (Table 5.4)

Table 5.4 Awareness Programme (AP) Monitoring

Awareness Programme	Social Indicator
General Awareness Programme (Stage I)	- Has the general knowledge of the community concerning groundwater, pollution and drought preparedness improved? - Is the community motivated to adopt positive water management practices? -Have community practices, such as littering and indiscriminate disposal of chemicals, improved? - Has the number of new, environmentally friendly pit latrines being built in the community increased?
Intervention Operation awareness and training	- Has the socio-economic situation of beneficiary/vulnerable households improved?
Intervention Operation awareness and training	- Are the community and Water Committee familiar with the physical intervention and do they know how to maintain and repair it?

5.2.4 Training

A groundwater awareness programme was presented to the broader community as well as specifically to the WMC. It followed the guidelines and used the material set out in the Groundwater Awareness Manual developed during the project. Several

awareness sessions were held during the implementation process and an awareness/training programme was completed.

As part of the intervention implementation process the WMC was provided with equipment with which to conduct the physical monitoring of water supplies [i.e. an electric water level dipper, a hand held water quality (TDS) meter and several direct reading rain gauges] and an awareness/training programme was completed. Specific training for the WMC and their appointed Monitoring Operative (MO) in use of monitoring equipment and documentation of monitoring data was implemented on completion of the physical interventions.

Going forward, the community has been encouraged to seek supplementary training from national and regional stakeholders in other aspects related to the sustainability and improvement of the SADC project intervention. Training has specifically been provided in equipment maintenance (windmill, pumps etc) and general CBO management (record keeping, finance etc). The community has resolved to do this and to improve stakeholder ties as much as possible.

5.2.5 Feedback Mechanisms

Data Collection and Reporting

- Data will be collected by the WMC MO. Basic equipment has been provided to the MO to enable data collection, entry, assessment and reporting. The MO will be responsible for data collection, recording, basic assessment, reporting to the TCWMC at its quarterly meetings, and archiving. The MO will also be tasked with the basic operation and maintenance procedures related to the intervention. The MO will also work closely with and collect data from on-going community level monitoring activities, including:

- the school rainfall monitoring programme,
- local clinic health status records,
- Social Welfare Programme quality of life assessments,
- agricultural staff records on arable and livestock production,
- reports from the government's Early Warning System which predicts, monitors and develops responses to drought and assesses the impact of interventions.

Data assessment will also involve a thorough assessment of project performance against the physical and social indicators. The data collected from the MO as well as from other community level sources will be assessed and compiled into a quarterly monitoring report. The TCWMC will use this monitoring report to assess overall project performance and to inform its decision-making.

The TCWMC will ensure effective monitoring through observation of the following:

- Reduced yield and hence abstraction from the groundwater source over a few days.
- Damage, disrepair and malfunction on the physical interventions.
- Change in water colour and/or smell.
- Livestock and humans fall ill after drinking the water (increase in health problems such as diarrhoea).

- Die off or changes in appearance of vegetables/crops irrigated with the water.
- Local vegetation die off in the vicinity of the water sources.

The TCWMC will also ensure the MO maintains a diary of:

- The introduction of any emergency water supply – frequency and period of water tankering to the village.
- Emergency support programmes – frequency and supply of non-standard supplementary feeding programmes to vulnerable social groups; provision of livestock supplementary feeds; provision of seeds, fertilisers; special measures for the protection of basic assets that households may need for survival (breeding stock, animal draught power).

Stakeholder Feedback

An essential component of this CMWP, i.e. enhancement of community ownership and control of both the physical interventions and the water resource. Feed-in and feedback processes, mainly through the Kgotla and other established community development forums, are planned through the TCWMC.

The TCWMC will meet on a quarterly basis to review project progress, achievements, challenges and community concerns as well as the strategies for addressing these. The TCWMC will be the decision-making body on project issues and will ensure effective community consultation on issues of concern related to the project. The TCWMC will ensure feedback on all these issues. The annual schedule of kgotla meetings will be used to share project progress, challenges as well as disseminate information on issues of relevance, interest and concern to the community.

The momentum for active and effective stakeholder participation will be reinforced through further development and dissemination of the community's blue-print of action outlining annual priorities, developed under the SADC project. Reporting will follow the roles and lines of communication outlined in this plan and will occur during regularly scheduled quarterly meetings of the TCWMC. The eligibility criteria and application procedures for community garden use as well as user rights and obligations will also be shared at this community meeting and referred to the kgotla forum if required.

The kgotla forum will also be used to keep the Tsetsebjwe community informed of issues in water and drought management raised by other stakeholders such as the District Disaster Management Committee, Early Warning Systems, WUC and DWA. PTA meetings and church conferences will also be used as vehicles for disseminating key water management and drought mitigation messages.

5.2.6 O and M Plan

With respect to the operation and maintenance of the additional water supply interventions installed during the project, the WMC was offered basic maintenance training by the suppliers of the equipment installed, particularly the windmill pumping system. This involved a presentation on the principles and components of the system together with a practical demonstration of preventative maintenance.

The WMC has appointed a MO responsible for regular basic operational management and maintenance of the system. The MO will report regularly to the WMC on system performance and will report any maintenance requirements. Dependent on the magnitude of these requirements the WMC will arrange themselves for any repair, possibly with communication with the equipment suppliers (see Annex D for details) or possibly by communication with other district stakeholders e.g. District Council, MoA, DWA, who may be able to assist.

5.3 Plan Actions/Strategy

The plan actions/strategy can be broken down into to two key components: triggers and responses. The triggers will be the points at which community actions are required to address the problem of drought and water scarcity. An example might be that the water level in the well has reached a depth that leaves the pump at risk of being exposed to the air, it might equally be a point at which the number of vegetables produced the garden are not enough for everybody to share, or it might be a point when, for example, over half the community is complaining of stomach disorders.

The responses are the actions that may be executed by the community to mitigate the possibility of increased hardship in times of water scarcity or in response to over us of the resources. The response needs to assist the community to cope with the drought/water scarce period in order to minimise hardship and livelihood loss. The combination of both the actions/strategies and the triggers and responses will result in the better management of the community water resources

5.3.1 Triggers

The TCWMC will through the monitoring system keep abreast of the available water resources. The series of triggers identified and modified by ongoing community experience will be used to make decisions regarding the use of water resources. Appropriate triggers can only be learned from experience with the monitored data and critical well levels combined with health, food and agricultural indicators will need to be created in due course. This should not be a difficult exercise as the community will recognise the critical conditions in each of these four sectors from past experience. It will be the successful integration of the monitored information that will create a meaningful single trigger that may be less easy to arrive at.

The committee will need to review the data they have gathered in order to recognise potential problems potential problems that may be arising. This review is the community's 'early warning system'. Data include groundwater depletion, reduction in water quality or system malfunction. Indicator thresholds will need to be established to initiate a pre-defined community response to address water shortage through system failure.

The most important triggers will be the changes observed and associated with water stress or signals of impending water shortage. The triggers will reflect periods of increasing and decreasing water stress, dependent on the status of the water resources and especially in the early part of the (presumed) rainy season.

5.3.1 Reaction

During periods of increasing water stress, the TCWMC plans to apply restrictions on water use. The Tsetsebjwe community will limit vegetable and stock watering and place priority on water for domestic use. The TCWMC will ration and allocate water to the community on the basis of their household size.

On completion of the physical intervention in Tsetsebjwe, groundwater baseline monitoring will be undertaken regularly by the community. Specific values of water level, abstraction or water quality will need to be identified at which point the WMC will need to act. Once this has been established and moderated by community experience, a structured community action plan will be developed and disseminated to the community. A key principle of the action plan will be that it is for the ultimate benefit of the community and that it will seek to help preserve communal livelihoods during periods of water stress (drought).

The TCWMC anticipates the following actions to ensure the sustainability of water resources:

- Restrictions on water use for gardens.
- Allocation and rationing of water based on household size.
- Relocation of livestock to alternative water sources.
- Use of existing social arrangements with owners of private boreholes.
- Reliance of government water tankers/supply during shortages and breakdowns.
- Restrictions on abstractions from specific sources (e.g. shallow wells).
- Restriction of abstraction for non-potable use.
- Segregation of potable and non-potable sources to reduce pollution.
- Change in agricultural practices (i.e. different, dry land, crops, planting times).

The implementation of the RCWMP and the use and further development of the additional water source interventions should be used as a platform to publicise the mandate and role of the TCWMC to a broader development constituency. Strategic links will also be developed by the TCWMC with regulatory stakeholders, district and community level institutions such as the District and Village Disaster Management and Farmer's Committees whose mandates have some overlaps with that of the TCWMC. Regular communication on the status of water resources will be shared. The TCWMC will keep abreast of all existing district level drought monitoring processes to include early warning, risk and impact assessment as well as mitigation and response mechanisms. By so doing, the TCWMC will have mechanisms through which its own monitoring system and action triggers can be validated.

ANNEX C Excerpt from the Technical Awareness and Training Manual

GROUP A – FORMATION OF A COMMUNITY BASED ORGANISATION (CBO)

The ownership of the planned physical interventions as well as their sustainability lies in the hands of the community. A body within the community needs to be identified that can take over the management tasks including the maintenance, the monitoring and the awareness-raising for such interventions. The country sociologist will, therefore, establish a new or train an existing Community Based Organisation (CBO) (water committee, village development committee etc.) to take on those responsibilities. Such a team will be the link between the project implementation side and the community.

A1. FORMATION AND TRAINING OF CBOS

Topic A1 of the Manual (Formation and Training of CBOs) includes three units:

Unit A1.1: Formation of CBO

Unit A1.2: Training of CBO

Unit A1.3: Child to Child approach

Unit A1.1. Formation of Community Based Organisation (CBO)

Message

The ownership of the interventions as well as their sustainability lie within the hands of the community.

Background information

In a village meeting the country team should explain the overall objectives of the project and emphasize the need for a CBO.

The committee should aim to represent all stakeholders (local authorities, specific community groups such as farmers, women, poor, etc.), including pump operators or other water managers on the ground. In cases where schools cooperate in monitoring activities, those should be represented as well. Representatives of districts or water suppliers could be included in such a committee to strengthen the communication between the community needs and these institutions. Positions in the committee which are responsible for the technical monitoring as well as the household/community based monitoring are essential. Other stakeholders who have to be informed of any development in the community will be invited or at least informed (district authorities, water departments/utilities, etc.).

The country sociologist can assist in the committee election process.

The committee will be a strong partner at community level and will be fully involved in the development and evolution of a workable Rural Community Water Management Plan (RCWMP) which will outline the monitoring, management and maintenance of the water resources in the community. It will also mobilize the community to participate in the monitoring to achieve sustainable changes.

Method

Suggestion 1:

- Village meeting, explaining the planned physical construction
- Ask for possible existing institutional or election processes
- Assist in election process

Reference material: Poster: Planned Intervention

Unit A1.2. Training of Community Based Organisation (CBO)

Message

Each member of the CBO will have a specific roll and specific tasks that everyone in the committee will know about.

Background information

A two-day workshop with this committee will be held to explain the project and its objectives as well as develop the committee tasks in more detail. In addition, the RCWMP (Rural Community Water Management Plan) will be developed within this workshop. The committee will act upon this plan and develop it further throughout the implementation phase and after project co-operation ends. The following positions are a list of possible members and associated tasks which could be represented in the committee:

1. **Intervention Manager** – one person out of a list of stakeholders should be identified who will be responsible for any matter regarding the physical interventions
2. Representative from **The Chief** or his representative - as the highest authority in the community they should form part of the committee to be informed about interventions and the water situation in the community.
3. Representative from **Local Municipality/ District Water Services** Section - as the water service authority, they should advise on the planning of activities during the intervention and will also be helpful in fostering community participation.
4. **Ward Council/ Village Development Committees –** A representative of any committee which is integrated in the governmental planning process is a valuable member who can take ideas forward in the official planning process or give insight in other ongoing developments on the ground. In addition, this person can be involved in the continuation of awareness raising activities among the community.
5. Representative of **existing water committee** – Some communities have already one or even several water committees. They might be responsible for other technical construction or responsible for the overall water situation in the community. Where the sociologist decides to create a new committee, a member of an existing water committee should join to share valuable experience and enhance the cooperation among them. In addition, household monitoring, regarding water related issues and change, can be supervised by this person.
6. **Pump operator or other technical personnel** – Technicians or those having water related technical positions already undergoing training to become knowledgeable about groundwater monitoring as well as technical matters which he will be responsible for.
7. **Representative of Learners** – In some Nodal Points we strengthen the cooperation with school so that pupils take over some of the monitoring

activities. Teachers who cooperate with the project and integrate the monitoring in their subject matter should be valuable committee members. He/she could be supervising the learners who will assist in data collection. The teacher should agree to guarantee the communication and cooperation with other stakeholders who are responsible for monitoring. Where the learners are organized and motivated enough, they could elect one representative as a committee member instead of, or in cooperation with, their teacher.

Method

Suggestion 1: (Community)

- Training workshop
- Each team member will think of their own tasks and responsibilities, short presentation and feedback from other team members.
- Document all in Community Water Management Plan.

Unit A1.3. Child to Child Approach

Message

Children are essential disseminators in the community who can distribute messages and push ideas forward.

Background information

The child-to-child approach believes that children are essential stakeholders in the community and can assist the project to get messages disseminated and enhance the buy-in and commitment from other stakeholders.

The nature of children is such that they like to talk about the things they learn, hear about, are interested in or are curious about.

Children can either talk to younger children, peers or older people about things and they can inform smaller siblings, neighbour's children or parents about what they have learned in school (Figure 1). At the same time children will adapt their behaviour and attitude when they are convinced about what they have learned or heard about and can be role models for others.

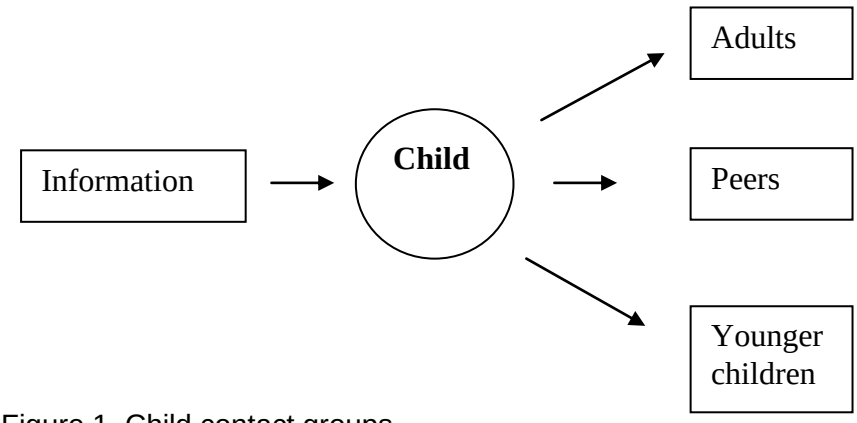

Figure 1. Child contact groups

Within this project the cooperation of children in the community is twofold. On the one hand, it is essential to integrate schools and children in awareness activities and to distribute general information about the project and intervention. They can spread the information and can be role models for sustainable use and management of the interventions.

On the other hand, schools can be institutionalised to take over a number of monitoring activities like measuring rainfall and temperature and even groundwater levels in wells and boreholes. The documentation and analysis of the data will become part of their educational training and augment their skills. The benefit of this approach is that the data collection can be controlled (through the teacher), can be documented, while the children learn about real life skills and the benefit of learning. The ownership of data and the responsibility of the resources (especially when discussing groundwater monitoring) will not only stay with the Water Committee but be spread among the population. This method will strengthen the community ownership and responsibility for the intervention and its sustainability.

It is important to discuss with the community the role of children and emphasise why the project wants to work with schools. Before training the school children (e.g. in measuring rainfall and temperature or groundwater levels) it is important to discuss with them their specific role in the community.

Method

Suggestion 1: (Community)

- Use a Venn diagram (use cards) showing all stakeholders in the village (ask community members to write them down). Identify with them how children have access to the community members. Inform the community why the cooperation with schools and children is essential for this project.
- Find out if other children or youth groups are in the community which can be integrated in the management and monitoring of the intervention and water resource.

Suggestion 2: (Children)

- Ask pupils about their role in the community, note on a board, sand or paper which position they have in regard to information distribution within the community, and which communication channels are they using.
- They could produce a poster for the community (to hang up at the school, church or other central places) explaining their role and task in the community.
- Develop ways with children to feedback their findings either to the entire community (e.g. regular meetings, presentation in community meetings, flyer, poster) or the Water Committee.

GROUP B – PHYSICAL PROCESSES: AWARENESS PROGRAMME ON GROUNDWATER RESOURCE, DROUGHT IMPACT AND GROUNDWATER MONITORING

Visits and research in the communities showed a general lack of knowledge and understanding regarding groundwater and drought and the management of both. The interventions presented as Group B of the Manual will enable communities to gain an understanding of the issues addressed by the project.

Group B of the Manual (Physical Processes) includes three topics:

B1. Groundwater Resources

B2. Drought Impact

B3. Groundwater Monitoring

These topics can be presented within one day or presented over several visits. The idea is to present and discuss the topics with stakeholders including the community as a whole, and separately to women groups, water committees, teachers and students, Chiefs and other stakeholders. The methods used to disseminate the messages will vary depending on the level of understanding of the stakeholder group and the village they are presented to. This is why the methods presented in the manual are meant as suggestions only.

The instructor should try to vary the methods and tools to gain the participants' interest and motivation. The villagers should, as much as possible, be involved in the activities to emphasize their participation and commitment. Hence, participatory methods such as Venn-diagrams, matrix rankings, drawings, and maps are essential tools and flip charts, coloured index cards or self made posters are useful.

The different ways of implementation and lesson learned were compiled at the end of the project phase into this document so that it can be used for up-scaling in the SADC region.

B1. GROUNDWATER RESOURCES

Topic B1 of the Manual (Groundwater Resources) is divided into four units:

Unit B1.1: Hydrological Cycle - Groundwater in the hydrologic cycle

Unit B1.2: Groundwater – Where from? Where to?

Unit B1.3: Groundwater Abstraction

Unit B1.4: Pollution of Groundwater

Unit B1.1. Hydrological Cycle - Groundwater in the hydrologic cycle

Message

The hydrological cycle is driven by the energy of the sun and by gravity. Water moves from the oceans and through the atmosphere and back to the oceans through various routes. Groundwater is part of the Hydrological Cycle that consists of four major elements:

- Evaporation,
- Condensation,
- Precipitation,
- Run-off and Infiltration.

Background Information

1. Evaporation
Evaporation occurs when the sun heats up water in ponds, rivers, lakes or the ocean (any surface water) and turns it into water vapour. It also takes water transpired from plants and taken from the soil into the air (evapotranspiration).

2. Condensation
As it rises, water vapour in the air gets colder and forms droplets, forming clouds. Clouds are transported by wind over long distances.

3. Precipitation
Precipitation occurs when so much water has condensed that the air cannot hold any more or cloud particles collide, grow, and then fall out of the sky in the form of rain, hail, sleet or snow. When rain falls onto the land surface, a component infiltrates into the soil with the remainder evaporating, or running over the ground into rivers. Water stored as soil moisture can be taken up by plants and transpired, or flows quickly (a few days to a year) through the soil to a stream or a river channel. Rainfall measurements, using a rain-gauge (Figure 2), are needed for the management of water resources. Rainfall amounts also include hailstones that can fall during thunderstorms. A rainfall event contributes enough rain to produce significant runoff. In tropical countries distinct periods of each year may have weather that is dry, and others when it is wet. The rainy periods may be called ‘the rains’ occurring during specific seasons.

ANNEX D Scope of works for Physical Interventions

SCOPE OF WORKS

The Scope of Works for the interventions in the different places was as follows:

BOTSWANA

The works on the two sites in Botswana consisted of the following:

Gobojango – Dinde River

- Constructing a new sub-surface weir built with rubble masonry and concrete complete with stilling basin.
- Excavating a 2.0 m diameter collector hand dug well to a depth of 6m and lining it with 1.5 m diameter concrete rings.
- Connecting the collector well with the sub-surface weir using up to four (4) 140 mm diameter HDPE pipes fitted with wire wrap screens at the ends and buried within the river channel below the scouring level of the river.
- Fitting mountings for a windmill over the collector well in accordance with manufacture's specifications
- Supplying and installing 2 no. 5,000 litre capacity uPVC tanks and mount them on 1.0 m high dwarf walls.
- Supplying and fitting 150m in length and 63mm diameter pipe work from the sub-surface weir, collector well, windmill and to the storage tanks.
- Reticulating water to the tanks and the community gardens.
- Providing heavy duty diamond mesh fencing for plot size 100m by 100m complete with access gates.

Tsetsebjwe

- Excavating a 2.5m diameter hand dug well to a depth of 6m and lining it with 2.0m diameter concrete rings.
- Fittings mountings for a windmill over the hand dug well in accordance with the manufacture's specifications.
- Supplying and installing 2 No. 5,000 litre capacity uPVC tanks and mounting them on 1.0m high dwarf walls.

- Supplying and fitting 150m in length and 63 mm diameter pipe work from the hand dug well, collector well, windmill and to the storage tanks.
- Reticulating water to the tanks and community gardens.
- Providing heavy duty diamond mesh fencing for plot size 100m by 100m.

During the construction of the facilities, the following items were strictly adhered to:

- Trees were only cut down when absolutely necessary
- Open trenches were restricted to minimum to prevent animals falling in and allow free movement of animals and people.

ZIMBABWE

The works on the two sites in Zimbabwe consisted of the following:

Dite

- Constructing a new sub-surface weir built with rubble masonry and concrete complete with stilling basin.
- Excavating a 2.0m diameter collector well to a depth of 6m and lining it with 1.5m diameter concrete rings.
- Connecting collector well with the sub-surface weir using up to four (4) – 140mm diameter HDPE pipes fitted with wire wrap screens at the ends and buried within the river channel below the scouring level of the river.
- Fitting mountings for a windmill over the collector well in accordance with manufacturer's specifications.
- Supplying and installation of 2No. 5,000 litre capacity uPVC storage tanks and mounting them to a 1.0m high dwarf walls.
- Supplying and fitting 63mm diameter pipe work from the sub-surface weir, collector well, windmill and to the storage tanks.
- Reticulating water to tanks and the community gardens.
- Providing heavy duty diamond mesh fencing for plot size 100m by 100m community garden.
- Rehabilitating 3 other wells (Ben 01, Ben 02, Mushatone). Wells need cleaning and re-equipping with hand pumps.
- Drilling a new borehole for Dite Primary School.

- Rehabilitating Mapanda Well. Well needs cleaning, and re-equipping with hand pump.
- Rehabilitating a reticulation system and internal plumbing for clinic water supply.

Whunga

The works at Whunga comprised:

- Constructing a new sub-surface weir built with rubble masonry and concrete complete stilling basin.
- Excavating a 2.0m diameter collector well to a depth of about 6m and lining it with 1.5m diameter concrete rings.
- Connecting collector well to with the sub-surface weir using up to four (4) – 140mm diameter HDPE pipes fitted with wire wrap screens at the ends and buried within the river channel below the scouring level of the river.
- Fitting mountings for a wind mill over the collector well in accordance with manufacturer's specifications.
- Rehabilitating existing concrete storage tank.
- Supplying a 63mm diameter uPVC pipe work from the collector well windmill to the storage reservoir.
- Reticulating water to storage tank and community garden.
- Providing heavy duty diamond mesh fencing for plot size 100 m by 100 m community garden.
- Rehabilitating an existing sub-surface weir built with rubble masonry and concrete complete with stilling basin.
- Excavating 2.0 m diameter collector well and lining it with 1.5 m diameter concrete rings then equipping with a hand pump at the existing sub-surface weir.
- Excavating a 2.0 m diameter well and lining it with concrete rings then equipping it with a hand pump at Right Hand side of the river near the drift.
- Excavating a 2.0 m diameter well and lining it with concrete rings then equipping it with a hand pump at the other side of the new sub surface weir opposite the new collector well.

During the construction of the facilities the following items were strictly adhered to:

- Trees were only cut down when absolutely necessary

- Open trenches were restricted to minimum to prevent animals falling in and allow free movement of animals and people.

SOUTH AFRICA

The scope of the intervention in the three villages of South Africa comprised the following:

Maheni Village

- Head works rehabilitation and heavy duty diamond mesh fencing of an existing supply (backup) borehole.
- Fitting a monitoring access conduit for the supply borehole.
- Providing 1200 m of 63 mm diameter HDPE reticulation pipe work from the supply storage reservoir to the village to act as a backup to the Municipal Village Water Supply.
- Installation of ground water and climatological monitoring equipment for involvement of local school children and other community members in ground water level and rainfall monitoring.

Sagole Village

- Spring protection works i.e. construction of a berm at least 17m uphill from the spring to divert any surface runoff away from the eye of the spring.
- Construction of a collector chamber at the spring to function as a distribution box for pipes.
- Installation of v-notch for flow measurement of the spring.
- Providing heavy duty diamond mesh fencing for the spring area.
- Fitting a monitoring access conduit for an existing borehole.
- Installation of groundwater and climate monitoring equipment for involvement of local school children and other community members in groundwater level and rainfall monitoring.

Shakadza Village

- Head works rehabilitation and fencing the existing supply borehole.
- Fitting a monitoring access conduit for the supply borehole.
- Installation of groundwater and climate monitoring equipment for involvement of local school children and other community members in water level and rainfall monitoring.