

FINAL

# Rural Community Water Management Planning Process for Tsetsebjwe, Botswana

## TSETSEBJWE

Bobirwa Sub District, Central District, Botswana

Location Lat: S 22° 24' 49" Long: E 28° 23' 54"



*'Tangible benefits to the community resulting from  
community managed interventions that can be replicated  
elsewhere'*

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## LIST OF ACRONYMS

AP	Awareness programme
CBO	Community Based Organization
CSO	Central Statistics Office
DWA	Department of Water Affairs
EPP	Emergency Plant Protection
FMD	Foot and Mouth Disease (cattle)
HDP	Heavy Duty Polypropylene
MO	Monitoring Operative
MoA	Ministry of Agriculture
NGO	Non-governmental organisation
O&M	Operation and maintenance
Pvc	Poly-vinyl chloride
RCWMP	Rural Community Water Management Plan
SADC	Southern African Development Community
TDS	Total Dissolved Solids – Water quality
VDC	Village Development Committee
VET	Village Extension Team
Quantities	
ha	hectare
km	kilometre
l/sec	litre per second - yield
l/sec/m	litre per second per metre of drawdown – specific capacity
masl	metres above sea level
mg/l	milligrams per litre (hydrochemical quality)
mm/year	millimetres per year (rainfall or evaporation)
m <sup>3</sup> /day	cubic metres per day
m <sup>3</sup> /hr	cubic metres per hour

## 1. Introduction

This Rural Community Water Management Planning Process (RCWMP) has been developed in full consultation with the Tsetsebjwe community so that the community can better manage its water supply during periods of drought and assist in maintaining community livelihoods and wellbeing in times of water shortage and hardship.

The RCWMP is the product of a sub-regional project entitled '***Development and Testing of Groundwater Drought Management Strategies in the Limpopo Basin Pilot Areas***' funded by a GEF grant from the World Bank and implemented by the Groundwater Management Programme within the Southern Africa Development Community (SADC). This RCWMP is one of a number of similar Plans that have been developed as pilot programmes in rural communities in the Limpopo Basin in Botswana, Zimbabwe and South Africa.

The Planning Process described in this report is the process that will lead to the Plan itself. This report describes that process and the procedure by which the community becomes empowered to determine the type of intervention that it stands to gain most from, the monitoring work required with which to measure the impact of the intervention and most of all the rightful ownership of the RCWMP. The resultant RCWMP is described in the companion document *Rural Community Water Management Plan for Tsetsebjwe, Botswana*.

## 2. Principles of the Planning Process

The Rural Community Water Management Plan (RCWMP) has to be understood as a tool which will provide guidance to the recipient community in times of drought. It offers background information and action advice which the community members can relate to and make decisions on. *Physical as well as social interventions involving the concept of community water management are presented in this planning process document, but it can be assumed that the initial management approaches and specific issues that are propounded herein will undoubtedly be modified as the Plan itself evolves.*

This RCWMP follows a number of guiding principles that will enable the community to sustain its livelihoods and improve wellbeing during periods of drought by better community management and use of local groundwater sources. The key guiding principles are:

➤ **Community Ownership**

Close consultation with the Tsetsebjwe community and other secondary stakeholders is essential to the achievement of successful and sustainable results. The planning processes contribute to community ownership of the project and the resultant Rural Community Water Management Plan represents the community's expectations for water management.

➤ **Functional Simplicity**

The content of the plan has been drafted to ensure that it suits the local context and is understandable to the majority of the community. The planning process has also involved detailed consultation with the Community Water Management Committee to ensure their understanding of the water supply interventions.

➤ **Essential Data Collection**

Comprehensive and accurate quantitative data collection is essential in order to measure social and biophysical changes resulting from the water supply interventions. These data are key to evaluating the effectiveness of each intervention.

➤ **Basis of Long Term Community Water Management**

The management plan was developed by the community in cooperation with the project team and it aims to provide a strong foundation for long term rural community water management. The plan will be adapted and updated over time by the Community Water Management Committee as lessons are learned by the community through the monitoring of various water supply and social indicators.

➤ **Enhance Community Knowledge**

The RCWMP recognises the knowledge that exists within the community regarding time-proven techniques and traditional ways of water management. The Plan and the cooperative environment within which it has evolved provides additional information and knowledge to community members. A major outcome of the planning process, therefore, has been to enhance technical and management and skills within the community.

➤ **Community Contribution**

The community was committed to helping initiate and subsequently maintaining the water supply intervention.

➤ **Equity and Special Needs**

Although the interventions may benefit all residents of the village of Tsetsebjwe, the Rural Community Water Management Plan respects the special needs of the vulnerable members of the community. The needs of women, resource poor farmers, youth, disabled people and those living with HIV and AIDS have been prioritised as beneficiaries of the Plan.

➤ **Sustainability**

This principle aims to sustain the physical, organisational and financial resources for the interventions, but cannot guarantee that this will continue in the post-project phase.

## 2.1 Plan Development Process

The inception phase of the project involved participatory research into the issues of water and drought management in the community. Focus group discussions - that included livestock and arable farmers, resource-poor farmers, traditional leadership, gender based groups, female headed households, youth and government extension agents - ensured that the project was fully informed by the views, opinions, concerns and aspirations of the different social groups that are found in Tsetsebjwe.

The draft Rural Community Water Management Planning Process document for the Tsetsebjwe community was discussed with village leaders, institutions and government extension agents. The purpose of this participatory process was to validate the draft Community Water Management Plan and reaffirm community commitment and ownership to it. The validation process was fully achieved and also provided opportunities for the Tsetsebjwe community to identify the potential livelihood initiatives that would be carried out once the physical interventions were completed.

The final planning process involved the detailed community action plan that would guide implementation by the now established Tsetsebjwe Community Water Management Committee (TCWMC). The outputs of this participatory planning process involving the TCWMC, village leaders (*Dikgosi*) from all village wards, government extension workers (Department of Crops, Animal Health and Production, Social and Community Development, Adult Education, Health Education and Teachers from Local Schools) included a blue-print of action for the community level project initiatives.

The community liaison exercise (Planning Process 1) to develop the RCWMP involved the following members of the community:

<b>Name</b>	<b>Organisation/Department</b>
Okhaba Aobakwe Dichaba	Village Health Committee
Selelo Ntwaapelo	Mogadingwane Ward
Peloyame Phole	Polaseng Ward
Oabona Baakile	Machekane Ward
Bosele Phuthego	Health Clinics
Omphitlhetse Busang	Kgosing Ward
Timothy Tau	Farmer
K. Motsamai	Kgosi
Monthusi Dikgang	Farmers Committee
S. Motsamai	
Mothusi Tsie	Village Elder
Mr. Pontsho	Farmer

Tshiamiso Motsamai  
Gabohiwe Manyeula  
Lesego Maphakela  
Tebogo Busang  
Kemmony Elias  
Ditebogo Mokgane  
Maipelo Mokoko  
Joyce Tawele  
Thato Majagana  
Setho M. Nkawana  
Lucy Rammutle  
Johannah Thamo  
Meshack Motsumi

Mandelo Ward Head  
Councillor  
Youth Group  
Youth Group  
Secretary, Farmers Committee  
Village Health Committee  
Youth  
Youth  
Village Health Committee  
VDC  
Village Elder  
Village Elder  
Village Elder

### 3. Goal and Objective of the Plan

#### 3.1 Goal

The goal of the RCWMP is:

To facilitate and empower the community to maintain its livelihoods and wellbeing during periods of drought.

This is not an easy task, but the planning process and the resultant RCWMP provides the framework and guidelines that will assist the community to achieve both technical and social improvements.

It will also help to build linkages between the community and regulatory stakeholders with respect to water provision and use. The RCWMP provides the community with specific ways in which the cooperation between stakeholders and regulatory bodies can be integrated and enhanced to improve sustainable water management at community level in the future.

#### 3.2 Objectives

The specific objectives of the RCWMP are:

- a) To promote improved rural community management and use of water sources, especially groundwater sources, during periods of drought.
  - More water available for domestic use especially during drought spells
  - More water available for food gardens especially during drought spells
  - More water available for livestock especially during drought spells
  - As a result of better water management practices reduce the need for emergency water supply
  - Improved water quality
- b) To maintain and improve livelihoods, self-reliance and level of development during drought by means of community managed actions.
  - reduce food shortage: Number of emergency feeding programmes decrease
  - increase the number of food gardens
  - increase the period of food garden activity
  - Increase the number of months harvesting crops from gardens can occur
  - Increase the quantity and quality of locally produced vegetables
  - As a result of greater self-sufficiency from gardens throughout the year, has the socio-economic situation of beneficiary/vulnerable households improved
- c) To improve general health in the community
  - Improved nutritional levels
  - Number of diarrhoea occurrence stays the same or decrease
  - Decrease in cases of malnutrition amongst children under the age of 5years

- d) Destitution remains the same or decreases.
- e) To improve the general knowledge of the community concerning groundwater, pollution and drought preparedness
- f) Motivate the community to adopt positive water management practices
- g) Ensure the community and Water Committee are sufficiently familiar with physical intervention and know how to maintain and repair it
- h) Empower the community to take control and manage their water resources effectively, by improved knowledge, data collection and data interpretation

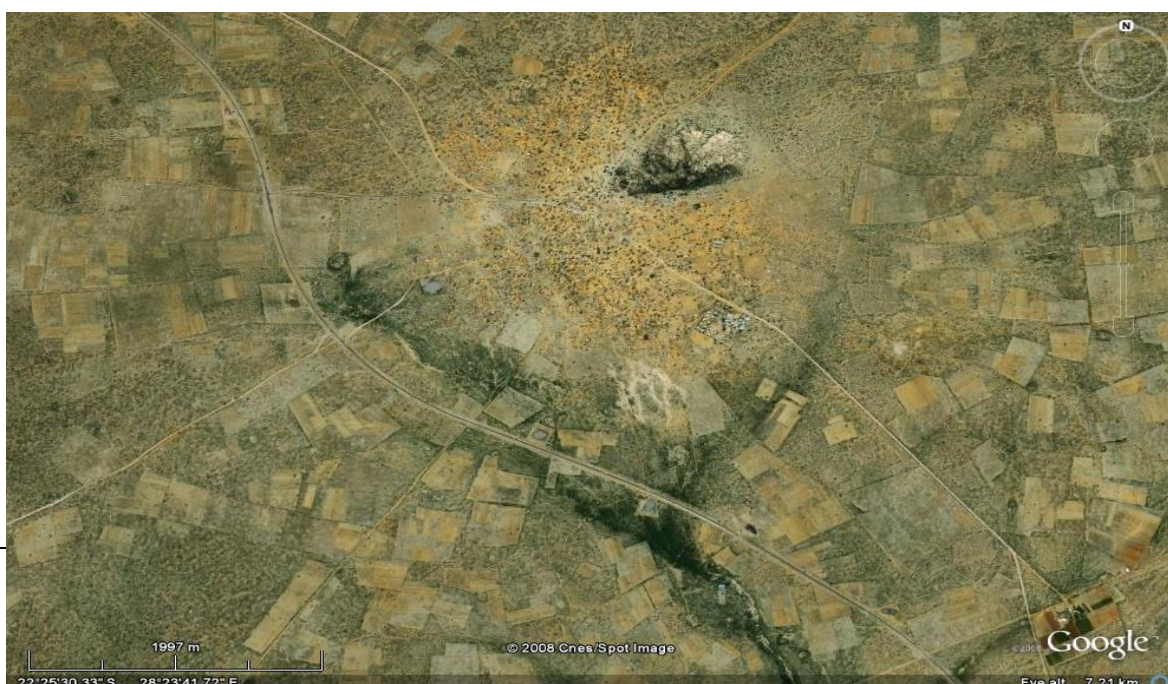
### 3.3 Anticipated Outcome

The RCWMP is designed around community ownership and enhanced community understanding of water provision and drought. It lays down a basis for improved rural community water management at a strategic level rather than at a recurrent seasonal 'fire-fighting' level. The anticipated essential outcome for the rural community is enhanced livelihood security through the provision of a better managed and more secure water supply. Although it is not anticipated or specifically intended that this will enable the community to develop external markets for produce, it will provide the community with an improved basis for stock watering, gardening and other activities during times of water shortage resultant on drought conditions i.e. it will assist in maintaining essential community livelihoods.

*The level to which community wellbeing is improved by the proposed interventions will be carefully monitored and compared against pre-intervention base line data by the project with the assistance of the community. If the anticipated outcomes are not achieved, the interventions will need to be revisited to ascertain what additional physical or social actions could be required to improve the outcome. This will be essential information that will either support or inhibit the roll out of similar interventions elsewhere in the region.*

The community of Tsetsebjwe is one of seven communities selected within four of the SADC Member States to trial the value of both social and physical interventions intended to empower communities to lessen the hardship of drought. The lessons learned in the Planning Process, both by the community and by SADC, will help to inform the eventual roll out of similar process planning for communities throughout the SADC region.

### 4. Baseline Information

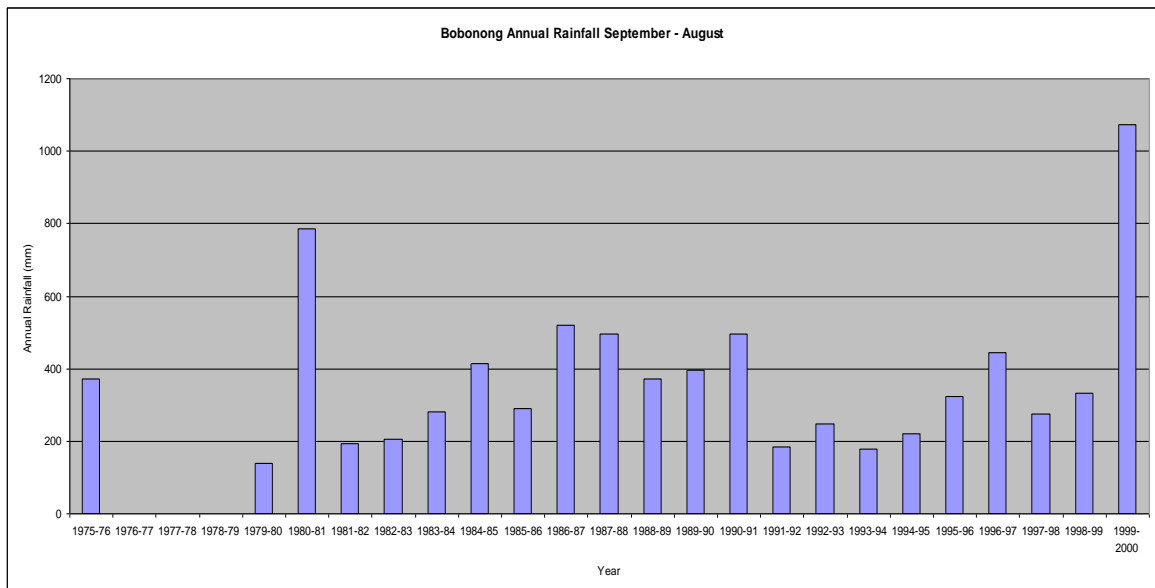


**Figure 1 Google Image of Tsetsebjwe Community****4.1 Location**

- 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-Maclaute junction -greatly exceeds rainfall.

**Figure 2 Annual Rainfall Plot – Bobonong, Botswana**

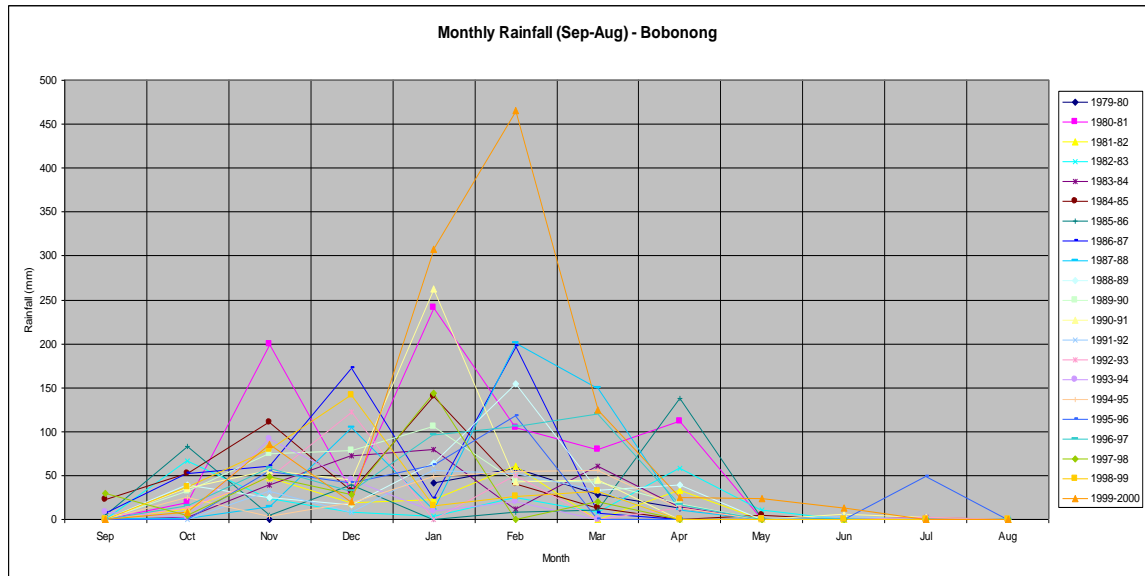


Figure 3 Monthly Rainfall Plot – Bobonong, Botswana

#### 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 m<sup>3</sup>/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 Kethlalefile 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 further 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. There 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
British Geological Survey Wallingford, Oxon, UK	Wellfield Consulting Services Pty, Gaborone, Botswana	CSIR, Pretoria, South Africa

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 be 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.

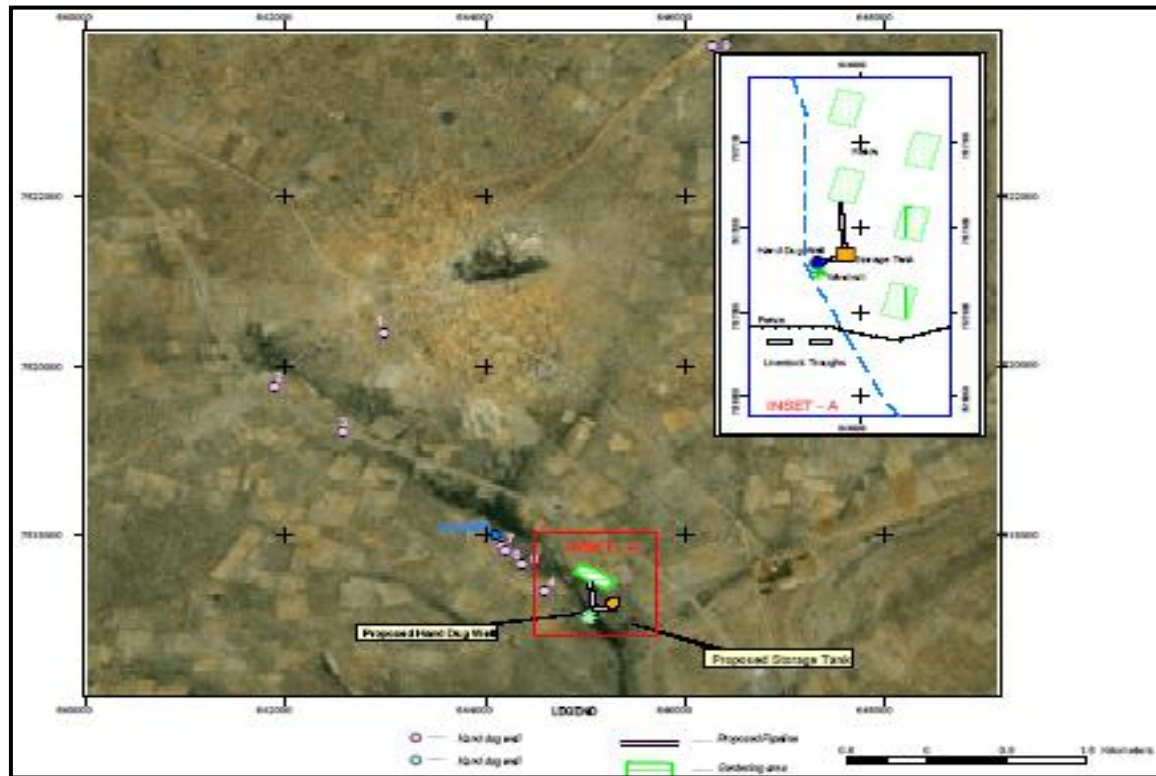
An assessment of training needs will be determined. The training requirements will then be incorporated into the final awareness/training programme to be undertaken once the interventions are in place.

### 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.**

<b>Intervention Site No.</b>	<b>Physical Intervention</b>	<b>Other engineering input</b>
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	



**Figure 4** Location of Physical Interventions – Tsetsebjwe, Botswana

### 5.3.1 Physical Interventions

The following physical interventions are planned:

#### *Intervention Site T01- Install New Large Diameter Well*

- Existing structure – none
- Planned intervention - the proposed hand dug well site is located 6 km from Tsetsebjwe to avoid pollution from pit latrines and downstream of existing wells.
- Intervention design – install a well completed at 1.5 to 2 m internal diameter and at least 6 m deep to penetrate fully the full weathered Basement Complex sequence and be deep enough to provide water through the dry season. The well will be fully lined with pre-cast porous concrete rings placed against permeable horizons to maximise the seepage area. A manhole cover will be constructed to allow continued access to water if the pump breaks down.
- The well will be test pumped on completion to determine its yield and storage characteristics. A storage tank will be constructed close to the well.
- Water Quality — generally good locally with a low TDS. Elevated nitrate concentrations may indicate that the weathered basement aquifer is vulnerable to contamination from human and animal wastes

#### *Intervention Site T02 - Equip Well With Windmill Pump*

- Existing structure – none

- Planned intervention – erect windmill pump in newly constructed lined dug well
- Intervention design – Climax type shallow well windmill pump to deliver water via a reticulation system to a surface water tank
- Water Quality – as above

*Intervention Site T03 - Reticulation Pipeline to Storage Tank Adjacent to Well*

- Existing structure – none.
- Planned intervention – a small diameter PVC pipeline from the well to the storage tank
- Intervention design – the pipe line is anticipated to run up-hill from the well to an elevated water reservoir.
- Water Quality – as above.

*Intervention Site T04 - Elevated Tank Adjacent to Well*

- Existing structure – none.
- Planned intervention – construct an elevated water storage tank midway between the hand dug well and communal gardens/cattle watering troughs.
- Intervention design – An elevated storage tank will be constructed close to the large diameter well. The size of the tank will be determined after detailed user requirements investigations are completed. The tank needs to be able to hold sufficient water for the irrigation of communal gardens and water livestock for a week, to cover periods of low or no wind. The tank also needs to be sufficiently elevated to supply water under sufficient pressure head for delivery for drip irrigation along plastic lines.
- Water Quality – as above.

*Intervention Site T05 - Reticulation Pipeline from Storage Tank to Livestock Watering Points and Gardens*

- Existing structure – none.
- Planned intervention – construct a PVC pipeline to deliver water from the reservoir to the communal gardens and livestock watering point
- Intervention design – water to flow under positive head from the reservoir to a delivery point at the communal gardens. Water maybe delivered from that point for irrigation via a drip irrigation pipeline network or be made available for hand watering by individual household members.
- Water Quality – as above.

*Intervention Site T06 – Fence Water Source and Gardens*

- Existing structure – none.
- Planned intervention – erect an animal proof boundary fence around the community gardens and the water source, with simple access for humans.

### **5.3.2 Sociological Intervention**

Each of the proposed physical interventions described in Section 5.3.1 requires well planned social interventions targeted at specific members of the community. The

following social interventions to accompany the physical interventions will be implemented (Table 3).

It is anticipated that further social interventions might be demanded by the community at a later stage during the RCWMP community participatory development and these can be added to this list.

**Table 3 Social Interventions Needed to Support Physical Interventions Aimed at Groups within Tsetsebjwe Community**

Physical Intervention	Social Intervention	Target Audience
Sink new large diameter well	Awareness General Awareness Wells <i>Agricultural training</i>	Community and Water Committee
Equip well with windmill	Awareness General Awareness Windmills <i>Agricultural training</i>	Community and Water Committee
Provide reticulation to elevated tank	Awareness General Awareness Reticulation <i>Agricultural training</i>	Community and Water Committee
Provide elevated storage tank adjacent to well	Awareness General <i>Agricultural training</i>	Community and Water Committee
Provide reticulation from tank to livestock water points and gardens	Awareness General <i>Agricultural training</i>	Community and Water Committee
Fencing around gardens	<i>Agricultural training</i>	Community and Water Committee

AP = Awareness Program

The physical interventions need to be accompanied by social interventions to:

- enhance the ownership among community members,
- enhance the cooperation and participation among community members,
- bridge the knowledge gap regarding water and drought which exists among the community (such as gardening, operation of dams, etc.).
- develop the RCWMP and empower the community in monitoring and decision making.

It is envisaged that the Sociological Intervention Programme conducted as part of this planning process will be phased as set out below.

### **Stage I**

In a first community meeting of the Intervention Phase the community will identify an existing community based organization (CBO) or assist in creating a new one that will be responsible for any matter regarding the physical intervention and the community. In Tsetsebjwe, the VDC is a very strong body which can be trained up to become also a Water Committee. The responsibilities and role of such Committee may be extended to cover the planned interventions.

A Community Water Committee will be a strong partner at community level and will be fully involved in the development and evolution of a final workable Community Water Management Plan as well as any community inputs into the implementation of the intervention. The Community Water Committee will also mobilize the community

to participate. A one day workshop with this CBO will be held to explain the project and its objectives as well as develop the committee tasks in more detail. The Community Water Management Plan lies in the hands of this CBO which will act upon this plan and develop it further throughout the implementation phase.

In 2010, the TCWMC was established through a participatory process. This process involved a thorough analysis of the need for a completely new structure or use of ewxisting ones. The community opted for the creation of a completely new water management structure for the village.

Stage I will see the establishment of, or involvement with, a Community Water Committee and the initial liaison that will gather/update baseline data and start to develop the RCWMP - expected duration: 1-2 days

### ***Stage II***

A general awareness programme relating to water, groundwater and drought will be held with different stakeholders at community level at the beginning of the implementation phase. Information will be provided on the following topics:

- the hydrological cycle,
- the distinction between ground and surface water,
- groundwater recharge and groundwater pollution,
- drought, and indicators of drought,
- reasons for and impact of droughts,
- possible preparedness strategies, and
- monitoring of interventions and sources (especially for the Water Committee and schools).

Tsetsebjwe residents who participated in the Installation of Physical Interventions and General Groundwater Awareness workshop discussed:

- The major causes of groundwater pollution and how these can be prevented.
- What drought is, the different types and how we can be more prepared for and manage it.
- Where groundwater comes from and where it goes.
- How we can best conserve groundwater resources.
- Abstraction of groundwater.
- The importance of being better stewards of our environment.
- The hydrological cycle.
- Types of wells that are used in groundwater abstraction.
- The importance of being prepared for drought as opposed to fire-fighting.
- The objectives of the SADC groundwater drought management project and its history.

### ***Stage III***

As the project plans to rehabilitate and build a new hand dug well, an appropriate accompanying awareness programme for the community members will be carried out. The other components will be explained within this awareness session. Other stakeholders in the village and regional representatives (District Council, DWA, and Ministry of Agriculture) need to be present. Expected duration: 1-2 days

#### **Stage IV**

An awareness programme will focus on agricultural and horticultural activities and possible improvements that may be possible with more available water and more careful crop selection. This intervention will be essential as community-focussed gardens will be introduced or enhanced as an important livelihood support for the villagers and this may be a foreign or old-fashioned concept in Botswana. The session needs to emphasise the benefits from gardens and will show villagers the advantages of subsistence horticulture and agriculture activities. The use of modified dry area cropping patterns and improved utilisation of limited water resources through more efficient water application, e.g. drip irrigation, should result in higher crop yields throughout the year. Some cropping should be maintained during periods of prolonged drought. Sustainable and improved use of family gardens will be an important indicator of success for the project.

This Stage of intervention is will require inputs from an appropriately trained but locally knowledgeable specialist.

#### **Stage V**

Stage V will further develop the RCWMP together with the Community Water Committee into a final document. This will include the necessary agreed management mechanisms, construction monitoring and community water source and water supply monitoring. The final RCWMP will contain a drought action plan stating action 'triggers', actions to be taken in time of water stress and a communication feedback strategy to address community and other stakeholders when actions are to be taken. Expected Duration: 2-3 days.

#### **Stage VI**

Regular monitoring visits in cooperation with the Community Water Committee, will identify any further knowledge gaps. A refresher awareness programme may need to be implemented with the respective stakeholder group. Expected Duration: 1 day (per visit)

### **5.4 Community Structure Development with Respect to Water Management and O&M**

Experience indicates that projects implemented at community level are likely to be more successful and sustainable if the ownership of the project lies within in the community itself. In addition, participation in decision-making processes and implementation are essential to achieve the anticipated benefits for community members.

In Tsetsebjwe the community is used to working with both the Village Development Committee (VDC) and the Village Extension Team. These committees consist of a President, Vice President, Secretary, Treasurer and Vice Treasurer and additional community members and can take over the role of a Community Water Committee.

It is, however, proposed that two further positions should be added in such an existing or newly created committee, namely:

- Technical Member, responsible for technical O&M of intervention, repairs etc.
- Awareness Member, responsible to monitor the messages from the awareness programmes, raise further awareness in the community and motivate community members to participate.

Both these supplementary members will be required to document their observations and activities and report regularly to the committee as this is the forum in which solutions are discussed and decisions are made.

The Tsetsebjwe community successfully selected a community water management committee in 2010. This committee is constituted by a Chairperson, Vice Chairperson, Secretary, Vice Secretary and Treasurer. In addition, five members have been selected as ordinary members. The TCWMC has co-opted members of the Village Extension team (VET) as ex-officio members who bring their expertise in the areas of arable and livestock development, water management, social and community development.

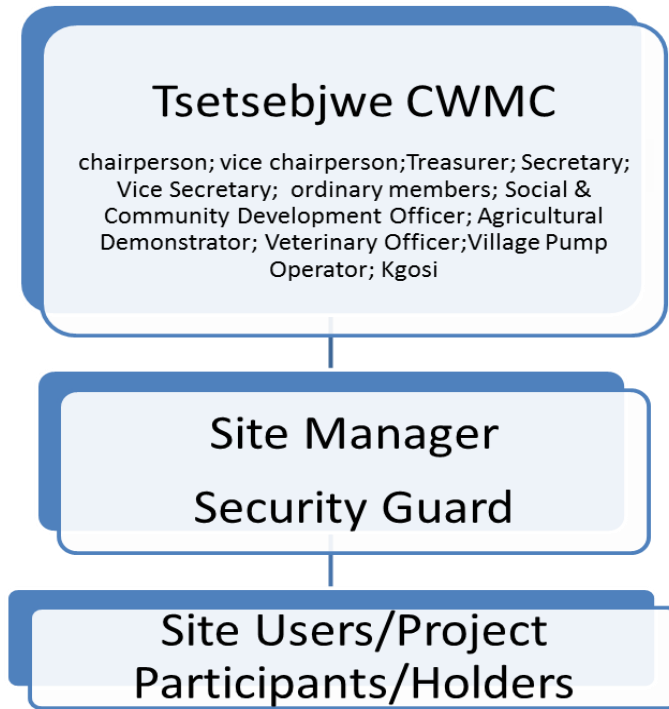
The community reached consensus that funds be sought to fully employ a full-time Project Manager. A possible option was for the Ipelegeng programme to meet the costs. The role of the post is:

- To be responsible for leadership, oversight, administration and management of the project. This officer will be responsible for the day to day monitoring of the physical interventions, repairs, maintenance and will report to the TGCWMC.
- The TCWMC will select an Awareness Member from its members who will be responsible for monitoring the messages from the awareness programmes, raise further awareness in the community and motivate community members to participate.

The Project Manager and Awareness Member will be required to document their observations and activities and report regularly to the committee as this is the forum in which solutions are discussed and decisions are made.

**Outcome:**

The TCWMC (Figure 5) has been established and has played a key role in the planning and execution of the activities of the project since it began. Although the TCWMC has not been closely involved in the construction of physical interventions, it has been kept informed of developments on site.



**Figure 5 Organogram for the TCWMC**

The TCWMC consists of the following members:

Name	Organisation/Department
David Manake	Community Water Management Committee (CMMC) Chairperson
Kgotso Modise	Vice Chairperson CMMC
Gaborekwe Ketumile	Secretary
Onalenna Nchadi Ale	Vice Secretary
Kebareng Gabanamotse	Treasurer
Collen Seitumeng	Ordinary member CMMC
Tshepo Tukisi	Ordinary member CMMC
Mokgadi Mokwena	Ordinary member CMMC
Galeyo Gaerupi	Ordinary member CMMC
Paul Montsho	Ordinary member CMMC
Kgosi Motsamai	Kgosi Social & Community Development Officer
Lucus Lesotho	Agricultural Demonstrator, Department of Crops, District Agricultural Office
Kgosi Gabanamotse	Tribal Administration
Mphoreng Philly	Pump Operator Veterinary Officer

The roles and responsibilities of the TCWMC have been agreed as follows:

- To raise the required funding for the community to implement income generating activities on the project site; ensure security of the facilities as well as the repair and maintenance of the equipment.
- To draft a constitution that will guide the community water management structure.
- To provide leadership and oversight in the effective and efficient implementation of the project.
- To develop guidelines and selection criteria for the use of project facilities.
- To generate applications for the use of project facilities from different community groups.
- To develop detailed plans for the use of project facilities during periods of drought and communicate these to Tsetsebjwe residents.
- To monitor the progress of the project.
- To disseminate information to the community on issues related to the project.
- To ensure the proper use and maintenance of project facilities.
- To ensure that the facilities, equipment and tools are safe and secure.
- To ensure frequent monitoring of groundwater resources and disseminate the results to the community.
- To facilitate community access to information on groundwater and drought management.

The process of forming or electing of the Community Water Committee will be defined by the RCWMP, listing names of members, positions, professions or positions within the community as well as describing roles and responsibilities. Other entities within the community (i.e. schools, clinics etc) who may also collect monitoring data will also be listed.

In addition, the mode of meeting of the Community Water Committee to effect water management for the community as well as communication/cooperation with other stakeholders will be defined in the final RCWMP.

## 6. Knowledge Transfer and Awareness/Training Programmes

As a vital part of the implementation of the various interventions it will be crucial to transfer a certain level of knowledge relating to particularly the physical interventions but also the sociological interventions to the community if community 'buy in' and commitment to and involvement in the monitoring aspects of the project are contemplated. This knowledge transfer will be largely undertaken by the project team sociologists and will be achieved by the extensive use of a newly developed Awareness Manual.

### 6.1 The Awareness Manual

It is envisaged that the Awareness Manual will ultimately constitute a 'generic tool box' comprising largely visual aids in the form of posters and other material that can be utilised by sociologists involved in water supply development and livelihood sustainability and enhancement in rural communities in the SADC region.

#### 6.1.1 Aim of Awareness Manual

The Awareness Manual includes all awareness programmes to be implemented by the SADC Limpopo Groundwater and Drought Management Project at target communities within nodal areas located in Botswana, Mozambique, South Africa and Botswana.

The manual aims to assist the country sociologists through provision of programmes needed to prepare participating communities for the planned installation of physical interventions within Nodal Point communities. One copy will remain in the community and can be used as background information and a reference book in case questions regarding the interventions occur.

The awareness component of the project programme is aimed at gaining the support and delivering a sense of ownership and understanding of project elements by the community. These are needed to ensure the sustainability of planned physical interventions thus enabling successful community-based groundwater management.

#### 6.1.2 Content of Awareness Manual

To aid the sociologists in their discussions with community members simple notes describing awareness units in 9 subject areas divided into two broad groups have been prepared:

Group A – Awareness of Physical Processes (subject areas 1-3)

Group B – Awareness of the Types of Physical Interventions to be Implemented (subject areas 4-9)

The first deals with physical processes such as Groundwater Resources, Drought Impact and Water Supply Monitoring. To aid description these subject areas are divided into a series of training units. Many of the processes described occur underground and therefore hidden and difficult to visualise. The concepts presented may be difficult to understand by community members but some understanding is required if groundwater resources are to be developed and utilised sustainably.

The physical intervention awareness subjects present a general understanding, of each type of intervention describing its operation, maintenance, rehabilitation and monitoring. Being physical viewable entities these concepts are easier to describe.

The awareness units are presented as a series of posters that can be selected according to the requirements of each different community. Reference will be made to specific manuals that describe specific interventions in greater detail.

### **GROUP A – AWARENESS OF PHYSICAL PROCESSES**

1. Groundwater Resources
2. Drought Impact
3. Water Supply Monitoring

### **GROUP B – AWARENESS OF THE TYPES OF PHYSICAL INTERVENTIONS TO BE IMPLEMENTED**

4. Awareness Programme on the Construction and Maintenance of Subsurface Weirs, Pumps, Wells and Boreholes (to be implemented where subsurface weirs are planned)
5. Awareness Programme on the Construction of Water Storage and Ancillary Structures such as fencing around gardens; irrigation systems (canals/pipes for gardens); reticulation systems to tanks/gardens; and surface water storage tanks.
6. Awareness Programme on the Installation and Maintenance of Equipment such as windmills; hand pumps; water storage tanks and irrigation pipes (drip/spray irrigation)
7. Awareness Programme on the Rehabilitation of Structures such as subsurface weirs, wells, boreholes, water storage systems, water supply reticulation systems and small scale irrigation systems
8. Awareness Programme on the Installation and Use of Monitoring Systems such as rainfall gauges; water level recorders; and well/borehole abstraction rate recording methods
9. Awareness Programme on Community Gardens including methods of cultivation of specific crops (especially advisable for Botswana)

#### *Subject Areas*

Each subject area is broken down into a series of training units. In turn each unit comprises the following parts:

- Message –brief description of unit content
- Background information – fuller descriptions of the components of each unit using simple text, line diagrams and photographs
- Methods of putting information across with suggestions on how to achieve knowledge transfer.

It is envisaged that the sociologist will adapt the programme to the specific needs and planned intervention in the community. Community feedback will be used to improve the process of implementation and develop a more cohesive document by the end of the project. It is intended that the Awareness Manual will be assembled in such a way that it can be utilised on other projects by both SADC and Member States as well as for up scaling the present pilot programme.

## **6.2 Community Empowerment Aspects**

In order that the physical interventions are maintained and operated in a manner to ensure longest possible life the community, and specifically the community Water Committee and their selected Monitoring Operative will undergo short but essential training courses on the operation and maintenance of such things as windmill pumps, hand pumps, water distribution lines, and hand dug wells.

A summary of possible training requirements is indicated in Table 4 below.

**Table 4 Overview of possible training requirements and target audiences according to physical intervention type - Tsetsebjwe**

Physical Intervention	Training Requirement	Target Audience
Sink new large diameter well	O&M well,	Water Committee; Monitoring Operative
Equip well with windmill	O&M wind mill,	Water Committee; Monitoring Operative
Provide reticulation to storage tank	O&M reticulation system	Water Committee; Monitoring Operative
Provide storage tank adjacent to well	O&M tank	Water Committee; Monitoring Operative
Provide reticulation to livestock watering points and gardens	O&M reticulation system <i>Agricultural training</i>	Water Committee; Monitoring Operative
Fence water source and gardens	<i>Agricultural training</i>	Water Committee; Community

As these courses are relatively technical in nature it is envisaged that they will be conducted by the sociologist but supported by the hydrogeologist team member. It is envisaged that the courses will be of short duration (say 1 day) and will be undertaken during installation/commissioning of the particular intervention so that 'hands on' experience can be demonstrated and gained.

The specific training course material is expected to form part of the Awareness Manual documentation to be produced by the project.

## 7. Monitoring

*“Monitoring is the measurement or observation of the effects or reactions produced by a specific cause or action imposed by a change in the equilibrium or balance that currently exists in a natural system”.*

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.

In order to undertake monitoring the existing, ‘baseline’, conditions at the site prior to any imposed change. The baseline conditions enable specific ‘indicators’ of effect or reaction (‘impacts’) to be measured in terms of change.

### 7.1 Definition of Monitoring Indicators

The implementation of the planned interventions will result in both physical and sociological impacts and thus both physical and sociological indicators have to be defined.

The indicators will be discussed and agreed with the community as part of the development of the RCWMP.

#### 7.1.1 Physical Monitoring Indicators

Physical indicators will be used to monitor physical impacts of the intervention, especially those related to the impact on, or created by the use of, groundwater resources. In addition, other physical factors such as climate, water quality, agricultural practises and conditions will require to be monitored to assess temporal variability that may impact the ‘success’ or sustainability of the intervention.

##### Groundwater

The magnitude and temporal sustainability of a groundwater resource can be assessed by the measurement of groundwater level, quality and rate of depletion/replenishment (both natural and artificial).

The indicators are:

- Groundwater Level
- Groundwater Quality
- Rate of Abstraction

##### Climate

The local climatic conditions have significant influence on the availability of surface water and the potential for replenishment of groundwater. They also have a major influence in the agricultural activities and outputs of the community.

The indicators are:

- Rainfall
- Temperature
- Evaporation

#### Water Quality

Water quality is important with respect to agriculture and the tolerance of different crops to different chemical constituents of irrigation water.

The indicators are:

- Total Dissolved Solids (TDS) content
- Chloride content

#### Rural Water Supply

In order to assess the community-wide situation with respect to existing water supply from boreholes, wells and surface water sources, and the extent to which this supply system becomes 'stressed' during periods of drought, it is important to measure and/or observe::

- Surface water levels (depth, lateral extent and length of time of flood events).
- Water levels in wells and boreholes (and any decline during drought and recovery after drought).
- Water abstraction rate from wells and boreholes (and any decline during drought).
- Water quality ( any decline, especially in taste, during drought).

#### Agriculture

Measurement and/or observation of a number of general agricultural indicators can provide an assessment of the status of community livelihoods. Individual farmers and agricultural extension workers should be able to provide information on the following topics;

- Numbers of livestock kept per household.
- Crop yields.
- Areas and location of plots cultivated.
- Crop types grown and in what rotation.
- Irrigation methods employed e.g. furrow, drip.
- Rates of fertiliser application.

### **7.1.2 Social Monitoring Indicators**

The expected outcomes and impacts from physical interventions vary according to the specific intervention implemented. Therefore, a number of indicators need to be formulated which can be used to measure the various changes. The two main groups are indicators regarding population welfare and food production and agriculture.

These indicators were developed through a participatory process with the community during the numerous interventions and were derived from discussions on livelihood constraints and aspirations as well as later during the detailed planning for the groundwater drought management project undertaken with the with the TCWMC. These indicators include those that have been developed by government health and social development extension workers to monitor community health, nutrition and overall wellbeing.

These indicators, discussed and agreed with the community as part of the RCWMP development, will be monitored by the community. Further indicators will probably result from community discussion and can be added to the RCWMP.

### Population Welfare

The intervention will impact the quality and quantity of water available in the community and, therefore, the population's welfare which can be monitored by institutions in the village (Table 5).

**Table 5 Monitoring of Population Welfare Indicators**

<b>Population Welfare Indicators</b>	<b>Monitored through</b>
Health: Number of diarrhoea occurrences	Periods of illness
	Numbers affected people
Health: Cases of Malnutrition	District Health Team Statistics on the nutritional status of children under five years of age
Destitutes: number of people registered as destitute	Social and Community Development Destitute records
Water Shortage: Need for emergency water supply	Frequency of water bowsering to village
	Period of water bowsering to village
Food shortage: Number of emergency feeding programmes	Frequency of supplementary feeding/distribution programmes
	Period of supplementary feeding/distribution programmes

### Food Production and Agriculture

The interventions will enable the community to increase its food and agricultural production to sustain livelihoods in times of drought. There are six main indicators (Table 6):

**Table 6 Monitoring of Food Production and Agriculture Indicators**

<b>Food Production and Agriculture Indicators</b>	<b>Monitored Through</b>
Number of gardens	Number of gardens
Time spent 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
Water available for domestic use	Weekly observations (documented in diary)
	Document special happening
	Discussion in regular village meeting
	Village observation
Water available for livestock	Daily litres abstracted for livestock consumption
	Weekly observations (documented in diary)
	Document special happening
	Discussion in regular village meeting
	Count cattle/livestock
Good water quality (nitrate level)	Test water quality, including TDS and nitrate
	Observation smell, taste, colour

An overview is given in Table 7 below showing each physical intervention and the respective social indicators. Some interventions will be measured and monitored by the same indicators.

**Table 7 Social Impacts of the Physical Intervention**

<b>Physical Intervention</b>	<b>Social Indicators</b>	
	<b>Food Production and Agriculture</b>	<b>Population Welfare</b>
Sink new large diameter well	Number of existing gardens increased Longer period of working on garden	Health: Number of diarrhoea occurrence stays the same or decrease. Decrease in cases of malnutrition amongst children under the age of 5years. Destitution remains the same or decreases.
Equip well with windmill	Number of months living from garden increased	Water Shortage: Need for emergency water supply decrease
Provide reticulation to elevated tank	More water available for domestic use	
Provide elevated storage tank adjacent to well	More water available for livestock	Food shortage: Number of emergency feeding programmes decrease
Provide reticulation from tank to gardens	Good water quality (nitrate)	
Fencing around gardens		

### Awareness and Training

The awareness programme although not monitored over time had the immediate impact of 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.

In addition, the outcome of the awareness programmes (AP) was also monitored (Table 8):

**Table 8 Awareness Programme Monitoring**

Awareness Programmes	Social Indicator
General Awareness Programme (Stage I)	<ul style="list-style-type: none"> <li>• As a result of the AP the general knowledge of the community concerning groundwater, pollution and drought preparedness improved.</li> <li>• As a result of the AP, the community is motivated to adopt positive water management practices.</li> <li>• As a result of AP, community practices such as littering and indiscriminate disposal of chemicals improved.</li> <li>• As a result of the AP the number of new, environmentally friendly pit latrines being built in the community increase.</li> </ul>
Intervention Operation awareness and training	<ul style="list-style-type: none"> <li>• As a result of greater self-sufficiency from gardens throughout the year, has the socio-economic situation of beneficiary/vulnerable households improved.</li> </ul>
Intervention Operation awareness and training	<ul style="list-style-type: none"> <li>• As a result of the AP and O&amp;M training, are the community and Water Committee sufficiently familiar with physical intervention and know how to maintain and repair it.</li> </ul>

## 7.2 Physical Monitoring Programme

The most assured method of determining the sustainability and usability of groundwater resources is for the community to regularly measure water levels and record all abstractions on a daily basis, especially during drought periods. The continuation of monitoring activities during the period following any prolonged drought is crucial for the community to gain understanding of the rate of recovery of its groundwater resource. Since groundwater cannot be seen, it is only through the monitoring of specific factors that the community will become fully aware of the limitations of the groundwater resources available to it under different climatic conditions.

### 7.2.1 Monitoring Processes and Data Collection

In order that the monitoring of the physical indicators can be undertaken in accordance with a regular schedule and to ensure community 'buy in' and continuity of monitoring beyond the life of the project, it is essential that the monitoring process be undertaken and managed by a member of the community Water Committee, or a responsible Monitoring Operative (MO) appointed by them.

During the initial awareness campaign the community Water Committee will be advised of the role and activities of the MO and the qualifications required for the work such that a suitable candidate can be proposed and appointed. The TCWMC recognises the commitment, dedication and time inputs that will be required from the Monitoring Operative (MO). The TCWMC is thus working on a fundraising strategy to meet the costs of the MO who will not only be responsible for the monitoring aspects of the initiative but will also be responsible for the day-to-day administration and management of the project. The engagement of the MO will be crucial to the success and sustainability of the interventions. The MO will be selected from the core group of participants who have received training in the processes of monitoring, data recording, basic data assessment and communication to the project, as well as basic operation and maintenance procedures related to the intervention.

The MO will be required to visit all monitoring sites on a regular basis, probably once a week (or more frequently in the case of any problems with water quantity or quality), and will make and record the relevant measurements pertaining to the various indicators. This data will then have to be archived by the Water Committee, who will then evaluate the performance of the intervention over time. In addition, the data will be available to the Water Committee to examine and take action if certain indicators reach specific 'trigger' levels that determine resource depletion or quality degradation.

The position and conscientious performance of the appointed MO will be vitally important to the operation and long term performance of the interventions, and will constitute the most critical link between the project and the community on an ongoing basis.

In addition to the MO a number of simple monitoring activities can be undertaken in cooperation with local schools, such as climatic monitoring and even water quality monitoring as part of the normal educational programme. The benefit of this approach is that the data collection can be controlled (through the teacher), can be documented, the children learn about life skills and the benefit of learning. Children speak about their experience in school and enhance the awareness of the family and friends (child-to-child) regarding the rainfall, water resources and the interventions. This method will strengthen the community ownership and responsibility for the intervention and its sustainability. It is envisaged that the involvement of schools will enhance community ownership as well as raise community awareness.

## 7.2.2 Monitoring System

The monitoring system may involve only the MO as representative for the Community Water Committee or other groups (schools, clinic etc) but will be decided upon with the community during RCWMP development meetings.

However, the following basic guidelines will be adhered to in planning and installing the monitoring system.

### Groundwater Monitoring

Intervention	Minimum monitoring requirement	Location of monitoring sites	Measurement method	Indicator
Hand Dug Well	1 No piezometer	Adjacent or within to the well	Electric contact gauge Or graduated rope and ruler	Groundwater level
Pumping Unit	1 No totalising flow meter	Fitted on pump outlet	Record gauge reading	Groundwater abstraction
Tank outlet	1 No totalising flow meter	Fitted on reservoir outlet	Record gauge reading	Irrigation water use

### Climate Monitoring

#### Rainfall

- a. Use a simple rainfall gauge located at the local school where dally measurements become a school activity.

- b. Use a basic tipping bucket recording rain gauge to measure total rainfall plus rainfall intensity and duration. (*data download automatic*)

#### Temperature

- a. Use simple wet and dry mercury thermometers located at the local school where daily measurements become a school activity at set times during the day.
- b. Incorporate temperature sensor into the recording rain gauge (see b. above)

#### Water Quality

##### TDS/Chloride

- a. Use a simple 'taste' test – 'salty' or 'not salty'
- b. Use simple disposable test strips to measure TDS and Chloride
- c. Use hand held battery operated meters to measure TDS and Chloride

#### Rural Water Supply

##### Surface water levels

- a. Depth gauge mounted on road culvert – mark levels of major floods on building or permanent structure with date
- b. Lateral extent of flooding – mark with pegs or stone mounds
- c. Period of flood event

##### Water levels in wells and boreholes (rates of decline during drought and recovery after drought)

- a. Measure depth to water level from a permanent reference point at well or borehole top using a plumbed line and ruler in the absence of a water level dipping tape. Record levels in a notebook

##### Water abstraction rate from well (decline during drought)

- a. Measure time to fill a known volume tank plus water levels at the beginning and end of filling. Measure also the time for water level in the well to recover after filling. The impact of the drought will be indicated by a marked decline in groundwater level and increased difference in well water levels at the beginning and end of the pumping period.

##### Water abstraction rate from reservoir

- a. Record water delivered to and abstracted from the reservoir by recording water levels in the reservoir and recording periods of flow out of the reservoir using an in-line flow meter on the outlet pipe.

### **7.2.3 Monitoring Equipment and Procedures**

In order that a physical monitoring programme can proceed it will be necessary to provide some basic equipment for data collection. This should include any essential instruments and data recording materials (notebooks, writing material etc) as well as facilities for mobility (if necessary) and communication to the data gathering centre (if possible).

Failure to provide such equipment, and incentives, may seriously hamper the longer term monitoring component of the programme.

### **Equipment**

To be sustainable in a rural community environment monitoring equipment should be both robust and simple, with as few technological aspects or power requirements as possible, such that the equipment can be operated and maintained by the Monitoring Operative without outside assistance.

The following equipment is should be provided to the community Water Committee for use by the MO and/or local schools:

- Water level battery operated contact gauge ‘dip meter’ with 2 sets of rechargeable cells and solar operated charger.
- Hand held battery operated water quality meters (TDS and Chloride) with 2 sets of rechargeable cells and solar operated charger. Also standard calibration solution and appropriate beakers etc. *Alternatively, proprietary field water testing kits.*
- 1 years supply of disposable water quality test strips.
- Low cost rainfall and temperature recording gauge (to be established at local school or other secure location).
- Notebooks, graph paper, general stationary, ruler, tape measure, stop watch, satchel or briefcase, bicycle, small hand tools.
- Digital camera with 2 sets of rechargeable cells and solar operated charger.
- Cell phone with solar operated charger.

### **Procedures and Frequency of Monitoring**

The procedures related to the specific monitoring activities and the use of the monitoring equipment will be advised during the awareness meeting with the community Water Committee and the training of the Monitoring Operative.

The frequency of monitoring measurements will vary in accordance with the actual system setup as well as the season and drought occurrence, but water level, abstraction and (some) quality measurements will be required at least once a week. During drought periods this should be increased to daily measurements of water levels in the well. Quality measurements may also be increased if any quality issues arise.

## **7.3 Sociological Monitoring Programme**

Two main monitoring approaches for the sociological indicators will be implemented:

- internal monitoring activities (by community)

- external monitoring visits (by sociologist)

### **Internal Monitoring**

The internal monitoring activities are conducted by different institutions and members of the community as well as by the Water Committee itself with assistance and support from the sociologist. The Water Committee is responsible for the collection of monitoring data produced by households and for in-depth documentation of observations, protocols of repairs and complaints. The exact instruments, methods and time schedule will be discussed with the Water Committee and community during the Stage I and II visits by the sociologist and during discussions of the Community Water Management Plan.

The data will be reviewed together with the project sociologist to assist the Water Committee in analysing the data and developing the required actions or reactions. These reviews will also be shared with the community

Simple observations reported by the community users of the water sources to the Water Committee rather than specific measurements by the MO can be invaluable and can provide important information with respect to intervention performance as well as the groundwater resources. A Water Committee member should also be encouraged to keep a daily diary of events from the beginning of a recognised drought period.

Monitoring could, for example, document water consumption, cases of ill and sick people, their number of livestock etc., with data gathered by the Water Committee and/or Clinic. Depending Sustainable measures to conduct community-based monitoring will be developed.

The following suggestions regarding responsibilities of monitoring are presented here but are open to modification and further development by the community.

**Monitoring of Population Welfare:**

Population Welfare Indicators	Monitored through	Monitored by
Health: Number of diarrhoea occurrence; cases of malnutrition decrease; destitution	Periods of illness	Clinic Social & Community Development Social Welfare Committee Household member
	Numbers affected people	Clinic Social & Community Development Social Welfare Committee Household member
Water Shortage: Need for emergency water supply	Frequency of water bowsering to village	Chief/Headman Village Water Supply Operator Water Committee
	Period of water bowsering to village	Chief/Headman Village Water Supply Operator Water Committee
Food shortage: Number of emergency feeding programmes	Frequency of supplementary feeding/distribution programs	Chief/Headman Social Welfare Committee Water Committee
	Period of supplementary feeding/distribution programs	Chief/Headman Social Welfare Committee Water Committee

**Monitoring of Food Production and Agriculture:**

Food Production and Agriculture Indicators	Monitored through	Monitored by
Number of gardens	Number of gardens	Household member Water Committee Agricultural Demonstrator
Longer period of working on garden	Number of months working on garden	Household member Agricultural Demonstrator
Number of months harvesting crops from garden	Number of months living from garden	Household member Agricultural Demonstrator
Water available for domestic use	Daily litres abstracted for domestic consumption	Household member
	Weekly observations (documented in diary)	
	Document special happening	
	Discussion in regular village meeting	Water Committee Village Water Supply Operator
Water available for livestock	Village observation	Household member
	Daily litres abstracted for livestock consumption	
	Weekly observations (documented in diary)	
	Document special happening	Water Committee Village Water Supply Operator Veterinary Officer
	Discussion in regular village meeting	
Water quality (nitrate)	Count cattle/livestock	Water Committee Household member
	Test water quality	
	Observation smell, taste, colour	

The community Water Committee also needs to be informed in case the community members observe the following:

- less yield and hence abstraction from the groundwater resource over a few days,
- damage or malfunction on the physical interventions,
- change in water colour and/or smell,
- animals and humans fall ill after drinking the water,
- die off or changes in appearance of crops irrigated with the water,
- local vegetation die off in the vicinity of the water sources,
- an increase in health problems, such as occurrence of diarrhoea (possibly due to faecal contamination of the water supply).

The community Water Committee should also keep a record/diary of;

- the initiation of any emergency water supply – frequency and period of water tankering to village.
- emergency support programmes – frequency and period of supply of supplementary feed to local school children, provision of livestock feedstuffs, provision of seeds and fertilizers etc

Once the Water Committee and the community has developed their own monitoring systems and identified the respective persons, this will be documented in the Rural Community Water Management Plan.

### **External Monitoring**

The external monitoring conducted by the country team sociologists will concentrate more on the overall impact of the social and physical interventions.

The external monitoring will be conducted regularly (approximately every 3 months) by the sociologist and will follow the overall project monitoring plan. The methods will range from short standardized questionnaires conducted in monitoring households, observations in the villages, focus group discussions among the community or specific stakeholders. Once a year data gathering will be conducted which will evaluate the benefit of the project physical interventions.

## **7.4 Community Feedback**

The project tries to enhance the ownership among the village community regarding the physical interventions planned by the project but also regarding the water resource. Therefore, an improved communication process between all respective stakeholders is required so that they become actively involved in decision making and solution finding. The Water Community is the essential organ in the community which manages and monitors the interventions on the one side and the needs and demands of the population on the other. A system of information exchange and co-operation needs to be developed or an existing one (village meetings, Kgotla meetings etc.) used where feedback from all sides (community, Water Committee and other stakeholders) can be given on a regular basis (monthly).

The sociologist will assist developing the community monitoring activities during the Stage V of the awareness programme with the community. Suitable meetings for

such an exchange will be identified or established for this purpose and documented in the RCWMP.

#### **7.4.1 From the Community**

The community should monitor and document problems related to the intervention or water in general. Those issues need to be addressed to the Water Committee who will be responsible to take this forward to find solutions. In general village meetings or newly established regular meetings with the Water Committee such topics can be brought forward. It is important that negative (problems, failures) as well as positive incidences (success stories) can be reported in such a forum by anyone from the community. The positive feedback presented in front of others enhances the commitment and believe in the interventions and motivate the community to continue to manage the interventions and the resource in a sustainable way.

Such information and feedback are crucial for the decision making body (Water Committee). Especially in times of drought or prolonged dry seasons this information will establish the basis upon which they will make their decisions and build their management advice.

#### **7.4.2 To the Community**

The forum of exchange needs to offer the possibility of feedback from the Water Committee or other stakeholders outside the community (e.g. project team, Sub-District Council authorities, Water Utilities Corporation, DWA, Sub-District and Village Disaster Management Committee) back to the community. Opinion leaders, students and parents are influential groups in the community who can play a vital role in reinforcing the messages that will be sent through the project. Although the Kgotla will be the cornerstone of all project communication, these stakeholders will be an additional mechanism for the feed-in and feed-back processes of the initiative.

In times of drought it is the Water Committee which will make decisions on how to manage the resource and how to react and find new solutions based on the feedback and information given by the community. Other ways of how to feed information back in the community can be found, e.g. through Kgotla meetings, Parent Teacher Association meetings and leaflets.

### **7.5 Monitoring Database, Data Evaluation and Project Reporting**

#### **7.5.1 Physical Data**

Monitoring data gathered and archived by the community MO will either be collected from the community by the sociologist during their monitoring visits (see below) or dispatched to the project by mail by the MO in accordance with project instructions. These data will then be incorporated into the project database for evaluation.

Physical monitoring data evaluation will take the form of a regular (bi-annual) review of a data quality and highlights, trend analysis and an assessment of the groundwater resource in terms of quantity and quality. This review will feed into the project reporting in order to assess the success of the project intervention as well as to identify shortcomings and 'lessons learned'.

#### **7.5.2 Sociological Data**

Virtually all of the sociological indicators will be monitored by members and institutions of the community itself. In the beginning (every three months) the internally gathered data will be reviewed during monitoring visits of the project sociologist to assist the Water Committee in analysing the data and developing the required actions or reactions.

Once a year data gathering will also be conducted which will evaluate the benefit of the project interventions as formulated in the following indicators:

- As a result of the Awareness Programmes has the general knowledge of the community concerning groundwater, pollution and drought preparedness improved?
- As a result of the Awareness Programmes and O&M training, are the community and Water Committee sufficiently familiar with physical intervention and know how to maintain and repair it?
- As a result of greater self-sufficiency from gardens throughout the year, has the socio-economic situation of households improve?

The methods with which to gather the data will range from short standardized questionnaires conducted in monitoring households, observations in the villages, and focus group discussions among the community or specific stakeholders.

All sociological data will be analysed and stored by the by the SADC Groundwater Management Institute. A feedback to the community and Water Committee will be given periodically.

### **7.5.3 Project Reporting**

It is envisaged that brief monitoring reports will be produced following the 3 monthly visits to the community. Such reports will document the internal and external monitoring data, will assess the status and sustainability of the interventions and will form the basis for feedback to the community and other stakeholders.

## 8. Management Actions

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 groundwater resources.

### 8.1 Monitoring ‘Triggers’ and Early Warning

Appropriate triggers can only be learned from experience and analysis of monitored data including critical well levels. These should be combined with health, food and agricultural indicators as created in due course. This should not be a difficult exercise as the community recognises critical conditions in each of these 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 be provided with an early warning of potential problems through data generated from the monitoring process. Data include groundwater depletion, reduction in water quality and/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 definition of these ‘triggers’ and the decisions and actions that should follow are one of the most crucial aspects of the RCWMP and will be discussed extensively with the community during the RCWMP development.

The primary 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.

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.

The relationship between water availability and crop production is shown in Figure 3, together with observable impacts that could act as ‘triggers’ for early warning community action and decision making. Figure 3 indicates that groundwater will still be available for garden crops during a drought, but that after a prolonged dry period the volume of groundwater available for gardens will probably reduce, with consequent reduction in harvest. Quantitative monitoring triggers will, after a period of monitoring, be developed for each intervention. These will relate to groundwater levels (source depletion), pumping amounts and water quality. They will be characterised by definition of specific values of water level, abstraction or quality beyond which a line of community Water Committee action must be taken.

### 8.2 Action Plan with respect to ‘Triggers’

Once specific monitoring triggers have been defined in co-operation and discussion with the community a plan of action should be defined in the RCWMP. This plan needs to be devised in consultation and agreement with the community as many parts of the community will be affected when the plan is implemented.

Each monitoring trigger will be fully explained and discussed with the Community Water Committee and possible regulatory interventions and actions will be developed. Actions may be simply physical and individual (taking less volume of water for use; re-using or re-cycling water in the household) or may require more concerted social cooperation with respect to overall abstraction from particular sources, changes in usage practises etc.

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).

It must be explained clearly during community discussions that the actions to be taken with respect to water supply are for the benefit of the whole community and will help maintain their livelihoods during times of water stress (drought). Community ‘buy in’ to this concept is needed if the interventions and monitoring are to be meaningful to the community.

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).

### 8.3 Stakeholders

The Tsetsebjwe community recognises several internal and external stakeholders associated with this project initiative. Tsetsebjwe is not a homogeneous community and the different social groups that make up the community have been further delineated. This process was seen as critical in future decision-making processes of the TTCWMC specifically around issues of project participation and benefit sharing. There is general awareness of stakeholder interests, expectations, the extent to which the project can meet these and potential opportunities for forging strategic linkages within the institutional environment that can contribute to the long-term sustainability of the project initiatives.

Stakeholder	Conditions/Problem Issues	Interests and Expectations from the Project	Can the project meet stakeholder expectations
Tsetsebjwe residents	<ul style="list-style-type: none"> <li>Water shortages during breakdowns</li> <li>Poverty and food insecurity</li> <li>Cyclic droughts which negatively affect livelihoods</li> <li>Unemployment especially amongst youth.</li> <li>Inadequate skills in to enable high arable and livestock productivity</li> </ul>	<ul style="list-style-type: none"> <li>Access to water to improve livelihoods</li> <li>Access to employment opportunities for livelihood improvement.</li> <li>Access to expertise and skills in agricultural development</li> </ul>	Yes. Through improving access to drinking water; livestock water during drought spells; enhancing household food security and the creation of employment opportunities.
Tsetsebjwe youth	<ul style="list-style-type: none"> <li>High unemployment</li> <li>Lack of skills and experience in agriculture</li> <li>Lack of capacity and guidance on income generating projects</li> <li>Lack of access to land and water resources to access agricultural development funding.</li> </ul>	<ul style="list-style-type: none"> <li>Access to employment opportunities</li> <li>Access to income generating opportunities</li> <li>Participation in agricultural development initiatives</li> </ul>	Yes. Through facilitating youth access to land, water resources and access to employment on the project.
Arable Farmers	<ul style="list-style-type: none"> <li>Low crop yields due to low rainfall and drought.</li> <li>Insufficient skills in drought coping strategies</li> <li>Lack of skills to increase arable productivity and diversify production</li> </ul>	<ul style="list-style-type: none"> <li>Access to water resources to produce high value crops e.g. livestock fodder.</li> </ul>	Yes. Through developing and following guidelines of the use of the land for arable farmers.
Livestock Farmers	<ul style="list-style-type: none"> <li>Lack of livestock water especially during drought periods.</li> <li>Low yielding and drying up of boreholes.</li> <li>Lack of supplementary feeding.</li> <li>Lack of access to the BMC livestock market due to the frequency of foot and mouth disease (FMD) in the area.</li> <li>Insufficient skills to improve livestock management and productivity</li> </ul>	<ul style="list-style-type: none"> <li>Access to livestock water during periods of drought</li> </ul>	Yes. Through developing and following clear guidelines for use of the project water resources.
Poor, vulnerable social groups (PLWHAs; People Living with Disability; Orphans; Destitutes)	<ul style="list-style-type: none"> <li>Lack of capacity to fully participate in the development process.</li> <li>Lack of food, income and employment.</li> <li>Inability to access water during shortage and breakdowns due to their physical disability and/or fragility.</li> <li>Lack of money to purchase water during breakdowns and shortages.</li> </ul>	<ul style="list-style-type: none"> <li>Access to water at all times.</li> <li>Access to food at all times</li> </ul>	Yes. Through supplying them with some of the food produced by the project.

Village Leadership (Dikgosi)	<ul style="list-style-type: none"> <li>Lack of co-ordination and cooperation on development issues.</li> </ul>	<ul style="list-style-type: none"> <li>That the project benefits needy members of the community.</li> <li>That the project is well managed, successful and impacts positively on community livelihoods.</li> </ul>	Yes. Through effective leadership and co-operation across village institutions.
Village Development Committee (VDC)	<ul style="list-style-type: none"> <li>Lack of openness, transparency and following the right procedures regarding the powers and role of other village level institutions.</li> </ul>	<ul style="list-style-type: none"> <li>That the Community Water Management Committee (TCWMC) implements its role effectively and delivers on the mandate of the project.</li> </ul>	Yes. Through clear role clarification, effective co-ordination and co-operation with all village development structures.
TCWMC	<ul style="list-style-type: none"> <li>Challenges implementing their role.</li> <li>Lack of leadership and recognition of the role of the TCWMC by some project participants during the construction stage of the physical interventions.</li> <li>Lack of resources to efficiently implement the TCWMC's role.</li> </ul>	<ul style="list-style-type: none"> <li>Role clarification especially between the TCWMC and the VDC.</li> <li>Acknowledgement and respect for the role of the TCWMC.</li> <li>Support and capacity building for the effective implementation of the TCWMC's role.</li> <li>That the project succeeds through achieving its objectives.</li> </ul>	Yes. Through the acknowledgement of the role of the TCWMC; support and capacity building of the committee.
District Agricultural Office	<ul style="list-style-type: none"> <li>Low productivity resulting in reduced impact on agricultural production.</li> <li>Insufficient community development skills</li> </ul>	<ul style="list-style-type: none"> <li>To see the project compliment the objectives of the agricultural sector.</li> <li>That the project achieves its intended results.</li> </ul>	Yes. Through providing effective support and training to the community groups implementing the project.
District Health Authorities	<ul style="list-style-type: none"> <li>Inadequate capacity to deliver efficient health services.</li> <li>Low productivity resulting in limited impact on community health.</li> </ul>	<ul style="list-style-type: none"> <li>Improved community health and hygiene</li> <li>Clean project environment</li> </ul>	Yes. Through awareness building on health and hygiene issues in the community.
Water Utilities Corporation	<ul style="list-style-type: none"> <li>Insufficient water resources</li> </ul>	<ul style="list-style-type: none"> <li>Improved access to clean and safe water.</li> <li>Conservation of water resources</li> </ul>	Yes. Through advisory services on water management and conservation
SADC Groundwater Project	<ul style="list-style-type: none"> <li>Insufficient water in the Limpopo river basin.</li> </ul>	<ul style="list-style-type: none"> <li>Conservation and monitoring of groundwater resources.</li> <li>Improvement of community livelihoods.</li> <li>Efficient drought management strategies in the community.</li> <li>Efficient management of the ground water drought management physical interventions.</li> </ul>	Yes. Through community capacity development on the management of the physical interventions as well as in groundwater monitoring techniques.

### 8.3.1 Community Interaction with External Stakeholders

As part of the management and decision-making process the community Water Committee will hold discussions with regulatory stakeholders others so as to report the status of water resources at times of increasing water stress. These lines of communication will be established during the implementation of the interventions.

As part of the awareness programme the Community Water Committee will receive training regarding the communication with authorities and regulatory stakeholders in the region such that the community Water Committee will know to whom and what to report. A documented communication process will be developed with the Community Water Committee that sets out lines of communication with both external stakeholders as well as the community itself.

This communication is a primary function of the community Water Committee as, at times of water stress, there has to be a route that triggers external emergency intervention, be it provision of water by tanker and / or provision of food aid. In addition, assistance from non-community stakeholders for repair of equipment (pumps, etc) may also be necessary. Further external aid may also be needed at times of decreasing water stress to aid recovery of the community, e.g. provision of seed and fertilizer and assistance with stock purchase.

The Botswana government has an Early Warning System that has been set up as a decision-making tool for enhancing drought preparedness, mitigation and management. The system includes prediction to forecast the possible crisis; monitoring to identify the changes taking place; the response to decide on the appropriate actions to prevent a crisis and the assessment of impacts to measure the success of the response.

Governments' drought relief interventions have over the years sought to prevent human deaths brought on by drought; prevention of a decline in nutritional levels particularly for vulnerable social groups (PLWHAs, TB patients, adults with chronic ailments that affect their ability to get food, orphans and vulnerable children); emergency water supply for human consumption; as well as addressing the challenges of crop and income losses as a result of drought through labour based programmes. The GWMC will work closely with the Village Disaster Management Committee and Village Extension Team to plug into the governments' Early Warning System.

**Figure 4 Relationship between Water Availability and Crop Production**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun													
Season	Normal Wet Season						Normal Dry Season						Drought - rains fail																					
Rainfall	**	****	*****	****	***	**	*						*	*	*																			
Rainfed Crops	Planting		Crop Growth				Harvest						Little planting		Crop failure																			
Garden Crops	Harvest						Plant		Grow		Plant		Grow		Plant		Harvest fails		Plant		Harvest													
Surface Water availability	***	****	*****	****	****	***	***	***	**	**	*	*																						
Ground Water availability	**	***	*****	*****	*****	****	****	****	***	***	***	**	**	**	**	**	**	**	*	*	*													
Impact	Natural vegetation with first rainfall		Good crop growth				Good harvest		Start irrigation cycle of garden crops		First garden crops harvest		Most surface water dams dry		Second garden crops harvest		Natural vegetation with first rainfall fails		Crops wither		Cattle start dying -lack of fodder		Garden crops harvest		Wells start drying up, boreholes have reduced yields		Garden crops harvest		Boreholes begin to fail		Central Government declare drought		Water bowsering, emergency food relief	
<b>Triggers</b>	Failure of first rains - little planting - initiate monitoring of water levels in wells and sand river												1																					
	Total crop failure - move to drip irrigation of crops - waterconservation measures												2																					
	Livestock mortalities - due to lack of fodder - move cattle towards the Shashe												3																					
	Surface water all dry - wells start drying up - reduced demand for livestock water												4																					
	Groundwater levels decline in boreholes - total reliance upon garden crops												5																					
	Drought declared by national authorities - emergency water supply and food supply measures put in place												6																					
	Domestic water supply chemical quality may decline - water bowsered for human use, water frm remaining groundwater sources used for gardens												7																					
	Garden cropping reduced yield - supplemented by emergency food distribution																																	

## 9. Concluding Statement

The empowerment of rural communities to operate and maintain their own water supplies and to sustain and enhance their livelihoods during usually devastating periods of drought is a major goal for most developing countries. The key to achieving this goal is to transfer knowledge and instil a sense of responsibility to the community, defined and ordered by means of a Rural Community Water Management Plan specific to each community's needs, abilities and aspirations.

The concept of community management of water supplies is not new and has been tested in other projects and environments, but the current project is piloting this approach specifically with respect to the improved utilisation of groundwater during periods of drought. Drought is one of the scourges of rural communities in developing countries, bringing starvation and massive health problems, and any mitigation of these devastating effects, no matter how small, can only be welcomed.

With the aforementioned perspective in mind, the Rural Community Water Management Plan, as envisaged in this Planning Process document, is considered the best possible means of achieving the various components of the principle objective set out in Section 2. These components are:

- To facilitate better community management of the water sources.
- To improve community well being.
- To build linkages with stakeholders.
- To measure intervention success.
- To serve as guidelines for replication elsewhere in SADC.

This Process Planning document is based on baseline information gathered during physical investigations and initial interaction with the community. Further development and refinement of this information and continued dialogue with the community and other stakeholders will be necessary for the RCWMP to develop and evolve to a workable entity. All stakeholders involved in the intervention and monitoring phase agree that the RCWMP is the optimum way to proceed and that it is likely to produce the best outcome.

However, it is recognised that there are a number of assumptions that have had to be made, not least that the community will continue to act in accordance with the RCWMP. It is also assumed that no other external influences will impact the community during the intervention and monitoring phase. Given these assumptions and uncertainties, the Plan as envisaged is nevertheless applicable and achievable and is seen as the optimal approach towards a successful set of outcomes for the project as a whole.

The RCWMP template as contained in Annex C is viewed as a prototype Plan template for use in intervention phases elsewhere in the project. It is critically important that this prototype Plan is robust, clear and transparent, whilst at the same time simple and non-technical enough to be accepted and managed at community level. It may be, however, that some aspects of this prototype Plan template will need to be modified to be more 'community specific' as both physical and sociological intervention as well as monitoring proceed. However, it is hoped that such modification will only be of a minor nature and will not negate the application of the template across all the Nodal Point communities.

## Annex A Overview of Physical Interventions in Tsetsebjwe

### Intervention overview

Tsetsebjwe									
A	Physical Intervention	Objective	Social Intervention	Other engineering input	Target audience	Social indicator	Indicator showing change	Method to monitor indicator	Time line to monitor indicator
1.	Sink new large diameter well	Livestock watering and enhance gardening	- AP General - AP Sand weirs - Agricultural training	- O&M sand weir	- Community - Water Committee	- Number of existing gardens increased - Longer period of working on garden - Number of months living from garden increased	- Number of gardens - Number of months working on garden - Number of months living from garden	- Count gardens - Interviews (external) - Documented Observations (HH members)	- Once a year
2.	Equip well with windmill	Livestock watering and enhance gardening	- AP General - AP Sand weirs - Agricultural training	- O&M well	- Community - Water Committee	- Number of existing gardens increased - Longer period of working - Number of months living from garden increased - More water available for domestic use	- Number of gardens - Number of months working on garden - Number of months living from garden - Evaluation by household	- Count gardens - Interviews (external) - Documented Observations (HH members) - Interviews (external) - Documented Observations (HH members)	- Once a year
3.	Provide reticulation to storage tank	Livestock watering and enhance gardening	- AP General - AP Sand weirs - Agricultural training	- O&M sand weir, well, wind mill, reticulation system, surface tank	- Community - Water Committee	- Number of existing gardens increased - Longer period of working on garden - Number of months living from garden increased - More water available for livestock - Good water quality (nitrate)	- Number of gardens - Number of months working on garden - Number of months living from garden - Evaluation by household - Water quality test (esp. Nitrate test)	- Count gardens - Interviews (external) - Documented Observations (HH members) - Interviews (external) - Documented Observations (HH members) - Water quality testing (external and by committee)	- Once a year - Monthly - Monthly
4.	Provide storage	Livestock watering and	- AP General - AP Sand	- O&M sand weir, hand pump	- Community	- More water available for domestic	- Evaluation by household	- Interviews (external) - Documented	- Once a year

Tsetsebjwe									
A	Physical Intervention	Objective	Social Intervention	Other engineering input	Target audience	Social indicator	Indicator showing change	Method to monitor indicator	Time line to monitor indicator
	tank adjacent to well	enhance gardening	weirs - Agricultural training		- Water Committee	use - Number of existing gardens increased - Longer period of working on garden - Number of months living from garden increased from garden increased	- Number of gardens - Number of months working on garden - Number of months living from garden	Observations (HH members) - Count gardens - Interviews (external) - Documented Observations (HH members)	
5.	Provide reticulation from tank to livestock water points and gardens	Livestock watering and enhance gardening	- AP General - Agricultural training	- O&M well, hand pump,	- Community - Water Committee	- More water available for domestic use - Number of existing gardens increased - Longer period of working on garden - Number of months living from garden increased	- Evaluation by household - Number of gardens - Number of months working on garden - Number of months living from garden	- Interviews (external) - Documented Observations (HH members) - Count gardens - Interviews (external) - Documented Observations (HH members)	- Once a year
<b>B Other</b>									
6.	Irrigation system for gardens	Enhancing gardens	- Agricultural training		- Community - Water Committee	- Longer period of working on garden - Number of months living from garden increased	- Number of months working on garden - Number of months living from garden	- Interviews (external) - Documented Observations (HH members)	- Once a year
7.	Fencing around gardens	Enhancing gardens	- Agricultural training		- Community - Water Committee	- Longer period of working on garden - Number of months living from garden increased	- Number of months working on garden - Number of months living from garden	- Interviews (external) - Documented Observations (HH members)	- Once a year
<b>C Overall</b>									
						- Due to AP the general knowledge of the community concerning groundwater, pollution and drought	- More households know about drought preparedness strategies - More households know about	- Interviews (external)	- Once a year

Tsetsebjwe									
A	Physical Intervention	Objective	Social Intervention	Other engineering input	Target audience	Social indicator	Indicator showing change	Method to monitor indicator	Time line to monitor indicator
						preparedness has improved	factors contaminating the groundwater		
						- Due to auto-consumption from gardens throughout the year, the socio-economic situation of households improved	- Less problems concerning food - Less problems concerning water supply	- Interviews (external) - Documented Observations (HH members)	- Once a year
						- Due to AP and O&M training, community and Water Committee are familiar with physical intervention and know how to maintain and repair it	- Number of breakdowns - Number of needed repairs - Type of repair	- Documentation by Water Committee/responsible person (report book) - External monitoring visits	- weekly/monthly basis - every 3 months, yearly (?)

## Annex B Overview of Sociological Interventions in Tsetsebjwe

### Overview of Sociological Interventions in Tsetsebjwe

Tsetsebjwe						
I	II	III	IV	V	VI	
AP General	CBO training, creation	AP Sand weir	Agricultural training	Monitoring and Feedback Agreement	Monitoring visits	
<p><b>ons</b></p> <p>a) Sink new large diameter well            b) Equip well with windmill            c) Provide reticulation to elevated tank            d) Provide elevated storage tank adjacent to well            e) Provide reticulation from tank to gardens            f) Fencing around gardens</p>						
<p><b>oup</b></p> <p>Community key multipliers (teachers, priests, traditional leaders), CBO, govt. structures (to be informed)</p>	CBO	Community CBO	Community, key multipliers, CBO	Community, key multipliers, CBO	Community key m CBO	
1 day, initial community visit,	1-2 days	1 day	To be decided	1-2	1 day visit (every	
<b>ted by</b>	Botswana Team Sociologist/ Engineer	Botswana Team Sociologist/ Engineer	To be decided	Botswana Team Sociologist/ Engineer	Botswana Team Sociologist/ Engineer	
<b>f tation</b>	Community meeting Smaller focus groups (maybe women separately)	Workshop	Community meeting Smaller focus groups (maybe women separately)	To be decided	Workshop	<ul style="list-style-type: none"> <li>- meeting with CE</li> <li>- check their data</li> <li>- meet with comm</li> <li>- focus group disc</li> <li>- questionnaires</li> <li>- visit community</li> </ul>

**Annex C Rural Community Water Management Plan Template****RURAL COMMUNITY WATER MANAGEMENT PLAN TEMPLATE****1. Introduction****2. Principles of the Plan****3. Goal and Objectives of the Plan****4. Community Overview**

*taken from Planning Process document – abbreviated or newly gathered during community participation discussions*

*To include the following subheads:*

- Location
- Community Characteristics
- Demography
- Community Amenities
- Community Economic Activities
- Water Management Structures
- Rural Water Supply Stakeholders
- Water Stakeholder Interactions
- Drought Awareness and Coping Mechanisms
- Community Perception of Drought
- Current Coping Mechanisms
- Future Drought Mitigation Measures
- Community Water Supply
- Existing Water Supply System
- Additional Drought Mitigation Water Supply Structures (Piloted)

**5. Community Water Management Plan**

*To include the following subheads:*

- Plan Administration
- Plan Implementation and Monitoring
- Physical Monitoring
- Social Monitoring
- Awareness
- Training
- Feedback Mechanisms
- O and M Plan
- Plan Actions/Strategy

**6. Plan Proponents and Signatories**

*To include a list of persons who assembled the plan (community and project) plus a signature page for community 'sign up'*