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BASELINE SURVEY AND ASSESSMENT FOR WATER AND SANITATION DEVELOPMENT AND REHABILITATION PROJECT IN BARI REGION, PUNTLAND

FINAL REPORT

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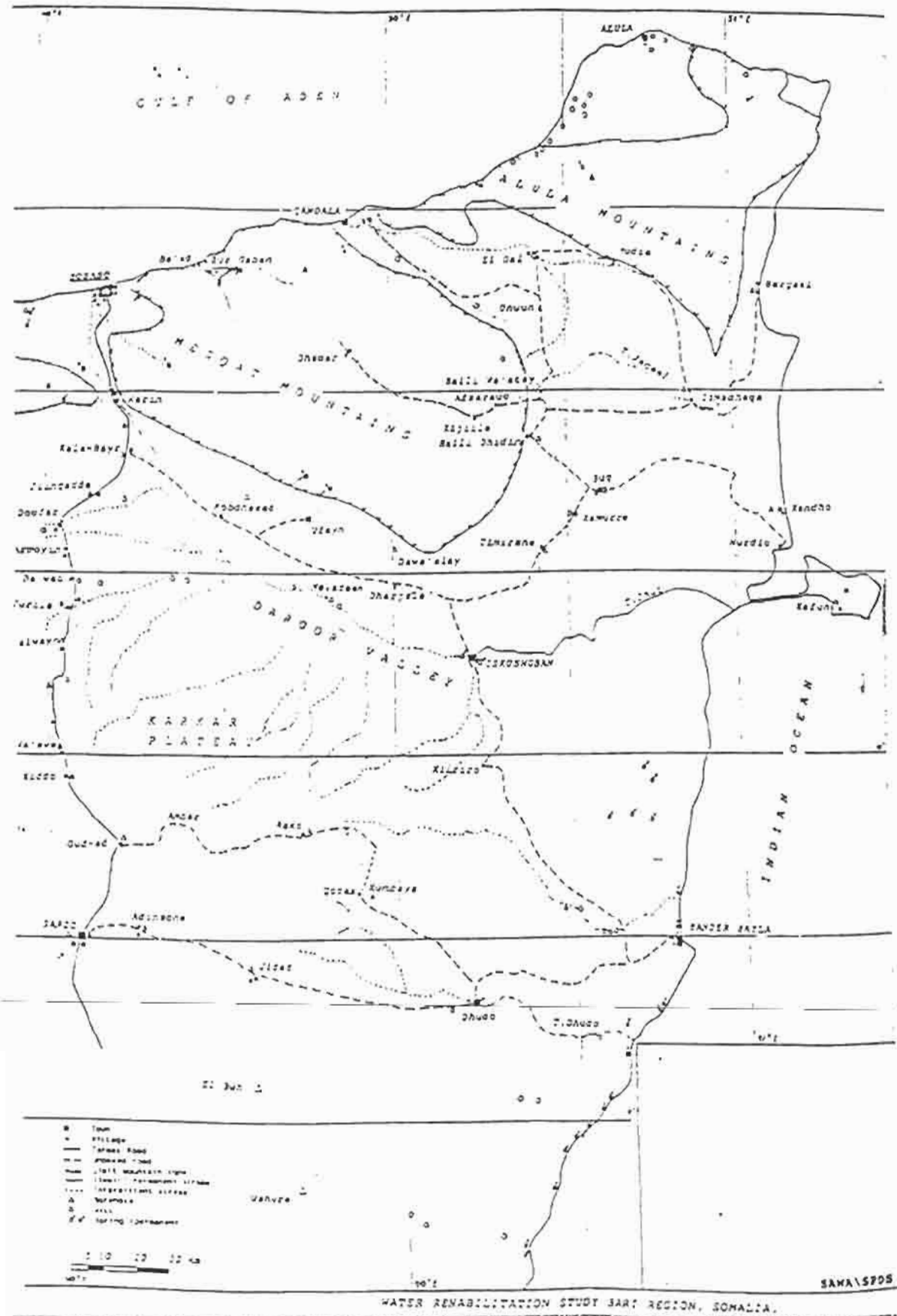

WATER REHABILITATION STUDY BARI REGION, SOMALIA.

List of Abbreviations and Acronyms

µS/cm	- Micro-Siemens / centimetre
ADRA	- Adventist Relief and Development Agency
CARE	- Co-operative for American Relief Everywhere
CEFA	- European Committee for Agricultural Training
DEPHA	- Data Exchange Platform for the Horn of Africa
DGIS	- Directorate General for International Co-operation (Dutch)
EC	- European Commission
EU	- European Union
FAO	- Food and Agriculture Organisation
FSAU	- Food Security Assessment Unit
GB	- Great Britain (also UK – United Kingdom)
GTZ	- Geselschaft Technische Zussamenarbeit (German Technical Co-operation)
Ha	- Hectare
ICRC	- International Committee of the Red-Cross
IDP	- Internally Displaced Person(s)
K-Rep	- Kenya Rural Enterprise Programme
kW	- KiloWatt
m^3	- Cubic metre
mg/l	- milligrams/litre
NFI	- Non-Food Items
NGO	- Non Governmental Organisation
O&M	- Operation and Maintenance
OGB	- Oxfam Great Britain
OTP	- Ocean Training and Promotion
PEER	- Programme for Emergency Education and Reconstruction
pH	- Potential of Hydrogen (a measure of the acidity or alkalinity of a solution)
PRA	- Participatory Rural Appraisal
PSAWEN	- Puntland State Agency for Water, Energy and Natural Resources
RRA	- Rapid Rural Appraisal
SACB	- Somalia Aid Co-ordination Body
SAWA	- A Dutch International NGO
SORSO	- A local NGO experienced in agricultural projects
SS	- Somali Shilling
UNA	- Una teera mondo di tutti (International Italian NGO)
UNDOS	- United Nations Development Organisation for Somalia
UNDP	- United Nations Development Programme
UNESCO	- United Nations Educational, Scientific and Cultural Organisation
UNICEF	- United Nations Children's and Education Fund
UTM	- Universal Transverse Mercator
VDC	- Village Development Committee
WFP	- World Food Programme

Glossary of terms

Berkad	Small ground tank for surface water collection and storage; mostly lined with concrete.
Togga / Lagga	Stream bed of a wadi or ephemeral river (sometimes valley).
Waro / Wharo	Large ground water catchment for surface water collection and storage, mostly unlined – sometimes called balley or water pan.

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1. INTRODUCTION

1.1 Activities of Oxfam Great Britain in Somalia

Since the collapse of the Somali government in 1990, Oxfam Great Britain (OGB) has been involved in assisting peaceful Somali communities in Somaliland to reduce their vulnerability and increase their self-reliance in water supply and sanitation. Concurrent to the overall objective of OGB to reduce poverty through water development in Somaliland, it is the intention of OGB to address related issues elsewhere in Somalia as and when the peace and stability situation on the ground permits.

Over the past few years (1998 – June 2001), the political situation had improved and was characterised by relative peace and stability, which had attracted the attention of OGB among several other donors who had hitherto kept away. Following an assessment of the socio-economic and political conditions in Bari Region of Puntland State of Somalia, OGB designed this project with the thrust on water and sanitation activities in Puntland, with European Union (EU) funding. OGB subsequently commissioned ETC East Africa (ETC-EA) to conduct this *Baseline Study and Assessment for Water and Sanitation Development and Rehabilitation in Bari Region, Puntland State, Somalia*. However, the political situation worsened from June 2001 and deteriorated in November 2001 whereby all expatriate staff were recalled from Puntland thereby hampering progress of the projects, including the nascent OGB project. The situation only returned to normal towards the end of February 2002. At present the Government of Puntland is displaced from Garowe the administrative capital to Bosaso.. Some stability is starting to show and development activities are now restarting.

1.2 Objectives

1.2.1 Project Objectives

As one of its objectives for intervention in the development of Puntland, OGB wants to *enhance peace and stability through increasing self-reliance in water supply among the various communities*. The overall objective of the project is therefore ***to contribute to the process of social rehabilitation and strengthening the community's ability to manage their own affairs in terms of ensuring sufficient availability of water and better sanitary conditions***. The proposed project will enable communities in the selected project areas to have access to increased quantity of hygienically acceptable water.

This project, as a water and sanitation intervention therefore, is planned to address the water and sanitation problems in the intervention areas by:

- Extending the duration for which water will be available in the villages by increasing the water holding/maintaining (storing) capacity of existing berkads and by helping the community to construct new ones where appropriate,
- Increasing the awareness of the community about the need for consideration of sanitation issues and integrating sanitation activities in all water related activities, and
- In close co-operation with other agencies (like Africa-70) involved in sanitation activities, intensively engaging the (urban) communities in sanitation awareness activities and assisting the local authorities to take up the matter in a sustainable manner.

The project idea was to adopt the same formula as used by OGB in Somaliland, whereby OGB made outlay payments to communities to construct / rehabilitate physical structures, which on a revolving fund basis, reach other beneficiaries not only for water projects but also spin off to other development activities. However, the economic status of the community in the rural population in Puntland has been greatly eroded by a serious drought that has run for 2 years, coupled with a ban on livestock exports, a cost sharing approach would be considered until the situation improves. Prior to involvement in the implementation of physical structures, efforts will be made to establish and strengthen village development committees (VDC) up to a level where they are able to manage their development activities in general and water resources in particular in a sustainable manner.

1.2.2 Study Objectives

From the brief received from OGB and the Terms of Reference (TOR) (Annex 1), the assessment is meant to generate a better understanding of the water and environmental sanitation situation in Bari Region, particularly the three districts of Bosaso, Gardo and Iskushuban. The study would also provide a way forward for facilitating sustainable access to water and sanitation facilities in the area. As berkads are the preferred technology by the community, special focus would be aimed at this technology, which is the most important water source in the area; this will also include an understanding of the community ownership of the berkads.

Whereas on the one hand this assessment may be viewed as a purely technical (engineering) exercise, experience gained by ETC-EA in Somalia indicates that the sustainability of water projects is influenced by a complex combination of social, economic and political factors. An important element of the assessment will therefore be considerations of factors such as nomadism, community mobilisation and management (socio-engineering), credit availability and the overall rural financial landscape. It is notable that Bari Region is the main trading corridor, serving central and part of southern Somalia for livestock exports to the Middle Eastern states. Water and sanitation are therefore key considerations for the selected project area. This project has been sanctioned by the state as it blends well with the state policy for water development in Puntland State of Somalia.

1.3 State Policy on Water Sector Development: A New Manifesto

The young Puntland State of Somalia recognises that the state faces several serious socio-economic problems that call for urgent action if current trends in poverty and underdevelopment are to be halted. The crucial role played by water in contributing towards wished development goals is widely acknowledged. On the face of it, water is a precious natural resource, vital for life, development and the sustenance of the environment. When supplied in the right quantity and quality, it can lift people out of the degradation of having to live without access to safe water and acceptable levels of sanitation, and in this way bring prosperity directly and indirectly to many.

In realisation of the crucial role played by water in development, the Government has drafted a guide to investment in the water sector[1]. The paper presents an inventory of water resources in the state and estimates the potential for water development to cater for all future needs - human, livestock and irrigated agricultural production. To be effective, this guide will require a clear investment policy and progression that among

[1] See Khalif Nur Ali (Qonof), Puntland Water Energy and Natural Resources Corporation (PSAWEN), *Guidelines for Planning Inventory for Existing Water Sources in Puntland State of Somalia*, Bosaso, 2002/2003.

other things will mainstream donor investment and gender issues into the sector. It will also require institutional arrangements and management practices that will, above all, adhere to the following critical success factors:

- Openness, transparency and accountability in the decision-making process.
- Political will, public awareness, grassroots support and individual commitment among all.
- Appreciation of the various development challenges and a clear understanding of where the water sector is, where it is required to be, and how it can be steered to get there. The vision should ensure that in future water is available in a sustainable way and at quantities that ensure adequacy in quantity and quality to meet competing demands in the long term. Investment therefore should be guided accordingly.
- The adoption of sustainable financing and cost recovery methods that are equitable and sustainable, while at the same time reflecting the concerns of the poor and vulnerable.
- Ability to generate and receive knowledge and information.

To achieve this vision calls for:

- Improving and strengthening governance in the water sector,
- Improving water wisdom and knowledge,
- Instituting measures to meet urgent water needs, and
- Strengthening the financial base for increased future investment in the water sector.

To ensure that communities are involved in decision-making in all stages of the development process, a bottom-up participatory approach should be adopted. This means that the approach should incorporate participatory research, stakeholder consultations through workshops and other forums, and use of various media for disseminating information. The principal players in this drama will be Regional Water Co-ordinators and staff in the Water Authorities, Directorate of Natural Resources and various donors such as the European Union who have funded this study, as well as project implementers such as Oxfam UK. Besides guiding the investment, they have to continue with research, and so lay a firm planning foundation for future investors in the sector. This development should aim to fully adhere to the Dublin-Rio Principles formulated in 1992 as follows:

a) Fresh water is a finite and vulnerable resource, essential for sustaining life, development and the environment.
b) Water development and management should be based on a participatory approach, involving users, planners and policy makers at all levels.
c) Women play a central role in providing, managing and safeguarding water.
d) Water has an economic value in all its competing uses and should be recognised as an Economic Good and also as a social good.

The state has also prepared a policy paper[2] that further underscores the need for development to be a people-driven process. The paper notes that this is fundamental as is confirmed by world-wide experience that the provision of services in poor communities will fail if the people themselves are not directly involved. The involvement and empowerment of people is thus a cornerstone of the approaches proposed. One step towards achieving this ideal is the education and democratisation of the institutions at community and other levels of the water sector.
Since water in particular can easily become a focus for conflict within and between communities, the development of effective delivery mechanisms must contribute to the

[2] PSAWEN. *Water Supply Policy Green Paper.* A discussion Paper for Review, Bosaso, February 2001.

principle of achieving peace and security for all. As noted above, OGB subscribes to this ideal and further sees the development and sustainability of a water infrastructure as a way to ensure steady economic growth.

The overall policy adopted by the State covers at least four mutually related factors required for development:

- Physical infrastructure: water supply, sanitation, roads, electricity and communications.
- Social infrastructure: schools, hospitals, clinics and welfare organisations.
- Economic infrastructure: employment, production and trading base including access to markets and finance.
- Institutional infrastructure: organisational and civil administration structures at all levels.

The role that communities must play in their own development was given its due attention by the Abidjan water conference, where it was agreed that for sustainable progress, particularly in rural development projects, there was a need for:

- Involvement of communities in the planning, design, financing, construction and maintenance of improved water supplies, with women's groups taking the leading role;
- Use of public and private sector resources to provide initial training and long-term support, so as to create an environment in which community management can function successfully; and
- Choice of affordable, sustainable technology.

Until recently, cost recovery policies in the water supply sector world-wide were dominated by a view that is now seen as largely outdated: the premise that neither rural nor peri-urban communities could afford to pay for services.

An insistence that disadvantaged people should pay for improved water services may seem harsh but the evidence indicates that the worst possible approach is to regard poor people as having no resources. This leads to people being treated as the objects rather than as the subjects of development; it generates proposals for unaffordable subsidies which tend to reach only those with influence, leaving the situation of the majority unchanged. Promises of free services for all have, in practice, usually resulted in some service for a few and little or none for most. A key element influencing a household's willingness to pay for an improved water supply is the households' sense of entitlement to Government services and their attitude toward Government policy regarding water supply and sanitation. In general, communities are reluctant to involve themselves in countries where the perception prevails that it is the Government's responsibility to provide services.

Besides the establishment of a policy framework and the setting and monitoring of policy goals, central Government agencies still have vital supportive functions to perform in the areas of training, information dissemination, and technical and managerial assistance. In addition, they continue to have an important role in the targeted allocation of finance to achieve public goals. By initiating this project OGB is aware of the thrust of government policy and will indeed conform for the common good of all the targeted communities. This policy framework therefore forms the backdrop against which the project has been developed. And the project directly contributes information into the planned water inventory of Puntland whose one of the objectives is to *estimate the abstractions of existing Puntland water sources such as boreholes, springs, berkads, rainwater catchment structures.*

1.4 Overview of Current Water Supply and Sanitation Status in Puntland

Rainfall in Puntland averages only 72 mm annually and this is not sufficient to recharge ground water resources to replenish the annual losses drawn by boreholes and shallow wells. Both surface runoff and groundwater should therefore be efficiently harvested and carefully preserved and protected as these are just about the only reliable sources of water in Puntland.

It is estimated that livestock production provides livelihood for over 70% of the population of Puntland. However, seasonal temperature variation, rainfall shortage and frequent lengthy droughts mean that pastoralists have to compete for scarce water with urban water schemes where rapid population growth leads to ever-increasing demand. This competition has led to social conflicts, environmental degradation, and constant interruptions of water supply.

At the time of the fieldwork, there was an acute shortage of water in the study area as the rains had failed for two consecutive years. PSAWEN was involved in distribution of water on cost sharing basis to the more affected parts of the state including the project area. The community is providing transport while PSAWEN gives the water. Viewed in the context of this prevailing situation, this project may be considered as a partly emergency intervention to provide water to a greatly disadvantaged region.

Since the collapse of the government of Somalia, various parts of the country have declared regional political autonomy, as did Puntland State in 1998. Till now, little attention has been paid to sanitation by these emerging administrations. There are no organised garbage collection and disposal arrangements and in some instances there is no authority charged with the responsibility of ensuring a clean environment for the expanding human settlements, or where such authority exists, there are no resources allocated to the activity.

1.5 Study Methodology

The study applied participatory rapid rural appraisal (RRA) methods to collect information from focus groups of the intended project beneficiaries. Similar methods were applied on local and international stakeholder agencies in Nairobi, Bosaso town, Hargeisa and the project area. Interview guides were used to direct the discussions (Annex 9).

The study of the hydro-geological characteristics of the area was largely conducted through review of secondary data. The mission relied on observations during the field visits to the existing water sources to verify information obtained from secondary data sources. Geo-references were recorded as a way of linking and confirming information from the visited water sources.

For fieldwork in November 2001, first, the consultant mission paid courtesy calls on the local administration and technical authorities in Bosaso to explain the purpose of the study, identify project partners and rally their support. Interviews were then conducted on the agencies with water and sanitation-related operations in Bosaso. Before these interviews were over however, there were disturbances of a political nature and the mission moved to Hargeisa in Somaliland. The Hargeisa leg of the field survey was intended to study the modalities applied in the application of revolving credit by the Oxfam Somaliland programme with a view to borrowing a leaf from their experiences in the operation of the proposed revolving credit scheme for the Puntland programme.

Due to internal disturbances that caused the study team to be evacuated from Puntland in November 2001, fieldwork resumed four months later in March 2002 when fifteen villages were visited (Table 1.1) and focus group discussions held with villagers, the administration and water sector personnel. The villages sampled with the help of village elders were 6 in Gardo district, 6 in Iskushuban district and 3 in Bosaso district. In selecting the villages to be covered in this study, some of the criteria used in the Somaliland project were applied for the purpose of bringing about equitable development and creating peace and harmony among the people of Somalia. To be favoured under the project a village had to:

- Have no permanent source of water
- Be placed at least six hours return walking distance from the nearest water source
- Have existing berkads, which were supplying water
- Lie along the traditional migratory and marketing routes of livestock
- Be in an area that is peaceful and where clans are living in harmony with each other

The sanitation situation in Bosaso town was assessed through visits to camps of Internally Displaced Persons (IDP) and discussions with the Water and Sanitation department and other responsible organisations. The real ability and willingness of the communities to contribute towards improvement of and effectively manage the water and sanitation facilities was analysed through these participatory community sessions. In addition an assessment was made of the methods used by OGB to implement a revolving fund credit scheme for berkad rehabilitation and small-scale business in Somaliland. Interviews were held with villagers and several new and rehabilitated berkads were visited.

Table 1.1: Sample of Villages

Gardo District	Iskushuban District	Bosaso District
1. Hagi (Xaaji) Kayr Village	1. Duud Hoyo Village	1. Kobdehad Village
2. Dahan (Dhaxan) Village	2. Hubabays Village	2. Kala-Bayr Village
3. Adinsoone Village	3. Hiriro (Xiriro) Village	3. Bogol Kabush IDP Village
4. Sanjilbe Village	4. Timirshe Village	
5. Yaka Village	5. Rebi Dirikle Village	
6. Amba Sare Village	6. Darod Village	

1.6 Summary of the Study Terms of Reference

Among other things, this report pays specific attention to the tasks as spelt out in the TOR, which are:

1. *Needs assessment of specific* community groups and ownership of the water points.

2. *Technical Evaluation will* include the design aspects, choice of technology, type of equipment, and technical performance. This will result in an inventory of the points (functioning /not functioning), yield estimate, water quality (pH, EC) and O&M methods and costs.

3. *Cost recovery analysis covering* prices charged, fee collection methods and cost effectiveness.

4. *Environmental impact aspects* including range-land carrying capacity, scale of degradation, soil erosion and gully formation, human de-vegetation (deforestation) and animal de-vegetation (over-browsing and over-grazing), factors that may have

accelerated the distribution (over-concentration due to possible insecurity, the availability of reliable water sources and other services such as relief activities), impact of the increased livestock numbers as a result of new water points.

5. *Institutional assessment in respect of* community organisation affecting O&M, community income versus cost recovery aspects; financial management; degree of dependency on external assistance, traditional systems and inter-relation with modern water supply systems, degree of local participation - particularly organisational and supportive structures outside the communities served.

6. *Health and Sanitation* situation - indicators include disease pattern, waste disposal systems, water use and storage at household and community levels, awareness creation.

7. *Gender representation especially the role and voice of* women as can be seen from the level of representation and participation in the management of the water points.

8. *Community identification* taking into consideration community animal grazing grounds and water points, sub-clan and family structure.

2. NEEDS ASSESSMENT OF THE COMMUNITY GROUPS

2.2 Project Area Location, Climate and Economy

Bari Region is located at the horn of Africa and falls between the latitudes 8°20'S - 12°00'N and longitudes 48°50'E and 51°26'E. It is one of the five regions that constitute the Puntland State of Somalia. The other four regions are Nugal, Mudug, Sanaag East and Sool. Bari Region is bounded by the Gulf of Eden to the north and Indian Ocean to the East. It borders Nugal and Sol Regions to the south and west respectively. The project area covers Bosaso District in the north, Iskushuban District to the south-east and Gardo District to the south.

Bosaso District borders the Gulf of Aden to the north, Qandala District to the east, Gardo District to the south and Sol Region to the west. Gardo District borders Bosaso to the north, Beyla District to the east, Eyil District to the south and Sol Region to the west. Iskushuban borders the Indian Ocean to the east and borders Beyla District to the south, Bosaso to the west and Alula District to the north.

Bari Region is characterised by extremely low rainfall (in some parts less than 100 mm/pa) resulting in acute shortage of water both for human and livestock use. Temperatures are also high for the greater part of the year (diurnal maximum averages of over 30 °C) which leads to high evaporation losses and cracking of empty berkads. The covering of berkads with brushwood (Annex 3: Plate 1) offers but an unsatisfactory and temporary solution against this natural phenomenon.

Currently, about 30% of the population of Puntland live in the fast growing towns of Bosaso, Gardo, Garowe and Galkayo and in villages that are mushrooming along the well-maintained main road which links those towns from North to South. Approximately, 70% of the population is below the age of 30 years. Apart from 20,000 people who are engaged in fishing in the villages of Eyil, Barga/Hafuru, Alula, Qandala and Bender Beyla at the Indian Ocean coast, almost all the rural dwellers are pastoralists: camels, goats and sheep are the main species of livestock. The number of head of livestock and related products that are marketed fluctuate from year to year, depending on the rainfall patterns. On average, approximately 500,000 head of livestock are marketed through the port of Bosaso. The main destinations are Saudi Arabia, United Arab Emirates, Oman and Yemen. Several families in Puntland survive on remittances provided by relatives and friends who live abroad; this explains the growth of money transfer companies in Puntland and their significance as a revenue base for the Administration. Puntland has some possibilities to diversify the economy in the field of agro-livestock products, fishing and the processing of minerals. In Puntland, nascent regional and inter-regional policies continue to provide the communities with stability, security, basic services, and governance, while the private sector and civil society are vibrant.

Puntland has been relatively stable politically, is safe and secure, and in some instances boasts regional and municipal structures. Economically, Puntland, although fragile, continues to thrive, with interregional and export/import oriented commerce expanding. Throughout most of Puntland economic activities are widely believed to exceed pre-war levels. Puntland is considered a region enjoying relative peace and tranquillity. Basically, inter-clan fighting is absent (as there is only one clan); there is adequate response by local authorities to serious incidents and freedom of access to information exists.

2.2 Assessment of Water Resources

2.2.1 *Physiography*

Bari Region is covered predominantly by sediments derived mainly from the basement complex. Most of the area to the south and east is covered by the Karkar formation (E-kr) of the Eocene age and consisting mainly of limestone and marls. The northern E-W coastal strip has a series of N-W fracture zones within the northern primary watershed divide. These have deposits from the Miocene-Oligocene age consisting of conglomerates, sandstone and evaporites (anhydrite, gypsum, marls) in the north and some 100 km east of Bosaso. The latter are also found in the area generally to the south-east of Bosaso for nearly 150 km. The area running eastwards is a minor watershed starting from a point about 70 km south of Bosaso and is covered mainly by evaporites, clays, marl and sandstone. The upper part to the west of this watershed is covered by conglomerates visible along the road going southwards from Bosaso while limestone makes up the area towards the east along the coastline.

2.2.2 *Hydrogeology*

a) Ground water recharge

Groundwater recharge in Bari is mainly from rainfall run-off and, given the very low rainfall amounts, it is aided by high rates of infiltration. Torrential rainfall, especially in the mountainous areas result in rapid run-off through the toggas to the Indian Ocean and the Gulf of Aden. A significant amount of water that infiltrates into the soil is evaporated in the early days after the storm. Thus, little water reaches the deeper ground water levels in general. Under the following conditions, however, ground water recharge is more substantial:

- in the togga beds;
- in the local depressions on the karst plateaus;
- at the foot-slopes of the mountain zone;
- on flat to slightly sloping terrain with sandy or gravelly top soils.

As calcareous rocks cover most of the area, ground water can be found in most of the project area. However, high permeability in karstified limestone beds, together with the raised topography, results in areas of deep ground water tables. Average borehole depth is over 200 m but the deepest borehole drilled at Rako went up to 420 m.

b) Groundwater movement

Movement of the groundwater in Bari Region is generally towards the coastline and occurs in three main directions:

- Towards the north starting from an E-W line running approximately 40 km south of the northern coastline from the Mesqat Mountains and the Alula hills;
- Towards the eastern coast from the Mesqat Mountains south west of Bosaso;
- Towards the south-east within the southern half of Bari Region predominantly within the Karkar formation underlying the togga beds.

c) Discharge of the groundwater

Groundwater discharges in the form of springs at several points:

- Along the northern coastline and also from the foot-slopes of the mountains in the neighbouring Sol Region and to the south east of Bosaso.
- High discharge springs also found along the middle and upper section of the minor watershed starting from 70 km south of Bosaso and running eastwards to the coast.

d) Quality of the groundwater

The quality of the groundwater is negatively influenced by the gypsiferous layers in the Taleex and Hafun/Iskushuban Formations. Also the dominant Karkar formation contains gypsiferous layers, which causes high levels of Total Dissolved Solids (TDS), sulphate content and hardness. High fluoride contents are also found making water in most places suitable for livestock watering only.

e) Recent water development activities

The programmes that started after 1990 had a local character and were focused on installing pumping devices on existing water points and on the construction of berkads. GTZ had intended to implement a 10-year development programme in the region, but its plans were cancelled after a decision was made to stop by the German Ministry of Economic Co-operation in March 1995, before the programme could become operational. The current thrust of the Government is to encourage privatisation at all levels of the management of water supply systems, especially for Municipalities and, thereby, reduce community management.

3. TYPES AND OWNERSHIP OF WATER FACILITIES

3.1 Existing Water Sources and Sanitation Situation

The region has an arid tropical climate resulting in a low potential for water resources development. Permanent surface water is almost absent, with the exception of some parts of the main river courses below the 300 m altitude, the most notable being two high yielding springs at Iskushuban.

Traditionally, the local people in the region used water from natural sources such as springs, pools, dug pits in togga beds and even some shallow wells. In the 50s, the Italians drilled several boreholes in the grazing areas in the plateaus. During the 60s, rainwater collection by berkads (lined sub-surface tanks) was introduced and found a wide response in the society. These have since encouraged the creation of more permanent settlements in places that only had nomadic camps before. These have over time become the most common water sources in the rural areas during the rainy season and the first dry month afterwards. Larger ground catchment structures (waros or whars) are less common, as they require large cash inputs and are commonly constructed with the assistance of outside agencies. Roof catchment is rarely applied and efficiency is very low.

Springs and borehole sources are communally owned. However, berkads are owned by individuals (mainly for commercial purposes), groups of families forming co-operatives so as to be able to finance the construction. Rarely are berkads truly communally owned in the general sense of the word. Communal berkads were found to be owned by families of religious leaders (Sheikhs) or *Her*. The co-operative berkads comprise several families (typically between 10 and 100), each with a average of 8 people. . These types of berkads can be described as communal given the large number of users. Whatever type of ownership, the community seem to take good care of them, but due to the prolonged drought, some of them have not been able to put some water in the berkads to prevent cracking, or are no longer in the area as they seek areas where water is more reliable and cheaply available.

3.2 Water Sources

3.2.1 Springs

Springs are the main traditional sources of clean water in the project area. These are often of good discharge and have varying degrees of chemical quality. There is always a risk of organic pollution. Iskushuban, Ufayn and areas around Bosaso are the most notable spring sources in the project area. Out of the numerous spring improvements possible, only in a few cases have springs been captured and improved. These are:

a) *Permanent springs*
A number of permanent springs are found around the main urban centres:

- Bosaso has five main springs, to the west (2) 30 km away, south (3) 30 km radius (partly from the east (1) 10 km away; some are hot water springs. 2 other springs are located about 90 km south-east of Bosaso just north of Ufayn (gravity scheme: 1959, 1979 and 1989) at the southern edge of Mesqat Mountains.
- Iskushuban (pumped supply: sixties, 1988 and solar pump 1992) has two major discharge points to the east and south-west of the trading centre, which join to form the only major permanent stream in the region, T. Dhut River. This supports, along its banks, several kilometres of small irrigation plots supplying vegetables as far as in Bosaso. Two other springs are found about 60 km south-east of Iskushuban.

- Within Bari Region, other permanent springs are found in Qandala District mainly discharging from the Mesqat Mountains (1 spring zone 10 km south of Qandala); Alula District has two discharge points - 1 at the sea on the south-western and the other near the north-eastern tips of Alula Mountains. The coastline south of Iskushuban District has numerous spring discharge points within Bari Region.
- More recently, a number of agencies have been involved in the improvement of oasis springs around Bosaso for small scale irrigation. In a number of instances, berkads have been included to store larger amounts of water overnight from the springs to enhance flow into small irrigation plots.

b) Seasonal springs

Several seasonal springs are found in Bosaso District (east, west and south of Bosaso and near the Bosaso/Iskushuban border at Ufayn), Gardo District in the hills to the west, along the coastline south-west of Alula, and along the eastern coast around Xandho and some 60 km to the north of Bander Beyla inland towards Xiriro.

3.2.2 Water Tankers

Water supply by tankers is an important source of water in Gardo, Bosaso and (during the dry season) in several rural market centres. The tankers fill at permanent water sources and supply to empty berkads and small ground level storage tanks every year. Tankers, therefore, play an important role in the economy of the area, especially after the collapse of most of the borehole sources. It is remarkable that the owners have not abused the situation by hiking the price of water to unrealistic levels. The main disadvantages of this system of supplying water are:

- Many of the tankers are in a poor state.
- High risk of contamination at the source, in transit and in storage tanks.
- High price of water, mainly due to trucking costs.

3.2.3 Hand-dug Wells

Few shallow wells are found in Bari Region. Concentrations of wells are found in Bosaso, and along the main inland streams. These are communally or privately owned. High-yielding wells based on springs have been dug in togga beds (by *Aquater*). Such wells include those at Ufayn, Iskushuban and Bander Beyla.

Water depths are generally shallow in the range of 7 - 15 m. Some of the shallow wells were covered over time. Although there are no test-pumping data, most of these hand-dug wells can be said to be of good yield. Several of the hand-dug wells in the town are equipped with hand-pumps provided by agencies, especially the Afridev hand-pump installed by UNICEF.

3.2.4 Rainwater Catchment Structures

a) Berkads

Rainwater catchment structures include the berkad and the 'war' or 'balley'. Construction of berkads in the region was introduced in the late fifties. These have become the most common water sources in the rural areas during the rainy season and for 1 - 2 dry months afterwards. Recent surveys by SAWA (1999) and PSAWEN (2000) found that villages without other water sources have large numbers of berkads, varying in size between 250 - 1,000 m^3. Approximately 30-50% of households have berkads in such areas. Berkads are constructed by families, groups of families (co-operatives) or wealthy individuals, who also sell water to neighbours.

Berkads can be associated with a number of water related diseases, notably malaria, diarrhoea, hepatitis, typhoid, intestinal worms and occasional cholera, and people have to depend on expensive tanker water for 2 – 4 months in a year. Nevertheless, they are widely accepted by the community as they give people the chance to settle in water deficit areas. Their value is underlined by the fact that communities finance the construction fully up to the tune of US$ 14,000 in cash mainly obtained from livestock sales. They also regularly maintain the berkads. The fact that berkads run out of water during the dry months, forcing livestock to move out to areas of more permanent sources of water also gives the grass time to regenerate.

The salient features of the berkads visited by the mission are as summarised in table 3.1.

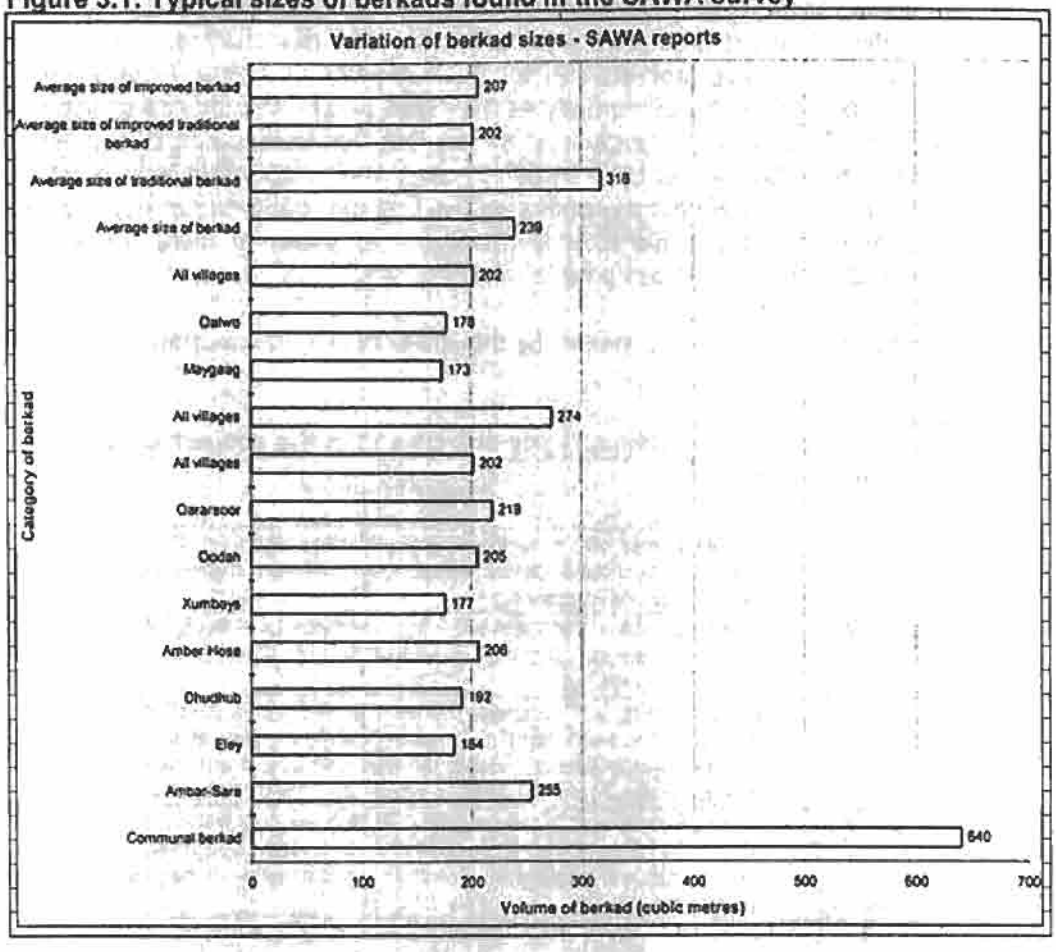
Table 3.1: Salient features of various types of berkads in the project area

Type of berkad	Size range (m^3)	Salient feature
Traditional	30 - 630	Leaning walls with entry steps, wall thickness between 400 - 600 mm, poor inlet and outlet canals, variable workmanship depending on artisan - prone to cracking.
Traditional improved	30 - 630	Leaning walls or vertical walls with entry steps, wall thickness between 400 - 600 mm, dividing wall, improved inlet channels, small silt chamber - prone to cracking.
Improved SAWA	200 - 250	Vertical walls, wall thickness 900 mm, large silt trap, filtration chamber, side well and hand-pump, GCI roofing painted green, improved inlet channel with grit screen; outlet channel, 'privatised' community management, good technical performance - Very expensive.
CARE International (more recent - March 2002)	750 - 900	Vertical walls, wall thickness 600 - 750 mm, with or without silt trap, GCI roofing, short inlet and outlet channels, side elevated tank, dividing wall, variable workmanship, communal management - modified form of the SAWA design.

Berkads are constructed at selected sites where run-off water can be intercepted. The pit is excavated to a good foundation, often hard rock. Most berkads are 6 - 20 m long, 3 - 8 m wide and 3 - 4 m deep so that the effective storage is between 30 - 1,000 m^3. They are usually covered with brushwood spread on gabion wire suspended across the berkad to minimise evaporation. (Plate 1: Annex 3) SAWA made a detailed technical assessment of existing berkads as part of a programme whereby they constructed several berkads during 1998-1999.

Typical berkad sizes were found to be between 200 and 250 m^3, for both traditional and improved berkads. The results, containing traditional, improved and new berkad designs, are summarised in Figure 3.1.

Figure 3.1: Typical sizes of berkads found in the SAWA survey



b) Wars or Whars or Balleys

In Bari Region, *wars* are man-made unlined ground catchment structures usually excavated with machines (commonly called pans in Kenya). Very few *wars* are found in the area. Their sizes vary between 1,500 - 5,000 m^3 and depths ranging between 2 and 3 m (Plate 2: Annex 3). Wars are communally owned and are mainly used for livestock watering and to a lesser extent, for domestic consumption. They hold water for a few months depending on the size and extent of leakage, but are strongly influenced by high evaporation rates. Due to the absence of silt traps, they tend to silt very quickly and so require annual desilting to maintain their capacity.

3.2.5 Boreholes

Boreholes were introduced in the fifties by the Italians and most local people consider boreholes as the best technology. The Government paid most attention to the development of a network of boreholes. In the seventies, a network was planned for one borehole for each 60 km, which was to be reduced to 20 km in later years. In the past, 34 boreholes were drilled by the Government, the Chinese borehole programme, the Italian Aquater[3], GTZ and Western Geophysics. Other boreholes were drilled by oil explorations and road construction companies but were abandoned after construction

[3] The drilling rig used by Aquater has been abandoned near the coast on a side road in Bosaso and is estimated to require approximately USD 100,000 to put back into operation.

of the works. Although these latter type of boreholes was incidental, they have resulted in the creation of villages in places where no other water supply is available for long distances. In the three districts under consideration, boreholes are found in Gardo (2), Adinsoone (1), Timirshe (1), Kobdehad (1 No. pumping water to the village from 13 km from the village) and Kala-Bayr (1 No. located 7 km from the village; this borehole is now damaged after children filled it with sticks and stones).

Several boreholes are not functioning, having been damaged after the government collapsed in 1991. Sometimes, these have been filled with stones by passers-by, mostly by children. These types of systems are generally poorly managed and usually include a pump-house and a small tank (No. – Plate 3: Annex 3). Collection and management of revenue is poor and, in most cases, money collected is hardly sufficient to pay for fuel, a token 'salary' for two attendants and minor servicing. Major servicing or replacement of parts of the system is not provided for. Any time such maintenance is required, the people seek assistance from outside mainly through PSAWEN. As a result, water charges at these boreholes are far below what people pay at the berkads. (See detailed O&M cost analysis in Annex 7)

3.3 Water Quality

Boreholes and hand-dug wells generally yield water of similar chemical characteristics according to aquifer formations. Boreholes are least vulnerable to pollution. Hand-dug wells, however, are usually open and often encounter organic pollution. Pollution is less pronounced on upgraded wells. Water obtained from rainfall catchment structures is typically of good chemical quality but usually with high contents of organic pollution.

The quality of the water in the berkad deteriorates as the dry season advances. At the time the mission made the visits, virtually all berkads had been dry. Water that the mission found in the berkads had been trucked from elsewhere and could not be used for analysis. The quality of water in the berkads is negatively influenced by the following:

— Livestock and people draw water from the same points leading to high levels of organic pollution mainly from continuous contamination by water containers;
— The location of the berkad relative to the village. Those berkads located on the lower side of the village collect large amounts of organic pollution from rainfall run off traversing the village.

The quality of the water in wells and high yielding springs is negatively influenced by the gypsiferous layers in the Taleex, Hafun/Iskushuban formations. Also the dominant Karkar formation contains gypsiferous layers. Hence, water quality standards established by the World Health Organisation (WHO) cannot be met in most of the areas in respect of total dissolved solids, sulphate content and hardness.

3.4 Sanitation

3.4.1 Overview

Sanitation is generally poor and latrine coverage is very low with hardly any latrines visible in most villages and suburbs. Garbage is strewn all over major and rural human settlements. In all villages, community practices with regard to proper hygiene such as washing hands, boiling water, etc., including food hygiene, were poor. Even where the water in the berkad was clearly contaminated, people drank it directly. This behaviour shows the strong need for awareness creation and focused training on water use.

Within Bosaso, some women from IDP camps collect garbage from homes for a small fee, but they lack a place to damp it. The problem stated is that there is no assigned place for damping the garbage, and so they simply throw it away outside of the very premises they had removed it from. Also, sanitation facilities at the IDP camps themselves are grossly inadequate.

The municipality has been making proposals to UNICEF for assistance to improve the sanitation situation in the town. None of the proposals has been successful as the Municipality always requests full (100%) assistance, which the potential donor does not favour. Furthermore, continuity in follow-up is always lacking, as each new Mayor always wants to present a fresh proposal and discards those presented by previous Mayors. This is complicated by the fact that Mayors have been changed four times in the last two years - an average of once every six months.

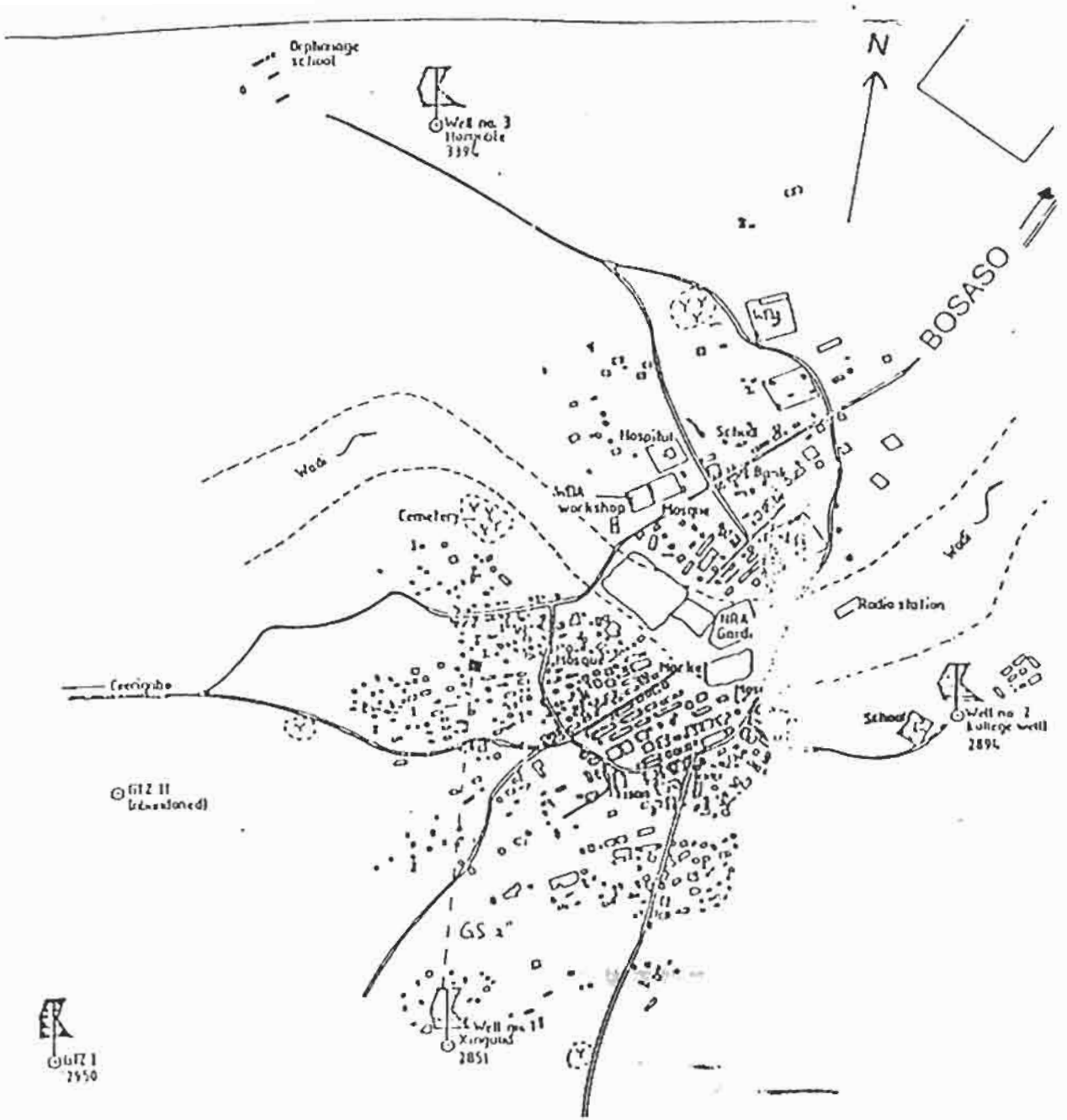
3.4.2 Current Water and Sanitation Situation in the Urban Water Supplies

Gardo: Gardo is the second major town in Bari Region (after Bosaso) and is located about 230 km south of Bosaso on the main tarmac road to Garowe, the administrative capital of Puntland State. There are three functional boreholes in the town. The next borehole is located about 60 km away. The area between Iskushuban and Gardo has good rangeland and attracts large livestock populations.
It is located 240 km (road distance) south of Bosaso and is an important centre for nomads and an important commercial centre for the pastoral areas of Bari and Sanaag Regions. The present population is estimated to be 30,000 inhabitants. It has a functioning electricity supply running from 6 p.m. to mid-night.

The water supply for Gardo relies on two boreholes, Xingood and Kawane. The Xingood borehole supplies water through a GI rising main pipeline that leads to a 50 m^3 storage tank, and is subsequently distributed to the town. The boreholes have a high EC level of around 3,000 $\mu S/cm$.

A number of the main buildings have on plot sewage disposal in septic tanks, while the rest of the population relies on pit latrines. However, a large section of the population does not have latrines. This is a major source of interest, especially due to observed high E-Coli count in the water recently observed by UNA.

The town has a lot of uncollected garbage. Africa 70 and the Municipality collect the garbage every 2 days. However, this is only possible where the garbage is centralised for collection. A 20m x 8m garbage pit has been dug but is not used.



PLAN GARDO
not to scale

Drawn by:
SAWA/SPDS Bari water rehabilitation study

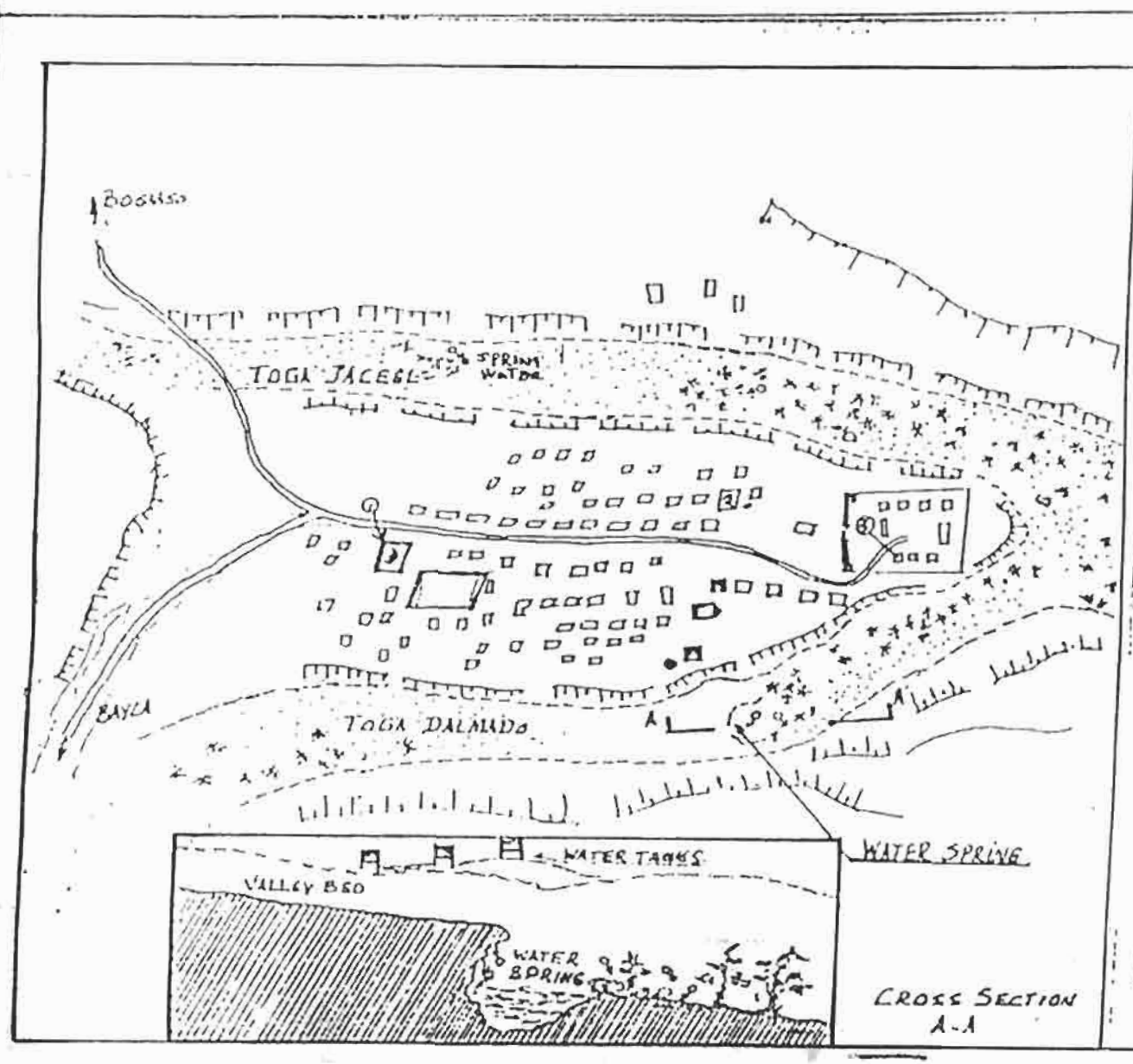
Iskushuban: Iskushuban is located 240 km (by road) to the south-east of Bosaso. It is a district capital and is located at the centre of Bari Region. It is an important historical centre that housed the Daarod kings that for 2 years resisted Italian occupation between 1925 and 1927. It is beautifully located high above the two toggas that join here. It has about 400 houses and the main sources of income for the population are livestock and small irrigated agricultural production. It has a primary school, an intermediate school and a health centre albeit poorly stocked with medicine and related supplies.

Iskushuban has a high yielding cascading spring. The town is located on higher ground than the water sources. As such, the only option was pumping from the springs running down from the hills. Most people fetch water from the southern togga, 30m below the village. The total capacity of this togga has been estimated at approximately 30 litres/second. The spring emerges out of *Travetin*, deposited on a layer of solid rock in the *Karkar* formation. The EC of the water normally ranges between 1,650 and 1,850 μS/cm, pH = 7.5 - 8.0, Total Hardness > 370 mg/l and NO_3^- in the main pool < 5 mg/l. During prolonged drought, however, the water becomes increasingly saline with EC levels rising to as high as 2,930[4] μS/cm with a pH of 7.2.

In 1996, UNICEF provided pumps and generator. Pipes were laid and three kiosks established. The support also extended to a few shallow wells. The committee elected members to the Water Authority for the town and contracted somebody to operate and maintain the water supply system. A submersible pump driven by a generating set provides water to the town through a GI pipe to a raised 20 m^3 steel tank provided by UNICEF with funds from the Netherlands. Water is then piped to communal water points and the main buildings. Water charges average at 500 Somali Shillings for a 4-litre container. This could be as low as 300 SS during the wet season and as high as 1,000 SS during the dry season. UNICEF's required the community to contribute 30% of the cost of the project, which they did by providing unskilled labour, local materials and some cash. This insistence has helped empower the community. This was demonstrated in 1998 when floods washed away part of the pipelines and damaged the pipes. The community was able to repair the system at their own expense. It is, however, notable that there is no systematic plan for banking in place and accounting to the community is not transparent.

Apart from the main administration building of the mayor and the hospital that have on plot sewerage disposal, the rest of the population depends on a few latrines, which they find difficult to construct due to hard rock formation in the area. Sanitation is thus a major concern for the town.

[4] This high EC was observed by Oxfam-GB baseline mission on 09-03-2002, at the end of a prolonged drought with no rains for four consecutive seasons in 2000 and 2001.



PLAN ISKUSHUBAN

not to scale

1 - Hospital

2 - School

3 - GTZ office

Drawn by: Samater Abdi Samater
SAWA/SPDS Bari water rehabilitation study

Bosaso: Bosaso is a bustling city located along the coast of the Gulf of Aden and is the business capital of Puntland State and also the main trading centre of Bari Region. The town has remained relatively calm even after the collapse of the Somalia Government. At present, Bosaso is also serving as the administrative capital after the President and the Ministers were force to leave Garowe in November 2001. The harbour at Bosaso is the main port for the whole of the north-east. Surveys carried out by SAWA in 1998 indicated that, for the population living in the rural areas around Bosaso, water as a priority came after 'road improvement' and 'cash crops'. With the rapidly increasing population and the rising need for a regular supply of vegetables, pressure for irrigated agriculture will increase water demand on the oasis farms.

Bosaso has been a refuge for thousands of people displaced from Mogadishu and surroundings during and after the war, especially due to continued instability in the south under the control of warlords. The present population is estimated at approximately 200,000, which has risen sharply since disturbances at the Administrative Capital Garowe. This is a phenomenal increase as the population was only 15,000 people before the collapse of the government in 1991 (30,000 in 1995).

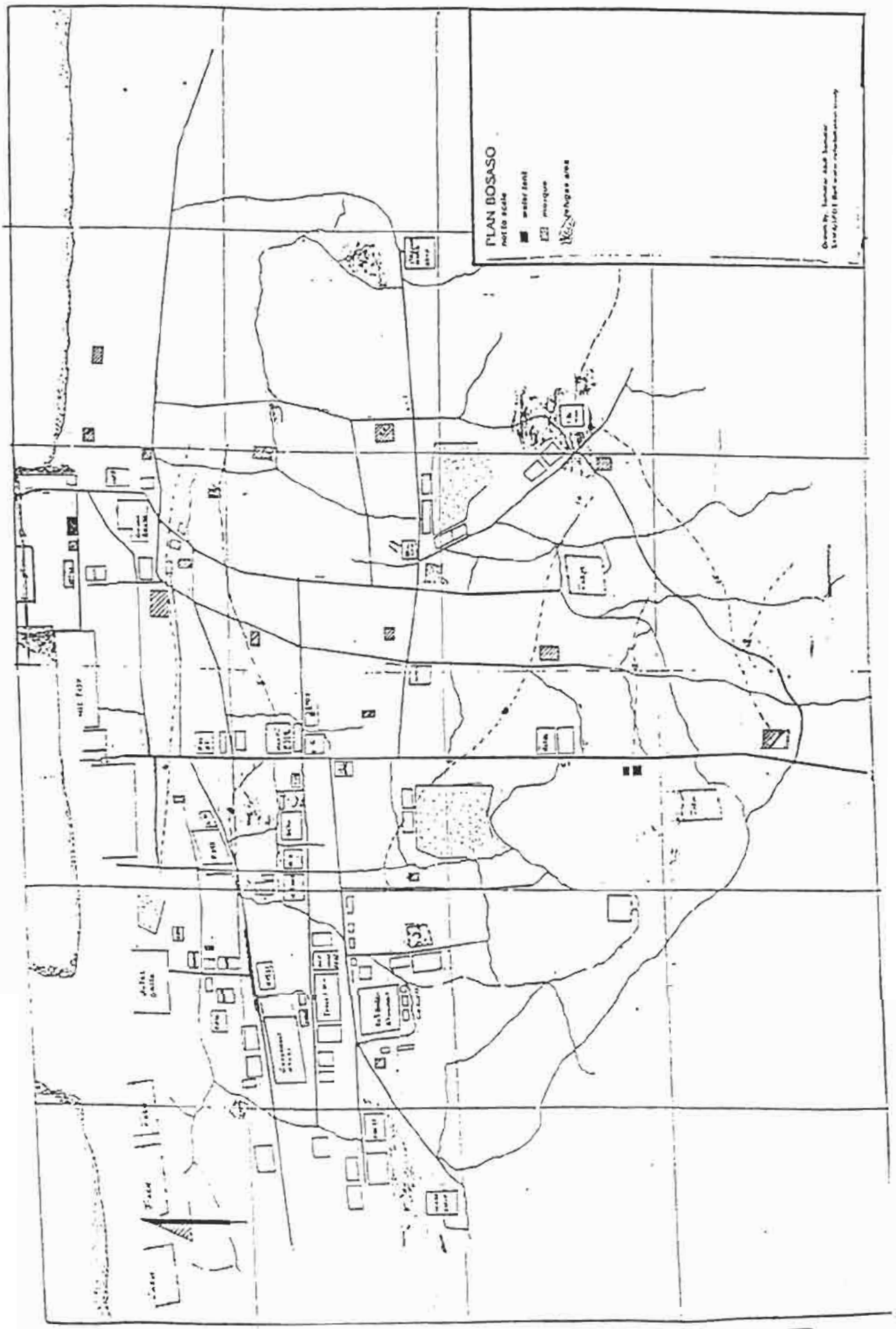
The town is supplied with water from boreholes as the main sources of water with EC ranging between 1,800 and 3,800 μS/cm; it has not rained in Bosaso for the last 8 years, i.e. since 1994. Three private wells have the best water with EC ranging between 1,800 and 2,600 μS/cm, while nearly 100 shallow wells dug in various parts of the town have relatively poor quality with EC ranging between 2,800 and 3,800 μS/cm (close to the sea).

The distribution system may be divided into three types: piped network which has been leased out to a private company under the supervision of PSAWEN, water supplied by private tankers and bottled water from a private bottling firm. The Dutch government funded the piped network system and it was implemented by UNICEF. Management of the water supply system is being done by a private company and the supply is fairly reliable. The charges of water may be divided as follows:

- Water in house connections is metered and charged at 6,000 SS per m^3 (0.3USD/m^3) or 6 SS per litre.
- Trucks buy water at special drawing points at the rate of 14,000 SS (0.7 USD per m^3) for 6 m^3 truck, which translates to 2,350 SS per barrel (200 litre drum).
- Treated water that is normally bottled is sold for 20,000 SS per *jerry* can (20 litres) at the factory of the bottling company, and 7,700 SS per litre once the water is bottled (USD 50 and USD 385 per m^3 respectively).

A spring located 35 km from Bosaso, with an estimated discharge of an estimated 40 litres per second, is yet to be tapped.

Sanitation consists of house septic tanks and pit latrines; there is no sewerage system for the town. However, several pit latrines are dug close to highly dense hand-dug wells. Because of the high permeability and high density of latrines and defecation in the area, contamination of the wells occurs regularly due to organic pollution as faecal waste percolates into the wells. Collection of garbage is poor and, in times when this is done by women from IDP (internally displaced camps), there is no designated place to dump it. Environmental sanitation as a whole, therefore, is a major source of concern that requires intervention.


PLAN BOSASO
not to scale

Sanitation is still relatively poor. Cholera outbreaks occur annually and large amounts of garbage remain uncollected. Around IDP camps, the women in the camps collect garbage from households for a small fee, but there is no dumping site for the garbage. Also, latrines in IDP camps are inadequate for the large numbers of people living there. For instance, for *Bogol Kabush* ('100 bushes') IDP camp located a short distance to the east of Bosaso Airport, there are only 4 private latrines serving an estimated 60 families.

For purposes of comparison and in order to gain a broad view of the situation in Puntland as a whole, an analysis was given of the status of water and sanitation in Galkayo although this, the third largest of the three Puntland municipalities, lies outside of the project area.

Galkayo: Galkayo town lies about 700 km to the south of Bosaso and has no water supply or sanitation system despite being home to about 100,000 people. In 1996, the GTZ rehabilitated two wells but these are no longer sufficient to supply the ever-growing population. With EU funding and UNICEF as the implementing agency, there are plans to rehabilitate two wells which are 200 m to 350 m deep, construct a 750 m^3 storage tank and lay 22,000 m of pipeline to supply an estimated 3,000 individual connections and strategically placed public water kiosks. The design is complete, and the tendering process for construction and system management was expected to commence in December 2001. However, UNICEF has not yet revealed the budget for the project to the Water Authority, a fact that is causing great uncertainty.

Presently Galkayo is using only shallow wells which give hard and unhygienic water on account of the very shallow water table (about 10 m.) leading to seepage of latrine waste into the shallow wells. UNICEF is involved in garbage collection and construction of public latrines. So far 40 twin toilets have been constructed and are managed by private operators. However, sanitation is still very poor.

The Galkayo water Authority is composed of six members as follows:

- Chairman who is from PSAWEN,
- one member from the municipality,
- two members from the business community,
- one member from the women's organisation and
- one member from among the elders

The mandate of the water authority encompasses solving community problems, evaluating tenders, assisting project managers and regulating the project management company and advising on the water tariff to be charged. The tariff is based on the pricing of water sold by water trucks and other vendors. The board is supposed to sit for three years after which new members are renewed.

The economy of Galkayo is dependent upon livestock exports in form of live goats and sheep, cattle, meat and hides and skins. There is an international airport from where an estimated 10 tons of chilled meats are airlifted daily to the Middle East from a recently constructed abattoir. *Miraa* or *khat* from Kenya is landed daily and imports of food and other consumables are also landed at this airport regularly. The ban on export of live sheep and goats to the Middle East due to an imagined outbreak of Rift Valley Fever has hurt the farmers over the last three years. A milk factory has been constructed in nearby Gardo and one is planned for Galkayo. There are three water filtration plants in Galkayo, one dispensing un-bottled purified water. The by-products of the abattoir i.e. liver, blood, head, hooves, and viscera are not utilised and their

disposal is already causing health concern for the town. An estimated 1,800 shoats are slaughtered daily and meat airlifted to the Middle East market.

3.5 Agencies Involved in Water-related Issues in Bari Region

The government used to be the only agency involved in water development in the region. But today, a number of other agencies are now involved in water development and related activities. The following is a brief overview of agencies involved in the area and their key activities relevant to this study.

PSAWEN: The Water, Energy and Natural Resources Corporation is the governmental authority responsible for water resources development in Puntland. Its head is the Director of Water Development. The Corporation is considered beneficial by agencies active in the water and sanitation sub-sector. It reaches closer to the communities through the Regional Co-ordinators stationed at District level.

World Food Programme (WFP): WFP operates on the principle of food for work. WFP's priority areas for the region are: 1) Water, 2) Road maintenance, and 3) Smallholder irrigated farming. In relation to water and sanitation, WFP provides food for digging pit latrines on "food for work" basis.

The WFP does not construct new roads but maintains rural roads annually especially those used for transportation of frankincense, horticultural produce and livestock from the production areas. Difficult areas such as hilly Alula are accorded some priority attention in the annual rehabilitation and maintenance programme.

WFP is involved in the construction of water reservoirs and canals for supply of water for smallholder irrigation. It also sinks shallow wells and constructs flood protection structures at specified check-points as well as agricultural production through improvement of canals (25-30 cm x 20 cm high) and reservoirs.. WFP works closely with the FAO which provide planting materials and other inputs to the farmers.

WFP co-finances projects with other agencies, for instance UNICEF, which provide materials while WFP provides food for work. No assistance is given in the form of materials or non-food items (NFI). In one special case, WFP has distributed seeds and fertiliser but only as a facilitator for the FAO funded Food Security Assessment Unit (FSAU).

Ocean Training & Promotion (OTP): is a local NGO involved with the rehabilitation of water systems using funds from private sources. OTP has been working in the water sector since 1995 during which period it has collaborated with many agencies in that sector but many have left and never returned to make a follow-up on their work. OTP has however been permanently on the ground all this time. OTP considers water as the highest development priority in the region and is of the opinion that all the agencies in the sector have not met even half of the water requirements for Puntland.

OTP is engaged in protection of springs, sinking of boreholes and digging of deep wells. Its main areas of operation are in Bari, Nugal, Mudug and Sanaag regions. OTP sees the main problem with berkads as that of protecting the berkad from impurities because berkad water is collected on the surface of the ground. Using a water engineer, civil engineer and a sanitation officer OTP constructs its structures directly without the engagement of contractors. OTP then trains water facility operators in management, water and environmental sanitation and the running and maintenance of pumping systems. In Gardo OTP has so far constructed a 1,000 m^3 tank and 7 water kiosks.

ADRA: Activities of ADRA are mainly in the neighbouring region around Garowe. These are primarily aimed at emergency interventions to combat epidemics, such as cholera.

UNICEF: has been rehabilitating and constructing new boreholes in Bari Region. Their specific focus is development of water supplies based on deep water levels that are unlikely to be contaminated. UNICEF, therefore, does not deal with surface water sources or shallow wells. They also provide sanitation facilities and have activities in Bosaso, Gardo, Iskushuban and Alula Districts.

UNICEF insists on a 30% contribution from the beneficiary community in cash or kind. Normally, no other agency is involved in a UNICEF project. Labour and diesel are paid for at the following rates: Diesel (US$ 65 per 200 L), skilled labour (US$ 10 per day) and unskilled labour (US$ 2 per day (UNICEF rate is USD 2.5 per day).

Typically women are not included in the water committees. However, during times of crises, they are engaged in fund-raising. Although UNICEF insists that at least one be included in the water committees, this has not borne fruit.

Communities in these areas, for some reason, believe that borehole water is the solution to their problems. UNICEF cannot cope with the ever rising community requests for rehabilitation of boreholes or drilling of new ones. The problems that UNICEF has faced in its efforts to implement its interventions in the water and sanitation sector of Puntland State of Somalia, include the following:

i) UNICEF capacity on the ground is rather thin, as the establishment is quite small. As a result, UNICEF cannot cope with the project demands of the local communities. UNICEF has a water engineer, civil engineer, social mobiliser and an internationally recruited project co-ordinator, and use local artisans and technicians.

ii) The main office of UNICEF is in far away Nairobi forcing communications and replenishment of supplies to take too long. Sometimes the local office in Bosaso has to seek leave to make purchases locally and often obtains that leave.

iii) The local administration is not financially strong because of lack of a revenue base. For this reason it has to rely on meagre grants from the government in Bosaso. Though the local administration may tax livestock selling, the ban on livestock sales to the Middle Eastern countries and specifically Saudi Arabia, which has lasted three years to-date, has impoverished the people and promises dire consequences on the environment due to uncontrolled multiplication of shoats

ICRC: is involved, with ICRC funds, in the development of water & sanitation and infrastructure and is operating in Bosaso, Bander Beyla, Alula, Iskushuban, Qandala, and Gardo areas. Key activities relevant to this study include rehabilitation of 4 water catchments and 1 shallow well through cash for work. Another activity is emergency response in case of localised severe lack of access to water.
Other agencies involved in related activities are the following:

Co-operative for American Relief Everywhere (CARE): The programme components include institutional capacity building and sustainable development among women NGOs and communities. Project activities also include water and sanitation.

K-Rep Holdings Ltd: deals with providing credit to business people. This organisation is especially important to water vendors.

UNESCO-PEER (Programme for Emergency Education and Reconstruction): Providing access to quality technical and vocational education training.

SAWA: is a Dutch NGO and has been active in the water and sanitation sector of Puntland since 1998. During that period, they documented the berkad technology in use in the various regions and particularly in Bari. Several designs of berkads were proposed and others were drawn as built. These are contained in a series of drawings that were made available to the mission. SAWA is a member of the Tali Waadag, a consortium of twelve NGOs working in the water and sanitation sector.

SAWA has also been running a programme on small-scale irrigation called '*Improved Agricultural Production in Oases*'. Before the current intervention, SAWA implemented a water project focusing on the construction of berkads funded by the EU and DGIS and implemented in partnership with a local NGO called. In addition to generating project documentation in the form of reports, plans and extension materials, the project also bought several pieces of water testing and water facility construction equipment. These were bought with EU funds, which has asked SAWA to hand over the equipment to Oxfam-GB for use in the forthcoming project for the construction and rehabilitation of berkads in Bari Region.

In the current project, SAWA is partnering with SORSO, a local NGO experienced in agricultural projects. At the time of this study however, SAWA had folded up and had handed over its mandate in this project to CEFA, an Italian NGO. This project targets 12 oases in the two districts of Bosaso and Alula. The project aims to increase horticultural production with a focus on date palms. Plot sizes generally range between 0.5 - 2 ha although there are plots of 3-4 ha. Activities include (i) baseline survey, (ii) demonstration blocks, (iii) irrigation structures and (iv) rehabilitation of small irrigation systems. With the rapid growth of Bosaso, the demand for dates is very high. At the moment, all dates produced are consumed fresh, which implies that the demand far outstrips the supply. The project assists individual community members who contribute 5% in cash for all direct expenses (mason, materials, transportation and mixers).

The equipment purchased under the project include: Conductivity and temperature meter, *PalinTest* for pH and Turbidity measurements, Water testing kit - *AquaTest*, Cooker, Poker vibrator complete with engine, *Pionjar* rock breaker: Jack-hammer, Concrete mixers (2 No). The equipment is the property of the EU and has been handed over to Oxfam-GB as SAWA will no longer continue constructing berkads.

There was a one-year gap between projects - the current project, which is scheduled to close in January 2002, focuses its efforts on 12 oases in Bosaso and Alula regions where irrigation is taking place. The main crop irrigated is date palms. In some places, farmers have up to 2 ha of irrigated land while in others, the maximum is a mere 0.25 ha. Most of the production is sold in Bosaso where the population is estimated at 150,000 persons. There appears to be great potential in the irrigated production agricultural sector. Over 90% of all the irrigation structures are individually owned. The irrigation farmer has to pay at least 50% of the total investment in cash and then sign the agreement. The individual or community then has to pay for materials and labour. Materials from far are supplied by the project.

Problems in paying back the credit are anticipated because generally, beneficiaries lack financial discipline. This aspect of the project is best organised through a Somali bank, which would then bear the risks. Community organisation is not strong and more

often than not there are no elected committees. The traditional organisation takes control of the project. There are many absentee landlords in the agriculturally productive areas covered by the project. These are usually well-to-do who live in Bosaso and other urban centres. Those left on the land often cannot take any worthwhile decisions, many being just employees, some from neighbouring Ethiopia.

4. TECHNICAL EVALUATION

4.1 Choice of Technology

Water occupies the highest priority in the rural areas of Puntland, especially in the hinterland where springs are less available. Along the coastline, several perennial springs are found and water development is of lower priority compared to roads and agricultural production. The water needs in the entire area are enormous and the input of this project would have to be focused on cost effectiveness and the ability and willingness of communities to pay.

Berkads: The fact that communities have been constructing berkads over a long time indicates a good opportunity for further development of this technology.

Boreholes: UNICEF uses local artisans and technicians for the construction works. It was reported that there were four drilling companies in Puntland. There are four local drilling companies that are used for the rehabilitation of boreholes. The current drilling cost stands at USD 350 - 500 per metre.

Sanitation: Experience from agencies active in various sectors indicates a willingness of the community to pay for water services so long as they have ability. The level of contribution varies and so far local contribution required by various agencies has been reported to be successful. Between the requirements for local level contribution by two major local agencies, UNICEF (30%), SAWA (5% direct cash only), a contribution of at least 30% seems reasonable. This has also been confirmed by OTP who report a positive experience with community contribution

4.2 Design Aspects and Construction Methods

The communities construct the berkads using artisans, who act as designers and 'labour-only' contractors. The communities that own the berkads provide materials as well as semi-skilled and unskilled labour.

Table 4.1: Berkad Condition in the Surveyed Villages

Name of village	Year first berkad & village started	District	No. of families using the water in the village	Sound berkad	Cracked berkad	Dugout berkad- to be built	Total berkads
Xaaji Kayr	1962	Gardo	1,405	13	0	-	13
Sherbi	ina	Gardo	-	-	0	-	-
Yaka	ina	Gardo	-	30	4	-	34
Dhaxan	ina	Gardo	1,500	10	4	1	15
Adinsoone	1967	Gardo	1,000	19	3	10	32
Sanjiibe	1986	Gardo		13	0	9	22
Amba Sare	ina	Gardo	900	60	50	10	120
Dud Hoyo	1969	Iskushuban	1,000	58	2	15	75
Hubabays	1998	Iskushuban	500	12	11	9	32
Hiriro	1959	Iskushuban	2,000	100	10	10	120
Timirshe	1986	Iskushuban	3,000	60	0	15	75
Rebi Dirikle	1998	Iskushuban	1,000	9	0	5	14
Kobdehad	1969	Bosaso	300	16	4	18	38
Kala-Bayr	1987	Bosaso	250	5	2	5	12
TOTAL			8,950	392	90	107	589

Key: ina - information not available

The designs in place have been prone to cracking progressively across the centre of berkad on the shorter side or on other parts of the structure, and sometimes as micro-cracks on the wall as well as on the floor. (Plate 4: Annex 3). The cracking has been attributed to emptying during prolonged drought. In the villages covered by the survey, there were 90 cracked berkads out of 401 operating berkads. This represents 22.5%, which is a very high proportion considering the possible loss of water in the expected rainy season.

4.3 Inventory of Water Points

The mission visited several villages in the three districts of Gardo, Iskushuban and Bosaso. Table 4.2 shows the villages where interviews were conducted. For purposes of completeness, other villages visited were also included although interviews were not necessarily conducted. Three of the villages visited also have boreholes, namely, Adinsoone, Timirshe and Kala-Bayr. The geo-reference data is indicated in the Universal Transverse Mercator (UTM).

Table 4.2: Status of visited berkads

Name of village	Latitude (North)	Longitude (East)	District	Source of water	Year first berkad & village started	Families using the water in the village	No of berkads in place	Main use	Sound	Cracked	Dugout to be built	Dist. to reliable source of water (km)	Sale price (SoS/ Barrel)	Volume of berkad (m^3)	Cost (US$)
Adinsoone	1053930	39305842	Gardo	Berkad	1967	1,000	27	Livestock/ Domestic	19	3	10	16	0	882	ina
Amba Sare	1076584	39329750	Gardo	Berkad	ina	900	120	Irrigation/ Livestock	60	5	10	50	0	162	ina
Arta	1160919	39289451	Bosaso	Berkad											
Bika	1115686	39425053	Iskushuban	Berkad											
Bosaso	1246539	39298912	Bosaso	Borehole											
Dalmado	1136580	39416128	Iskushuban	Spring											
Darod	1153640	39369721	Iskushuban	Well											
Ceeley	1076584	39329760	Gardo	Berkad			0							176	
Dhaxan	1035482	39280367	Gardo	Berkad	ina	1,500	11	Livestock/ Domestic	10	4	1	65	25,000	875	ina
Dud Hoyo	1092823	39384823	Iskushuban	Berkad	1969	1,000	60	Livestock/ Domestic	58	2	15	30	35,000	750	9,000
Gardo	1051963	39290298		Borehole			0							176	
Hinra	1103034	39418052	Iskushuban	Berkad	1959	2,000	110	Livestock/ Domestic	100	10	10	50	30,000	225	9,100
Hubabaya	1108158	39443647	Iskushuban	Berkad	1998	500	13	Livestock/ Domestic	12	11	9	60	25,000	216	7,000
Iskushuban	1136734	39416418	Iskushuban	Spring											
Kala-Bayr	1197747	39309248	Bosaso	Berkad	1987	250	7	Domestic	5	2	5	50	20,000	30	5000
Kobdahad	1178211	39335812	Bosaso	Borehole	1969	300	20	Irrigation/ Livestock	16	4	18	13	1,000	216	7500
Leg	1220515	39301915	Bosaso	Well											
Rako	1081038	39360124	Iskushuban	Borehole											
Rebi Dinkle	1152731	39411222	Iskushuban	Berkad	1998	1,000	9	Livestock/ Domestic	9	-	5	17	30,000	234	ina
Sanjilbe	1063937	39299487	Gardo	Berkad	1986		13	Commercial	13	-	9	17	50,000	150	4,500
Shel Monshle	1158899	39382605	Iskushuban	Berkad											
Sherdi			Gardo	Berkad	ina	-	0	Commercial	-	-	-	85	0	156	ina
Timirshe	1168617	39436578	Iskushuban	Borehole	1986	3,000	60	Livestock/ Domestic	60	-	15	0	4,000	360	7,500
Tulo Issa	1152571	39407298	Iskushuban	Berkad											
Xaaji Khayr	994725	39309261	Gardo	Berkad	1962	1,405	13	Livestock/ Domestic	13	-	-	60	21,000	882	12,700
Yedan Yobil	1121544	39410832	Iskushuban	Bailey											
Yelh	1207471	39309045													
Yaka			Gardo	Berkad	ina	-	34	Commercial	30	4	-	17	0	202	ina
AVERAGE SIZE OF BERKAD						989	31		29	3	8	37.9	17,214	355.9	7,787.5
TOTAL						13,354	497	0	405	45	107	39.5	16,538	311.9	8,242.2

Notes:
1. Dashes indicate either zero entry or lack of information
2. The purchase of water is mainly derived from the cost of buying a truck of 100 barrels (drum), there such trucks are said to be available in Gardo.
3. Data for Amba Sare was taken very early in the morning from 2 women and a young man. This was considered indicative as it lacked detail.

4.4 Technical Performance of the Water Supply Facilities

Berkads: The technical performance of the traditional berkads is poor with a cracking rate of nearly 25%. There is a high variability of the quality of workmanship observed from satisfactory to poor. The best quality was observed on the SAWA berkads and on rehabilitated berkads by Oxfam-GB in Somaliland.

The causes of failure of the traditional berkads may be defined as follows:

(a) Drying up of berkads for long periods is considered to be the main cause of cracking. The water column in a berkad exerts lateral pressure that counter-balance the earth pressure. A pressure vacuum is created in side once the berkad becomes dry, whereas the surrounding soil continues to exert pressure which is usually strongest around the centre of the berkad. Due to the sandy nature of the soils, additional earth pressure likely to be caused by swelling of the soil is rather small.

(b) In a number of cases, poor concrete mix design and inadequate curing of concrete has resulted in spalling of concrete mortar and surface cracking.

Major repair works carried out by Oxfam-GB in Somaliland addressed these types of problems. (Plate 6: Annex 3)

Boreholes: Communities at all boreholes visited (Adinsoone, Timirshe and Kobdehad in Iskushuban, Gardo and Bosaso Districts respectively) lamented of poor discharges of the boreholes, which range between 1-2 m^3/hour. In some cases, the discharge is so low that the machines have to be switched off to allow the borehole to recharge. It should be noted, however, that three boreholes deliver water all year round.

Balleys or *wars*: All the four *wars* visited were dry. Three of these have not received and not taken action promptly. In all cases, the storage capacity was too small, i.e. 1,500 -2,500 m^3. The main weakness with all the balleys is the lack of a silt trap with the result that the pans are generally heavily silted.

4.5 Yield and Consumption

Most berkads are located within 1-2 km from the villages. However, the actual animal browsing and grazing range around the villages is usually much more. For 2-4 months in a year, when most berkads run dry, communities in the villages visited indicated they have to fetch water from a minimum and a maximum water fetching distances of 16 and 60 km respectively to permanent water points. Water points are busiest during the dry season, while some are completely out of use during the rainy season. At present, virtually all berkads in the villages away from the Bosaso - Gardo tarmac road ran dry 8 -20 months ago because of the drought.

Water in towns is mainly used for domestic purposes while the largest amount of water from berkads in the rural centres is used for livestock. Under normal circumstances, a family of 6 uses a barrel (200 litres) over a period of three days. This is equivalent to 11.6 litres/person/day. In times of shortage, this decreases to about 7 litres/person/day.

Water use for irrigation is found in specialised farming arrangements in small oasis farms. It should be noted, however, that some communities are developing berkads in villages near areas with a high potential for growing frankincense. Water use in the rural areas is heaviest for livestock purposes, while only small quantities are used for domestic consumption. In general, water for human consumption is of less importance

than that for livestock to rural communities. The livestock drink water either from traditional troughs or from concrete troughs at borehole sources.

The search for water and grazing determines the movement pattern of the communities. (See maps in Annex 5 obtained from UNDP office for Somalia). People and livestock use berkads and seasonal water ponds during the rainy season, and move away to the more permanent water sources (springs and boreholes) during the dry season. In general, livestock stay near berkads for 1 - 2 months after the rains before finally moving out.

5. COST RECOVERY ANALYSIS

5.1 Prices charged for Water

Villages with permanent sources sold water to the immediate hinterland. Individual, communal and co-operative berkads, whether they had water collected from runoff or had purchased it from tanker vendors, also sold water to the villagers. In order to gain a clear view about the prices and pricing methods for water, villagers were asked questions regarding how much they bought and sold water for. The results are summarised in Table 5.1 below.

Table 5.1: Level of Utilisation and prices paid for berkad and borehole water

a) Berkads

Name of village	Year first berkad & village started	District	No. of families	No. of berkads	Main uses of the water	Cost of filling a berkad (SS/ Barrel)	Dist. to reliable source of water (km)	Sale price (SS/ Barrel)
Xaaji Kayr	1962	Gardo	1,405	13	Livestock/ Domestic	21,000	60	21,000
Sherbi	ina	Gardo	-	0	Commercial	-	85	0
Yaka	ina	Gardo	-	34	Commercial	0	17	0
Dhaxan	ina	Gardo	1,500	11	Livestock/ Domestic	25,000	65	25,000
Adinsoone	1967	Gardo	1,000	27	Livestock/ Domestic	25,000	16	0
Sanjiibe	1986	Gardo		13	Commercial	25,000	17	50,000
Amba Sare	ina	Gardo	900	120	Irrigation/ Livestock	0	50	0
Dud Hoyo	1969	Iskushuban	1,000	60	Livestock/ Domestic	35,000	30	35,000
Hubabays	1998	Iskushuban	500	13	Livestock/ Domestic	25,000	60	25,000
Hiriro	1959	Iskushuban	2,000	110	Livestock/ Domestic	30,000	50	30,000
Rebi Dirikle	1998	Iskushuban	1,000	9	Livestock/ Domestic	30,000	17	30,000
Kala-Bayr	1987	Bosaso	250	7	Domestic	12,500	50	20,000
Average size of berkad			989	33		16,679	37.9	17,214

b) Boreholes:

Name of village/ borehole	Year first berkad & village started	District	No. of families served	No of berkads	Main use	Dist. to reliable source of water (km)	Sale price (SS/ Barrel)
Adinsoone	1967	Gardo	1,000	27	Livestock/ Domestic	16	4,000
Timirshe	1986	Iskushuban	3,000	60	Livestock/ Domestic	0	4,000
Kobdehad	1969	Bosaso	300	20	Irrigation/ Livestock	13	1,000

The charges for water varied from village to village depending on the distance to the nearest reliable water source, which either could be a borehole or a high yielding spring. The equivalent of 200 litres container costs between 12,500 and 35,000 SoS from such sources inclusive of transport. Once in the berkad, the water could be retailed at prices ranging between 20,000 – 50,000 SoS per barrel of 200 litres.
The mission visited three boreholes in the project area, namely Adinsoone near Gardo, Timirshe in Iskushuban and Kobdehad on the southern part of Bosaso District.

Using the case of Adinsoone in Gardo District as a typical example, the total running cost is estimated at US$ 3.47 with a safe hourly discharge of 1.6 m^3/hr and an average of 4 hours of pumping. Using this discharge the sale price of water at US$ 0.20 per barrel (200 litres container), the potential hourly income is expected to be only US$ 1.6. This relates well with the collected income that translates to US$ 1.88 per hour. Both these figures are approximately 50% of the actual cost of water. This explains why major repairs, which account for slightly over 70% of the total cost, are usually paid for by external sources. It is notable that the cost of water at the berkads is approximately 6 times the cost of water at the boreholes. Thus the committees managing the boreholes are collecting a very small fraction of what they could potentially collect. (See full O&M cost analysis in Annex 7)

5.2 Financial Management Methods

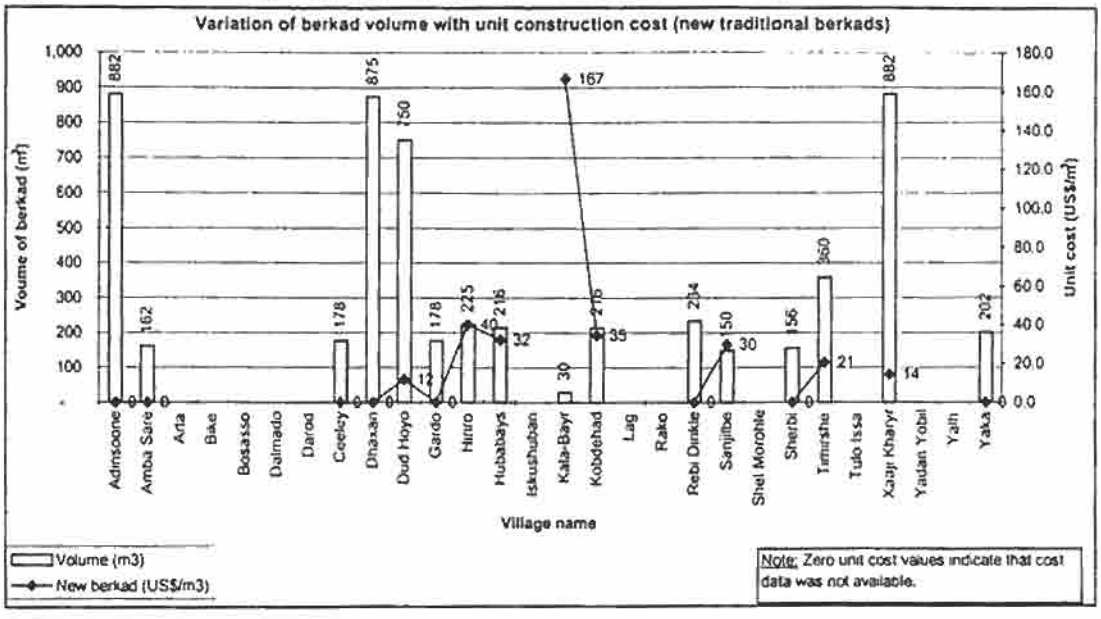
Methods of water fee collection vary greatly depending on the method of water supply. For the boreholes, water is paid for on the spot to employees of the water committee, who then hand-over the money to the committees. The committees keep custody of the money until the end of the month when some of it is used to pay the workers. Some of the money is kept until it is required for servicing and/or repair of the pumping equipment and delivery system.

In contrast, water from communal berkads is generally not paid for. The important thing for the communities is to have some water in the berkad. This is often arranged by asking groups within the community, which are interested in water, to fill the berkad with water while the community/ family that owns the berkad also shares in the water. Berkads owned by individuals, especially along the tarmac road, are purely commercial in nature and are characterised by high sale prices for water.

5.3 Cost Effectiveness of Applied Methods

The estimated cost of one berkad in different villages indicates large variations in the unit price of construction. This ranges between US$ 12/m^3 and US$ 166/m^3, with an overall average of US$ 39/m^3, whilst the per capita investment cost varies between US$ 0.42 and US$ 4.17, with an average of 2.25 US$. Figure 5.1 shows the variation of unit and per capita cost of the berkads analysed. (Detailed costs are presented in Annex 7)

Figure 5.1: Summary chart of variation of unit cost of berkad



These variations depend largely on the size of storage created, the distance of the village from the main source of materials (mainly Bosaso) and the local cost of labour.

6. ENVIRONMENTAL IMPACT ASSESSMENT

6.1 Rangeland Degradation and Carrying Capacity

Land in most of the project area was found to be highly de-vegetated through overgrazing, over-browsing and cutting of trees to provide housing, fencing and berkad covering materials. Trees are extremely scarce and in most areas, grass has been removed down to bare rock. Signs of soil erosion are easily visible with gullies showing on bare hillsides.

Goats and camels are kept widely and their continual browsing even during prolonged drought has led to removal of most of the consumable biomass in this region. At the time of the field visit, it had not rained in the project area for over two years and most of the livestock had been removed to other parts of the country. The carrying capacity of the land has subsequently been greatly reduced and could be estimated to be of the order of over 10 ha to a livestock unit. However, due to the ban on livestock (mainly sheep and goats) exports to the Middle Eastern Arab countries which has lasted three years, the tendency is for livestock numbers to increase without control. This over-concentration leads to greater pressure on the land, thus reducing further its carrying capacity.

6.2 Factors Affecting Settlement Distribution

In the project area, human settlement has concentrated along the main routes linking the various parts of the country. This phenomenon is particularly visible after 1960, which is about the age of the oldest village visited. These are the supply routes for food (including relief supplies) and other necessities most of which come from abroad through the port of Bosaso. They are also the marketing routes for livestock, which is now trucked across the region to the port, as opposed to earlier days when livestock used to be walked across the region. One of the reasons livestock is not walked across the region today is because there is no grazing and no water along the way. This trend of growth of settlements along the main supply routes is expected to continue as most of the villages interviewed confirmed that they would not relocate having invested heavily in berkads. The villages were found to have most of the necessities for human settlement including pharmacies, grocery shops and so on.

6.3 Impact of Increased Livestock Numbers as a Result of Water Points

Rehabilitation of broken down berkads or construction of new ones would have the same effect: that of ensuring that water for livestock and human consumption remained in the area longer than is the case at present. This would generally mean that livestock would linger longer in the area than is presently the case, a view confirmed by observations made in the villages with permanent water points such as Adinsoone, Timirshe and Kobdehad where there are boreholes. These increased numbers of livestock would inevitably lead to overgrazing, over-browsing and land degradation. Since the carrying capacity of the land is such that, without regular and sufficient rainfall, a point is soon reached where the carrying capacity of the land can no longer bear the livestock load, livestock migration would, of necessity continue. The point at which livestock should be ordered out of an area can be determined with the help of the elders.

7. INSTITUTIONAL ASSESSMENT (Cost sharing and Credit focus)

7.1 Community Organisation Affecting Operation and Maintenance

In all the villages in the sample, a Village Committee existed. One of the roles of the village committee was to ensure that the village was provided with water. To achieve this, the committee was responsible for approval of new berkads' location relative to the village. Where permanent water sources existed (such as boreholes or springs) the committee saw to the sale of water, supply of fuel, employment of staff, and maintenance of the pumping equipment. However, there was no organised way of determining the price of water on the basis of operation and maintenance costs of the equipment. The committee did not know how much they needed to be able to keep the systems running for say, one month. They also did not know how much to expect by way of sales collection. Training is required for these committees to learn how to predict village water requirements for the immediate and medium term future.

This inability of the community to estimate what is required and how much income to expect from water sales makes it difficult for them to be able to know how much they need in order to recover their investment costs over a given period of time. The survey did not come across a village or berkad owner who had maintained careful berkad construction or repair records leave alone setting cost recovery targets. Somali communities live on mutual trust, observed for the common good of all. No detailed records of water sales collections are maintained, nor does the committee have any way of ensuring that the water seller has disclosed the full amount collected. There are no banks. Often, pump and berkad operators do not earn a salary and may be paid some token amount as 'food'. Overall therefore, financial management is weak.

7.2 Degree of Dependence on External Assistance

After the fall of the government and the ensuing chaos, many Somali people migrated to other parts of the world. These emigrants maintain close links with their relatives at home and continue to assist them financially. Although it is not possible to estimate the level of the inflow of financial assistance, sources argue that it is quite significant and plays a major role in the survival and well being of the Somali living in Somalia. Other than this, the degree of dependence on external financial assistance from external donor agencies was found to be minimal. The few organisations such as SAWA and CARE who have supported people in the project area by constructing new and improved berkads, are a recent occurrence and their impact is yet to be felt. Most of the berkads built with their assistance have yet to fill with water.

7.3 Cost Sharing

Any project implementation process should be hinged on existing traditional structures for it to be successful. The elders in village development committees play a central role in allocating space for water facilities and ensuring the success of community projects, although the actual implementation is organised around families. Most of the hundreds of berkads constructed in the areas visited have been fully financed by the community. However, the recent prolonged drought whereby most of the area has not received rainfall for four seasons (2000 and 2001) has caused the deaths and emigration of a significant proportion of the livestock. The result has been low incomes from livestock sales, which in turn has largely been financing the construction of berkads. The fact that the community has been sustaining the construction of berkads without assistance for over 40 years (1959 to-date), indicates that local contribution on cost sharing basis is feasible. However, the level of cost sharing should be

progressively increased from between 10-20% during this time of drought to 30% in better times.

7.4 Revolving Fund Scheme: Experiences from Somaliland

Between 1991 and 1996, Oxfam GB in Somaliland ran an emergency famine and poverty alleviation programme targeted at rehabilitation of berkads and desilting of dams in Galbeed Region and rehabilitation of shallow wells in Togdheer Region. In 1996 the programme was reviewed and OGB shifted its mode of financing for 15 villages of Galbeed Region from cost sharing to a revolving fund. This programme continued up to 1999 in Galbeed and Togdheer and has been extended to end of 2002 (for Togdheer Region). More often than not, villages that had berkads did not need dams and ideally therefore, the two types of facilities were not serving the same beneficiaries. The revolving fund amount was set at USD 500 per person (i.e. per berkad) and the beneficiary was at first supposed to repay this to the village development committee (VDC) at an interest rate of 10% of the borrowed amount. Later, as interest is prohibited under Islamic doctrine, the interest component was abolished and only repayment of the principal was maintained. Repayment was scheduled at three equal quarterly instalments that would lead to complete recovery of the principal after nine months.

Under the programme, berkad owners selected by the VDC would be advanced 20 bags of cement (credit), chicken wire and trained masons to rehabilitate their berkads. By and by the programme started advancing this credit in cash (USD 500) instead. The project would also meet the cost of training VDC members. This training comprised of:

- Understanding of environmental, water and sanitation issues;
- General management and construction in masonry; and
- Financial management.

With this training the committees were expected effectively be able to:

- Select project beneficiaries without bias;
- Follow up beneficiaries for loan recovery and issuance to new beneficiaries; and
- Ensure that funds were applied to the intended purpose.

Potential beneficiaries were screened by the VDC and selected according to need. They were then required to raise a guarantor who too had to be approved by the VDC based on his wealth, as he would pay if the beneficiary failed to do so. An agreement was then signed between the VDC and Oxfam covering the whole village (i.e. all the beneficiaries). Another agreement was signed between the beneficiary and the VDC with Oxfam as a witness and in which the guarantor was enjoined.

Initially, 15 villages were selected each with 12 berkads as the first beneficiaries. For every three loans recovered in full (USD 1,500), Oxfam advanced an equivalent amount. This meant that for each three initial berkads rehabilitated in the first round of loans, there was potential to rehabilitate another six in the second round. Out of the first 15 villages, 5 villages failed to repay at all, while ten villages were able to repay in full after nine months. Out of the 120 berkads first funded and whose loan recovery was complete, Oxfam was able to advance funds for 120 additional berkads. This expansion led to inclusion of 10 new villages in Galbeed region and another ten villages in Togdheer region.

An investigation revealed that beneficiaries failed to pay for two main reasons:

i) The VDC, instead of selecting beneficiaries from within their villages without bias, had selected themselves as the beneficiaries. In one instance the chairman of the VDC was a beneficiary and the rest of the beneficiaries waited to see whether he would repay. When he failed to do so, they all refused to repay their loans.

ii) During disbursement of the loans to those villages, beneficiaries and committees were asked to collect the money from Oxfam offices in Hargeisa instead of the project delivering the funds to them in the villages. Those who collected the funds assumed ownership and refused to release the funds to the rightful beneficiaries. It was not explained to them and to other villagers that this was a loan and required to be repaid. Recipients assumed that it was a grant and therefore failed to repay thus causing the recorded high rate of default.

The Oxfam programme management is pleased with the performance of the revolving fund component so far. They feel that this has benefited the intended population and should be encouraged to continue and expand to cover more villages.

This year, the programme intends to phase out the first 15 villages. However, no evaluation has taken place and there is no blueprint prepared for this phase-out process. It is therefore not clear how the remaining loans will be collected and how the funds will be utilised in the absence of Oxfam.

Lessons from the Village of Qudah in Somaliland

Credit has been applied to rehabilitation of cracked berkads. Beneficiaries then repay from proceeds from water sales and the repaid funds allocated to a new beneficiary. This way, it is hoped that all the village berkads will be rehabilitated. The credit advanced for rehabilitation is USD 500 per beneficiary.

A beneficiary signs an agreement and provides two guarantors who will apply peer pressure to make sure that he pays. A ledger is maintained to record repayments from the beneficiaries. Individual sheets for each beneficiary are also maintained. In 2000 and 2001 the drought made it impossible for beneficiaries to repay their credit.

A case involving a truant beneficiary was recounted. When he failed to repay, his guarantors were summoned and told to urge him to repay. This they did but he did not pay nor show any reason why he should not pay. He instead disowned the guarantors, branding them trouble-makers. His case was taken to the police who promptly arrested him. At the police station he promised that he would pay and was released after two days in the cells and after signing a bill. Once out he sold livestock and repaid with expenses incurred in pursuing him. This served as a lesson to others and all have continued repaying their loans without fail.

Asked what would happen to the funds repaid once all the berkads had been rehabilitated, the secretary of the village credit committee replied that funds would be channelled to other sectors such as education. The aim was however, to rehabilitate all the available berkads so that if there was water left after domestic and livestock needs had been met, it could be used for irrigation of chillies, cabbage, kale, tomato etc.

7.5 Relevance of this experience to Bari Region in Puntland

It is notable that the population in Somaliland is a farming community with good income from trade routes to the Port of Berbera and sale of fodder to livestock exporters. Also the country has a strong administrative system. Lack of a functional local level administrative system in Puntland means that enforcement of payments by defaulters is unlikely to be realised at present, in contrast to the situation in Somaliland.

For the time being, the economic and political situation in Bari Region is far from developed to the same level as described in chapter 1. Most villages use water for their own consumption and rarely sell water for cash. Instead, anyone wishing to buy water from the co-operative / communal / family berkads is asked to purchase water by tanker and pour in the berkad for all to use. The community claims that they need water and not the money. It is necessary to wait for a comprehensive administrative system to be put in place and the economic status of the rural population in the area to improve, before an opportunity is open for starting the revolving credit for rehabilitation of berkads. Once started, this kind of credit could follow the same lines as the one that OGB is already using in Somaliland. Upon recovery of loan advances, the VDC would pass on to new selected beneficiaries. Careful planning of this external assistance is essential to ensure high recovery rates and success.

7.6 Local NGO credit experience: Dalmado Mothers Development Concern

Dalmado Mothers Development Concern was established in 1993 and operates in the district of Iskushuban where it has its offices. CARE funds most of their development interventions including a revolving fund credit scheme. Over the years, the NGO has carried out several activities the more notable ones being:

- Excavating 2 km long irrigation canal from Iskushuban Springs funded by CARE.
- Training farmers (2-years) on filtering water for domestic use, irrigation etc., using facilitators from Bosaso at an average fee rate of USD 60 /day/facilitator.
- Marketing of farm produce from the irrigation supported by Iskushuban springs. Traders come from Bosaso to ferry away produce.
- Education- the NGO supports an adult education school.
- Paying salaries for maternal child health care workers.
- Credit scheme to buy sewing machines and support women handicrafts with funding from UNDP whereby repayments were returned to the financier.

The NGO operates mainly in Iskushuban town and consists of Project Manager, Cashier, Administrator, Accountant, Members of Committee, 7-Member water committee and a Secretary. The establishment does not earn a salary unless there is a project to cater for it. To meet its overheads, the NGO collects funds from its members from time to time. All the listed members of the NGO were trained in credit management by the UNDP before they obtained the credit line to extend to the business community. The training was conducted over a four-month period.

The largest credit budget the NGO has so far handled during the last of three years funding from a UNDP credit was 150,000,000 SS (equivalent to the cost of construction one small new berkad or repairing two medium sized berkads). This credit scheme lasted two years and was managed in phases. Small businesses were allowed to borrow SS 500,000 (USD 25) the first year, SS 1,000,000 the second year and SS 1,500,000 in third year. Borrowers repaid weekly in equal instalments over a period of one year with a 12% interest in the first year, 22% interest for second time borrowers and 30% interest for third time borrowers. It was reported that there were no defaulters in the first and second years but a default rate of 30% was recorded in the third year. Perhaps this occurred because beneficiaries were aware that the credit scheme was coming to an end and that good performance would no longer be rewarded. Businesses benefiting from the credit scheme included farming, handicrafts, and other small businesses. The NGO believes that the poor performance of the credit had to do with micro-irrigation.

7.7 Women Representation in Water Management and Other Forums

All the villages visited except the IDP at Bosaso had a village development committee (VDC). In the majority of the villages the committee was composed of at least seven members consisting of five men and two women. During the interviews, those attending the interviews gave assurances that the views of the women were always considered before decisions were made on matters concerning water. In no instance however, were women seen to express their views freely though they happened to be present during the interview. Besides, UNICEF had already reported that women were rarely consulted on matters concerning water except when funds were required and women had to be mobilised to contribute. Overall, women representation in water management and other decision-making forums in the project area were found to be poor.

8. HEALTH AND SANITATION SITUATION

8.1 Disease Patterns

Presently, the most prevalent human diseases in the area are malaria, intestinal worms, hepatitis B, tuberculosis, diarrhoea and trypanosomiasis. It is expected that with improvement of berkads, these diseases may increase especially due to increased mosquito breeding as a result of an improvement of their habitat leading to a higher rate of malaria transmission. At the same time, bilharzia and diarrhoeal diseases will play an increasingly important role in the health of the population unless greater hygiene awareness is created among the communities. Availability of health facilities is extremely poor for rural villages with the main hospital only found in Bosaso and ill equipped health centres in Gardo and Iskushuban. Most villages see a passing vehicle once in 4-7 days, and may not be going towards the hospital. It is necessary therefore, to introduce appropriate preventive health interventions so as to safeguard the health of the population. One such intervention would be training of women in the handling of water, particularly boiling of drinking water.

8.2 Waste Disposal Systems (Sanitation)

The majority of the population in the project area defecates in the bush, i.e. they do not go to a toilet or latrine. As a result disease organisms are easily washed into berkads. Further, there is no organised garbage collection system and solid wastes are left anywhere. Although in a few villages it was revealed that there were garbage dumping grounds, there was no regular collection and disposal and no authority appeared to take responsibility for this activity. What had been found to be the case in Bosaso was true of all the villages visited.

8.3 Water Use and Storage at Household and Community Levels

At the community level, water is stored in berkads, whether it has been collected by the berkad or has been purchased by tanker. Without any kind of treatment and given the evaporative losses that occur, it soon turns green and mucky. This water is used for all purposes - domestic and livestock watering. Waterborne and related diseases are said to increase when it rains, implying that dirt is washed down into the berkad from the catchment area of the berkad.

At the household level, there is a tendency to re-use water for washing and to preserve even dirty water in containers. Whereas it is true that water is often in great shortage, this practice exposes people to many dangers as water is easily contaminated with re-use.

8.4 Awareness Creation

In view of the above, there is dire need for an awareness creation campaign to be conducted in the project area. The awareness campaign should target construction and use of pit latrines, regular and responsible garbage collection and disposal, proper storage of water to avoid contamination and water treatment such as chlorination of berkads or boiling of drinking water. Awareness should further be created on how to destabilise mosquito breeding ground by adding oils and introducing mosquito larvae-eating fish. This awareness campaign is best conducted before the commencement of project implementation.

9. PROFILES OF SAMPLED VILLAGES

9.1 Gardo District

1. Hagi (Xaaji) Kayr Village

This village lies about 65 km to the south of the Gardo district headquarters. 20 men attended the focus group discussion. The village has over 500 families and about 100 families have no berkads of their own but depend on those owned by other villagers.

The village has 13 berkads all owned by various families. There are no communal berkads. Of these, 3 are badly cracked and are in urgent need of repair. Very little by way of repair work was going on because of the dire shortage of cash in the village. Construction and repairs are carried out using local masons but sometimes there arises the need to hire more skilled masons from towns such as Bosaso. Inspection of berkads and repairs is biannual i.e. during each of two dry seasons.

A village committee decides on the positioning of each berkad before construction starts. But each berkad has to be placed where it can easily collect runoff, which sometimes originates as far as five km from the location of the berkad. Therefore collection canals can be as long as 5 km.

The village committee selects a person to be in charge of the berkad and to sell water but the proceeds from water sales go to the proprietors of the berkad.

The most common diseases in the area are malaria, diarrhoea and bilharzia. Patients have to travel to Bosaso for treatment, as there is no health facility in this or nearby village.

Villagers were not aware of any agencies donating funds for development in the area. They named their areas of greatest priority as water, health and education.

2. Dahan (Dhaxan) Village

17 people - 13 men and 4 women attended the focus group discussion in this nomadic settlement.

The village has 11 operating berkads, which serve 1,500 families both around the commercial centre and in the surrounding hinterland. On average the berkads measure 25m x 10m x 3.5m. 10 of the berkads are owned by what is generally called a co-operative, but is essentially a loose partnership built to enable the participants to put together sufficient funds to complete construction of a berkad. 14 new berkads have been excavated and not constructed.

All the berkads were dry at the time of the study and had remained so for two years. Villagers were therefore dependent on water brought by truck by traders at SS 1.5 million for 100 barrels, a price, which was considered to be relatively cheap.

The village has no toilets, no health facility, no garbage collection mechanism and no school. Diseases common in the area include malaria, diarrhoea (especially during the dry season when berkad water is brackish), smallpox and tuberculosis.

Villagers said that they had heard of SAWA who had developed a berkad in a neighbouring village but no agency had ever come to their rescue. They said that their livelihoods were adversely affected by the ban on livestock sales to the Middle Eastern states.

3. Adinsoone Village

The focus group discussion was attended by 15 men and 4 women but the women were generally quiet as the men gave their views on the various issues.

The main source of water for Adinsoone village is a borehole drilled originally to a depth of 280m but today thought to be drawing water only from a depth of 200m with the pump set at 180 m. It was built with Chinese aid in 1989 and gives a yield of 2 cu m. The borehole uses a Perkins diesel pump-set with a 22kW rating pumping into a 5,000 litre overhead tank. At the time of the visit the old pump-set had just been replaced with a new one by PSAWEN. The new machine had been obtained through Islamic aid. The pump has 20 operators who work free except for SS 20,000 (USD 1) per day 'food' allowance for the one on shift.

The community sells water from the borehole to the surrounding villages at SS 1,000 per camel watering, SS 500 for a cow and SS 150-200 for a shoat. Villagers also pay SS 200 for a 20-litres jerry can for the water in order to raise operation and maintenance finances for the pump-set. The village has about 20 berkads, which were all dry at the time of the visit.

There is a village committee which, keeps the collection from water sales and release it to purchase machine servicing and fuel requirements.

Due to there being a permanent supply of water in this village, the surrounding areas are heavily overgrazed because livestock remain in close proximity of the borehole for longer than would normally happen. This concentration of livestock has led to severe environmental degradation. This is true of the surrounding villages too, the closest of which was 15 km away.

4. Yaka Village

Yaka is a fast-growing roadside settlement, which started in 1996. It is the second largest centre in Gardo District and has about 500 families in and around the centre. These depend on 33 berkads for water supply, some of which are very small – less than 10 m^3. At the time of the visit all the berkads were dry except 3 which had been filled with water trucked from as far as Gardo 35 km away.

5. Sanjilbe Village

The village has 70 families but many had migrated in search of water. There are 13 berkads in the village and all were dry except those filled with purchased water to stop them from cracking. Water was delivered to the village at SS 2.2 million for 100 barrels. When selling water in the village, SS 500 is paid for a jerry can of rain berkad water and SS 2,500 for purchased water. The village started in 1986 and it has now become a permanent settlement.

Co-operatives own seven of the berkads, while families own 3 and individuals own 3. There are committees for co-operative-owned berkads and there is also a village committee made up of 5 men and 2 women, which is responsible for all matters affecting the village.

The village has no latrines partly because the villagers believe that when it rains, the latrines easily fill up with water because of the poor drainage and dirt spreads everywhere. The cost of digging a latrine was put at SS 200,000 (USD 10), which sounded high for most of the villagers.

Highest priorities for development were named as a) water, b) education - a primary school as there is only a *Koranic* school at present, and c) sanitation - the digging of pit latrines and training on how to use them.

9.2 Iskushuban District

1. Duud Hoyo Village

Water Supply

Seventeen men and four women attended the focus group discussion for *Duud Hoyo* village, Iskushuban District. Village started in 1969 when the first berkad was built. The site was chosen because it was a good grazing area.

The group reported that the main and indeed the only source of water were berkads. The village has 60 berkads, 58 of which are operating and 2 are cracked and require repair. 15 others have been dug but not yet constructed. The cracking was attributed to lack of water in the berkads as rains had failed throughout 2000 and 2001 (four seasons). The village had filled 4 berkads with water brought by tanker from Rako, which was 28 km away. There were at least 1,000 families using this water for both domestic and livestock watering purposes. These families were purchasing the water for Somali shillings (SS) 35,000 per barrel (200 l) and SS 3,500 per 20 litre jerry-can. This is the same price paid to the water supplier - the community was not selling water for a profit.

The berkads dried up twice in a year about two to three months after the end of the rainy season (i.e. about September) as the rains come between April and June. For as long as there is water in the berkads, livestock remains in the area and this sedentary nature of livestock leads to overgrazing thus devastating an already fragile environment.

Of the operating berkads 20 were family-owned while "co-operatives" or partnerships between several families owned 40 berkads. The average size of the berkad was reported to be 25m x 10m x 3m (750 m^3) and was estimated to cost USD 10,000 (Somali Shillings 200 million) to construct. Details on the construction costs of berkads are contained in Chapter 4 of this report.

Hygiene and Sanitation

The village had 10 pit latrines, 5 of which had been dug and built by UNICEF and were for public use, while 5 were privately owned. The village did not have a health post and sick people had to travel to Bosaso, a distance of about 170 km. The main diseases experienced in the area were Malaria, diarrhoea, intestinal worms, tuberculosis, respiratory tract infections and amoebiosis. It was reported that in the three months preceding this study, at least 15 villagers had died of various diseases.

Livelihoods
The main source of livelihood is the sale of livestock and particularly goats. However, the market had dwindled because of a ban on Somali goats by the Arab states of the Middle East, due to suspected Rift Valley Fever. This ban had gone on for two years. There was charcoal burning for the Bosaso market but this had adverse effects on the environment.

Community Organisation
The village had a Village Committee made up of 7 persons - 2 women and 5men. Elections for office bearers were conducted annually and the last election was held in December 2001. They reported that there had not been any agency wishing to assist them with water development but have heard of SAWA which was assisting communities in the neighbourhoods. AAH had assisted them by constructing and manning a primary school which had up to Standard Five Class, but was due to pull out in March 2002. The community was preparing to take over the school if no extension of AAH aid can be obtained. The community listed their priority development areas as 1) Water, 2) Health, and 3) Primary School.

2. Hubabays Village

Water Supply
8 men and 2 women attended the focus group discussion for Hubabays village.

The village started in 1999 and only one villager had goats. The first berkad was built in 1999 villagers settled 2 months after completion of the berkad. So far there were 400 – 500 families in the urban centre and the surrounding rural areas. The only reliable source of water was the spring at Iskorosar, which was 60 km away. Water is purchased at SS 700,000 for 30 barrels and is delivered by tanker. In the village, water is generally not sold but when it has to b e sold it fetches about SS 30,000 per barrel.

There were 13 operating berkads, of which one was cracked; and another 9, which had been excavated but not yet constructed. At the time of the field survey, only one berkad had the equivalent of 10 barrels of water, which had been purchased from Iskorosar. The community was aware that keeping berkads without water might lead to their cracking but argued that they had no resources with which to fill all the berkads.

One of the berkads was owned by a "co-operative" of three persons while single families owned 12 berkads. A berkad was reported to cost SS 8 million to construct, exclusive of unskilled labour. The typical size of the berkad was given as 12m x 6m x 3m (126 m^3). Each year, the berkads dry up for 3-7 months starting in February, having kept water for 1-3 months after the end of the rainy season. The general tendency is to bring livestock to the area during the rains and this causes the water to be quickly used. Livestock remains in the area until there is a drought and water runs out. Villagers expressed the view that they would like to maintain livestock in the area so as to obtain meat and milk and therefore make the village more populated.

Hygiene and Sanitation
The village had four private latrines but the majority in the village used 'the bush' to dispose of human waste. Although the villagers said that they were aware of the dangers of not using latrines, especially as berkads collected runoff from all the areas including where villagers defecated, the villagers argued that they had no resources with which to construct latrines. They also said that they had no experience in construction and use of latrines.

The main diseases reported were Jaundice (Hepatitis B?), malaria, and diarrhoea. The nearest place where they could obtain medication was Bosaso, some 200 km away. Villagers have dug garbage pits, where they dump solid waste and burn it from time to time.

Livelihoods
Like in most of the other villages, communities in this area depended on sale of goats for their livelihood. The reported that since the ban on exportation to the Middle East, marketing of their livestock had been greatly hampered. Further, due to the 2-year absence of rain, most of the livestock was emaciated and could not fetch a price in the local market.

Asked to give their views on what is considered wealth in the area, the community ranked the richest person among them as one who owned 300 goats and 10 camels; medium rich as one with 150 goats and 5 camels; and poor as those who possessed 30 goats and one camel. There were also the very poor who possessed "nothing" according to the focus group. This lot was totally dependent on the other members of the community for their livelihood. Villagers estimated that their 500-family community comprised 25% rich, 25% medium rich, 40% poor and 10% very poor people. The very poor are not denied basic necessities of life by the rest of the community; and sometimes they do casual work for pay.

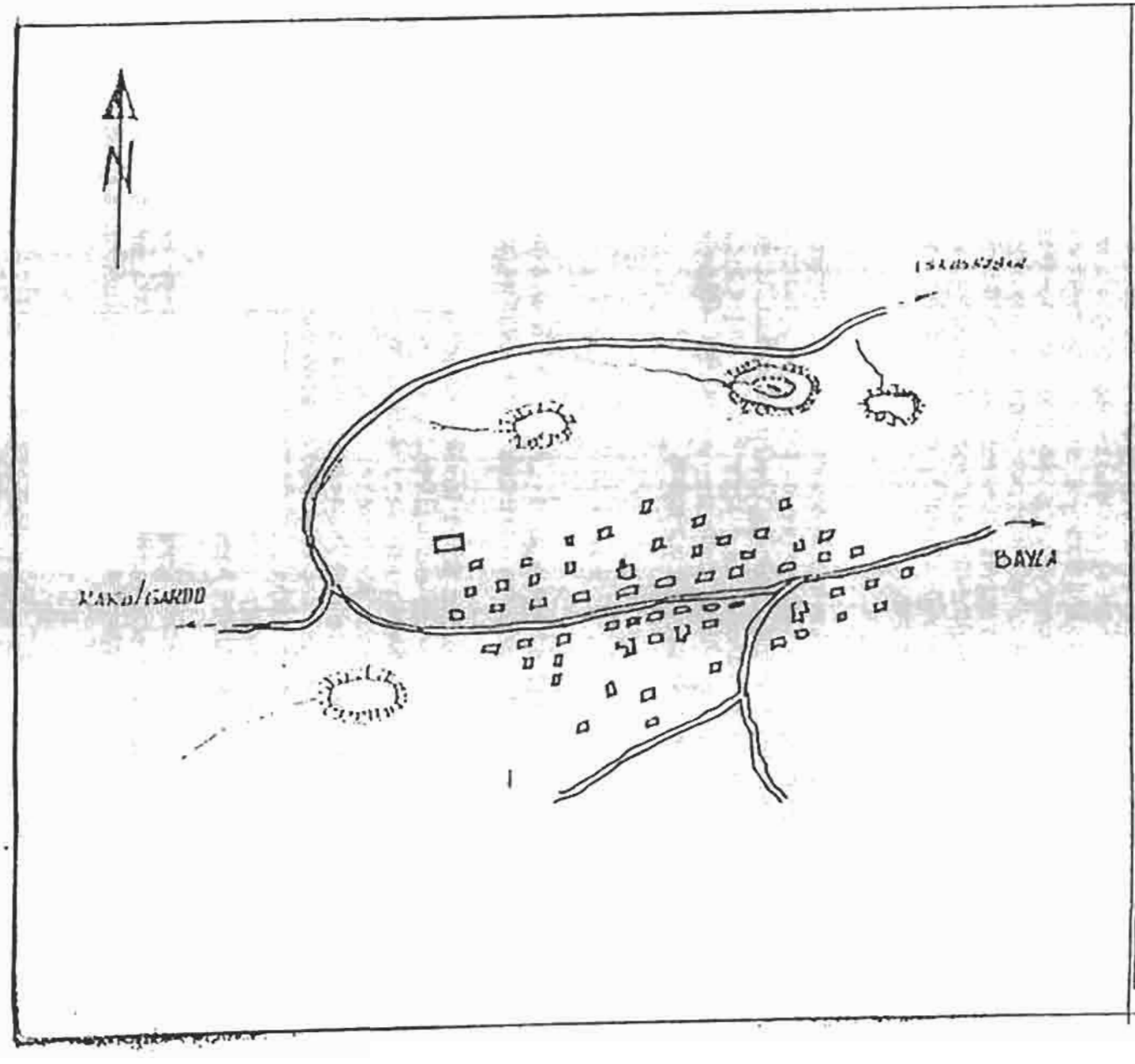
Community Organisation
There was a village committee which had 8 persons, 2 of them women. However, all the members of the committee except one had left the village in search of pasture for their livestock and livelihoods in the larger urban centre of Bosaso. Asked to rank their immediate problems in order of priority, the villagers listed 1) Water, 2) Sanitation, and 3) Education in that order. The village committee has initiated two projects: a health post and a school, but these are yet to be completed.

3. Hiriro Village

Water Supply
6 men and 3 women attended the focus group discussion. There were very few people in the village as the majority had gone away to Bosaso in search of water.

The village started in 1959 and had 2,000 families including those living in the immediate rural area. The first berkad was also constructed in 1959. There were 100 operating berkads, 10 of which were cracked and required repair. At the time of the survey not a single berkad had water and more ran the risk of cracking although they were protected with a brushwood canopy. The nearest natural source of water was the Iskushuban springs, which were 50 km away. Berkad sizes varied from as large as 20m x 6m x 3m to as small as 5m x 5mx 2.5m. Of the 100 operating berkads, 97 were family-owned while the community owned only three. The Government had constructed two of the three and UNDP had constructed one.

The village was purchasing water from either Iskorosar - 90 km away, or Iskushuban - 50 km away. The price quoted for a barrel of water was SS 30.000, and the villagers used this water without further paying for it because it was already communally owned.



PLAN XIRRIRO

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Drawn by: Samater Abdi Samater
SAWA/SPDS Bari water rehabilitation study

On average, the area went through a dry spell for at least four months in the year - it was reported that since September 2001, there had been no rain in this area, and no rains had come as anticipated between October 2000 and January 2001. Berkads keep water for about two to three months after the rains after which they dry up. Heavy concentration of livestock in the area when water is available leads to fast depletion of vegetation cover. Under normal circumstances, water is available in May, June and July. It was reported that drought had occurred in 1997–1998 and 2000 to the time of this study. Before that, droughts had also occurred in 1994 and 1984. *Africare* had constructed one balley but this was found to be dry. The balley keeps water for only a short while after the rains due to the high evaporative losses and the intense siltation, which reduces balley capacity.

Hygiene and Sanitation
The village had 61 pit latrines, twenty of which had been constructed by CARE and 40 by families. CARE had constructed one additional pit latrine at the health centre.

The most common diseases reported in the area were Malaria, diarrhoea, flu, respiratory system infections (generally call bronchitis by the villagers), hepatitis B which causes jaundice, and typhoid. The villagers do not boil drinking water. AAH built the health post and employed personnel in 1990 and will continue paying their salaries until February 2002. The health facility collapsed after the withdrawal of AAH because the village committee was not prepared for the take-over of the facility. Villagers reported that business was so bad that even privately run pharmacies had closed shop and relocated to Bosaso.

Community Organisation
There is a village committee made up of seven members - 6 men and 1 woman.

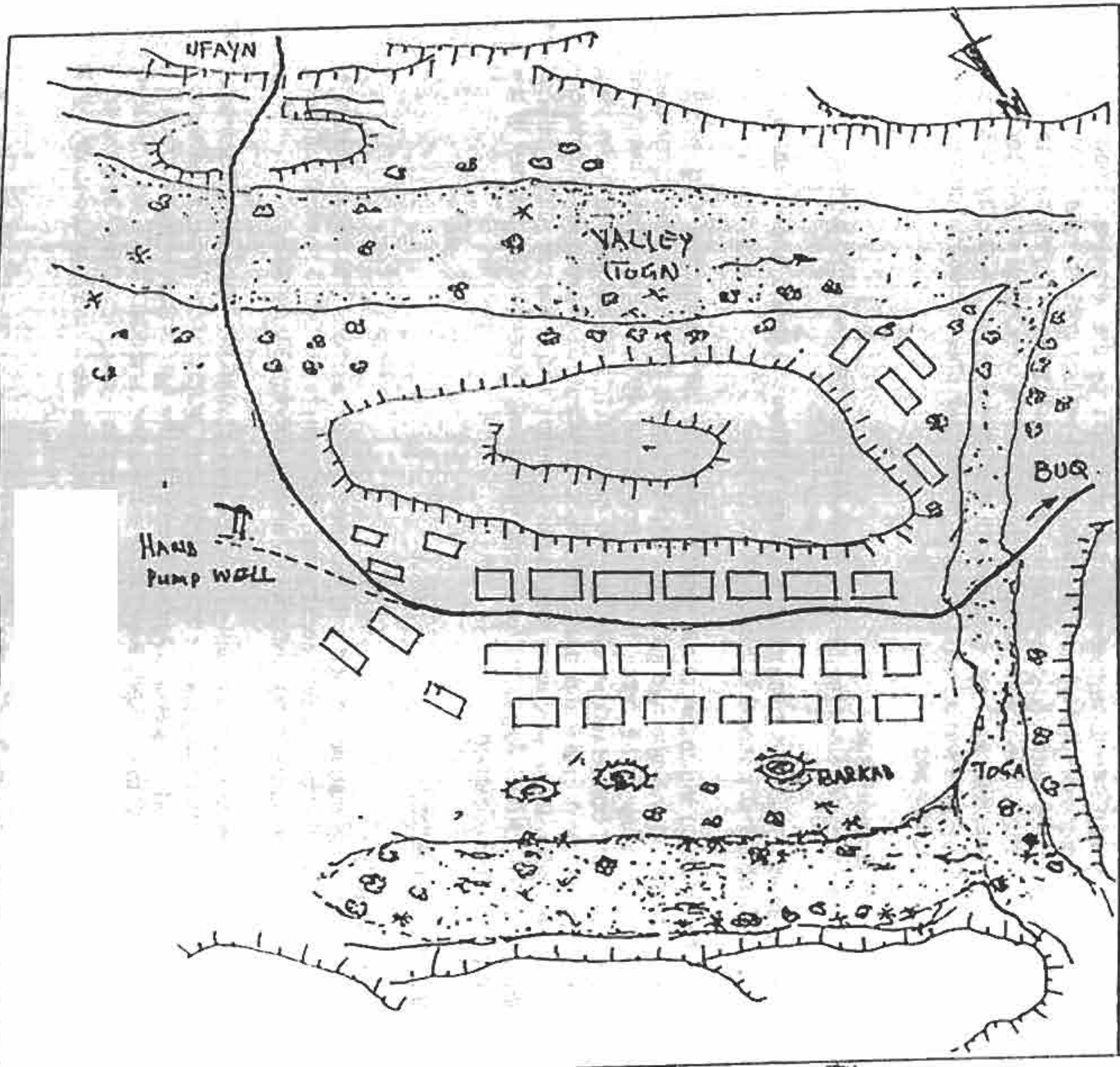
The community identified their priority areas as 1) Water, 2) Health and 3) Education. There was no primary school in the village.

Asked to give an indication of the wealth ranking in the village, they said that the richest person is one who had 300 goats and 50 camels and this number constituted 30% of the village. The medium rich made about 40% of the village heads of households and possessed on average 150 goats and 10-20 camels while the poor had 30 goats and 1 camel and made up 20% of the village. There was also a category of the very poor, those who were said to have nothing and these constituted 10% of the population of the village. The very poor were solely dependent on the rest of the society for their livelihood.

4. Timirshe Village

Water Supply
The focus group discussion had only ten men and no women. The village started in 1986 when the first berkad was constructed. Today there are 3,000 families within the village and in the surrounding rural areas. Families average 10 persons.

There are two main sources of water: berkads and a borehole. There are 60 operating berkads serving the village and although they were all dry at the time of the survey, none were cracked. However, villagers expressed the fear that they might crack if it didn't rain soon. All the berkads were family-owned and averaged 15m x 8m x 3m (360 m^3). 15 more berkads had been excavated but not yet constructed. Berkads are dry 2 months after the end of the rain and by the time of this study, they had been dry for at least two years. Rains come during mid-April to mid-July.



PLAN TIMIRSHE

not to scale

Drawn by: Samater Abdi Samater
SAWA/SPDS Bari water rehabilitation study

Villagers were buying water from the borehole which was sank in January 1989 Western Geophysics Company and started pumping in 1999 using a diesel pump. Borehole water cost only SS 4,000 per barrel, SS 10,000 per 100 goats and SS 1,000 per camel watering.

A village committee is responsible for the operation of the borehole. The pump operator collects money from water buyers and people watering livestock and hands it over to the committee. There are four persons manning the communal water point and a pump operator. The pump operator earns SS 900,000 per month and the others SS 150,000 each. When water sales are low, this staff is paid about SS 7,000 per week (for food). Part of the collection is put aside for purchase of fuel and oils for running and repair and maintenance of the pump.

The major problems mentioned by the villagers were 1) cracking of berkads, 2) Malaria infection, and 3) Inability to protect the berkads with cover because of shortage of funds.

The villagers reported that there had been several agencies working in the area including CARE, which had constructed the borehole and supply of pumping station. They had done this in 1998, ten years after the borehole was drilled by Western Geophysics, an oil exploration company. Western Geophysics had signed an agreement with the local community to the effect that they would not be involved in construction of the borehole after they had completed the drilling.

Hygiene and Sanitation

The village had 150 pit latrines - 4 built with AAH assistance (2 at the Primary School and 2 at the Koranic School). All the others were privately owned and all averaged a depth of about 3 metres. Most of the residents of the village were reported to be using latrines.

There were no garbage pits in the village but there was a specific area where garbage was routinely gathered and burned every 2 months or so. The village appeared relatively clean during the field visit.

The more common diseases were reported to be Malaria, diarrhoea, bronchitis, TB. Since the beginning of 2002, 5 people had died, most of them children. There was no health facility and the sick had to travel to Bosaso for treatment, a 22-hour return journey that costs S 100,000 (USD 5). This travel was compounded by the fact that it took 4 to 7 days before the village received any form of transport.

Community Organisation

The village had a committee of seven people - 5 men and 2 women. The committee is responsible for paying the borehole operators and setting charges for the water. The collection from water sales is kept in the custody of the committee.

The environmental effect of keeping livestock in the area for long periods is that there is considerable defoliation, overgrazing and land degradation. It was reported that before there was permanent supply of water from the borehole, livestock would move away from the area during the dry season in search of grazing. This way vegetation cover would get a chance to rejuvenate. Today, however, the villagers lament that the area has become bare because livestock is not moved away as there is water throughout the year. This, they said, is not good for the land.

Villagers gave the following priorities to be addressed by any agency wishing to assist in development 1) Health post, 2) Tanker to take water to livestock, and 3) Fuel for pumping station. On the third problem it appears like the water sales proceeds are not capable of maintaining an operational budget as it was reported that the pump had stopped about two months before due to lack of fuel. When this happened, the committee collected money from villagers and bought fuel. It was clear whether each household had contributed the same amount of money towards this venture.

Villager ranked wealth as follows:

i) Richest - those owning 100 or more goats, constituting 40% of the population
ii) Medium rich - those owning 50 goats to 100 goats who made up 30% of village
iii) Poor - those owning 20 -50 goats and these made up 30% of the village population
iv) The poorest of the villagers made up 20% – 30% of the population and were said to have 'nothing'. These people depended solely on others for their livelihood.

5. Rebi Dirikle Village

Water Supply

Rebi Dirikle Village started only in 1998 when the first berkad had been built and had 9 operating berkads that were all dry at the time of the visit. None were cracked and all were owned by various families. Five other berkads had been excavated but not constructed.

This village had a total of 1,000 families including those inhabiting the surrounding 'rural' areas. The village itself had 30 families in this village but at the time of the visit only about 20 people remained in the village because it was so very dry and most of the families had migrated in search of water. The berkads had remained dry for no less than 8 months and were in great danger of cracking. Those remaining purchased water by tanker from Iskushuban at SS 30,000 per barrel. No livestock remained in the village because of the problem of water. Food too was being imported from Bosaso where some of the relatives of the remaining villagers dwelt.

Hygiene and Sanitation

There were no toilets in the village. The main diseases reported were Malaria, diarrhoea, bronchial aliments and treatment was only available in Bosaso, a distance of 190 km.

In this village, they had not heard of any agency assisting the population with any type of development. They listed their priority concerns as Water, Health, and School in that order.

6. Darod Village

Darod village has a small 'war', which is fenced, and heavily silted. It is fed by runoff from hills located more than 50 km away. At the time of the field visit, the silt was over 1 m deep (Plate 7: Annex 3) although the war had been desilted the previous season.

9.3 Bosaso District

1. Kobdehad Village

Water Supply
In this village, 8 men and 1 woman attended the focus group discussion. The village started in 1969 with only a few families but today there are over 300 families excluding rural people. The average size of the family is 6 persons.

The main source of water is berkads but there is also a borehole located about 15 km from the village from where water could be fetched. There are 22 operating berkads (3 group-owned and 17 family-owned). Among them, 4 were cracked and 18 were functioning but were dry and there was general apprehension that they might crack since they had remained dry for over 24 months during which time no rainfall had been received in the area. 10 other berkads had been excavated on a promise by the UNDP that they would be constructed but the project fell through and they were never constructed. It was said that the head of UNDP in the district had been transferred before he could fulfil his promise and his successor appeared disinterested in the project. When elders followed up the matter in Bosaso in 1997, they were informed that the project had already been closed. Earlier on, berkads were used for irrigating about 40 garden plots, which produced a variety of horticultural crops.

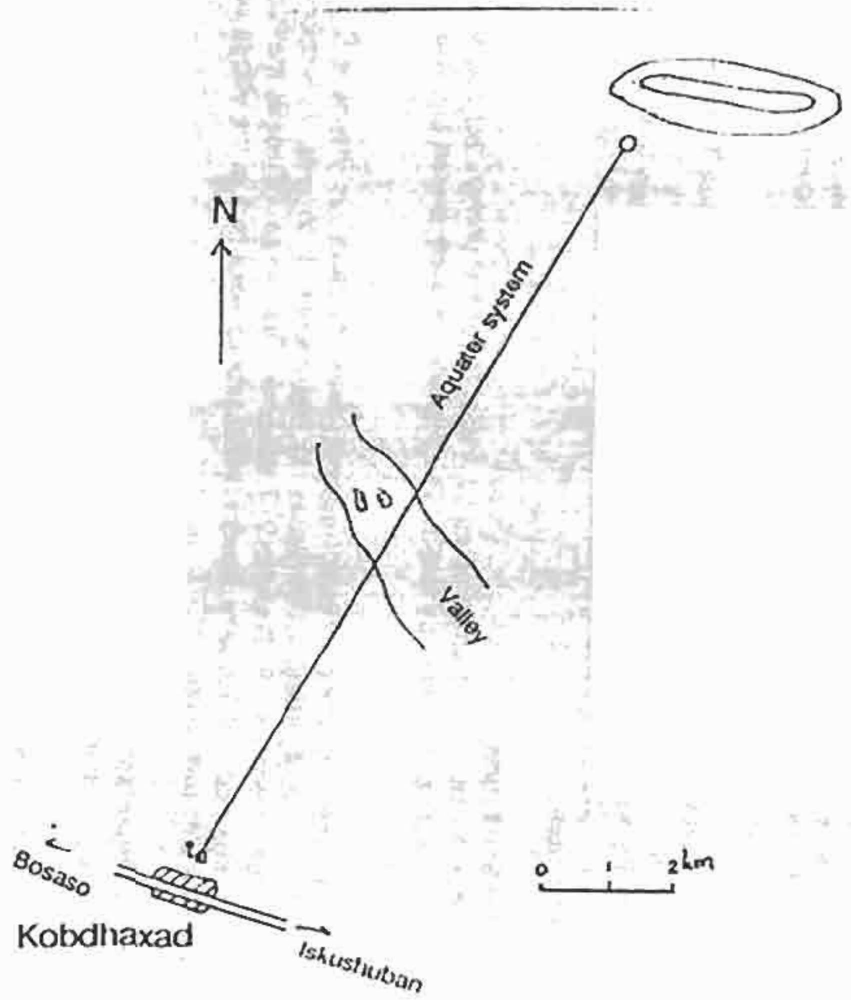
The borehole lies some 13 km from the village and was drilled by Aqua-Terra in 1987. Donkeys are often used to ferry water from the borehole to the village. Water brought by truck from the borehole costs SS 10,000 per barrel, and the money is kept by the borehole operator. Watering livestock with this water costs SS 8,000 for 100 goats and SS 1,000 for a camel.

Hygiene and Sanitation
The village has 40 latrines - 1 constructed by Africa 70 for the primary school, and 1 for the health centre constructed by CARE. The rest are privately owned and used by specific families.

It was reported that the more prevalent diseases were 1) Jaundice (hepatitis B), 2) Malaria, 3) Diarrhoea, 4) Intestinal Parasites, 5) Pneumonia, 6) Worms, 7) bronchial (respiratory tract infections), 8) TB, and 9) Trachoma. The clinical officer at the local health centre reported that Sexually Transmitted Diseases were rare in the village and HIV/AIDS was unknown altogether.

Community Organisation
There is a village committee of 7 persons - 6 men and 1 woman. Further, the village has a crew for running the borehole comprising an accountant, a pump operator and 2 guards. The pump operator may from to time keep about 30% of the collection from the sale of water as his salary. Fuel is often ferried to the borehole by donkeys volunteered by the villagers. The last election of the committee was conducted in August 2001. The village boasts a primary school that runs up to Standard 8 and a Koranic school.

Presently, the most important development intervention areas by order of priority are:
1) Berkads for irrigation of maize, sorghum, melon, tomato, etc.
2) Sanitation education
3) Income generation activities – agriculture, small business, pharmacy



PLAN KOBDHAXAD

not to scale

Drawn by:
SAWA/SPDS Bari water rehabilitation stu...

The village ranked people in the village and the surrounding areas by what they conceived to be wealth as follows:

- % of households as the richest own 200 goats today (500 before drought) goats, and 50 camels today (100 before drought)
- 20% of households as medium rich own 100 goats today (200 before the drought and 20 camels today (50 before the drought)
- 50% of the households ranked as poor own 50 – 60 goats and 5-10 camels
- 20% of the households ranked as the poorest own no goats and no camels.

Environment

Reflecting on the state of their immediate environment over a 5-year period, villagers observed that before the berkads and the borehole were built, there was sufficient vegetation cover but today all was gone due to overgrazing. The situation today is that during the dry spells livestock concentrates in the area and destroys the vegetation by grazing and trampling. Further livestock numbers do not cyclically reduce as was the case before the ban on livestock sales to the Middle East (and particularly Saudi Arabia). This ban has persisted for 3 years now.

2. Kala-Bayr Village

Water Supply

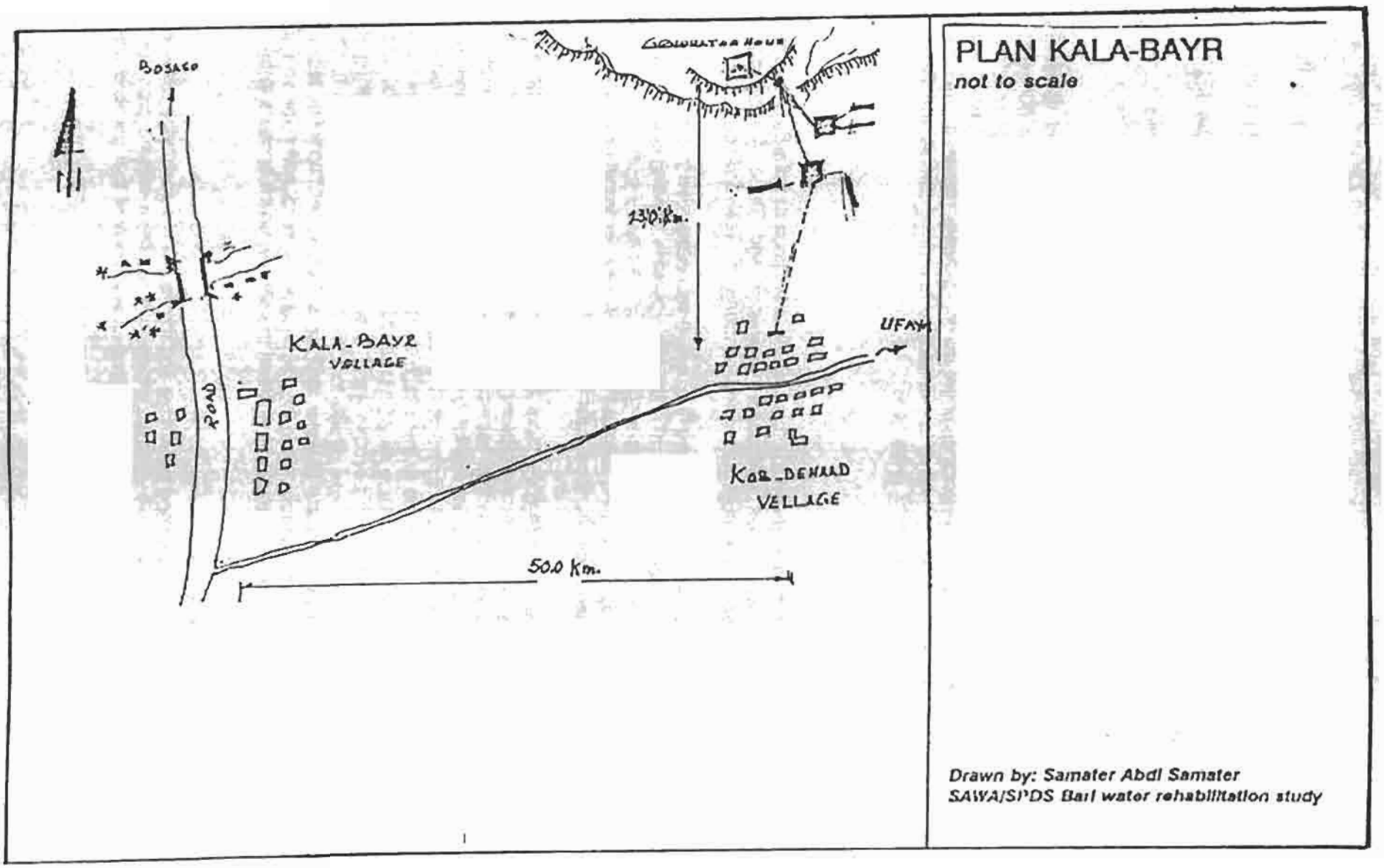
Seven men and two women attended the focus group discussion at Kala-Bayr Village situated at the three-way junction to Bosaso, Iskushuban and Gardo. A new large CARE berkad had recently been constructed and was ready to receive water.

The village was established in 1987 but the first berkad was completed in 1989. Today there are 250 families with an average family size of six persons residing in the village. The settlement is made up of people from Mogadishu, Kismayu, Bosaso and other places. There were small farms in the area using shallow wells for irrigation located 18 km away. These supplied horticultural produce to the village.

The main source of water is berkads - there are 6 small berkads and the large one recently constructed by CARE. The average size of a berkad is about 6m x 2.5m x 2m. Five new berkads had been excavated but not yet constructed. Among the operating ones, 2 were cracked due to remaining for 8 months without water. All the berkads except the one constructed by CARE, which is owned by the community, are family-owned. Presently water is delivered to the village by tanker because all the berkads are dry. A 40-barrel tanker from Karin near Bosaso (23 km away) costs SS 500,000, which basically caters for transport because water is collected gratis from a spring at Karin. This water is then sold in the village for SS 2,000 per jerry can (20 l). On average a family of six uses 1 barrel of water for 3 days. Purchase of water by tanker is an annual phenomenon because after the rains berkads keep water for only 2 months. There is no provision for livestock water in this village, which appears to be a trading centre by the highway.

Hygiene and Sanitation

The village had only 4 family owned pit latrines and the rest of the population relieved themselves in the bush. There were some garbage-pits but there was no organised method of garbage collection and disposal. It was however claimed that garbage was burnt regularly at the pits outside the village.



PLAN KALA-BAYR

not to scale

Drawn by: Samater Abdi Samater
SAWA/SPDS Bari water rehabilitation study

The main diseases encountered in this village were Malaria, diarrhoea, intestinal parasites, skin diseases, trachoma, typhoid, and jaundice. Water for drinking was never boiled except to give to infants. The villagers reported that although no deaths had been recorded in the last three months, there had been several serious illnesses in the village. The village possessed a health centre with a health officer all funded by CARE. There were also 4 community health workers (nurses) who earned SS 500,000 each per month paid by he community. The health centre runs a revolving fund arrangement with the initial capital for purchase of drugs having been provided by CARE. An estimated SS 600,000 profit is realised monthly from the sale of drugs.

Livelihoods
Marketing of livestock is a major problem since the ban on exports to Saudi Arabia was imposed three years ago. At the time of the survey goats were skinny and were selling only locally for as little as SS 200,000 but a fat one could fetch up to SS 400,000 in the local market.

Community Organisation
The village has a committee of seven members but it was not disclosed whether there were women members. The last election of the committee had been held one year before and elections were held every 2 years.

The main problems reported with respect to the use of berkads were that:

- They cracked on the walls and the floor whenever they dried up and repair work was very expensive, sometimes costing as much as USD 2,000 to repair one berkad.

- They provided a breeding ground for malaria, which was a constant major health problem in the area.

The highest priorities for village development were named as

- Water more berkads and if possible a borehole closer to the village.
- Hospital ward at the health centre where patients could be admitted; expansion of the health centre; a laboratory to improve the diagnosis; training of health staff; and training of more traditional birth attendants (TBA). It was revealed that CARE and UNICEF had trained some of the TBAs.
- Education: so far the primary school has up to Std 3 and the village would like to get to Std 8.

When villagers ranked themselves on basis of wealth, they said that the richest were those who owned at least a restaurant, and there were 9 such persons; medium rich were those who owned a kiosk and there were 15 such persons; and the poor owned nothing - these were about 70 persons. For the first time in the survey it was recognised that infusions of funds from relatives abroad played an important role in the village livelihoods. It was however, not possible to establish the volume or frequency of these remittances. The poorest of the poor lived on alms.

3. Bosaso Town and Surrounding Areas

During discussions in Bosaso town with the Director for Water Development, it was established that some of the communal berkads in Bosaso and other districts had been taken over by individuals because communities could not participate as required in their construction with assistance from various agencies. This meant that for communities to effectively assume their role of active and contributing participants in water development both training and some way of enabling them to earn livelihoods so

that they could contribute funds were required. A community that cannot take control of the water development early is likely to lose out to some contributing individual or group of individuals including well-off families.

At Dud Marakinle near Bosaso town the team saw a private oasis developed with assistance from Africa 70 in 1997. The oasis had harnessed several springs, which had been protected by stone-walling. There were two open storage pans (berkads) receiving water continuously from the springs. All the main irrigation distribution channels had been concrete lined and commanded an area of about 11 hectares where date palms, Paw-paw, Sweet pepper, Hot pepper, Tomato, Beans, Onion, Melons (water), Maize and Frankincense were planted. The irrigation system used is small basin irrigation. The main problem with the crops was pests and diseases and the agriculture office rendered no assistance.

4. Golden Utilities Management Company (GUMCO)

One of the water supply projects for Bosaso was funded by the Dutch government between 1998 and 2000 and implemented by UNICEF. Early in its operation it was realised that for the project to survive, it required to be managed along commercial lines and a local company - Golden Utilities Management Company (GUMCO) - was commissioned to manage it. The system was constructed when there was an estimated population in Bosaso of only about 30,000 persons; today there are over 200,000 persons.

Through this project, 1,100 households have been connected and are on round the clock water supply. GUMCO has hired a consultant to advice in the best way to reticulate the system and serve the city.

There are three other water supply systems, one developed and managed by Aqua-Terra, one funded by the German government (GTZ) and one previously run by the defunct Government of Somalia. These three additional water supply systems are running with various levels of success. But together, they still cannot satisfy the demand in the town of Bosaso. An additional borehole is required because even with 24-hour pumping, there is likelihood for shortages during the driest parts of the year (e.g. March-April).

The GUMCO water supply system has the following features:

1. The pipeline plan and distribution network covers 46 km^2 of Bosaso.
2. GUMCO three boreholes that lie 800 m apart. It is not clear whether these boreholes could be tapping water from the same aquifer.
3. There are 6 water kiosks and 6 tanker filling points but the latter no longer operate.
4. An individual connection is usually ½ inch but hotels and factories are allowed a 1 inch connection.
5. The system uses a metering system with an initial charge of USD 70 for the connection and SS 6,000 per m^3 of consumption.
6. The system expects to breakeven after about 3 years of operation.
7. Tariffs are set in consultation with PSAWEN who regulate water and sanitation activities in the State of Puntland. Tariffs have not been adjusted since the being of the agreement in March 2000.
8. No major problems have been experienced in the system so far and O&M costs have remained low. Losses have been recorded at 10% of the gross taking in the second year of operation.
9. Pumping is first to a tank and then distribution is by gravity to all the areas served.

10. Water treatment is only chlorination.
11. The supply so far is 800 m^3/24-hour day from 3 boreholes about 5-6 km from Bosaso town.
12. Other suppliers are providing an estimated 400 m^3/day from other boreholes.
13. GUMCO supplies water to more than 10 ice factories and one meat factory.
14. Defaulters are warned and if they do not comply are disconnection.
15. Water sells in the GUMCO kiosks at SS 1,400/barrel.

Besides the above water supply systems, there are six (6) more boreholes run by private individuals all contributing 75 m^3/day to the daily Bosaso water consumption.

All the above facilities however cannot supply sufficient water for Bosaso. A lasting solution would be to draw water by gravity from Gaca Springs situated about 35 km from Bosaso to supply the fast growing urban concentration.

GUMCO is not involved in any way in sanitation activities. Since three months ago, the government is engaged in garbage collection and a dumping ground about 12 km from the town has been set aside.

4. Bogol Kabush Slum Village (IDP)

Background
The focus group discussion for this IDP village comprised of 5 men and 19 women. Bogol Kabush is an IDP camp in Bosaso town housing about 600 families of persons displaced from Kismayu, Mogadishu, Baidoa, Ballat, Jowhar, Bulo Burti, Belet Weyn, Kalafu, Lekhabul (Ethiopia), Jigjiga, Dire Dawa, and Mandera. The settlement started in 1996. The average size of the family is 6 persons all living in cardboard shelters without proper roofing. Other villages similar to this one in Bosaso town are Bula Elai (1200 families), Biyo-Kulule (1200 families), Bura Ajelan (600 families), ten villages with about 500 families each. From this it can be estimated that there are at least 30,000 IDPs in Bosaso making about 10% of the entire population. This camp is built on private land with tenants paying a rent of SS 30,000 - 40,000 per month per plot of 5m x 3m. Defaulters are evicted but no defaulters had so far been evicted. Residents were reluctant to register with the UNHCR and many did not want to return to their homes.

Water Supply
The camp has a shallow well equipped with a hand pump but at the time of the visit, this hand pump was broken down. There was also a hand dug well, which was reported to have broken down on the morning of the team's visit. UNICEF had developed these facilities in 1996. There was a water kiosk outside the camp where water sold at SS 500 per 20l jerry can.

Livelihoods
IPD livelihoods are derived from working as casual labourers, and as masons with construction sites. Women collect garbage around town for pay. Some have garbage carts where they put garbage bags and charge SS 3,000 (USD 0.15) for one removal.

Hygiene and Sanitation
The camp had 4 toilets which residents argued were private but which the water department confirmed were meant for common usage. These toilets were said to be 6 m deep. Residents argued that most of them went to the seashore to relieve themselves, a practice, which exposed women to rapists under the cover of darkness.

The main diseases in the IDP camp were flue, back pains, diarrhoea, jaundice, and respiratory tract infections. There was no health facility in the village and sick persons have to attend the main hospital in Bosaso where fees charged per visit were as follows:

- Laboratory test - SS 20,000
- Visit - SS 20,000
- Medicine - SS 170,000

There were 12 TBA serving village charging a token amount for delivery of a baby.

Community Organisation

The camp had no committee, no council of elders, no chief or any other form of organisation for maintenance of law and order. There appeared to be no mechanism for conflict resolution.

Women drew the following priority listing of needs:

1) Maternity facility and a doctor to be stationed nearby
2) Jobs for husbands
3) Primary school as children attended only a Koranic school
4) Plastics for covering houses to protect them from the rain

Men drew the following priority listing of needs:

1) Wheel burrows to ferry garbage
2) Primary school
3) Health centre
4) Decent housing as the cardboard house exposed the family to the weather.

10. CONCLUSIONS AND RECOMMENDATIONS

10.1 Needs Assessment

It is conceivable that most berkads would regularly dry up each year for an average of 3 months, due to the extremely low rainfall, high temperatures and the high water consumption especially by livestock. Such regular drying of the berkads is desirable as it gives the forage in the area a chance to recover. The fact that construction of new berkads is driven first by the need and then by the ability of the individual or co-operating families, implies that the population settling in a place have a strong cohesion among them but, more importantly, they believe in what they can do there.

It is therefore recommended that the focus of the project be hinged on supporting existing community structures, with the greatest emphasis being on rehabilitation of berkads. The construction of new berkads should only be on special circumstances where people have already made substantial contribution, like digging the berkad, provision of stones and sand, and are willing to pay for all labour. Preference should be given to families who focus on non-livestock activities such as farming.

10.2 Technology Choice and Management

Borehole development is complicated and costly, as it requires careful siting and deep drilling (average depth 300 m and costing approximately US$ 100,000). In addition, yields are low (1 – 2 m^3/hr) and community management is still poor. Opportunities for spring development are very limited as these do not occur in most of the villages apart from the main centres, e.g. Iskushuban, which are already developed. However, it may be possible to find springs at certain discharge points from the foot-hills of the Mesqat mountains and the hilly areas west of Bosaso. Overall, permanent water sources have a devastating environmental impact if the density is high, as noted in Timirshe where the drilling of one borehole in the late 80s, albeit low yielding, has virtually finished the formerly luxuriant vegetation there. Rainfall harvesting remains the best option for the time being, especially the rehabilitation of berkads and to some limited extent, balleys.

It is recommended that the programme gives the highest priority to the rehabilitation of berkads, and where justifiable balleys or *wars*. Interventions in areas with boreholes and high yielding springs should be limited to improving environmental sanitation, hygiene education and training on water management.

10.3 Water Quality

Water quality considerations are most significant for berkads, which are the main source of water for most people in the rural areas. It is clear that water from berkads and tankers can be easily contaminated. This is worse, where water from surface sources is used for filling the tankers. The scale of this phenomenon is big given the long distances between rural villages. Treatment is complicated and likely to be expensive and difficult to carry out for all villages without full involvement of users.

It is recommended that hygiene training, particularly concerning water handling be included as a prime agenda for the project. Basic water treatment, especially boiling of water before use should be included. The option of supporting an element of chlorinating water could also be investigated.

10.4 Implementation

Berkads: The fact that the prolonged drought has not only reduced livestock numbers but also lowered the potential income from the pastoralists, makes the community highly vulnerable in that many of them are not in a position to repair their broken berkads. Thus, even if the rain came, the community will lose the water collected, thereby throwing the familiar transhumant movement off-balance. This underlines the need for support at least to return the capacity of the berkads to their original state. Still, the large number of dug-outs made without finance to actually construct the berkads opens an opportunity for new berkads on limited basis.

a) **The highest priority for improvement of berkads should initially focus on rehabilitation of cracked berkads. Repair of such berkads will also enhance the participation of a wider group of the community in filling berkads with water thereby encouraging a wider support of vulnerable groups in the villages.**

b) **The second level would focus on existing dugouts for which the community lack funds to finish the projects. Special attention should be paid for berkads that also have a purpose of promoting productivity through, e.g. growing of frankincense as an important source of income.**

Balleys: The balleys constructed are too small and their ability to store water for long is very low. Where other sources of better quality water can be found, e.g. Hiriro village, the balleys are poorly taken care of, as opposed to villages where available alternatives are inadequate and of poor quality, e.g. Darod village. The fact that in all cases the balleys are dry shows the general inadequacy of the capacities installed.

Intervention aiming at the development of balleys or wars should initially be largely on pilot basis. These should in the first instance focus on the rehabilitation of selected balleys that have a) the potential for good recharge, b) good maintenance by the community. The balley at Darod valley generally satisfies these criteria.

Boreholes: Community management of the boreholes in the villages is not sustainable at present management levels. The total revenue collected is far below the real cost (only 50% recovery). The fact that no maintenance costs are recovered implies that external assistance will be needed as soon as the first major service falls due. There seems to be a general over-dependence on PSAWEN as a community fall-back system.

Interventions with regard to boreholes could focus on improved management training for operation and maintenance, improved sanitation and hygiene education.

10.5 Sustainable Maintenance of Berkads

The risk of cracking of the berkads is very high on all berkads, since they run dry twice a year for a total of 3-4 months. This period is equivalent to 60 - 90 days of filling. The community reportedly uses one truck for 2 - 3 days, which calculates to between 20 - 30 trucks costing on average a total of approximately SS 50 million (2,500 USD per year). This indicates a good opportunity for communities to be able to actively contribute or cost-share in the project implementation.

Special provision should be made to minimise direct evaporation through covering. It is proposed that the berkads are covered with strong gabion wire tensioned in position with high tensile cables anchored at appropriate locations. The community would later cover with grass. In addition, the community should contribute all required unskilled labour, stones in the area and sand where available.

10.6 Hygiene Education and Training

Water availability at the rate of between 11 litres/person/day and 7 litres/person/day is still above the basic recommended in order to achieve basic personal hygiene (i.e. 6 litres/person/day). The high prevalence of water borne diseases can therefore be directly linked to a large extent to poor hygiene practices either due to a lack of knowledge or lack of sanitation facilities or a combination of both, but the first problem is the most significant.

a) **It is essential that the programme should place hygiene education and awareness high on the agenda. Hygiene education, especially at the berkads and at household level including food hygiene, should precede the construction of physical sanitation facilities.**
b) **Specific training focusing on the process of water provision including the purpose of various component in the design and construction process. This training should involve the care takers, the community and masons.**

10.7 Revolving Credit

So far, target beneficiaries in the project area have not had significant experience with micro-credit and the approach used should be one that gives them the desired orientation before release of funds. It should be noted that credit *per se* without an accompanying presence of suitable opportunities will not lift people from poverty. Nor will a micro-finance scheme be automatically sustainable just out of achieving high repayment rates, e.g. case of Dalmado above for which the credit programme stopped as soon as the donor funding ceased. One should therefore be cautious in approaching micro-finance from both the point of view of the credit services provider or the recipient as evidence so far shows that many of the stories of extreme success cannot be empirically verified. Given the difficult socio-economic and political uncertainty in the project area, it does not seem opportune to start with a credit scheme right away, but the situation could be reviewed later after the adequate administrative structures are in place. At that time, the approach would be to use village development committee who would receive repayment and in turn extend it to other beneficiaries. This would cover both rehabilitation and new construction of berkads using the same line of credit.

a) **It is recommended that, the programme initially focuses on cost sharing basis for rehabilitation and new construction of berkads and balleys. The level of cost sharing may initially be small (10-20%) and increased progressively to 30%.**

b) **In later years, and on a pilot basis, an agreement could be entered into with local organisations known to be active and knowledgeable in credit administration. These organisations should then be allocated funds and, together with the VDC administer the credit.**

10.8 Design Aspects of the Various Structures

10.8.1 Design of the Berkad

The failure of berkads to function properly in terms of delivery of clean water and frequent cracking can be attributed to two major factors: inadequate design provisions and poor quality control, which mainly relies on artisans. Apart from a few artisans that have been trained in formal institutions, the fact that many of the artisans have been trained on the job provides a good opportunity for upgrading their skills through specific orientation training on berkad construction for them to embrace new ideas. It is notable that such artisans work on contract basis and are paid on the basis of performance. This implies that the agency has the chance to demand a certain standard of performance.

Run off flow into the berkad is often torrential. Under such conditions, colloidal material (mainly silt) would require a large and sedimentation basin for effective removal. This would raise significantly the cost of the camber beyond justifiable levels. As such, the rehabilitation should aim to remove grit, mainly gravel.

The proposed new design for berkads will have a total effective volume of 248 m^3 (76 m^3 for people and 184 m^3 with a separating wall). However, the volume remains the same for traditional berkads. Each berkad will have the following features:

- Inlet structures consisting of inlet wall, inlet channel and grit chamber;
- Reservoir with 2 chambers: one for livestock and the other for people;
- Outlet channel (see schematic layout sketch below).

Figure: Schematic layout plan of berkad

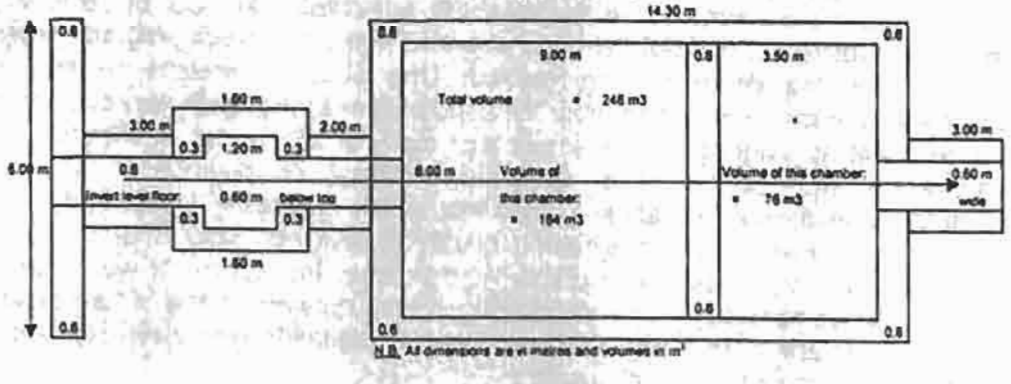
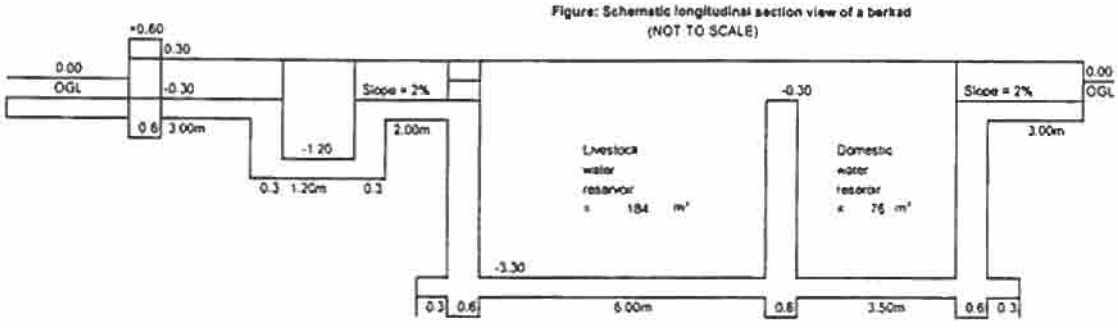


Figure: Schematic longitudinal section view of a berkad
(NOT TO SCALE)



1. The *inlet structure* will have the following elements:
   - Protective rubble wall 600mm thick and extending 3m on either side of the centre of the inlet channel; the wall will also acts as a guide for the flow.
   - Wide screen to obstruct trash, e.g. rags, garbage and woody matter. The screen will be fabricated in welded 10mm diameter high tensile steel reinforcement spaced 100mm centre to centre. The screen will cover the entire open area of the channel.
   - The inlet channel will be 600mm wide x 600mm deep, with 200mm thick rubble stone wall plastered internally. The overall length of the channel will be 5.0m excluding the grit chamber (3m before and 2m after the grit chamber).
   - The grit or sedimentation chamber will be 1,200mm x 1,200mm x 600mm deep (internally) and constructed in 200mm thick rubble walling plastered inside. The purpose of this chamber will be to remove gravel and grit.

2. The *main berkad reservoir* will have an overall internal length of 14.3m and a width of 6.0m. It will be divided into two chambers: the first one having a length of 9.0m for livestock and will hold most of the silt load, while the second chamber will have a length of 3.5m. Both chambers will have an overall depth of 3.6m. The two chambers will be separated by 600mm thick rubble wall 3.0m high. The reservoir will be constructed in rubble walling 600mm thick. The floor will be made in hand-packed and rammed hard-core. All walls of the reservoir will be plastered internally. Floor screed and plaster will be reinforced with chicken wire mesh with 12mm openings to control micro-cracking on the walls and floor during periods when the berkad is dry. Access steps for desilting purposes; anti-crack chicken reinforcement will be provided. The entry to the berkad will have a screen fabricated in welded 10mm diameter high tensile steel reinforcement and spaced 100mm centre to centre.

3. The *outlet channel* from the berkad will have the same internal dimensions as the inlet channel but with a length of 3m and slope of 2% leading away from the berkad. All walls shall be vertical with strip footings set to depths at least equal to the thickness of the walls.

4. The berkad will be *covered* with galvanised high tensile gabion wire fastened tightly by supporting high yield stainless steel cables of 8mm overall diameter, and anchored 1.0m away from the outer edge of the wall. The gabion wire will be covered with closely woven wire-grass made into an layer that blocks the penetration of sunlight in order to minimise evaporation.

5. Two *concrete pads* will be provided on the longer side of the berkad and set at the ends of each of the chambers. This will provide a landing for people coming to draw water for livestock and cattle. Each pad will be 1.2m x 1.2m square and at least

300mm thick; it will be finished with a 2% slope towards the water pan reservoir to avoid wastage of water.

6. A *French drain* will be provided at a distance approximately 3.0m all around the water pan. The drain will generally slope towards the downstream end of the berkad and will serve the purpose of keeping the berkad area well drained. The area around the berkad will be back-filled to provide a slope of approximately 5% towards the French drain. Partial stone pitching will be provided around the walls leading to the French drain to protect the berkad from water logging.

Rehabilitation of berkads:

Berkad rehabilitation will be the main focus of the project. Cracked berkads are generally the traditional type. These will be upgraded to have some of the features described above while ensuring that they will hold water effectively. However, the volume of the main reservoir will not be adjusted. Berkad rehabilitation will, therefore, involve the following:

- Construction of entry wall with screens as detailed in (1) above but with a length of 4 metres.
- Extension of the inlet channel by an average of 1.5 metres to stabilise the flow.
- Construction of dividing wall in the reservoir separating water for people from that of livestock.
- Reinforcement of wall and floors with anti-crack chicken mesh.

10.8.2 Design of the Balley or War

The balleys visited (1,500 – 2,500 m^3) are too small and too shallow to overtake the dry season periods given the very high evaporation rates in Puntland (over 2,000 mm per year). The lack of silt traps also seriously minimises the storage efficiency of the reservoir as a large part of the volume is taken up by silt.

In order to overcome these limitations, the following is proposed:

- The balley or war should have a minimum size of 10,000 m^3 and have a depth of at least 3 metres excluding a freeboard of 1 metre.
- Each balley or war should have a silt trap of capacity not less than 1,500 m^3 to hold a silt load of at least one-year.
- Community members should completely fence the balley, initially with a structural fence and later with a live fence of appropriate species depending on the area.
- Water will be drawn from a well on the side linked to the balley through an infiltration basin / gallery and also through a pipe.
- Water for drinking will be drawn through a hand-pump while water for livestock would be taken from an open well. The strategy will be to discourage watering of livestock directly from the balley. (See sketches in Annex 6)

10.8.3 Design of Sanitation Structures

Although the sanitation coverage in terms of latrines is generally poor in most of the villages visited, use of proper hygiene practices is almost absent. There is a high prevalence of water related diseases even in villages with good latrine coverage. In this regard, awareness creation and hygiene training should occupy the highest priority and should precede any installation of physical latrine structures. The rocky, hard soil

and often-sandy formations implies that latrines cannot be very deep but depths of up to 6 metres are achievable.

In order to maximise on the pits dug, it is recommended that the latrine pit be dug long and wide so that even with shallow depths, an effective storage volume of at least 3.8 m^3, should still be provided for a typical household. In areas with collapsing soils, it is recommended that the latrine pit be constructed on the side with a 150mm-diameter uPVC pipe installed at 45° to the vertical and leading to the latrine pit. (See sketch provided in Annex 6).

ANNEXES

Annex 1: Terms of Reference
Annex 2: Study itinerary and list of people met
Annex 3: Photographs
Annex 4: Database of visited villages
Annex 5: Maps
Annex 6: Drawings
Annex 7: Detailed Cost Tables / Bills of Quantities
Annex 8: Bibliography - List of books consulted
Annex 9: Interview guide

Terms of Reference
Baseline study and assessment for
Water and Sanitation Development and Rehabilitation Project
Bari Region, Puntland State of Somalia

1. Background

The overall aim of Oxfam GB's work in Somalia lies in enhancing the capacity of peaceful communities as a building block for enhanced community participation in the consolidation of peace and stability. Oxfam's strategies in achieving this target include reduction of vulnerability of the communities, increasing self-reliance in water development at the community level and increasing awareness in health and hygiene and sanitation issues among the communities.

Oxfam GB has been addressing the needs of poor people in Northwest Somalia (self-recognised state of Somaliland) since 1991. Its interventions started in the areas of emergency relief in urban communities for water supplies in Hargeisa, Burco and Lasaanod, and later a more development programme for the rehabilitation of rural water supply and sanitation facilities, which have been significant mainly for the people affected by the civil war. Since then, Oxfam GB has worked in Somaliland in the field of water and sanitation in an operational mode. The integration of lessons learnt from its Somaliland interventions is expected to furnish and obtain a deeper understanding of the nature of Somali society through interaction and working with local communities.

Oxfam GB is to implement a two-year water and sanitation rehabilitation project under the EU funding in the Bari region of Puntland State of Somalia. The project will specifically implement and facilitate the construction and rehabilitation of sub-surface masonry water tanks (popular by the name of Birkads) and appropriate sanitation facilities in 15 villages in the two districts of Bari Region. A modest contribution is also been envisaged in the area of urban sanitation. The project implementation is designed on the concept of revolving fund, a new concept to be introduced in the rehabilitation of such water tanks.

Water is obtained from both the surface and underground sources. Springs are common in the mountainous regions. The two main sources of water are from the rain catchment systems. Birkads are underground cement lined water reservoirs and are predominantly used for human consumption and also used for livestock watering during the dry months. Water is sold to the livestock owners. Whars are generally machine dug earth dams and are mainly used for livestock watering. Shallow wells and deep wells are also exploited in some parts of the region and especially in the urban centres.

Puntland State of Somalia is situated at the North Eastern corner of Somalia facing the Gulf of Aden in the North and the Indian Ocean in the East. It is predominantly an arid region and the population is mainly pastoral communities with few fishing communities in the coastal villages. Puntland has three administrative regions: Bari, Nugal and Mudug all of which have invariably enjoyed relative peace and stability since the end of the civil war, a condition which can be easily consolidated with interventions that promote peace and livelihoods.

Bari Region, the target area of this project, is the northernmost region of Puntland with relatively low levels of rainfall. Bari has six administrative districts: Qardho, Iskushuban, Bossaso, Bandarbeila, Qandar and Alula and its regional headquarter Bossaso is a port city with emerging economic opportunities as well as being the commercial capital of Puntland. These characteristics of Bossaso, coupled with its relatively sound environment, make it a safe heaven for the internally displaced persons (IDPs).

2. Objectives of the Study

The project was formulated on the basis of the available data sources from various agencies and state water authority on ground, although sufficient hard data do not exist. In addition to

this, the Oxfam GB team had conducted rapid assessment in some of the villages to better understand the needs and priorities of the communities in the water sector.

The overall objective of this assessment is to generate better understanding of water and environmental sanitation situation in Bari region and to facilitate sustainable access to water and sanitation facilities in the area. The specific objectives are as follows:

2.1. Conduct analyses of the socio-economic and political situation that underpin the access, management and use of water sources in Puntland with specific focus on Bari region.

2.2. Carry out a preliminary assessment (mostly data gathering from already available sources) of the hydro-geological characteristics (ecological zones) of Bari region with a view to facilitating a better understanding of the various water sources in the area. Bearing this in mind, the consultant will also highlight on the impact of increased livestock numbers due to the construction of new water points. To the extent possible, the consultant will make use of satellite digital information and other literatures readily available in FAO, SACB and local water authority in Puntland.

2.3. Make analyses of the socio-cultural and economic factors influencing sanitation in Bari region to facilitate a better understanding of rural and urban sanitation related problems in the area. The consultant will use and/or adopt the most appropriate indicators so as to assess the hygiene and environmental sanitation in the study villages.

2.4. Employing participatory approaches with primary stakeholders, facilitate the integration of appropriate outputs of the baseline study into programme's implementation activities and arrangements.

2.5. Make an assessment of the community organisations that affect the operation and management and sustainability in the long run. The consultant will also look into the issues on gender equity. Make an analysis on strengths, weaknesses, opportunities and threats within the sphere of the project perspective.

3. Expected Outputs

The consultant assisted by local experts, having discussed with all the concerned stakeholders and conducted the baseline study, will produce the report, the recommendations of which would be incorporated into the project implementation plan due to start shortly after the submission of this report.

A situation report on water and sanitation in Bari region and the development of a suitable mechanism for increased, more equitable, and more sustainable access to water and sanitation facilities by the people of Bari region using culturally friendly participatory methodologies will be produced. The specific outputs that subscribe to this overall output, as well as having direct correlation with the objectives outlined above are:

3.1. Contextual analyses report of the hydro-geological, environmental, political, social, economic and cultural factors influencing the supply and demand of water in Bari region produced. Various types of water sources studied and best option recommended for implementation in addition to the Birkads.

3.2. Report on rural and urban sanitation problems and prospects produced. Appropriate indicators developed and/or adopted.

3.3. Programme objectives, outputs and implementation activities and arrangements revised using culturally friendly participatory methodologies.

3.4. In depth assessment on the existing community organisations and other relevant issues studied and recommendations on any further needs (institution capacity building etc.) based on the findings, drawn.

4. Methodology

4.1. Review of the available literatures on water and sanitation in Puntland, vis-à-vis other initial findings of the project formulation process as detailed in the project document will be carried out. This review will also map the context in which the project will be implemented.

4.2. Stakeholder analyses of water and sanitation sectors with a view to identifying the different interest groups in the target communities, the diversity of their interests and the extent to which they can be engaged in the redesign and implementation of the programme.

4.3. Preparation of primary research activities. This will involve the design and the field-testing of questionnaires and the determination of methods to employ in the field.

4.4. Actual field research involving data collection using the methodologies agreed to in 4.3. above.

4.5. Data analyses and preparation of draft report

4.6. Stakeholders' workshop to facilitate the review and the incorporation of appropriate outputs into the programme implementation activities and arrangements.

Due to the available time, the environmental impact assessment part of the study can not be holistically carried out. To capture the environmental impact on the study area, the consultant will use the available documented information, satellite imagery and aerial photographs whenever available (to be collected during the initial period in Nairobi). Field transects will also give additional indicators about changing environment situation in the region. The state water authority in Bossaso also has documents on the ecological zones and data on the rainfall.

5. Project study period

The consultant will commence the above mentioned task within two weeks of award of contract for a period of six weeks including:

- 7(seven) days data and information gathering in Nairobi
- 31(thirty one) days on field work/research, meetings with agencies in water sector, assessment and survey including one field trip with the Oxfam GB Somaliland team. This period also includes the consultants' office works to finalise the study report.
- Flights NBO-Hargeisa-Bossaso and back 4 (four)days.

Before going to Somalia, the consultant will be briefed at the Oxfam GB Nairobi office on issues of security, logistics support etc.

6. Reporting

The consultant will submit the first draft report with all findings, recommendations, in two copies to the Oxfam GB office in Nairobi for its review and envisaged approval. The comments made by the Oxfam GB office shall be communicated and incorporated in the final report.

The consultant will then submit four copies of final report (including drawings, sketches, and maps as appendices) to the Oxfam GB office in Nairobi.

Annex 2: Study itinerary and list of people met

2-1: ITINERARY

Day	Date	Day	Activity
Day 1	12.11.01	Monday	Appointments, telephone interviews: UNA, Africa 70, SAWA, FSAU
Day 2	13.11.01	Wednesday	Meeting Oxfam – GB: Detailed briefing
Day 3	14.11.01	Friday	Meeting: UNDP-Somalia / DEPHA
Day 4	15.11.01	Friday	Meeting: UNDOS-Documentation
Day 5	15.11.01	Friday	Meeting: Team planning and logistics
Day 6	19.11.01	Monday	Travel Nairobi – Hargeisa - Bosaso (5 a.m. to 4 p.m.)
Day 7	20.11.01	Tuesday	Meeting: PSAWEN – Mr Khalif Nur, Director Meeting: UNICEF – Mr. Said Ahmed Mohamed, APO Meeting: SAWA – Peter Egging, Project Manager
Day 8	21.11.01	Wednesday	Meeting: PSAWEN – Abdirizak Mohamed, Galkayo Meeting: PSWAEN – Abdi Mohamed Ali, Regional Co-ordinator, Gardo Meeting: OTP – Abdullahi Warsama, Executive Director EVACUATED – EMERGENCY ECHO FLIGHT TO HARGEISA
Day 9	22.11.01	Thursday	Meeting: Oxfam-GB – Pranab Shah, Eng. Abdi, Water Co-ordinator
Day 10	23.11.01	Friday	Office work (morning) Report writing – Local people do not work Friday (*Ramadhan*)
Day 11	24.11.01	Saturday	Field visit: Xidinta, Galbeed area, Somaliland
Day 12	25.11.01	Sunday	Office work (morning) Report writing (afternoon)
Day 13	26.11.01	Monday	Office work (morning) Report writing (afternoon)
Day 14	27.11.01	Tuesday	Office work (morning) Report writing (afternoon)
Day 15	28.11.01	Wednesday	EMERGENCY IN PUNTLAND WAS STILL UNRESOLVED Travel: Hargeisa - Nairobi (The assignment was postponed until stability was restored in the project area)
Day 16	4.3.02	Monday	1. Travel Nairobi to Bosaso (5 a.m. to 3 p.m.) 2. Night in Bosaso
Day 17	5.3.02	Tuesday	1. Travel: Bosaso - Gardo (240 km - 6 hrs) 2. Meeting: Mayor/District Commissioner of Gardo 3. Interviews in 3 villages of Gardo district; Night in Gardo
Day 18	6.3.02	Wednesday	1. Interviews in 3 villages of Gardo district 2. Night in Gardo
Day 19	7.3.02	Thursday	1. Travel: Gardo - Iskushuban (240 km: 5 AM – 4 PM); Interview in 1 village 2. Night in Iskushuban
Day 20	8.3.02	Friday	1. Interviews in 3 villages of Iskushuban, including 2 water pans 2. Night in Iskushuban
Day 21	9.3.02	Saturday	1. Interviews in 3 villages of Iskushuban 2. Night in Iskushuban
Day 22	10.3.02	Sunday	1. Travel to Bosaso (240 km - 6 hrs); Visits: 3 villages (Iskushuban), 2. Night in Bosaso
Day 23	11.3.02	Monday	1. Meet Mayor of Bosaso 2. Inspect Bosaso town water supply/sanitation 3. Night in Bosaso
Day 24	12.3.02	Tuesday	1. Interviews in 3 villages of Bosaso district 2. Night in Bosaso
Day 25	13.3.02	Wednesday	1. Wrap up mission - presentation to stakeholders 2. Travel Bosaso – Hargeisa – Nairobi (8 hrs)
Days 26-31		March	Report preparation

2-2: List of people met

Date	Name	Position	Organisation
Nairobi	Dr Giorgio Sartori	Director	Data Exchange Platform for Somalia
	Mr Peter Kimathi	Data base co-ordinator	Data Exchange Platform for Somalia
	Mr Ali	Librarian	United Nations Development Office for Somalia - Documentation Centre
Puntland	Mr Abdi Jamah Abdi	Water & Sanitation Co-ordinator	Oxfam GB, Somaliland
	Mr Abdi Mohamed Ali	Regional Co-ordinator, Gardo	Puntland State Agency for Water, Energy and Natural Resources (PSAWEN)
	Mr Abdirizak Mohamed	Chairman	Galkayo Water Authority
	Mr Abdullahi Warsama	Deputy Executive Director	Ocean Training & Promotion (OTP)
	Mr Ahmed Hagi Noor	Irrigation Engineer	Freelance consultant/resource person, Gardo and Iskushuban Districts
	Mr Khalif Noor Ali	Director for Water Development	Water, Energy and Natural Resources Corp. (PSAWEN)
	Mr Khamis Chome	Programme Director	Norwegian People's Aid
	Mr Mohamed Abdullahi	Officer in Charge, Bosaso	World Food Programme
	Mr Peter Egging	Project Manager	Improved agricultural Production in Oases
	Mr Pranab Shah	Project Co-ordinator	Oxfam-GB, Puntland
	Mr Said Ahmed Mohamed	Assistant Project Officer	UNICEF Bosaso
	Mr Ibrahim Jama	Hydro-geologist	OTP
Somaliland	Mr Khaddar Hussein Mohamed	CDW Supervisor	Oxfam GB, Somaliland
	Mr Abdi Jamah Abdi	Water Co-ordinator	Oxfam GB, Somaliland
	Mr Ahmed Osman Ibrahim	Project Officer	Oxfam GB, Galbeed West, Somaliland
Gardo	Mr Abdi Ali Geyer	Mayor	Gardo Town
	Mr Abdi Mohamed Ali	Regional Water Co-ordinator	Bari Region
	Mr Liban Hirsi Farah	Deputy Mayor	Gardo Town
	Mr Abdi Ali Muse	Chairman of the Water Authority	Gardo Town
	Captain Omar Elmi Ismail	Commander of Police	Gardo Town
	Mr Apshir Farah Hassan	Deputy Commander of Police	Gardo Town
	Mr Awale Musa Osman	City Council Member	Gardo Town

Annex 3: Photographs

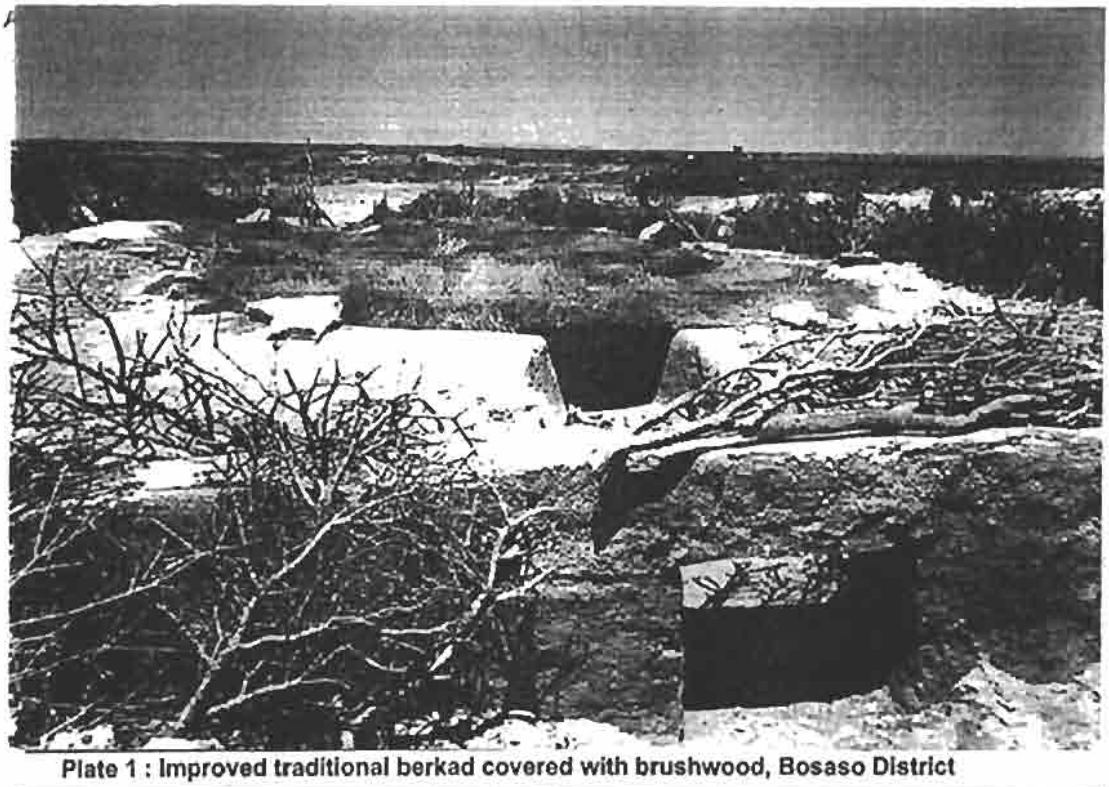


Plate 1 : Improved traditional berkad covered with brushwood, Bosaso District

Plate 2: Silted balley or war at Darod village, Iskushuban District

Plate 3 : Borehole with pump house and small tank, Adinsoone village, Gardo District

Plate 4: Cracks on berkad, Dhaxan village, Gardo District

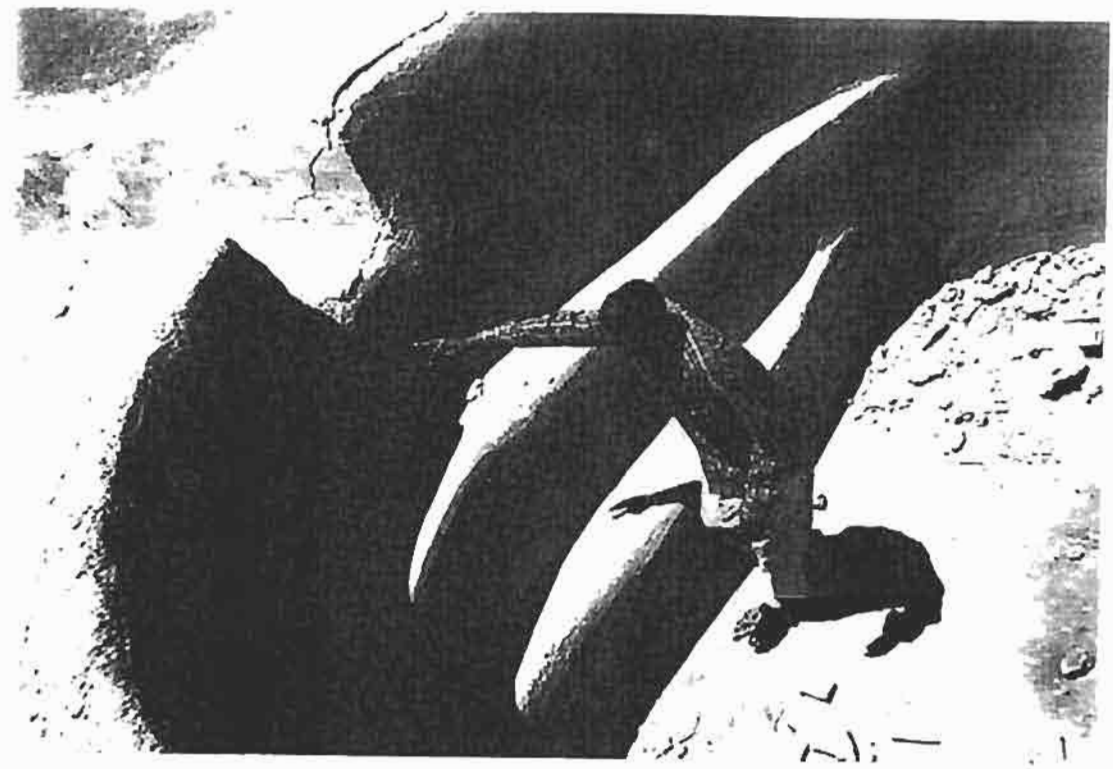


Plate 5: Cracking on inlet structures of empty berkad

Plate 6: Berkad repaired by Oxfam-GB in Qudah village, Galbeed area, Somaliland

P'ate 7: Thick silt in Darod balley or war, Darod valley, Iskushuban District

Plate 8: One of many holes dug by communinties awaiting funding to construct berkads

Plate 9: Improved berkads constructed by SAWA

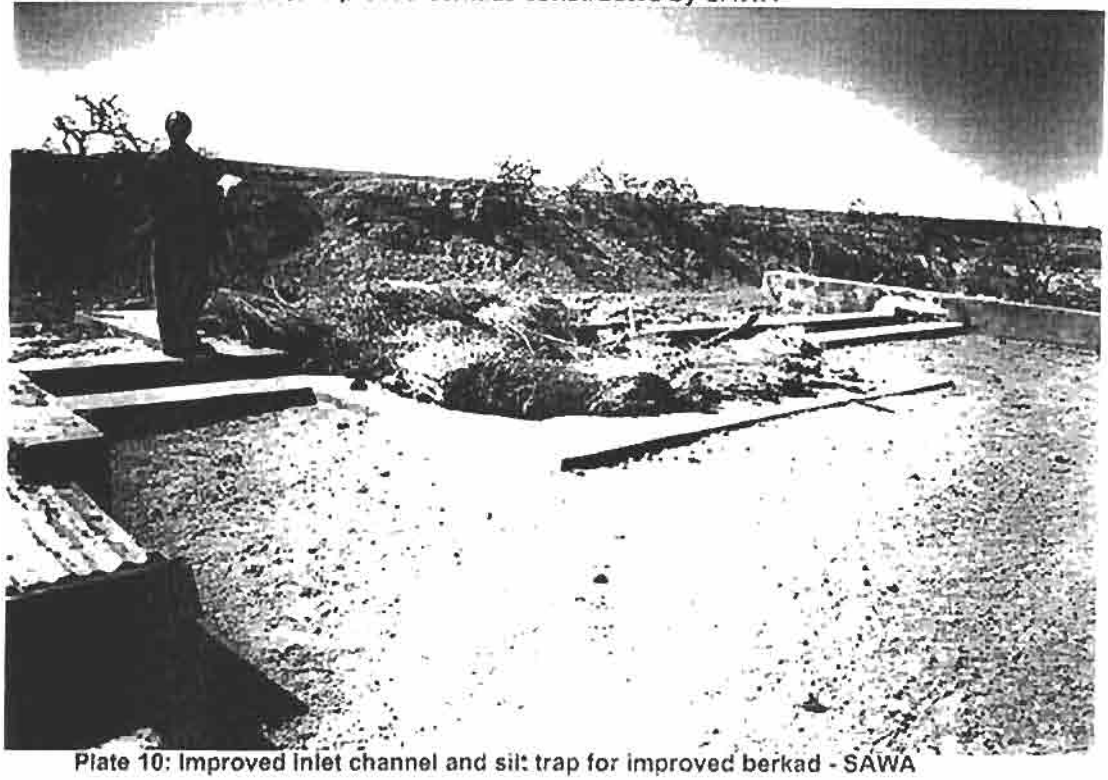


Plate 10: Improved inlet channel and silt trap for improved berkad - SAWA

Plate 11: One of the oldest berkads – Constructed I 1959 (Hiriro village)

Plate 12: Oasis farm 30 km to the south of Bosaso

Annex 4: Database of visited villages

Name of village	Georeference data: Latitude (North)	Georeference data: Longitude (East)	Source of water	Yr first berkad in village started	District	Number of families using the water in the village	Ownership: No family berkads	Ownership: Co-operative berkads	Ownership: Individual berkads	Ownership: Commercial berkads	Ownership: Total	No of families/berkad	Main use of berkad water
[illegible]	1053830	39305842	Berkad	1967	Gardo	1,000	0	72	0	5	77	37	Livestock/ Domestic
Amba Sare	1070584	39329760	Berkad	n/a	Gardo	500	0	120	0	0	120	8	Irrigation/ Livestock
[illegible]	1160019	39289451	Berkad										
[illegible]	1115660	39425053	Berkad										
[illegible]	1246530	39298917	Borehole										
[illegible]	1196000	39116120	Spring										
[illegible]	1157640	39360721	Well										
[illegible]	1076584	39329760	Berkad								0		
[illegible]	1035482	39280367	Berkad	n/a	Gardo	1,500	0	10	1	0	11	136	Livestock/ Domestic
[illegible]	1062823	39384823	Berkad	1965	Iskushuban	1,000	20	40	0	0	60	17	Livestock/ Domestic
Gardo	1051963	39250298	Borehole								0		
[illegible]	1103034	39418052	Berkad	1950	Iskushuban	2,000	107	0	0	3	110	18	Livestock/ Domestic
[illegible]	1108156	39443647	Berkad	1990	Iskushuban	500	12	1	0	0	13	38	Livestock/ Domestic
Iskushuban	1136734	39416418	Spring										
[illegible]	1197747	39300924	Berkad	1987	Bosaso	250	0	0	0	1	2	30	Domestic
[illegible]	1176211	3933562	Borehole	1960	Bosaso	300	17	3	0	0	20	12	Irrigation/ Livestock
[illegible]	1220512	39381915	Well										
[illegible]	1081039	39360124	Borehole										
[illegible]	1152731	39411222	Berkad	1990	Iskushuban	1,000	5	0	0	0	5	111	Livestock/ Domestic
[illegible]	1067937	39299487	Berkad	1984	Gardo		3	10	0	0	13		Commercial
[illegible]	1158890	39382665	Berkad										
[illegible]			Berkad	n/a	Gardo		0	0	0	0	0		Commercial
[illegible]	1168617	39436578	Borehole	1986	Iskushuban	3,000	60	0	0	0	60	50	Livestock/ Domestic
[illegible]	1152571	39107298	Berkad										
[illegible]	1154725	39309261	Berkad	1963	Gardo	1,400	13	0	0	0	13	100	Livestock/ Domestic
[illegible]	1121544	39410832	Balley										
[illegible]	1207471	19309045											
[illegible]			Berkad	n/a	Gardo		34	0	0	0	34		Commercial
Proposed			Berkad	2002	All areas	498					0		
AVERAGE SIZE OF BERKAD						989	20	15	0	1	31	47	
TOTAL						13,354	281	206	1	5	497	574	0

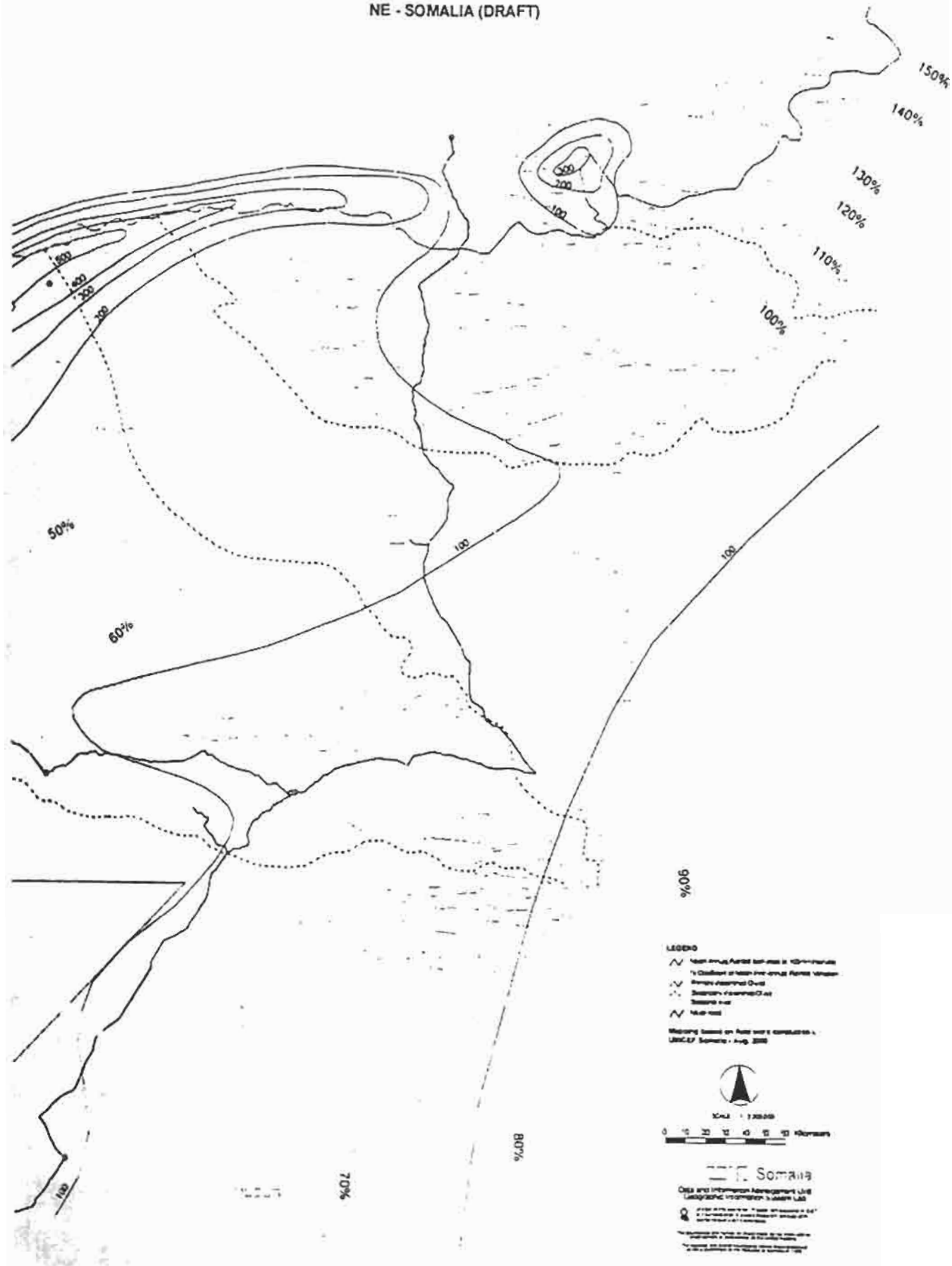
Name of village	Condition: Sound	Condition: Cracked	Condition: Dug out to the wall	Condition: Total	To fill berkad (SoSh/Barrel)	Price of water: Dist. to suitable water source (km)	Price of water: Sale price (SoSh/Barrel)	Length (m)	Width (m)	Depth (m)	Volume (m³)	New berkad (US$)	New berkad (US$/m³)	Per capita cost new berkad (US$/m³)	Repair cost (US$)	Repair cost (US$/m³)
[illegible]	15	3	10	32	25,000	10	0	28.0	9.0	3.5	882	n.a			n.a	
Amba Sare	60	5	10	75	0	50	0	9.0	6.0	3.0	162	n.a			n.a	
[illegible]																
[illegible]																
[illegible]																
[illegible]																
[illegible]																
[illegible]				-				9.6	6.0	3.1	178		0.0			0.00
[illegible]	10	4	1	15	25,000	60	25,000	25.0	10.0	3.5	875	n.a			n.a	
[illegible]	58	2	15	75	35,000	30	35,000	25.0	10.0	3.0	750	9,000	12.0	1.50	n.a	
Gardo				-				9.6	6.0	3.1	178		0.0			0.00
[illegible]	100	10	10	120	30,000	50	30,000	15.0	5.0	3.0	225	9,100	40.4	0.76	5,000	22.22
[illegible]	12	11	9	32	25,000	60	25,000	12.0	6.0	3.0	216	7,000	32.4	2.33	n.a	
Iskushuban																
[illegible]	5	2	5	12	12,500	50	20,000	6.0	2.5	2.0	30	5000	166.7	3.33	2000	66.67
[illegible]	16	4	18	38	1,000	13	1,000	12.0	6.0	3.0	216	7500	34.7	4.17	500	2.31
[illegible]																
[illegible]																
[illegible]	0		5	14	30,000	17	30,000	13.0	6.0	3.0	234	n.a			n.a	
[illegible]	13		9	22	25,000	17	50,000	10.0	5.0	3.0	150	4,500	30.0		n.a	
[illegible]																
[illegible]						85	0	13.0	4.0	3.0	156	n.a			n.a	
[illegible]	60		15	75	4,000	0	4,000	15.0	8.0	3.0	360	7,500	20.8	0.42	n.a	
[illegible]																
[illegible]	13			13	21,000	60	21,000	28.0	9.0	3.5	882	12,700	14.4	1.51	n.a	
[illegible]																
[illegible]																
[illegible]	30	4		34	0	17	0	8.0	8.0	3.2	202	n.a			n.a	
Proposed								9.6	6.0	3.1	178	11880	66.9	3.97		0.00
AVERAGE SIZE OF BERKAD	23	3	8	35	16,679	37.9	17,214	14.9	6.7	3.1	355.9	7787.5	35.1	2.25	2,500.0	18.[illegible]
TOTAL	405	45	107	557	16,038	39.5	18,538	13.7	6.5	3.0	311.9	8,242.2	38.0	2.25	2,500.0	15.[illegible]

Notes
1 Dashes indicate either zero entry or lack of information
2 The lengths shown were indicative measurement estimates as the majority of berkads did not have a truly prismatic shape
3 The purchase of water is mainly derived from the cost of buying a truck of 100 barrels (drum), three such trucks are said to be available in Gardo
4 The data for Amba Sare was picked very early in the morning and only two women and a young man were available. This was therefore considered indicative as it lacked detail
5 During drought the rural people prefer that interested water vendors put water in the berkads for all to use. As such, sale price is the same as purchase price

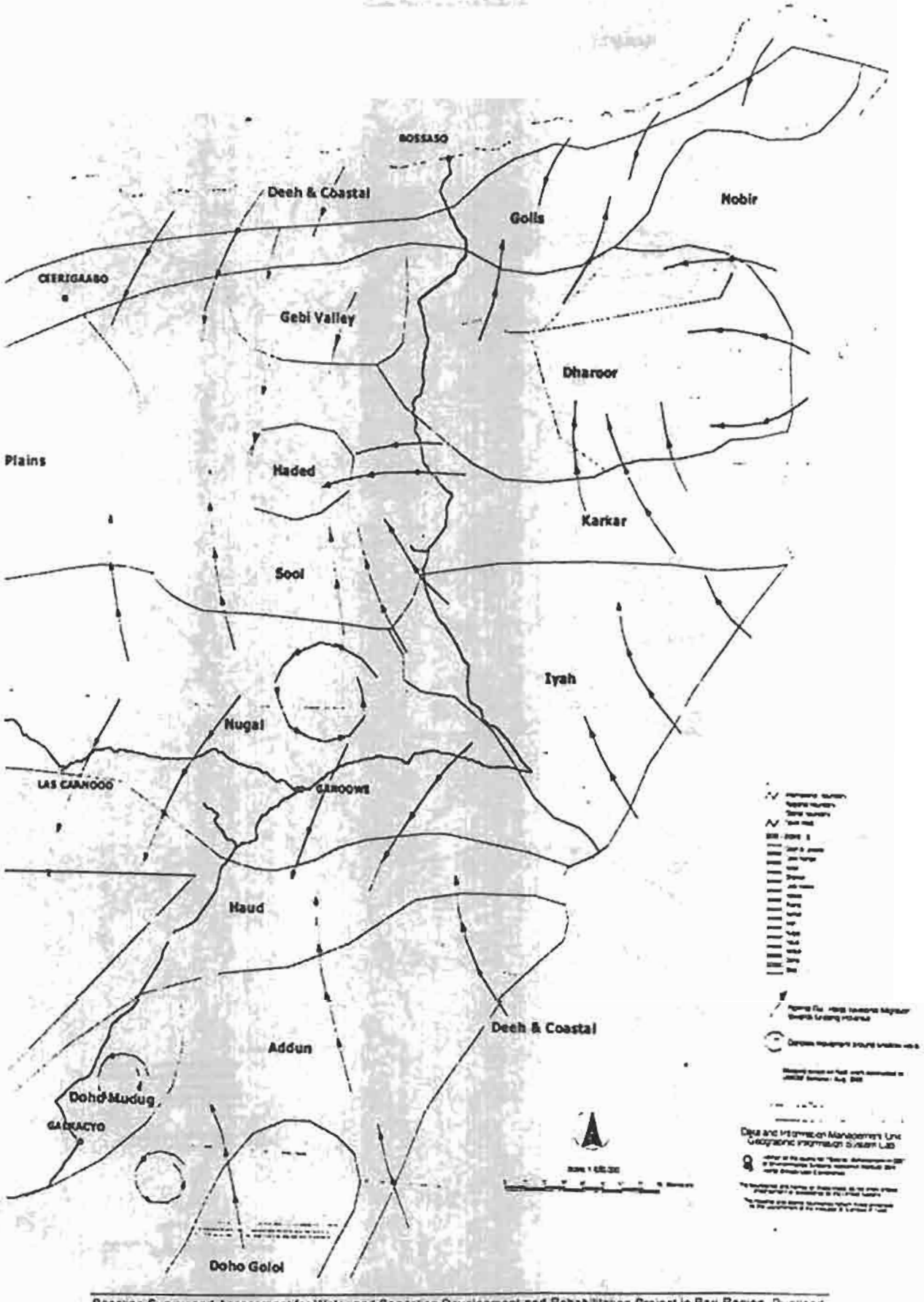
Annex 5: Maps

RAINFALL, MAJOR CATCHMENTS AND DRAINAGE

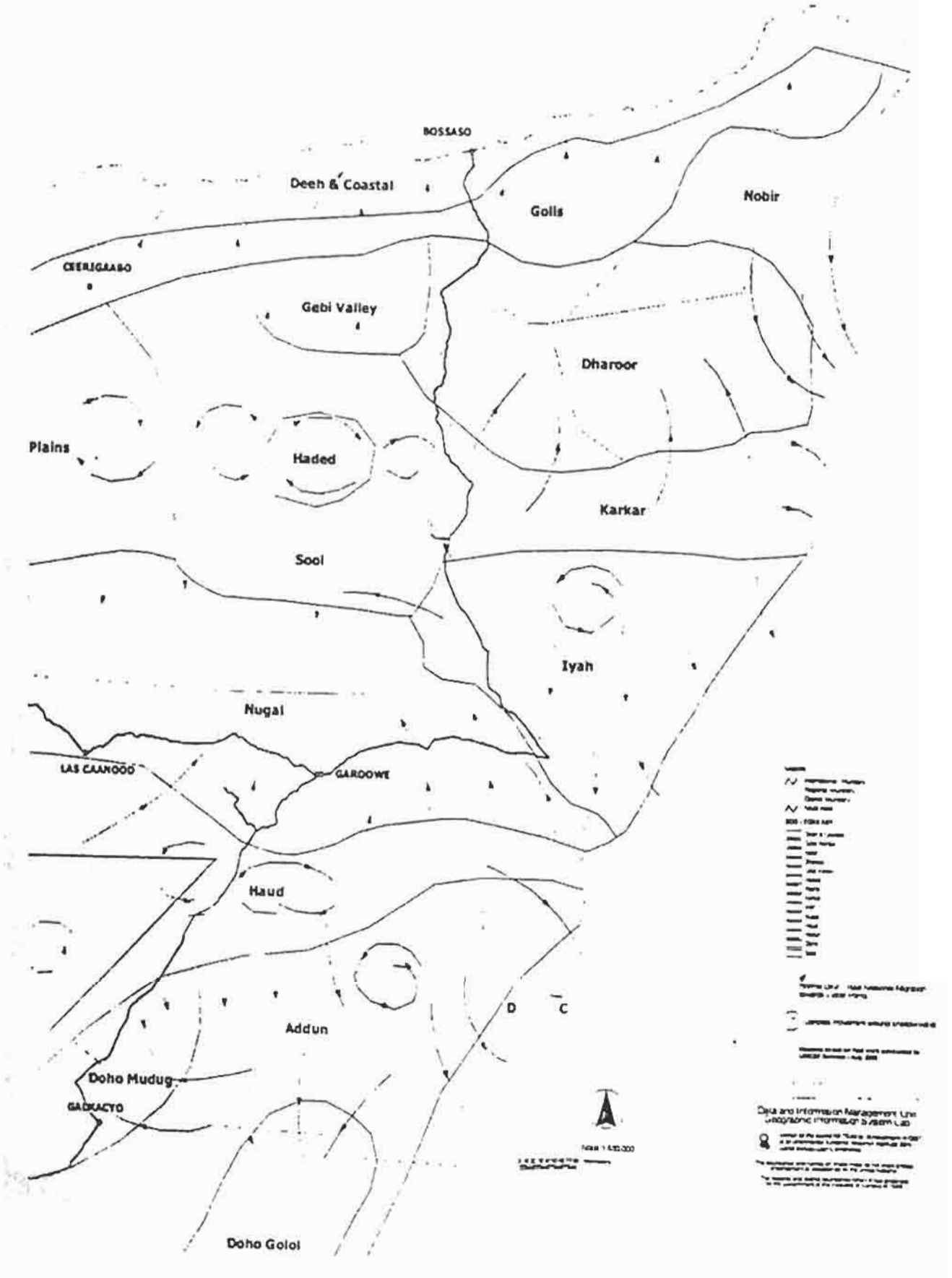
NE - SOMALIA (DRAFT)

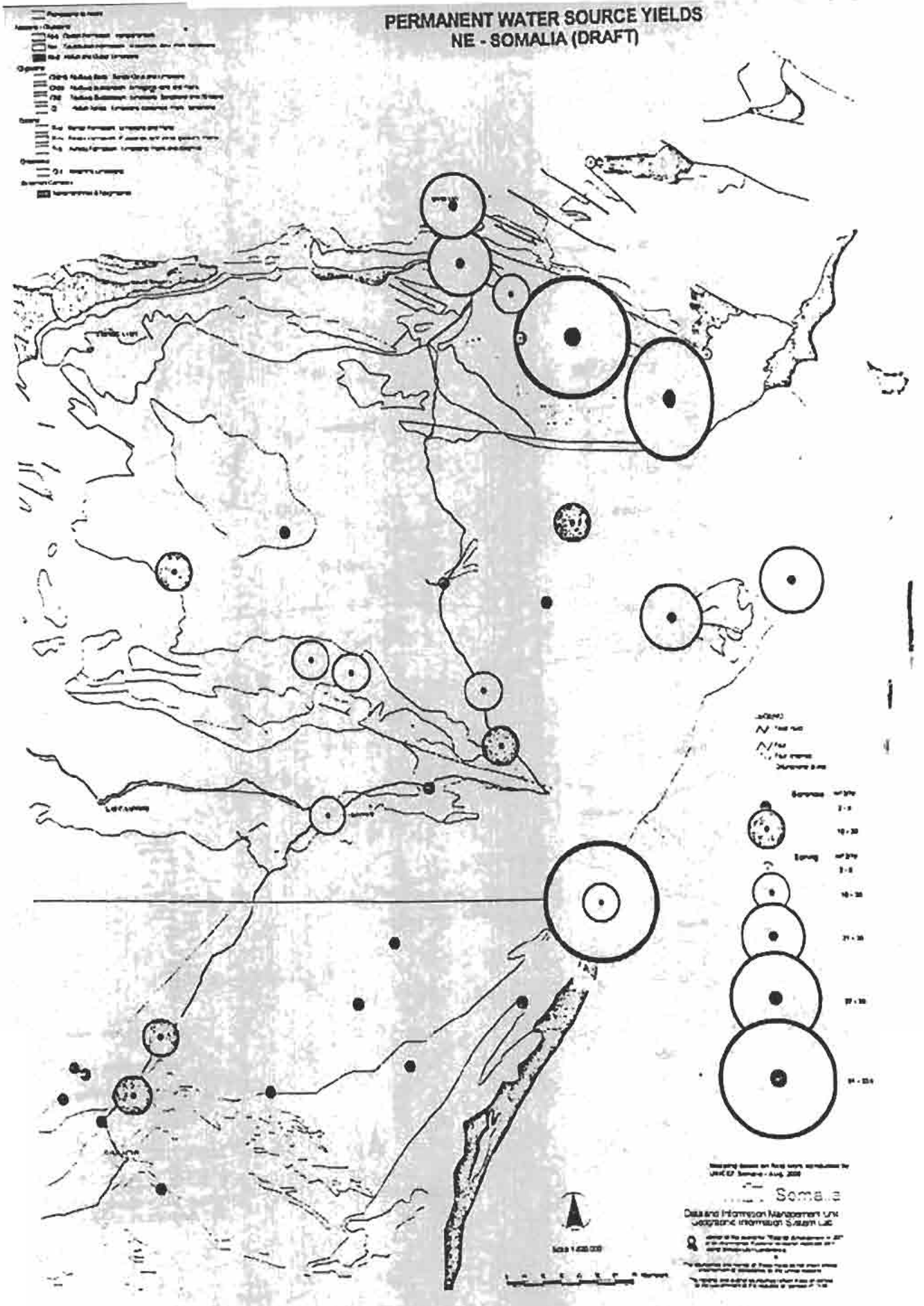


ECOLOGICAL ZONES
NE - SOMALIA (DRAFT)

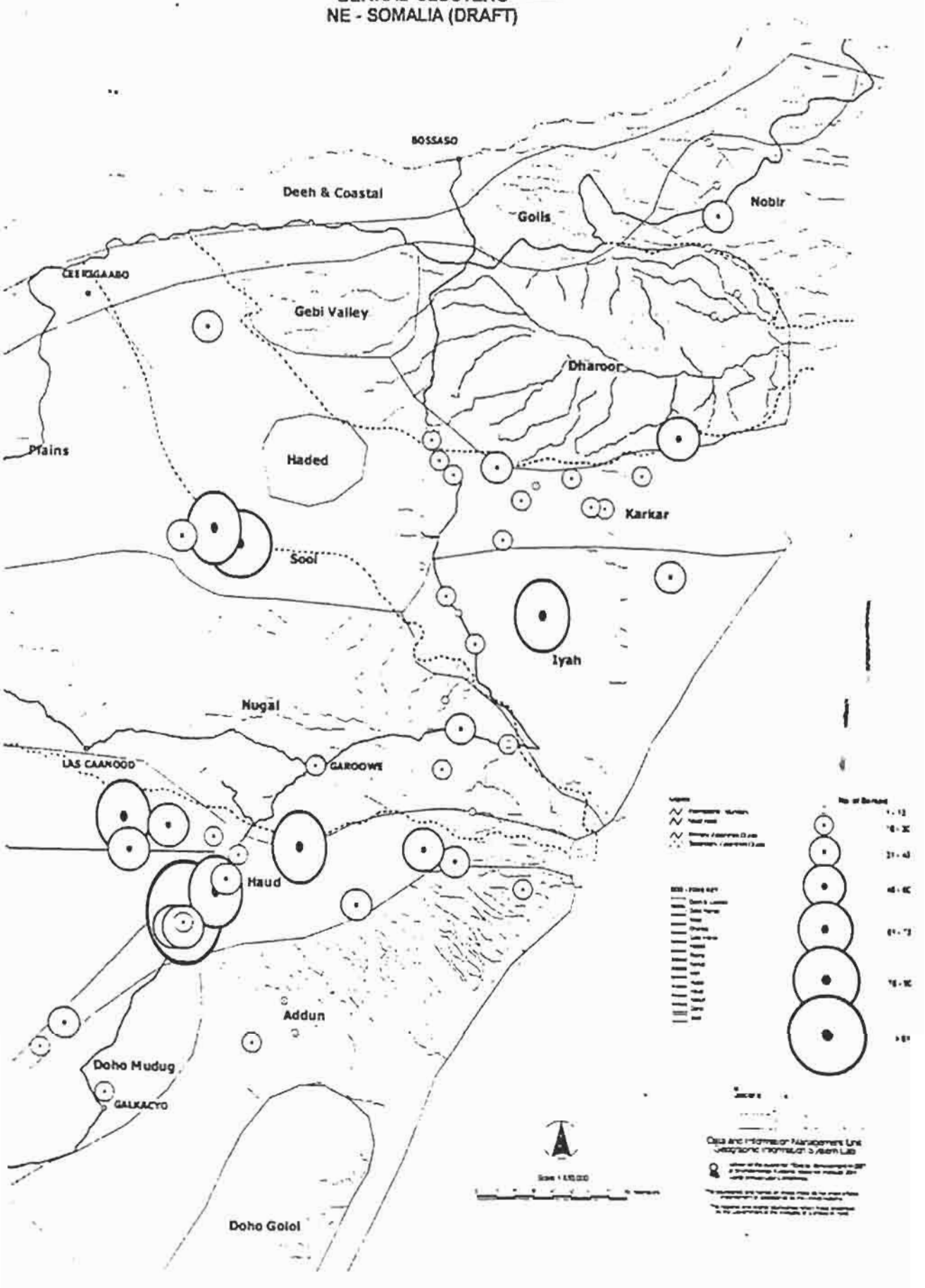


ECOLOGICAL ZONES
NE - SOMALIA (DRAFT)




PERMANENT WATER SOURCE YIELDS
NE - SOMALIA (DRAFT)

BERKAD CLUSTERS
NE - SOMALIA (DRAFT)



Annex 6: Drawings

Annex 6: Drawings

Sketch of proposed improved berkad

Figure: Schematic layout plan of berkad

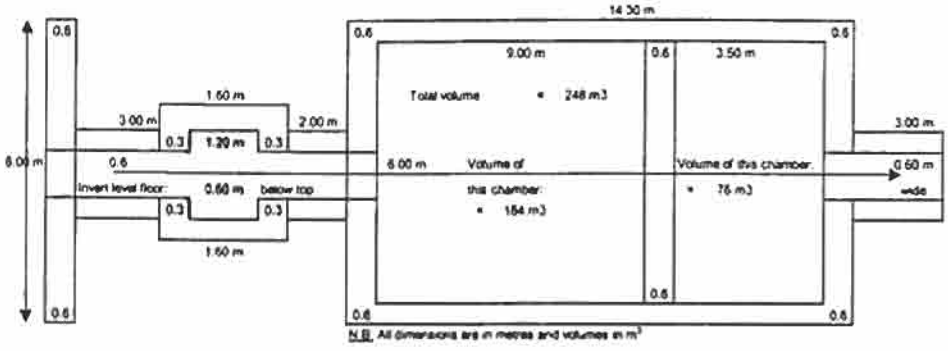
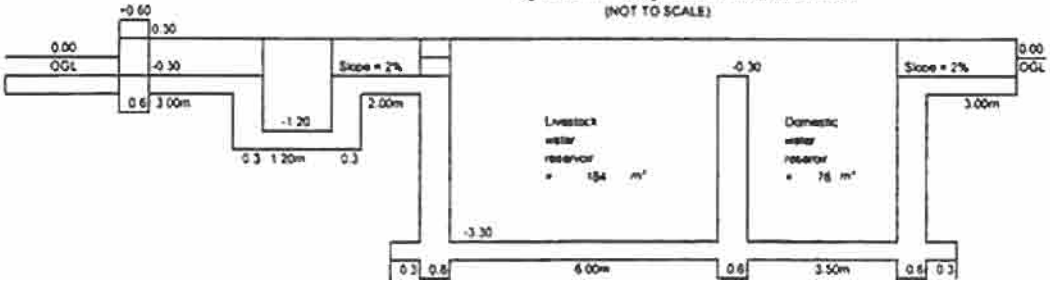
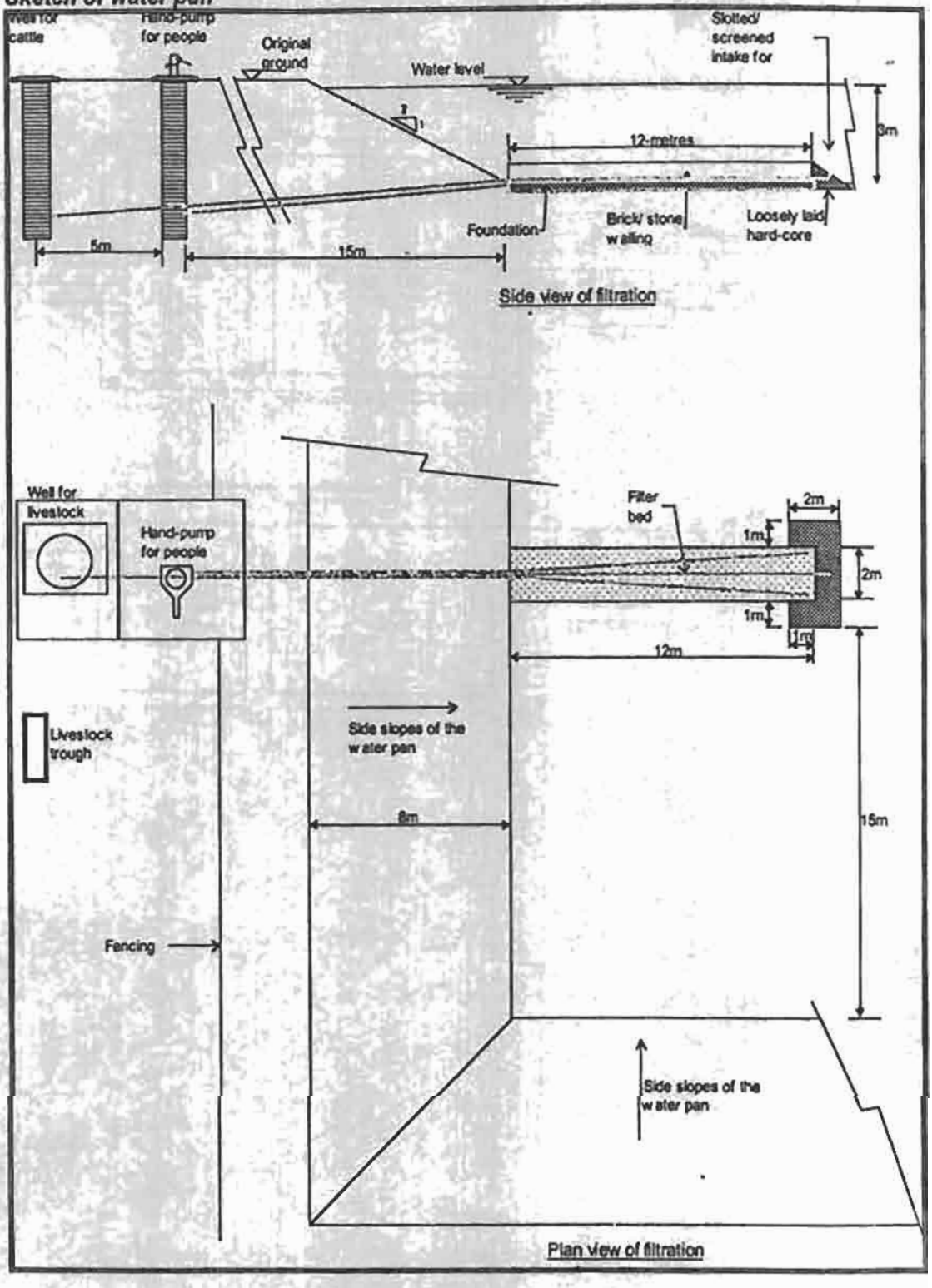
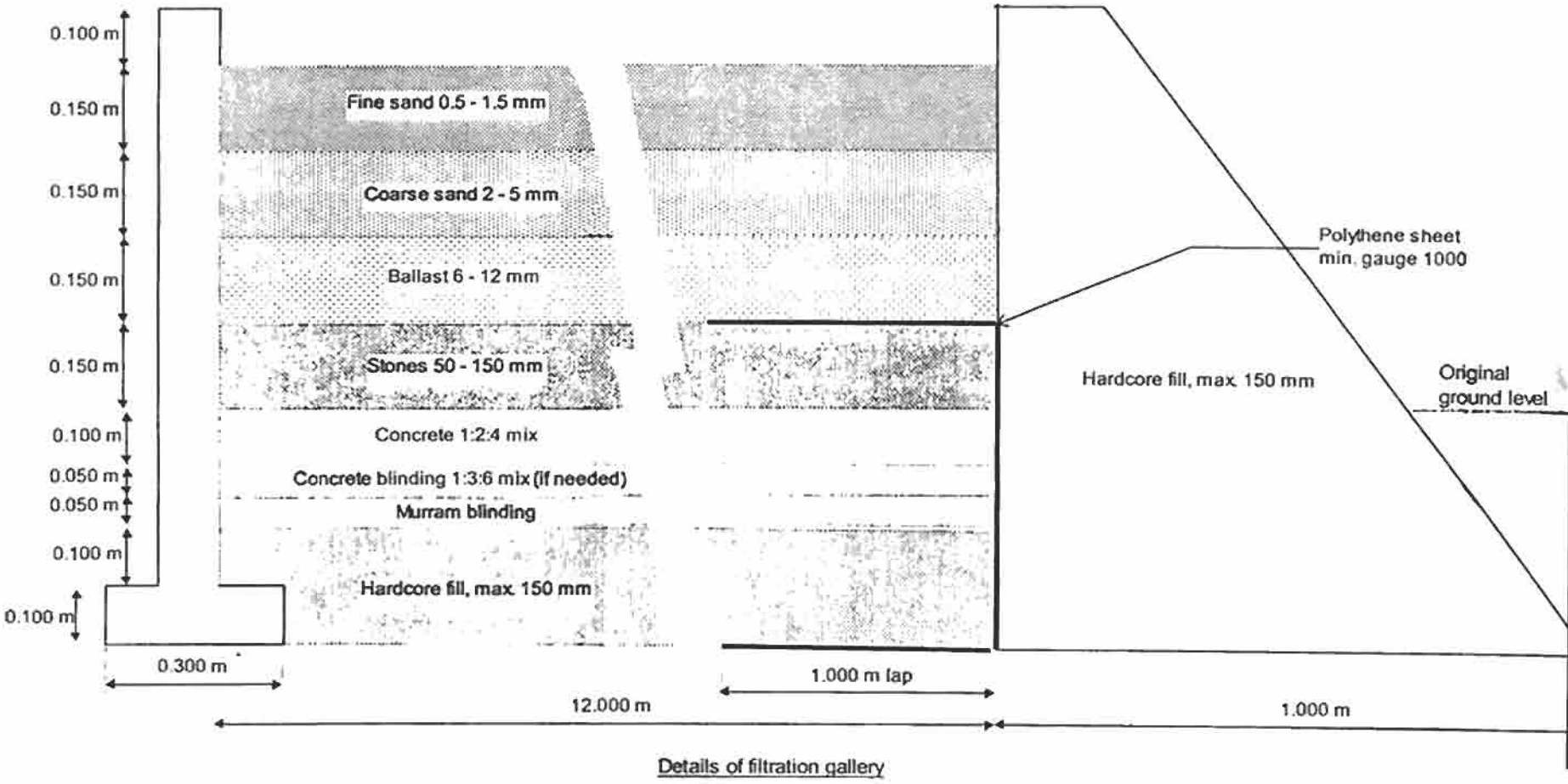


Figure: Schematic longitudinal section view of a berkad (NOT TO SCALE)

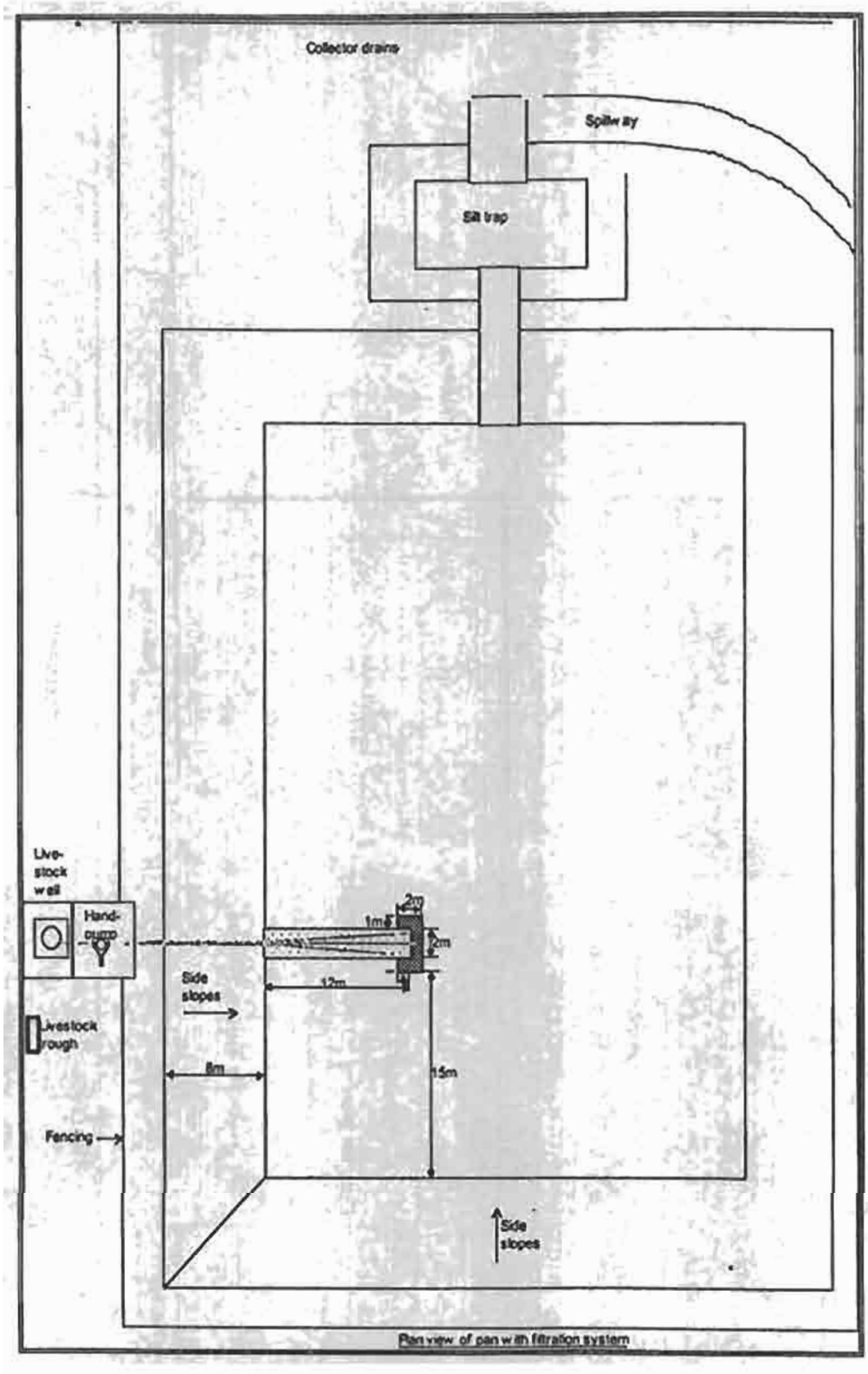


Sketch of water pan



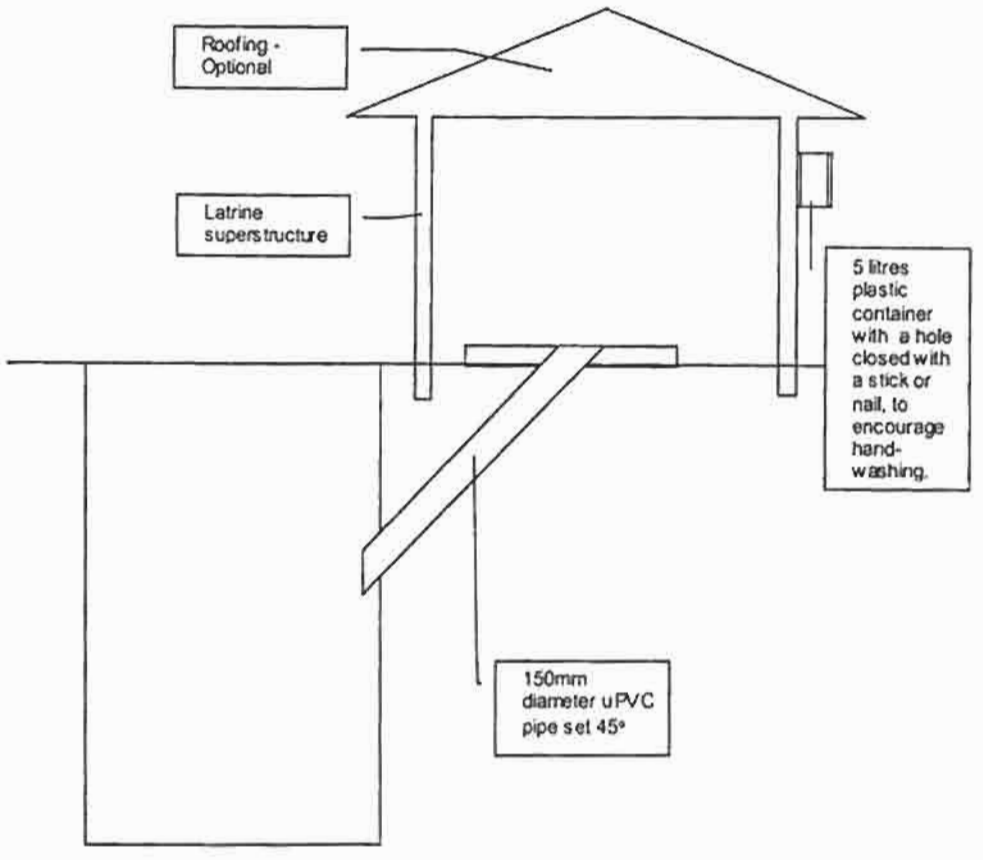


Details of filtration gallery



Plan view of pan with filtration system

Sketch of latrine in collapsing formations



Proposed latrine layout for collapsing soils

Annex 7: Detailed Cost Tables / Bills of Quantities

Reported construction costs of berkads in some of the villages visited

Examples of quantities used for construction of berkads (for different villages)							
Item	Description	Unit	Xaaji Khayr	Dud Hoyo	Hubabays	Hiriro	Timirshe
	Size of berkad (m^3)		1,200	750	216	225	360
1	Digging (mandays)	Quantity	520	800	520	900	520
		Rate (SoS)	70,000	60,000	70,000	60,000	50,000
			36,400,000	*48,000,000*	*36,400,000*	*54,000,000*	*26,000,000*
2	Cement (Ordinary	50 Kg	250	300	150	200	250
	Portland), 50 kg bag	Rate (SoS)	120,000	100,000	100,000	100,000	110,000
			30,000,000	*30,000,000*	*15,000,000*	*20,000,000*	*27,500,000*
3	Construction Stone	m^3	200	130	40	100	150
	(loads of 3 m^3)	Rate (SoS)	300,000	200,000	300,000	400,000	400,000
			60,000,000	*26,000,000*	*12,000,000*	*40,000,000*	*60,000,000*
4	Sand (loads of 3 m^3)	m^3	35	20	12	20	20
		Rate (SoS)	400,000	300,000	400,000	400,000	400,000
			14,000,000	*6,000,000*	*4,800,000*	*8,000,000*	*8,000,000*
5	Water	Drum	1,050	850	450	500	200
		Rate (SoS)	20,000	20,000	25,000	30,000	10,000
			21,000,000	*17,000,000*	*11,250,000*	*15,000,000*	*2,000,000*
6	Reinforcement	Pieces	15	10	10	50	10
	steel bars	Rate (SoS)	200,000	200,000	200,000	200,000	200,000
			3,000,000	*2,000,000*	*2,000,000*	*10,000,000*	*2,000,000*
7	Semi-skilled labour	Mandays	120	60	140	200	80
		Rate (SoS)	100,000	100,000	100,000	70,000	75,000
			12,000,000	*6,000,000*	*14,000,000*	*14,000,000*	*6,000,000*
8	Skilled Labour	Mandays	160	120	120	120	80
		Rate (SoS)	150,000	150,000	130,000	100,000	150,000
			27,000,000	*18,000,000*	*15,600,000*	*12,000,000*	*12,000,000*
9	Un-skilled Labour	Mandays	720	600	400	400	640
		Rate (SoS)	70,000	60,000	70,000	60,000	50,000
			50,400,000	*36,000,000*	*28,000,000*	*24,000,000*	*32,000,000*
12	**Total construction cost (SoS)**		253,800,000	189,000,000	139,050,000	197,000,000	175,500,000
13	**Total construction cost (US$)**		12,690	9,450	6,953	9,850	8,775
14	**Cost per m^3 storage (US$/$m^3$)**		10.58	12.60	32.19	43.78	24.38
Community contribution (unskilled labour, stones)			25%	22%	30%	19%	22%

Unit prices of materials and labour

Description	Specification	Unit	Rate (SoS)
Materials			
Cement	50 kg (Ordinary Portland)	Bag	110,000
Sand	3 m^3 truck	Load	300,000
Ballast	3 m^3 truck	Load	300,000
Water	1 barrel (drum) = 200 litres	Drum	30,000
Reinforcement - 10mm	High tensile steel	Piece	200,000
Stones - Rubble	3 m^3 truck	Load	300,000
Hard-core	3 m^3 truck	Load	300,000
Chicken mesh (1m x 30m)	Roll of 30 metres	Roll	900,000
Gabion mesh sheet (1m x 2m)	Pieces (High tensile). 50mm	m^2	100,000
Labour			
Digging labour	2 m^3/manday	m^3	35,000
Unskilled labour	Day rate	Manday	70,000
Skilled labour - Mason	Day rate	Manday	150,000
Semi-skilled labour - mixer	Day rate	Manday	100,000

Bills of Quantities for proposed balley or war (whar)

Cost Estimate of water pan or balley or war of capacity 10,000 m³

	Description	Unit	Quantity	Rate (US$)	Amount (SoS)	Responsibility
1	General					
1.1	Clearing of bush	m²	9,650	2,000	19,300,000	Community
1.2	Stripping 250 mm top vegetation soil	m³	1,500	72,000	108,000,000	Community
1.3	Fencing (by community)	m	350	50,000	17,500,000	Community
2	Construction of water storage					
2.1	Excavating earth	m³	10,000	20,000	200,000,000	Agency
2.2	Laying 300 mm thick clay cover	m²	4,000	22,000	88,000,000	Agency
3	Inlet and outflow structures					
3.1	Excavation of earth	m³	2,500	20,000	50,000,000	Community
3.2	300 mm thick rip rap held in 1:3 mortar	m²	370	80,000	29,600,000	Agency
3.3	Concrete sill in 1:2:4 concrete mix	m³	4.2	2,400,000	10,080,000	Agency
3.4	Skilled labour at 8% of the cost of materials	Sum			7,174,400.00	Agency
3.5	Unskilled labour at 7% of the cost of materials	Sum			6,277,600.00	Community
3.6	Cutting collection trench as per drawing	m²	100	72,000	7,200,000	Community
4	Sub-Total 1 (Construction of the Water Pan)				543,132,000	
	Overall unit cost of construction for a water pan of 10,000 m³ US$				27,156.60	
	CONTRIBUTION BY THE COMMUNITY			208,277,600	10,414	38%
	CONTRIBUTION BY IMPLEMENTING AGENCY			334,854,400	16,743	62%
5	Bill of quantities for 5 m hand-dug well and infiltration gallery at the water pan					
Item	Description	Unit	Quantity	Rate(SoS)	Amount (SoS)	Responsibility
5.1	Digging: 2 people x 30 days@0.4 m/day; days for 1 m	Mandays	10	70,000	700,000	Community
5.2	Cement (Ordinary Portland)	50 Kg	2.5	110,000	275,000	Agency
5.3	Construction Stone	m3	9	300,000	2,700,000	Community
5.4	Sand	m3	24	300,000	7,200,000	Agency
5.5	Water	Drum	2.5	30,000	75,000	Community
5.6	Iron Bars 8 mm diameter	100 Kg		200,000	200,000	Agency
5.7	Skilled Labour (including food) = 2 x 20	Day	40	150,000	6,000,000	Agency
5.8	Un-skilled Labour (including food)= 3 x 20	Day	60	70,000	4,200,000	Community
5.9	Miscellaneous (Pulley, Rope, Bucket)	Sum	1	2,000,000	2,000,000	Agency
	Total				23,350,000	
	Total cost of the well and infiltration gallery (US$)				1,168	
	CONTRIBUTION BY THE COMMUNITY			7,675,000	384	33%
	CONTRIBUTION BY IMPLEMENTING AGENCY			15,675,000	784	67%
	Grand total for the balley or war and a hand-dug well	SoS			543,133,168	
	Grand total for the balley or war and a hand-dug well	US$			27,156.66	
	OVERALL CONTRIBUTION BY THE COMMUNITY			215,952,600	17,126	60%
	OVERALL CONTRIBUTION BY THE DONOR/ IMPLEMENTING AGENCY			350,529,400	11,198	40%

Note:
The community can contribute substantially in the form of digging and rip-rap provision.

Bills of quantities for construction of a typical latrine

Bills of quantities for one latrine

Item	Specification	Unit	Rate (SoS)	No.	Amount (SoS)	Amount (US$)	Contribution
Digging	2 - 4 metres	m	70,000	4	280,000	14.00	Community
Cement	50kg.	Bags	300,000	4	1,200,000	60.00	Donor
Sand	Coarse, clean	Tons	300,000	0.6	180,000	9.00	Community
Water	210 litres	Drum	30,000	1	30,000	1.50	Community
Ballast	Medium	Tons	300,000	1.5	450,000	22.50	Community
Timber	4' x2'	Ft	0	10	0	-	Donor
Door unit	Shutter	No.	0	1	0	-	Community
Nails	2 ½"- 4"	Kg.	0	3	0	-	Donor
GI sheets	G 30 2X1m	Sheets	0	2	0	-	Community
Labor	2 artisans	Manday	0	5	0	-	Donor
	2 unskilled	Manday	0	10	0	-	Community
TOTAL					2,140,000	107.00	

Contribution by the community per latrine	180,000	47.00	43.9%
Contribution by the donor per latrine	1,960,000	60.00	56.1%

Bills of quantities for berkad rehabilitation / construction – up to 250 m³

Bill of quantities for berkad rehabilitation- volume between 150 - 250 m³

Item	Unit	Rate (SoS)	Quantity	Amount (SoS)	Responsible
Materials					
Cement	Bag	110,000	72	7,920,000	Donor
Sand	Load	300,000	7	2,039,739	Community
Ballast	Load	300,000	0	42,882	Community
Water	Drum	30,000	50	1,485,000	Community
Reinforcement - 10mm	Piece	200,000	117	200,000	Donor
Stones - Rubble	Load	300,000	10	2,922,480	Community
Hard-core	Load	300,000	0	89,100	Donor
Chicken mesh (1m x 30m)	Roll	900,000	3	2,700,000	Donor
Gabion mesh sheet (1m x 2m)	m²	100,000	62	6,180,000	Donor
Sub-Total materials (SoS)				23,579,201	
Labour:					
Excavation	m³	35,000	3.27	114,450	Community
Construction: Skilled labour (masons)	Manday	70,000	257.14	18,000,000	Donor
Construction: Semi-skilled labour (mixers)	Manday	150,000	53.33	8,000,000	Community
Construction: Unskilled labour (helpers)	Manday	100,000	280.00	28,000,000	Community
Total cost (SoS)				77,693,651	
Total cost (US$)				3,885	
Add overall contingency of 5%				583	
Grand TOTAL cost (US$)				4,467	
Unit cost of berkad, i.e. cost per cubic metre of storage - US$ per m³			18.05		
Contribution of the community		42,604,551	2,130	55%	
Contribution of the donor / implementing agency		35,089,100	1,754	45%	

Bill of quantities for a new berkad of volume 247.5 m³

Item	Unit	Rate (SoS)	Quantity	Amount (SoS)	Responsible
Materials					
Cement	Bag	110,000	717	78,870,000	Donor
Sand	Load	300,000	70	20,854,937	Community
Ballast	Load	300,000	14	4,183,888	Community
Water	Drum	30,000	493	14,788,125	Community
Reinforcement - 10mm	Piece	200,000	117	200,000	Donor
Stones - Rubble	Load	300,000	114	34,315,776	Community
Hard-core	Load	300,000	19	5,775,660	Donor
Chicken mesh (1m x 30m)	Roll	900,000	10	9,000,000	Donor
Gabion mesh sheet (1m x 2m)	m²	100,000	62	6,180,000	Donor
Sub-Total materials (SoS)				174,168,386	
Labour:					
Excavation	m³	35,000	3.27	25,129,913	Community
Construction: Skilled labour (masons)	Manday	70,000	257.14	18,000,000	Donor
Construction: Semi-skilled labour (mixers)	Manday	150,000	53.33	8,000,000	Community
Construction: Unskilled labour (helpers)	Manday	100,000	280.00	28,000,000	Community
Total cost (SoS)				253,298,298	
Total cost (US$)				12,665	
Add overall contingency of 5%				1,900	
Grand TOTAL cost (US$)				14,565	
Unit cost of berkad, i.e. cost per cubic metre of storage - US$ per m³			20.29		
Contribution of the community		135,272,638	6,764	53%	
Contribution of the donor / implementing agency		118,025,660	5,901	47%	

Annex 8: Bibliography - List of books consulted

1. Bari Rural Water Supply Rehabilitation Project, Proposal - Phase II, by SAWA and SPDS, September 1995.
2. Bari Water Rehabilitation Study, Volume II (Final Report), by SAWA and SPDS, September 1995.
3. Development Economics Group (DEG), Somalia Water Law Draft (1990).
4. ETC Kenya Consultants, Evaluation of Water Projects and Assessment of Water Needs in Hiraan and Middle Shabelle Regions, Somalia, Report to the European Union, November, 1996
5. Feasibility study on irrigation systems improvement in Alula District, SAWA/SORSO, January/February 2002.
6. Feasibility study on irrigation systems improvement in Bosaso District areas, SAWA/SORSO, August/September 2001.
7. Guidelines for Planning Inventory for Existing Water sources in Puntland State of Somalia, Bosaso, 2002/2003, Eng. Khalif Nur Ali (Qonof), Water Energy and Natural Resources Corporation (PSAWEN).
8. Oxfam Great Britain in Somalia, Water and Sanitation Rehabilitation and Development Project in Bari Region of Puntland, Project Proposal, Hargeisa July 2000.
9. Progress report: March - May 1999, Rehabilitation Programme for water supply systems in small towns and urban centres in the Bari Region of Somalia, SAWA-Somalia/ The Netherlands, June 1999.
10. PSAWEN, Water Supply Policy Green Paper, A discussion Paper for Review, Bosaso, February 2001.
11. Richard Rosenberg, 1998. Independent Review of UNCDF Micro-finance Activities, UNCDF Programme Evaluation, UNDP
12. Talo Wadaag, Ana analysis of Talo Wadaag, a First Experience in Decision Sharing of 12 Local NGOs in Puntland, Somalia, Bosaso, May 2001.
13. UNDP, UNDPA, UNOPS and PSIS, Building From the bottom: Basic Institutions of Local Governance, Final Draft, 1999.

Annex 9: Interview guide

Demography
- Population size, growth rate, mobility
- Household size and composition (special features such as women heads of households

Health
- Major health problems in the community and the relative importance of water and sanitation-related diseases
- Seasonal variations

Occupation
- Major occupations and approximate distribution
- Seasonality of employment.
- Organisation and Participation
- Major local organisations and types of membership
- Community and family-level leadership in decision-making
- Major local political or social factions which might affect participation
- Extent of previous interest and participation in water, sanitation/other development activities
- Importance characteristics that would determine the acceptability and influence of outsiders working on projects in the area

Level of Interest
- Evidence of popular interest in improving water supply for livestock and domestic use or latrines, compared with other potential improvements in the community
- Evidence of leadership commitment to improvements

Physical Structures
- Types of dwellings, their physical condition and layout
- Types of building materials used
- Existing water supply and sanitation facilities
- Space availability inside and outside dwellings

Willingness and Ability to Pay for Water
- Ownership of land and houses
- Income distribution
- Expenditure patterns
- Borrowing and savings customs

Water-use Patterns and Practices
- Preferred source of water (by purpose)
- Quantity and uses
- Water source-related activities (e.g. laundry, animal watering, bathing)
- Possibilities for contamination of drinking water

Defecation Habits and Associated Practices, Underlying Beliefs, Attitudes
- Existing practices (noting important differences between castes; religions; men, women and children; different age groups)
- Cleansing and ablution materials and practices (e.g. anal cleansing materials; prevalence of bathing in latrines)
- Underlying causes of above

Typical operation and maintenance cost of a borehole (example of Adinsoone)

Hourly O&M cost of Adinsoone borehole in Gardo District, Bari Region, Puntland (US$)

	Item	Change hours	Unit	Rate (SoS)	Rate (US$)	Quantity	Amount (US$)	% of Total
1	**Fuel Costs**							
1.1	Fuel cost - Diesel	5	Litre	7,000	0.35	0.20	0.07	2%
1.2	Lubricating oil-1 litre	250	Litre	2,400	0.12	0.00	0.00	0%
	Sub-total 1						0.07	2%
2	**Cost of Servicing**							
2.1	Engine oil change	250	Litre	2,400	0.12	0.00	0.00	0%
2.2	Oil filter change	500	Piece	400,000	20.00	0.00	0.04	1%
2.3	Fuel filter change	500	Piece	480,000	24.00	0.00	0.05	1%
2.4	Change of v-belts (Two)	2,500	Piece	720,000	36.00	0.00	0.01	0%
2.5	Change of gland-packing	1,000	Piece	450,000	22.50	0.00	0.02	1%
	Sub-total 2						0.13	4%
3	**Cost of Repairs**							
3.1	Engine decarbonation	5,000	Sum	10,000,000	500.00	0.00	0.10	3%
3.2	Engine overhaul	10,000	Sum	40,000,000	2,000.00	0.00	0.20	6%
3.3	Change of pumping shaft	2,500	Piece	30,000,000	1,500.00	0.00	0.60	17%
3.3	Change of pulleys	2,500	Piece	80,000,000	4,000.00	0.00	1.60	46%
	Sub-total 3						2.50	72%
4	**Cost of Labour**							
4.1	Cost of pump attendants (two)	2	m/day	20,000	1.00	0.50	0.50	14%
	Sub-total 4						0.50	14%
5	**Other Costs**							
5.1	Entertainment of guests	24	m/day	10,000	0.50	0.04	0.02	1%
5.2	Community training expenses	2	m/day	10,000	0.50	0.50	0.25	7%
	Sub-total 5						0.27	8%
	TOTAL MONTHLY OPERATION AND MAINTENANCE COST						3.47	100%

Souce: Community interviews and reference to supply shops.

Income/Expenditure Summary Analysis

A. Total hourly running Cost (US$) =	3.47	E. Number of barrels produced per hour =	8.00
B. Safe hourly discharge (80 % of ave.) =	1.60	F. Hourly income using current sale rates (US$) =	1.88
C. Cost of water per barrel (200 litres) =	0.20	G. Average hourly potential income in (US $) =	1.60
D. Ave. daily income: 4-hrs of pumping =	7.50		

Notes

1. Average pumping hours per day = 4
2. Average daily discharge (CM/hour) = 2
3. m/day = man-day
4. CM = cubic metres
5. Minimum income is based on field interviews. However, communities seem to collect only about 12.5% of total hourly potential income, or less than 7.5% of the real O&M cost.
6. Cost of major service and repairs (items 2.4-3.3): 2.54 is not provided for by communities and amounts to 73%
7. Rates fluctuate according to shipping and the security situation; conservative rates assumed.
8. The possible income based on current rates is far below the real O&M cost of the system.
9. Prices based on TS2 Lister engine and submersible pump.
10. Exchange rate: 1 US$ = 20,000 SoS

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- Household size and composition (special features such as women heads of households

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- Existing practices (noting important differences between castes; religions; men, women and children; different age groups)
- Cleansing and ablution materials and practices (e.g. anal cleansing materials; prevalence of bathing in latrines)
- Underlying causes of above

- Important taboos, beliefs, related to locations, sharing, etc.
- General household cleanliness (who washes and how often, how are utensils kept clean)

Local Technology and Resource Availability

- Local availability of building materials
- Availability of skilled and unskilled labour
- Availability of technology-related inputs (such as water for pour/flush latrines)
- Education Activities and Potential
- Literacy level
- Mass media access in area
- Coverage by field workers, volunteers
- Ongoing formal or non-formal health education activities