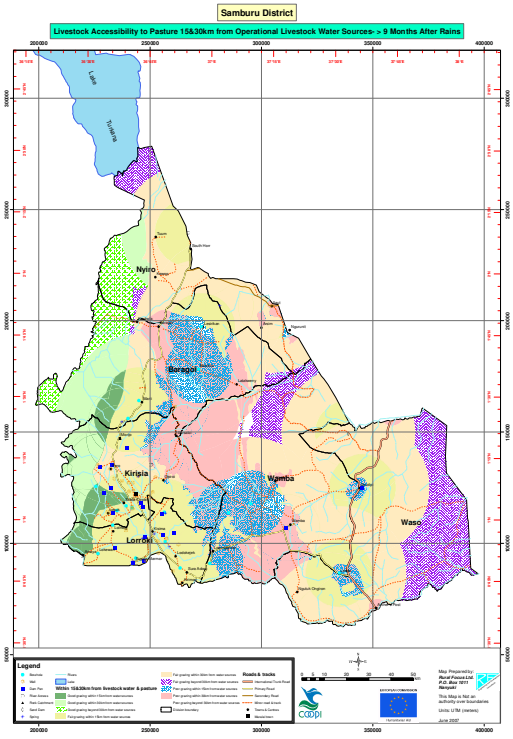
EUROPEAN COMMISSION
Humanitarian Aid

WATER, SCHOOLS AND HEALTH MANAGEMENT INFORMATION SYSTEM (MIS) FOR SAMBURU DISTRICT

FINAL REPORT

VOLUME ONE: MAIN REPORT



Prepared by:

Rural Focus Ltd
P.O. Box 1011
Nanyuki
Tel: 062-31321/32237
Email: Info@ruralfocus.com

Submitted to:

COOPI
P.O. 3857-00100
Nairobi
Tel: 020 – 3750055/3749746

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PREFACE

This report is the first comprehensive record of the water sources in Samburu District which can be linked to users in communities, schools and health facilities. The water source assessment and mapping has been done with the financial assistant of the European Community through COOPI. The exercise built on previous work carried out in Turkana, Garissa, Mandera, Marsabit and Wajir districts, through collaboration between ECHO, Unicef, Oxfam Quebec and Rural Focus. The exercise also covers Rural Water Supply and Sanitation (RWSS) Service assessment and mapping.

The report is based on data collected by three teams that covered the district between 13th February 2007 and 16th March 2007, assessing 369 water sources, 131 Rural water Supply and sanitation service level points, 163 schools, 53 health facilities and 28 proposed development sites (for water, schools and health facilities). Relevant data for each source, covering the geo-referenced position, capacity, operational status, management system, demand, etc, were obtained and entered into a Geographical Information System (GIS).

Technical expertise provided by:
Rural Focus Ltd.
Email: Info@ruralfocus.com

FOREWORD

The Water, Schools and Health Management Information System project for Samburu district is another milestone in the co-operation between the Government of Kenya and European Community through COOPI. The Geographical Information System GIS, one tool that has been designed to manage large volumes of information and to enable user friendly presentation of data, is indeed very useful for the district.

The project builds on similar ones undertaken in Turkana, Garissa, Wajir, Marsabit and Mandera districts.

The availability of reliable information has proved critical in identifying appropriate and timely drought responses and other development needs. Strategic planning and appropriate development and management of water resources can be strongly assisted by accurate and accessible information. This project will respond to data management and planning needs in the districts with its good coverage of schools, health facilities and water and sanitation services.

This project was undertaken with the participation of the key stakeholders in the district, who were involved both in data collection and analysis. It is anticipated that all stakeholders in and out of the district will take full advantage of this useful opportunity and put the information in good use for the benefit of all interested parties.

Paola Grivel
Representative
COOPI

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LIST OF ACRONYMS

ALRMP	Arid Lands Resource Management Project
ASAL	Arid and Semi-Arid Lands
CBOs	Community Based Organisations
CBS	Central Bureau of Statistics
COOPI	Cooperazione Internazinale
DDA	Discrete Development Areas
DDO	District Development Officer
DICECE	District Centre for Early Childhood Education
DEO	District Education Officer
DLPO	District Livestock Production Officer
DRSRS	Department of Remote Sensing and Resource Surveys
DSG	District Steering Group
DWO	District Water Officer
ECD	Early Childhood Development
GIS	Geographic Information System
GoK	Government of Kenya
GPS	Global Positioning System
GTZ	German Technical Cooperation
JICA	Japan International Cooperation Agency
IMC	International Medical Corps
KWSP	Kenya Water and Sanitation Programme
LSU	Livestock Units
MIS	Management Information System
MoEST	Ministry of Education, Science and Technology
MEPD	Ministry of Economic Planning and Development
MoH	Ministry of Health
MoWRMD	Ministry of Water Resources Management and Development
MWD	Ministry of Water Development
NGOs	Non-Governmental Organisations
RWSS	Rural Water Supply and Sanitation
UNICEF-KCO-WES	UNICEF Kenya Country Office, Water, Environment and Sanitation Section
WES	Water Environment and Sanitation
WRAP	Water Resources Assessment Project
WRMA	Water Resources Management Authority
WSB	Water Services Board
WSRB	Water Services Regulatory Board
WUA	Water Users Associations

Acknowledgements

The authors of this report wish to express their appreciation and gratitude for the assistance provided by the Arid Land Resource Management Project (ALRMP), the district steering group (DSG), and the district based field co-ordinator and data collectors. Specifically the authors would like to thank the ALRMP and the rest of the DSG members Samburu for all their assistance in facilitating this exercise. The effort of the Kenya Water and Sanitation Programme (KWSP) in the initial formulation of the RWSS questionnaire is appreciated.

1. INTRODUCTION

1.1 Background

Appropriate water resource development is an important component in promoting sustainable livelihoods. This is particularly so in arid and semi-arid areas (ASAL) where access to and reliability of water sources have such a large influence on the economy and there are significant environmental impacts associated with those water sources. Strategic planning and appropriate development and management of the water sources can be strongly assisted by accurate and accessible information. In addition the availability of reliable information has proved to be critical in identifying appropriate and timely drought responses.

COOPI has been working in Samburu District in the water sector since 2004 and in the livestock sector since 2001. They are supporting water supply development and management for local communities. Although both WRAP and IMC have previously undertaken water resource mapping work in the district, the outputs have been maps and reports that are not easily updateable and are not readily available in a digital format. The current work funded by COOPI is an attempt to use modern GIS and database software to record and store key information relating to water supplies, water users and related environmental features. The resultant MIS and maps are easily updateable and can be distributed in an electronic format. This means that decisions on water development, especially during critical disaster periods (such as drought or floods) can be made with reference to up to date strategic information.

It is well known that unless data is easily accessible and is presented in a user-friendly format, decision makers will commonly make do without the information. Selecting, collecting, quality controlling, archiving and retrieving data in a user-friendly format are activities that require investment in human and institutional resources. One tool that has been designed to manage large volumes of data and to enable user friendly presentation of the data is a Geographical Information System (GIS). A GIS is a digital database in which all the information is spatially referenced. The data is stored in thematic layers, called “coverages”. The software provides a digital database environment to create maps to display information and to undertake spatial analysis of the data.

The main functions of a GIS are to:

- Provide a digital database for data archival and retrieval;
- Provide a mechanism for data quality control;
- Provide a mechanism to undertake spatial analysis, to seek spatial relationship within the data, and to query the database;
- Provide a decision support tool.

In recognition of the power of a GIS to support strategic planning in the water sector, COOPI, the District Steering Group (DSG) [district based co-ordination body] decided to undertake a Water, Environment and Sanitation Assessment and Mapping Project in Samburu District. The project was supported by the European Community and COOPI as part of their long-term commitment to support water supply development and management in Samburu District. COOPI commissioned Rural Focus Ltd., a Kenyan consultancy firm with GIS expertise, to implement the project.

The project was based on similar exercises undertaken by Rural Focus in Turkana, Mandera, Wajir, Marsabit and Garissa districts. The process of undertaking the Water Source Assessment and Mapping Project in these districts has demonstrated the following:

- The need to improve water source data at the district level;
- The need for a proper water source database;
- The capacity of a GIS to support data management at the district level;

- The capacity of a GIS to support strategic planning;
- The need to carry out Rural Water Supply and Sanitation service level mapping

On the strength and experience of the projects in other districts, the Samburu District project was designed to collect data on both water sources, rural water supply and sanitation service level and related institutional information for schools and health centres, to develop the GIS, and present the results. A second Phase, which has been implemented in Garissa, Mandera, Wajir and Marsabit, focuses on building the capacity of district actors to operate and use the GIS for planning and monitoring. Only Phase 1 has been undertaken to date in Samburu and this report describes the methodology and results of the project.

1.2 Samburu District

Samburu District covers 20,988 km^2 of some of the most arid parts of Kenya. Samburu is located in Rift Valley Province and borders on Turkana to the west, Marsabit to the north, Isiolo to the east and Laikipia and Baringo to the south west (see Map 1a in Vol. 2 Appendix 5). The District is made up of 6 divisions, 35 locations and 108 sub-locations.

Samburu district has various physiographic units viz.

i) the high parts of Leroghi Plateau and mountain ranges of Nyiru, Ndoto and Mathews. The altitude ranges between 1,500 m and 2,500m a.s.l.
ii) central plains around Baragoi and Barsaloi range from 1,000m to 1,300m a.s.l.
iii) the lowest parts of the district have an altitude of about 750m a.s.l.

Most of the district is a continuous basin which slopes towards Lake Turkana and from the Mathews range eastward to Isiolo and Marsabit.

The district is classified as one of the arid districts of Kenya. However the climate of the district varies with altitude. The highest mountains receive over 1,250mm of rain per year (Swartz, *et al* 1992). Generally the highlands receive between 600 and 1000mm of annual rainfall. The lowlands receive between 200 and 500mm of rainfall. It is highly variable and unreliable. The rainfall is in two main seasons - long (March to May) and short (October to December). The rainfall pattern varies in the south-west with peak amounts being experienced in the months of July and August, with significant rainfall in March and November. The district is characterised by severe and recurrent droughts.

According to the range management handbook 8% of the district is agriculturally high potential with annual rainfall of over 875mm, enough for production of wheat, barley and maize. This area also contains forest reserves and important watersheds which provide grazing in cases of extreme drought. The rest of the district is rangeland. The traditional form of livelihood is nomadic pastoralism.

The total district population is estimated at 143,547.00 (as of 1999 National Census). The annual population growth rate is estimated to be 3.3%.

The district has a District Steering Group (DSG) which was established through the initiative of the Arid Lands Resource Management Project (ALRMP) to strengthen sectoral co-ordination for drought management and pastoralist development activities.

Successive droughts through the 1980s and 1990s have demonstrated the vulnerability of the pastoral livelihood system to the ravages of drought. Severe droughts appear to recur every 3 to 4 years. Additional factors, such as insecurity, inaccessibility, and poor government services and infrastructure have also impacted on the strength of the pastoral economy within the district. Supporting and strengthening the pastoral livelihood system has been the target of many government and donor-supported initiatives.

Main factors associated with the water resources in Samburu District are:

- Lake Turkana at the northern edge of the district. The water is not fit for human consumption and it is difficult to access it through the rough lava terrain for livestock watering.
- Ewaso Ng'iro river- a major source of water on the southern part of the district. It is perennial for most parts in the district and is a source of water for many settlements, livestock and wildlife.
- The upper parts of the Seiya, Ngeny, Amaya, Wamba, Ngurunit and Arsim streams are perennial except for extreme drought periods.
- Springs- there are a number of springs some of which have enough yields to supply water to villages. Most of them are located in high rainfall areas.
- Other water sources include boreholes, wells, pans and dams
- In most of the district the main reliable permanent water resource is groundwater, especially associated with the shallow groundwater aquifer associated with dry riverbeds. It is also of better quality than most of the surface water sources in the district.
- Most of the district is classified as having low to medium groundwater availability.
- Ephemeral rivers provide significant water sources mainly via shallow wells. Shallow wells on seasonal rivers are the most abundant source of water in the district.
- Migration of livestock into and out of neighbouring districts. The timing and extent of migration is highly dependent on water and pasture availability, and security.

2. TERMS OF REFERENCE

The Terms of Reference for Phase 1 were:

2.1 Activities

To map and document all existing water sources in Samburu District and overlay them on existing/available forage/vegetation data.

Specifically, the Consultant will:

- Introduce the study to the Samburu DSG, Northern Kenya Water Services Board, WRMA offices and Ministry of Water and Irrigation office to ensure that all actors are aware of the goals and activities of the study;
- Review all available data for the district and incorporate relevant information into the database and corresponding report;
- Develop data collection tools that are consistent with studies conducted for other districts to ensure complementariness with other studies. The data collection format should allow addition of new data and updating of developed data base;
- Train data collectors, including GoK and Northern Water Service Board personnel to ensure transfer of knowledge to district level systems;
- Undertake field data collection that should map all existing water points. Permanent rivers and springs can be digitized from existing maps if not included in the available GTZ data base;
- Develop an MIS that incorporates GIS for the district;
- Enter data into MIS and GIS, ensuring that the data is consistent before entry;
- Train the relevant Ministries and stakeholders on updating and using the information in planning;
- Using GIS analysis, develop layers of data with the following criteria;
    - Spatial distribution of various water sources in relation to demand and availability of grazing resources. Each water type should have own layer.
    - Spatial distribution of water sources in relations to settlement centres, schools, health centres and other important institutions.
    - Wet and dry season water demands (domestic and livestock, using available people and livestock census data).
    - Water sources operational status and existing infrastructure on each water source
    - Water sources management status
    - Identify areas that lack water sources and have potential for grazing, especially during dry and drought periods
- Prepare 3 draft reports including colour maps and submit them to COOPI for review;
- Prepare 20 final reports including coloured maps and 20 CD-copies on the MIS and Digital copy of the report and maps;
- Identify and give recommendations on the way forward for district level capacity to manage the MIS, detailing the required resources, trainings and associated cost. This should be provided as a separate stand alone Document.
- Organize a one day workshop for DSG and other stakeholders to present final report findings and circulation of final report to relevant institutions in consultation with COOPI.

2.2 Outputs

1. DSG and COOPI Staff aware of project and its role at project inception
2. 6 Trained data collectors
3. Field data collected on institutions, water sources, institutional sanitation facilities
4. MIS covering water source, sanitation and institutional data for Samburu

5. DSG familiarised with project outputs
6. 20 Hardcopies and 20 digital copies (CD) of Final Report and MIS

3. METHODOLOGY

3.1 Introduction

A water source assessment study involves obtaining and analysing detailed information regarding all the water sources in Samburu District. Given the large area to be covered and the large number of water sources, the following approach was adopted:

- Review of existing water, schools and health facilities data;
- Establish data needs and formulate data capture forms for different water source types, and the water and sanitation services at schools and health centres;
- Field data collection using 3 teams;
- Development of an MIS;
- Data entry and compilation of a Samburu GIS concentrating mainly on the water sector and related schools and health facilities infrastructure;
- Spatial analysis of data;
- Assessment of several water development proposals to demonstrate the use of the GIS as a planning tool.

3.2 DSG Briefing

A brief presentation regarding the proposed project was given to the DSG-Samburu on 17th January 2007. The DSG members were given draft copies of the data capture forms and asked to give their comments.

Further discussions were held with the heads of departments for the relevant ministries, including water, livestock, health and education.

Discussions were also held with the Northern WSB office at Maralal in January 2007. The importance of having coordinated efforts in gathering and storing water sector information was discussed in the meetings, among other issues.

3.3 Existing Information

A review of available water source data was undertaken. The main sources of water source data in the District are the District Water Office records and the Water Resources Assessment Project (WRAP). Digital data on vegetation cover was obtained from the GTZ-Range Management Handbook and Department of Remote Sensing and Resource Surveys (DRSRS) and additional data on administrative boundaries was obtained from the Central Bureau of Statistics (CBS). These sets of data were then used as basic coverages/layers within the Samburu GIS.

In addition the following documents were obtained and relevant information included in the database:

- National Water Master Plan Study. JICA 1992;
- Monthly District Health Centre Reports;
- DEO- number of schools/institutions;
- DEO/DICECE (District Centre for Early Childhood Education)- ECD enrolment per ECD centre;
- DDO- on human population;
- DLPO- Livestock figures.

3.4 Establishing Water Resource Data Needs

Extensive consultations were undertaken at the start of the programme. Consultations included WRMA and WSB representatives. Other actors were involved through the DSG in developing the water resource data needs.

Various types of water sources were identified including:

- Boreholes;
- River abstraction points;
- River access points (Ngutuk naoki/Ngutuk namati);
- Dams/pans;
- Wells;
- Springs;
- Seasonal rivers/laggas;
- Rainwater collection tanks/Roof Catchment Systems;
- Emergency water tankering points;
- Subsurface dams/sand dams;
- Underground tanks;
- Lake access points;
- Rock catchments.

General narrative information regarding some of the water sources can be found in Appendix 1.

Various data needs regarding each source were identified, including:

- Position;
- Yield or capacity;
- Domestic demand (wet, early dry, late dry and drought conditions);
- Livestock demand (wet, early dry, late dry and drought conditions);
- Water quality (salinity, pollution level);
- Reliability or duration that source lasted after the end of the rains;
- Management system;
- Ownership;
- Operational status;
- Infrastructure

3.5 Establishing Rural Water Supply and Sanitation Data Needs

The RWSS service level data collection was unique to Samburu and Turkana districts because it was not carried out in other districts that have been mapped (i.e. Garissa, Mandera, Wajir and Marsabit).

The RWSS targeted the population level and captured data on:

Service level details including

- Water quality used for domestic purposes
- Water quantity used for domestic purposes
- Service type
- Distance to water source
- Waiting time at water source
- Cost of water

Sanitation levels

- Service type
- Facilities used in public places

3.6 Establishing Education and Health Data Needs

Education and health are sectors in which Rural Focus has only limited experience. The consultants therefore relied on District officers to guide the design of data collection and review of data analysis in these sectors.

For the education sector data needs included:

- School location, type and management system;
- School enrolment (segregated by sex and class);
- Teacher number;
- School infrastructure & equipment;
- Water sources and reliability;
- Sanitation

For the health sector data needs included:

- Health institution location, type and management system;
- Health facilities and services provided;
- Area served;
- Water sources, reliability and usage;
- Sanitation;
- Most common diseases.

3.7 Data Capture Forms

Once the main data needs were identified, data capture forms for each water source type and for schools and health facility data were prepared (see Appendix 2) in consultation with COOPI and the DSG. The data capture forms were used to ensure that consistent data was collected. Collection of data in a consistent format is essential to establishing a GIS.

3.8 Data Collection

The positions of various water sources/points, RWSS points, schools and health facilities were taken using a Global Positioning System (GPS). Handheld GPS receivers set to an ARC1960 datum and reading in UTM coordinates were used.

Information related to the water sources and RWSS service level was collected through formal and informal survey techniques. Key community informants gave information on water sources and RWSS service level in their area. Due to the large number of water sources (especially wells), the short field time allowed by funding constraints and the problems of access to certain areas, it was not possible to visit all the water sources. However, the field data collection exercise was considered to have covered nearly all significant sources. For the purposes of the mapping and spatial analysis exercise, only those water points whose GPS positions are known have been included. Additional water sources can easily be added to the GIS and the relevant maps updated.

Information related to schools and health facilities was collected through interviews with relevant personnel such as head teachers or medical officers.

3.8.1 Data Collectors

Seven data collectors were selected from the private sector. The data collectors were trained on the data collection methodology from 05/02/07 to 08/02/07 in Maralal. This included use of a GPS and use of the data capture forms.

Only six data collectors trained carried out the data collection. The seventh data collector was trained to act as a reserve. The data collectors were divided into three teams of two in each team. The teams went to the field with a clear plan of their coverage. Each team was given the necessary support- materially and financially.

Data collectors

Position	**Name**	**Organisation**
Field Coordinator	Julius Lalampaa	Samburu Wings of Mercy
Data Collector	Franca Lembara	Private/Public Health
Data Collector	Caroline Loosenge	Private/Community Development
Data Collector	Martha Dida	Private/Catholic Diocese
Data Collector	Patrick Lobuk	Kenya Water Institute
Data Collector/Reserve	Lempushuna R. Victor	Private
Data Collector	Lekuchula Felix Sainoi	Private/Kenyatta University, BEd
Data Collector	Mark Lenolkulal	Private/IT

The training was conducted by the following resource persons:

Resource Person	Mark Leagile	Northern WSB, Maralal
Resource Person	Nicholas P. Lenaiyasa	Min. of Education, Maralal
Resource Person	Ritchie A. S. Kitilit	District Water Coordinator, Northern WSB, Maralal
Trainer	Michael Gitonga	Rural Focus
Trainer	Jackson Mwihuri	Rural Focus

3.8.2 Data Collection Exercise

The data collection exercise took 30 days beginning on 13th February 2007 to 16th March 2007. Three separate teams consisting of two data collectors each were assigned to different parts of Samburu District.

Most of water sources were assessed except for a few points that were not captured due to inaccessibility of some parts of the district. There were difficulties in gathering schools information during the weekends as most of them were not in session and it was rest days for the pupils and teachers.

After assessing the extents of the data collected it was decided that there was no need for an additional data collection exercise.

3.9 Database and GIS

The Management Information System (MIS) is made up of two components, a digital database based on MS-ACCESS software and a Geographical Information System (GIS) based on ARCGIS Version 9 software. The data within the two components is the same and a “hot” link has been developed so that the database accesses the same data as the GIS. Updating the database therefore automatically updates the GIS and the pre-defined maps.

3.9.1 MS-ACCESS Database

A user-friendly interface, coded in Visual Basic, provides the user with data entry and retrieval masks and button-driven commands on a MS-ACCESS database. The database provides significant advantages over more sophisticated database software options. MS-ACCESS is available on all personal computers that use the MS-OFFICE software suite. This means that the Samburu database can be easily transferred between computers which facilitates sharing of data, and building ownership and a community of data users. Essentially this makes the data available. Visual Basic and MS-ACCESS are commonly used software so obtaining technical support in Maralal town is much more likely. Incorrect usage of the database is controlled through the use of user passwords and different level users can be specified to ensure that the structure and data within the database is not accidentally erased or interfered with.

The database is provided on a CD which enables button-driven installation of the database onto a PC. Included in the installation is:

- A "readme" file covering installation procedures and other relevant information;
- The database;
- The final report in PDF format;
- Final report maps in JPEG and pdf formats;
- Acrobat Reader software to read the PDF files;
- Database manual;
- Data capture forms/questionnaires.

The CD installation provides access to the data through the structure of the database, access to the report and maps which can be reprinted at the user's wishes, availability of the maps for inclusion in user specified reports, etc.

The database has been reconfigured from previous mapping work for better data entry and for improved reporting from the database. Substantial efforts have been put into the report formats.

The database was initially developed based on the data capture forms and was tested and modified to accommodate all the data collected from the field. Various data reports have also been developed.

3.9.2 ARCVIEW GIS

It is recognised that GIS software is a more sophisticated but more powerful tool in that it allows the user to develop maps and undertake spatial analysis of the data. Functions of the GIS include:

- Viewing baseline maps (e.g. vegetation, rangeland, geology, administrative areas);
- Developing and viewing thematic maps (e.g. position and type of water points);
- Undertaking relational analysis between different layers of information;
- Undertaking accessibility analysis through "buffering" user-specified distances;
- Exploring different scenarios;
- Querying the data related to specific features through the maps.

The GIS software that has been used for this study is ARCGIS Version 9.0, which is the most commonly used GIS software. This means that technical support can be obtained reasonably easily in Kenya. The software is licensed and costs approximately US Dollars 1,700. This limits its availability primarily to institutions. A Rural Focus Ltd. licensed copy of the software was used in developing the GIS. It is expected that initially Samburu District only needs to acquire one license to serve the needs of the district. In addition, GIS operators will need to be trained and this is anticipated in Phase 2 of this study.

The GIS itself is available to users in Samburu at the completion of Phase 1. However, unless the user has the software he/she cannot use the GIS and is therefore limited to using the digital version of the report maps.

3.10 Data Entry

The data was entered into the MS-Access Database using updated data entry masks for better data entry and for improved reporting. The data masks were initially developed by Rural Focus for the GIS exercise in Mandera and have been improved upon in each successive mapping exercise. Use of the data entry masks simplifies the task of data entry and ensures that data is entered accurately and in the required format. GIS databases require a very rigid and consistent data format and the use of specialized data entry masks is highly recommended.

3.11 Data Validation

As much as possible the exercise ensured valid data was collected. For instance, the data was collected by local data collectors selected by the DSG. Local data collectors have the advantage of local knowledge and speak the local languages. In addition they were trained on the data collection needs of the project.

At the conclusion of the data entry, two members of the resource and data collection teams (Mark Leyagile and Franca Lembara) visited the Rural Focus office to verify the accuracy of the data and to provide preliminary feedback on the initial mapping of water sources, RWSS, schools and health facilities in the district. The input of these two specialists was invaluable as it enabled the Rural Focus team to verify the data and check the validity of the preliminary analysis. In addition the participation of these district representatives provided an opportunity for them to obtain an overview of the district GIS including how the data is entered and managed, how the GIS interacts with the MS-Access database, and how to solve some of the common problems that are frequently encountered in this exercise. Further validation was done during the DSG workshop and will be done in future by the data users.

However no other independent data verification has been done. The MIS is a starting point for an interactive database for the district. There is need for a longer term verification and updating system.

3.12 Data Analysis and Mapping

The data analysis and mapping was orientated towards addressing the following key areas:

- Spatial distribution of different water source types in relation to demand and pasture;
- Wet and dry season water demands (domestic and livestock);
- Water source operational status;
- Water source infrastructure;
- Water source management;
- Ground water salinity mapping;
- RWSS- areas/sub-locations with or without at least one safe water source;
- RWSS- percentage population with or without acceptable level of service;
- Water accessibility in assessed learning institutions;
- Sanitation coverage for schools and health centres;
- Standard education service indicators such as pupil to teacher ratio, pupil to desk ratio;
- Distribution health facilities and population density.

The bulk of the analysis undertaken has been treated in detail in Chapter 4.

4. DATA ANALYSIS

Data analysis followed closely with the previous water mapping projects carried out by Rural Focus and is described below.

4.1 General Data

4.1.1 Data Scale

Point Information

All the field data collected is for individual water sources, schools and health facilities. For hand dug well clusters, a single point is used to locate the cluster but the yield and demand information is based on the total yield and demand of all of the wells in the cluster.

Sub-locational Information

The 1999 human population census data was obtained from the CBS for each sub-location. The figures have been adjusted for population growth between the census date and year 2006 using a 3.3% annual growth rate, as recommended by CBS.

District Thematic Information

Some of the baseline information had to be generated specially for this exercise from the following sources:

- Digital data on vegetation cover from the Department of Remote Sensing and Resource Surveys (DRSRS);
- Range cover and vegetation cover maps were drawn from GTZ Range Management Handbook;
- Geology data was drawn from Geological Map of Kenya and Water Resources Assessment Project (WRAP);
- Administrative boundaries, covering sub-location, location, and division boundaries were digitised from maps produced by the Central Bureau of Statistics.

4.1.2 Spatial Representation of Data and Results

The data has been analysed and displayed on a point source basis. However, as a planning tool, the results can be consolidated and displayed for different spatial zones. For example, the results of all analysis are displayed based on the administrative units (e.g. sub-locations and divisions).

An alternative system which is commonly used by district based development agents has divided the district into three zones namely:

- Agro Pastoral
- Pastoral- all species
- Formal Employment/Casual Waged Labour/Business

This zone definition has been presented as basic baseline data. However, for the purposes of this assignment, no analysis has been done on the basis of these zones. One of the main advantages of a GIS as a planning tool can be demonstrated by the fact that any definition of zones can be used as a basis for displaying the data or results. If required, it is relatively straightforward to shift the analysis and relevant mapping from the administrative units shown to the livelihood zones described above.

4.1.3 Temporal Representation of the Water Data and Results

There was a clear recognition at the outset of the assignment that demand and supply can vary greatly at an individual water source over the different seasons in a year and also in the event of an extended dry season or drought. In order to capture these changes, the domestic and livestock demand figures were obtained for typical wet, early dry, late dry and drought conditions. Additionally the reliability or duration that the source remained with water after the end of the rains was reported.

During the data collection and analysis, the "dry" season was sub-divided into three phases (early dry season, late dry season and drought) to reflect the progression of a dry season as the water availability situation changes. It was assumed that some types of water sources would cease to be available in different stages of the dry season. Table 1 presents the source types that are available in the different seasons.

Table 1
Water Source Types For Different Seasons

Wet Season	Early Dry Season (Reliability > 2 months)	Late Dry Season (Reliability > 4 months)	Drought (Reliability > 9 months)
Boreholes	Boreholes	Boreholes	Boreholes which were reported to last more than 9 months
All wells	Wells which were reported to last more than 2 months	Wells which were reported to last more than 4 months	Wells which were reported to last more than 9 months
Springs	Springs	Springs	Springs
All dams/pans	Dams/pans which were reported to last more than 2 months	Dams/pans which were reported to last more than 4 months	A few dams
Rainwater tanks	Rainwater tanks		
River abstractions	River abstractions which were reported to last more than 2 months	River abstractions which were reported to last more than 4 months	River abstractions which were reported to last more than 9 months
Ngutuk naoki/namati (river access points)	Ngutuk naoki/namati	Ngutuk naoki/namati	Ngutuk naoki/namati mainly along Ewaso Ng'iro R., Kurungu & Amaya streams
Sand dams	Sand dams which were reported to last more than 2 months	Sand dams which were reported to last more than 4 months	Sand dams which were reported to last more than 9 months
Rock catchments	Rock catchments which were reported to last more than 2 months	Rock catchments which were reported to last more than 4 months	Rock catchments which were reported to last more than 9 months
		Emergency water tankering points	Emergency water tankering points

The analysis of the data based on these season stages means that for each stage only certain sources are relevant. Considering that all the data is specific to a source, eliminating a source when considering a certain season means that the associated data is also eliminated. For example, let us take the case of a dam that lasts for 3 months after the end of the rains. The analysis of supply and demand for the wet and early dry season will include this water source. However, for the late dry and drought

cases, this source will be excluded as it is no longer supplying water and the demand figures will have been "picked up" by other sources that are still supplying water in the area.

4.2 Water Demand

Water demand was calculated for each of the four seasons based on the stated number and type of users for each water source for the different seasons.

4.2.1 Domestic Demand

The value of 15 litres per person per day has been used to estimate daily domestic demand. The field data collected was for the number of households using a particular water source. The average number of persons per household is 7.

If domestic water demand for a water source is zero, then this supply is assumed not to serve domestic needs. This can arise from a source whose water quality is acceptable for livestock but unacceptable for humans.

4.2.2 Livestock Demand

The following values have been adopted based on the Practice Manual for Water Supply in Kenya (MoWI, 2005):

- 1 livestock unit (LSU)= 1 dairy cow = 2 camels = 3 local cattle = 15 shoats (sheep or goats) = 5 donkeys;
- 1 livestock unit (LSU) uses 50 litres/day;

The data was collected as actual numbers of livestock. There was no distinction done between the dairy and local breed cattle. There are some dairy cattle in Kirisia and Lorroki divisions.

There are some water sources that have zero livestock demand. These sources are assumed to be unavailable to livestock due to low yield or other factors (i.e. strategic domestic source, range condition, etc.)

4.3 Daily Water Supply

4.3.1 Boreholes

The data collected for boreholes covered the borehole yield in m^3/hour and the average number of pumping hours in each of the four seasons. The type of power sources for each borehole were also covered and mapped.

4.3.2 Rivers

The main river in Samburu is Ewaso Ng'iro which forms the southern boundary with Isiolo district. Ewaso Ng'iro river provides water to many residents and wildlife in the southern parts of the district. Other rivers with perennial flow only on the upper reaches include: Seiya, Ngeny, Amaya, Wamba, Ngurunit and Arsim.

Discharge of the Ewaso Ng'iro river is determined by the rainfall and abstraction levels from its tributaries in the upper catchment. The main catchments of the river are in the Mt. Kenya and Aberdare Ranges. Ewaso Ng'iro river is on the southern edge of the district and is low lying. Therefore it is only used by a few people living near the river. In Samburu the river is not utilised for any major irrigation.

There are several ephemeral rivers/lagas in Samburu district. Such lagas have water flowing for only a few days and perhaps not every year. Nevertheless these ephemeral flows are important water sources in Samburu, mainly via shallow wells.

4.3.3 Lake Turkana

The most prominent surface water is Lake Turkana at the northern edge of Samburu district. The lake is at an elevation of about 365m a.s.l.

The lake water is generally not suitable for drinking by either humans or livestock. The water is characterised by high pH (8.6-10.6), high content of sodium and potassium, and high content of total dissolved solids. The lake water also has high amounts of silt and organisms. This makes the water not potable, not fit for long periods of livestock watering and unfit for irrigation. The water quality is not homogeneous. The water is of 'better' quality near the Omo Delta in Turkana and has low salinity.

Due to its location, inaccessibility (rough lava terrain) and inadequate pasture few animals of Samburu district are watered here.

4.3.4 Dams/Pans

The data collected for dams and pans included:

- Dimensions, to obtain total volume
- Reliability or duration. This was the length of time that the dam/pan normally lasted after the end of the rains (in months)

It was assumed that 40% of the total volume is lost by evaporation and seepage i.e. 60% remains for consumption.

4.4 Access to Water

A GIS provides a useful tool for mapping the area that is accessible from each water source for humans, and different types of livestock. The following general assumptions have been used:

- 5 km is the maximum distance for humans to fetch water from a source;
- 10 km reflects a distance used by cattle with normal stress in terms of travel distance to water;
- 15 km is the maximum distance for cattle to access a water source; and
- 30 km is the maximum distance for camels and goats to access a water source.

An additional assumption has been adopted to highlight the water sources that are significant for livestock watering. Significant water sources are assumed to be those that serve at least 100 livestock units (i.e. equivalent to > 300 cattle).

Discussions with district resource persons confirmed that these figures were relatively accurate. The general assumptions given above have been used as acceptable standards reflecting low to medium stress conditions for the maps provided with this report.

4.5 Access to Pasture

The district has a vast area (about 63%) with fair range conditions, a few areas (about 13%) rated as good range areas and few areas (about 24%) that can be rated as poor range condition.

Good range condition in the context of this report regarding Samburu district is considered to be areas with good vegetation ranging between 55-60% vegetation cover; medium range conditions ranges

from 40-50% vegetation cover; and poor range condition are interpreted to rate from 20-35% vegetation cover. Other criteria taken into account in determining the classification for different areas were:

- Decrease in dominant vegetation species;
- Dense or thick vegetation cover;
- Few or no boreholes or pans;
- No environmental degradation activities;
- The main factors responsible for good condition rangelands are poor security, tsetse fly menace and shortage of water. Insecurity implies that pastoralists do not venture into the areas for livestock grazing and there are no or limited settlements. The poor security areas include Charda, areas bordering Turkana, Baringo and West Pokot due to frequent cattle rustling. There is moderate security risk along the border with Marsabit district. The risk is greatest where there are shrubs and trees.

The range condition can be overlaid over the "access to water" coverage (see above) to obtain the accessibility to "good" pasture because pasture can only be accessed with respect to a water source.

4.6 Geology and Groundwater Salinity

Basic geological information was drawn from the Geological Map of Kenya and WRAP study report of Samburu district. This information has been overlaid with the borehole data to indicate the geological formations which are likely to have good groundwater potential.

The field data collected includes data on water salinity. Water was described by the users as one of the following categories:

- Fresh;
- Saline but OK for humans;
- Saline, not OK for humans but OK for livestock;
- Too saline for any consumption;

According to the WRAP study report the depth to the aquifers ranges between 2 m and 123 m (mean water rest level is 25m) in basement areas; and between 26 m and 169m (mean water rest level is 50m) in the volcanics. The groundwater level fluctuations correspond to the seasonal variations. Groundwater is exploited through wells, which tend to be shallow and boreholes which tend to be deeper depending on geological formations.

The groundwater potential in Samburu district varies depending on the location and extent of the water bearing zones and on water quality.

4.7 Assessment of Proposed Water Points

The water development options that were proposed during the course of the assignment were assessed in relation to the following criteria:

- Does the proposed source provide new access to water for humans?
- Does the proposed source provide livestock access to pasture that is otherwise inaccessible?
- Does the proposed water source meet the required reliability criteria?

4.8 Assessment of RWSS Service Level

The questionnaire for the RWSS was developed in conjunction with the Kenya Water and Sanitation Programme (KWSP) detailing service level classes. The data captured was through use of a

questionnaire administered at a water point addressing the service level of all those that use the water point. The questionnaire was administered by trained data collectors to local people including administration or local leaders.

The data collectors used focus group discussions with key persons and PRA approaches (e.g. proportional pilling) to determine the relative proportion of population in each service level.

The RWSS service level information/data was analysed at various levels from site, sub-location, location, division and district level.

4.8.1 RWSS service level overview

The average RWSS service level was analysed from site and sub-location to district level. From the reports menu of the database/MIS it is possible to get an overview of each site and administration unit. The reports are also displayed via a pie chart that gives a global overview.

Analysis and reports were also developed to show the percentage of the population without acceptable level of service (water and sanitation separately). The results can be displayed in reports at site, sub-location, location, division and district levels.

The analysis of the data demonstrated two key points:

1. The RWSS service level in the district is very low, with minor variations in different areas. The situation is not different if sanitation is examined independently of water service level;
2. The methodology resulted in various sub-locations being not covered – not out of a deliberate approach to exclude them but rather it was found that at the end of the field exercise, various sub-locations were not covered i.e. the RWSS questionnaire was not administered there due either to lack of water sources in the sub-location or due to the sampling nature of where the RWSS questionnaire was administered.

4.8.2 Coverage of safe water sources

The RWSS survey was also analysed to get the sub-locations with at least one safe water source. The number of operational water sources and their density (number of operational safe water sources per km^2) were also analysed and reports developed.

Analysis of the data with respect to whether each sub-location has a safe water source is based on the following assumptions:

- All significant water sources, whether safe or not, were assessed;
- That a safe water source is one where the water quality is not open to contamination (e.g. wells with handpumps, boreholes, springs, treated piped water supplies).

4.9 Assessment of Schools

4.9.1 School type

Schools were classified into five types according to the responses of the key informants. School types are:

- ECD
- ECD/Primary
- Primary School
- Secondary School
- Tertiary Institution

4.9.2 Infrastructure

Data was collected on the state of the classrooms at the schools. The classrooms were rated as "good" or "inadequate". A good classroom was considered to be one that met the following standards:

- Cemented floor
- Stone or timber walls
- Waterproof (not thatch) roof

4.9.3 Water Accessibility and Reliability

School data was analysed on the basis of whether the children had access to reliable water supply. Accessible water was considered to be a source within the school compound or within a reasonable walking distance from the school. The criterion for accessible water was whether the children had to carry water from home. Reliable water is defined on the basis of whether water is available all year round or only for some months of the year. The criterion for reliable water was whether the supply is operational > 75% of the time, > 20 days/month or > 9 months/yr.

Groundwater was considered to be of adequate quality without treatment but river water and water from other sources was only considered "good" quality if treated with chlorination or boiling.

4.9.4 Sanitation

The number of latrines per school was recorded and the data was analysed to show the number of boys and girls per latrine. This can then be compared against the government standard of less than 25 per latrine for girls and less than 30 per latrine for boys.

4.10 Assessment of Health Facilities

A considerable amount of data on health facilities was collected and the database provides an opportunity for analysis of specialised health service indicators such as inpatient beds and staffing levels. For the purposes of this study only data on location/distribution of health facilities, accessibility to water, reliability of water supply and health facilities vs. population distribution were analysed.

5. DISTRICT RESULTS

All maps for Samburu District are presented in Volume 2 Appendix 5.

5.1 Administrative and Planning Units

Map 1a presents the location of Samburu District in Kenya and the Administrative Units for Samburu District. The study has adopted the boundary of Samburu District from the CBS, but the Baragoi division boundary has been modified to include the Latakweny and Ndoto locations which were erroneously located in Nyiro division. Map 1b presents the Livelihood Zones for Samburu District. Map 1c presents main conflict prone areas and grazing patterns.

5.2 Water Demand

Table 2a and 2b present the total human and livestock populations for the District for the different seasons, based on different data sources. Examination of the two tables shows that the water source data indicates that the dry season livestock population is approximately two times that of the wet season population. If this migration is approximately correct, this indicates a significant immigration of livestock into the district as the dry season progresses.

Various additional points should be noted:

- It is an established fact that the livestock population, and to a lesser extent the human population, is highly variable due to the migratory patterns of the nomadic pastoralists in response to water and pasture availability. The fluctuation in numbers means that obtaining accurate information is difficult;
- The high variability in population numbers is a factor that affects planning at the district level;
- There is a discrepancy between the water source data and census data mainly for livestock populations

It should be remembered that all the data, including demand data, is “attached” to a water source. As the dry season progresses, water sources are eliminated from the analysis which eliminates demand. The assumption is that the remaining demand is captured in the data for the remaining sources.

Clearly, this part of the analysis depends on reliable population data and it would seem that the water source data on populations might not be sufficiently accurate. This comment can inform future data collection exercises.

In the drought case, the majority of livestock are watered at the functional boreholes, permanent wells and few long lasting pans. As a follow up to this study, the data of the actual number of livestock watered at the boreholes during the drought should be obtained from borehole records. This would enable the field data collected for this assignment to be compared with the actual drought situation.

Map 2a presents the sub-locational population density based on the 1999 census data projected to 2006 using a 3.3% annual growth rate. This map reflects the population data and indicates that the areas of maximum density, and therefore high water demand are Baragoi sub-location, Maralal Town, Wamba Town and Suguta Marmar. This is reasonable given that these are towns and market centres with relatively big population.

Map 2b shows the poverty incidence measure or the percentage of population falling below poverty line (living on less than KSh. 1,239 per month). The poverty map can be used by the development actors to target community welfare programmes to the poorest communities in the district. In Samburu about a fifth of the locations have more than 50% of their population living below the poverty line.

Table 2a
Total Human and Livestock Populations for Samburu District
(Data source: Water source data 2007)

Data Source	Item	Population Wet Season	Population Early Dry Season	Population Late Dry Season	Population Drought Season
1999 Census data	Human Population	143,547			
2006 Census data projected at 3.3% annual Growth Rate	Human Population	177,997			
Water Source Data	Human Population	190,862	254,975	325,304	317,233
	Total Livestock Units (LSU)	56,671	87,096	106,506	117,452

Table 2b
Livestock Population
(Data source: DLPO, 2006)

DIVISION	CATTLE		GOATS	SHEEP	CAMEL	DONKEY	LU
	Zebu	*Dairy*					
TOTALS	207,190	4612	992,620	863,404	20,461	24903	212,621

Detailed Divisional livestock population are given in Appendix 3.

5.3 Water Supply

5.3.1 Spatial distribution of the water sources

Table 3 provides a summary of all the sources that were assessed during this assignment (including non-operational supplies).

Map 3a and 3b presents all **ASSESSED** and **OPERATIONAL** water sources respectively, assessed during this assignment.

Various points can be observed:

- At the moment water sources seem to be well distributed in almost all of the divisions in the district, except Waso and western parts of Baragoi and Nyiro divisions. These areas are conserved for dry season grazing and are also a conflict/insecurity prone. These areas also have low-to-medium and low groundwater availability (see Map 12). There was a proposal to have water sources in these areas in order to make pasture accessible and shorten distances to water sources.
- There are several shallow/hand dug wells along the main rivers and laggas that supply the bulk of the water during early dry and late dry periods.
- Most of the centres and the lodges along Ewaso Ng'iro river obtain water from the river through pumping or direct fetching. There are also some other water sources near those centres.

Table 3
Summary of All Assessed Water Sources

Source Type	Number
Boreholes	92
Pans/dams	93
Wells	68
Springs	31
River Abstractions	6
River Access Points (Ngutuk naoki/namati)	15
Emergency water tankering points	5
Rock catchments	9
Sand dams	5
Roof catchments	40
Underground tanks	5
Total	**369**

5.3.2 Operational status and management systems of water sources

Boreholes

Map 4a and Map 4b show the operational status and management system respectively for all the boreholes assessed. Of the boreholes assessed 75% were operational. Of the 19 non-operational boreholes, 14 are temporarily non-operational. The boreholes could be non-operational due to lack fuel, low yield/dry, poor water quality, not fitted with equipment, have a non-functional equipment or insecurity. Only 5 of the boreholes assessed were permanently non-operational. They were non-operational due to non-functional equipment, low yield, too salty, borehole collapsed, silted, filled up with stones, theft of equipment, vandalism and insecurity.

Over 70% of the assessed boreholes are under the management of community via a water users association/a management committee (58%) and traditional system (13%). Most of the remaining

boreholes are managed by institutions (17%). Map 4c shows the power sources of the assessed boreholes. Most of the boreholes are mainly run on hand pumps and diesel powered pumps. The majority of the boreholes managed by the institutions and management committees are mainly diesel powered and hand pump (manual) operated. Some of the institutions and government ones are run by electricity.

Dams/pans

Map 5a presents the spatial distribution of dams and pans. Of the pans assessed 61 or 63% of them were found to be operational although there were various problems reported in 4 cases. Siltation was the most common physical problem. Other problems included eroded inlets and spillways.

It should be recognised that, although there is a technical difference between a dam and a pan, there is very poor recognition of the difference. Therefore no distinction has been made between the two different types of structures. Technically speaking, a dam has a structural wall which holds back the water. A pan is generally excavated below ground level.

Map 5b presents the management system for dams/pans. Many pans in the district (49%) were under traditional management system. The remainder of the pans are under management committees (26%) and open access (17%) management. The high proportion of pans under traditional management (49%) is also a feature of Samburu District. This provides a challenge in ensuring reliable access to water for livestock and domestic use, especially in the early dry season.

Wells

Map 6a and Map 6b present the operational status and management system respectively of wells within Samburu District. The majority of the wells are along seasonal river beds. About 80% of the wells assessed were operational. The remainder either had broken handpumps, were under construction or abandoned. Causes of wells being abandoned included low or no yield/drop in water level, collapse of the walls, silted, broken hand pump, vandalized, high salinity, contamination and insecurity. Many of the wells are temporary wells, dug along the “laggas” during the dry season, then abandoned during the rainy season and re-dug in the next dry season. However majority of those assessed had permanent siting.

Majority (over 75%) of the wells are managed by communities via management committees, WUA, communal and traditional systems of management. A few (4) of those assessed are owned and managed by individuals and others by institutions (8). Some of the wells (4) assessed were under open access system of management.

Nugutuk naoki/namati (River access points)

Maps 7a and 7b show the recognised “ngutuk naoki/namati” in the District and their management systems. Only a few (15) river access points were mapped, a number of them on Ewaso Ng’iro river. The Ewaso Ng’iro river is a significant water resource in the District and ngutuk naoki/namati are access points on the river used by livestock, humans and wildlife. Information provided by herdsmen and elders identified the majority (over 70%) of ngutuk naoki/namati as being under traditional management system.

Roof catchments

There were only 40 roof catchments identified during the data collection, the majority of which were institutional. These are shown on Map 7a and Map 7b. It is noticeable that out of 163 schools and 53 health facilities assessed only 36 had operational roof catchments.

Emergency water tankering points

Map 7a and Map 7b show the distribution and management system respectively for the emergency water tankering points. The majority of the water tankering points were operational during the time of the assessment. Four of the tankering points were still being used during the data collection. Two out of the total 5 tankering points assessed were being managed by institutions, two by management committee and one by the government.

River Abstractions

Map 8a and Map 8b show the operational status and management system respectively for river abstractions. These are gravity/pumped abstractions for domestic, livestock and irrigation purposes. All of the assessed abstractions are operational which is in marked contrast to other water supply systems and suggests that the owners place a high value on the supplies. The abstractions are mainly managed by water committees and institutions like lodges along the Ewaso Ng'iro.

Rock Catchments

Map 8a and Map 8b show the operational status and management system respectively for rock catchments. The majority of the rock catchments assessed were in Kirisia division. A few others were in Nyiro, Baragoi and Lorroki divisions. 7 of the 9 assessed were operational with the remaining 2 being abandoned.

The rock catchments were under traditional (5), management committee (1), open access (2) and individual system of management.

Underground tank

Map 8a and Map 8b also show the operational status and management system respectively for the underground tanks. There are relatively few underground tanks in the District- only 5 were assessed around Maralal and Baragoi towns. All the underground tanks assessed were managed by institutions.

Springs

Map 9a and Map 9b show the operational status and management system respectively for springs. There were 31 springs assessed during the exercise. 29 springs were operational, one had pipe blocked and 2 were abandoned due to insecurity. The springs are mainly in Lorroki, Wamba and Nyiro divisions. Some of the springs need protection and rehabilitation of drawoff pipes to ease water fetching and reduce contamination by people, livestock and wildlife.

Some of the springs are managed by the management committees (about 40%), open access (25%), traditional (13%), water users association (13%) and the rest by individual and a water service provider.

Sand Dams

Map 9a and Map 9b show the operational status and management system respectively for sand dams. There are about 5 sand dams in the district, the majority of which are in Baragoi area. All except one are operational. These water sources have not been long in the district and there is potential to develop them.

Most of them are under traditional management system. The other 2 are under a management committee and open access.

5.3.3 Reliability of operational water sources

The reliability of the operational water sources was categorised seasonally as:

i) Wet season reliability– to include all operational water sources
ii) Early dry season reliability- to include water sources with water for more than 2 months
iii) Late dry season reliability- to include water sources with water for more than 4 months
iv) Drought situation- to include water sources with water more than 9 months

Map 10 shows the water sources that are operational during the wet and drought seasons.

During the wet season the operational sources are distributed throughout the district. During a drought situation it is mainly the boreholes, springs and permanent wells that provide water. It is interesting to note that many pans (in Kirisia and Lorroki) continue to supply water throughout the dry season, unlike it is in other arid districts.

It is possible to show the seasonal changes in supply availability for different supply types. However, for the purposes of this assignment, only Map 10 which shows the reliability of all water source types has been displayed.

Map 11 shows the reliability/adequacy of supply of a single water source type, namely wells. In this case reliability is described in 4 classes with different percentages of times the well is not operational i.e. <5%, 5-10%, 10-25% and >25%. The classification was done for wells with and those without hand pumps. The majority of the wells assessed had a high reliability and were without hand pumps. Because of the nature of the survey the data collection could have concentrated on the significant and more reliable wells due to limitations of time and resources during the exercise. There could be many locations in laggas where wells could be hand dug.

5.4 Geology and Distribution and Salinity of Boreholes

The groundwater potential in Samburu district varies depending on the location and extent of the water bearing zones and on water quality. The various groundwater potential zones are described below.

- The *medium to high* groundwater potential is limited to the alluvial deposits in major laggas. The groundwater quality is good but deteriorates as you move away from the laggas.

- The *Leroghi and Marti Plateau* areas have medium potential. The existing boreholes have better yields than anywhere else in the district and are of good quality. The area is underlain by extensive regional aquifers.

- Most of the district is classified as of *low to medium* groundwater potential. The areas are underlain by the *metamorphic rocks of the basement system*, or underlain by *alluvial or colluvial* deposits covering directly the basement.

- The *valleys* have relatively good groundwater potential. This is in contrast with the *mountainous* areas where the dominant rock type is the more resistant massive *granitoid* type of basement, with low groundwater potential. Also included in these area is the extensive outcrop of plateau basalts in the eastern part of the district, the Marti Serteta.

- The *Western Strip Volcanics* have *low* groundwater potential. The area is the step faulted zone between the rift valley shoulders and the bottom. In similar areas groundwater levels are very deep (often > 200m). The groundwater levels are too deep for groundwater exploitation.

The *Mountain ranges*, *Inselbergs* and *Small Basalt Capped Table Mountains* are rated as having *very low* groundwater potential. They are underlain by fresh granitic or migmatitic rocks, and the small areas covered by plateau basalts. The groundwater is unlikely to be in sufficient quantities for exploitation. There are a few springs on the mountain ranges.

Map 12 displays geological data taken from the WRAP study report of Samburu district. The map shows the borehole salinity and broad geological units, showing the majority of the District is on low to medium groundwater potential characterised by metamorphic rocks of the basement system, or underlain by alluvial or colluvial deposits covering directly the basement. Most of the operational, fresh water boreholes are contained along major rivers/laggas and on plateau phonolites.

Of the 93 boreholes assessed, 59 of them were saline but ok for humans, only 9 of them were too saline for human consumption and 5 are considered too saline even for livestock.

5.5 Access to Water Sources

5.5.1 Distance to domestic water sources - within 5 km

Map 13 shows human accessibility (<5 km) to domestic water sources 9 months after the rains, excluding the emergency water tankering points. It is interesting to note that there are 18 pans which continue to provide water into the drought situation. This suggests there is potential for extending the reliability of pans in the district. The presence of emergency water tankering points in areas outside the 5km radius indicates the importance of water tankering in increasing access during drought periods. Where tankering points are in already covered areas they may be supplementing the supply from the regular water source, which could have dwindled in the drought season.

5.5.2 Distance to water sources - within 10 km

Map 14 shows the area that is accessible to a significant livestock water source, based on a criterion of a 10 km radius. It should be remembered that sources that serve less than 100 livestock units are not considered to be significant and are therefore not represented. It is clear that there are large areas of Waso, Wamba, Nyiro and Baragoi divisions which have no access to water for cattle in the dry season. The rest of the district appears reasonably well covered.

5.5.3 Distance to water sources - within 15 & 30 km

Map 15 shows the area accessible to a significant livestock water source, based on criteria of 15 and 30 km radii. Most of the district is accessible to livestock during the drought season except some parts of Waso and Wamba divisions. About a third of Waso division is not covered because these areas are conserved for dry season grazing. Some are also conflict/insecurity prone areas. There was a proposal to have water sources in the area in order to make pasture accessible and shorten distances to water sources.

5.6 Access to Pasture

5.6.1 Good Range Areas

Map 16 shows the land cover classified into vegetation and range condition in Samburu District. It is clear from these maps that the parts of the district that have good range condition are predictably those with limited access for livestock due to water constraints and insecurity (parts of Baragoi and Nyiro bordering Turkana and Baringo districts).

5.6.2 Access to Good Range Areas

Map 17 shows accessibility to good and fair rangeland for a 10 km buffer around significant livestock water sources. Map 18 shows similar information but for 15 km and 30 km accessibility from water sources. Accessibility to poor rangeland is not highlighted because the maps are trying to draw attention to those areas of fair to good range which are not accessible due to limited water supplies.

These maps reinforce the fact that there are some "good" and "fair" range areas that are not accessible by livestock during the drought period. It is also clear that the area of good range condition coincides with areas with high security concerns and low groundwater potential (see also Map 12).

5.7 Proposed Water Points

During the fieldwork 19 proposed sites for various water source types were assessed. These are shown in Map 19. About half of the sites were proposed by the community and some of them by the government staff.

Table 4
Proposed Water Development Options

Type	Number
Boreholes	8
Pan/dam	4
Sand dams	1
Rock catchments	2
Roof catchment	1
Wells	3
TOTAL	**19**

In order to demonstrate the power of a GIS to evaluate the proposed water points, Map 19 shows the relationship between the proposed sites and existing accessibility to water for humans. It is clear from the map that some of the sites will increase accessibility and others are already covered by existing sources. The proposed sites already covered would therefore only have merit if they were able to provide a more reliable supply of water than the existing sources.

The map also shows that some of the proposed water development options will provide water to the proposed institutions like dispensaries and schools.

Map 20 and 21 shows the relationship between the proposed sites and existing accessibility to water for livestock and pasture.

Conclusions from Maps 20 and 21 are similar to Map 19. It is clear that there are proposed sites that will increase coverage of water for livestock. Some of proposed sites are already covered by existing sources and will only be justified if they supplement the existing ones. In Map 21 some of the proposed water sources are increasing accessibility to an already poor range condition, and therefore may only compound the poor pasture condition. Care should be taken to avoid provision of secondary water sources which may contribute to over concentration of livestock and result in poor pasture conditions.

Map 22 shows that most of the borehole sites are located in regions with medium (on plateau phonolites) and medium-to-high (near laggas) groundwater potential. One of the proposed sites is in the low-to-medium groundwater potential. Therefore majority of the proposed borehole sites are likely to have water at reasonable depths.

5.8 RWSS Service Level

The RWSS data analysis has been presented in the form of reports based on different RWSS parameters two of which have been selected and mapped.

5.8.1 Coverage of safe water sources

Map RWSS01 shows that about half of the sub-locations in Samburu have no safe water source. These are spread throughout all the divisions. Together with human population density these results can give a quick indication of where to have water development interventions that cover both quality and quantity of safe water sources.

5.8.2 RWSS service level overview

Map RWSS02 shows that the majority of the locations in Samburu district have over 75% of the population without acceptable service level. For mapping purposes, acceptable service level has been taken as access to clean (borehole, handpump, sand dam, etc) water with good reliability.

It must be noted that the data collection on RWSS was done for the water sources visited and not strictly by sub-location. Therefore there are a number of sub-locations for which there is no RWSS data. This may be due to the lack of an operational water source or the RWSS questionnaire was not administered in the particular sub-location. There is a need to update the RWSS data in order to cover the locations/areas not covered during the mapping exercise.

5.9 Health Facilities Data

According to the Ministry of Health record Samburu District has about 42 health facilities run by GoK, Missions and NGOs as shown in the table below.

Table 5
Summary of Health Facilities

(Data source: MoH, Maralal)

Type of facility	GoK	NGO/Mission	Total
Hospitals	1	1	2
Health centres	3	2	5
Dispensaries	22	13	35
Total	**26**	**16**	**42**

During fieldwork 53 health facilities were assessed, 11 more than from the MOH records.

5.9.1 Distribution of Existing Health Facilities

Map H1a presents the distribution and an analysis of the adequacy of water for these health facilities. The majority of rural health facilities (mostly dispensaries) do not have a reliable or safe water supply.

Map H1b shows the health facilities, the adequacy of water and population distribution. It shows that the densely settled areas have health facilities. However it is clear that still a large number of people in the district are not served by the health facilities. They travel more than 15km, and in some places even more then 20 km to health facilities.

5.9.2 Population Per Existing Health Facility

Map H2 shows the population per health facility. The information is based on divisional data from the 1999 Population Census projected to 2006. Wamba division has the highest number of people per health facility. However Wamba is the host of the Wamba Hopsital, which is also a referral hospital

for specialised treatment. Wamba hospital has good facilities and a number of specialists. It serves Samburu district and patients from the nearby districts of Isiolo, the greater Meru, Laikipia and Marsabit.

5.9.3 Proposed Health Facilities

Map H3 shows the sites proposed for development of health facilities and the area within 10km from existing health facilities. The proposed facilities were 4 dispensaries. Some of the sites were proposed by the community and government agencies. The proposals made will improve on coverage significantly. There is a proposal to have a GoK dispensary at South Horr because the existing one is run by the catholic mission.

5.10 School Results

5.10.1 Location of Learning Institutions

The table below shows the DEO number of learning institutions in Samburu. During the fieldwork, a total of 163 learning institutions were assessed.

Table 6
Summary of Schools

Institution type	Number
Pry schools	126
Sec schools	
Public	9
Private & missionary	5
ECDs	287

Data source: DEO, Samburu

In the beginning of 2006 there are about 704 primary school teachers in Samburu district.

Map S1-N and S1-S shows the location of various types of learning institutions within Samburu District. This demonstrates the huge concentration of schools around towns and centres, and in divisions of Kirisia, Wamba and Baragoi. The western sides of Nyiro, Baragoi and Kirisia divisons and the vast part of Waso division are relatively underserved probably due to insecurity and lack of other facilities/services like water.

5.10.2 Water Accessibility and Reliability

Map S2 shows the accessibility and reliability for water sources for schools in the District. The majority (over 70%) of schools rely on water which is untreated and has to be collected by hand by the children and brought to school in small containers.

There is very little rainwater harvesting being undertaken at any schools.

5.10.3 Education Environment

A number of indicators have been mapped to show the education environment. Map S3 shows the pupil enrolment per teacher ratio where less than 25 pupils per teacher is considered good, 25-50 is considered fair and more than 50 is considered poor. The mean ratio for Samburu district is 35 pupils per teacher. The majority of the schools with more than 50 are in the relatively big town centres of Maralal, Wamba and Baragoi. Map S4 shows the number of pupils per good classroom ratio which is

an indicator of the number of adequate classrooms, rather than the actual class sizes. Map S5 shows the number of pupils per desk which is a reflection of the number of desks rather than actual students to a desk. There are quite a number of schools where pupils to desk ratio is more than 10 indicating an acute shortage of desks.

5.10.4 Latrine Coverage

Map S6 shows the pupils to toilet ratios for assessed schools. Majority of the schools are above the MOH standard of 25 pupils per latrine for girls. It is noticeable that the majority of the schools with the ratio below 35 are in the main town centres of Maralal, Wamba and Baragoi with a few in other centres. The district average number of pupils per latrine is 58, based on the assessment done. This poses a public health risk.

5.10.5 Proposed Schools

Map S7 shows proposed school sites. Some of the sites were proposed by the community and government agencies. There were 7 school sites proposed for development, distributed among Waso, Wamba, Lorroki and Nyiro divisions. The majority of them (5 out of 7) are primary schools. The majority of the proposed sites are at the existing ECDs/nursery schools which need to be upgraded to primary schools. Some are next to existing primary schools and there is need for a secondary school.

5.10.6 General comment on school data

The detailed data collected for schools was added to the scope of the work during the course of the project. While the database contains much useful data for the District, it does not necessarily lend itself to spatial or temporal analysis which is the strength of a GIS. More conventional graphical methods may be more suitable for presenting the results of the school data analysis.

6. CONCLUSIONS

6.1 Samburu GIS

A GIS has been developed for Samburu District and is intended to be hosted within an institution in Samburu District during Phase 2 of this exercise. Unique coverages were generated specifically for this exercise, combined with primary data collected during the course of this assignment and are contained in the GIS. The GIS provides a powerful tool to display thematic maps and to investigate and evaluate water and other development options.

The MIS is a starting point for an interactive database for the district. There is need for a longer-term verification and updating system.

6.2 Data Gaps

Most of water sources were assessed except for a few that were not captured due to inaccessibility of some parts of the district. The lake access points and some springs in the mountains were inaccessible due to poor/lack of roads. Less number of wells than estimated were captured because the majority of them are in clusters and some are seasonal and dry or get silted up. The data on Rural Water and Sanitation Service Level points was captured per area except for the abandoned areas (temporarily or permanently) where there were no users present.

Fewer ECDs than documented were assessed since some of them migrated or were abandoned after migration of the community.

6.2.1 Water Source Data

Not all the water sources were visited due to inaccessibility and insecurity in some areas and limited resources. It is important to capture all the water sources and to ensure that water source data remains up-to-date. This requires an ongoing data collection, data entry and GIS management process.

6.2.2 Population Data

Apart from the 1999 population census data, and the DLPO livestock data, all the remaining data was obtained during the fieldwork exercise and is specific to individual water sources. There is a need to have independent data sources on which to compare/verify the water source data. One example is the livestock data. Livestock data sources such as from borehole WUA records or vaccination campaigns should be obtained and compared to the water source data.

6.2.3 Seasonal Changes in Demand

Water demand data was obtained for wet, early dry, late dry and drought conditions. Population data was difficult to estimate for these four conditions and could use additional investigation.

6.3 Access to Water and Pasture

The district has fairly good coverage for livestock water and pasture. Areas with good and fair pasture that are not exploited are border areas mainly with security concerns and also have low and low-to-medium groundwater availability.

The area of good grazing that is outside the accessibility zone is the western parts of Baragoi and Nyiro divisions. However, improved access to good pasture should not be seen as a requirement for permanent water sources.

Improved access to good pasture can be gained through improving the reliability of the water sources within the good pasture areas, improving pasture conditions around permanent water sources, and/or managing livestock populations and movements better. For example, increasing the capacity of dams/pans within the good pasture areas may reduce the duration that the livestock are dependent on the permanent water sources and the grazing accessible from these sources.

6.4 RWSS Service Level

RWSS levels are fairly low and could be improved through development of more safe and reliable domestic water sources.

The methodology for determining RWSS service level and coverage needs to be reviewed with respect to sub-locations where the RWSS data form was not administered at a water source within each sub-location.

The methodology of presenting safe water sources per sub-location is an easy indicator to analyse and it does give an indication of the distribution of safe domestic water throughout the district.

6.5 School Data

As usual there is concentration of schools around settlements due to high population density. Areas with insecurity and shortage of water are underserved with schools. Some had been abandoned.

Few schools are using rainwater harvesting as a water source.

6.6 Health Data

The health facilities are spread all over the district apart from the insecure and less densely populated areas, and those that have water shortage (mainly in Waso and western parts of Nyiro and Baragoi divisions). The health facilities are mostly located in towns and centres.

6.7 Proposed Developments

The proposed sites for water development would increase coverage/accessibility to water if developed. At some of the sites schools and health facilities have also been proposed in which case the facilities/institutions will have access to water nearby. The spatial analysis/overlay clearly shows which proposals would enhance coverage or water supply to humans and open up pasture to grazing.

The assessment did not have proposals on areas that are scarcely populated (Waso, western Baragoi and Nyiro divisions) and insecure yet they have fair and good range condition for grazing. Further investigations need to be done on water development options in these areas.

7. RECOMMENDATIONS

The following recommendations are offered:

- Develop new, rehabilitate or improve the capacity of seasonal water sources especially the runoff harvesting ones (e.g. pans and dams) in the good and fair range areas (especially Waso and western Baragoi and Nyiro divisions) of the district to extend the access period without introducing permanent water sources. If permanent ones are developed then a mechanism to restrict access during non-drought periods (i.e. contingency sources) is required. Contingency boreholes are boreholes that are only opened in cases of extreme drought to open up inaccessible pasture.
- Evaluate proposed sites and rank according to those that may have positive impacts with respect to access to pasture and negative impacts on pasture condition due to duplication of water sources.
- Improve on operation and maintenance and management especially of boreholes, wells/hand pumps, dams/pans, roof catchment through capacity building of the local management structures.
- Improve the range condition especially for dry season grazing in the areas around permanent water sources.
- Discourage the proliferation of new, permanent water sources as the only solution to lack of good grazing near existing permanent water sources. Examine contingency water sources in depth.
- Use the Samburu GIS to map other scenarios or thematic issues of interest.
- Use the Samburu GIS to map RWSS service level. The RWSS assessment should be updated to include the sub-locations that were not assessed during the mapping exercise.
- Use the Samburu GIS to explore and validate development and drought management water sector interventions.
- Use the Samburu GIS to evaluate the impact of introducing extra health facilities and schools in areas in need of them. The GIS can then be used to assess the proximity of water sources and other infrastructure to the proposed facilities.
- Examine the options for improving water quality in some of the permanent and drought significant water sources. The sources in this category are typically used by both humans and livestock and excessive pollution renders the water sources unusable.
- Update database and maps to incorporate some of the areas/water sources that might have been missed out during the mapping exercise.
- There is need for a longer-term validation/verification and updating system.

The DSG strongly recommends that a feasibility study be done on the proposed development options. It also recommended that more suitable sites for runoff harvesting structures like dams and pans should be investigated especially on the uncovered areas of Waso and western Baragoi and Nyiro divisions which have fair and good range conditions respectively. The harnessing of runoff can also reduce the risk of damage/erosion to infrastructure (roads, buildings) by the raging floods. However all the salient features should be considered in determining the suitable site in order to avoid building dams or pans in areas prone to erosion/siltation, with high permeability, and therefore last only for a short time. Appropriate catchment conservation measures should be introduced to control soil erosion and therefore minimize siltation of dams and pans.

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APPENDICES

APPENDIX 1

OVERVIEW OF SAMBURU WATER SOURCE TYPES, HEALTH AND SCHOOLS

(Prepared by the 2 District Resource Persons)

BOREHOLES

Background

Samburu district being one of the semi-arid districts in Kenya receives inadequate rainfall. This implies that surface water sources are unreliable in some parts during drought periods. Groundwater is the only permanent source of water which is reliable. Groundwater (via boreholes) was first exploited in the colonial times in the 1950s and majority of the boreholes were drilled either along the roads or in schools.

The GOK under the ministry of water drilled a few more boreholes in the late sixties and early seventies. The government also carried out major rehabilitation on the Maralal water supply in 1986 by constructing a new dam and treatment works, which can meet a domestic demand of 10,000 people.

The ministry of water drilled more boreholes in 1987 and carried out geophysical survey in the district through the WRAP project. In 2000 the ministry managed to drill some more borehole in the district through grants from JICA (between 14-16 boreholes). The district has a total of approximately 60 boreholes which are mainly being managed by communities.

Most of the boreholes are operational but a few are non-operational because of poor management, insecurity and poverty (lack of resources to maintain them) or are dry. It is important to explore ways of carrying out pump testing to determine the yield of the old boreholes.

Management

The GOK through the Ministry of Water was responsible for running and carrying out routine maintenance of motorized boreholes. The maintenance of piped water schemes was unsustainable due to poor revenue collection, high operation cost and poor cost recovery strategy.

These factors culminated in the preparation and adoption of a new water policy as espoused in sessional paper No1 of 1999 on National policy on water resources management and development. This policy document proposes wider community and private sector participation in water supply and sewerage service delivery. The legal framework in operationalisation of the water policy was achieved through enactment of Water Act 2002 that vest the responsibility of provision of water and sewerage services in WSPs contracted by water service boards. These WSPs are individuals, communities, private companies, public companies, CBOs or NGOs who will now meet all the maintenance costs of the water supply facilities.

The WSB through the District Water Coordinator has sensitised communities of the existing water systems about the new water policy, and there is need for follow up.

PANS, DAMS AND NATURAL DEPRESSIONS

Water needs, mainly for pastoralists who are the majority in Samburu district is enormous. The existing groundwater sources cannot adequately meet their water demand requirements, not to mention the high cost of running and maintenance of the system.

In 1986 the GOK through MWD constructed dams and pans in the district for rainwater/runoff harvesting. The district through the DWO and other water sector actors has constructed over 50 water pans of various sizes ranging from 10,000m^3 to 40,000m^3 implemented through different modes which include hire of machinery and food for work. The other water harvesting methods include rock catchments and sand dams. All these structures hold water for a period of between 1 to 6 months depending on capacity and livestock population using it.

All these structures in the district do not have proper management committees to oversee their operation and maintenance. Efforts by DWE and other water sector actors to establish such committees have not been successful due to the negative attitude of the pastoralist and unwillingness to pay user fees. Moreover the nomadic lifestyles in some cases do not guarantee establishment of strong community institutions to manage remotely located water facilities.

These sad scenarios have left the water structure in a state of disrepair. As a way out the water sector actors in the district including the MOWI and COOPI, CODES, CCF, ALRMP, RPK, and Catholic Church should commence spirited efforts to sensitise communities on the need to establish committees to manage the runoff harvesting structures. Any future development of the water structure should be done with the demand and consultation of the communities, and obtain community commitments in maintenance sustainability arrangements, otherwise efforts should be done towards rehabilitation of the existing structures.

WELLS

There are many wells in the district but very few are protected from contamination.
Some of the wells were fitted with hand pumps but eventually fell into despair and the communities reverted to their old styles of getting water buckets dirty/contamination. Training on management/O & M has not effective due to nomadism.

Therefore there is need to sensitise the community on the need for proper management of the wells, including the need to protect them and use hygienic water fetching methods.

UNDERGROUND WATER TANKS

There are very few such structures in the district since they have not been developed probably due to resources limitation. The underground tanks are important structures for storage of water fro use during the dry spell. Therefore there is need to create awareness and to develop the underground tanks for use by the communities.

RIVER ABSTRACTION

There are only a few rivers in the district, and most of them have a very low flows which diminish during the drought. The majority of the water abstraction points along the rivers are for domestic use, and partly for irrigation. At these abstraction points flow measurement devices are lacking and efforts should be made by the management committee and regional WRMA office to install flow measurement instruments.

SAND DAMS

There are a few sand dams in the district probably due to lack of resources to build them or due to low awareness. These structures store water for a longer time and have an advantage over other open water sources because water loss through evaporation is minimal. There is great potential for sand dams in Samburu district.

SPRINGS

Most of the springs in the district are used for domestic and livestock watering. Most of them have sufficient water but due to overgrazing and cutting of trees (catchment degradation) there is low yield during drought. The communities with these resources should be trained to maintain such structures.

EMERGENCY WATER TANKERING POINTS

Emergency water tankering is mostly done in the district during severe drought. Most of the water tankering points are in schools. There is need to carry out investigations at these points to come up with other alternative water sources since water tankering is expensive and therefore not sustainable. Meanwhile the district requires more water boozers to cater for such services when there is need.

LAKE

Due to poor pasture/no grass near the lake livestock do no use the lake for watering. The lake is also inaccessible at most points bordering Samburu district.

ROOF CATCHMENTS

There are few roof catchments in the district. Most of shelters are manyattas with no roof. In addition those with roofs may lack resources to construct the storage facilities. The storage facilities are mostly PVC, masonry or concrete tanks that are expensive.

Most of the roof catchments are in institutions and centres/towns, and especially those with business premises like lodgings. There is great potential for development of roof catchment in Samburu district. For instance, the Marsabit Technical School uses rainwater to meet its needs almost throughout the year.

ROCK CATCHMENTS

There are very few rock catchments in Samburu district. The ones that are there need repair. However there is still potential to develop more rock catchments.

OVERVIEW OF HEALTH FACILITIES

Background

Samburu district is in northern Kenya and is an ASAL. During the colonial times the district had three health institutions, which were under colonial government and missionaries. Then during independence the Baragoi health centre and Maralal District hospital were handed over to the Kenya government, the Wamba mission hospital remained under the Catholic mission management. The Maralal district hospital, which was built in 1952, was covering almost the whole district i.e. Lorroki, Kirisia, and all referrals from Baragoi and sometimes Wamba. The Wamba hospital being a mission hospital had essential equipment and specialists from Italy and other parts of the world. The hospital used to manage all the complicated cases and people preferred it though more costly than the government health institutions.

Management

The government increased the number of health centres and dispensaries in the division level to reduce the mortality rates. Some of the NGOs also came in to establish some dispensaries after they had trained the community on the importance of hygiene and sanitation. They later trained the TBAs to attend to the delivering mothers during emergencies. Through all these skills the NGOs established dispensaries to reduce the long distances to the district hospitals or other health centres. The NGOs e.g. SWOM, SAIDIA, CCF and FARM AFRICA formed dispensaries committees, who would handle the dispensaries under the ministry of health. The dispensaries had all the required materials but no medical personnel/nurse. Due to lack of medical personnel and lack of use in some of the dispensaries there was wastage of resources e.g. expiring of drugs, breakage of windows and destruction of other infrastructure of the dispensary. Hitherto there are dispensaries which are not operating and not registered in the Ministry of Health.

Some of dispensaries are mobile clinics, some of which area under the catholic mission. The Loosuk, Kisima has a maternity wing, which is not yet operational. The community urges the government to register and post a nurse in the dispensary, which will help to reduce the distance people have to walk to the health centres and provide all the necessary treatment in the village level.

The Maralal district hospital has many facilities. The hospital has a big maternity ward, 2 wards for men and women. It has out patient facilities, VCT centre, laboratory, TBA manyatta, which is next to the hospital. The pharmacy and paediatric ward is incomplete. The hospital is permanently fenced and partitioned to control the flow of the people entering the hospital.

The hospital has administrative office, 3 doctors, Kenya registered nurses, clinical officers, technician and many nurses plus other specialists e.g. nutritionist doctor.
The ministry is also collaborating with other government stakeholders and NGOs for the smooth running the activities in the district e.g. Arid lands, ministry of education and county council and many others.

The HIV disease prevalence has reduced due to the awareness creation by many NGOs and hospital staffs. VCT clinic centres and one mobile clinic have been started, which being carried by the nomadic community trust. The VCTs are all under the health centres and dispensaries.

The water was connected in the dispensaries except for the non-operational ones and inadequate storage capacities.

NB: The international medical corps had provided the community dispensary with all the required equipments in 2003, and over to the DSG stakeholders, so that whenever the dispensaries started operating they would hand over to the community.

OVERVIEW OF LEARNING INSTITUTIONS

History

When Kenya got independence there were three primary schools in Samburu district viz. Maralal DEB, Sirata Oirobi and Wamba DEB Later the catholic missionaries constructed two more primary schools viz. Baragoi and Wamba CCM. The missionaries introduced sponsorship systems to attract many children and parents to come to the church and children to the schools. The education was free and children were provided with all the necessary requirements to maintain them from running away from school. Many parents did not want their children to go to school; some took them away from centres to look after their livestock.

The girl child education was a taboo in Samburu then; they believed that educating a girl would bring shame to their families as she would go to big towns and become a prostitute or a town dweller. If educated they would not be married and have families. As for the few who got a chance to be educated they brought many changes in Samburu culture, and they became role models in the community. The few who were educated at St. Mary's primary and St Theresa's Wamba secondary school proved the worth of the girl-child education and this led to many parents educating their girl children. A good number of girls are now educated although there is still early marriages, whereby girls of between 12-15 years are being sold to over 45yrs men. Some of the NGOs and women groups are raising awareness against early child marriage.

The Samburu, being pastoralists did not know the importance of education, and some of their children were forced by the colonial regime to go to school. Between 1965 and 1970 the catholic missionaries constructed more schools and enrolled a few more children. From 1970 onwards the missionaries did construct most of the existing schools in the District while the government, through the demand from the communities constructed a few more. It is in 1979 when free education was declared by the GOK that the pastoralists enrolled their children in big numbers in the primary schools.

There was only Maralal secondary school in Samburu district at the time when Kenya got independence. Later the missionaries, under the catholic church constructed one secondary school in Wamba (St. Theresas). By late seventies the communities realised the importance of education and subsequently Baragoi Boys and Kirisia Mixed Secondary schools were built through the harambee spirit. Presently there are nine public secondary schools in the district. The Catholic Church was the biggest contributor to education of the Samburu community. Sanitation in most of the schools is poor. Some structures are in need of repairs.

There is now free primary education and parents are urged, through the provincial administration and the county councils to take the school going children to school. The over-age children/pupils are introduced to the out of class programmes (Lchokuti programmes) introduced by Action Aid spread II in collaboration with the Ministry of Education, Science and Technology.

Management

The DEB and the management committees/Parents Teachers Associations (PTA) are responsible for all education issues in the district, making sure that schools operate under the education laws of the ministry of education. The secondary schools are managed by the board of directors and their respective PTAs.

Many schools run by the government are boarding and day mixed except St. Mary primary school, which is a girl's school, and still under catholic mission (the boarding side is managed by Catholic mission).

Pending Issues/Challenges

- Early marriages to school going girls.
- The old generation still see the girl child as a form of wealth to the families.
- Because livestock keeping is the main livelihood of Samburu, the community does not send some of their children to school, instead they look after the animals.
- *Moranism* reduces the number of pupils in school.
- Poverty and insecurity have a role to play in low enrolment rates in schools.
- There is need to create mobile school awareness in the district so that it can capture more children who are looking after livestock.
- Poor/lack of roads and water may prevent some of the communities from accessing education facilities in the district. The poor communication may contribute to absenteeism by teachers who have to walk long distances for their salaries and to buy commodities.

SUMMARY DETAILS OF SOME OF THE SAMBURU DISTRICT BOREHOLES

Data Source: Field Data Collection During the Mapping Exercise

Name	Serial Number	X-coordinate m	Y-coordinate m	Constructed	Funded By	Tested Yield m3/hr	Current Yield m3/hr	Operational Status	Power Source	Remarks
Amaiya		219848	94749	2000	Missionary			Permanently non-operational	None	The borehole tested yield was seemingly very high but the borehole was closed. So the Amaiya borehole is not functioning at moment.
Baawa Borehole		256389	114002		Catholic mission		1.20	Operational	Diesel/genset	The borehole is operated and maintained by catholic mission.
Baragoi Fresh Water BH	135461/02	256029	198722	1967		1.80		Temporarily non-operational	Diesel/genset	Currently the borehole is not operational due to breakdown of pumping system.
Baragoi Secondary BH	4417	253088	195497	1977		10.00		Operational	Diesel/genset	The water from the borehole is too saline and it's the only reliable source during the dry season for the school.
Baragoi Town BH	C033955/05	253644	197394	1968	MWA	3.50		Operational	Diesel/genset	The control panel is not working
Barsaloi		262623	147945	1989	World bank		0.60	Operational	Diesel/genset	The committee were very organised and knowledgeable about the management of the water supply. In 1992 the rising main and the 100 m^3 tank were rehabilitated- by CCF and Catholic mission.
Bishop borehole		245190	121288	2006	Maralal	3.00		Operational	Electricity	The borehole is newly constructed and it supplies Bishop's house but it is constructed in Irene Girls Training Centre.
Catholic Church Borehole		245047	120979	1960	Catholic mission			Operational	Electricity	The school requires more storage tanks to store enough water so that they may use it during water shortages.
Catholic Mission		352079	70787		Catholic mission			Operational	Wind	Information needs verification from the field. Saline and hard water.
Garma Borehole		263400	88997	2002	JICA		1.00	Operational	Manual (hand pump)	There is a need for another borehole because the present one is too saline for human being.
Good Shepherd seminary Boreholes	Ngari	244979	121231		catholic			Operational	Electricity	Very important facility for the nearby institutions and is well managed.
Jerusalem BH		312658	107059	1998	Arid lands		4.20	Operational	Diesel/genset	The borehole is functioning well except the water table is getting low (low yield) as compared to the beginning.
Kawop BH		252534	219805	1990	John Gakuo	2.00	1.60	Operational	Diesel/genset	The tank has a leak. Generator, stands are not in good condition. The cattle trough is inadequate.
KBC Borehole in Kisima		248769	100975	1992	KCB			Operational	Electricity	It is being used by the KBC operator only. No livestock taking water from the source.
Kijiji Angata rongai		243529	93388	2006				Operational	Manual (hand pump)	There is need for genset in the borehole in order to pump water to school and other places.

Name	Serial Number	X-coordinate m	Y-coordinate m	Constructed	Funded By	Tested Yield m3/hr	Current Yield m3/hr	Operational Status	Power Source	Remarks
Kirisia/Ngari Borehole		242915	120673		JICA			Operational	Manual (hand pump)	Due to high demand of water there is need to in stall a pump & genset and build a sizeable reservoir to serve both the school and community.
Kisima Catholic mission BH		251205	104829	1990	Catholic Mission			Operational	Electricity	The borehole is a great help to Kisima people during drought; it really helps the community.
Kisima Girls		250805	103689	2000		5.00		Operational	Electricity	Information needs to be verified from the field
Kisima Town Borehole		251370	105904	2000	JICA	0.00	1.20	Temporarily non-operational	Manual (hand pump)	There is need of another borehole because the water is very salty. Animals do not take water from the borehole.
Langusaka BH	AF 38535	312845	99220	2005	MBT(Masaai Barefooted Technology)		0.40	Operational	Manual (hand pump)	The borehole is operational but there is still some problems when pumping the water (low yield as compared from the beginning). Due to open access the borehole has started developing some deteriorating due to poor management/usage.
Lariak Orok		247315	93188	2000	JICA			Temporarily non-operational	Manual (hand pump)	There is a need for repair. It's the main water source around.
Larsens tented camp		340707	63360					Operational	Diesel/genset	Water is sufficient and the borehole is well kept. However during the dry season the level of water goes down.
Lchoro Lelerai		247527	102117	2000	JICA			Operational	Diesel/genset	The borehole has some major problems with pipes which supply water to the storage tanks, because they are plastic and break frequently.
Ledero borehole		249478	114747	2002	ENDA, Rotary club, Catholic mission	8.00		Operational	Diesel/genset	The person in charge of borehole and with pump house keys was not around so we are unable to measure yield and check operating amps because the borehole pump house was closed.
Ledero old BH		249537	114761	1991	CCF			Permanently non-operational	Diesel/genset	The borehole is permanently non-operational
Leir Borehole		253369	112096	2002	catholic		1.16	Operational	Diesel/genset	There is a need for rural water supply in the area due to congestion in the point.
Leir old borehole		253254	111966					Temporarily non-operational	Manual (hand pump)	The community need to renovate the borehole if possible
Lekolool BH		240826	122607	2000	JICA(Japan)			Operational	Diesel/genset	JICA drilled the borehole for the community but now used by an individual
Lempuranai	1385	312130	103520	2005	MBT (Maasai Barefoot Technology)		1.80	Operational	Manual (hand pump)	The borehole is well maintained but it has no watering point for animals e.g. troughs and other infrastructure. It is used mainly by humans for drinking. The community would wish to be provided with animal watering troughs.
Lengarde BH	301	295155	117758	2006	Maasai Barefooted Technology		0.72	Operational	Wind & Manual (hand pump)	The elders requested for livestock trough. The borehole is still in good condition.

Name	Serial Number	X-coordinate m	Y-coordinate m	Constructed	Funded By	Tested Yield m3/hr	Current Yield m3/hr	Operational Status	Power Source	Remarks
Lengei BH		276802	91034	2003	GOK			Operational	Diesel/genset	The borehole is well operated. The operator claims he has not been paid since July 2006. There is need for financial assistance & also fuel for the genset. 1st storage tank is located 1 km GPS x- 277486 y - 91200 elev - 1385 m; 2nd storage tank is located 1 km away GPS x- 277673 y - 96846 elev - 1339 m
Lengusaka BH	1401	312839	97331	2005	MBT (Maasai Barefoot Technology)		0.72	Operational	Manual (hand pump)	The borehole is still new and operational. No infrastructure for watering animals. Animals are not watered in the borehole; there is a lagga 30 m away where hand dug wells are used for watering animals.
Lerata A		334924	86663	1960	GoK			Operational	Diesel/genset	More tanks required. Request for another borehole; fuel/diesel problem.
Lerata B		339967	85687	2004	Arid/GoK		0.80	Operational	Manual (hand pump)	Trough for livestock is needed because this water source serves many people. Observation: there's a problem of mothers aborting due to hand pumping hence the community proposes to the government to change the hand pump to genset. More water sources are needed in the area due to long distances to water
Lerata B		340233	85594	1984	Missionaries			Temporarily non-operational	Wind	The borehole needs rehabilitation because it is currently not operational.
Lesirikan BH		272956	197332	1995	Coopi	4.00	9.00	Operational	Diesel/genset	Fencing is needed around the borehole. Soil erosion is occurring around the borehole which need attention
Lkiloriti Borehole		251834	108547	1988	Cord Aid through Codes		0.80	Operational	Manual (hand pump)	There is need to repair the communal tank which gives water to other part of the community; they require a washout in the cattle trough to enable cleaning.
Lkiltamany borehole		330395	71744	2004	catholic		0.51	Operational	Manual (hand pump)	Water source is not enough for the community. The manual (handpump) makes water fetching tedious and slow. Poor maintenance of the handpump makes it break down.
Lkisin	1394	306255	112223	2006	MBI		0.80	Operational	Manual (hand pump)	The borehole is under good management by the school i.e. have been fenced and hence no conflict or pollution. The head teacher proposed to have genset fitted because the manual system cannot serve the school & the community efficiently.
Lkuruto/ Loikurukor BH		241927	115939					Operational	Electricity	There is need for more storage tanks.
Lmisigiyoi primary bh		250938	96230	2002	DDMU		1.00	Operational	Manual (hand pump)	The water draining from the cattle trough need to be captured for irrigation and it will help in the school feeding programme.
Lodokeje borehole		260968	94004		mission			Operational	Diesel/genset	The borehole is privately owned by mission but not the community.

Name	Serial Number	X-coordinate m	Y-coordinate m	Constructed	Funded By	Tested Yield m3/hr	Current Yield m3/hr	Operational Status	Power Source	Remarks
Lodungukwe BH		279352	95045	1972		4.10		Permanently non-operational	Diesel/genset	Filled with stones. The pipes and pump are stuck in the hole. Genset transferred to Lengei borehole.
Logoben Borehole		231782	117248	2002	JICA			Temporarily non-operational	Diesel/genset	The borehole needs to be repaired because it's the only reliable source in the community; it's non-operational.
Loikas Borehole		244689	130122			4.00		Operational	Diesel/genset	The borehole needs urgent repair and replacement of pump house. This is a nice place and it needs proper protection. There is need of putting more storage tanks to supply other places like Maralal town.
Lolkuniani Borehole		303160	120911	2006			0.90	Operational	Manual (hand pump)	The borehole is still in good condition because it was constructed recently. A sand dam can be constructed in the lagga (Loosikirachi) next to the borehole. There is need for another water source because some people are far from the current borehole.
Lolkunono		232724	118586	2000	JICA(JAPAN)			Temporarily non-operational	Manual (hand pump)	There is need to repair the borehole because it's the only reliable source of water.
Lolkunono Borehole		232724	118586		JICA		1.14	Temporarily non-operational	Manual (hand pump)	There is need to repair the borehole since it's the main source of water in the place.
Lolmolog		233266	108161	1996	JICA		1.00	Operational	Manual (hand pump)	The community need extension of water to the school and other places.
Loltolelei		258945	97487	2000	Japan		1.24	Operational	Manual (hand pump)	There is a need of a pump & genset in the BH in order to pump water to other parts of the Loltuletei
Longewan		226543	95404	1999	ECHO	5.00		Operational	Diesel/genset	The committee members request for the transfer of genset to the newly built pump house; it needs extension to the other places.
Loosuk Bh		230828	114148	1999	SWAM	12.00	0.80	Operational	Diesel/genset	The committee members do not save the money for O&M (money is mismanaged).
Lpartuk		235939	124489	2002	SWAM	5.40	1.80	Operational	Electricity	
Lpetepet		256754	100765	2002	JICA		0.95	Operational	Manual (hand pump)	
Marti Borehole		244917	164099	1952	colonial	8.00		Operational	Diesel/genset	Pump replacement is needed; there are two gensets that are currently used.
Masikita BH		271742	178186	1989	SAIDIA	8.00	8.00	Operational	Diesel/genset	Silting has occurred- so desilting must be done. Taps are no longer in good condition so replacement must be done. A health facility has been constructed so piping should be done to the health facility. One tank is not reliable so an alternative one is needed.

Name	Serial Number	X-coordinate m	Y-coordinate m	Constructed	Funded By	Tested Yield m3/hr	Current Yield m3/hr	Operational Status	Power Source	Remarks
Mbukoi BH	05201374 TRA08	240033	156143	2006	NWCPC	18.00	14.00	Operational	Diesel/genset	The water fetching infrastructure are still under construction. They have a plan for construction of a tank and pipelines so that people will have access to enough water. Also there are plans for constructing cattle troughs.
Morijo Borehole		236262	147556	1999	Catholic Mission Morijo			Operational	Diesel/genset	The borehole share the same storage tank with the rock catchment. It's also being controlled by Morijo Catholic Mission.
Nagoroworu		300794	104170	2006	Mishing well trust		0.90	Operational	Manual (hand pump)	The borehole is still new hence it's in good condition. The water source serves few households. There's a stream (Nagorowan) nearby which is still used.
Naibor Keju		256250	105943	2000	JICA(Japan)			Operational	Diesel/genset	They require extension of pipes to other parts to enable efficient supply of water.
Naiborkenju wind mill		257600	104297	2000	Catholic		0.60	Operational	Wind	The borehole is temporarily not in good condition so the community were not paying for water at the time of visit.
Naisunyui		320028	93010	2001	GoK		0.45	Operational	Manual (hand pump)	The borehole needs cattle trough. Water table is low hence it is not reliable; the place needs another water source.
Namarlal Borehole		244001	121846	1953	British Army Colonial		1.24	Operational	Manual (hand pump)	The borehole requires pump & genset to supply water to other parts of the town, and also to reduce the congestion around the borehole.
Natiti community BH	A1029835	253012	198903	2005	CCF	2.60	4.80	Operational	Diesel/genset	
Nauneri BH		246897	107462	2000	JICA(Japan)			Operational	Manual (hand pump)	The community does not pay for water but the source of information said that they will start paying by the end of this month. The livestock does not take water from the BH, only for humans.
Ndonyo Enker BH		242584	156687	2006	NWCP	2.00		Temporarily non-operational	Manual (hand pump)	The area is deserted currently, no people around the area. The borehole is not operational due to breakdown of handpump.
Ndonyowasin		326330	151567	2003	Aridlands		2.40	Operational	Diesel/genset	There is need for rehabilitation especially in the generator parts e.g. oil and brushes have been damaged hence it makes it difficult to meet the demand of users in the community.
Ngari		246349	119295					Operational	Manual (hand pump)	Information needs to be completed & verified in the field. Near Ngari pry school
Ngari Tamiyoi BH		245992	121456	1980	Baptist mission			Temporarily non-operational	Manual (hand pump)	The borehole needs hand pump repair and other infrastructure because it has been broken for the last 5 months now. The community also needs to put the pump in the borehole and genset to pump water to the nearby tank to supply many parts of the community. By now they really have a problem since it is the only source of water within.
Ngilai BH		260646	196751	2006	CCF	0.30	0.30	Operational	Manual (hand pump)	Information needs verification from the field. The borehole is pumped dry and users have to wait for it to replenish.

Name	Serial Number	X-coordinate m	Y-coordinate m	Constructed	Funded By	Tested Yield m3/hr	Current Yield m3/hr	Operational Status	Power Source	Remarks
Nkeju emuny		241360	112080	2000	JICA			Operational	Wind	The windmill does not pump enough water to sustain the whole community.
Nkopeliani Borehole		235097	114680	2000	Jica		0.89	Operational	Manual (hand pump)	The borehole needs proper fencing and good management finances.
Nkupuruti Mabati		265472	142104	2005	CCF		1.00	Operational	Manual (hand pump)	There is need for a pump and genset to supply water to the nearby primary school and communities that are far from the source.
Nkutoto Arus		242219	98944	1998				Temporarily non-operational	Manual (hand pump)	The source needs to be rehabilitated because it's the main water source and it's in the centre of the community.
Nkutoto Arus (Borehole II)		237282	100759	2000	Baptist Mission Switzerland			Temporarily non-operational	Diesel/genset	The borehole needs to be rehabilitated and protected to reduce distances to the other far sources of water. The borehole also does not have a lot of water; the community members said that they only fetch about 30 jericans and then the borehole dries up until next day
Ntepes		258760	133011	2002	jJICA			Permanently non-operational	Manual (hand pump)	It's not repairable because it was not covered hence it has been silted. There is a need for another borehole due to water shortage around.
Poro Borehole (Lporokwai)		232553	135160	2000	Catholic		12.00	Operational	Diesel/genset	There are no livestock taking water from the borehole.
Pura Bore hole		225598	125543	2000	Japan	2.25	1.80	Operational	Manual (hand pump)	The community members want to extend water to the other side of the community and primary school.
Resim		285208	113793	2005	GOK		1.44	Operational	Manual (hand pump)	Well kept borehole. Requires additional infrastructure like watering troughs, a gen-set (already have a house but no genset), side taps and others. The borehole is sited beside a lagga, and inside the same lagga are wells (hand dug) in clusters. They also require improvement
Samburu Game reserve		337078	63273	2006	Samburu county council			Operational	Diesel/genset	Well kept and maintained. The source is reliable throughout the year.
Serelipi		344375	124653	1985	Catholic church		0.40	Operational	Wind	The borehole is okay but the tanks are not functional. Only one tank is operating. During the wet season there's no water in the borehole. There are some side effects to the community when the water is consumed
Shabaa		246325	122284	2000	JICA	3.00	4.71	Operational	Diesel/genset	There are also 3 individual connections. The operating genset is borrowed from CODES and submersible pump motor from Ministry of Water awaiting replacement.
Sharda BH		245550	176645		Colonial government			Permanently non-operational	None	Filled up with stones

Name	Serial Number	X-coordinate m	Y-coordinate m	Constructed	Funded By	Tested Yield m3/hr	Current Yield m3/hr	Operational Status	Power Source	Remarks
Sirata		239193	116855	1974	Ministry of water	2.00	1.20	Operational	Diesel/genset	The borehole need to be fenced because it's not in a secure place. It's far from town and people's settlement.
Sopa Lodge Borehole		333722	66889	2002	lodge			Temporarily non-operational	Diesel/genset	Currently the borehole is not operational due to low water table. The alternative water source that the lodge uses is water abstraction from the Waso river. The lodge has one lorry for water (tanker) which is used to draw water if the borehole is not functional
St. Theresas Secondary		312698	108852	2005	Diocese			Operational	Electricity	The borehole is well maintained and kept well by the school.
Suguta Mission borehole		242795	91342	1982	Catholic mission		3.60	Operational	Electricity	The livestock does not take water from the borehole; it's privately own by mission.
Sura Adoru		266236	88388	2003	Catholic mission		0.40	Operational	Manual (hand pump)	The borehole needs a pump & genset to supply water to other parts of the community.
Wamba BH		314044	108330	2006	MBT (Maasai Barefoot Technology)		0.60	Operational	Manual (hand pump)	The borehole is still new, constructed by MBT (Maasai Barefooted Technology). The community members would like to get a genset because currently there are gardens which need irrigation around the BH.
Wamba Chinese BH		312767	107343	1999				Temporarily non-operational	Diesel/genset	Information needs verification in the field.
Wamba Hospital		313061	108421	1986	CCM		0.50	Operational	Diesel/genset & electricity	Well kept borehole. Water is pumped to tank then supplied to taps.
Wamba Hospital BH		313017	107871	1997	Diocese		1.50	Operational	Diesel/genset	The system is operational & well kept by the mission. There is a lot of fuel used hence the operational cost is high; if possible any assistant may be given

Data Source: Field Data Collection During the Mapping Exercise

APPENDIX 2

DATA CAPTURE FORMS

(See individual files in electronic version)

APPENDIX 3

DIVISIONAL LIVESTOCK POPULATION FIGURES

DIVISION	**CATTLE**		**GOATS**	**SHEEP**	**CAMEL**	**DONKEY**	
	Zebu	***Dairy***					
Lorroki	35497	2720	15204	193237	525	2694	**29,249.7**
Kirisia	37582	1892	198795	242756	655	3079	**44,799.4**
Baragoi	35497		184505	85457	1570	3461	**31,307.0**
Nyiro	36636		210494	136718	2619	2986	**37,266.2**
Wamba	33410		234321	115872	9057	3653	**39,742.0**
Waso	28568		149301	89364	6035	9030	**30,257.2**
TOTALS	**207190**	**4612**	**992620**	**863404**	**20461**	**24903**	**212,621.4**

APPENDIX 4

WATER, HEALTH AND SCHOOLS MANAGEMENT INFORMATION SYSTEM (MIS)
SAMBURU DISTRICT

PROJECT REPORTING WORKSHOP AND WAY FORWARD
27th June 2007

At SAIDIA Hall, Maralal

SESSIONS/TOPICS COVERED

Workshop Objectives
Workshop expectations

Session 1: Introduction
Planning - Typical Questions
Data - Typical Situation
Advantages of a MIS

Session 2: Overview of Samburu MIS Project
Session 3 Database/GIS- Overview

Session 4 Practical Database/GIS Demonstration

Session 5 Way Forward

PARTICIPANTS LIST

	NAME	DESIGNATION/ORGANISATION	CONTACT
1.	S.M. Mathenge	District Commissioner Chairman of the DSG; briefed about the outcomes of the project	
2.	S.M. Lempushuna	ALRMP, DMO/DSG Secretary	
3.	Joseph Lepariyo	CODES	Box 275, Mararal
4.	Mark Leagile	MWI/Northern WSB	Box 99, Mararal
5.	Julius Lalampaa	Coordinator, SWOM/Field Coordinator Samburu Mapping Project	Box 311, Maralal
6.	Francis K. Ng'ang'a	DAPO/DLPO	P.O. Box 183, Mararal
7.	Petikas Lelendu	Information	
8.	Andrew Lenanyokie	SCDO/ALRMP	
9.	Fr. P. Leseketeti	Catholic Mission	Maralal
10.	Benjamin Lerosion	KVDA	Box 227, Mararal
11.	Patrick Lekenit	NEMA	Maralal
12.	Daniel Kipkochoi	DSDO	Maralal
13.	Mark Loloolki	IMC	Maralal
14.	Jackson Musomba	IMC	Maralal
15.	Isaac Wamugi		COOPI, Nairobi
16.	Jackson Mwihuri	Range/Livestock management specialist	Box 1011 Nanyuki, Tel 062 31321 info@ruralfocus.com
17.	Michael Gitonga	Land and Water Management Specialist/GIS, Rural Focus Ltd.	Box 1011 Nanyuki, Tel 062 31321 info@ruralfocus.com

SUMMARY OF PRESENTATION ON MIS OVERVIEW

Workshop Objectives

- Examine role of data in water resource planning & management in ASALs;
- Share project approach & results;
- Understand how MIS assists in water resource planning & development for water, schools and health facilities;
- Understand need for Phase 2 – institutionalisation of MIS

Workshop Expectations

The participants were asked to answer the following questions in plenary.

- Do you have a map displayed in your office? What does it show? Why do you display it?
- If you had a choice, what map would you display in your office and why this map? Why isn't it already displayed?
- What is the impact of no or poor data?
- What kind of data/information on water sources do you wish you had?

Majority of the participants confessed that they have no maps in their offices except for the range management handbook maps in the DLPOs and the districts of Kenya map with IMC. The participants said that the maps would ease their planning and help in building consensus with other development actors, politicians and community. A map describes location and neighbourhood better than words can.

The main reason for not having the maps/data is lack of resources and that maps/data are with a few in Nairobi.

Issues

- ASAL areas – water development must be linked to pasture
- Drought prone districts need up-to-date data for drought management
- Data must be accessible otherwise decisions will be made without it, affecting quality of decisions

Project Goal

To strengthen district planning and national co-ordination activities in the water sector through building capacity and developing tools for data collection, use and management.

Questions that MIS can help you answer

- What are the water sources in a certain area and what are their details?
- Which sub-location has the highest proportion of people without adequate water services?
- Which sub-locations do not have at least one operational safe water source?
- What are the strategic water sources with respect to drought situations – where are they and what kind are they?
- Where and what kind of future water development should/should not be supported with respect to rangeland condition?
- Which health or education institutions require investments in water and sanitation services?

Data - Typical Situation

- Hardcopy – administrative map
- No current water information maps

- Maps rare, old or not available, hardcopy only
- Digital data – NBI, expensive, out-of-date
- No current overlays of water, range, infrastructure, population etc
- No local (in-district) mapping facilities or experience

In Summary – data weak part of planning process

Data Issues

- What kind of data to be collected
- How to collect the data
- Quality of the data
- Platform for data management & transfer
- Data outputs/reports
- Sustainability of database

What is a digital database?

- Consistent data collection/identification of data gaps
- Access to data
- Archival of data
- Manipulation & analysis of data
- Reporting
- Robust
- Transferable

What is a GIS? (Geographic Information System)

- Database in which data is spatially referenced (think maps)
- ARCVIEW Version 9
- More sophisticated software to make maps
- But linked to MS-ACCESS database
- Licensed (approx $2000 per single site user)

Function of GIS

THEMATIC ANALYSIS using map reporting format

- Water source status and management
- Reliability, water demand and supply issues

ACCESSIBILITY ISSUES ("buffering")

- Spatial distribution of water sources in relation to various issues

RELATIONAL ANALYSIS

- Ground water salinity mapping (boreholes & geology)

TESTING SCENARIOS/PROPOSALS

Improved Planning & Reporting

- Data & maps used in decision making
- Quality & accuracy of Reports/Proposals builds confidence
- Sharing of data & maps facilitates consensus on decisions & efficient responses

PRACTICAL DATABASE/GIS DEMONSTRATION

Database/MIS

The participants were introduced to the Draft Samburu database/MIS and shown the following key elements:

- Menus and functions in the database
- How to access the data entry forms, questionnaires, data analysis reports and maps. Sample data entry forms, questionnaires, analysis reports and maps were shown.

GIS Demonstration

In addition to an introduction on the GIS, the following elements were included:

- Examination of the maps in the report;
- Updating of database and GIS - demonstrated by entering X and Y coordinates of a point around southeast of Baragoi into the database. The point automatically appeared in the respective GIS map; changing the operational status of Kawop borehole which change was reflected in some of the thematic maps showing the operational status of the water sources
- Developing user specified map. The effect/impact of introducing an extra water source in an area e.g. a pan in good grazing area west of Marti, was analysed. The pan details were entered in the database. The area of coverage for the "new" pan was then calculated using the GIS.
- Simple editing of GIS layers was demonstrated by showing how to create a new sublocation through the Cut Polygons command.
- It was explained that the GIS could assist the district stakeholders in doing a quick analysis based on existing layers of information like hydrogeology to assess a groundwater development proposal.

The need for a Phase 2 of the project that will build capacity to carry out database updates, do further analysis and produce maps of their choice at the district level was discussed. This will entail building both human, software and hardware capacity in Samburu.

ESTABLISHING MIS IN SAMBURU DISTRICT- PHASE 2

Points for Consideration

- Whether and how to make MIS operational at district?
- How to sustain & update MIS at district?
- How to ensure demand driven by district, not donor driven?

Activities for Phase 2

- Procurement & installation of hardware, software
- GIS/database operator training
- DSG training on use of MIS in strategic planning
- Capacity building for database sustainability
- Developing linkages between District & National Databases
- Medium Term technical backstopping

Issues for MIS Operators

- Criteria
- Interest
- Computer literacy
- Commitment to district
- Service orientated
- Available

DSG needs to identify candidates

Issues for Institutional Host

- Suitable premises;
- Budget for consumables & maintenance (around 100,000/= per year);
- Accessibility for all users;
- Mandate;
- Technical capacity

Identify & rank institutional options

Operational Procedures

- Access & demands
  Who has access?
- Updating MIS (when, how, whose budget)
- Reporting Schedule & Format
  Identify frequency of report (Annual, semi-annual or quarterly?)
  Identify contents of report
- Cost of services (materials & staff)
- Capacity Building for Strategic Water Sector Planning

DSG training on strategic planning in water sector

- DSG training on MIS use;
- Linkage between Decision Maker (DSG) and MIS
- Backstopping

MIS operation and maintenance, modifications;
(Hardware and software)

- MIS updating;
- Backing-up;
- Linkage to national level institutions;

- Building capacity at district level;

Challenges

- Institutional Host
- Sustainability of database & GIS. It was echoed that lack of sustainability has been a major drawback to the water MIS even in other districts. The Water MIS should be inbuilt in the normal district/Government activities so that it is not left out. Budgeting for it should be considered. The participants felt that it should be easy now to campaign for the MIS given that the government is promoting the e-governance.
- Routine monitoring & up-dating. Some of the participants felt that the operational status of some of the water sources like boreholes was too dynamic to keep up with. They resolved that a reasonable updating frequency should be arrived at.
- Data sharing for planning purposes. The participants felt that some of the government departments lack computers even to access the MIS. Furthermore the GIS software is limited in use to one commuter or in a network- it has a hardware key.
- Harmonizing National = District databases

It was agreed that the DSG would make follow-ups to establish the need for Phase 2 of the project and what it takes to do it.

Some of the participants were given copies of the reports and maps in hard copy and asked to give comments in order to finalise the phase one of the project.

20 copies of the final reports, Maps and CDs will be submitted to CCOPI as per the project contract. However the hard copies may not be enough for all the DSG members. Since making hard copies is expensive CD copies of the MIS can be given to all the DSG members and other relevant development actors.

VOLUME TWO

APPENDIX 5

MAPS FOR SAMBURU DISTRICT

(See maps in the A3 Size Report or in the MIS installation CD)

Water Sources

Map No.	Title
1a	Administrative Units and Infrastructure
1b	Livelihood Zones
1c	Conflict Prone Areas and Grazing Patterns
2a	Sub-locational Population Density- 1999 Census Data Projected to 2005
2b	Poverty Incidence: Percentage of Population Below the Rural Poverty Line- Location Level
3a	Spatial Distribution of Assessed Water Sources
3b	Spatial Distribution of Assessed Operational Water Sources
4a	Boreholes Operational Status
4b	Boreholes System Management
4c	Boreholes- Power Sources
5a	Pans Operational Status
5b	Pans System Management
6a	Wells Operational Status
6b	Wells System Management
7a	River Access (Ngutuk naoki/namati), Roof Catchment and Emergency Water Tankering Operational Status
7b	River Access (Ngutuk naoki/namati), Roof Catchment and Emergency Water Tankering System Management
8a	River Abstraction, Rock Catchments and Underground Tanks Operational Status
8b	River Abstraction, Rock Catchments and Underground Tanks System Management
9a	Springs and Sand Dams Operational Status
9b	Springs and Sand Dams System Management
10	Seasonal Reliability of Assessed Operational Water Sources- Wet season and 9 months after the rains
11	Adequacy of Supply of Wells- With and Without Handpumps
12	Salinity of Assessed Boreholes and Hydro-geology
13	Human Accessibility 5km from Assessed Water Sources- > 9 Months After the Rains
14	Livestock Accessibility 10km from Assessed Operational Livestock Water Sources
15	Livestock Accessibility 15 and 30km from Assessed Operational Livestock Water Sources
16	Vegetation Cover and Range Condition
17	Livestock Accessibility to Pasture 10km from Assessed Livestock Water Sources- > 9 Months After Rains
18	Livestock Accessibility 15&30km from Assessed Water Sources- > 9 Months After Rains
19	Proposed Development Options and Human Accessibility 5km from Assessed Water Sources- > 9 Months After Rains
20	Proposed Water Development Options and Livestock Accessibility 10km from Assessed Water Sources- > 9 Months After Rains
21	Proposed Water Development Options and Livestock Accessibility to Pasture 10km from Assessed Water Sources- > 9 Months After Rains
22	Proposed Borehole Sites and Hydro-geology

RWSS

Map No.	Title
Map RWSS01	Sub-locations With and Without at Least One Safe Water Source
Map RWSS02	Proportion of Population Without Acceptable Rural Water Supply Service Level

Health

Map No.	Title
H1a	Health Facilities- Adequacy of Water Supply
H1b	Health Facilities- Adequacy of Water Supply and Population Distribution
H2	Assessed Health Facilities- People Per Health Facility
H3	Health Facilities- Proposed Sites, Within 10km from Existing Health Facilities and Population Distribution

Schools

Map No.	Title
S1-N	Learning Institutions- Northern Samburu
S1-S	Learning Institutions- Southern Samburu
S2	Learning Institutions- Adequacy of Water Supply
S3	Learning Institutions- Pupils per Teacher
S4	Learning Institutions- Pupils per Good Classroom
S5	Learning Institutions- Pupils per Desk
S6	Learning Institutions- Pupils per Toilet
S7	Proposed Schools Sites and Existing Institutions