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CHRISTIAN RELIEF AND DEVELOPMENT ASSOCIATION

Proceedings of the Workshop on Water Development for Rural Communities

13 - 14 April 1989

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CONTENTS

WELCOMING ADDRESS

by Bro. Augustine O'Keeffe, Executive Director, CRDA.....Page 1

PRESENTATION NO. 1:

SOME NOTES ON THE ROLE OF WATER RESOURCES IN THE SOCIO-ECONOMIC DEVELOPMENT OF ETHIOPIA

by Ato Melesse Endalamaw, Water Resources Commission..... 4

DISCUSSION POINTS 21

PRESENTATION NO. 2:

SONG OF THE WATERFALL (FILM)

by the Ethiopian Water Resources Commission 24

DISCUSSION POINTS 24

PRESENTATION NO: 3

KALE HEYWET CHURCH DEVELOPMENT PROGRAMME'S EXPERIENCE IN WATER DEVELOPMENT

by Mr. Andy Meakins, KHCDP Water Projects Co-ordinator 27

DISCUSSION POINTS.....38

DISCUSSION PAPER

FOR A WATER PROJECTS INTEREST GROUP WITHIN CRDA

by Mr. Walter Funk, Kale Heywet Church Development Programme 40

FIELD VISIT TO SELALE, NORTHERN SHEWA

CPAR PROJECTS AT YAYA GULELE WEREDA 46

BGCM PROJECTS AT WUCHALE WEREDA 48

CONCLUDING DISCUSSION AND RECOMMENDATIONS 51

APPENDICES 54-60

CRDA

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WELCOMING ADDRESS

By Bro. Augustine O'Keeffe, CRDA

Gentlemen,

On behalf of CRDA and its membership I would like to welcome you to this workshop.

Today is the third in a series of workshops which correspond to our members' interest and needs in their development work.

As you know, in early February 1989 CRDA organized a three-day workshop on Project Planning, Implementation, Monitoring and Evaluation, including a field trip to Northern Shewa.

The second wokrshop on Credit Schemes for Agricultural Inputs, with particular emphasis on oxen credit programmes, was held on 13-14 March, 1989. It also involved a field trip to Selale.

Today's workshop will be on Water Development for Rural Communities. With the overall decrease of relief needs in the country, many CRDA member churches and agencies are becoming increasingly involved in water projects to assist rural communities and small farmers. The protection of springs, the construction of hand-dug wells, sub-surface dams and ponds, water distribution systems, supplementary irrigation schemes and the supply of pipelines, storage reservoirs and other materials are all useful steps in solving the problems of water supply for domestic and agricultural use.

Water is of course vital to life. It is also a crucial natural resource. In many areas lack of water may be more limiting to development than problems related to land. I believe that through discussion and exchange of ideas and experience on this topic, member churches and agencies can improve and assist each other in the common goal of fulfilling the basic need of water for life sustenance and development. That is why we feel that such workshops enhance our ability to provide assistance to the poor.

During the coming months we have also planned similar workshops on topics such as food-for-work, forestry development, income-generation projects, and appropriate technology.

As I have already said, the success of such workshops very much depends on the participation and involvement of our member churches and agencies.

Finally, I take this opportunity to thank BGCM and CPAR for agreeing to have the participants of this workshop visit their water projects in Selale awraja tomorrow. I would also like to thank our Development and Rehabilitation Department for organizing the workshop.

I hope you have a successful workshop.

Thank you.

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PRESENTATION NO.1:

SOME NOTES ON THE ROLE OF WATER RESOURCES IN THE SOCIO-ECONOMIC DEVELOPMENT OF ETHIOPIA

by Ato Melesse Endalamaw, Water Resources Commission

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PRESENTATION NO. 1 : THE WRITER

Ato Melesse Endalamaw is Head of the Planning and Programming at the National Water Resources Commisson, where he has been in post since 1984. He has a B.Sc in General Agriculture from Alemaya University (1959), he is a Fellow, Rural Development, at the Institute of Development Studies, University of Sussex, UK (1968), and a Consultant, Enterprise Management, of the Ethiopia Management Institute (1969).

Ato Melesse's experience includes his work as Unit Manager/Deputy General Manager at Awassa Agro-Industry Estate (1960-66), as Head of the Feasibility Studies Division, Agricultural and Industrial Development Bank (1969-71), as General Manager of the Bank. Middle Awash Agricultural Development Corporation (1975-76), and as a Head of the Planning and Programming Department, Valleys Agricultural Development Authority (1978-83) before he took up his present post at WRC.

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SOME NOTES ON THE ROLE OF WATER RESOURCES IN THE SOCIO-ECONOMIC DEVELOPMENT OF ETHIOPIA

by Melesse Endalamaw
Water Resources Commission

The Water Resources Base

It is not possible to give an accurate assessment of the water resources of Ethiopia because the existing data are too sparse and not of sufficient duration.

The limited data that are available indicate that Ethiopia possesses fairly rich water resources with an estimated annual surface runoff of 104.4 billion m3 flowing in ten of the fourteen major catchment areas. Of this total discharge, 78 billion m3 (75%) flows to the Sudan and Egypt; 16 billion m3 (15%) to Lake Rudolf, the biggest part of which is situated in Kenya; 6.5 billion m3 (6%) to Somalia; 0.2 billion m3 (2%) to the Red Sea and only 3.5 billion m3 (3%) remaining within Ethiopia.

The rivers, most of which are part of the transboundary system present extremely large variations in their monthly runoff values. For example, the average annual dry season discharge of the Abay (Blue Nile) River is 80 m3 per second while the wet season discharge is one hundred times this volume at 8,000 m3 per second. Many of the smaller rivers which have sizable discharges in the wet season dry up completely in the dry season.

The distribution is also uneven with 89% of the surface water potential concentrated in 35% of the land area. Most of it is found in the Abay (51%), Baro-Akobo (13%), Ghibe-Omo (15%) and Atbara-Tekeze (10%) basins. The Ogaden, Danakil, Red Sea and Gulf of Aden catchments are dry basins located in the most arid parts of the country.

Some studies indicate that the ground-water potential in some parts of the country is quite sizable, but most of the studies are sketchy at best, as a result of which large-scale exploitation has not been possible up to now. Groundwater provides a source of safe water at relatively low cost with little or no treatment and is therefore an attractive proposition for the expansion of water supply in rural areas.

The proper utilization and conservation of even a small portion of the available water resources potential could greatly enhance Ethiopia's economy and provide an improved standard of living for the people. The development of water resources would increase agricultural production; establish a basis for industrial expansion; create employment opportunities; aid in the control of floods and sedimentation; enhance the preservation of fish, wildlife, and the country's rich heritage; and bring about a transition from traditional subsistence agricultural practices to a more reliable and surplus-producing sector. Such a transition would support not only a higher standard of living, but

would also enable the rural population to become self-reliant and to increase its contribution to the national economy.

Community Water Supply and Sanitation

It is estimated that only 11 per cent of Ethiopia's rural population of 43.8 million have access to improved sources of water supply. The remaining 38.4 million people depend on traditional sources such as unprotected springs, rivers, ponds and open dug-wells. In areas where surface water is scarce during the dry season, women and children spend hours every day fetching some 10-20 litres that must cater to the survival needs of an entire family.

Water use from improved sources is intensive during dry periods when traditional sources are generally much further away. When the rains come, water use from improved sources drops sharply. Most rural communities are satisfied with seasonal springs or even water puddles that may collect during the rainy season. Such unprotected sources are often infested with high levels of micro-organisms, representing a major health hazard to consumers. This pattern of water use seems to indicate that distance from source, rather than quality consideration, is the overriding factor for people's choice at the existing level of awareness. This further suggests the strong need for health education and for bringing improved water sources as close to dwellings as possible. However, in a situation of limited resources and problems of accessibility, this is better said than done.

Of the estimated 4.7 million people living in urban areas (excluding Addis Ababa), some 20 per cent get adequate, clean and reliable water, while nearly 80 per cent get inadequate services.

Though much remains to be done, water supply coverage has increased remarkably over the last decade as a result of the high priority placed on developing the rural sector and the emphasis given to the improvement of rural water supply services. Aside from constructing new rural scheme, there are programmes aimed at maintaining and rehabilitating rural water supply schemes that are presently out of operation. Until recently, rural water supply services were characterized by the expansion of borehole schemes. They are now diversified to include hand-dug wells, springs, cisterns, sub surface dams and ponds. Operation, maintenance and rehabilitation facilities are available at regional and a few sub-regional levels to ensure the reliability of services. Unfortunately, the efforts that are being made to provide excreta and waste disposal facilities have not kept pace with those for the provision of water supply.

At the end of the Ten-Year Plan Period (1994), it is hoped to provide around 35 per cent of the rural and 85 per cent of the urban population with clean and dependable water supply services. The plan also envisages the provision of latrines to 80 per cent of the rural households.

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In Ethiopia, draught-power from oxen is the most important livestock output enabling the annual cultivation of over five million hectares of cropland. Water supply problems in the rural areas are not only confined to the human population but are also a serious hindrance to the development of livestock. Where distance to water sources are prohibitive for daily watering, it is not uncommon for livestock to be watered every other day or even less regularly, with negative impact on animal productivity.

Although some steps have been taken to address the problem, the search for cost-effective methods have proved elusive. Recently, however, the Internation Livestock Centre for Africa (ILCA) has developed a system of small pond construction which promises to overcome the obstacle. Initially, a demonstration pond with a storage capacity of 2,300 m3 was created by constructing a three metre earth dam using draught oxen for excavation and hauling earth. The system is based on the use of ox-drawn metal scoops for pond construction. The compaction of earth fill was also carried out by oxen. This technique, which utilizes the resources available in rural areas, is rapidly gaining acceptance by Peasant Associations for constructing ponds for use of livestock. So far some 30 ponds with an average capacity of 7,000 m3 have been constructed under the responsibility of ILCA.

Agicultural Water Use

Irrigation is not just an aid to cultivation in dry lands where precipitation is not enough to grow any crops at all. It helps to overcome seasonal shortage in those parts of the country which have pronounced wet and dry seasons, as well as in those areas which have rainfall, but not enough during the growing season. Irrigation may permit two crops to be harvested in place of one by extending the length of the growing season. It can supplement natural soil moisture at periods when high temperature and rapid evaporation tend to deplete the supply from an otherwise adequate rainfall. It permits the raising of more valuable crops in place of inferior ones, and it can permit the use of soil types that would otherwise be unsuitable in the given climatic conditions. Even in regions of comparatively infrequent shortage of soil moisture, its value may be such as to make it worthwhile to construct quite costly works simply as insurance and protection against crop failure.

In Ethiopia, the consequences of deforestation, overgrazing and erosion and the importance of irrigation were, perhaps, not fully appreciated until the early 1970s when the devastating series of droughts resulted in severe and widespread famine. Two important facts emphasize the necessity of increased use of water for irrigation in the years ahead.

First, out of the country's total area of 122 million hectares, 15.74 million are cultivable and most of this land is situated on the rugged mountain slopes of the central highland plateau. Average family land holding is about 1.5 hectares. Total livestock population is 77 million, well above the carrying capacity of the rangelands.

Secondly, as Ethiopia's human and livestock populations have grown above normal expectations, so has the amount of water needed to produce food, fibre crops and pasture. Given the country's age structure some demographers project that the number of Ethiopians will rise until it reaches at least 231 million or more than the 1950 population of the African continent. Closely paralleling the impovershment of agricultural lands as a result of unmitigated population growth is the deterioration of grasslands as sheep and goat numbers expand nearly as fast as the human population. As the country's grasslands have deteriorated, the composition of its livestock population has shifted. This shift toward sheep and goats that live on crop and household waste and woody foliage reflects a period of unrelenting rainfall decline, loss of grass cover and intensified pressures on land use. This has resulted in desertification over large areas of the highlands and droughts are becoming a 'process' rather than isolated events.

Technically, Ethiopia possesses a big potential for irrigation development with an estimated gross irrigable area of three million hectares. In addition, there also exist potentials for small-scale irrigation. The area currently under formal irrigation is about 150,000 hecatres, or just five per cent of the potential. Of this, 69,000 hectares are in the Awash Valley, 15,000 hectares in the Northern Rivers Basin, and the remainder in the Rift Valley Lakes catchment area and the Wabi-Shebelli Basin. Unquantified small-scale traditional schemes exist in some areas.

Over the past decade, government has pursued a programme of valley development based on irrigated agriculture as a means of realizing its objectives of achieving self-sufficiency in food crop production and substitution of imports. In order to help achieve these objectives, it is planned to develop some 113,000 hectares under large-scale (3,000 ha and above) irrigation by the end of the Ten-Year Plan Period. In addition, plans are in hand for the implementation of numerous medium (200-300 ha) and small-scale (below 200 ha) schemes throughout the country, especially in the drought-affected areas.

Fisheries Development

Fish represent an important opportunity for animal protein production in Ethiopia. Conservative estimates place the minimum yield of this resource at around 92,000 tons per annum, including 66,000 tons from national waters in the Red Sea and 26,000 tons from inland sources. However, the present contribution of fisheries to national income and food supply is an insignificant fraction of this potential. At present, Red Sea catches are estimated to lie between 1,000 and 2,000 tons per year, which are mainly landed in the neighbouring countries and only a little over 2,000 tons are produced from inland fisheries. Approximately 300 tons of processed fish, mostly canned sardines are imported and retailed at comparatively high prices and the demand for fish remains unsatisfied.

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Ethiopia is a food deficit country and there is a definite demand for fish, especially in the urban areas, particulrly at periods of the year when dietary restrictions inhibit the consumption of animal products for a large segment of the population. The assumption of even very modest annual per capita consumption rates would thus indicate a demand very considerably larger than the current supplies from inland, marine and imported sources.

Hydropower Generation

The hydropower generation potential of the major Ethiopian rivers is estimated at 60 billion kilowatt hours per year. Only about two per cent of this potential is being used at present. Of the 480 MW of generation capacity in public and private hands, nearly 80 per cent is hydro. The rest is oil-fired steam and diesel engine generation.

Average per capita electricity consumption in the early eighties was 21 kwh per year which is extremely low even by regional standards. At present the diversion of the Amerti River into the Fincha reservoir is complete. This would increase the energy production of Fincha by about 180 GWH annually. The recently completed Melka Wakena Hydropower project has a capacity of 560 GWH (160 MW) when fully operational. Detailed designs for the 300 MW Gilgel Gibe hydropower project are completed and construction work has already commenced.

A recent survey of potential small-scale hydro stations has resulted in the identification and design of a number of stations based on the construction of small dams. These will form isolated consumption centres which will eventually be absorbed into the national grid system. A few have already been earmarked for construction.

It is envisaged to increase the share of hydro and thermal generation capacity to 80 per cent of the total by the end of the Ten-Year Plan Period. It is estimated that seven percent of the total population would be served by electricity and total capacity would more than double to 700 MW.

Industrial Water Use

Although it is difficult to quantitiy the amount of water currently consumed by the industrial sector, it is considered to be substantial enough to arouse concern, and the availability of water has become an important factor in the choice of location of new industries. Large water-using industries such as paper mills, breweries, tannaries and abattoirs have to be located near streams and lakes where ample water is available.

Most of the existing industries in the major towns were built without due consideration of their effect on the environment. Strict monitoring and control measures have not been possible in the absence of legislation.

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Water Transport

None of the Ethiopian rivers are navigable year-round. At present, Lake Tana, Lake Abaya and Baro River are the major water bodies used for inland navigation.

Wildlife, Recreation and Tourism

There are many river valleys that are rich in archaeology and wildlife. Most of the rivers, lakes and springs are suitable for recreation and tourism, but are at present little used for these purposes.

Environmental Aspects

The major environmental problems in Ethiopia relate to excessive pressures on basic life support systems resulting in dwindling forests and grasslands, eroding soils, and falling water tables. These are mainly the result of unrestrained human and livestock population growth. The country has no population policy and family-planning services are far short of the existing needs.

Table 1. Changes in Ethiopia's Physical Condition

Indicator	Reading
Forest Cover	Forest cover estimated at 40 percent of country's area a century ago, now reduced to just three per cent annual wood demand now exceeding total annual production by about 16 million m3; position leading to forests being rapidly depleted in excess of their annual growth -- perhaps to the extent of 200,00 ha each year.
Species Diversity	Countless plant and animal species now extinct, many before they were named or catalogued; remaining ones in danger of extinction.
Topsoil on Cropland	An estimated one billion tons lost annually in excess of new soil formation (grain produced to soil lost ratio = 1:15); fertilizer value of this lost soil estimated at US$ 1,280 million.
Cow Dung Diverted	Amount of dung annually diverted to fuel capable of adding an estimated 1-5.5 million tons of grain to country's harvests; supplying lost nutrients with imported commercial fertilizers estimated to cost estimated to cost US$ 123 million/year.
Rivers and Lakes	Rivers flowing through major cities now biologically dead; lakes in these areas in danger of dying.

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Fresh Water	Underground water tables falling in parts of the country as demand for water rises above aquifer recharge rates.
Groundwater Quality	Sewerage and toxic waste sites contaminating groundwater in cities; extent of contamination unkown.
Climate	Mean tempratures rising, total annual rainfall decreasing in many parts of the country.
Droughts and Famines	For some 600 years, droughts and accompanying famines experienced at 13 to 14 year intervals; since beginning of this century, at seven to eight year intervals each lasting for a two to three year period.
Desertification	Increase in rainfed agriculture problems and deterioration of irrigation systems; some increase in sand dune encroachment; dangerous increase in forest depletion and rangeland deterioration; put differently, stage set for desertification.

Cyclical droughts are not a new phenomenon to Ethiopia, but the droughts of the past two decades have been extremely harsh. Measures taken to counteract possible future droughts include the introduction of irrigation, the resettlement of farmers in the relatively fertile and underpopulated parts of the country and the strengthening of an early-warning system through the intensification of weather data collection and faster means of data analysis and communication. The services will include flood predication. Irrigated pasture development for lowland livestock is also being carried out on a limited scale in the Awash Valley. Further actions taken by the government include the promulgation of a Forestry Proclamation; the establishment of two Forestry Training Institutes, a National Soils Laboratory and a Wood Utilization Research Centre. In December 1988, the first national conference on a Disaster Prevention and Preparedness Strategy for Ethiopia took place under the auspices of the Office of the Nationonal Committee for Central Planning (ONCCP).

Institutions

In the past, responsibilities in the field of water resources development, use and conservation proliferated in a great number of government agencies without any effective co-ordination of programmes, integrated planning, effective multiple-purpose development and co-ordination between related water activities.

In recognition of this weakness, the government established in 1981 the National Water Resources Commission. The Commission's major responsibilities included ensuring the optimum development and use of the country's inland waters; ascertaining the co-ordination of all activities which may influence the quality, quantity and distribution or use of water; and ensuring the application of appropriate standards

and technique for the investigation, use, control, protection, management and administration of inland waters. The Commission was restructured by proclamation in 1987 with water resource assessment and project study functions transferred to the recently established Ethiopian Valley Development Studies Authority. The Commission has a Water Resources Council composed of the vice ministers of the Ministries of Agriculture, State Farms, Industry, Health, Mines and Energy and Urban Development with the Commissioner of the Water Resources Commission acting as chairman. The Commission also works closely with other ministries, government agencies and mass organizations for their programme components or in their capacity as project beneficiaries.

Under the Commission, there are three authorities and one agency that are responsible for the implementation, administration, management and supervision of water sector development programmes. These include the Water Resources Development Authority (design, construction supervision and water administration), the Water Supply and Sewerage Authority (study, operation and maintenance of rural and urban water supply and urban sewerage systems), the Ethiopian Water Works Construction Authority (construction of water works), and the National Meteorological Services Agency (collection, synthesis and dissemination of climatological information).

Human-Resources Development

A human-resources assessment survey for the water sector was conducted in 1977 in which medium-term requirements as well as recommendations for training programmes to meet these requirements were made. The programmes that are under implementation include low-level and high-level technician programmes and advanced programmes leading to B-Sc degrees in hydraulic, sanitary, mechanical, electrical and irrigation and drainage engineering as well as in meteorology.

The Arba Minch Water Technology Institute accepted its first batch of 176 students in 1986 and enrolment is expected to increase to 1,560 student per year at the third and final phase of its expansion.

The Institute, which is under the Water Resources Commission, currently provides courses of study under 15 programmes in the main curriculum and two courses at the lower-certificate level.

With the arrival of young engineering graduates, some of the critical needs are now being met. However, the shortage of senior professional staff in both techinical and administrative fields continues to be a major constraint.

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Research and Technology

Research and technology activities so far initiated under the Water Resources Commission include salinity control in irrigated lands, climate classification and rainfall variability determination, defluoridation and desalination, shallow wells. Research in wind-powered pumping is now at a relatively advanced stage. Research in animal-powered pumping and water-wheel pumping, where a water turbine drives a centrifugal pump, are also being considered for both potable water supply and irrigation use.

The development of low-cost water-lifting devices was started by the National Water Resources Commission in the late seventies with the assistance of UNDP and the Government of Canada. The shallow and deep well hand-pump prototype that resulted from this research (named Shalla and Ibex) have now reached the mass production stage after successful laboratory and field trials. A wind power project for borehole pumping and low-lift irrigation application which is being carried out with the assistance of the Government of Sweden, is currently engaged in the preparation of designs that would be suited to the different wind regimes of the country after having successfully concluded field tests of different prototypes.

Notable among water-related research topics to be pursued in the future are detailed country-wide hydrogeological investigations, local production of chemicals for water treatment and local manufacturing of water supply treatment plant and irrigation equipment components.

Legislation

Ethiopia to this day has no water legislation and the provisions which regulate water management are based on traditional practices which do not have comperhensive application.

Steps have been taken to rectify this weakness and a Draft National Water Code with improved and streamlined scope to cover all aspects of water resources management, protections, pollution control, penalties for undesirable effluent discharge, licensing, abstraction and ownership has now been completed and is awaiting enactment. Other polices being considered include an irrigation policy, an urban water supply tariff policy and an environmental protection policy.

Community Participation

The community is the primary resource in water supply and sanitation and small-scale irrigation programmes. Community involvement in water supply and sanitation has assumed an increasing role since the launching of the International Drinking Water Supply and Sanitation Decade in 1981, and the organizational preconditions are firmly established in Ethiopia. Mass organizations like the peasant, urban dwellers, youth and women's associations provide favourable forms for the initiation and implementation of community-based programmes.

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The Meo-Gassera Water Supply Scheme in Bale region is a good example of a project constructed with community participation. The project provides gravity-fed safe and dependable water supply to 22 farming communities and is designed to serve 68,000 people. In this project, over 120 km of pipeline excavation was completed with massive community participation. Some 65,000 people have contributed free labour worth nearly Birr 200,000. Nation-wide, a total of 169,000 people have participated in rural water supply projects sponsored by the Water Resources Commission between 1984 and 1987 with an estimated labour contribution of almost half a million Birr. Some 511 water committees have been established in five regions up to March 1988.

The involvement of women at the various stages of water supply programmes is especially encouraged and the Revolutionary Ethiopia Women's Association, with a membership of over five million, has assisted in mobilizing women to take part in the initiation, construction and operation of rural water supply and sanitation schemes.

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Public Information and Extension Services

Public information in the form of TV and radio interviews, press releases and newspaper articles have been disseminated at an increasing rate since the launching of the DWSSA. A weekly half-hour campaign using the national media network has been transformed into a regular public information programme.

The programme focuses on eliciting public awareness and popularizing simple water development, protection and conservation techniques and on sanitation. Efforts are also being made to train community participation promotion agents aimed at increasing community involvement in water resources development efforts.

Finance and External Assistance

Government budgetary allocations for the water sector have increased many-fold during the last decade. External assistance has also increased substantially, largely as a result of the recurrent drought experienced during that period. There are currently 17 bilateral, seven multilateral and 11 non-governmental organizations co-operating with the Commission in water supply and irrigation activities. Their involvement includes financial, material as well as technical assistance.

The Commission places emphasis on mobilizing internal resources for the financing of water resources programmes, and the possiblities of making projects, as far as possible, self-sustaining. Attempts are also made to reduce project costs through greater involvement of communities; extensinve use of local labour, materials and technology; adoption of standard designs; and lately, through local manufacturing of pumps and pipes. The Commission supports, where appropriate, the work of NGOs engaged in the promotion of water resource projects, particularly those which are low-cost and self-help based.

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Major Constraints

The following are the major sectoral problems:

1. Paucity of data on surface and groundwater resources due to weaknesses in gathering, storage, retrieval, analysis and dissemination; the unreliability of such data.

2. Inadequacy of national and institutional scientific infrastructure for water assessment activities.

3. Lack of national water-use policy. Unavailability of guidelines, strategies and programmes (masterplans) for the integrated development and management of water resources.

4. Shortcomings in co-ordination among bodies responsible for the investigation, development and management of water resources.

5. Lack of legislative and administrative structures concerning water resources planning, construction and management.

6. Lack of science and technology policy for the development, management and conservation of water resources. Inadequacies of technological capacities at regional and national level.

7. Scarcity of technological packages including proper design, operation, machinery, agricultural inputs, on-scheme management and support to extension and research programmes.

8. Wastage of water or its use in excess of actual needs as a result of unplanned development and the absence of legislation.

9. The absence of an "ecological approach " by which the enviromental hazards posed by development activities could be anticipated and corrective measures incorporated into the planning process.

10. Too much reliance on emergency measures rather than on disaster planning and prevention.

11. Lack of comperhensive programmes for the progressive implementation of the development of water resources for the benefit of drought-affected areas.

12. Lack of programmes to reduce the losses associated with floods within the framework of programmes for land and water management and for disaster prevention and preparedness in general.

13. Deterioration of the quality of water resources as a result of urbanization and industrialization , requiring increasing man-forced flows of water which produce heavier effluent discharges into rivers and lakes.

14. Deterioration of the quality of groundwater resulting from highly concentrated and intensive utilization which upset the hydrological cycle.

15. Excessive pressure on basic life support systems brought about by population growth resulting in dwindling forests and grasslands, eroding soils and falling water tables; lack of government policy on population growth, inadequacies in family planning services.

16. Shortage of scientific, technical and managerial manpower in water resources and allied fields.

17. Shortcomings in training programmes and facilities.

18. Inadequacies in public information programmes and extension services.

19. Absence of community participation in planning, operation and management of water resource schemes.

20. Emphasis of many water resource programmes on cost-effectiveness at the expense of social benefits, environmental conditions and the protection of human health and well-being.

21. Scarcity of capital and foreign exchange.

ANNEX I

10-YEAR PERSPECTIVE DEVELOPMENT PLAN OF THE WATER SECTOR

TARGETS

1. Urban Water Supply

Activity	Number of Projects
- Improvment	1
- Emergency	16
- Feasibility study	96
- Design	42
- Construction	50

(85% of the urban population will be served)

2. Rural Water Supply

Type of Scheme	Number of Projects
- Spring development	897
- Hand-dug well	10,400
- Sub-surface dam	200
- Slow-sand filter	146
- Borehole (productive)	1,657
- Borehole (non-productive)	412
- Pond	76
- Cistern	54

(11.5 million of the rural population will be served.)

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3. Medium-Scale Irrigation Development

- Carry out a nation-wide indicative study of medium-scale irrigation development
- Conduct studies on 70 projects
- Complete the construction of 50 projects

4. Large-Scale Irrigation Development

- Preparation of master plan for the Baro-Akobo basin (1 million hectares)
- Conduct feasibility studies on an area of 263,000 hectares in various basins
- Develop 113,000 hectares of land in 7 different areas
- Construction of 10,000 ha. sub-surface drainage system

5. Meteorology

- Increase the number of meteorology stations to 3000
- Improve data collection, processing and dissimination
- Strengthen weather forecasting and early warning services

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6. Hydrology

- Establish 577 hydrological stations
- Carry out hydrological studies for water supply irrigation and power projects
- Establish facilities for calibration and repair of hydrological equipment
- Strengthen data processing and documentation facilities
- Carry out nation-wide hydrological studies.

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ANNEX II

TABLE 2. Comparison of Various Drinking Water Standards

B. Physical Characteristics

Criterion	U.S. Public Health Service, 1962		World Health Organization, European, 1961		World Health Organization, International, 1963			AWWA Recommended Potable Quality Water Goals,[a] 1968
	Recommended limit[c]	Tolerance limit[c]	Recommended limit[c]	Tolerance limit[c]	Recommended limit[c]	Acceptable limit[c]	Tolerance Limit[c]	
[illegible], units	15				5	50		<3
[illegible], threshold number	3, inoffensive				Unobjectionable			No odor
[illegible]								
Filterable, mg/l	500							200
[illegible] mg/l								Virtually suspension free
Total, mg/l					500	1,500		
[illegible]	Inoffensive				Unobjectionable			None objectionable
[illegible] units	5				5	25		<0.1[e]

C. Chemical Constituents (mg/l)

Substance	U.S. Public Health Service, 1962		World Health Organization, European, 1961		World Health Organization, International, 1963			AWWA Recommended Potable Quality Water Goals,[a] 1968
	Recommended limit[c]	Tolerance limit[c]	Recommended limit[c]	Tolerance limit[c]	Recommended limit[c]	Acceptable limit[c]	Tolerance limit[c]	
[illegible] benzene sulfonate (ABS)	0.5				0.5	1.0		<0.2
[illegible]minum (Al)								<0.05
[illegible]			0.5				0.05	
[illegible]senic (As)	0.01	0.05		0.2			1.0	
[illegible]ium (Ba)		1.0					0.01	
[illegible]mium (Cd)		0.01		0.05				
[illegible]ium (Ca)					75	200		<0.1
[illegible]form alcohol extract (CAE)					0.2	0.5[d]		<0.04
[illegible]form chloroform extract (CCE)	0.2		0					
[illegible]rine dioxide, free $(Cl)_2$					200	600		
[illegible]oride (Cl)	250		350				0.05	
[illegible]mium, hexavalent (Cr^{+6})		0.05		0.05				
[illegible]per (Cu)	1.0		3.0[f]		1.0	1.5		<0.2
[illegible]ide (CN)	0.01	0.2		0.01			0.2	
[illegible]ride (F)	0.8–1.7[f,g]	1.4–2.4[f]	1.5			1.0–1.5		
[illegible]ness (as $CaCO_3$)			100–500[h]					80–100
[illegible]rogen ion concentration (pH)					7.0–8.5[h]	6.5–9.2[h]		
[illegible]n (Fe)	0.3		0.1	0.3[f]	0.3	1.0		<0.05
[illegible]d (Pb)		0.05	0.1	0.3[f]			0.05	
[illegible]nesium (Mg)			125[k]		50	150		
[illegible]nesium + sodium sulfate					500	1,000		
[illegible]anese (Mn)	0.05		0.1		0.1	0.5		<0.01
[illegible]rate (NO_3)	45		50			45		
[illegible]en, dissolved (O_2)			5[i]					
[illegible]ic compounds (as phenol)	0.001		0.001		0.001	0.002		
[illegible]um (Se)		0.01		0.05			0.01	
[illegible]r (Ag)		0.05						
[illegible]ate (SO_4)	250		250		200	400		
[illegible]	5		5		5	15		<1.0

D. Radioactivity, $\mu\mu c/l$

	U.S. Public Health Service, 1962	World Health Organization, European, 1961	World Health Organization, International, 1963	AWWA Recommended Potable Quality Water Goals,[a] 1968
	Recommended limits	Recommended limit	Tentative limits	
[illegible]			10	
[illegible]	10		30	
[illegible]	1,000	10[j]	1,000	
[illegible]		1		

[illegible] health standard but desirable maximum limits

[illegible] supplies which are distributed without treatment or disinfection cannot be maintained to the bacteriological standards [illegible] and disinfected water, steps should be taken to institute chlorination, disinfection or other treatment of the water

[illegible] recommended limit

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ANNEX III

Annex III

JUST ADD WATER

by David J.Ford

The words on labels tell this tale,
In recipes, in ads by mail,
And chances are, at work or play,
You'll see these famous words today-
Just add water.

You'd be surprised how many things
Are dry and useless till one brings
The magic liquid known to all;
You use it when you heed the call-
Just add water.

To illustrate and prove this thought,
Remember all the food you've bought
On which was printed, clear and bright,
Instructions that make cooking light-
Just add water.

Imagine for a minute, please,
An arid wasteland, bare of trees;
This could be farmland, rich and good
And quite productive if we could
Just add water.

What turns cement into concrete?
What changes seed to golden wheat?
No other words now known to man
Can answer that; but these words can:
Just add water.

1. Water Operation and Maintenance Bulletin No. 146

December 1988

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DISCUSSION OF PRESENTATION NO.1

In the course of the discussion on the first presentation, the following points were raised by the participants and Ato Melesse Endalamaw.

1. Water is only the vehiale for diseases which actually arise as a consequence of poor sanitary conditions. The development of safe water supply and the provision of good sanitation should go together. However, sanitation has been much neglected in the past, and even in the ten-year perspective plan no provision has been made for sewerage development and measures which would limit water-borne diseases. Safe water alone cannot improve health, and is meaningless without the parallel development of sanitation.

2. Proper links should be forged between the community, the Ministry of Health and various boards within the Water Resources Commission to stress how water supply and sanitation are inextricably linked. Even in the main cities of Addis Ababa and Asmara the sewerage system reaches only a small proportion of the local population. However, no complete proposal has yet been drawn up on the development of good sanitation in the ten-year perspective plan, although the scale of the problem is revealed there. Addis Ababa's current programme of sewerage development reaches only 100,000 people out of a population of 1.4 million.

3. In the rural areas the question of water supply is seen by villagers essentially as a domestic problem, possibly because of the low-levels of output from the sources they use. Technical advice is however available to agencies which aim to assist villagers from the Water Resources Commission. Each autonomous agency within WRC, such as the Ethiopian Water Works Construction Authority and the Water Supply and Sewage Authority, are all represented at regional and sometimes sub-regional level. These offices are provided with a budget and a ceiling for the number of projects they can implement, and it is then their responsibility to decide where their services, including maintenance and repair, should be given.

4. Some regional programmes are very well organized and in others local communities have taken over the new projects that have been implemented, as for example is the case in Arsi. Villagers there pay for the services they receive so that they have been able to invest in more new projects. Other regions rely on outside funding in order to continue their programmes.

5. All regional WRC offices face similar problems in repair and maintenance. These centre on the difficulty in finding spare parts for the proliferation of pumps and other equipment supplied by various donors. Maintenance services cannot hope to keep pace with the type and specifications of these manifold pieces of equipment.

6. Similarly, the rate of population growth means that however good the projects and services provided are, they will soon be outstripped by the numbers of people requiring additional clean water.

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7. Regional WRC services are not adequately or evenly spread throughout the country as yet, but they represent the best way of working. They are assisted by local water committees formed by members of the local farmer' association, of whom at least two must be women.

8. When water supply to rural communities is mentioned in the ten-year perspective plan, the team refers to public systems located at strategic sites, not house-to-house systems.

9. Poorly constructed pit latrines in rural areas are probably worse than no latrines at all. In urban areas, vacuum trucks and at present very rudimentary sewrage systems are the methods of sanitation used. These policies are the responsibility of the Ministry of Health.

10. In some rural areas, levels of hygiene we further complicated by the fact that livestock is often kept inside the home and family living space. The construction of latrines therefore needs to be accompanied by health education on their use and maintenance, as well as on all aspects of personal and domestic hygiene. Ventilated improved pit, or VIP, latrines represent a marked advance, but they are expensive to construct and technically more complex for the beneficiary community. If, however, good latrines cannot be provided, then it is better to leave the community to rely on traditional methods of excreta disposal than run the risk of causing an epidemic with poorly built latrines.

11. The pursuit of better sanitation is beset by problems of economics and of attitude. If the means are made available to provide better sanitary facilities, then the necessary work in changing social attitudes must also be undertaken. Various designs of improved latrines are available from WRC, who can assist in all technical matters of water supply and sanitation. However, it is important to remember to consider the resources being requested of the community in building latrines or water systems: their level of poverty may be such that they are living in conditions which they already know are unsanitary or less good than they would prefer. Similarly, it will be difficult to prevent contract with animals in the short-term when fuelwood is in such short supply that cow dung is regularly used as an energy source. This practice represents both a loss of fertilizing capacities and a constraint on improving health.

12. One of the major problems with boreholes and wells is not the actual construction, but their maintenance and repair. WRC has conducted research and developed the design of two handpumps - the Shalla and Ibex - for local manufacture. The design is bases on the India Mark II, and it is hoped that by introducing their use in Ethiopia maintenance and repair can be standarized. Training will also be conducted for communities so that they can undertake their own maintenance. Ultimately, the introduction of improved pumps and generators with the appropriate training should connect the current problems caused by the proliferation of makes and types of equipment. The setting up of an internal supplier of handpumps Ethiopia represents the first step in this process.

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PRESENTATION NO.2

" SONG OF THE WATERFALL " :

A FILM ON WATER RESOURCES AND DEVELOPMENT IN ETHIOPIA

by the Water Resources Commission (with UNICEF support)

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PRESENTATION NO. 2:

"SONG OF THE WATERFALL" (WRC Film)

The film, made by the Water Resources Commission with UNICEF support, was in two parts: the first focused on natural water resources within Ethiopia, and the second on governmental efforts to develop these resources for clean water supply and agricultural irrigation.

DISCUSSION OF PRESENTATION NO. 2

The discussion which followed continued on issues raised by Presentation No. 1, as well as those newly raised by the film:

1. A policy has been drawn up covering the work of NGOs and the requirements made of them by WRC in order to implement their projects. The main points of this policy are covered in Ato Melesse Endalamaw's paper. The way in which NGOs work is integrated into official policy is by means of tripartite agreements involving the RRC, WRC and the implementing agency. Until now there has been no legislation governing this work, although a need is now being felt to develop policy into law.

   Standards of work are based on World Health Organization international standards, but due to the pressures of need the implementation of these standards is not well developed. At present, a kind of water resources code is adhered to by all parties involved. However, once legislation has been enacted, drilling engineers and other personnel will need to have achieved certain technical qualifications in order to work in Ethiopia.

5. WRC, in the form of EWWCA and WSSA regional offices, is able to give technical advice to water project implementators in rural areas, while the Research Department at the WRC head office in similarly available for consultations. The provision of materials by WRC is considered on a case-by-case basis, but since WRC is also dependent an external assistance materials are limited.

3. Responsibility for NGO involvement in water development projects formerly resided with the RRC. It has now passed to WRC, which is currently dealing with 14 churches and agencies, UN bodies and multilateral organizations and funders through tripartite agreements. RRC and WRC enjoy a productive relationship under this new division of responsibility.

4. While no mandatory regulations have yet been set, the current modus operandi is to have WRC supervise small-scale NGO projects, and co-operation has been effective so far. In future, studies and designs will have to be approved by WRC, via EWWCA, and contractors will have to bid to implement larger projects. These contractors, including WSSA, will in turn be required to meet certain standards.

5. Research is now being carried out on windpumps to draw water from boreholes. They are energy-saving and potentially less difficult to maintain. Policy will soon be set on their use in Ethiopia.

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6. NGOs implementing rural water supply systems should make an approach to the relevant regional WSSA offices so that projects can be eventually handed over to the local authorities. It is important that NGOs, once they have completed their involvement, do not leave behind a legacy of maintenance and repair problems. The regional office should be made aware of the type of pump in use and its technical specifications. No definite formula exists at present on whether WRC should assume responsibility for all water projects implemented within the country by other agencies, but studies are currently being undertaken in order to develop policy.

7. The flouride content of water supplied in the Rift Valley area is high. WRC guidelines are taken from WHO's 1963 international standards (Annex II, Presentation 1), and studies in Ethiopia by UNICEF and WHO continue on reducing flouride content especially. However, because high standards for potable water are a luxury in a country with serious clean water supply problems, it is not always possible to impose strict controls without closing down water systems that are probably better than those local sources which would otherwise be used.

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PRESENTATION NO. 3

KALE HEYWET CHURCH DEVELOPMENT PROGRAMME'S EXPERIENCE IN WATER DEVELOPMENT

by Mr. Andy Meakins, KHCDP Water Projects Co-ordinator

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PRESENTATION NO. 3 THE WRITER

Mr. Andy Meakins is a Chartered Civil Engineer from England. He graduated from the City University in London in 1986. He has had 12 years professional experience mainly on water project, nine of which have been in Ethiopia.

Six months after graduation he first came to Ethiopia to work with SIM on small-scale water supplies for rural communities for a period of two and half years. He gained grass-roots experience while leading a mobile water team working in Southern Shewa and Sidamo. On returning to England he worked on water related projects for a firm of consulting engineers. After a year they sent him to Ethiopia to work on the Amibara Irrigation Project. For nearly two years he was involved in the design and supervision of the construction of various canals, drains and associated irrigation structures. Following this he joined another firm of consulting engineers to work on the Asseb Water Supply project for a period of 16 months.

In 1986 Mr. Meakins returned again to Ethiopia to join his present organization, the Kale Heywet Church Development Programme. He now works as Water Projects Co-ordinator, assisting the various Kale Heywet Churches and Central Office in their water related activities.

Over the years Mr. Meakins has made visits to Benin Republic, Thailand and India as a water consultant for Tear Fund (UK).

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THE KALE HEYWET CHURCH'S EXPERIENCE IN WATER DEVELOPMENT

By Mr. Andy Meakins
KHCDP Water Projects Coordinator

INTRODUCTION

The Development Department of the Kale Heywet Church (KHCDP) was established in 1984. The Kale Heywet Church is divided into 37 autonomous regions each implementing its own programmes. Many are involved in development; some in a big way. The Central Office in Addis Ababa mainly acts as a coordinating office, assisting the regional offices in their various activities. This gives the KHCDP a community-based structure and personnel through whom development assistance can be channelled.

With 75% of the rural population of Ethiopia not having access to clean water, the KHCDP has from the outset been involved in water development mainly drinking water but also some irrigation. Two mobile water teams have been established whose task is to carry out project construction and to train teams to operate in the KHC's regional church areas. Two regional teams have been established and training has commenced in other areas. The Central Office staff provide technical assistance to the regional churches in their various water activities, as well as helping procure funds, pipes, fittings and other imported items.

To date work has mainly concentrated on spring protection, pipelines, reservoirs and distribution system, hand-dug wells and pond construction. A total of 50 projects of varying sizes have been completed in Shewa, Gamu Gofa and Eritrea. In addition two woreda towns in Kambatta and Hadaya Awraja have been assisted. For Durami town, funds were obtained for the materials, pipes and pumps, which were then installed by EWWCA. At Shinshichio funds were obtained from World Vision Ethiopia and a contractor employed for the construction - an expensive option when compared with carrying out work by our own teams.

Since its formation, KHCDP have wanted to provide water in areas where surface and shallow groundwater resources are not available. A water well drilling programme is about to start operations. Equipment worth Birr 1.0 million, including an Ingersoll Rand TH10 rig with an Ingersoll Rand 750 cfm/300 psi compressor, has just arrived in the country. A target of 50 successful wells with hand-pumps has been set for the first year of operation. This extension of our water programme will enhance our capability but will somewhat change its nature. We will be moving away from relatively simple projects and construction techniques. This will require more highly skilled staff.

REASONS FOR KHCDP'S INVOLVEMENT IN WATER DEVELOPMENT

As a church the KHC sees its main purpose as meeting man's religious or spiritual needs. But they realize that meeting man's social and physical needs is also part of their calling. The Government and people look to the KHC for assistance in meeting their development goals.

The provision of clean water at reasonable distance from the users in a very necessary component of any community development programme. The lack of it can thwart many other development efforts such as health, sanitation and cottage industries. This is recognized by the Government and generally by

the communities themselves. Therefore the KHC sees this to be an expedient area of involvement. Although only a first step towards improving the health of a community, a new water supply generally requires a one-off input from the KHC, which then brings an immediate benefit. Other areas of development require longer term inputs to see results.

PRINCIPLES FOR INVOLVEMENT IN WATER DEVELOPMENT

The KHCDP Water Development Programme operates on the following principles:-

1. The recipient community must express their desire for an improved water supply. Requests are generally forwarded through KHC members to the regional or central offices.

2. The community must be willing to contribute to the construction; usually free labour, locally available materials and occasionally money. On completion ownership of the projects is handed over to the community.

3. The project must be within the present capabilities and resources the KHCDP and its donors. A request to develop 750 ha of irrigated land in a settlement area had to be turned down since it was beyond KHC's means.

4. The technology must be appropriate to the human and physical environment. Generally in rural areas it should be as simple and free from maintenance as possible. In certain areas a hand-pump is "hi-tech" to the users.

5. In each KHC region young men should be given on-the-job training and assistance given to establish them into water teams.

6. A number of people from the community should be trained to maintain and repair the system.

7. The way the KHC Teams carry out the work and live among the communities is as important as the work itself.

SPECIFIC EXPERIENCE GAINED ON SPRING PROTECTION PROJECTS

Ground water emerging as springs, if protected from contamination, can provide a valuable, safe and simple source of drinking water. In many parts of highland Ethiopia springs are a major source of domestic water.

Investigation and Planning

Requests for assistance are directed though the regional churches to the KHCDP office in Addis Ababa. From there a member of the Water Team is despatched to investigate and set priorities.

Ideally surveys are carried out during the driest time of the year, around January to March. With the regional KHCDP Coordinator, contact is made with Awraja and Woreda officials. They arrange for visits to the various kebeles. With prepared

survey forms an inventory of existing and potential sources is made, including enquiries regarding the flows during recent droughts. Flows are measured with a vee-notch weir or by bucket and stop watch. The location of the springs and their type are recorded, together with locally available resources.

As important as the technical survey are the sociological enquiries. Local representatives are asked to give a general idea of the number of families using each source at different times of the year and whether there are any particular water related health problems. If some improvement appears practical, the leaders are asked if the community are willing to contribute towards the construction of the new scheme.

Having surveyed a number of springs, priorities for improvement are set. The following criteria is usually adopted:-

1. Source badly contaminated.
2. Large number of people using the source, particularly in the dry-season.
3. Willingness of community to participate in the project.
4. Practicality of making improvements.

No hard and fast rules are adopted in applying the criteria to a particular spring. Usually an enthusiastic community with a willingness to cooperate are not disappointed.

Occasionally the location of a spring makes it impossible to improve by simple measures and a well dug into the same water bearing strata proves a suitable alternative.

Site for improvement are chosen in consultation with woreda officials and the concerned Planing Office. A project proposal for funding and government approval is then drawn up. To date surface water programmes have been covered by agreements with the RRC.

Community Participation

The recipient community are asked to cooperate as work beings. Usually a large work party is organized by the Farmer's Association to make an access to the spring, to collect building materials (sand, gravel, rocks etc) and, under supervision, to clean and dig back to the source of the spring. If cooperation is not forth coming at this stage the Teams have been instructed to abandon the project before too much time and effort has been invested. Where trenches for long pipe lines are required, dividing the work and allocating the digging to groups of beneficiaries has proved successful.

The construction work is then carried out by the Water Teams assisted by locally hired labour.

Design and Construction

Springs occur where an impervious layer of rock or clayey soil forces ground water to flow out onto the surface. The impervious layer can be quite thin.

Ground water, as it moves through the soil, is filtered and therefore is reasonably pure. Unfortunately it often polluted as it emerges from the ground. Springs are often seen feeding directly into muddy pools, used and polluted by humans and animals alike. A spring, if it is to used for human consumption, must be protected at source.

After digging away all muck and vegetation three basic types of spring are encountered in southern Ethiopia:-

1. Single eye spring - water emerges from one point, often a fissure or joint between rocks.

2. Multi-source spring - water flows out of the ground over some distance, forced out by a definite horizontal boundary of impervious rock or clay.

3. Diffused spring - water percolates or "boils" to the surface through soft soil but without any defined source. This kind of spring is not as good as the other kinds but may be heavily used.

Occasionally a stream will disappear into the ground and reappear as a "spring". There would be no point in protecting this kind of "spring" as any pollution will not have been filtered out in the short passage through the ground.

Armed with a few of simple principles and some basic tools, improvement and protection measures can be carried out on a good number of springs. These principles are listed as follows:-

1. Contain the pure ground water before is emerges from the ground and prevent outside contamination and surface runoff from entering at or near the spring source.

2. If the protection works cause the water level to rise above the spring it is likely to be forced to divert elsewhere. Therefore the position and size of the outlet and overflow pipes is important.

3. The protection works should be long lasting and strong enough to withstand human or natural forces. Assume that very little maintenance will be carried out, but make provision so that repairs can be done without too much difficulty, ie include a manhole in the spring box and unions in the pipeline.

4. When digging to expose the source do not disturb the spring unnecessarily and do not dig through the impervious layer below the spring.

5. If water from a springs is to be pumped to a village, do not pump directly from the spring as the fluctuations in level might force the spring to go elsewhere. Build a separate tank from which to pump.

Although each spring is different, through experience two basic designs for protective works have developed. The aim is to keep any design as simple as possible so that local technicians, with limited previous experience, can be trained to continue the work.

Single eye or multi-source springs

To contain and protect this kind of spring, a concrete chamber or box is built over it (figure 1). The length of the box should be long enough to catch all the spring. The height will depend on its location and flow. For a large important spring a chamber may be needed into which a man can climb to clean it out. The top needs to be above any flood level if close to a river. Usually chambers do not need to be large and expensive. In practice they turned out to be about 50 to 70 cm high.

The side on which the spring enters is built up with rocks leaving small gaps between them. Where the water bearing layer contains fine particles, a gravel and then sand layer is placed behind the rocks to prevent the particles being washed into the box.

At least three galvanized steel are cast into one wall of the chamber; an outlet pipe, an overflow pipe and a wash-out pipe. The outlet pipe is set about 15 cm above the floor of the chamber to allow any silt to settle without being carried into the pipe. It should have a rust proof strainer on the end. A piece of plastic pipe with one end plugged and 6-8 mm holes drilled or burnt into it will do the job. The wash-out pipe should be as low as possible and fitted with an end plug or cap to allow silt to be drained out from time to time. The overflow of the same diameter or larger than the outlet, should be positioned below original level of the spring. The end of the pipe is covered with plastic mosquito gauze fixed with plastic coated electrical wire.

The size of pipes required depends on the maximum flow of the spring and the length and slope of the pipeline. In order to help prevent blockages, usually a 1½" diameter pipe is used even though the flow might not demand it. In one case three 1½" pipes were used and still some flow went out of the overflow.

Galvanized steel (G.S) pipes should be used to ensure that the pipes are not broken off in the concrete. To firmly anchor them into the wall a couple pieces of reinforcement bar can be welded to the pipe. Alternatively the pipe can be made rough by sawing the surface with a hacksaw.

The walls of the chamber are constructed of 10 to 15 cm thick concrete with 8 mm diameter steel reinforcements bars placed 15 cm apart in horizontal and vertical directions in the centre of the wall. Masonry could be used if skilled masons are available, in which case the walls should be 40 cm thick. The walls must be founded on firm ground, a little below the chamber floor. Timber is used to build a formwork to cast the concrete.

It is possible to place concrete under water if it is not moving. The formwork can be sealed outside with mud and grass roots. The water is diverted out through previously threaded pipes which later become the washout. A concrete mix of 1 part cement, 2 parts sand and 3 parts gravel or crushed rock is mixed thoroughly, placed in the formwork and compacted well with a tamping rod.

For small chambers a concrete roof slab 8 cm thick with 8 mm diameter steel bars at 15 cm spacings in both direction is sufficient. For a larger chamber the slab will need to be thicker with more steel. To cast the slab a formwork capable of supporting the wet concrete is

built. For small chambers it may not be possible to get the formwork out after concreting in which case galvanized steel or asbestos cement roofing sheets supported by stone pillars can be left in place. The slope of the roof is to the front of the box.

An opening for an access manhole for cleaning out or repairs is left over the outlet pipes. A heavy concrete cover raised above the slab level is required, which is either secured in place by a chain and padlock (if the area is not wet) or sealed with weak cement mortar.

Where it is possible for surface water to enter the spring behind the box it should be sealed using puddled clay (clayey material with sufficient water added to make it plastic) stamped into position with feet and poles.

The protected spring is then connected to a water point at a lower convenient location by a G.S. or PVC pipe or pipes. The slope between the spring and the water point should be about 1 in 50 or steeper. PVC pipes, which are cheaper and easier to lay than G.S., can only be used where is no danger of them being uncovered. They should be buried at least 60 cm in the ground and surrounded by sand or soil without stones. The PVC pipe needs to be changed to G.S. pipe where the pipe is near the surface and as it enters the water point.

Diffused Springs

The purpose of the design for this kind of spring is to collect the water while it is still 1 or 2 metres in the ground and before it becomes diffused and polluted (figure 2). To achieve this a PVC collector pipe is set in the ground, uphill of the spring outlet.

The collector pipe is laid in a trench 1 or 2 metres deep, dug into the water bearing layer across the slope of the hill. To determine the depth to the aquifer a number of trial holes are dug. The collector trench is then sighted so that it slopes to one point.

After digging the trench a PVC pipe with holes drilled or burnt into it is laid and surrounded with rocks. Around the rocks gravel and then sand is placed to at least 15 cm above the pipe. The trench is then backfilled with the soil mounded over the trench.

At the lowest point in the trench a small concrete or masonry collector box is built. The PVC pipes are set into this box and an outlet pipe takes water to a water point. The construction of the box is similar to that described for single eye springs. The area round the box is backfilled with puddled clay so that water is forced to enter the box and is not able to flow along side the outlet pipe.

User's Water Point

From the point of view of the user the water point is the most important part of the scheme. It is no pleasure to wade in ankle deep mud to obtain clean water.

The principles of the design are given as follows:-

1. Large hard-stand of concrete or masonry is constructed below the outlet.
2. A good slope on and away from hard-stand is maintained.
3. One water spout should be high enough to fill the largest pots.
4. On all outlets an elbow is to be fitted to prevent corn-cobs or sticks being jammed in the pipe.
5. Outlet pipes should be held firmly in a small concrete or masonry support wall or structure.
6. If the pipe reaches a low point and rises again, a wash-out is required.
7. Stones or rocks are required around the area to prevent it becoming too muddy.
8. If access is steep and slippery, steps should be built.

It has been found that the users benefit from a concrete slab built on the ground a short distance away for use as a laundry pad. The slab has to be well drained.

Storage Reservoir

Where the flow from a spring is small or reduces during the dry season a decision has to be taken whether to build a small tank or not. If taps on the tank are not maintained, as often is the case, the tank will not fill up and the work wasted. Only if the user's will look after and repair the taps is a tank of reinforced concrete, block work or masonry constructed. New robust self closing "Talflo" taps are now being used - locally available taps have a very short life.

Because of the danger of disrupting the spring it is not good practice to use the spring box as a reservoir. The outlet of the spring should remain free flowing - into a tank or outlet spout.

Further Protection Measures

To divert surface water away from the spring a ditch should be dug 8 to 10 m away uphill from the spring. Spoil from the ditch can be placed to form a bund on the down-hill side of the ditch. To protect a diffused spring this is particularly important.

To keep humans and animals away from the spring, a fence or thorn hedge should be established around the area, preferably on the bund. Also the water point should be fenced to keep animals away. These tasks are normally done by the users, as they will be responsible for maintaining them.

Handover and Maintenance

On completion of a spring protection project, local officials and farmers' representatives are invited to the spring. Maintenance procedure are explained to them and the scheme is then handed over. It then becomes entirely their responsibility. There are no long term inputs from the KHC Water Teams. For larger projects a report and "as constructed" drawings are given to WSSA.

The only maintenance usually required is keeping the area round the spring and water point clean, repairing any fences, maintaining the diversion ditch and occasionally clearing out tree roots and flushing out silt from the chamber. On the occasions when a tank is installed a pipe wrench and spare taps are donated to the community.

Training

As the Water Teams move from region to region the local KHC assigns 2 or 3 young men to the Team for training. Also two or three men from the kebele's are appointed to work on their own projects in order to understand how it works and what might need repairing.

PROBLEMS ENCOUNTERED AND FUTURE IMPROVEMENTS

With more and more of national life being centrally planned the process of surveying grass-roots needs has become more complicated. However, if one has the correct papers from a central government department, regional officials are only too willing to assist in any way they can. Problems can arise when a visit to a site is taken as a promise of help by the farmers or officials.

It has become clear that, in order to obtain the maximum benefit from a new water supply, education on the use of water and its link with health must accompany the construction programme. We are beginning to develop this. Ideally our water activities should be integrated into other development work to see the greatest impact on a community.

Maintenance still constitutes a major problem to be overcome on many rural water supply projects. It is encouraging to see WSSA taking more of a role in this but they have limited resources and an ever increasing number of systems to maintain. The key lies in educating the users to take responsibility for their own systems. This is WSSA's own goal.

An indicator that we have sometimes failed in our efforts to educate the communities as to the benefits and correct use of new water systems is the damage and misuse that often occurs. One can understand inquisitive children dropping stones into a well but not adult beneficiaries who do nothing about it.

General we are happy the way our Water Programmes are developing. The key to success is dedicated, well trained field staff with the necessary technical, logistics and fund-raising support from the regional and central offices. We trust that we can continue and increase our activities in the future as we seek to meet the very basic need of men - the provision of good, wholesome water.

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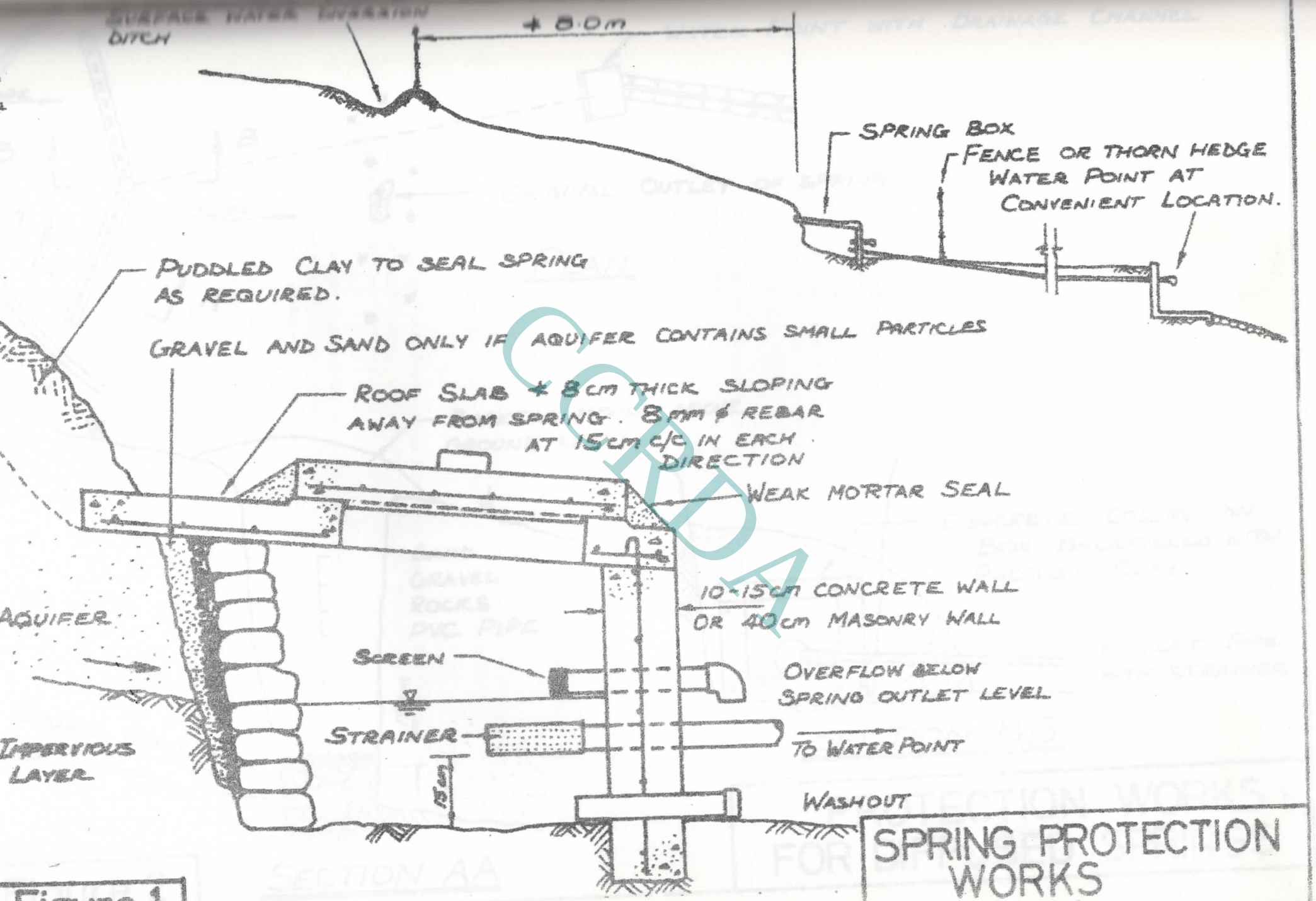

SURFACE WATER DIVERSION DITCH
+ 8.0m
SPRING BOX
FENCE OR THORN HEDGE
WATER POINT AT CONVENIENT LOCATION.
PUDDLED CLAY TO SEAL SPRING AS REQUIRED.
GRAVEL AND SAND ONLY IF AQUIFER CONTAINS SMALL PARTICLES
ROOF SLAB + 8cm THICK SLOPING AWAY FROM SPRING. 8mm ϕ REBAR AT 15cm c/c IN EACH DIRECTION
WEAK MORTAR SEAL
10-15cm CONCRETE WALL OR 40cm MASONRY WALL
AQUIFER
SCREEN
OVERFLOW BELOW SPRING OUTLET LEVEL
STRAINER
TO WATER POINT
IMPERVIOUS LAYER
15cm
WASHOUT
SPRING PROTECTION WORKS

Figure 1

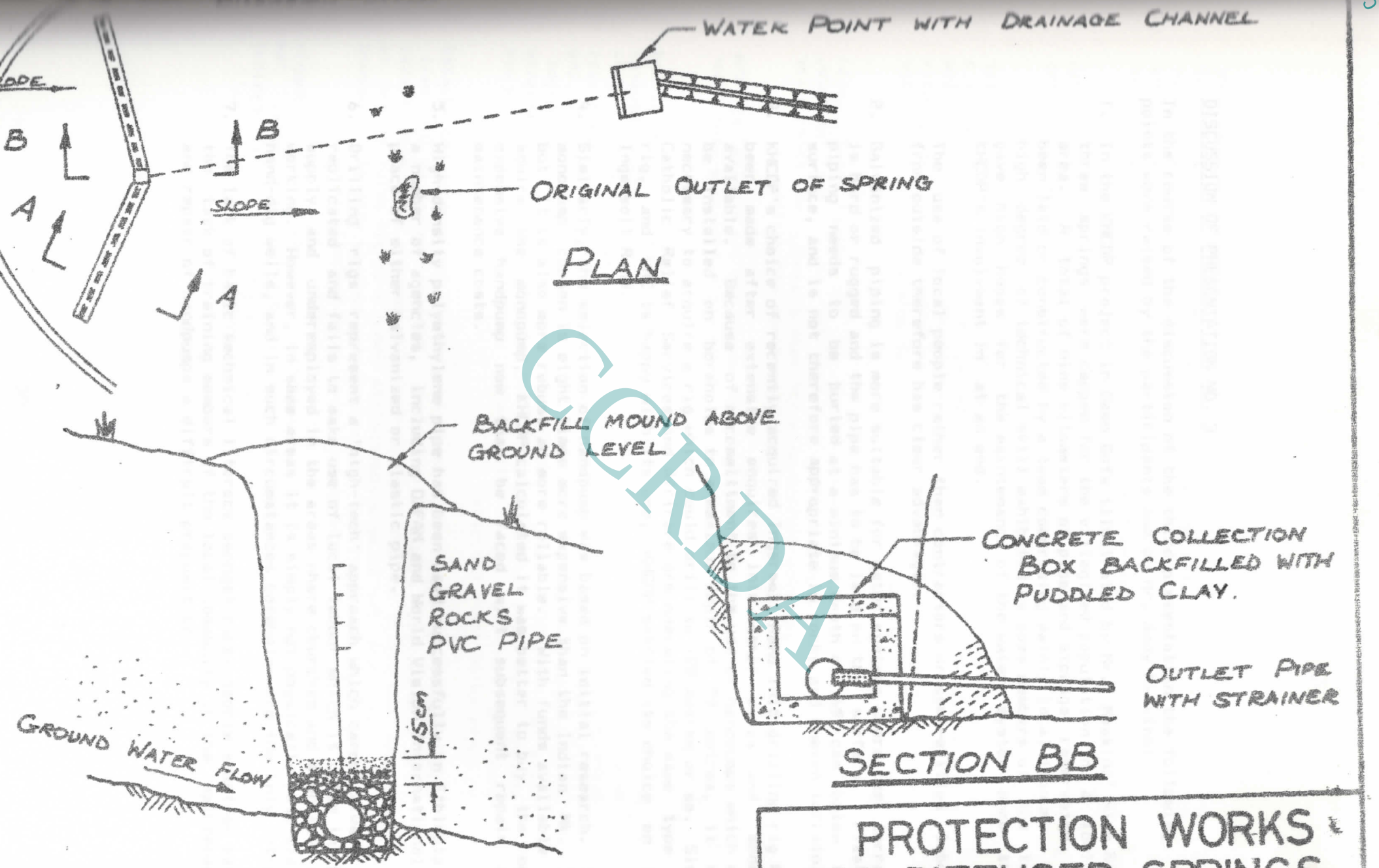


Figure 2

PROTECTION WORKS FOR DIFFUSED SPRINGS

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DISCUSSION OF PRESENTATION NO. 3

In the course of the discussion of the third presentation the following points were raised by the participants and by Mr. Andy Meakins:

1. In the KHCDP project in Gamo Gofa illustrated by Mr. Meakins' hide how, three springs were capped for the villagized population in a lowland area. A total of nine kilometers of pipe and storage reservoirs had been laid or constructed by a team comprising mainly local labour. The high degree of technical skill exhibited by some members of the team gave high hopes for the maintenance of the water system once that KHCDP's involvment in at an end.

   The use of local people rather than contractors or semi-skilled labour from outside therefore has clear advantages.

2. Galvanized piping is more suitable for water systems where the terrain is hard or rugged and the pipe has to be laid on the surface. Plastic piping needs to be buried at a minimum depth of 60 cms below the surface, and is not therefore appropriate in rocky and uneven terrain.

3. KHCDP's choice of recently acquired Ingersoll Rand TH10 drilling rig had been made after extensive enquires into other makes and models available. Because of a committment to the use of handpumps which can be installed on boreholes to a maximum depth of 90 metres, it was necessary to acquire a rig which could drill to 120 metres or so. Since Catholic Relief Services and Africare are operating the same type of rig, and WRC is happy with its use, KHCDP settled its choice on the Ingersoll Rand.

4. Similarly, the selection of handpump was based on initial research. The monopump chosen is eight times more expensive than the Indian Mk. II, but it is also more robust ad more reliable. With funds available to aquire the monopump, KHCDP calculated it was better to buy the more expensive handpump now than be faced wiht subsequent repair and maintenance costs.

5. High-density polyethylene pipe has been used successfully in Ethiopia by a number of agencies, including OXFAM and World Vision International in place of either galvanized or plastic pipe.

6. Drilling rigs represent a 'high-tech' approach which cannot always be replicated and fails to make use of local labour which is often in good supply and underemployed in the areas where churches and agencies are working. However, in some areas it is simply not physically possible to hand-dig wells, and in such circumstances boreholes are the only option.

7. The lack of basic technical literacy amongst rural people sometime makes the task of training members of the local community in the maintenance and repair of handpumps a difficult proposition.

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8. While the hydrgeological status of the land determines whether drilling or hand-digging is appropriate in a given area, it is vital that handpumps are maintainable, sustainable and replicable. On the basis of this maxim, UNICEF for example is about to launch a clean water supply campaign adopting the twins combination of borehole and handpump; it is essentially a 'high-tech ' approach with a 'low-tech ' objective.

9. On-the-job training for water supply teams, perhaps through the implementing agency or local church office, provides the best grounding and experience for semi-skilled labour in water projects.

10. Provision should always be made in the design of installations for future repair and maintenance: for example, a union on the waterline a manhole cover on the spring box and a wire mesh over the end of the overflow or water pipe are all essential to guard against contingencies which are actually quite likely to occur at some point in the water system's history.

11. KHCDP uses few food-for-work inputs in the belief that local communities should be willing to work for their own welfare. Technicians are employed individually for each project, and receive per diems and a salary according to their experience and ability.

12. It is worth spending time on the water source and the profile of the pipe to the supply point at the start of the project to save time later on maintenance and modification.

13. Brass taps can be a problem, first because they malfunction easily and secondly because they are sometimes taken away as ornaments. Several agencies, including KHCDP, have had favourable experience with self-closing TALFLO valves, which are robust and reliable. However, care must be taken with the head of water above the TALFLO: if it is too great the valve is difficult to open, if too small the flow is restricted. Night storage reservoirs are worth installing with these valves to maximize available resources. Other self-closing, spring-loaded taps are in use in parts on northern Ethiopia.

14. Other traditional methods of transporting water, for example the adapted inner tube bucket, should be respected. Rollers mounted on the wall around the top of an open well can assist in drawing water with bucket and rope, and can be more appropriate where a single water source is serving larger communities. Improvement can be made with slabs around the water source and strengthened walls around the well itself.

15. Health education undertaken in parallel with clean water supply development is vitally important to any project in rural areas. The integrated approach will greatly enhance the impact of the physical improvements made to the water supply in a given community.

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DISCUSSION PAPER:

FOR A WATER PROJECTS INTEREST GROUP WITHIN CRDA

by Mr. Walter Funk, Kale Heywet Church Development Programme

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WATER ASSOCIATION PROPOSAL

A Discussion Paper

A nearby and adequate supply of good water is not only convenient, but is also essential for health, hygiene and nutrition. Next to the air we breathe, water is more critical to our general well-being than any other single commodity. An adequate supply of air is a simple matter to most people, no matter where they live. Unfortunately, a good supply of water is not such a simple matter. We who have been working with water supplies realize this better than most people. In our context here, the problems are not only technical, but social, economic and logistical as well.

One way of solving these problems is through meetings such as this, where we can gather to share our experiences and in general be encouraged to know we are not alone in facing the challenge of supplying water to an ever growing population.

However, there is much more that we can do. I strongly believe it would be beneficial to form an association of water workers. This would be a technical association, geared to meeting the needs of the engineers and technicians. These are the people who are exposed to the daily problems and challenges of implementing water projects successfully.

Why a water association?

1) To encourage and motivate each other.
   one's work being evaluated and recognized by one's peers.

2) To exchange information.
   avoid duplication of efforts.
   let others learn from one's mistakes and successes, both on a technical and sociological/political level.
   rapid dissemination of innovations in products and procedures.
   consultants/experts can be brought in for the benefit of more than one group.

3) To establish standards in equipment and procedures.
   prevent the use of inappropriate equipment and procedures.
   ease of maintenance: because the same type of equipment is used by various organizations, one technician can maintain all projects in a given area.
   also easier to maintain stock of spare parts in country and eventually to manufacture parts and equipment in this country.

4) To encourage and train newcomers, both national and expat.
   junior technicians and engineers can be given specific goals to strive for and attain (some type of accreditation).
   receive recognition for good work.
   provide a support infrastructure to which these people can turn to for advice.

5) To present the views of the association as a strong, unified voice.
   easier to bring in experts and equipment.
   influence decisions that affect the members.
   respond quickly and efficiently in emergencies.

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Operation of Water Association:

Formal meetings semi-annually:
- each member presents a report of activities of the last 6 months.
- members encouraged to present formal reports of unique or new projects, procedures or equipment.
- special presentations from experts outside the association.
- review standards for equipment and procedures.
- formal recognition of members who have made exceptional contributions in their work.
- outlook for the future and setting of goals.
- usual procedures of electing officers, making by-laws, etc.

Informal meetings bi-monthly:
- relaxed atmosphere to make acquaintances to share ideas.

Executive meetings of the various committees as required.

Note: This association would operate under the CRDA.

Establishing this Association:

Membership should be composed of individuals who are technicians and engineers working for members of the CRDA. Because the purpose of the association is to deal primarily in the technical area of water development, the identity of the NGO will be of secondary importance to that of the individual himself.

Initially a committee of a minimum of five members is required to establish this association. Two members can be from the CRDA, but three must be from the NGO's themselves. This committee will then start working towards establishing an association, according to their best judgment and the wishes of the potential members. The association may in the end be quite different from that outlined above, and it may take some time to achieve its goals and become fully operational. However, it will be successful if there is good cooperation from its members.

CRDA has assured its support, without which such an association could not be possible. However, judging by the success of the medical committee, this association has every potential of being very successful.

One problem I have heard expressed is that many of the members would be working in quite remote areas, and be unable to attend all the meetings. It should be possible, however, for most members to attend the formal meetings on a twice-yearly basis. Also there will be newsletters to keep members informed of events within the association and other relevant information as well. Hopefully, this association will operate so well that members will find the benefits of full participation worth making it a priority.

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Functions of Water Association:

Administrative Committee:

- call meetings.
- ensure members are informed of meetings and other events.
- selection of officers.
- general coordination.

Technical Committee:

- establish standards for equipment and procedures (criteria of technical merit, practicality and safety).
- identify members deserving special recognition, not only in absolute terms of achievement, but also in terms of achievement relative to resources available.
- call for, and review reports for meetings.
- identify consultants/experts both in Ethiopia and from abroad that would be of value to members.

Information and Publications Committee:

- publish a newsletter (perhaps bimonthly).
- maintain a reference library,
  - -textbooks.
  - -periodicals.
  - -manufacturers literature.
  - -formal reports presented at meetings.
- publish formal reports presented at the semi-annual meetings.
- publish a directory of all members.
- publish a catalog of suppliers and a guide to import procedures.
- publish a directory of expat consultants and organizations that can assist in specific areas.

Social Committee:

- plan social gatherings.
- plan itinerary of guests.

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DISCUSSION OF CRDA WATER PROJECTS INTEREST GROUP PROPOSAL

Following Mr. Walter Funk's proposal for a Water Projects Interest Group, Bro. Augustine O'Keeffe, CRDA, told the meeting that two other interest groups-one for churches and agencies operating medical programmes and the other for those involved in child-care programmes - are currently meeting within CRDA. Both are serving a useful purpose, and are assisted by committees that arrange and produce newsettlers for the entire group.

In order to discuss the proposal further and review what resources and involvment would be required, the following four volunteers put theaselves forward to meet in the future with Ato Sahle-Mariam Mogus, CRDA Rehabilitation and Development Department, as a working group:

Mr. Andy Meakins	- Kale Heywet Church Development Programme
Ato Girma Regashaw	- World Vision International
Ato Beyene Megersa	- Lutheran World Federation/US
Mr. Walter Eshanaur	- Baptist General Conference Mission

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FEILD TRIP TO SELALE, NORTHERN SHEWA:

to visit CPAR and BGCM rural water development projects

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CANADIAN PHYSICIANS FOR AID AND RELIEF (CPAR)
PROJECTS AT GINNO AND NUNNO HARBO, YAYA GULELE WEREDA, SELALE

Ato Gizaw Shiberu, CPAR Project Co-ordinator gave a briefing to the participants on projects being implemented in the three weredas of Yaya Gulele, Debre Libanos and Wuchale in Selale awraja. Since January 1989, 13 springs have been capped and plans are in place to complete 60 by the end of the year. A total of 24 kilometres of road has also been built on a food-for-work basis to the project sites.

Technically different spring protection methods are used to suit conditions at each site, but all are implemented as part of a 'matching fund' programme: that is to say, CPAR conducts a feasibility study and provides capital inputs, while the community provides locally available materials and labour. At present, each community sends between ten and fifteen people each day to work on each project.

CPAR is also encouraging local involvement in repair and maintenance by training semi-skilled labour from the area. Four water development teams are currently working, comprising a mason and other craftsman drawn from the local community rather than from outside.

In addition to the spring capping programme, CPAR is also undertaking work in the agricultural and health sectors. All projects at present are situated in the highland area of the awraja, but further work is planned for the rural communities in the Muger valley. Because of very different conditions there, feasibility studies are now being done and designs drawn up for effective water supply systems. In the highland areas there is no shortage of water, and springs are left without taps so that the flow can be used for the irrigation of surrounding fields.

Following this briefing at CPAR's Debre Libanos base camp, the participants made their way to Ginno and Nunno Harbo farmers' associations, and in the discussion and questions that followed, Ato Gizaw gave the following additional information:

1. At first, it took between two to three weeks to construct each spring protection unit. Now, each is complete in ten to twelve days, and in one case it took little as five days to cap a spring.

2. The cost of each unit is between 800 and 1,200 Birr. This does not include the cost of installing laundry stands and cattle troughs which, due to limited funds, will be provided in phase two of the project once clean water has been supplied to each community.

3. Different grades of gravel have been laid over the eye of each spring, starting with the largest and becoming finer towards the collection chambers, in order to provide some filtration of water before it reaches the supply point. In addition, the surroundings have been cemented below the surface, and plastic Sheeting laid on top to prevent surface water seeping in. A two-metre deep diversion ditch will also be dug into the incline about the spring, and a wall erected around the installation to prevent animals and humans congesting the area or causing damage.

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4. The gravel over the spring not only provides filtration of the water but makes subsequent maintenance easier. That is why the collection chamber are not placed directly over the springs.

5. Discharge from the spring at Ginno has been measured as high as 1.5 litres per second, although the flow was not so great at the time of the field visit.

6. No elbow had been fitted to the overflow pipe from the collection chamber. Participants felt this represented a risk, since children are wont to be inquistive and stick objects down open-ended pipes. It was felt such a contingency should be taken into account, despite the community's commitment to maintaining the spring and the water stand.

7. The protected spring at Nunno Harbo was built to similar specifications as the one at Ginno. However, two pipes had been fitted at the water stand because of the great rate of discharge following rainfall. Up to 1,500 people are dependent on this newly protected spring for their clean water supply.

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BAPTIST GENERAL CONFERENCE MISSION (BGCM)
PROJECTS AT MACHELLA ANDODE AND BOSOKE, WUCHALE WEREDA, SELALE

Mr. Wally Eshenaur, BGCM Projects Engineer, gave a briefing to the participants at BGCM's base camp at Muketuri on projects being implemented in Wuchale wereda.

BGCM has been providing domestic water supply to communities in the area since September 1986, following an initial involvement in relief programmes in 1985. Hand-dug wells, boreholes, spring protection units and handpumps are all being provided under BGCM's water development programme.

The handpumps installed are designed by BGCM and locally made and maintained. A fibre-glass rod is used for the pump itself, and the design is such that there is no lateral movement in the moving parts. Only the brass and leather piston and fibre glass are is imported; the remaining part are made at BGCM's workshop in Addis Ababa and then assembled at Muketuri.

As a concequence of the flat terrain, there are very far springs on the high plain around Muketuri, and BGCM has dug or drilled 16 wells in the area. All hand-dug wells are subsequently lined with concrete tubes. Beyond Lemi there are many springs on the escarpment at the edge of the gorge, and BGCM has been capping many of these.

When implemnting a project, BGCM first visits the village and makes contact with the farmers' association. An internal structure in the form of a water committee is then set up, and a physical study of the area undertaken in parallel. The water committee mobilizes the community to provide labour for the project: initially this was achieved on a relief food-for-work basis, but it is hoped that the shift to voluntary labour can be made in the future. Ten to twelve people are chosen to dig the well, although if the depth required is below 15 metres, BGCM uses its rig to drill a borehole.

A health education programme is undertaken in tandem with the physical work. Visits are made to the community nine times during and after the construction of each water supply installations by a health education team to teach the importance of hygiene and sanitation in connection with the clean water supply. Four or five months later, the team returns to evaluate the success of the educational programme.

Subsequent to the sinking of a well or protection of a spring, the community is required to dig diversion ditches, build fences and generally protect the surrounding area with slabs and rocks. This work might also include the establishment of vegetable gardens. BGCM's involvement with the physical aspects of each project is complete once the well has been dug or the spring capped.

In the course of the ensuing question and answer session and visit to two project sites, Mr. Eshanaur provided the following additional information:

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1. The BGCM handpump, which is based on a number of other designs, was initially intended for installation on boreholes to a depth of 60 metres. However, none so deep were required in the area. so the pump was redesigned to operate to a depth of 40 metres. At present, the deepest borehole in Wuchale is 35 metres deep. No maintenance has yet been required on any of the pumps installed.

2. Due to pressure to meet in time the requirements of the agreement signed with RRC, BGCM neglected both training in the repair and maintenance of the water supply units, and health education. In future, BGCM would like to spend more time with each village working on these aspects of the programme. Ideally, a month or more should be devoted to each village, even though the physical work can be complete within a week or so. BGCM would also like to expand into irrigation programmes with the water resources developed.

3. Although the piston of BGCM's handpump is imported, it might in future be possible to have it manufactured by a local foundry. One advantage of the design being used is that the piston can be withdrawn from the handpump without removing the pipe.

4. At present, approximately 25,000 people are being served in the area by these newly installed water supply systems. BGCM's target for the next three years is 30 new systems, taking into account the time to be spent with each community on training and health education.

5. Despite the fact there have so far been no problems with the handpumps when in uninterrupted use, there are advantages to limiting the hours of their use. At Bosoke village, the use of the handpump is restricted to eight hours each day. This system encourages someone in the villages to be charged with the responsibility for locking the pump, stopping its abuse by children and generally looking after it. The water committees, each comprising at least two women, make their own rules in each village, and BGCM imposes no requirements of its own on the community. At Bosoke, the villages pay 25 cents each month per household to pay the guard to chain and watch the pump, and his monthly salary there amounts to 25 Birr.

6. Discussions are currently taking place with the WRC regional authority to decide who should be responsible for maintaining pumps. It is hoped a system will be set up within the next phase, so that decisions can be made on who to train, what equipment should be provided, and whether a revolving fund for spart parts can be established to keep each pump operational.

7. It is difficult to test the yield of each water source. Once water has been found with a resistivity test, BGCM digs to three metres or more and then installs a pump. On the basis of ten litres per person per day, all the wells sunk to-date have been sufficient to serve the standard 1,000 person villages of the area. That have been no problems with yields so far, except at one hand-dug well that was sunk into rock and which runs dry at some times of the year.

8. If EWWCA introduces a standard pump for Ethiopian to assist in the maintenance and spare parts process, BGCM would be happy to use such a pump rather than its own design, as long as it was also inexpensive. Without the brass piston casing, each BGCM pump losts 700 Birr for raw materials. It could also be made more cheaply by importing the steel, but BGCM uses Ethiopian produce to prove that it can be manufactured locally. For all parts, including the piston but excluding skilled labour, the BGCM pump costs approximately 1,400 Birr to make. If all overheads and incidental costs are added in, then the cost rises to 12,000 Birr each in the context of BGCM's water development programme.

9. BGCM's small drilling rig can go to a depth of 100 metres and can bore a hole of up to eight inches in diameter. BGCM uses a six inch hole with a four inch casing. Ditches are dug to a depth of 50 cms around wells and filled with gravel and concrete to prevent the seepage of rainwater. When hand-digging a well, the hole is two metres in diameter, and concrete conduits packed around with gravel used to line it.

10. The reason two water supply points are so close to each other in Machella Andode and Bosoke is that one was established next to the BGCM base camp as a demonstration model. The resistivity test proved accurate, so a well was hand-dug. Later, BGCM plans to install a submersible pump to supply water to the base camp. The borehole on the other hand was provided solely for the use of the village. A survey was conducted in the area to see which villages has priority needs, and otherwise the water systems BGCM has provided are evenly spread throughout the wereda.

11. BGCM and CPAR work in close proximity in Selale awraja, and even in the same wereda. Talks are going on over a possible awraja-wide programme, and co-operation between the two agencies is productive. BGCM above all wants to provide water to communities throughout the two weredas of Wuchale and Ensaro, while CPAR is intent in the training of Traditional Birth Attendants, Health Assistants and other personnel in the awraja.

12. BGCM has had to concentrate on wells and borehole on the high plain only because of the scarcity of springs. There is some water near the surface, and if a spring with an eye is identified the policy is to cap it. However, if there is no eye, BGCM favours the sinking of a borehole and installation of a handpump.

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CONCLUDING DISCUSSION AND RECOMMENDATIONS

On their return to BGCM's Muketuri base camp, the participants discussed both sets of water projects visited in Selale. Questions were answered on behalf of CPAR by Ato Seyoum Abebe and for BGCM by Mr. Walter Eshenaur.

Following their discussion, these recommendations were offered by the workshop based on observations made during the field visits:

1. The interests of a rural community's livestock are indivisible from these of the human population. Cattle ploughs and laundry stands should be provided at the same time as clean water supply.

2. The immediate vicinity of wells and protected springs should be improved to enhance drainage and prevent the build-up of mud.

3. Better sanitation should be introduced in parallel with clean water systems. If pit latrines situated in villages are not appropriate for a rural population which spends much of its time in the fields, then the 'car method', or 'dig and cover', should be encouraged through health education. If pit latrines are not well constructed or well maintained, it is better to have no latrine at all than risk the spread of disease.

4. Tests on the rate of discharge or springs on the capacity of wells is advisable to ensure there is sufficient water for the beneficiary population. Submersible pumps represent one good means of testing the capacity of a well.

5. Projects must be sustainable: the setting up of revolving funds so that spare parts can be purchased after the implementing NGO has withdrawn, and the training of local people to maintain the installations in case of malfunction or wear, are vital strategies for sustainability.

6. Baseline studies at the outset and impact studies once the project is complete are integral parts of a good water development project. For example, studies in behavioural change to gauge the effectivity of health education, and technical tests in bacteriology to judge the purity of water, give an objective base for future planning. Very little data existed for Selale before CPAR and BGCM's projects were implemented, but it was evident from an MoH survey that only seven per cent of the awraja's population had access to clean water, while access to health services was similarly low. Each child could expect five medical episodes each year. In these circumstances, an integrated approach, involving clean water, health education and services, is necessary. While little baseline data exists for Selale, impact studies should still be undertaken. In the final analysis, the success of a project depends on how people's lives have been changed, and ultimately this impact should register as improved food productivity for farmers in the area.

7. Cut-off drainage every ten or twenty metres is needed alongside roads constructed on steep inclines to ensure that the surface is not washed away by heavy rainfall.

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8. Surveys of springs to be protected should be undertaken at least in the dry season, and also if possible during the rainy season, to ensure there is sufficient discharge. Ideally, springs should be surveyed three times. Care should be exercosed when asking the community about the rate of discharge from a spring, because people will sometimes exaggerate in the belief that work on the spring can improve the flow. It is important therefore that the spring is seen at least once in the dry season despite any assurances received from the community to its reliability.

9. Elbows should be fitted to water point outlet and overflow pipes to ensure nothing is placed inside to damage the system. If elbows are not available, pipes can be crimped or bent downwards to the same effect.

10. CPAR's target to protect 60 springs in one year is ambitious. Some participants felt it would be better to concentrate on a smaller number and improve the quality of associated work. They felt that by gaining experience slowly, mistakes can be avoided: if a design fault is identified at a later stage when 60 springs have already been completed, the remedial action required will be costly and damaging. Other participants felt that spring protection units are not so complicated that really disastrous mistakes could be made, and in view of the pressing need for clean water it is better to cap springs whenever possible. This camp felt reaching the population was of paramount importance, and that it is a luxury to worry excessively about detail and thereby delay impact: if basic services are provided now, minor mistakes can be tolerated. It will always be possible to go back and make improvements at a later date.

11. Prolonged food-for-work campaigns can depress the price of grain on the local market. Spot prices should be collected though regular market surveys to ensure water projects implemented though food-for-work do not have a deleterious effect a farmers' food production incentives. CPAR has not used food-for-work in protecting springs because it is believed that projects undertaken for the benefit of the community should include a voluntary contribution. BGCM have been using food-for-work on a relief basis, but hopes to be able to stop at the end of 1989 to ensure market prices are not permanently depressed in Muketuri. The participants noted that if food-for-work had been used previously by an implementing agency, or if it was being used by another agency in a nearby area, it may be difficult to encouarge a community to give their labour freely on further projets.

12. Community participation has brought down the unit cost of each water supply system dramatically, and both CPAR and BGCM were applauded for this accomplishment by the participants. If the benefits of clean water can be impressed upon a community through health education, then voluntary participation will follow. Ultimately the test of whether a rural water development project has been worth the effort is to see if the community is now willing to maintain and repair the installation to maintain the flow of pure water to their homes.

13. If there are genuine food deficits in a given area, and if market prices have still not returned to their pre-1984 level in the local towns, a balance can usefully be struck between relief food-for-work needs and

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the supply of clean water to the local community.

14. Much emphasis has been placed on pure water for drinking. However, the use of water to supplement natural precipitation for food production should not be underestimated. The possibility of using water supplies for small-scale irrigation should always be taken into account when planning projects.

In response to some of the points raised, Ato Seyoum Abebe said that the road to the CPAR project sites was not yet complete: the final phase, involving culverts and a fine gravel surfacing, should be complete within the month.

Similarly, the target figure of 60 springs had been set to balance the construction of a chain of health posts in the area. These would be limited in their impact if clean water was not available at the same time. He also pointed that these 60 units are not complex municipal water systems, but rather small-scale rural supply models.

Mr. Wally Eshanaur, in response to the question raised over food-for-work, said BGCM continues to conduct spot surveys in the market to ensure food-for-work inputs are not depressing prices and thereby production. Grain prices are still relatively high, indicating overall food deficits in the area, and food-for-work is therefore considered for the time being a legitimate means to encourage water development projects and meet shortfalls in food availability.

Ato Melesse Endalamaw said WRC is available to give assistance wherever it can, but from his observation of the BGCM and CPAR projects in Selale, NGOs are making a positive contribution already. So far WRC's reasearch on low-cost rural water supply as opposed to large-scale resource development has been limited, and locally produced, standarized handpumps are not yet in production. However, if implementing agencies have specific questions, on maintenance or want to talk over the projects they are planning, Ato Melesse encouraged them to contact the WRC Research Department.

WRC believes in the kind of small-scale, appropriate water supply projects that BGCM and CPAR are undertaking, and the work being done by WRC follows the same line as that seen in Selale on the field visit, said Ato Melesse. Limited resources and the need for its own external assistance means that WRC is unable to provide much hardware or materials to assist agencies implementing projects.

Several participants expressed an interest in seeing the new Shalla and Ibex handpumps being developed for local manufacture in Ethiopia. Ato Melesse said they were welcome to see the designs at the Faculty of Engineering, Addis Ababa University, and that contact should first be made through his office as Head of the Planning and Programming Department, Water Resources Commission, Addis Ababa (Telephone 18 01 25).

Finally, Ato Sahle-Mariam Mogus thanked the speakers, the participants and field workers for their involvement in the workshop, which he hoped had contributed to the exchange of ideas and experience between those working for improved rural water supply systems in Ethiopia. Special appreciation was extended to BGCM and CPAR for opening up their projects to scruting by others. Ato Sahle then wished everyone a safe journey back to Addis Ababa.

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APPENDIX I LIST OF PARTICIPANTS

1.	Andrew Hood	SIM
2.	Kail Pfahler	Hope/MME
3.	Thomas Kimidu	Hope/MME
4.	David Harris	SIM
5.	Paul Stanfield	KHCDP
6.	Mogus Mehari	KHCDP
7.	David Hardware	ADRA
8.	Andy Meakins	KHCDP
9.	Patrick A.Dromey	Concern
10.	Tesfaye Tefera	Concern
11.	Mauro Rosso	LVIA
12.	Luca Fabbri	LVIA
13.	Fikre Negussie	LVIA
14.	Hagos Ahmed	24 Hour TV
15.	Bedru Seid	24 Hour TV
16.	Ferede Yetbarek	REDD BARNA
17.	Abera Aboye	REDD BARNA
18.	Gabre Emanuel Teka	AAU-FM
19.	Mengesha Mamo	CPAR
20.	Samuel Tuffa	L'Esperance
21.	Fekade Gessesse	L'Esperance
22.	Abraham O/Michael	CRS
23.	Girma Begashaw	World Vision
24.	Billy Hud	BGCM
25.	Alemu Fida	BGCM
26.	Walter Funk	KHCDP
27.	Rupert Talbor	UNICEF
28.	W. Bradfield	FFHC/FAO
29.	A. Shamley	CRS
30.	Berhane G/Heywet	OXFAM
31.	Kifle Balcha	OXFAM
32.	Beyene Megersa	LWF/WS
33.	Addisu Haile	BGCM
34.	Tekle G/Mariam	Faith Mission
35.	Terry Dutto	LVIA
36.	Wally Eshenaur	BGCM
37.	Melesse Endalamaw	Water Res. Commission
38.	Ato Seyoum Abebe	CPAR
39.	Sahle-Mariam Mogus	CRDA
40.	Bro. Augustine O'Keeffe	CRDA
41.	Julian Summers	CRDA

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APPENDIX II WORKSHOP PROGRAMME

CHRISTIAN RELIEF AND DEVELOPMENT ASSOCIATION

WORKSHOP ON

WATER SUPPLY FOR RURAL COMMUNITIES

April 13 - 14, 1989

Day One

8:45 - 9:00	Registration
9:00 - 9:10	Welcoming Address by Ato Hagos Araya, CRDA Deputy Executive Director
9:10 - 9:30	Presentation 1 Some notes on the Role of Water Resources in the Socio-Economic Development of Ethiopia by Ato Melesse Endalamaw, Water Resources Commission
9:30 - 10:30	Discussion on the above presentation
10:30 - 10:50	Coffee/Tea Break
10:50 - 11:40	Film Show - Song of the Water Fall
11:40 - 12:15	Discussion on the film show
12:15 - 1:15	Lunch Break
1:15 - 1:35	Presentation 2. The Kale Heywet Church's Experience in Water Development by Mr. Andy Meakins, KHCDP Water Projects Coordinator
1:35 - 2:35	Discussion on Presentation 2
2:35 - 2:50	Water Association Proposal by Mr. Walter Funk
2:50 - 3:00	Travel Arrangments for day 2.

Day Two Field Visit

Friday 14th April 1989

6:45 a.m.	Meet at the CRDA office
7:00 a.m	Travel to Selale
9:00 a.m.	Arrive CPAR's Debre Libanos Camp.
9:00 - 9:20	Briefing at CPAR's Debre Libanos Camp
9:20 - 10:00	Travel to Ginno and Nunno Harbo PAs
10:00 - 12:15	Visit water development programmes
12:15 - 1:15	Lunch at Fiche
1:15 - 1:45	Travel to BGCM's Base Camp at Muka Ture
1:45 - 2:00	Briefing on BGCM's water programmes
2:00 - 3:30	Visit water programmes in Machella Andode and Bosoke
3:30 - 5:00	Discussion on the Field Visits
5:00 -	Departure for Addis

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APPENDIX III

General Terms of Reference For the Field Assessment On
Water Development Programmes in Selale

The effects of water supply/development programmes to the well being of children and the community in the project area.

Objective

The objective of the water development programme is to overcome shortage of potable water and to minimize water borne diseases in the area.

Expected Results-Measurement of Achievement

- Meeting the demand of potable water for human/animal consumption
- Reduction of water borne diseases affecting children and the community
- Participation of the community in the programme/matching inputs
- Reduction of women's work burden in fetching potable water
- Coverage of the water programme as planned
- Proper organization and management of water programme for operate and maintain installations
- Change of attitudes as the result of the programme
- Sustainability of the activity. Is the scale of the project such that the water may be expected to be available indefinitely?
- Have the effect on the environment near the water resources been throughly thought through?
- If it is for irrigation have all the implications for requirement of other inputs, for labour and for use and/or marketing of the additional crop or increased yield been considered?

Methodology

- General introductry briefing on the project activity (historical background activity components (health, agric., infrastructure, income generation, human resources development)..
- Field Visit
- Documentation assessment if available
- Interview with the community leaders/women and other members
- Discussion with PA officials
- Discussion with project staff directly involved in the planning and implementation of the activity

Report by the Group

Observations/findings and opinions to all the participants in the form of a brief oral presentation to be followed a comprehensive written report.

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APPENDIX IV

SUMMARY OF PARTICIPANTS' EVALUATION OF THE CRDA WORKSHOP ON:

WATER DEVELOPMENT FOR RURAL COMMUNITIES

Twenty eight questionnaires were returned with the following remarks:

1. DID YOU FIND THE WORKSHOP USEFUL?

✓ - All the respondents replied yes

2. HOW COULD IT BE IMPROVED? PLEASE MAKE SUGGESTIONS

- By working to a co-operative method
- More time should be given to the workshop with more presentations.
- By using more visual aids and presenting more individual case studies to demonstrate successes and failures.
- By increasing the variety: water projects are not only handpumps and and spring protections.
- By including more participants and speakers with more extensive experiecne of the subject matter.
- By giving more time for discussion.
- By informing the participants about the topics on which discussion will take place ahead of time.
- By repeating the process every three months.
- By increasing the number of field visits, because it is observation of small-scale, replicable project which is most useful.
- By avoiding general introductions and concentrating on practical aspect of NGO work.

3. DID YOU FIND THE FIELD VISIT USEFUL?

All respondents replied yes. In particular, they cited the value of seeing projects that have been implemented by other agencies, the example of CPAR building a road to make water projects possible, and the general improvement of knowledge on how to protect springs and hand dig wells. It was felt by some participants that seeing projects that accomplish the same ends by different means from their own has a good way to consider new ideas and other methods of construction.

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4. HOW COULD THE FIELD VISIT BE IMPROVED? PLEASE MAKE SUGGESTIONS:

- By sharing more practical experience and ideas.

- By fewer project sites visited and a higher degree of factual information.

- More time is required for discussion in the field.

- The field visit could be extended to two days.

- By less time spent travelling, or else a wider variety of projects should be seen when covering such a distance.

- By selecting three or four practical problems being experienced by NGOs and have working groups discuss them throughly to arrive at recommendations.

- By focusing more tightly on training and the way in which it is accomplished by other agencies.

- The range of techniques demonstrated at project sites should be wider.

- By visiting projects of specific interest even if they are distant from Addis Ababa.

- By allowing participants to prepare their own transportation to the project sites before beginning the workshop.

- Higher density of project sites is needed for each workshop field visit.

- By discussing the technical details of each individual project more deeply.

- By visiting projects which have been established longer and where experience is more extensive.

- By sharing experiences, problems and suggestions in further workshops.

- By covering the subject more widely, and including other forms of water supply, such as surface catchment, which are more relevant to drier areas.

- By holding another meeting in two to three months' time on the same subject.

- By allowing more time.

- By inviting experts and holding group discussions.

- By concentrating on only one or two themes, such as the sustainability of completed projects or the choice of handpump.

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- By providing the workshop programme a week or two in advance to allow personal transportation for the field visit to be arranged.

- Specific field experience was useful, but the general information on national water resources was less helpful.

- By repeating the excercise frequently.

- By including all concerned staff from each agency in the discussion of their project.

- By gathering the agencies concerned for a fixed period to analyse their practices together.

- By visiting a project in the course of its implementation rather than after it is completed.

5. WILL THE WORKSHOP BE BENEFICIAL TO YOUR WORK?
IF YES, PLEASE SPECIFY:

- All respondents replied yes. The following reasons were given for the workshop's usefulness.

- Improving knowledge, especially on food-for-work issues.

- Helping to plan future projects.

- Learning of problems and their solution by other agencies.

- Standardizing methods and materials.

- Sharing experience and ideas, and giving encouragment.

- Introduction of new ways of working in the smae field, and ideas of community participation and maintenance.

- Proposal of CRDA water interest group to continue the exchange of ideas and knowledge.

- Demonstrating that a more integrated approach is required: quality and not quantity is important. More time needs to be spent withe the people agencies are seeking to serve in order to have any lasting impact on their lives.

- Giving hints for improvement and for avoiding mistakes by looking at specific topics.

- Providing a chance to discuss problems with other practitioners in the same discipline.

- Discussion of the issue of health education for the people before and after completion of the project.

- Sharing general and practical knowledge for improved techniques.

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- Looking in detail at concepts of local design and production of handpumps.

- Demonstrating how economical some organizations are in undertaking their tasks. The details of construction and specification shared by the field visit agencies will be useful for replication elsewhere, and will help in avoiding mistakes.

- Generating new ideas for projects in other localities, and exchanging specifications which will help improve design and construction elsewhere.

- Demonstrating systems for supervising workers and training them to maintain water supply installations themselves once the implementing agency has withdrawn.

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