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Evaluation of Maintenance Systems in Ghana

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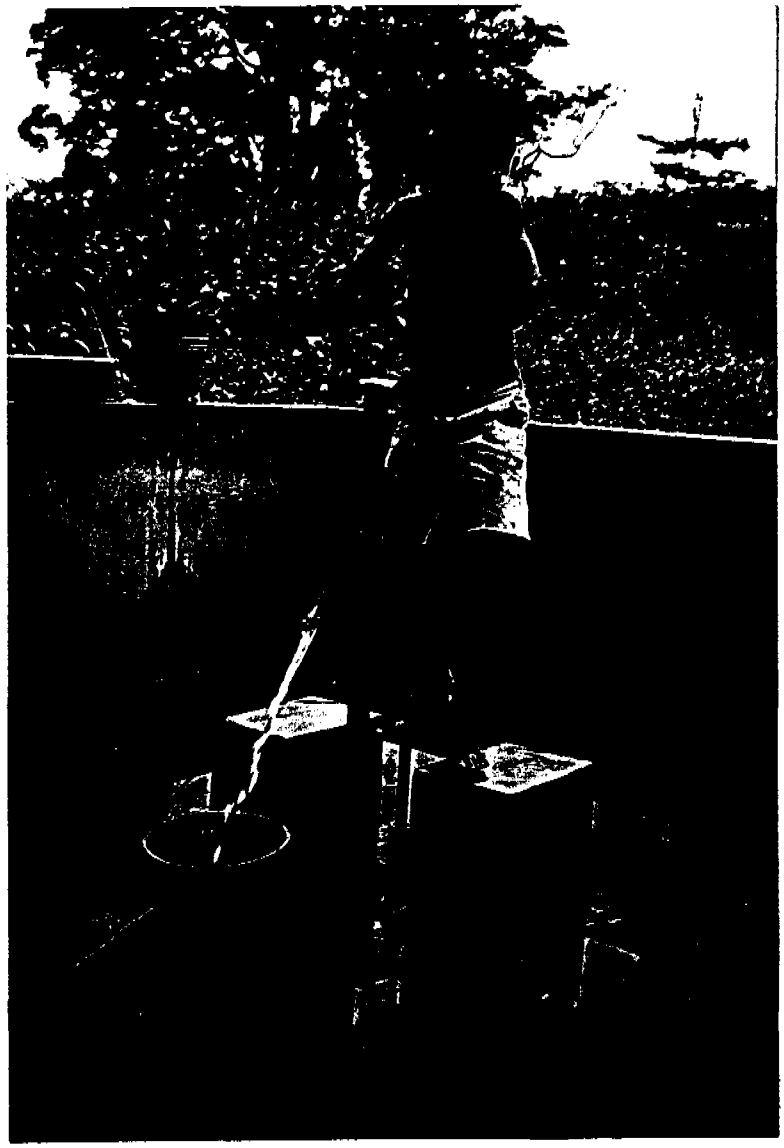
Appendices



The Findings, interpretations, conclusions and recommendations expressed in this report are those of the mission members and do not necessarily reflect the views of the Government of Ghana or World Bank.

Acknowledgement

The mission team would like to express its gratitude to all visited projects. We were received in all projects with openness despite the short notice given. Information was shared with the mission team in a frank and cooperative manner. Without this cooperation it would not have been possible to collect so much reliable data in such a short time.

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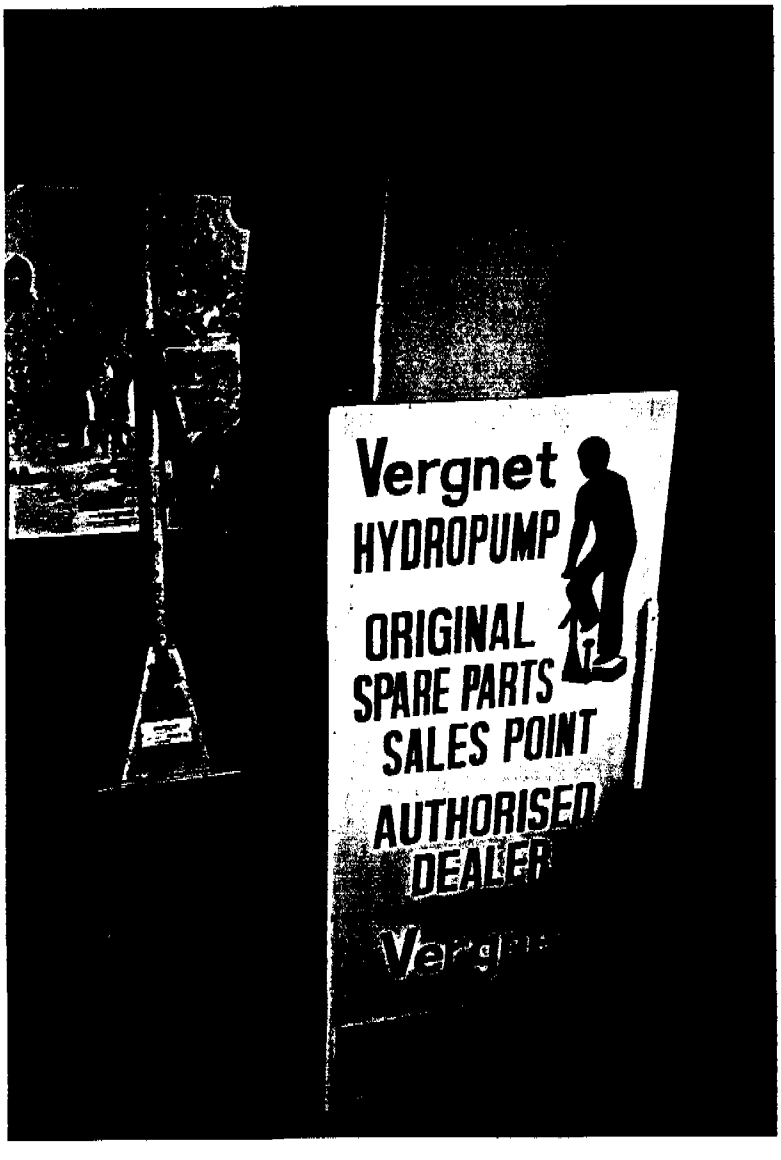


Executive Summary

Ghana has recently decided to shift from centralized maintenance of handpumps to community managed maintenance. Presently about 8,000 handpumps are under the government managed maintenance structure. New projects leave the overall financial and managerial responsibility to the communities. The fact that Ghana has centralized and decentralized systems in operation allows to assess and compare costs, sustainability and effectiveness of both.

The mission visited 6 projects in Ghana, collected data, analyzed the weaknesses and potentials. The objective of this study was to recommend a maintenance strategy that strives towards cost effectiveness, sustainability and safeguarding existing water points during transition.

The visited projects were:

GWSC/IGIP 3000 Wells Project	Catholic Mission Wenchi
GWSC/CIDA Upper Regions	GWSC/CFD Central Regions Project
NORRIP	Afram Plains Development Organization

Centrally managed maintenance systems allow preventive maintenance. This system is effective in terms of how many pumps are in serviceable condition at any time. The visited projects had 70% to 95% of all the pumps operational even after 15 years. However the need to organize tariff collection makes it difficult to operate the system efficiently.

In community managed projects preventive maintenance is generally not done. About 50% of the pumps are not regularly maintained. Experience in neighbouring countries shows that about 3 - 5 years after the project ends only approx. 60 - 70% of the pumps are operational.

The data from the 6 projects was used to compare the cost of O&M. The results for maintenance of pumps only (all other factors like well redeveloping or rehabilitation excluded) were as follows:

Project	Total O&M Cost /Pump	Cost Recovery from Community	Subsidy required	Subsidy provided by
3000 Wells Project	$ 106.-	$ 69.-	$ 37.-	Project
Catholic Mission	$ 181.-	$ 44.-	$ 137.-	Project
Upper Regions	$ 169.-	$ 18.-	$ 151.-	Project
CFD Central Region	$ 152.-	$ 51.-	$ 101.-	Vergnet/Agrovets
NORRIP	$ 188.-	$ 88.-	$ 100.-	Funding missing
Afram Plains	$ 210.-	$ 55.-	$ 155.-	Project

The most determining factor for the cost appears to be the number of pumps. The organizational structure has little impact on the overall cost. A well organized tariff collection allows about the same rate of cost recovery as the cost sharing arrangement in community managed projects.

All visited projects subsidize O&M. They all feel that without technical back-up the communities will not be able to sustain O&M. This leads to the conclusion that some form of subsidy will be required. In most projects GWSC or donor provides financial support to maintenance. In the Central Region CFD project the pump supplier provides the subsidy. The cost of the handpumps are higher than normal and the difference is used for after sales services. This appears to be costly, the price bonus paid for setting up O&M structures is very high.

Spare parts supplies is the weak link in the chain of after sales services. Selling of spare parts is not profitable, therefore nobody in the private sector will do it except when forced to do so. None of the projects has achieved a satisfactory method of spare parts distribution. Even if supply contracts specify that after sales services need to be established this is not really sustainable. The legal commitments do not last longer than the project.

Recommendations

A maintenance strategy needs to be formulated, for new and existing facilities, based on:

- The establishment of a District Water and Sanitation Team (DWST) in every district.
- GWSC CWD will have to take a regulatory role, it will monitor that the rules and regulations are adhered to in the DWST and the private sector.
- Maintenance Units/Teams are not dissolved but gradually changed and incorporated into the new CWS system.
- Standardization of Handpumps
- An O&M Technician is to be included in the DWST. He will monitor the pumps at regular intervals. He is responsible for advising and motivating the communities to fulfil their O&M obligations.
- Communities sign an agreement that they will inspect the handpump under an annual monitoring scheme during which preventive maintenance is encouraged.

The cost for the monitoring and technical back up of the pumps at district level would be US$ 65.-/pump and year. Projects that are implementing new water supply schemes can support the District Assemblies to set up this monitoring capacity. It is

hoped that the District Assemblies will develop their own source of revenues.

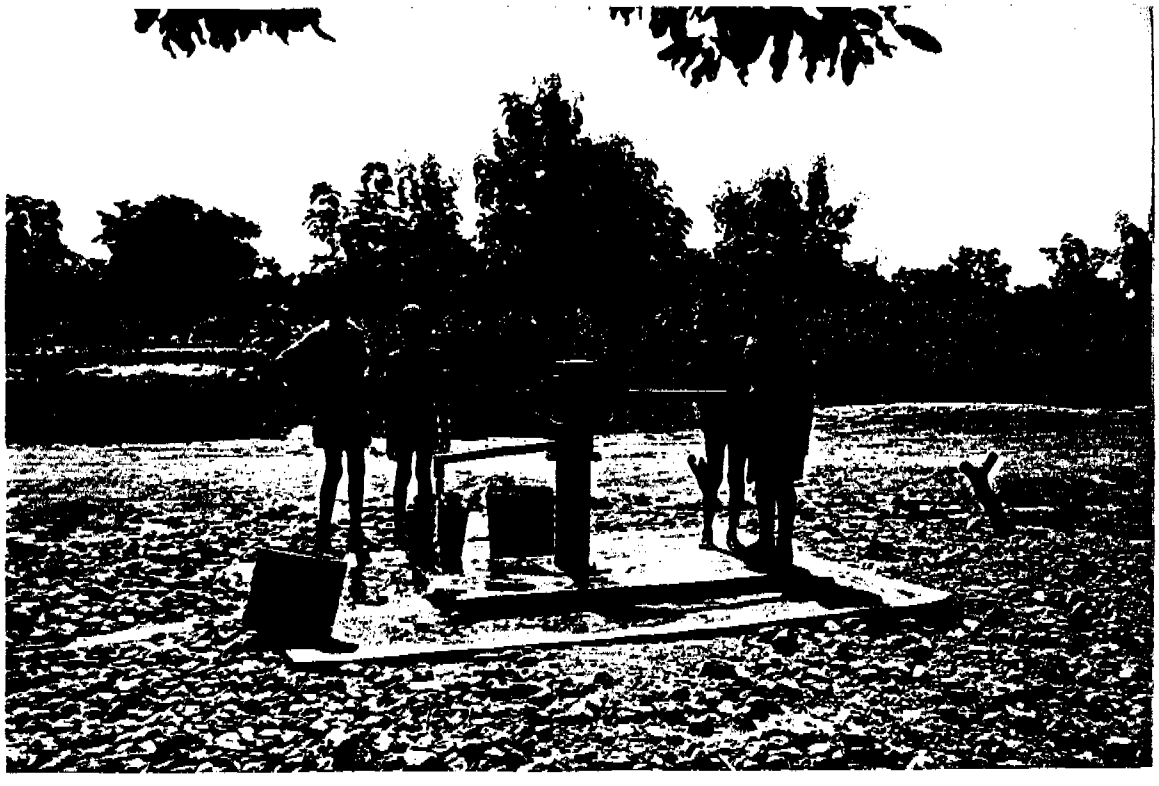
Spare Parts Distribution

GWSC will approve pump suppliers that will have to set up a network of spare parts outlets. The national supplier keeps fully comprehensive stocks of spares in his central store. Regional dealers will keep adequate stocks of spare parts. The financial risk will be with the national supplier. The margin for the regional dealer could be about 30% of the sales price. The quantity of spare parts in stock would have to be sufficient to cover at least 80% of all breakdowns. The area mechanic is the principal outlet for spare parts sales. He would have a margin of (let's say) 20% on all spares. He would stock only the fast moving parts that normally need to be replaced during the inspection.

The government prepares a list of recommended spare parts sales prices for all the standardized pumps. This list would be reviewed and agreed on with the approved suppliers/manufacturers. The price list would be published as recommended prices so that the communities would know how much the spare parts cost.

Private Sector Involvement in O&M

Spare part distribution on its own is not economically viable. It has to be tied in with the supply of new handpumps. GWSC CWD will approve only suppliers that are willing to provide the necessary after sales services and enter into long term contracts with them. The renewal of the prequalification status depends on the availability of spare parts in the districts, thus suppliers have to ensure the supply.



List of Abbreviations

APDO	Afram Plains Development Organisation
CFD	Caisse Française de Developpement
CIDA	Canadian International Development Agency
CMW	Catholic Mission Wenchi
CWS	Community Water Supply
DWST	District Water and Sanitation Team
GI	Galvanized Iron
GOG	Government of Ghana
GWSC	Ghana Water and Sewerage Corporation
GWSC-CWD	GWSC Community Water Division
GWSC MT	GWSC Maintenance Team
GWSC MU	GWSC Maintenance Unit
KfW	Kreditanstalt für Wiederaufbau
NORRIP	Northern Region Rural Integrated Project
O&M	Operation and Maintenance
RWSG	Regional Water and Sanitation Group
SS	Stainless Steel
VLOM	Village Level Operation and Management of Maintenance
VORADEP	Volta Region Development Project
WUP	Water Utilization Project
4WD	4 Wheel Drive

1. Background

The provision of safe water requires high initial investments for the construction of the water supply systems. A borehole and with a handpump fitted costs approx. US$ 12,000.- to 20,000.- in Africa. It is generally assumed that African countries would for years to come depend on external donor support to cover the initial investment cost for the development of infrastructure for rural water supply. Experience in the past has shown that these investments are often endangered as the water points fall out of service after a short period of time because of lack of adequate maintenance.

Ghana has recently decided to make the transition from centralized, government managed maintenance of handpumps to decentralized, community managed maintenance. Presently about 8,000 handpumps are still under the traditional maintenance structure. New projects have introduced maintenance structures that involve the private sector and leave the overall financial and managerial responsibility to the communities. The fact that Ghana has centralized and decentralized systems in operation allows to assess and compare costs, sustainability and effectiveness of both.

The mission visited 6 projects in Ghana, collected data, analyzed the weaknesses and potentials of them. The objective of this study was to recommend a maintenance strategy that strives towards:

- effectiveness (high percentage of pumps in operation)
- cost effectiveness
- sustainability
- safeguarding existing water points during transition

2. Visited Projects

The data collected from the 6 project is compiled in detail in Appendix III. The following chapters highlight some of the key aspects.

2.1 Projects based on Centralized Maintenance System

2.1.1 3000 Wells Project

The 3000 Wells project is funded by KfW and implemented by GWSC-IGIP Consultants. The project area is bigger than half of Ghana. It entails 6 (out of 10) Regions, Western -, Central -, Brong Ahafo-, Ashanti -, Eastern - and Volta Region. Drilling phase commenced in 1978 and lasted till 1984. Since 1984 the activities have concentrated mainly on the maintenance of the water points. The GWSC Maintenance

Unit (MU) was set up for this purpose. Recently rehabilitation of all pumps with Ghana modified India MKII was carried out.

The following is the information on the total budget and water points completed:

a) Total No. of water points completed by 3000 Wells project:	3,222
b) Total No. of water points presently maintained by MU:	3,956
c) Total No. of water points planned by end of 1996:	4,885
c) Total project cost (drilling and maintenance):	~ DM 121,000,000
d) Drilling cost per borehole:	~DM 20,000
e) Cost of Ghana *modified India MKII pump*:	~ DM 1,860
	(equivalent of US$ 1,200)

The boreholes were drilled by Prakla Seismos, a German drilling company now firmly established in Ghana. Initially the project bought and installed India MKII and Moyno hand pumps. At present the MU has assumed responsibility for the maintenance of 3222 pumps installed by the 3000 Wells project and an additional 734 pumps installed by other agencies (UNICEF, VORADEP, etc.) in the six regions the project covers. All these water points are now rehabilitated with Ghana modified India MKII and Nira pumps.

MU is an independent unit within GWSC having its own account. It generates revenue directly from the community. The tariff is set by GWSC and presently stands at ¢ 270 per household per month for all the regions where the project is in operation. The tariff is subjected to periodic review. The average tariff collection in the six regions amounts to 67% of the total actual tariff. If the arrears in a community amount to more than ¢ 200,000 the MU follows the policy to disconnect all except one pump. This pump will be maintained under the preventive maintenance scheme. The reduced service is used to enforce early payment of the arrears. However the disconnection policy is rather lenient and differs from place to place.

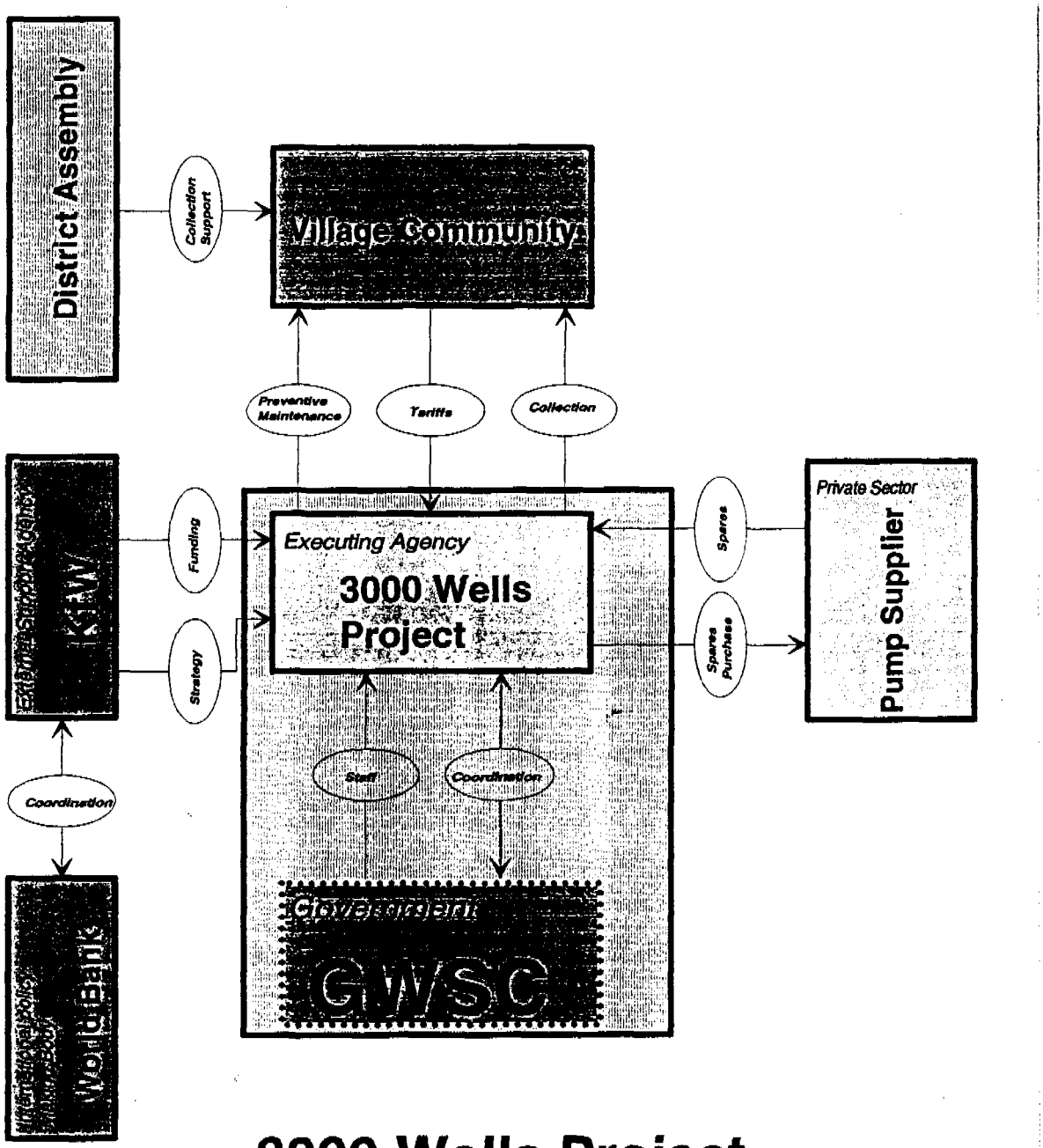
Preventive maintenance is done without any involvement of the community. Each region is typically staffed by one supervisor, one storekeeper and two pump repairmen. For well maintenance work, three well maintenance rigs manned by one mechanic and driver are serving two regions each.

The pump repairman uses a motorcycle equipped with a tool box. The repairman visits about 300-400 pumps once every 3 months. He carries out preventive maintenance on the pumps. During these visits, the repairman collects the tariff and any outstanding arrears from the community by issuing receipts.

When there is a breakdown of pump, villagers inform the supervisor who is stationed in the regional capital. The supervisor then arranges the repairman to attend to the repair. However, if the repairman is out in the field, then the repairs will be attended soon after his arrival from field. A 4WD UNIMOG vehicle is available in case of any major repair needing to transport pipes, rods etc.

Each water point has a committee, but no training is provided. Pump caretakers are selected from the community for the purpose of cleaning water point area and reporting breakdowns to MU. They were not provided with spanners simply because in the past the project found communities unnecessarily meddling with the pump.

Maintenance Structure:



3000 Wells Project

All spare parts used in preventive maintenance and repair work are supplied free of charge to the community. Spare parts are centrally stored in the regions. Maximum distance to the spare parts store vary up to 100 km. Spare parts were purchased by the consultant during the rehabilitation phase. 10% of the materials purchased for the change-over from the old pumps to Ghana mod. India MKII were earmarked as spare parts. Presently stocks are low for certain items and new orders will need to be placed soon.

The MU has an approved plan to make its operations leaner. It reduces its present staffing from a total of 66 to 42 members. The staff required for pump maintenance will be 35. The others 7 are required for well maintenance. The maintenance rigs and unimog trucks available for well maintenance purpose have an overcapacity. Therefore the cost of these services are relatively high. The cost calculations in Appendix IV do not include the cost of well maintenance.

Project achievements:

Success	Potentials
■ > 90% of all pumps operational even after 15 years ■ High rate of cost recovery ■ Well managed ■ Well accepted by communities ■ Standardization of equipment	■ Can recover all recurrent costs ■ Potentially the most cost effective solution ■ Preventive maintenance is built in ■ Potentials for cost savings ■ Capacity building within GWSC
Weaknesses	**Risks**
■ Continued dependence on donor support ■ Spare parts supply and distribution dependent on GWSC/Donor ■ Does not fit into the new sector strategy ■ Difficult to privatize	■ Requires stringent management ■ If other projects operate in the area the maintenance structure is endangered ■ Requires standardization of equipment

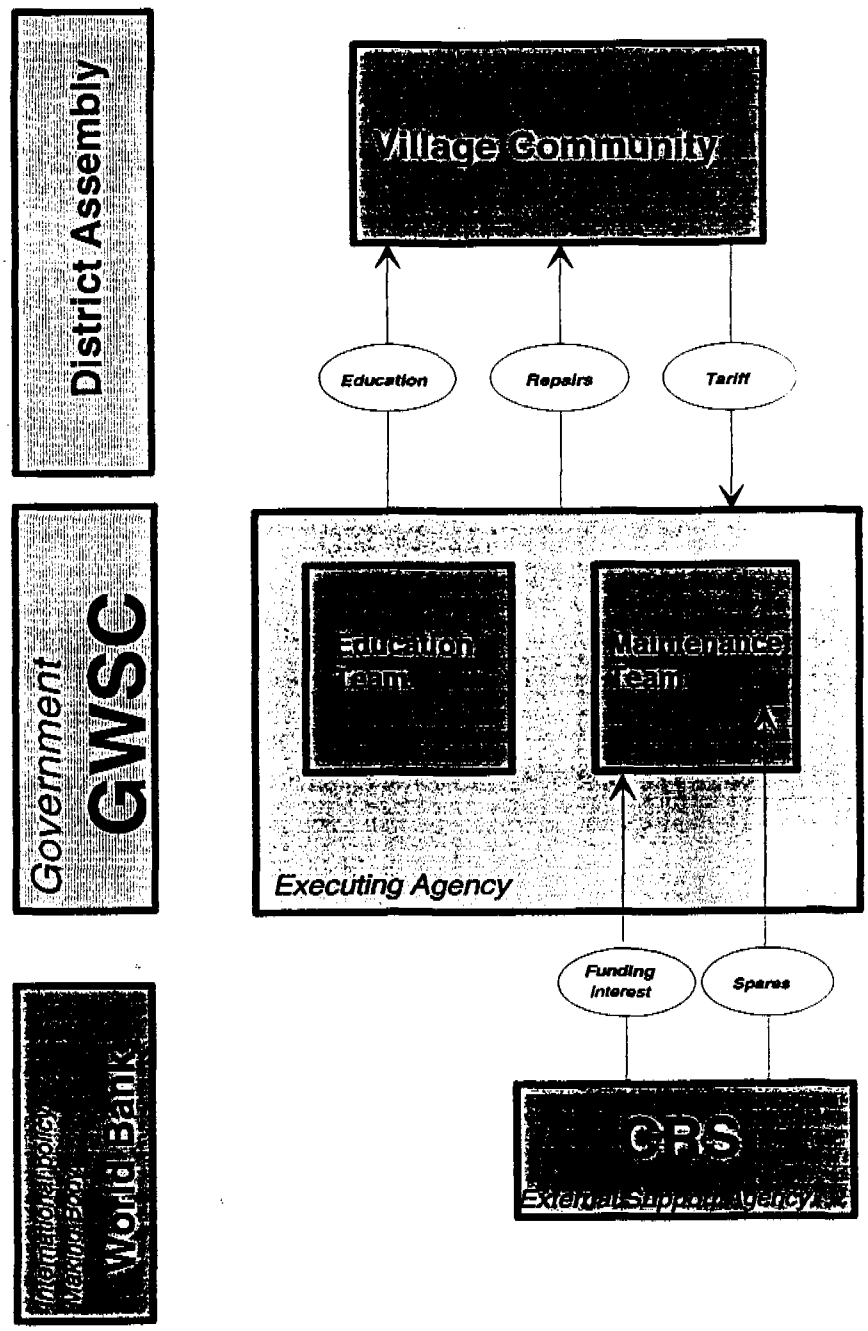
2.1.2 Village Water Supply, Catholic Mission, Wenchi

The Village Water Supply is funded by Catholic Church and implemented by Catholic Mission in Wenchi (CMW). The Project drilled 320 boreholes and installed them with India MKII pumps. Phase 1 commenced in 1985 and lasted till 1988 during which the drilling and installation of pumps were carried out. All handpumps were bought-in by the project. In Phase 2 (1988 - ongoing) only maintenance of handpumps was undertaken and presently is still in progress.

CMW was the first project in Ghana that generated revenue directly from the communities. The up-front payment was set by the CMW, communities were asked to pay ¢ 30,000 before commencement of drilling and additional ¢35,000 before the

installation of the pump, bringing the total contribution to ¢ 65,000. Of this ¢ 15,000 were retained by the project as a maintenance deposit which was meant for future repairs. Communities were asked to replenish the maintenance deposit whenever it was used.

Maintenance Structure:



Catholic Mission Wenchi

A new tariff was introduced in 1994, communities have to pay ¢ 3,000 per month per pump. If the pump needs a repair an additional ¢ 20,000 are charged in each case of a repair. With an average of one repair per annum the cost to the communities is ¢ 36,000 per year and pump. Communities who cannot pay at the time of the repair are given credit for the repair. Payment of the tariff is made to the dioceses, CMW uses the influence of the catholic church to obtain any arrears from the community.

CMW staff consists of one coordinator, two pump mechanic/driller, one mason and seven junior staff. Pump mechanic uses a pick-up equipped with tools for pump maintenance work. For any major repairs two trucks with a hoist is available. For borehole drilling, one old drilling rig and a truck is available, however, this is rarely used as drilling of boreholes stopped temporarily. An education team for general community development work is run by the mission and cooperates closely with the maintenance team.

The education team visits every water pump community once every 1-1.5 years for health and community education work. They make use of this occasion to collect any tariff arrears and check the pump performance so that they can inform maintenance team of any pump disorders. When there is a breakdown of the handpump, villagers inform the maintenance team in Wenchi. The pump mechanic attends to the repair using pick-up.

Maintenance is done with little assistance of the community. Each water point has a committee and training in health and minor maintenance is provided regularly. Pump caretakers are selected from the community for the purpose of cleaning water point area, greasing and tightening of bolts and reporting breakdowns to CMW in Wenchi.

All spare parts used in preventive maintenance and repair work are supplied free of charge to the community. Spare parts are centrally stored in Wenchi, however, few spares are kept in Sampa. Spare parts are purchased from India by CMW using the funds invested in Holland. In recent times CMW purchased some spare parts locally from Prakla Seismos. Maximum distance from the sites to the spare parts store is up to 150 km.

The income from repairs in 1993 was ¢ 4,000,000. This compares to an annual expenditure of ¢ 13,000,000 for recurrent cost only.

Project achievements:

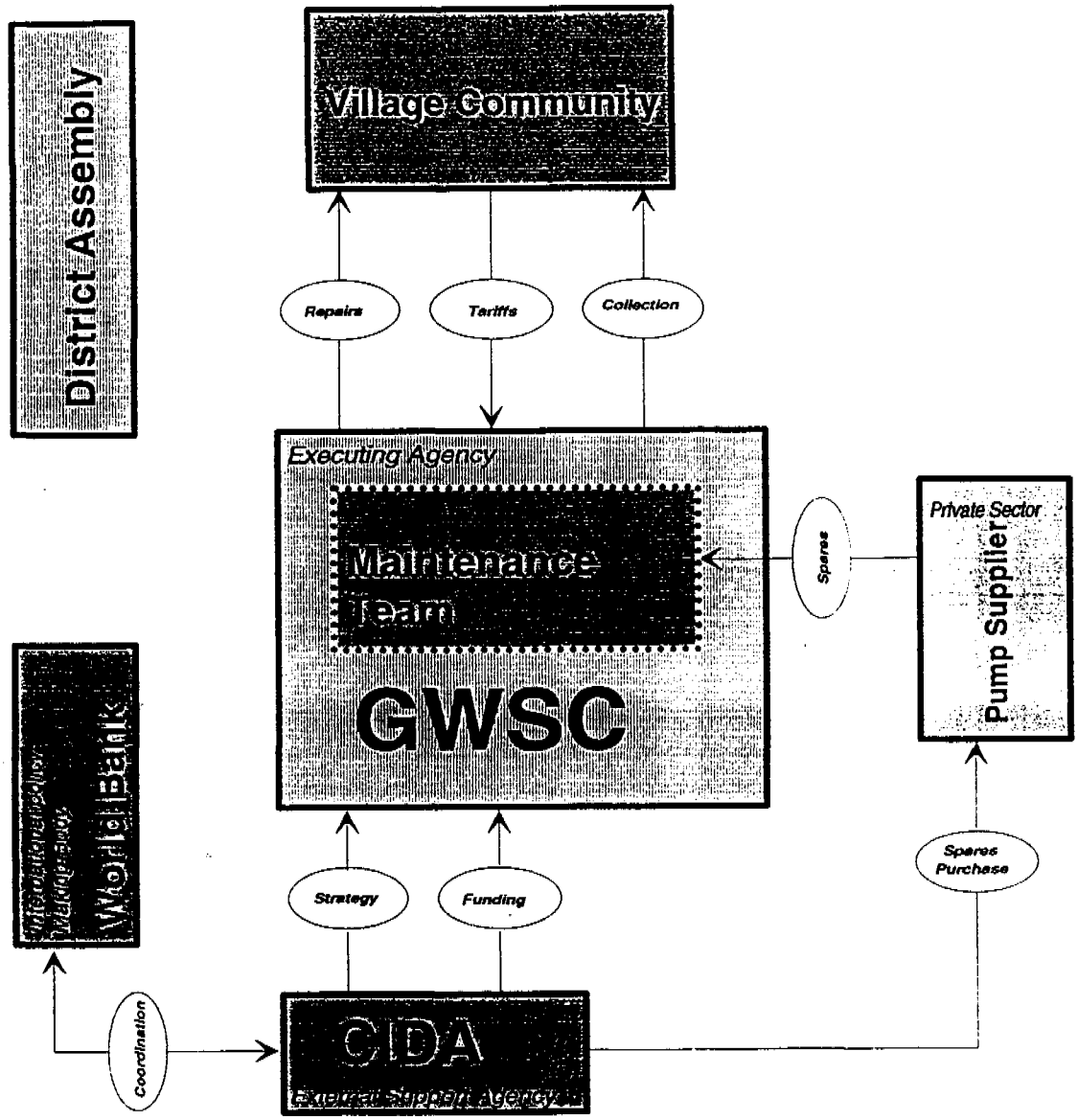
Success	Potentials
■ high % of all pumps operational even after 10 years ■ High rate of tariff collection ■ Well accepted by communities ■ Standardization of equipment	■ Close relation between community and project ■ Preventive maintenance can be built in ■ Potentials for cost savings
Weaknesses	**Risks**
■ Continued dependence on donor support ■ Spare parts supply and distribution dependent on Donor ■ Does not fit into the new sector strategy ■ Cannot recover all recurrent costs ■ No. of pumps does not justify the set-up	■ Requires stringent management ■ If numbers are increased the management problems will be bigger ■ If other projects operate in the area the maintenance structure is endangered ■ Requires standardization of equipment

2.1.3 GWSC Maintenance Team (MT), Upper Region.

The Project is funded by CIDA and implemented by GWSC. Wardrop up to 1993 and since 1993 Cowater are the consultants from Canada. Drilling phase commenced in 1974 and lasted till 1982. The maintenance phase began in 1982 and is still ongoing. The project has started a rehabilitation phase which started in 1994 and will extend to 1999. During the rehabilitation phase it is proposed to replace approximately 2600 Monarch and Moyno pumps with Afridev and Nira direct action pumps for deeper and shallow water levels respectively. Community management for all rehabilitated pumps will be introduced. Until this transition is over GWSC will maintain the pumps with its centralized system. The mission concentrated on the present centralized system as the new structure is only in the planning phase. In this new phase it is proposed to involve the communities with a completely demand driven approach.

Presently maintenance is carried out without any involvement from the community. Each region is staffed with seven supervisors, seven District Managers (serving part time about 25% involvement),a total of 32 mechanics, store keepers and support personnel. The mechanic staff will be reduced to 24 in the near future. Each region has seven 4WD vehicles (used part time about 50%) and 22 motor cycles. Mechanics collects any outstanding arrears from the community by issuing receipts.

Maintenance Structure:



GWSC Upper Regions Project

The tariff is ¢ 32,250 per pump per year. In 1992 the tariff collection (Tariff for 1992: ¢ 23,500) was as follows:

	Upper East Region	Upper West Region	Total
Billing	39,325,440	19,445,810	58,771,250
Collection	18,114,008	14,053,810	32,167,818
% Collection	.46%	72%	55%

When there is a breakdown of pump, villagers inform the supervisor who is

stationed in the district capital. The supervisor then arranges the mechanic to attend to the repair.

Spare parts are centrally managed in Accra. CIDA purchases spare parts directly in Canada depending on the consultants plans and store in each regional capital. Maximum distance from the sites to the spare parts store is up to 100 km.

Each water point has a committee, but no technical training was provided in the past. However, 2,600 village water organizers were trained on hygiene and water utilization under WUP (Water Utilization Project) in recent times. Pump caretakers are selected from the community for cleaning water point area and reporting breakdowns.

Project achievements:

Success	Potentials
■ reasonably high % of all pumps operational even after 18 years ■ Standardization of equipment	■ No. of pumps would justify an improved set-up ■ Preventive maintenance can be built in ■ Potentials for cost savings ■ Rate of tariff collection could be improved
Weaknesses	**Risks**
■ Suffered from inefficient management ■ Continued dependence on donor support ■ Spare parts supply and distribution dependent on GWSC/Donor ■ Does not fit into the new sector strategy ■ Cannot recover all recurrent costs ■ Not well accepted by communities	■ Requires stringent management ■ Difficult to privatize ■ If other projects operate in the area the maintenance structure is endangered ■ Requires standardization of equipment

2.2 Projects based on Community Managed Maintenance System.

2.2.1 GWSC-CFD Central Region.

The Project is funded by Caisse Française de Developpement (CFD) and implemented by GWSC. Burgeap are the Consultants.

Phase 1 commenced in June 1991 and lasted till December 1993. Phase 2 began in March 1994 and is planned to be completed in December 1996.

The following table provides information on the budget and water points completed and proposed during phase 1 and 2.

Phase 1.

a) Total no. of water points completed:		376
b) Total Budget:	FF	~45,000,000
Drilling:	FF	~23,000,000
Hand pumps:	FF	~4,800,000
Software:	FF	~5,000,000
Consultant fees:	FF	~12,000,000
c) Investment per capita:	US $	73

Phase 2.

a) Total no. of water points proposed:		300
b) Total Budget:	FF	33,000,000
c) Investment per capita:	US $	67

According to the consultants the boreholes are contracted to SEFI and the cost of a completed borehole varies between US$ 12,000 to 18,000 depending on the depth and area. Since the borehole siting is done by the consultant the cost of unsuccessful boreholes are paid to the contractor. The rate of unsuccessful boreholes are in the region of 30%.

In Phase 1 the cost of one Vergnet 4C handpump was calculated to be US$ 2,430. This price includes the costs of pump installation, pump/spare parts distribution and setting up of after sales service (including 18 motorcycles and toolboxes for area mechanics) and training of pump mechanics and caretakers in the project area.

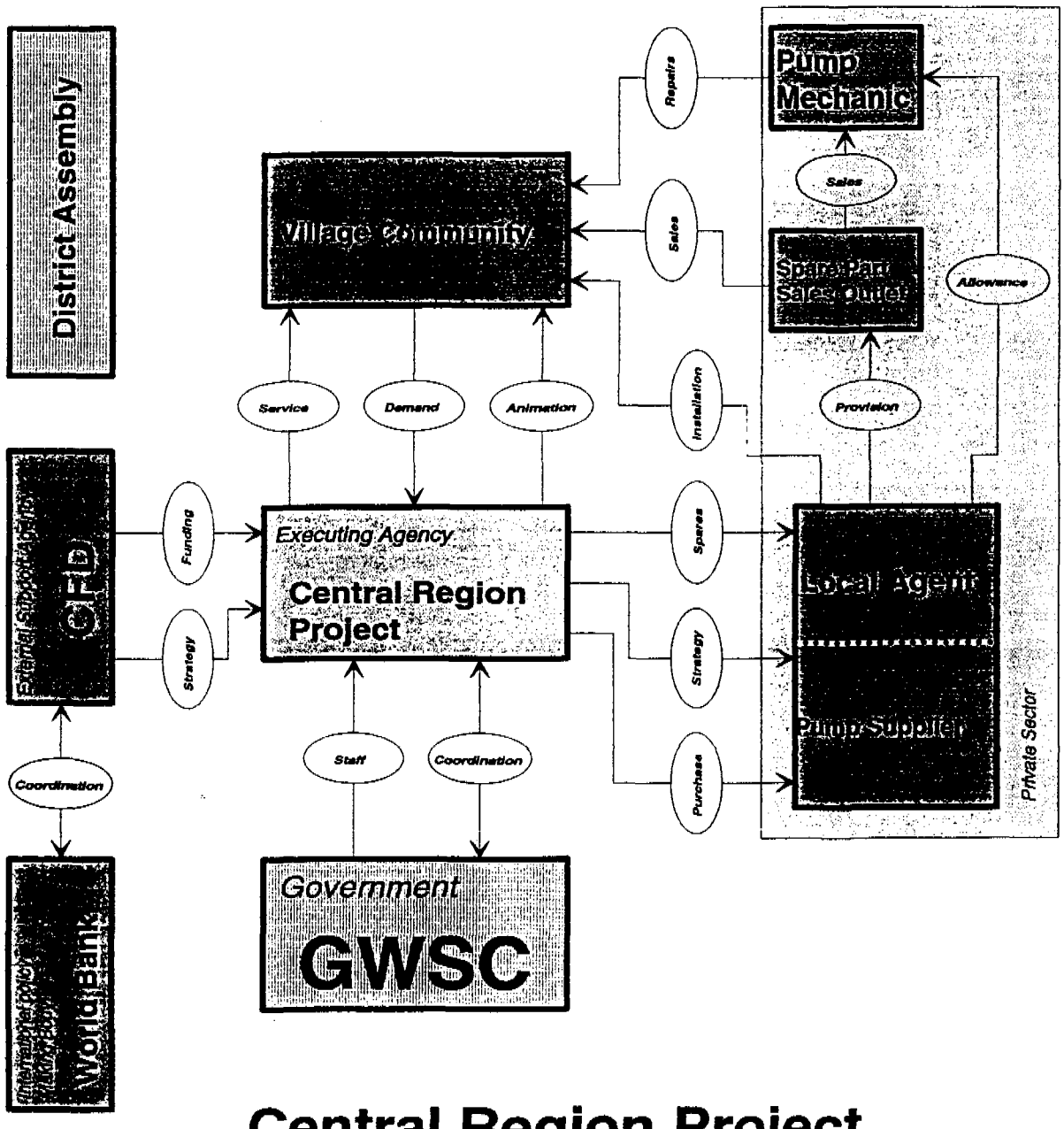
Vergnet parent company appointed Agrovets Ltd., a Ghanaian company engaged in marketing of agricultural chemicals, to import pumps and spare parts. However Agrovets has not entered into any formal agreement with GWSC or the projects that would bind them to maintain the services set up.

Agrovets appointed 5 local spare parts dealers in the project area. These spare parts shops are located at maximum distance of 30 km from the pump sites. All dealers sell spare parts as one of many other products. The appointed dealer in Cape Coast town deals with electrical parts and agricultural chemical products. Each dealer stocks spare parts to the value of ¢ 500,000 which is enough for 2 years operation. The spare parts prices are determined by Agrovets and the price list is attached in Appendix VI. The dealer receives a commission of 15% on the price and an additional monthly allowance. According to Agrovets the five stores made a total turnover of ¢ 800,000 from June 1992 to date.

Maintenance of pumps is carried out by 16 mechanics each having a motorcycle and a tool box provided free of charge by Agrovets (paid by the project as part of the total Pump cost). For two years bikes will remain the property of Agrovets project and afterwards the mechanics will own them. The mechanics are s-lf employed

however, they are paid an additional allowance by Agrovets. For each repair performed by the mechanic he is allowed to charge to the community an average amount of ¢ 5,000 plus the fuel for the motor cycle or an equivalent of the bus fare. Two preventive maintenance visits carried out by the mechanic in the first year are free to the consumer, however, Agrovets pays ¢ 2,500 to the mechanics for each preventive maintenance visit and any spare parts used are supplied free of charge.

Maintenance Structure:



Central Region Project

An Engineer is designated to supervise the whole operation and he assists in major repairs by using a pick-up.

Villagers can buy spare parts directly from the dealer or through the mechanic in which case the mechanic receives a commission. Each water committee consists of 5 members out of which one is a woman.

Pump caretakers are selected from the community and trained for minor repairs and general cleaning of the pump surrounding. Each water committee needs to collect a sum of ¢ 70,000. The community invests this money in their name in an account with a rural bank as a precondition before the drilling starts. The money remains the property of the community and serves as a saving for future repairs.

Project achievements:

Success	Potentials
■ Community management established with little animation ■ Spare parts supply and distribution through private sector ■ Does fit into the new sector strategy	■ Could serve as a model for involvement of private sector ■ Direct contacts between users and private sector
Weaknesses	**Risks**
■ The project does little to strengthen local institutions/district assemblies ■ High cost of equipment/handpumps ■ Level of after sales service can only be maintained if future sales of pumps at the high cost continue ■ Subsidies are hidden, no control by government	■ Preventive maintenance will not be done ■ The private sector is not legally compelled to continue after project ends ■ Cost for repairs and spares might escalate when project ends

2.2.2 Northern Region Rural Integrated Project (NORRIP), Northern Region.

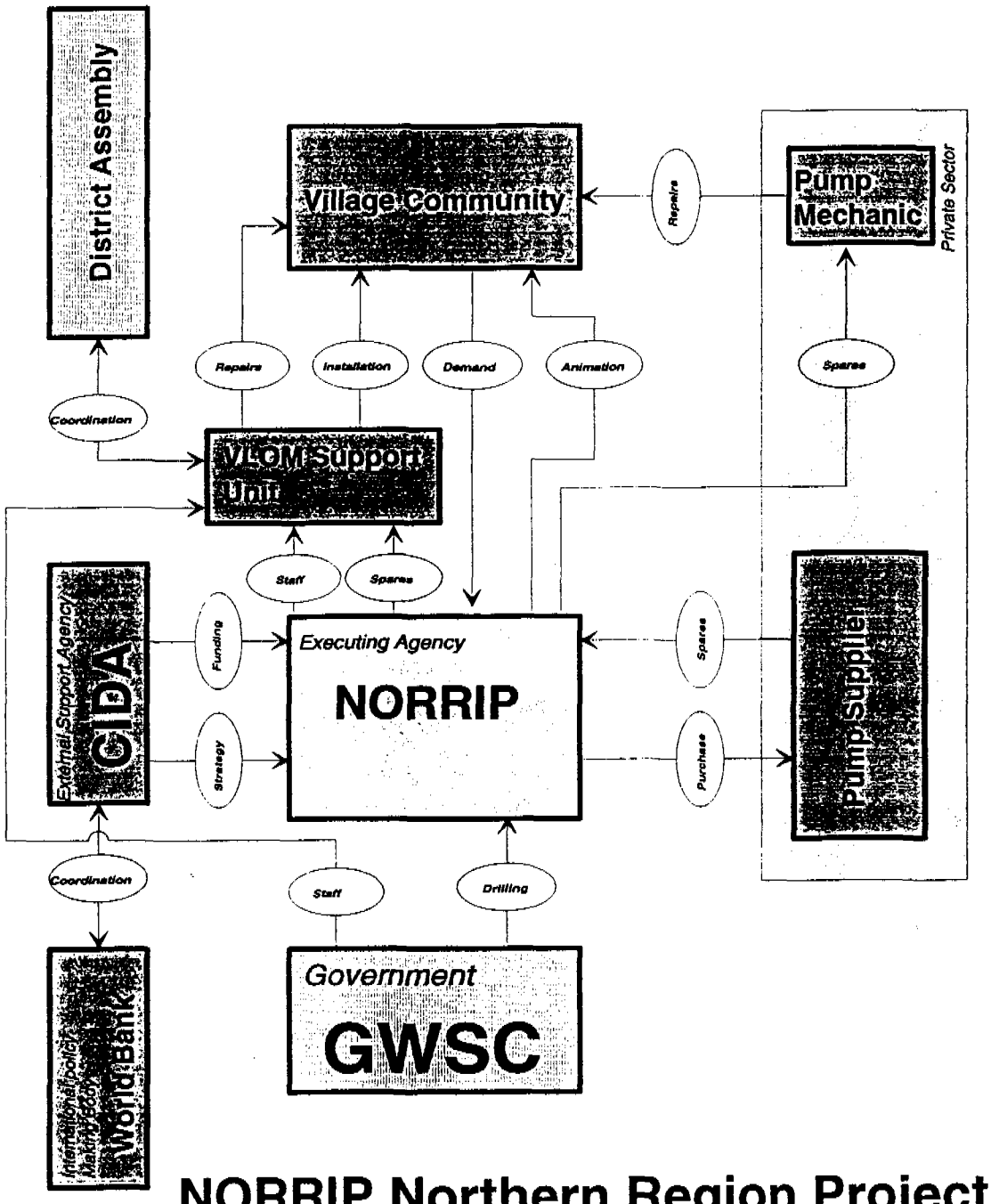
The Project is funded by CIDA and implemented by NORRIP. Stanley/Cowater were the Canadian consultants. Drilling and training activities commenced in 1990. Even though the Canadian input to the project came to an end in 1994 the planned drilling and pump installation operation will continue until the targeted number of water points is reached.

End of 1993 a total no. of 200 boreholes were equipped with handpumps. By end of 1994 ~340 boreholes will be drilled and Afridev pumps installed on them. GWSC Drilling unit was contracted to drill the boreholes.

The cost of an Afridev pump without installation and distribution is US$ 700. CIDA provided the funding for the project to purchase a large stock of spare parts

since additional funds will not be available in future. These stocks are managed in Tamale being the central store and two other sub-stores located in Yendi and Gambage. These (project run) spare parts shops are located at a maximum distance of 50 km from the pump sites.

Maintenance Structure:



NORRIP Northern Region Project

Maintenance of pumps is carried out by the villages themselves. The communities are supported by 6 self-employed pump mechanics, each having a motorcycle and a tool box provided free by the Project. Communities have to pay for spare parts and the services of these mechanics.

In each district one VLOM support unit is established consisting of one NORRIP and one GWSC pump mechanic attending pump installation and major repairs. The units are equipped with one pick up and two motorcycle. The VLOM support unit will be dissolved once the installation of the pumps is finished. The unit is now gradually replaced by the private pump mechanics.

Each water point has a water committee. The project has provided substantial training to the water committee on hygiene education. Pump caretakers are selected from the community and trained for minor repairs and general cleaning of the pump surrounding. Each water committee collects a sum of ¢ 40-60,000 per pump per year. They are motivated to keep ¢ 120,000 in bank accounts for future repairs.

Project achievements:

Success	Potentials
■ Community management established ■ Does fit into the new sector strategy	■ Could serve as a model for involvement of district assemblies ■ Direct contacts between users and private sector
Weaknesses	**Risks**
■ The donor support ends before project is completed ■ Problems with war in project area ■ High cost of animation and training, long time elapsed before implementation ■ Spare parts supply and distribution not established through private sector ■ Level of after sales service cannot be maintained (support teams dissolved)	■ Preventive maintenance is not done ■ The private sector (area mechanics) is not legally compelled to continue after project ends ■ Supply of spare parts not ensured

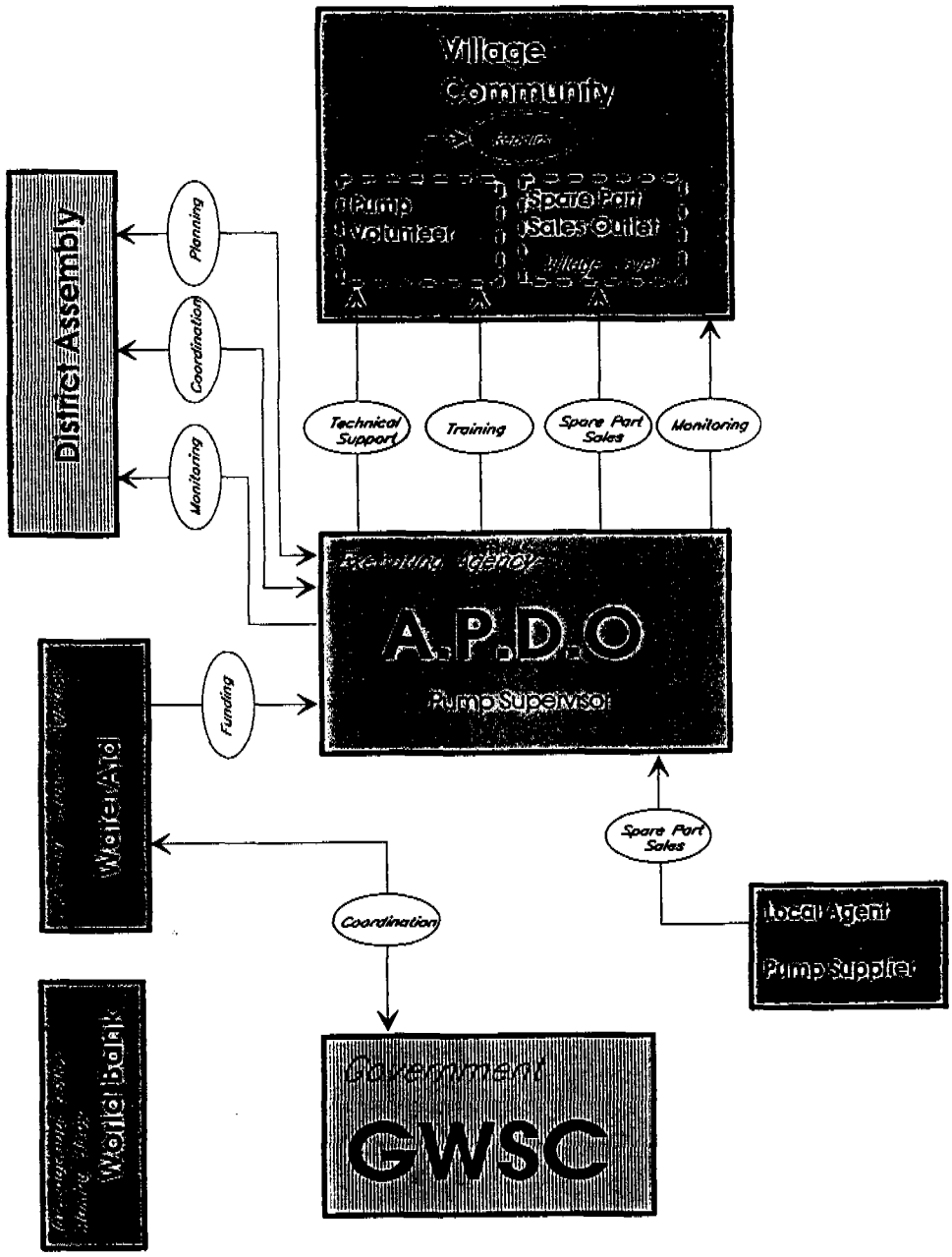
2.2.3 Afram Plains Development Organisation (APDO) Community Level Handpump Maintenance Project.

The Project is funded by Water Aid and implemented by APDO an NCO operating in the Afram Plains. APDO took charge of the maintenance of 147 India MKII handpumps in the area. The pumps were installed by UNICEF, World Vision and the Catholic Church. The project has maintained pumps since 1991. Because of corrosion problems with the pumps the project decided to rehabilitate the pumps by converting them to stainless steel. The rehabilitation commenced in 1992 and will last

till 1994. During rehabilitation communities have to pay ¢ 75,000 which includes replacing of GI pipes and rods with stainless steel.

In the past Water Aid purchased spare parts from abroad for APDO. Recently, project bought spare parts through local sources. Spare parts are managed decentrally by the project.

Maintenance Structure:



Afram Plains Development Organization

The project area is divided into 9 Zones and each zone is headed by a zonal executive who is responsible for all the development activities in the area. The zonal executive purchases few spare parts from the project and will in turn sell them to the communities. However the parts are sold without any overheads or a profit margin. Maximum distance from the pump sites to the zonal store is approximately 15 km.

Each pump has two fully trained volunteer pump mechanics who are selected from the area practising a technical trade (eg. bicycle mechanic, blacksmith etc.). 3-4 villages share a complete tool box suitable for all repairs of the pump. The pump volunteer is trained to perform all repairs on India MKII pumps with some help from his fellow villagers. The pump volunteers carry out all repairs free of charge, but the communities pay full cost of spare parts. In case of difficulty in repairing the pump, project pump supervisor assists them. In such a case the communities have to pay the project for providing his services and his transport (¢ 155 per km for transport and ¢ 3-4,000 per day of work).

APDO consist of one Project Manager, one Pump Supervisor and one Sanitation Supervisor. They are equipped with one 4WD vehicle and a motorcycle. Project pays salaries, allowances and fuel required for their work.

Each water point consists of a water committee. The project has provided substantial training to the pump volunteer on pump repairs and water committees on hygiene education. Furthermore refresher trainings on repairs are given on a half yearly basis. Each water committee is motivated to collect a sum of ¢ 100,000 per pump for any future repairs. When funds are available, project arranges with mobile bank to visit particular areas on a certain date for deposit of funds.

Project achievements:

Success	Potentials
■ Community management established ■ Does fit into the new sector strategy ■ The project cooperates closely with local institutions/district assemblies ■ Communities prove that they can maintain even India MKII pumps by themselves	■ Could serve as a model for involvement of district assemblies ■ Preventive maintenance can be introduced on a sustained basis
Weaknesses	**Risks**
■ Difficult to replicate in large scale ■ Spare parts supply and distribution not established through private sector ■ Depends on unpaid voluntary work	■ Requires continued refresher training ■ Depends on the willingness of volunteers to serve the communities free of charge ■ Cost of spare parts might escalate

3. Conclusions

3.1 Preventive Maintenance versus Breakdown Maintenance

The cost effectiveness of preventive maintenance is beyond doubt. An annual replacement of the few schedule maintenance parts cost about US$ 25.00 If they are not replaced most of the pumps will experience repairs that cost US$ 200.00 and more after about 4-5 years service.

Centrally managed maintenance systems allow to introduce a preventive maintenance scheme and are more effective in terms of how many pumps are in serviceable condition at any time. The visited projects had 70% to 95% of all the pumps in operation. Out of the pumps not working, many were not actually broken down but disconnected because of non-payment of tariffs. However the need to organize tariff collection makes it difficult to operate the system efficiently.

Community managed maintenance in which preventive maintenance is the general rule are not known. New approaches need to be sought to ensure that preventive maintenance is carried out also when the communities are responsible for O&M.

As a general rule it can be assumed that under community management about 50% of the pumps will not be regularly maintained. Experience in neighbouring countries (in which community management is common practice for years) shows that about 3 - 5 years after the project ends only approx. 60 - 70% of the pumps are operational. Ghana experience with centralized preventive maintenance indicates that the percentage of operational pumps, even after 15 years, can still be much higher around 85%.

The economic losses are considerable if 30 - 40% of the installations reach only 25-50% of their expected service life because the necessary US$ 100 to 150 per annum for preventive maintenance cannot be provided. The need to implement costly rehabilitation projects is then threatening.

3.2 Rehabilitation and Maintenance

During the discussion about the cost of the various O&M systems we often found that rehabilitation and maintenance are freely mixed. Cost of a rehabilitation programme are compared with annual cost of handpump maintenance. For example the 3000 Wells project has rehabilitated over 3600 boreholes in the last 4 years and is still in the process of changing an additional 1000 boreholes. It is therefore quite understandable that such an operation would be more costly than a pure O&M programme as run by the Catholic Mission in Wenchi. Similarly the cost to rehabilitate the 2,600 boreholes in the Upper Regions will be considerably higher (Can$ 11,000,000) than the cost of maintaining the handpumps as it was done up to now.

It is therefore important to make sure that we do not compare apples with pears in cost analysis.

The mission tried to separate these aspects. The cost analysis excludes the cost of rehabilitations and concentrates on O&M only. It is however necessary to look into the economic costs of rehabilitation as well.

3.3 Cost Analysis of Existing Maintenance Systems.

The data that was available from the 6 projects was used to compile the cost of the O&M structures. In order to have comparable results the mission calculated the cost of maintenance of pumps only, all other factors like well redeveloping or rehabilitation of pumps were excluded. The cost was calculated on the same basis for all, i.e. a typical handpump or a typical vehicle was assumed, no differentiation was made between the actual type of equipment that was used. The detail calculations are listed in Appendix IV.

The results in short are:

Project	Total O&M Cost /Pump	Cost Recovery from Community	Subsidy required	Subsidy provided by
3000 Wells Project	$ 106.-	$ 69.-	$ 37.-	Project
Catholic Mission	$ 181.-	$ 44.-	$ 137.-	Project
Upper Regions	$ 169.-	$ 18.-	$ 151.-	Project
CFD Central Region	$ 152.-	$ 51.-	$ 101.-	Vergnet/Agrovets
NORRIP	$ 188.-	$ 88.-	$ 100.-	Funding missing
Afram Plains	$ 210.-	$ 55.-	$ 155.-	Project

The most determining factor for the cost appears to be the number of pumps that are in a project area. Projects like NORRIP, Catholic Mission or Afram Plains have the highest cost. They cannot profit from the economy of scale like the 3000 Wells project or the Upper Regions project.

It appears that the organizational form (centralized or de-centralized) has little impact on the overall cost. Further it is also visible that a well organized tariff collection allows about the same rate of cost recovery as the cost sharing arrangement in community managed projects. The experience in Ghana indicates that a water tariff which is collected regularly is acceptable to most communities as long as they feel that the amount is not excessive and that they in return are provided with a reasonably safe and reliable water supply. The ability to pay varies considerably from region to region and over the seasons as well. It should however be noted that a big discrepancy exist between the cost recovery in the South and the North. The water tariff has been set in the Upper Regions at a level of 30% compared with the South.

This tariff is by no means sufficient to achieve a reasonable cost recovery.

3.3.1 Subsidies

All visited project have one aspect in common:

O&M is subsidized in all projects. And, the projects have few ideas how to reduce the level of subsidy

The persistent view of the projects that some support should be given to the communities, and their clearly voiced opinion that without the technical back-up the communities will not be able to sustain the O&M of the pumps leads the mission to the conclusion that some form of subsidy will be required for O&M.

Once this fact has been accepted, ways and means need to be devised to make sure that this subsidy is of the lowest possible level and in the most effective way spent.

In most projects it is either the project directly or GWSC supported by a donor that provides the financial support to maintenance. In NORRIP this support has come to an end. The consequences can already be felt.

In the Central Region CFD project a different approach has been adapted. The cost of a handpump is about 100% higher than it could be expected. The pump supplier has with this higher price been contractually bound to provide the subsidy. This system has the advantage that the government institutions do not have to be involved at all. It however appears to be much more costly, the price bonus paid per pump for setting up O&M structures are very high (cost of a handpump, including after sales service, is US$ 2,300). A further set-back is that the supplier can only be kept responsible for the after sales services as long as the project is running. This puts a serious question mark to sustainability of such an arrangement.

3.4 Community management

The GOG has recently declared that all rural water supplies will come under the direct management of the communities. Community management has the objectives to attain sustainability by motivating the communities to take over the full financial and managerial responsibility for O&M. Community management of O&M will relieve the government from the day to day intervention in remote rural areas. The proponents of community management assume that the running costs for O&M can be fully recovered from revenues collected by the villages.

The communities are in general willing to assume their share and contribute to O&M cost. They are also capable to perform the common repairs without help. The fear that communities if they are managing their own pumps would **not** carry out

preventive maintenance was once more confirmed during this mission. Despite all the efforts in training and education a large portion of the pumps under community management are only repaired when they break down completely. This means repairs are less frequent but much more costly than with preventive maintenance. The effects is that the villages do not experience the cost for maintenance as a continued small contribution to O&M. The cost for O&M is not perceived as the average cost over years but most of the time judged at the cost of the present repair (e.g. a repair that costs $ 200.- after 5 years is considered more costly than an annual repair of $ 50.-).

There seems to be a threshold to what extent the community participation can be expanded. If the cost for a repair rises too high the villages refuse to participate. Further constraints are that major repairs might be beyond the technical capacity of the village or area mechanic and well outside the financial capacity of the community. They require a technical back-up system and possibly a structure for financial aid.

3.5 Economic Cost of Maintenance

Cost assessment: Preventive Maintenance versus Breakdown Maintenance

Assumptions:	Preventive Maintenance	Breakdown Maintenance
Borehole cost	$ 12,500	$ 12,500
Handpump cost	$ 1,000	$ 1,000
Annual Maintenance cost	$ 150	$ 50
Service Life Borehole	25	25
Service Life Handpump	10	10
% of Pumps that reaches Service Life	80%	60%
% of Borehole that reaches Service Life	80%	60%
% of Pumps that reaches 50% of Service Life	90%	70%
% of Borehole that reaches 50% of Service Life	90%	70%
Interest Rate	7%	7%

Economic Cost per Borehole:		Preventive Maintenance	Breakdown Maintenance
Investment for Boreholes		$ 12,500,000	$ 12,500,000
Investment for Handpumps		$ 1,000,000	$ 1,000,000
Total Investment		$ 13,500,000	$ 13,500,000
Borehole annual Depreciation for:			
100% Service Life	$ -1,073		
50% Service Life	$ -1,533		
25% Sevice Life	$ -2,537		
Handpump annual Depreciation for:			
100% Service Life	$ -142		
50% Service Life	$ -244		
25% Sevice Life	$ -450		
Annual Depreciation Borehole		$ -1,265	$ -1,558
Annual Depreciation Handpump		$ -344	$ -364
Annual Maintenance cost		$ -150	$ -50
Total Economic Cost of Water Supply		**$ -1,759**	**$ -1,972**

The methodology used to assess the cost effectiveness of the maintenance systems was based on the following abstraction:

- Once a water supply project has been implemented and a certain percentage of coverage has been reached it will be necessary to make the further investments to maintain the level of service. After about 10 years (the end of the service life of a handpump) it will be necessary to replace the pumps. After about 25 years it will be necessary to drill new boreholes.

- E.g. if the project costs are $ 15,000 per bore hole and $ 1,000 per pump we need the same amounts again after 25 years and 10 years respectively. In order to make these future investments it is essential to depreciate the infrastructure over the above mentioned periods of time. This will allow to calculate how much money will be needed over the years to keep the level of service.

- The O&M structure that is chosen influences directly the time gap that can elapse before a rehabilitation programme needs to be implemented. e.g. the cost analysis tried to establish what the cost implications are if, due to inadequate maintenance, rehabilitation programmes need to be carried out before planned.

The most influential factor in this calculation is the cost of the borehole. The depreciation of a borehole is more than $ 1,200 per year. If the borehole does not reach its expected life the losses are by far exceeding the cost of the maintenance of a pump. It is therefore essential to ensure that the waterpoints are continuously monitored and maintained. $100 more per year spent on maintenance of a handpump are a wise investment.

3.6 Spare Parts

In nearly all African countries the spare parts supply is the weak link in the chain of after sales services. Selling of spare parts is generally not profitable, therefore nobody in the private sector will do it except when forced to do so. The mission clearly revealed that none of the project has achieved a satisfactory method of spare parts distribution. Small local dealers will not be able to replenish their stock by themselves. Presently they depend on supplies from a project or on GWSC.

Even if supply contracts clearly specify that after sales services need to be established this is not really sustainable. In neighbouring countries in which the system of spare part supply through pump suppliers is common, the bottleneck is normally that spares are not available in the rural areas. BURGEAP (the contractor for the CFD project) quoted in a study made in 1990[1] *# Even though the original supplier is*

[1] Operation and Maintenance of the Rural Water Supply Facilities in the Republic of Ghana, BURGEAP, F. Giovanetti, Feb 1990

contractually bound to provide after sales services, these commitments do not last longer than the deadline of the agreement, and no incentive system has been designed so far that could make the supply more reliable #

The system set in place by Agrovets in the CFD project looks impressive. It needs however to be realized that the above quote would apply for them when the project ends. The level of service for spare parts could never be maintained if the handpumps cannot be supplied at a price level that is considerably higher. This is even more aggravated by the fact that Agrovets presently sell spare parts at prices that are below cost (a Vergnet pump assembled from spare parts costs only about 70% of the price of a new pump).

4. Recommendations

4.1 Maintenance Structure

A general maintenance strategy needs to be formulated, for newly developed facilities as well as for existing facilities. The strategy has to be drafted in such a way that it would cater in a practical manner for the transition of the present centralized O&M system to the new CWS system, preserving the already existing infrastructures, keeping the present O&M structures operational and thereby making best use of the personal resources. This strategy should be based on the following:

- Acceptance that O&M needs to be subsidized also under community management. The strategy will include the establishment of a District Water and Sanitation Team (DWST) in every district. Initially donors would support the DWST to cover the cost of O&M aspects. The GOG/District Assemblies would gradually take over the financial responsibility.

- GWSC CWD will have to take a regulatory role, it will have to draw up national codes for O&M. The regional GWSC CWD teams monitor that the rules and regulations set by GWSC are adhered to in the DWST and the private sector.

- Assessment of the existing resources. GWSC Maintenance Units/Teams are not dissolved but gradually changed and incorporated into the new CWS system. Eventually privatization of the services provided by these units will be encouraged.

- Standardization of Handpumps. Involvement of the private sector for O&M and the provision of spare parts make it mandatory to keep the number of pumps to a minimum. Standardization on regional criteria.

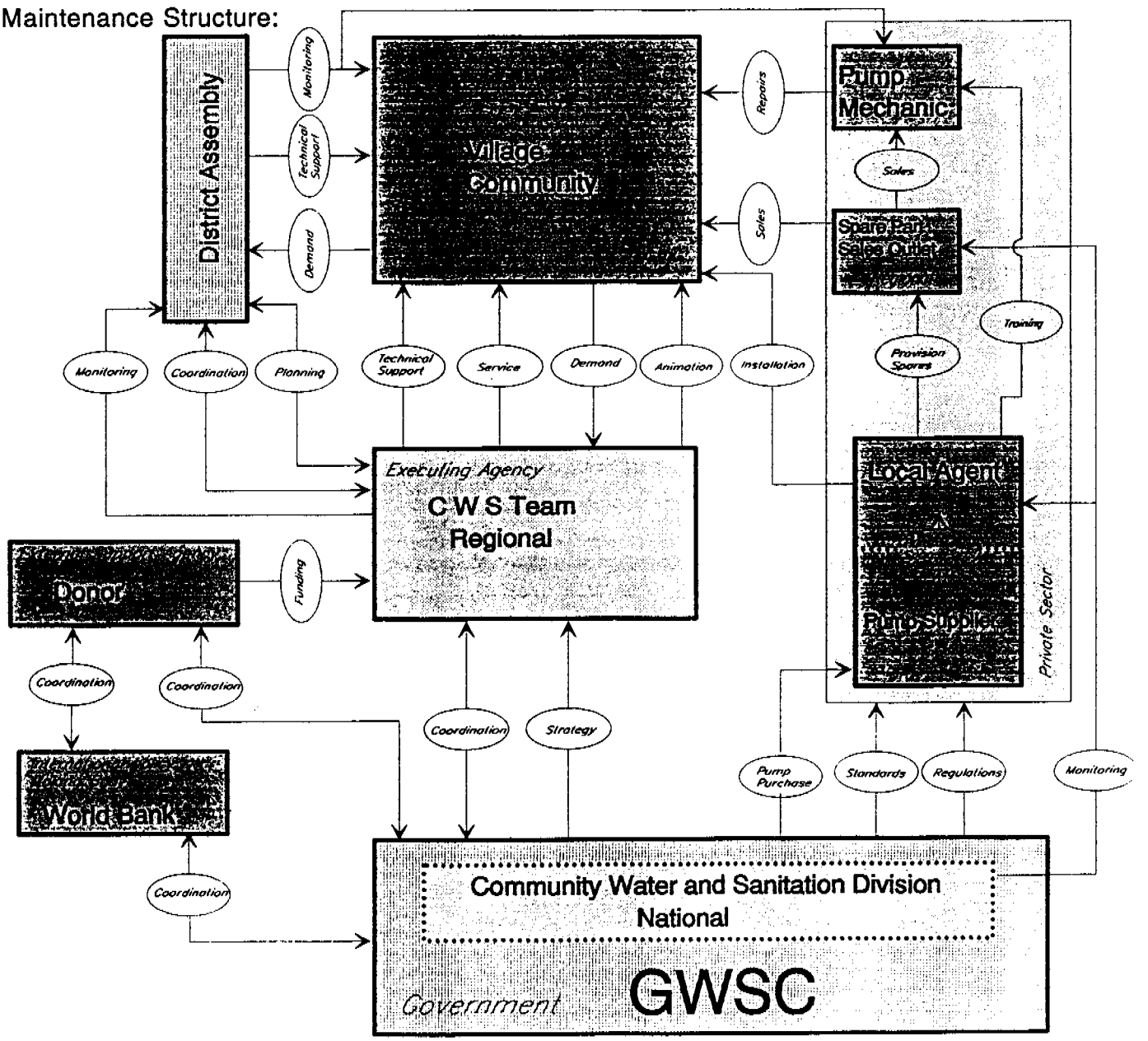
- An O&M Technician is to be included in the District Water and Sanitation Team (DWST). He will monitor the pumps at a regular interval of 6 months. He is responsible for advising and motivating the communities to fulfil their O&M

obligations. He will be responsible for maintaining the district data base of all water facilities. He is the link to private mechanics.

- Introduction of a continued annual monitoring scheme under which preventive maintenance is encouraged. Communities, when they assent to obtain a water facility, sign an agreement that they will inspect the handpump on a regular basis in presence of the O&M Technician of the DWST. During the inspection the fast wearing parts are exchanged. If communities choose to employ a mechanic for the inspection they will have to pay a fixed rate for this service to the mechanic. This will safeguard that the investments made by GOG are used and maintained properly.

- In order to perform the (preventive maintenance) inspections the area mechanic would need to be certified by Government. For this he would have to undergo the specified training. The training of area mechanics would be left to the supplier under the guidelines for pre-qualification.

Maintenance Structure:



The diagram of the recommended structure indicates that the organization of O&M with involvement of District Assemblies and the private sector is quite complex. It will be the role of GWSC CWD to make sure that efficient coordination between all the players in the field takes place.

4.1.1 Cost of recommended Maintenance Structure

If the same calculation criteria are used the cost for the monitoring and technical back up of the pumps at district level would be US$ 65.-/pump and year. The detail calculations can be found in Appendix IV. Projects that are implementing new water supply schemes would need to be encouraged to support the District Assemblies to set up this monitoring capacity. It is hoped that the District Assemblies will develop their own source of revenue collection so that such an initial outside subsidy could eventually be stopped.

4.2 Spare Parts Distribution

The GWSC approved suppliers will have to set up a network of spare parts outlets. The distribution network could have the following appearance:

- The national supplier keeps fully comprehensive stocks of spares in his central store.

- In each region/district the regional dealer will keep adequate stocks of spare parts. The financial risk will be with the national supplier. The regional dealer will pay a deposit of (let's say) 20% of the value of the spares that he has in stock. The margin for the regional dealer could be about 30% of the sales price. The quantity of spare parts in stock would have to be sufficient to cover at least 80% of all breakdowns. In the case that the components are not in stock with the regional dealer, he should be able to order the parts within one week from the national supplier. The regional dealer will sell the spare parts either directly to communities of through the appointed area mechanic. The bulk of the spare parts sales will be parts that are to be replaced during the (preventive maintenance) inspection. This will allow the regional dealer to plan fairly closely the annual turnover on spares. These planning figures will help the national supplier to establish the demand for spare parts on national level.

- The area mechanic is the principal outlet for spare parts sales. He would have a margin of (let's say) 20% on all spares. He will stock only the fast moving parts that normally need to be replaced during the inspection. He will have to order from the regional dealer any other spare part required for repairs outside the scheduled maintenance. The distribution network would need to be set up in such a way that (95% of the) spare parts could be available at the area mechanic in less than a week.

The government prepares a list of recommended spare parts sales prices for all the standardized pumps. This list will be reviewed and agreed on annually of half yearly together with the approved suppliers/manufacturers. The price list will be published as recommended prices so that the communities will know how much the spare parts cost.

4.3 Private Sector Involvement in O&M

Suppliers of handpumps will be compelled to set up their own after-sales service network. Thus the private sector will be responsible for the supply and distribution of spare parts. Spare part distribution on its own is not economically viable. It has to be tied in with the supply of new handpumps. GWSC CWD will approve only suppliers that are willing to provide the necessary after sales services and enter into long term contracts with them. If the renewal of the status of being eligible to supply depends on the continued availability of spare parts in the districts at reasonable cost, suppliers have to ensure the supply of spare parts. The setting up of regional sales centres equipped with the necessary tools and spares should be encouraged.

Area mechanics are small enterprises with part time activity to inspect, maintain and repair handpumps. Even though the regular inspections would provide a basic work load, the economic base of such a job is not sufficient to support a mechanic full time. The suppliers will be advised to appoint small entrepreneurs who are already operating in a related field (car/motorcycle mechanics, household articles repairers) as their district representatives.

- Any repairs and spare parts which become necessary between the inspections will have to be paid fully by the communities.

- Back-up for major repairs that are well outside the technical and financial capability of the communities would need to be ensured by the Government. Borehole redevelopment will have to be organized.

  In case of a major repair or borehole redevelopment the community can apply for financial assistance. Precondition to be eligible for any assistance would be that the community had all the annual inspections carried out. The cost sharing arrangement will include that the communities will have to pay a reasonable percentage of the cost.

- Identification of what services can be privatized. Franchising of some of the services to NGOs or private companies which are acting on behalf of Government will be considered.

- Assistance to the private sector to develop a network that can provide the spare parts and services. Pre-qualification of suppliers demands that after sales services are established in the regions and districts during the supply of the

initial pumps/equipment. This will guarantee that communities have spare parts and trained mechanics in the vicinity.

- Training of community pumps mechanics, area mechanics and O&M Technicians will be done by the suppliers under supervision of Government. District and Government personnel will need to be trained on all technologies.

Terms of Reference
for the Evaluation of Maintenance Systems in Ghana.

1. Background.

At present the following four types of pumps have been recommended by the Government of Ghana for various parts of the country:

1. NIRA AF 85
2. Ghana modified India Mark 2
3. Afridev
4. Vergnet

In parts of the upper region and northern region a combination of Afridev and NIRA pumps are proposed, depending on the respective water level of wells. In these regions a centralized maintenance system is in operation. However, in Bolgatanga a pilot project is in place to determine the sustainability of a decentralized maintenance system using village caretakers backed with area mechanics.

In some parts of Volta region, Ghana modified India Mark 2 pumps are being used having a centralized maintenance system. In the Central region Vergnet pump is used with community managed maintenance system and private sector taking care of the spare parts distribution in the area. Furthermore, several NGOs (Catholic Missions, Water Aid, etc.) operate in various parts of the country on centralized maintenance system. The idea of this study is to collect data from all these projects and evaluate the performance of all maintenance systems and make recommendations for the most suitable system or systems in the country or for the regions.

This study is proposed to be carried out in two stages. The initial stage being collection of data from randomly selected water points and from each project headquarters and sub-offices. In the final study, analysis of the collected data will be made and recommendations proposed with respect to each maintenance system and the changes required.

2. Terms of reference for the initial study:

Collection of data from randomly selected water points (say 5% of the total water point per project) as well as from project headquarters and sub-offices including all spare parts shops in the area. It is suggested that a form for the collection of data be used as it will make the data collection unilateral. The data should include the following information:

1) Institutional set-up, wether interlinked with other projects, GWSC or district assemblies.
2) Organizational structure of the established system for each area/region. who carries out repairs, no. of repairs done,etc.
3) Costs of repairs/preventive maintenance (labour, transport, depreciation and overheads, training, animation, tariff collection, etc.), spare parts costs,
4) Effectiveness of system, no of pumps out of service (temporarily/permanently), pump down time in each occasion,
5) Willingness and ability to pay for repairs with respect to each maintenance system. Method of fund collection and payment.
6) Availability of spare parts, distance to be travelled for purchase of spares, availability of tools, type of vehicles used.
7) Availability of water committees, how they are formed, how often the committee/ villages meet, how many village caretakers per water point, are they trained? level of training, responsibilities, Any assistance from area mechanic.
8) General condition of the pump and surrounding, any attempt to use water other than for drinking and washing, who fetches water.
9) General quality of water (eg. corrosiveness, colour, taste etc.), acceptability of water source, cylinder setting/SWL, no. of users per pump, who fetches water, type of pump used, pump ergonomics, purpose of water use.

During the final study the collected data will be used to assess the various maintenance systems operational in the area. The results of the assessment should include the following information:

1) A comparative study of organization, management, service levels and costs involved in the existing maintenance systems after careful consideration of the existing sociological and technical background of the area.

2) Recommendation on the most appropriate maintenance system for the regions/country with proposed changes including institutional framework, organizational structure and responsibilities of each organization and the personnel required for long term sustainability.

Travel Itinerary

18 Sept	So	Accra	Arrival in Accra
19 Sept	Mo	Accra	Meeting GWSC, 3000 Wells, RWSG, preparation of trip
20 Sept	Tu	Cape Coast	Transfer to Cape Coast, Meeting CFD project,
21 Sept	We	Kumasi	Field visit CFD project, Transfer to Kumasi
22 Sept	Th	Kumasi	Meeting 3000 Wells project, Field trip
23 Sept	Fr	Wenchi	Transfer to Wenchi, meeting Catholic mission, Field trip
24 Sept	Sa	Wenchi	Transfer to Tamale, Field trip NORRIP
25 Sept	So	Bolga	Transfer to Bolgatanga, meeting Cowater
26 Sept	Mo	Bolga	Field visits, meeting CIDA project
27 Sept	Tu	Kumasi	Transfer to Kumasi
28 Sept	We	Accra	Visit pump testing sites 3000 Wells, transfer to Accra
29 Sept	Th	Accra	Meeting RWSG-WA, 3000 Wells
30 Sept	Fr	Accra	Meeting CIDA, visit Ghanira Ltd., meeting WaterAid, debriefing with GWSC
01 Oct	Sa	Accra	Preparation of report
02 Oct	So	Accra	Preparation of report, Departure

Project Data

Project Data:

Name of the Project:	3000 Wells Project, Maintenance Unit (MU)	Village Water Supply, Catholic Mission Wenchi
Funding Agency:	KfW	Catholic Church
Implementing Agency:	GWSC-IGIP	Catholic Mission Wenchi
Co-operation between projects and institutions (formal/informal)	The MU has taken on the responsibility for the O&M of pumps that were installed by other agencies (UNICEF, VORADEP) No cooperation with other projects	No cooperation with other projects
Time schedule	1978-1984 Drilling 1985-1994 Maintenance 1990-1994 Rehabilitation	1985-1988 Drilling 1988-1994 Maintenance
Demand driven:	No	Partially. The communities had to pay ¢ 30,000 up front payment before the well was drilled. Additional ¢ 35,000 were charged for the installation of the pump.
Communities Trained:	No community involvement. A caretaker is trained for cleaning the pump site	A caretaker is trained for cleaning the pump site and greasing of the chain. Hygiene education is conducted about once every year by the Education team
Project Cost:	Total Project cost DM ≈121,000,000 Drilling cost DM 20,000/borehole	Total Project: cost no data Drilling cost: no data
Handpump cost:	Ghana Mod. India MKII US$ 1,200 This price does not include installation cost and distribution cost.	India MKII US$ 300 This price does not include installation cost and distribution cost.
No of Waterpoints	Presently Total 3,956 Planned Total 4,650 Ghana Mod India MKII SS	Total 320 India MKII SS
Persons/Pump	300 per pump, Total 1,200,000 persons	300 per pump, Total 96,000 persons
Typical usage per day:	medium usage, (guess 6 h a day) SWL ~ 15 m	medium to heavy usage, (guess 6-12h a day), SWL ~ 20 m

GWSC Maintenance Team (MT), Upper Regions	GWSC-CFD Central Region	NORRIP, Northern Region.	APDO, Community Level Handpump Maintenance
CIDA	Caisse Francaise de Developpement	CIDA	WaterAid
GWSC-Wardrop (Cowater)	Burgeap	NORRIP-Stanley/Cowater	Afram Plains Development Organization (APDO)
No cooperation with other projects	No cooperation exists between the 3000 Wells and the CFD projects.	Ministry of Health and Department of Community Development (MOH) in the Northern Region. GWSC has been contracted to drill the boreholes	District Assembly Afram Plains, NGOs operating in the district, Catholic Church, World Vision, Unicef
1974-1982 Drilling 1982-1994 Maintenance 1994-1997 Rehabilitation	Phase I June 1991-Dec 1993 Phase II March 1994-Dec 1996	1990-1994 Drilling and Training	1991-1994 Maintenance 1992-1994 Rehabilitation
No	No	Yes. Community contributes ¢ 60,000 initially plus 8 bags of cement for apron work. Although the community are supposed to collect ¢ 120,000 for the handpump fund, this is not strictly enforced.	No, but communities have to pay ¢ 75,000 for rehabilitation of pump
No community involvement for O&M. Community Water Organizers were trained for each pump.	Full community management. Water committee, pump mechanics and pump caretakers are trained.	Full community management. Water committee, village mechanics and pump caretakers are trained.	Full community management. Water committee, pump volunteers (Village mechanics) are trained.
Total Project: cost no data Drilling cost: no data	Phase I 45,000,000 FF Total (376 Waterpoints compl.) Phase II 33,000,000 FF Total (300 Waterpoints Planned) Drilling cost: US$ 18,000	Total Project: cost no data Drilling cost: no data	not drilled by project
No data, prices for 1978 apply	Vergnet US$ 2,300 This price includes installation cost and distribution cost, as well as setting up the structure for after sales services and training.	Afridev US$ 700. This price does not include installation cost and distribution cost.	Not purchased through project
Total 2600 (Monarch and Moyno	Phase I 376 Vergnet Phase II 300 Vergnet	Total 340 Afridev. Presently 200 boreholes are equipped with Afridev pumps, installation ongoing.	Total 147 in 68 communities, equipped with India MKII stainless steel rod and rising mains.
300 per pump, Total 780,000 persons	300 per pump, Total 112,000	300 per pump, Total 100,000 persons	500 per pump, Presently a total of 73,500 persons
medium usage, (guess 6 h a day) SWL ~ 10 - 15 m	medium usage, (guess 6 h a day) SWL ~ 10 - 15 m	medium usage, (guess 6 h a day), relatively deep boreholes for Ghana SWL ~ 30- 40 m	medium to heavy usage, (guess 8-12 h a day), SWL ~ 25 m

Project Data

Name of the Project:	3000 Wells Project, Maintenance Unit (MU)	Village Water Supply, Catholic Mission Wenchi
MAINTENANCE STRUCTURE:		
Organisational Structure for pump maintenance	Centralized Maintenance carried out without any involvement by the villages. The users have to pay a tariff The MU is an independent UNIT within GWSC with its own account. It can generate revenues directly for itself. Presently the districts are not involved at all, except in some cases the MU asks the District assemblies to help them with motivation for tariff collection.	Centralized Maintenance carried out without little involvement by the villages. The users have to pay a tariff of ¢ 3000/pump per month, plus an additional ¢ 20,000 for each repair. The Maintenance team is an independent UNIT within the mission, with its own account. It can generate revenues directly for itself. Presently the Districts Assemblies are not involved at all
Preventive maintenance:	4 visits by the Motorcycle mechanic per year. The mechanic collects during every visit the outstanding tariff.	The Education team visit the pumps about once every 1-1.5 years. They use the visit to vaguely check the pump
No. of persons employed	Presently 56 Personnel The MU is in process to reduce staff to: 1 Supervisor 8 Office Staff 3 Storekeeper 15 Mechanics/Pump Repairmen 12 Driver 1 Watchman	Maintenance Team: 1 Coordinator 2 Pump Mechanic/Driver 1 Mason 7 Junior Staff The maintenance team could also operate the drill rig if required Education Team (separate): 3 Trainers
Transport:	7 4x4 Vehicles 10 Motorcycles 4 Unimog Trucks For well maintenance: 3 Maintenance Rig Presently 3 more, under-utilized Unimog trucks are in addition in the MU. They were used in the previous maintenance strategy that was based on vehicles.	1 Pick-up 2 Pump Repair trucks with hoist 1 Truck 1 Drill Rig old
Operational costs: Fuel, Salaries, Allowances	For Ashanti Region only, serving 1,100 Pumps ¢ 5,700,000 per month ¢ 62,200 per pump per year	¢ 13,000,000 in 1993 ¢ 40,625 per pump per year

Appendix III

GWSC Maintenance Team (MT), Upper Regions	GWSC-CFD Central Region	NORRIP, Northern Region.	APDO, Community Level Handpump Maintenance
Centralized Maintenance carried out without any involvement by the villages. The users have to pay a tariff (32,250 per pump per year) The Maintenance Team is part of GWSC. Presently the districts are not involved at all.	The representative of the pump supplier is completely responsible for setting up after sales services. He has set up 5 spare part outlet in the regions and manages the mechanics. Private company that provides support to communities and mechanics. Community management for the pumps. 16 Area mechanics were trained by the pump supplier and they were given a toolbox and a motorcycle free. Initially the suppliers pays the mechanics an allowance because they do not find enough work when the pumps are new.	In each district one VLOM Support Unit consisting of one NORRIP and one GWSC pump mechanic. VLOM support unit equipped with one pick up and two motor cycle. These teams are reporting to NORRIP head office, Tamale. The VLOM Support Unit will be dissolved when installation is finished. VLOM Support Unit are being replaced by private area mechanics in each Zones. They were issued a motorcycle and tools box each. Minor repairs carried out by village caretaker and any other major repairs are done by the area pump mechanics.	Project area is divided into 9 Zones. In each zone a Zonal Executive is responsible for all the development activities of the Project. This Zonal executive hold few spare parts. The project has one pump supervisor equipped with one motor cycle. Villages were issued full tool boxes, about 3-4 villages have to share the tools. Each pump has two Pump Volunteers (mechanics), selected from technical trades in the area. They are fully trained to make all repairs.
Inspection Teams were stopped long time ago	Two visits by the mechanic in the first year. cost are free to the users. Agrovets pays the mechanic ¢ 2,500 per visit and supplies spares	Yes by VLOM Suoort Teams. After the unrest in the area the VLOM Support Units stopped operating	Yes, the supervisor monitors the pumps monthly and advises villages on repairs to be carried out. Once a year the villages dismantle and inspect the complete pump.
GWSC staff typical for pump maintenance only per Region: 7 Supervisor 7 District managers (Parttime 25%) 32 Mechanics Storekeepers and support personnel Staff will be reduced to 24 mechanics	1 Engineer, 16 Mechanics selfemployed but allowance paid, support staff for ordering customs clearance, etc.	VLOM Support Team 2 NORRIP Mechanics 2 GWSC Mechanics 6 Pump Mechanics (self employed)	3 in total, 1 Project Manager, 1 Supervisor Pumps, 1 Supervisor Sanitation
7 4x4 Vehicles (parttime 50%) 22 Motorcycles (old)	16 Motorcycles provided by supplier to the mechanics. For 2 years the bikes remain property of the project. Afterwards they will be owned by the mechanic	For VLOM Support Unit in the Region: 2 4x4 Vehicles 4 Motorcycle For pump mechanics: 6 Motorcycles	1 4x4 Vehicles 2 Motorcycle
No Data	No Data	No Data	Project pays Salaries, Fuel and allowances of the staff ¢ 6,000,000.- per year ¢ 40,820 per pump per year

Project Data

Name of the Project:	3000 Wells Project, Maintenance Unit (MU)	Village Water Supply, Catholic Mission Wenchi
COSTS AND REVENUES		
Tariff/Cost recovery	Data for Ashanti Region only: Tariff is ¢ 270 per household per month Collection is approx. ¢ 6,600,000 per month 100% collection would be ¢ 9,800,000 This represents about 67% collected tariffs If arrears amount to over ¢ 200,000 or 500,000 the MU disconnects all but one pump in the village to enforce payment. The disconnection policy appears to be rather lenient	Up to now the communities were asked to continuously replenish the maintenance deposit. The required deposit was ¢ 65,000. Any repair was charged at ¢ 20,000. A new tariff has just been introduced, the communities have to pay ¢ 3,000 per month and pump and an additional ¢ 20,000 per repair Communities that can not pay at the time are usually given credit for the repair Income in 1993 was ¢ 4,000,000
Depreciation of equipment	Not done, dependent on donor contribution for renewal	Not done.The project invested about US$ 400,000 in USA and in Holland. The interest from this investment is used to buy spare parts and new vehicles. Because of the large deficit, savings are spent to meet the operational cost.
Overheads, Rent, Housing	GWSC contribution is presently not calculated	The Catholic mission contributes houses store rooms and staff housing free. The value of this contribution is presently not calculated
Cost of Spareparts	Difficult to calculate, as rehabilitation and maintenance are not seperated. Parts cost fully covered by donor contribution	Are covered by the savings invested in Holland.
Spareparts Used	Could not be established as rehabilitation and maintenance are not seperated.	No Data
No. of breakdowns	Ashanti approx 2% per year Thanks to preventive maintenance 597 Pumps (of 3,952) not working = 85% operational Approx: 220 pumps disconnect due to arrears.	Pumps up to 30 m setting, approx. once every two years Pumps deeper than 30 m setting, about 2 times every year
Mean down-time	1 week average per repair reporting up to 14 days	4 days average per repair, reporting time might be longer
Who carried out the repairs	Motorcycle mechanic with little help from village	Pump Mechanic with very little help from village

Appendix III

GWSC Maintenance Team (MT), Upper Regions	GWSC-CFD Central Region	NORRIP, Northern Region.	APDO, Community Level Handpump Maintenance
Tariff is ¢ 32,250 per pump per year Collection is: Upper East: ¢ 18,114,000 (46%) Upper West: ¢ 14,054,000 (72%) Total 55% collected tariffs If arrears amount to over 200,000 the MT stops maintaining the pump	Labour cost not fixed average about ¢ 5,000 per repair Communities supplies the fuel or equivalent of bus fare Spares are purchased by the communities	Communities pay mechanics for the repairs, the cost per intervention is not fixed and needs to be negotiated. Spares are purchased by the community. Communities were told that the maintenance cost will be ¢ 40,000 - 60,000 per pump per year. They are motivated to keep ¢ 120,000 in bank accounts for future repairs.	Communities make all repairs themselves but they have to pay for the spare parts. They are motivated to keep a minimum of ¢ 100,000 in bank accounts for future repairs. If the supervisor has to assist in repairs the charges are: Transport ¢ 155.-/km, Labour ¢ 2,000.- per half day and ¢ 3-4,000 per full day
Not done, dependent on donor contribution for renewal	Not done. The project realizes that the mechanics will not be able to replace the motorcycles. Or else the cost per repair would need to be about ¢ 70,000 instead of ¢ 5,000	Not done.	Not done.
GWSC contribution is presently not calculated	Agrovets overheads are covered by the (high) purchasing cost of the handpump	NORRIP contribution is presently not calculated	Included in the above ¢ 6,000,000
No Data Are fully covered by donor contribution (CIDA)	Spareparts ¢ 2,900 per annum (all pumps new) Spareparts cost are about 40-50% of the equivalent prices in neighbouring countries. Agrovets now imported about $10,000 worth of spares financed by themselves	Prices are set by NORRIP, exclusive overheads Community pay in full	Communities pay full. Example prices: Piston seals (pair) ¢ 3,000 Bearings (pair) ¢ 5,000 Rising main SS ¢ 11,000
No Data	Total sales from 5 stores ¢ 880,000 in 2 years	No Data	Could not be established, some pumps were recently rehabilitated
70% operational (GWSC Statement), the reality is more likely to be about 60 % 340 not working because of tariff arrears 150 boreholes dry or condemned 50 poor yielding boreholes some broken down awaiting repairs	95% working (project statement), most pumps are less than 2 years old and were maintained under warranty Approx 1 repair per year per pump	No Data During inspection it was found nearly 50% out of order, awaiting repairs.	90% working 10% not working due to various reasons
4 weeks average per repair	29 days average per repair, reporting about 15 days	5 days (NORRIP statement) average per repair	3 days (Project statement) average per repair
Motorcycle mechanic with little help from village	Pump mechanic, no village help	Pump mechanic with little help from village	Pump volunteer with help from village

Project Data

Name of the Project:	3000 Wells Project, Maintenance Unit (MU)	Village Water Supply, Catholic Mission Wenchi
Other source of water during pump repair	Normally a village has 2 or 3 pumps because of the size of the villages (500-2000 population)	Normally a village has 2 or 3 pumps because of the size of the villages (500-2000 population)
SERVICES & SPAREPARTS AVAILABILITY		
From where spareparts are obtained/purchased	Spares are centrally managed in Kumasi. Each region has a store in the capital. Spares are purchased by the consultant depending on disbursement schedule by donor	Spares are kept in the store in Wenchi, few spares are kept in Sampa. Spares are purchased in India or recently through Prakla Seismos in Ghana. Payment is made from the fund in Holland
Technical-mechanical assistance available?	The MU can support all type of repairs	The Maintenance Team can support all type of repairs
Distance to the nearest sparepart shop	up to 100 km	up to 150 km
COMMUNITY ORGANIZATION		
User committee formed & functioning	Yes, But no training	Yes, But very little training (health education, etc)
Pump caretaker:	Yes, for cleaning and reporting only	Yes, for cleaning, greasing and reporting only
Funds collected:	Depending on village structure, some do some don't. The project does not interfere	Yes. According to contract and the maintenance deposit. Now the tariff is collected. Depending on village structure, some sell water, some contribute monthly and some after the harvest. The project does not interfere
Funds directly available at present	Many villages have arrears	Many villages have the ¢ 35,000 deposited with the project.

Appendix III

GWSC Maintenance Team (MT), Upper Regions	GWSC-CFD Central Region	NORRIP, Northern Region.	APDO, Community Level Handpump Maintenance
Rivers, Streams, Hand Dug Wells	Normally a village has 2 or 3 pumps because of the size of the villages (500-2000 population)	Normally a village has 2 or 3 pumps because of the size of the villages (500-2000 population)	Normally a village has 2 or 3 pumps because of the size of the villages (500-2000 population)
Spares are centrally managed in Accra. CIDA purchases the parts depending on the consultant planning. Each region has a store in the capital.	Agrovets purchased the spare parts with the pumps. Villagers can buy spares directly in the outlets or through the mechanic. In the case that the mechanic supplies the spares he receives a commission	Spares are centrally managed in Yendi & Gambaga. The project purchased a large stock of spares as funding will not be available in the future. These stocks are managed from Tamale	Spares are centrally managed in Project. In the past WaterAid purchased spares abroad. Recently the project bought spare parts from local sources. Each Zone purchases some stock from the project and sells them to the villages. Funds for these purchases come from a development fund to which all villages contribute. All these transaction are done without any overhead or handling charges. In this way WaterAid and the projects subsidies the spare parts prices.
The MT can support all type of repairs	If major repairs have to be done Agrovets has one engineer with a pick-up truck.	Yes. Pump mechanics are available in case of difficulty.	Yes. Pump Supervisor is available in case of difficulty.
up to 100 km	5-max 30 km	40-50 km	10-15 km to the nearest zonal outlet.
Yes, no technical training, Community Water Organizers were trained under WUP	Yes, 5 members, normally one women. No formal training	Yes, Training was provided to the community on minor repairs. Substantial input in training of water committees and in hygiene educations were given	Yes, Extensive training was provided to the community on repairs. Substantial input in training of water committees and in hygiene educations were given. Refresher training on repairs are given on a yearly basis.
Yes, Community Water Organizers take on this role	Yes, for cleaning and reporting only	Yes, for cleaning and preventive maintenance.	Yes, pump volunteers take on the role
Depending on village structure, some do some don't. The project does not interfere	Yes, in bank accounts	Yes, in bank accounts.	Yes, in bank accounts .
Many villages have arrears	Yes, Total ¢ 27,000,000 deposited with rural banks (70,000 per pump)	Yes, but not sufficient	Yes. ¢ 100,000 -200,000 Rural Banks are not always available. The project organises that mobile banks are coming into the zones on agreed dates.

Project: **3000 Wells Maintenance Unit**

Maintenance System: 1 1=Centralized 2=De-centralized

No of Pumps: 4428 Deep Well
50 Shallow Well

PERSONNEL:	*No:*
Manager/Coordinator	1
Engineer	0
Supervisor	1
Storekeeper	3
Mechanic	15
Driver	12
Sales Rep./Office Staff	8
Guard	1

EQUIPMENT:	*No:*
Motorcycle	10
Pick up	0
4WD Car	7
Service Truck(Unimog)	6
Truck	0
Toolsets	15
Computer	5
Furniture/Desk	114
Storage Rack	20

RENT:	US$
Office	54,000
Workshop	6,000
Housing Mgr	0
Housing Staff	0

Rent&Overhead subsidized by: GWSC

Income

Tariff per Household	Cedis/m	270
Tariff per Pump and Year	US$/y	$105.3
Collection Rate		66%
Total Tariff Collection/Year	$311,330	

Profit/Loss	Total	**$164,577.61**
Subsidy by Project	/Pump	**$36.75**

Project: 3000 Wells Maintenance Unit

FIXED COST:			
Depreciation:			*Total*
Motorcycle	10	762	7621
Pick up	0	3902	0
4WD Car	7	4878	34145
Service Truck(Unimog)	6	4983	29899
Truck	0	6699	0
Toolsets	15	152	2286
Computer	5	1524	7621
Furniture/Desk	114	214	24347
Storage Rack	20	43	854
Rent:			
Office		54000	54000
Workshop		6000	6000
Housing Mgr		0	0
Housing Staff		0	0
Capital Cost Spares:			
Interest on Capital (Spares)		13458	13458
TOTAL FIXED COST			**180,231**

RUNNING COST:			
Personnel Cost:	No:	Salary	*Total*
Manager/Coordinator	1	4,138	4,138
Engineer	0	3,547	0
Supervisor	1	2,365	2,365
Storekeeper	3	1,182	3,547
Mechanic	15	1,419	21,281
Driver	12	1,419	17,025
Sales Rep.	8	1,182	9,458
Guard	1	946	946
Transport Cost:	Maintenance	Fuel	
Motorcycle	762	2,460	3,222
Pick up	0	0	0
4WD Car	3414	12,425	15,839
Service Truck(Unimog)	2093	11,502	13,595
Truck	0	0	0
Premises maintenance, Electricity, Water			
Lump Sum (20% of Rent)		12,000	12,000
Spare Parts/Pumps:			
Deep Well Pump		191511	191,511
Shallow Well pump		750	750
TOTAL RUNNING COST			**295,676**

TOTAL COST	**475,908**
Cost per Pump	**106.28**

Project: **Catholic Mission Wenchi**

Maintenance System: 1 1=Centralized 2=De-centralized

No of Pumps: 320 Deep Well
0 Shallow Well

PERSONNEL:	*No:*
Manager/Coordinator	1
Engineer	0
Supervisor	0
Storekeeper	0
Mechanic	2
Driver	1
Sales Rep./Office Staff	0
Guard/Junior Staff	7

EQUIPMENT:	*No:*
Motorcycle	0
Pick up	1
4WD Car	0
Service Truck(Unimog)	2
Truck	0
Toolsets	2
Computer	0
Furniture/Desk	2
Storage Rack	2

RENT:	US$
Office	6,000
Workshop	0
Housing Mgr	0
Housing Staff	0

Rent&Overhead subsidized by: Mission

Income

Tariff per Pump	Cedis/m	3000
Tariff per Pumpand Year	US$/y	$55.2
Collection Rate		80%
Total Tariff Collection/Year	$14,124	

Profit/Loss	Total	**$43,927.39**
Subsidy by Project	/Pump	**$137.27**

Project: **Catholic Mission Wenchi**

FIXED COST:			
Depreciation:			*Total*
Motorcycle	0	762	0
Pick up	1	3902	3902
4WD Car	0	4878	0
Service Truck(Unimog)	2	4983	9966
Truck	0	6699	0
Toolsets	2	152	305
Computer	0	1524	0
Furniture/Desk	2	214	427
Storage Rack	2	43	85
Rent:			
Office		6000	6000
Workshop		0	0
Housing Mgr		0	0
Housing Staff		0	0
Capital Cost Spares:			
Interest on Capital (Spares)		969	969
TOTAL FIXED COST			**$21,655**

RUNNING COST:			
Personnel Cost:	No:	Salary	*Total*
Manager/Coordinator	1	4,138	4,138
Engineer	0	3,547	0
Supervisor	0	2,365	0
Storekeeper	0	1,182	0
Mechanic	2	1,419	2,837
Driver	1	1,419	1,419
Sales Rep.	0	1,182	0
Guard	7	946	6,621
Transport Cost:	Maintenance	Fuel	
Motorcycle	0	0	0
Pick up	390	1,420	1,810
4WD Car	0	0	0
Service Truck(Unimog)	698	3,834	4,532
Truck	0	0	0
Premises maintenance, Electricity, Water			
Lump Sum (20% of Rent)		1,200	1,200
Spare Parts/Pumps:			
Deep Well Pump		13840	13,840
Shallow Well pump		0	0
TOTAL RUNNING COST			**$36,397**

TOTAL COST	**$58,052**
Cost per Pump	**$181.41**

Project: **GWSC/CIDA Upper Regions**

Maintenance System: 2 1=Centralized 2=De-centralized

No of Pumps: 2600 Deep Well
0 Shallow Well

PERSONNEL:	*No:*
Manager/Coordinator	2
Engineer	0
Supervisor	7
Storekeeper	0
Mechanic	32
Driver	0
Sales Rep./Office Staff	0
Guard/Junior Staff	0

EQUIPMENT:	*No:*
Motorcycle	22
Pick up	1
4WD Car	4
Service Truck(Unimog)	2
Truck	0
Toolsets	32
Computer	0
Furniture/Desk	14
Storage Rack	20

RENT:	US$
Office	40,000
Workshop	0
Housing Mgr	0
Housing Staff	0

Rent&Overhead subsidized by: GWSC

Income

Tariff per Pump	Cedis/y	32250
Tariff per Pumpand Year	US$/y	$32
Collection Rate		55%
Total Tariff Collection/Year	$45,436	

Profit/Loss	Total	**$393,392.13**
Subsidy by Project	/Pump	**$151.30**

Project: GWSC/CIDA Upper Regions

FIXED COST:			
Depreciation:			*Total*
Motorcycle	22	762	16766
Pick up	1	3902	3902
4WD Car	4	4878	19511
Service Truck(Unimog)	2	4983	9966
Truck	0	6699	0
Toolsets	32	152	4877
Computer	0	1524	0
Furniture/Desk	14	214	2990
Storage Rack	20	43	854
Rent:			
Office		40000	40000
Workshop		0	0
Housing Mgr		0	0
Housing Staff		0	0
Capital Cost Spares:			
Interest on Capital (Spares)		15652	15652
TOTAL FIXED COST			**$114,520**

RUNNING COST:			
Personnel Cost:	No:	Salary	*Total*
Manager/Coordinator	2	4,138	8,276
Engineer	0	3,547	0
Supervisor	7	2,365	16,552
Storekeeper	0	1,182	0
Mechanic	32	1,419	45,399
Driver	0	1,419	0
Sales Rep.	0	1,182	0
Guard	0	946	0
Transport Cost:	Maintenance	Fuel	
Motorcycle	1677	5,412	7,089
Pick up	390	1,420	1,810
4WD Car	1951	7,100	9,051
Service Truck(Unimog)	698	3,834	4,532
Truck	0	0	0
Premises maintenance, Electricity, Water			
Lump Sum (20% of Rent)		8,000	8,000
Spare Parts/Pumps:			
Deep Well Pump		223600	223,600
Shallow Well pump		0	0
TOTAL RUNNING COST			**$324,308**

TOTAL COST	**$438,828**
Cost per Pump	**$168.78**

Project: **GWSC/CFD Vergnet-Agrovets**

Maintenance System: 2 1=Centralized 2=De-centralized

No of Pumps: 676 Deep Well
0 Shallow Well

PERSONNEL:	*No:*
Manager/Coordinator	0.1
Engineer	1
Supervisor	0
Storekeeper	0.5
Mechanic	16
Driver	0
Sales Rep./Office Staff	0.5
Guard	0

EQUIPMENT:	*No:*
Motorcycle	16
Pick up	1
4WD Car	0
Service Truck(Unimog)	0
Truck	0
Toolsets	16
Computer	0
Furniture/Desk	2
Storage Rack	2

RENT:	US$
Office	6,000
Workshop	0
Housing Mgr	0
Housing Staff	0

Rent&Overhead subsidized by: Agrovets

Income

Tariff per Household	Cedis/m	0
Tariff per Pumpand Year	US$/y	$0
Collection Rate		N/A
Total Tariff Collection/Year	N/A	

Cost sharing between Communities and Agrovets

Communities pay about $35,000 of Total

Profit/Loss	Total	**$103,032.41**
Subsidy by Agrovets	/Pump	***$100.64***

Project: **GWSC/CFD Vergnet-Agrovets**

FIXED COST:			
Depreciation:			*Total*
Motorcycle	16	762	12194
Pick up	1	3902	3902
4WD Car	0	4878	0
Service Truck(Unimog)	0	4983	0
Truck	0	6699	0
Toolsets	16	152	2439
Computer	0	1524	0
Furniture/Desk	2	214	427
Storage Rack	2	43	85
Rent:			
Office		6000	6000
Workshop		0	0
Housing Mgr		0	0
Housing Staff		0	0
Capital Cost Spares:			
Interest on Capital (Spares)		4070	4070
TOTAL FIXED COST			**$29,117**

RUNNING COST:			
Personnel Cost:	No:	Salary	*Total*
Manager/Coordinator	0.1	4,138	414
Engineer	1	3,547	3,547
Supervisor	0	2,365	0
Storekeeper	0.5	1,182	591
Mechanic	16	236	3,783
Driver	0	1,419	0
Sales Rep.	0.5	1,182	591
Guard	0	946	0
Transport Cost:	Maintenance	Fuel	
Motorcycle	1219	2,624	3,843
Pick up	390	1,420	1,810
4WD Car	0	0	0
Service Truck(Unimog)	0	0	0
Truck	0	0	0
Premises maintenance, Electricity, Water			
Lump Sum (20% of Rent)		1,200	1,200
Spare Parts/Pumps:			
Deep Well Pump		58,136	58,136
Shallow Well pump		0	0
TOTAL RUNNING COST			**$73,916**

TOTAL COST	**$103,032**
Cost per Pump	**$152.41**

Project: **NORRIP**

Maintenance System: 2 1=Centralized 2=De-centralized

No of Pumps: 340 Deep Well
0 Shallow Well

PERSONNEL:	*No:*
Manager/Coordinator	0
Engineer	0
Supervisor	0
Storekeeper	0
Mechanic	4
Driver	0
Sales Rep./Office Staff	0
Guard	0

EQUIPMENT:	*No:*
Motorcycle	4
Pick up	0
4WD Car	2
Service Truck(Unimog)	0
Truck	0
Toolsets	10
Computer	0
Furniture/Desk	2
Storage Rack	2

RENT:	US$
Office	6,000
Workshop	0
Housing Mgr	0
Housing Staff	0

Rent&Overhead subsidized by: NORRIP

Income

Tariff per Household	Cedis/m	0
Tariff per Pumpand Year	US$/y	$0
Collection Rate		N/A
Total Tariff Collection/Year	N/A	

Cost sharing between Communities and NORRIP

Communities pay about $30,000 of Total

Profit/Loss	Total	**$63,832.89**
Subsidy by Project	/Pump	**$99.51**

Project: **NORRIP**

FIXED COST:			
Depreciation:			*Total*
Motorcycle	4	762	3048
Pick up	0	3902	0
4WD Car	2	4878	9756
Service Truck(Unimog)	0	4983	0
Truck	0	6699	0
Toolsets	10	152	1524
Computer	0	1524	0
Furniture/Desk	2	214	427
Storage Rack	2	43	85
Rent:			
Office		6000	6000
Workshop		0	0
Housing Mgr		0	0
Housing Staff		0	0
Capital Cost Spares:			
Interest on Capital (Spares)		2047	2047
TOTAL FIXED COST			**$22,888**

RUNNING COST:			
Personnel Cost:	No:	Salary	*Total*
Manager/Coordinator	0	4,138	0
Engineer	0	3,547	0
Supervisor	0	2,365	0
Storekeeper	0	1,182	0
Mechanic	4	1,419	5,675
Driver	0	1,419	0
Sales Rep.	0	1,182	0
Guard	0	946	0
Transport Cost:	Maintenance	Fuel	
Motorcycle	305	0	305
Pick up	0	0	0
4WD Car	976	3,550	4,526
Service Truck(Unimog)	0	0	0
Truck	0	0	0
Premises maintenance, Electricity, Water			
Lump Sum (20% of Rent)		1,200	1,200
Spare Parts/Pumps:			
Deep Well Pump		29,240	29,240
Shallow Well pump		0	0
TOTAL RUNNING COST			**$40,945**

TOTAL COST	**$63,833**
Cost per Pump	**$187.74**

Project: **APDO, Afram Plains (WaterAid)**

Maintenance System: 1 1=Centralized 2=De-centralized

No of Pumps: 147 Deep Well
0 Shallow Well

PERSONNEL:	*No:*
Manager/Coordinator	1
Engineer	0
Supervisor	1
Storekeeper	0
Mechanic	0
Driver	0
Sales Rep./Office Staff	0
Guard	0

EQUIPMENT:	*No:*
Motorcycle	2
Pick up	0
4WD Car	1
Service Truck(Unimog)	0
Truck	0
Toolsets	20
Computer	0
Furniture/Desk	2
Storage Rack	2

RENT:	US$
Office	4,000
Workshop	0
Housing Mgr	0
Housing Staff	0

Rent&Overhead subsidized by: APDO

Income

Tariff per Household	Cedis/m	0
Tariff per Pumpand Year	US$/y	$0
Collection Rate		N/A
Total Tariff Collection/Year	N/A	

Cost sharing between Communities and NORRIP

Communities pay about $ 8,000 of Total

Cost Total	Total	**$30,811.45**
Subsidy by Project	/Pump	**$155.18**

Project: APDO, Afram Plains (WaterAid)

FIXED COST:			
Depreciation:			*Total*
Motorcycle	2	762	1524
Pick up	0	3902	0
4WD Car	1	4878	4878
Service Truck(Unimog)	0	4983	0
Truck	0	6699	0
Toolsets	20	152	3048
Computer	0	1524	0
Furniture/Desk	2	214	427
Storage Rack	2	43	85
Rent:			
Office		4000	4000
Workshop		0	0
Housing Mgr		0	0
Housing Staff		0	0
Capital Cost Spares:			
Interest on Capital (Spares)		445	445
TOTAL FIXED COST			**$14,408**

RUNNING COST:			
Personnel Cost:	No:	Salary	*Total*
Manager/Coordinator	1	4,138	4,138
Engineer	0	3,547	0
Supervisor	1	2,365	2,365
Storekeeper	0	1,182	0
Mechanic	0	1,419	0
Driver	0	1,419	0
Sales Rep.	0	1,182	0
Guard	0	946	0
Transport Cost:	Maintenance	Fuel	
Motorcycle	152	328	480
Pick up	0	0	0
4WD Car	488	1,775	2,263
Service Truck(Unimog)	0	0	0
Truck	0	0	0
Premises maintenance, Electricity, Water			
Lump Sum (20% of Rent)		800	800
Spare Parts/Pumps:			
Deep Well Pump		6,358	6,358
Shallow Well pump		0	0
TOTAL RUNNING COST			**$16,403**

TOTAL COST	**$30,811**
Cost per Pump	**$209.60**

Project: **Recommended O&M Structure**

Maintenance System: 1 1=Centralized 2=De-centralized

No of Pumps: 300 Deep Well
0 Shallow Well

PERSONNEL:	*No:*
Manager/Coordinator	0.5
Engineer	0
Supervisor	0
Storekeeper	0
Mechanic	1
Driver	0
Sales Rep./Office Staff	0
Guard	0

EQUIPMENT:	*No:*
Motorcycle	2
Pick up	0
4WD Car	0.5
Service Truck(Unimog)	0
Truck	0
Toolsets	2
Computer	1
Furniture/Desk	2
Storage Rack	2

RENT:	US$
Office	6,000
Workshop	0
Housing Mgr	0
Housing Staff	0

Income

Tariff per Household	Cedis/m	0
Tariff per Pumpand Year	US$/y	$0
Collection Rate		N/A
Total Tariff Collection/Year		N/A

Communities pay directly for repairs and spare parts
= ca. $40.- per annum

Cost Total	Total	**$32,487.47**
Subsidy by Project	/Pump	**$108.29**

These Costs are not calculated For Monitoring only

Project: Recommended O&M Structure

FIXED COST:			
Depreciation:			*Total*
Motorcycle	2	762	1524
Pick up	0	3902	0
4WD Car	0.5	4878	2439
Service Truck(Unimog)	0	4983	0
Truck	0	6699	0
Toolsets	2	152	305
Computer	1	1524	1524
Furniture/Desk	2	214	427
Storage Rack	2	43	85
Rent:			
Office		6000	6000
Workshop		0	0
Housing Mgr		0	0
Housing Staff		0	0
Capital Cost Spares:			
Interest on Capital (Spares)		908	908
TOTAL FIXED COST			$13,213

RUNNING COST:			
Personnel Cost:	No:	Salary	*Total*
Manager/Coordinator	0.5	4,138	2,069
Engineer	0	3,547	0
Supervisor	0	2,365	0
Storekeeper	0	1,182	0
Mechanic	1	1,419	1,419
Driver	0	1,419	0
Sales Rep.	0	1,182	0
Guard	0	946	0
Transport Cost:	Maintenance	Fuel	
Motorcycle	152	328	480
Pick up	0	0	0
4WD Car	244	888	1,131
Service Truck(Unimog)	0	0	0
Truck	0	0	0
Premises maintenance, Electricity, Water			
Lump Sum (20% of Rent)		1,200	1,200
Spare Parts/Pumps:			
Deep Well Pump		12,975	12,975
Shallow Well pump		0	0
TOTAL RUNNING COST			$19,274

TOTAL COST	$32,487
Cost per Pump	$108.29

Persons met

P.O. Sackey, Director Rural Water, GWSC

Collins Annoh, RWSG-WA,

Thierry Barbotte, Project Manager, GWSC-CFD Project
Emmanuel Gaze, Co-Project Manager, GWSC-CFD Project
Samuel Ayekwei, Managining Director, Agrovets
Emmanuel Abaidoo, Engineer, Agrovets
Michael Coleman- de Graft, Agrovet Store, Cape Coast
T.K. Aidoo, Chaïrman Water committee, Mpredwe

Peter Kabah, Ghana Broadcasting Corporation, Cape Coast

Emmanuel Boateng, 3000 Wells Maintenance Unit, GWSC
Joseph T. Konlan, Manager, 3000 Wells Maintenance Unit, GWSC
Klaus Riexinger, IGIP/3000 Wells Maintenance Unit, GWSC
E.O. Kankam, Supervisor Ashanti Region, 3000 Maintenance Unit
J. Odan, Field Operations Manager, 3000 Maintenance Unit
Kwasi Owusu, Motorcycle Mechanic, 3000 Maintenance Unit
Richmond Nti, Member Water Committee, Fufuo

Josef Kipu, Coordinator, Catholoc Mission Wenchi
Peter Kromo Ababio, Driller/Pumpmechanic, Catholic Mission Wenchi
Nana Moses Attah Kwabena, Chairman Watercommittee, Kyingakrom
Paul Addie, Chairman Watercommittee, Branam

David Kidd, Project Coordinator, COWAP, Bolgatanga
Elisabeth Kidd, Social Advisor, COWAP
Blandina Batir, Regional Co-coordinator, COWAP
Raphael Nampusuor, Technical Advisor, COWAP
Alfred Yeboah, Hand Pump Specialist, COWAP
Dan Coleman, Chief Accountant, Cowater, Cananda
John ...; Mechanic, GWSC
George Yanore, Technology Specialist, COWAP
George Kumasi, Spareparts Dealer, Bolgatanga
Adola Yaba, Chairman Water Committee, Sumburungu-Dasungu

Chandran Tiruchittampalam, CIDA

Anssi Tihekari, Managing Director, Ghanira Ltd.
Ansah Manukure Emmanuel, Production Engineer, Ghanira Ltd.
Mensah ... , Training and Installation, Ghanira Ltd
Jose Mouiche, Marketing Manager, Ghanira Ltd.

Judith Thomson, Executive Secretary, Pronet

A.Y.O. Modoc, Project Manager, Afram Plains Development Orgainisation

Sufur Ali, WaterAid Co Representative, Water Aid

PRICE LIST GHANA 1994

N°2 : Spare parts for VERGNET Hydropump

Please to ABIDJAN underline all the name of spare parts under warranty.

DESIGATION	REFERENCE	PRICE-CEDIS
FOUNTAIN	21310599	72050
WATER TIGHTNESS SEALING	21220308	1760
FRAME TO BE CASTED	21220312	28160
DRIVE CYLINDER	21230305	63470
SCREW BOLT HM 10 x 25	21999042	121
GUIDE NUT	21220309	7810
GUIDE BUSHING	21220301	5940
PEDAL 4 C	21230201	20240
PISTON	21220202	1980
PISTON RING	21220205	990
PISTON TIGHTNESS SEALING	21220203	220
PISTON NUT HM 12	21999012	2860
LOWER STOP RING	21220302	583
SEPTOR TYPE FITTING 33x42	21999004	5060
SEAL WASHER FOR SEPTOR	21999037	110
PUMP BODY CYLINDER	21120210	111980
CHECK VALVE BOX LOWER PART	21120501	45430
CHECK VALVE BOX UPPER PART	21120502	51590
STRAIGHT JOINT 1 mm	21120504	935
SCREW CHC M5x50	21999041	385
SEAL RING FOR CHECK VALVE BOX	21999001	165
ELASTIC SLEEVE	21120199	61600
SCREW CHC 5x16	21999005	198
SUCTION VALVE SEAT	21120303	6215
SCREEN	21999008	1485
VALVE BALL	21999046	880
SEAL RING FOR SUCTION VALVE	21999002	110
HOSES COUPLING	1431025	7590
DISCHARGE HOSE	21999020	836
DRIVE HOSE	21999026	1430
SECURITY COLLAR	21999055	330
ROPE LENGHT 2 METERS	21999044	165
SEPTOR NUT MALE	21999065	1650
SEAL RING FOR SEPTOR	21999059	220
ACETATE RING	21999060	110
BAGUE DE SERRAGE	21999062	1100
SPANNER FOR ROUTINE MAINTENANCE	21220303	4620