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## **Maintenance in village water supply section, Lesotho**

### INTRODUCTION

The Rural Water and Sanitation project funded by USAID effectively began in May 1981, to provide clean water and maintenance for new and existing systems country-wide and to build up the institutional capacity of VWSS. With the success of this project other donors are now participating recognizing the importance of good maintenance and are providing funding for both maintenance and transport as well as for new construction materials.

A basic organizational structure was established with maintenance sub-divided into sections according to responsibility.

The maintenance engineers are responsible for all vehicles, equipment, water system maintenance and transport. Personnel have been recruited and trained to fill the job slots and to absorb the workload.

At the beginning, the maintenance capability of Village Water Supply was very low, however the situation has since reversed. We now have three regional workshops in operation, two workshop managers trained overseas, a systems maintenance supervisor, 4 regional water system repair crews, a drill rig repair crew and a transport officer. The section is well organized and staffed such that at present level of activity, vehicles and water supplies are attended to on a timely basis.

The maintenance engineers directly supervise the activities of all three regional workshops, a welding shop, transport officer with 14 professional drivers, 60 vehicle fleet, 4 systems repair teams and a drill rig repair crew. The M.E.'s design all diesel engine powered pumping systems for water supplies and are responsible for their installation. Steel frames have been designed and built in the VWS welding shop for various combinations of engines and pumps for standardization. A machine has been designed and built to test borehole yields. Reusable steel frames have been designed and built for the casting of handpump slabs and standpipe foundations. Crews have been trained for the installation and repair of handpumps.

### VEHICLE MAINTENANCE

The Maseru workshop (Central Region and

Headquarters) employs one workshop manager, three mechanics, one welder, one helper and two storekeepers full time. The Maputsoe workshop (Northern Region) has one mechanic stationed full time and resident in the area. One workshop manager trained in Germany divides his time by spending approximately half of each week in Maputsoe and the remainder of the week in Maseru. The maintenance facility in Maseru's Hoek (Southern Region) is equipped to handle most routine services and repair. There is one mechanic full time. This mechanic has been utilized outside the workshop to weld base plates on boreholes and service a few diesel engine powered water systems.

The two workshop managers are working managers, that is, they are responsible for the supervision and scheduling of the workload among the mechanics and are doing service and repairs on vehicles right along with their subordinates. They are active in training or consulting with the other mechanics upgrading their skill and assisting them in difficult repairs. When workloads demand, a mechanic is pulled in from one of the field system maintenance crews for temporary duty.

The Maseru workshop is equipped with modern tools giving the capability for wheel alignment and balancing, engine analyzer and tune-up, engine rebuild, transmission overhaul, and general service. Training courses have been given on all specialized equipment making each mechanic more versatile.

Vehicles are routinely scheduled into the shop by a jobcard system initiated with the transport officer who monitors kilometer usage. Every 2,500 km each vehicle passes through the shop receiving major or minor service as the kilometer usage indicates. Breakdowns are also reported to the transport officer who sends the vehicle to the shop with a jobcard requesting specific repairs.

An inventory of spare parts has been built up gradually as experience is gained. A new computer has been added to VWS by the Project which will enable all spare parts to be better controlled. Security of the spare parts store is also being strengthened in that with two store keepers on duty there will always be one on the counter to supply the mechanic with needed supplies or parts without

the mechanic or some unauthorized person having access to the store.

Spare parts constitutes the major portion of the vehicle maintenance budget. Their purchasing and control, especially since the stock on hand is growing, must receive the attention that it deserves. All parts requirements (that is, new purchases) are first listed on a requisition form. This requisition is reviewed by the M.E. for correctness in terms of source, quantity and cost. A vote number is then assigned to the requisition by the M.E. informing the accounts section from which vote to commit the necessary funds to cover the purchase. The financial controller or senior accountant will check the vote to be sure that funds are available, initial the requisition which is then taken to the general stores office for order preparation. The order is accepted as guarantee of payment by suppliers and is quoted on their monthly invoice.

When the new spare part is received it is logged in on its own special inventory card by part number. If the part is to be used immediately it is logged out to whatever vehicle, machine or piece of equipment that is being repaired. If, when a part comes in, there is no inventory card as this is the first time to purchase that particular item then a new inventory card is created and the part logged in/out as appropriate. A decision is made as to the adviseability of having a spare in inventory and if so, one or more as needed will be ordered through the requisition process for stock.

A complete shelf count of parts has been completed and all parts have been coded by part number, assigned a bin location, an inventory card prepared, and this information has been computerized. The emphasis now is on training and motivation to ensure that all movements of spares both in and out are properly recorded. Each inventory card has a max/min quantity level for that particular item. As a part is issued it must be recorded on the card telling where it was used, a deduction in the balance on hand, and a check to see if the new balance indicates a reorder level. If reorder is required then a sufficient quantity should be ordered immediately to bring the stock level up to the maximum level indicated. When an entry is made on a card, the card is "flagged" with a paper clip. Once a week the information entered on the cards which have been flagged is entered on the computer such that an up to date inventory report is always available showing stocks on hand, stocks on order, value of stock, current cost for each item and total value of stock in the store. At present there are over 800 different spares in stock with a value exceeding R65,000.

The small inventory of spare parts currently in stock in the regional centers needs to be supplemented and expanded. We plan to implement an inventory control system compatible to Maseru and train the mechanics in its use. Maximum and minimum levels of stocks will be dictated based on the number of vehicles to be served. Once a month the inventory cards will be sent to Maseru for computer updating and new printouts showing current price information and stock levels will be supplied. A printout of the Maseru stock levels will also be furnished to the centers so that the mechanic will know what is available directly from the Maseru store.

### III. Other District Workshops (Country-wide)

At the present time there are no immediate plans to staff the District Offices with a mechanic. With three exceptions, Mokhotlong, Thaba Tseka, and Qacha's Nek, the district offices are fairly convenient to a regional workshop which can serve their requirements. In the three exception districts there is only one vehicle for each District engineer and normal monthly visits to regional centers have been sufficient to meet service requirements.

### IV. Drill Rig Maintenance

We are slowly building up a stock of spare parts for the drill rigs such as bearings, belts, and other perishable items. In addition we try to keep two engines in stock ready to go on an exchange basis. When an engine goes down for something other than routine service the policy is to exchange the complete engine with one in stock and put the rig back in to production in a matter of hours. The faulty engine is then brought in to the workshop and repaired or overhauled and placed on the shelf.

An effort has been made to keep all 12 rigs working in close proximity to each other. As long as this is feasible the present repair crew can continue to handle all repairs. If it became necessary to split up the rigs then a second crew would have to be organized, equipped and trained to keep down-time to a minimum. The present team has performed well to date with all the requirements for repair and service.

### V. Systems Maintenance

The burden on systems maintenance at the beginning of the Project was to "catch up" on all of the old requests for repairs. Through equipping and training 4 separate crews under the supervision of a Mosotho who holds a Trade Test "B" Certificate and successfully completed the VWS foremans course, the backlog has been erased and current requests are promptly

answered. The challenge now is to continue the rapid response recognizing that 229 new systems of all types have been placed into operation since the beginning of the Project and approximately 100 new systems are being constructed annually.

The tremendous expansion of the handpump program in response to drought relief necessitated a separate crew being trained for installation and repair of handpumps. Training is under way to help the system maintenance teams to also become proficient in service and repair of these pumps so that the installation crews can concentrate on new work and keep up with the various drilling programs currently underway. By the end of this Project approximately 1,000 new handpumps will be installed. It is envisioned that eventually all handpump repairs will evolve to the systems maintenance section.

With all the activity in VWS it is expected that the workload will substantially increase. To offset some of this increase the policy is to have selected villagers named by the Village Water committee to work with construction technicians during the building of a system. These people known as water minders are taught and receive on-the-job experience in how to cut, thread and seal pipe joints, assemble and lay pipe, install water taps, assist in catching springs, building silt boxes, pipe stands, and water tanks. They mix concrete, shape stones, and learn many more useful skills. In the process they become familiar with how and why the system works. Upon completion of the system each water committee is issued a tool box with sufficient tools to carry out simple repairs.

The above policy is newly implemented and with each new system completed there are more and more water minders with some basic skills. There is a large skill gap between water minders from the older systems and the newer systems. Frequent changes in water minders cause voids in repair knowledge as the more skilled leave the village for more lucrative jobs. We wish to identify all villages that have an improved water supply completed within the past 5 years. The objective is to train a team of trainers, equip them with plumbing and construction tools and hold maintenance courses in each village on the list. This program would be continuing, never quite catching up as once through the list (which grows by approximately 100 systems per year) the team would begin again at the start of the list to either reinforce or train new water minders. The prime objective is to assist the village to become more self-sufficient thereby reducing the burden on the system maintenance teams for routine repairs.

The SM supervisor has been maintaining jobcard records on each repair since June, 1983. Costs

are recorded for materials, parts, labor, and transport on each job. Much discussion has taken place on how to recover part or all of the costs from the village rather than have a donor or GOL cover the bill. Each system is only constructed after the village has collected money on a per capita basis and deposited that money in a bank account which is controlled by the village water committee.

A first draft of a policy paper has been prepared and submitted to the VWS coordinating committee for discussion and revision. It was recommended that upon completion of a repair a bill prepared by the maintenance section covering actual cost for materials and parts be presented to the village committee with payment to be made to the D.R.D.O.'s office. This would accomplish several things. Firstly, a portion of the cost (or all) of maintaining systems would be returned to VWS relieving the financial burden on the government. Secondly, it would reinforce the philosophy that the system belongs to the village and not to the government. Third, when the village becomes aware of the cost of repairing their system they will be more interested in protecting it from damage. Fourth, it will encourage them to make the repairs themselves which are within their level of expertise only calling on VWS when the repair is beyond their capability. In summary, funds could be collected to recover a portion of the annual maintenance budget and current resources within VWS could be spread further. The mechanism of submitting a bill to the village can be developed within the maintenance section. The collection of payments and the return of those funds to VWS operating funds will have to be set up.

Training of maintenance personnel continues as we try to expand the skill base. A four day course taught by the Salister Diesel Engine supplier in the R.S.A. was attended by all the SM foremen and their supervisor in early December, 1984. The course content was devoted to preventive maintenance and trouble shooting.

TABLE M-1

MAINTENANCE SECTION PROGRESS SUMMARY

60 VWS vehicles countrywide  
 30 Project vehicles purchased plus 3 on order  
 31 Mechanical training courses completed  
 3 Regional water system repair teams  
 1 National preventive maintenance team  
 1 Drill rig repair team  
 4 Handpump installation crews trained  
 1 Borehole yield test crew  
 3 Regional workshops in operation  
 2-way radio communication in each district  
 Maseru workshop expansion complete  
 Maputsoe workshop expansion under construction

Spare parts store in operation  
 Computerized inventory control system implemented  
 Welding shop constructed  
 Workshop equipment and tools expanded and upgraded  
 Workshop jobcard system implemented  
 Transport officer appointed  
 Individual vehicle fuel consumption report  
 Transport policy paper published  
 Best driver award program implemented  
 Servicing offered for other Ministry vehicles

TABLE M-2

## SUMMARY OF REPAIRS MAY,1984 - APRIL,1985

Repairs are based on completed jobcards

Vehicles:	997
Drill Rigs:	165
Windmills:	116
Diesel Engines:	80
Water Systems:	564

A. North Team

The foreman for the Northern Region was officially retired from Government service in December, 1984. He has been rehired and is working on a daily paid basis. This is a temporary respite as he may decide to retire the second time at any point. This man is the resident VWS windmill expert and we are transferring men from other teams to work with him to learn as much as possible about windmill repairs. We are looking at all members of the SM crews to identify a candidate for promotion to foreman to step in when Mr Molemane does decide to retire. At the same time the man selected for this position should have experience in small diesel engine service and minor repairs which is a current shortcoming within the North team.

B. Central Team

This team is perhaps the most versatile team in the section. They have been specially trained (in addition to their "normal" duties) to cast foundations and install the diesel engine powered pumps. We have started the policy of having a second team participate in any new such installation. This will enable us to transfer these skills eventually to all the SM teams and make them less dependent on help from outside their home region. Since each section of the country will or does have each type of water supply we must have each team as versatile and able to work independently as possible.

C. South Team

This team is perhaps the weakest in terms of overall repair knowledge. What they can do,

they do well such as gravity system repairs, rebuilding silt boxes, recatching springs, etc. As outlined above, steps have been taken to broaden the base of knowledge and skill for this team. In the southern region there are several diesel engine powered systems so whenever a problem develops a second team knowledgeable on diesel repairs will assist in the repair, teaching the south team on-the-job. Likewise when a windmill or handpump has a problem then a second team will come in to assist. A member of the North team is being transferred to the South to help them gain windmill experience. Similarly when a spring escapes, the South team will be called in to assist one of the other regional teams. It is felt that this approach of sharing skills amongst ones peers will be the quickest and most effective form of training that we can implement.

D. Preventive Maintenance Team

This team is by design the most specialized team in the section. It was founded with the purpose of working with mechanical (engines and windmills) systems country-wide. The foreman holds a Trade Test "A" certificate and is very proficient in Lister diesel engine repairs. This team also supplements the Drill Rig team by doing most of the engine overhaul or repair when an engine is brought in to the Maseru Workshop. There are no plans at the present to change the status of this team which performs specialized work for all the other regional teams.

The original idea was to have this team circulate around the country on a regular basis following a route that would touch each mechanical system. A survey was made identifying the villages that depend on a windmill or engine. Once that was complete they were to periodically visit each of these systems to prevent, as much as possible, a breakdown by doing routine services such as replacing a worn rod on a windmill before it breaks, or checking oil levels in engines, etc.

To date this route has not been set up because the normal workload of the section has been too great. In addition to maintenance duties the foreman taught several courses at the village level throughout each region to water minders responsible for diesel engines. He showed them the proper engine oil levels, how to clean air filters, and gave instruction on the proper care of "their" engine and pump room. This course will be repeated from time to time because waterminders change frequently. An example of the type of problem we hope to eliminate is the placing of diesel fuel in the crankcase which of course does substantial damage to the engine.

## VI. Handpumps

There is a crew headed by a Danish volunteer that is based in Mafeteng. They were set up two years ago to build pads and install handpumps. That crew has split into a pad building crew and an installation and repair crew. A faulty handpump has historically been repaired by the installation crew with the occasional help from a systems maintenance team.

With the advent of the EEC drilling program, other donor input, and USAID furnished handpumps the numbers of handpumps to be installed is expected to reach 1,000 over the next couple of years. Crews have been trained to install the pumps in Leribe, Berea, Maseru, Mafeteng and Mohale's Hoek districts. These crews with one exception are all construction personnel. Regional SM teams are being trained to service and repair handpumps but considering the large quantity it is expected that another full time team will have to be organized.

## VII. Borehole Testing

A trailer mounted unit has been built and placed into service to test borehole yields. A crew devotes full time to testing "doubtful" wells, wells to see if increased pumping is feasible such as replacing a windmill with a diesel engine, or to test a well as a production well for large villages. When not actually testing a borehole this crew is used to repair handpumps:

## VIII. Transport

Transport control is under the supervision of a Mosotho transport officer. He has the responsibility for the supervision of the drivers, interviewing, testing, and hiring new drivers as well as discipline for offenders of G.O.L. and VWS vehicle policy. A transport policy has been written as a guideline for driver and vehicle control. A driver job description has been developed and each new driver is required to read and sign it.

The T.O. monitors and schedules vehicles for service based on kilometer usage. Each vehicle is routinely scheduled for either a major or minor service every 2,500 kilometers. The VWS fleet has grown to 60 vehicles logging approximately 1,000,000 kilometers per year. On a monthly basis the T.O. prepares a report on individual vehicle fuel consumption. This report is used to assist VWS in its budgeting process, as a cross check on accounts on fuel billings by government garage, and as a check on misuse of fuel.

All vehicle accidents are investigated and

recommendations made as to whether or not driver discipline is warranted. Some serious accidents have occurred but we believe that the transport officer's attention, enforcement of discipline and constant monitoring has contributed to an overall good safety record.

Both heavy and light duty vehicles are allocated wherever possible by job tasks and assigned to the individual responsible for carrying out that work (See Table M-3).

## IX. Communications

There are now resident engineers in each district equipped with 2-way radio communications. Three times a week a regular call-up schedule is observed such that each engineer can relay important information, transport requests, repair requests, and maintain closer contact with Maseru headquarters. The base stations in Maseru and Mohale's Hoek stay on call during working hours 5 days a week.

## X. Training

There have been 31 mechanical training courses completed. The majority of the courses were held locally using Project personnel and special instructors. Two Basotho have returned after completing workshop manager training overseas and are in-charge of the Maseru and Maputsoe workshops. Three maintenance men have obtained the trade test "A" certificates and all mechanics now hold the trade test "B" certificate. All "professional" drivers have a minimum of a heavy duty license.

A syllabus has been written and translated into Sesotho for a course in basic engine maintenance and operation. This course was presented to village water minders who are in charge of a diesel powered system. A maintenance team foreman was the instructor.