HEALTH
ZATION

ORGANISATION MONDIALE
DE LA SANTÉ

SOUTH-EAST ASIA REGION

SEA/EH/251
2 June 1981
RESTRICTED

OPERATION AND MAINTENANCE OF LOGGING EQUIPMENT, RURAL WATER SUPPLY, THAILAND

Assignment Report, July-November 1980

Dr S.P. Mathur
WHO Short-Term Consultant

WHO/UNDP Project THA EHP 001

CONTENTS

		Page
1	INTRODUCTION	1
2	FINDINGS	2
3	ACTIVITIES UNDERTAKEN	3
4	RECOMMENDATIONS	4
5	ACKNOWLEDGEMENTS	5

1 INTRODUCTION

The writer was assigned by WHO in July 1980 for a period of four months as a consultant in well logging under WHO/UNDP project THA EHP 001. The terms of reference outlined were:

(1) To train Thai technicians in the use, repair and maintenance of electric logging equipment;

(2) To deliver lectures and prepare written papers for demonstration purposes, and

(3) To conduct both laboratory and field demonstration related to the operation and maintenance of the equipment, with the actual logging of drill holes as required, in the four regions of operation.

The ongoing WHO/UNDP project THA EHP 001 is attached mainly to the Rural Water Supply Division (RWSD) and the Sanitation Division of the Department of Health, Ministry of Public Health.

The RSWD serves drinking water to villages with populations of less than 2000. This aim is chiefly achieved by drilling small-diameter tube-wells fitted with hand pumps. In addition to this main activity, the Division also undertakes construction of small water supply systems for hospitals, schools and temples. The Sanitation Division of the Department is engaged in the conversion of open wells into protected sources fitted with hand pumps and secures community participation in their operation and maintenance.

The activities of the RWSD are executed by its regional offices at Saraburi, Korat or Nakorn Ratchasima, Khon Kaen, Lampang and Songkhla. The major thrust of these activities is in the first three regions mentioned above.

The RWSD has 36 rigs of various capacities and types. These include nine percussion rigs (Dandoo 400) to be received under this project. Nine small jet percussion rigs were designed and developed by the Department and are now being put into use successfully. These rigs are distributed among the five regional offices. During the last financial year, the RWSD drilled 473 small-diameter tube-wells, of which 398 were fitted with hand pumps; 5 boreholes were fitted with piped systems and 70 boreholes drilled were dry.

Fairly well equipped workshops exist at Saraburi and Khon Kaen, where regular repairs and maintenance of rigs and accessory equipment could be undertaken.

The Division has two resistivity meters (ABEM terrameter and a Bison model 2350) used for the location of suitable sites for drilling boreholes. The Bison model was obtained under the WHO/UNDP project.

The RWSD also has two items of well-logging equipment (Widco logger and Logmaster). The Widco logger was obtained under the WHO/UNDP project and the Logmaster from UNICEF.

A few portable chemical analysis kits (for water), a spectrometer, and sieve analysis kits are also available with the RWSD.

2 FINDINGS

Considering the technical aspects of a small-diameter tube-well programme, four discrete steps or processes are involved and they are carried out in the following sequence: (a) site location; (b) drilling of borehole; (c) well assembly design and construction, and (d) installation and maintenance of pump.

The RWSD has gained adequate experience in the drilling of boreholes. A number of on-the-job training courses in operation and maintenance have been organized in the past, and such courses are planned for new rigs to be received in the near future.

The RWSD has also gained experience in the installation and maintenance of hand pumps.

The RWSD has no special staff trained in the aspects of site location and well assembly design and construction. Although the importance of hydrogeology in such a programme is well understood, the RWSD has great difficulty in attracting geologists or hydrogeologists to work (since there are no career prospects). In the absence of a hydrogeologist,the drillers (sometimes engineers) carry out the site location, design the well assembly, and construct the borehole. Training courses in these aspects were not conducted earlier pending the recruitment of hydrogeologists (6 posts vacant), and therefore the RWSD is not well equipped to solve all the related problems. Some observations related to these two specific activities are:

(1) The selection of sites (done by the driller/engineer) is not based on geological or hydrogeological surveys. Their only guides are the drill hole data of the previously drilled borehole, if any, in that village or the neighbouring village and/or the existing geohydrological map (1:250 000). Selection of sites based on such an approach is rather approximate and not a healthy practice.

(2) The litholog data are collected with varying skills. The presentation of the data is not standardized (symbols, scales used, position of screens, etc.).

(3) The well assemblies adopted appear some time to be arbitrary and do not suit the litholog reported. The choice of gravel size is limited. Better results with the available assorted gravel could be obtained by sieving it and choosing a particular size. The thickness of gravel pack is kept around one inch which is rather small and does not serve the normal purpose for which it is used.

(4) The depths of borehole drilled are some times more than necessary. This is because the drillers do not have sufficient knowledge of the geohydrological conditions and hence, to be very sure, they tap a larger thickness of the aquifer than necessary. This results in wasteful drilling.

(5) Chemical analysis of water samples for the freshly drilled boreholes is not done as a routine part of the programme.

The purpose of the present assignment was to train the technicians in the use of the well-logging method for choosing the proper well assembly, which forms a part of the well design aspect.

3 ACTIVITIES UNDERTAKEN

The writer undertook a field trip to Saraburi, Korat and Khon Kaen to acquaint himself with the local geological and hydrogeological conditions and to orient the training programme in the well-logging method accordingly. The trip was also aimed at familiarizing the writer with the routine approaches adopted in the drilling and construction of boreholes. Notes for record were prepared.

The Widco logger and logmaster were installed and tested. Replacements of the damaged components of the Widco logger resistivity panel were made. The self-potential (SP), resistivity and natural gamma logging systems of both the Widco and Logmaster equipment were calibrated.

A six-week course in the methods and techniques of well logging was organized. The course was attended by four engineers and five technicians from the five regional offices of the RWSD. Also, the only geologist working with the Accelerated Rural Development Organization (ARD) at Khon Kaen attended the course.

The course covered lectures on the theory and practice of the SP, resistivity and natural gamma logs (30 hours in the first two weeks). During this period, afternoon sessions were devoted to a practical course in the interpretation of the well log data (30 hours).

Background lectures on geology and hydrogeology were also given. This was followed by three weeks of practical field course (144 hours) at Saraburi and Khon Kaen. During this period, actual operation and day-to-day maintenance of both (Widco and Logmaster) were taught. The field data obtained were also interpreted. Stress was laid on the use of this method in the proper choice of well assembly based on lithology identification. In the last week at Bangkok, feed-back sessions were held (30 hours). The course was supported by slides and this proved to be of great use in the feed-back sessions.

Copies of the texts of lectures prepared by the writer were distributed to the trainees. Stress was laid on the procedures covering all the different sequential steps to be followed in order to organize properly the operation and maintenance of equipment. These portions were translated into Thai.

Routine logging of freshly drilled boreholes as a part of on-the-job training (also as a follow-up of the course) could not be carried out as the drilling activity was stopped with the start of the rainy season and also because the financial year targets were near completion.

Realizing that expertise in the location of sites for drilling boreholes do not exist in the RWSD, the writer planned to organize an on-the-job training programme in the use of the electrical resistivity method for site location (period: one month). This programme was aimed at exposing the RWSD staff to the effectiveness of this method in site location. This course could not be conducted as the resistivity meter owned by the Department needed major repairs which could not be carried out because of the non-availability of workshop and repair manuals. (The model is also quite old.)

The writer designed and fabricated a portable resistivity meter for shallow investigations (up to 250 metres) which is well suited for the Rural Water Supply Programme. The total cost of the equipment is less than US$ 150, which is quite low compared to imported ones (more than US$ 1 500). The equipment was assembled from parts available in the local market. Repair and maintenance can be done locally. The development of this equipment is a step towards appropriate technology. Details of this equipment which would facilitate operation, maintenance and duplication were written.

On receipt of the workshop manuals, the imported resistivity meter was also repaired and tested in the laboratory.

At the request of ARD at Khon Kaen, their portable logging unit was repaired and correct procedures of operation of the equipment were demonstrated to the geologist in the field.

4 RECOMMENDATIONS

The Rural Water Supply Division has, in a short span of time, built up expertise and gained experience in the art of drilling shallow borewells, and in the installation and maintenance of handpumps. It is now the right time for the Division to concentrate on such methods that are economical and yet would yield adequate results.

On specific aspects of site location and well construction, the recommendations are:

(1) The Division should try to attract candidates and fill the existing vacant post of geologist. In the absence of a geologist, the same group of engineers/technicians trained in the well-logging method may also be trained (on-the-job) in such aspects as site location, well assembly and well construction (6 months' duration).

(2) For the selection of sites for drilling, an integrated approach using geological and hydrogeological methods for reconnaissance survey, and the electrical resistivity method for final spot-checking, should

be used. Such an approach will reduce the failure rate considerably, optimize the footage to be drilled and help in a proper choice of the rig to be used for drilling.

(3) For the selected group and all the drillers in charge of rigs, a short, on-the-job course should be given to educate them on the importance of litholog and methods to collect representative samples,and also train them to identify and describe the samples correctly.

(4) The well-logging method, in the present RWSD organizational set-up and with the shortage of technical staff, cannot be used in a routine way. The use of this method at present may be limited to deep borewells (if any, drilled by the organization) or in areas having complex lithological and salinity problems. Most of the borewells drilled by the RWSD are shallow (average depth around 40 metres). In such shallow borewells, a good litholog is adequate to design the well assembly.

(5) The well-logging method is sophisticated and expensive and requires well trained engineers for operation and maintenance. It is sufficient to train about ten persons (two from each region). The Department at the moment has only two sets of equipment. Training of a large number of, say, 100 technicians in this method is not possible and would also be superfluous in a country such as Thailand and more so for the RWSD.

(6) Chemical analysis of water samples (at least from the freshly drilled borewells) should be done in a routine way. Chemical analysis data should be studied to correlate the chemical composition with the taste factor. This would help in understanding whether the non-acceptance of deep-well water (in certain alluvial regions only) is based on the chemistry of the water or on traditional habits.

5 ACKNOWLEDGEMENTS

The author would like to express his sincere thanks to Mr Chetpan Karnkaew, Director, Rural Water Supply Division, and all his staff for their help and active support in this assignment. He owes special thanks to Mrs Tuk Devarugsa for translating into Thai some difficult portions of the lectures as they were delivered. His thanks are also due to Mrs Suvaroon Liengsri for typing out this report.