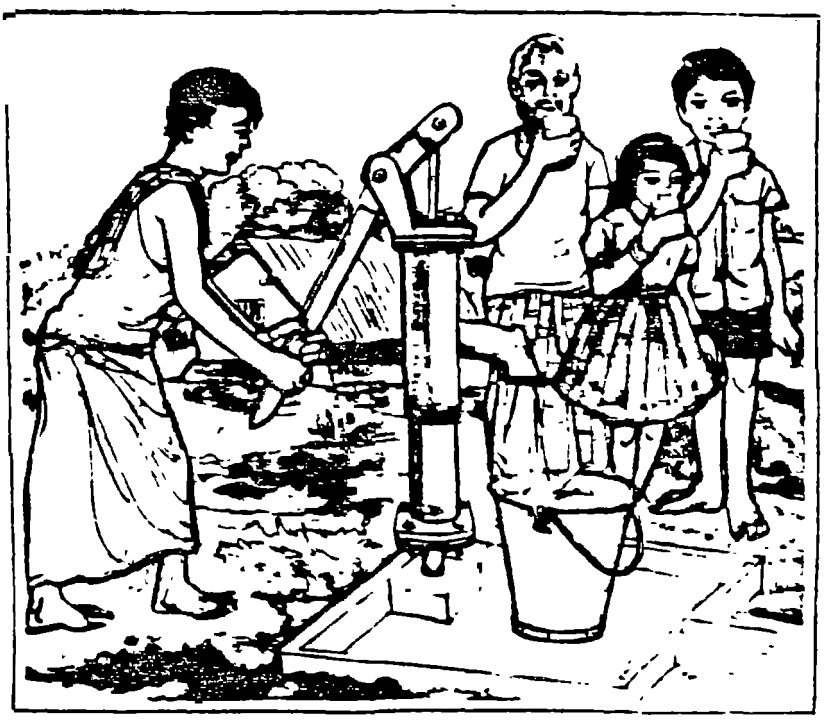
HOW USEFUL ARE RURAL WATER SUPPLY PROGRAMMES?



JOINT FRG/UNICEF ASSESSMENT OF UNICEF-ASSISTED RURAL WATER SUPPLY PROJECTS IN BANGLADESH, NEPAL AND BURMA, MAY 1983

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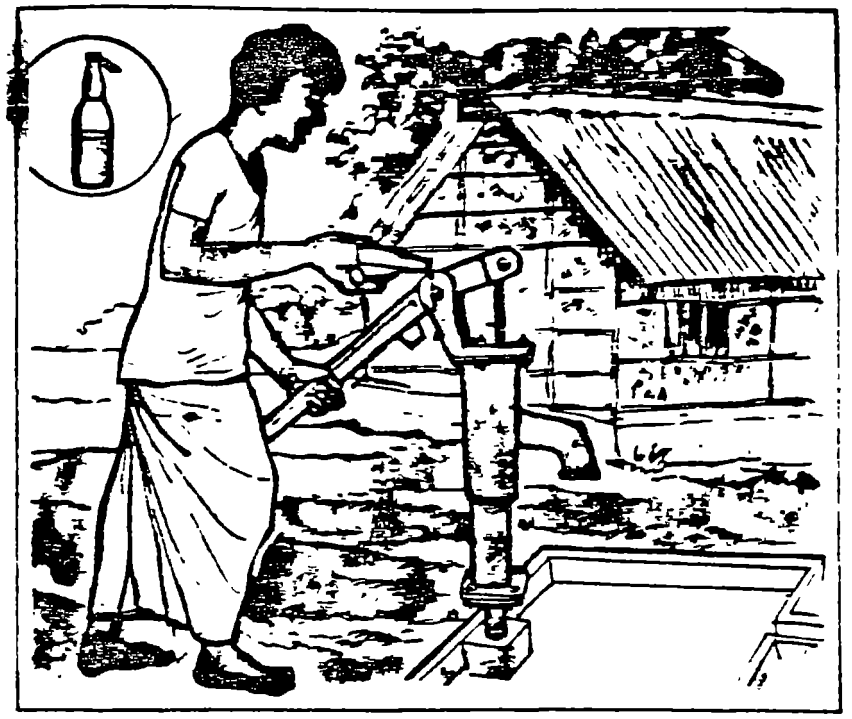

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1. Introduction

1. From January to April 1983, a joint team from UNICEF Headquarters and the Federal Ministry for Economic Co-operation (BMZ) of the Federal Republic of Germany, undertook a study in order to assess drinking water supply programmes with UNICEF co-operation in rural areas of Bangladesh, Nepal and Burma. The objectives of the joint study were: to share knowledge, expertise and experiences between the Government of the Federal Republic of Germany and UNICEF on critical issues related to the planning, implementation, operation, maintenance and impact of water supply projects and attempting to identify fields for improvement in the planning and implementation of these projects.

2. This co-operation between UNICEF and ~~one of the Member States of the United Nations, in the same time being a Member of long-standing of the Executive Board of UNICEF, as well as being a major donor country~~, began to be discussed during 1981. By that year, BMZ had carried out several evaluations and cross-sectoral analyses of water supply projects ~~financed by BMZ. In 1982 another study on behalf of OECD of water supply projects, which had been funded by different members of OECD, was concluded by BMZ as well~~. Now BMZ wished to extend its experience from bilateral donor-funded to multilaterally funded projects. UNICEF, being one of the largest single agencies involved in low-cost water supply projects in rural areas, agreed to the proposal.

3. The team comprised, on the German side, two independent consultants from BMZ, ~~Mr. Hartmut Sacher~~, Civil Engineer, with responsiblity for the technical aspects of the water supply programmes, and ~~Mr. Heinecke Werner~~, economist, for the socio-economic aspects of the programmes, analysing the related issues of health, nutrition and hygiene as well. For the health, nutrition and hygiene aspects, it was originally planned to recruit on UNICEF's side a local independent consultant in each country. Because of the short notice, this could not be done. ~~Mr. Martin Beyer~~, Senior Policy Specialist (Drinking Water and Sanitation Programmes), UNICEF Headquarters, was assigned as leader of the joint team. During the field visits in the three countries covered, the team was accompanied and advised by staff members of the UNICEF field offices, jointly with government officials involved with the different programmes and projects.

4. The team met first for one week in January 1983 in New York for planning and drafting the Terms of Reference (Annex 11). This was done together with representatives of UNICEF's management and different sections of UNICEF Headquarters, and Mr. Weber, Head of the Evaluation Section of the BMZ. It was then decided to label the joint undertaking an "assessment" rather than an "evaluation"; the short time available for its planning and implementation made the word "evaluation" sound too ambitious. The present report thus is a review rather than an in-depth evaluation. The field trips in the three countries were organized by the UNICEF Country Offices in each country, the staff of which dedicated a great deal of time and energy to assist the joint mission, which the authors wish to gratefully acknowledge. In February and March, the team visited the three countries, altogether for four weeks. (Detailed itineraries in Annex 3.) In April, the team met for another full week in New York in order to discuss common findings and conclusions, and to write up the draft of the report.

5. The time for planning and implementation of this study was very short. Therefore, no strict methodology was given and the team was allowed to work flexibly. Nevertheless, the authors in their report followed the recommended evaluation checklist of the BMZ. (See Annex 1.) This checklist also determined the disposition of the contents of the report. Although we sometimes may have felt squeezed into a rigid reporting structure, we believe that this checklist made us place the appropriate emphasis on issues such as the analysis of objectives and planning. BMZ is particularly interested in the socio-economic and health aspects of the water supply programmes so emphasis is placed on these two items throughout the report.

6. The period of collecting information started at New York, where we had access to all documents available about the three countries. During the field visits, the team interviewed the staff members of the UNICEF Country Offices and had discussions with government officials and representatives of other donor agencies.

7. The nature of the mission and the limited time available did not allow for any in-depth interviews with the villagers/users of the water supply systems. Our assessment therefore to some degree had to rely on indirect sources regarding some aspects of the relationship of the users to the projects. It is hoped that the present report provides a balanced synthesis of the various views and perspectives which were shared and form a comparative analysis of our findings, resulting in a number of recommendations.

8. A continuation of the present evaluation in order to obtain a globally, more rounded review of the issues of rural water supply, has been preliminarily discussed. As presently foreseen, this wuld be carried out in the Sudan. Following our experiences from the now concluded assessment in Asia, we feel that this would be a valuable complementary exercise.

Summary of main findings

9. It should be noted that the main findings presented in this report emanate from our most salient observations during our brief field trips. We present them to the reader in a comparative way, so that the different approaches and different situations, as well as the advantages and constraints of the three programmes in the three countries would be highlighted.

10. The most important objective for the water supply programmes described, is the improvement of the health of children and mothers, as well as responding to felt needs from the side of the communities. Numerous studies have tried to confirm the assumption that safe water improves health. Specialists presently seem to hold the view that it is not possible to get a clear answer through such mono-causal linking of water supply to health improvements. Firstly, there are so many other factors which interfere with the relation of safe water and health. Secondly, safe water is just one of the many essential pre-conditions for health, but not sufficient by itself alone to improve the health situation of any target population. Thirdly, any possible health effect of a water system hinges on its proper use, operation and maintenance. Even the seemingly simple low-cost technology, with which we are dealing here, needs careful planning of the engineering and social approaches in combination with proper education of the users in order to achieve the desired health effects.

11. For historical and organizational reasons, primary health care and nutrition have not been brought as close to water supply as health education and sanitation. In none of the three countries visited, do all people in the rural areas have access to primary health care. In particular, the immunization of children is lacking in most parts of the rural areas, because it seems to be too difficult and expensive to build up a cold chain. In Bangladesh and in the western part of Nepal, malnutrition and under-nutrition, particularly seasonally, is a serious problem for the health of the children. UNICEF, together with other organizations, try to help to overcome these constraints.

12. Among the most important components, which need to be added to safe water, are health education, sanitation, primary health care and nutrition. It is believed that if all these components are offered to the target groups, together with safe water in a planned, co-ordinated way, a significant impact on the improvement of health could be reached. During our study of water supply projects in Bangladesh, Nepal and Burma, we therefore tried to see, whether these other components were included in the ongoing work, so that a balanced approach to basic social services would be offered to the rural communities.

13. In addition to the above, we also took into consideration the Report on the State of the World's Children 1982-1983 by Mr. James P. Grant, Executive Director of UNICEF, which focuses on the most urgent elements of basic social

services for children in order to improve their health situation. The document lists as the most important measures for immediate improvement of health: oral rehydration therapy, universal immunisation, the promotion of breastfeeding and growth monitoring, together with family planing and food supplements.

14. In the countries we visited, the drinking water supply programmes for rural areas are well established and, particularly in Bangladesh, have already reached a remarkable coverage on a nation-wide scale. During our discussions with government officials, we found that because of the tremendous interest of the rural population in water supply, water supply programmes are excellent entry points, as a vehicle to promote the emergency measures mentioned by Mr. Grant in his global report to introduce other basic social services.

15. In Nepal, an income-generating programme is an additional component to basic social services for the rural population. Particularly in the Hill areas, the population pressure in relation to the limited land, agricultural and financial resources, is so high that income generation is the most urgent problem for the villagers. This priority concern for poorest families has led to a strategy of UNICEF Nepal to make income generation an entry point for other basic social services.

16. Two further elements, UNICEF's ability for advocacy and its flexibility, must be mentioned as well. One of the most important and continuous tasks of UNICEF officials in the countries is advocacy for children at all governmental levels. This essential role of each staff member of UNICEF was evident during all our discussions and visits in the field.

17. The flexibility of UNICEF makes it possible for the organization to respond rapidly, often immediately, to the frequently sudden needs and sometimes changing situations which UNICEF meets in each country. Whether they have to plan or to advise, whether they have to design programmes jointly with the government, or just monitor and evaluate, whether they have to supply materials or expertise, whether they have to switch over to emergency measures or to work on long-term effective programmes, whether they have to support government or NGOs, the flexibility of UNICEF and its staff, as we saw it in all three countries, is one major reason for the success of UNICEF's work.

1.2.3 Socio-economic Aspects

18. Community participation varies considerably from programme to programme. In all three countries women participate to some extent but socio-cultural factors influence the level and degree of their participation. Efforts to involve women more actively are being undertaken in Bangladesh and Nepal (Terai); Burma offers greater possibilities for women's participation.

19. Local contributions in Bangladesh can come from the richest community members. Often these alone come up with the whole financial input and take care of the operation and maintenance. In Nepal and Burma, the village elders and the most prominent members of the community organize and manage the community inputs, while the different households, including the majority of the users, contribute with labour, materials and food.

20. In all three countries, community participation is an essential part of the programme. The involvement of the community in planning for the water supply seems to be most developed with the gravity flow schemes in Nepal. As in the two other countries, a written initial request must come from the community. Then a survey team comes out into the village and together with the village plans the design and all other aspects of the scheme. For the implementation phase, community participation is most pronounced in Burma. There the villages have to provide money and labour, which together quite often exceeds 50% of the total cost of the projects. In Nepal, efforts are made by the community to dig the trenches and to install the standposts. It must be noted that the farmers in the Hills have to do this work in addition to their already hard agricultural work. This particularly affects women, who with ten hours per day of gruelling, physical toil, are overworked. The demand for participation in the construction of water supply projects thus is an additional burden to the villagers, which they nevertheless willingly undertake.

21. In Bangladesh, contractors are doing the main part of the work, while the community has to cover 75% of the well-sinking costs, and to care for and assist the drilling team. Altogether this corresponds to about 5% of the total expenditure. The monetary contribution in Bangladesh normally comes from only one to four members of each community.

22. In all three countries, the community is held responsible for maintenance and operation. Government technicians are foreseen only to be called upon for major repairs. But as elsewhere, operation and management in the three countries is not quite adequate nor satisfactory from a technical point of view. In Bangladesh it is estimated that up to 20% of all handpumps are out of order at any given time, because bolts are not drawn, bearings not oiled and wells are sanded or silted up. In Nepal, water supply systems that were designed for a controlled flow of water, have their taps left open and sometimes broken. In Burma, lack of local management and technical abilities can lead to breakdowns of the motor pumps. While in Burma the motor-driven pump stations require more rather sophisticated managerial and technical abilities to run and maintain than in Bangladesh; the simply designed handpumps there need maintenance and repairs at a simpler level. The gravity flow systems in Nepal also need maintenance, although the operational aspects are simpler. The project designers try to overcome these constraints through better education in management and technical skills for the caretakers from the user group, and to design the technical equipment with even simpler features, so that it can be easier operated and maintained (e.g. through further development of handpumps, following the VLOM concept - Village Level Operation and Maintenance).

23. These constraints, mentioned here, were mainly reported to us by the field personnel and were not frequently observed by us. Altogether, we feel that operation and maintenance improvements should be planned on a long-term basis.

24. The second important objective for water supply projects is the saving of time and energy for women including mothers. This objective applies mainly to the Hill areas of Nepal and to the Dry Zone of Burma. In the other areas, it is not regarded as much an essential objective by the project planners. Neither in the Nepal nor the Burma programmes, were any efforts undertaken to measure the time and energy saved by the new supply systems. Secondly, not much is known about alternative productive occupations of women, carried out in the time they probably have saved. Thirdly, we observed in the Dry Zone that men also participated in the drawing of water and even used bullock carts in cases where the distances are great. For these reasons, we feel that the project designers and officials often regard time and energy saved, not as a specific objective, but just as a positive by-product of the water supply systems.

25. During the short time given, we could not find out very much about the use of the new water supply facilities. In Bangladesh, some studies have been made to find out more about this. But altogether not very much is known about the various aspects. We thus can only make the following tentative observations on the water use:

Most of the schemes are not fully used by the community. Their capacity is larger than the present demand of the villagers. This is mainly because all the systems we met in the rural areas have public standposts and no water taps in the private households. So there are still some distances to the water points and particularly in Bangladesh, the privacy of women is kept protected so strictly that they even tend to show themselves in public as little as possible at the handpumps.

26. Wherever people do use the new water points instead of their old traditional sources (wells, rivers, ponds, etc.), this mainly seems to be so because the population prefers safe water and seems dimly aware of its benefits. This awareness we regard as a result of general education and health education together. Often the water from closed wells and gravity schemes tastes different from that of the old surface or shallow well water sources. Particularly in Bangladesh, the high iron content of some wells makes the water taste unwholesome to the consumers. In a few cases we observed that this leads to a general prejudice, that the new water supply systems offer only bad-tasting water and because of that are not to be preferred. The installation of de-ironing devices is only recent, but seems promising or counter-acting this negative effect.

27. Because of management and other constraints , government departments and other authorities do not always provide continuous support (fuel, repair services, etc.) so that because of such reasons the water supply schemes would not function thus denying users a safe source of water. This is not only a disadvantage, but may undermine the users' confidence in the system and would be counterproductive to the health education efforts aimed at leading to the exclusive use of safe water.

28. As UNICEF does not implement programmes of its own, but acts only as partner of the governments of the host countries, it is in general the governments, who decide at which level a balanced growth of basic social services should be promoted. Water supply has a natural appeal to the rural population and government officials as well. Not so with other essential components for the improvement of health, such as immunization of children or even sanitation. We therefore are under the impression that in all three countries the water supply programmes are far ahead as compared to sanitation, health education, primary health care and nutrition.

29. This must remain a very general statement, because there are not yet the evaluative tools available, which would allow us to compare the different stages of development of basic social services with one another. Health education, for example, is complementary to water supply: where safe water sources are not close enough from homes of the the users because of financial constraints, there are many more risk moments that easily can lead to the pollution of the water, before it is consumed. Health education can help prevent at least some of these pollution risks. Better hygienic standards can best be introduced in connection with latrine construction programmes. Thus latrine construction is equal in importance with as water supply, but without water supply, double efforts would be needed to convince the population and governmental officials about the advantages and needs for latrine construction.

30. In Nepal, we could observe that health education and latrine construction are closely combined with water supply. For example, all water technicians working with the supply schemes are urged to give good examples to the community and to install a toilet themselves. While water supply is constructed for a community, the public institutions such as schools and health posts are supplied with latrines, and the villagers are encouraged to construct their own latrines. At the same time, health education takes place in the communities, directed at both the adults and the school children. This combined approach impressed us. In Bangladesh, water supply, health education and sanitation are not implemented together, but are offered separately to the community. In Burma, the government has just started to develop sanitation and health education programmes, with sanitation still in the pilot programme stage.

1.2.4 Technical Aspects

Appropriateness of Technology

31. The technology chosen for Bangladesh (shallow tubewells with handpumps and gravity flow schemes) can be labelled as appropriate, given the hydrological conditions of the country.

32. Conversely, due to the geological conditions in one project in central Burma, the drilling equipment used there while, appropriate, is somewhat sophisticated and therefore high-cost with corresponding problems of logistics of spare parts supply and fuel for the remote well sites; level of technical expertise, and the like. All other projects in Burma, where geoOhydrological conditions so permit, use village-level technology with gravity flow schemes, new handpumps and rehabilitation of old ones.

Quality of Construction

33. In Bangladesh, the quality of construction has improved during the ten years of the project. There are some details that could be improved further but altogether the quality of construction is appropriate.

34. In the Terai region of Nepal, the handpump project is still in its initial pilot project stages. Many procedures and standards were taken over from Bangladesh and were modified according to local conditions. The gravity flow programme is under implementation for over the last ten years. After initial problems and a thorough review of the procedures, the quality of the new constructions can now be rated as good and appropriate.

35. In Burma, the quality of construction is appropriate but still with room for improvement. The water well drilling practices and well development (including the use and interpretation of well logs) could be improved. The design of the pump stations, especially of the water tanks, should be standardized and the construction controlled in order to prevent malfunctions or breakdown.

General Maintenance Situation

36. The standard of maintenance in all countries visited could be further improved, irrespective of the level of technology involved. This problem has been recognized and there are serious efforts to change the current situation.

37. For example, in Bangladesh, supportive means such as education kits for the caretaker courses, special tools and lubricants are provided by UNICEF in order to support the level of local caretaker training and enable them to properly tend to their handpumps.

38. In Nepal, the needs for maintenance recently were analysed and a policy for maintenance is now agreed upon with the government for more systematic implementation.

39. In Burma, trained courses for the drilling crews are being held in the course of the project implementation. A system of mobile maintenance crews, periodic inspections and local pump operators to look after the pump engines, has been instituted.

General level of Technology and Future Prospects

40. The general level of technology in all three countries is low. There is no inherent feeling for the needs of maintenance to keep any technical device functioning regardless of its complexity.

41. In Bangladesh, local industry has the capability to supply all the parts needed for the handpump programme except for the filter screens (which also later may be manufactured locally). Only raw materials have to be imported.

42. In Nepal, most of the materials needed are imported from India. There are efforts to assist local industry in producing the parts needed in the next few years, such as handpump production planned for the existing foundries.

43. In Burma there will probably be no local spare parts production for pumps and drilling rigs within the next several years, since the technology involved is too sophisticated and the materials are not locally available.

Water Sources and Water Quality

44. In the Bangladesh handpump programmes, the groundwater is generally of good quality. In some areas, the iron content is relatively high (up to 10 mg/l) and simple iron removal plants are being tried out at various project sites. Problems can arise with contamination of the drinking water, when the well is drilled with the sludger method (cow dung), when the pump is primed with contaminated surface water, or where the groundwater in itself is contaminated through environmental pollution, when the spout has been dirtied or when the containers used for water transport are not clean.

45. The same applies to the Terai handpump project in Nepal. The gravity flow systems generally are supplied from springs with reliable yields, only exceptionally from water course intakes. All have to be protected from pollution. This is done for example, through barbed wire fences surrounding areas around the springs. Quality problems arise during transport and storage by the users.

46. In Burma, groundwater from different aquifers at different depths constitute sources of safe water, the water quality generally being good. Here as elsewhere the same problem of transport and storage of water can influence the water quality.

Distances to the water sources and site selection

47. In all countries, site selection procedures and surveys before installation have to be conducted.

48. In Bangladesh on the Thana level a Water Committee decides upon the installation of the handpumps requested. This involves a mutual agreement between the national field staff, the committee and the UNICEF District Office. Due to the scattered settlement pattern, the criterion of short distances from the tubewells to the individual homes cannot be completely met.

49. In the Terai pilot project, the field technicians have to give their technical approval to the requests for handpumps. The District Panchayats then decide upon the installation. Site selection criteria have to be followed.

50. For the gravity flow schemes, the decision also is taken by the District Panchayat after a preliminary feasibility study conducted by an engineer. The distribution of standposts has to be agreed upon mutually by all parties concerned including the Village Water Committee.

51. In Burma, after a survey of the general situation of the villages in the Dry Zone, 3,000 well sites were selected by RWSD, especially considering the distance from the water sources to the villages. Most sites are located near the traditional water sources, normally dug wells, in the centre of the villages. Since one well has to serve up to 1,000 inhabitants, distances to the water points still are very far for a great number of the inhabitants.

Efforts to Identify Constraints and Shortcomings

52. Within all UNICEF Field Offices, internal reviews of programme activities, including those for water supply and sanitation are undertaken. In most cases, the problems are identified and efforts are made to change and improve the actual programme progress, wherever required.

53. In Bangladesh, the maintenance level is being improved and the training of local caretakers gets increasing attention within the programme.

54. In Nepal, in the Terai project so far there is no experience yet available but the project is closely monitored for its performance. For the gravity flow schemes, conclusions have been drawn from past experiences and standard procedures for the implementation and maintenance are established and applied.

55. In Burma, the proper use and maintenance of the drilling rigs partly connected with the drilling methods still are problem areas. The other constraint is the shortage of fuel, diminishing the usefulness of the water wells to the villagers. The maintenance of the engine pumps so far has not shown any major problem, since the equipment still is fairly new and the pumps are well cared for by the operators.

Sanitation

56. Sanitation as linked with supply in all UNICEF-assisted programmes by now has become a mandatory complementary input towards better health conditions. UNICEF's work in this context consists of supporting promotion of policies, the transfer and introduction of new low-cost technologies, providing basic construction materials or at least partly subsidising the materials costs in both rural and peri-urban areas.

57. In Bangladesh locally produced latrine construction sets are sold at the Thana level. This activity is supplemented by advice on installation.

58. In Nepal, the Terai pilot project from the outset has combined water supply and sanitation. At the District Selling Centres, interested villagers can buy subsidised construction sets. The promotion of sanitation is to be achieved by building a demonstration latrine in every village where a handpump is installed. In the Hills every water and sanitation technician has to build a latrine of his or her own at the place where he or she is living and/or working.

59. In Burma, the Environmental Sanitation Department of the Ministry of Health is now implementing pilot projects for latrine construction jointly with the installation of water supply facilities in co-operation with RWSD.

Recommendations (Technical Aspects)

60. The handpump production and implementation of the Bangladesh tubewell programme throughout the years has become well established. It is recommended that the insufficiently covered areas, which include some of the poorest target groups, should get more attention and higher priority within the programme. Since lift handpumps will be needed in other parts of the country soon, the development of the new TARA handpump should be accelerated. Maintenance problems, training of the caretakers and the supply of spare parts should also continue to get increased attention.

61. In the Terai tubewell programme in Nepal, the modifications of the handpumps and tubewell construction should be restricted to a minimum in order to avoid too much delay from seeking the perfect design. New developments can be very time-consuming and if they prove faulty after some time, this can seriously affect the progress of the project.

62. In the gravity flow systems, more variations of the standard designs should be used in order to properly adjust the constructions to the varying local conditions. The standard procedures formulated should become the actual field procedures including the necessary internal revision of the activities. Educational efforts to teach the villagers the necessity of properly functioning water taps should be strengthened.

63. In Burma, UNICEF should increasingly dedicate its support to less sophisticated schemes than those of the Dry Zone. UNICEF policy guidelines normally recommend simple, low-cost technologies. There is nothing wrong with an engine pump for a well, but if there is neither the staff available to implement the drilling programme properly, nor the necessary spare parts and logistics, nor the fuel to run the engine pumps, the programme would be of only limited value to the water users. We would recommend UNICEF to have government take over more of the responsibilities for support to the higher technology schemes, if possible with the external component, which UNICEF now provides, taken over by some other donor agency. This would enable UNICEF to withdraw its engagement from the highly sophisticated technologies during the next few years and to concentrate entirely on simpler, low-cost technology schemes in part of the country outside of the Dry Zone.

1.2.4 Management and Organisation

64. The administrative structures to support the programmes and projects vary from country to country. In all cases, however, they have to be viewed as a complex web of government and community level structures on the one hand and those of UNICEF and other co-operating agencies and organizations on the other, partly, as in Nepal, interwoven with each other.

65. An increasingly noticeable feature is the conceptual impact of the International Drinking Water Supply and Sanitation Decade (1981-1990), to which all three countries visited have become committed. In practice this means that the relevant government agencies have formulated national plans for the planning and implementation of joint projects.

66. Correspondingly, the external agencies, in the first hand the United Nations organizations but also bilateral and in some cases non-governmental organisations have established a co-operative mechanism, to support government activities.

Government organisations

67. The responsibility on the government side for rural water supply in Bangladesh and in Nepal is in the hands of one single agency, in Burma of two, viz:

- Department of Public Health Engineering (DPHE) - Bangladesh
- Department of Water Supply and Sewerage (DWSS), Ministry of Panchayat and Local Development - Nepal
- Agricultural Mechanization Department (AMD) and Environmental Sanitation Division (ESD) - Burma

68. These national agencies all have a certain autonomy when it comes to the detailed planning and implementation of the work. For the objectives and more long-term goals, however, they are all subject to longer term government planning, directed from higher and more political levels.

69. For the overall national planning, the trend seems to be towards inter-sectoral approaches. This is important at community level, since this broadens the scope of water supply making it easier to be linked with other fields of development and to be used as the entry point to other improvements for the community, than was possible only a few years ago, when water supply in most countries used to be implemented as a pure public works type of activity with a top-down approach.

70. With regard to the functioning of the government agencies there are noticeable concentrations on policies and increased attention to priorities with corresponding increases in the national budgets and personnel allocations. This is more often the case in Bangladesh and Burma than in Nepal.

71. Despite these developments, there are many constraints that remain. Solutions to these are constantly being sought, but there is still a long way to go. The major bottleneck seems to be that of human resources and their development.

72. Even if there is a personnel budget and employment opportunities - especially in Bangladesh and Burma - the overall number of posts is too small, especially in the field, for the governments to be able to fully respond to the overall needs.

73. There is also the difficulty to find sufficient numbers of trained personnel. This applies especially to Nepal, where also low salary levels cause many professionals to stay with the private sector. In Bangladesh and Burma there is a broader recruitment basis both for professionals and staff on an intermediary level, with a greater number of technical and administratively trained persons available.

74. Nevertheless, particularly for higher technology-type activities such as the Dry Zone Project in Burma, there is a great need for continued intensive specialised training in a number of fields, such as hydrogeology, geophysics, water well drilling, other aspects of groundwater technology, logistics and related administrative practices.

75. Among the professional categories, the basic skills are good in all three countries. For the intermediary technicians and administrators (including e.g. storekeepers) there is a need for keeping up and intensifying training paired with practice.

76. In the case of Nepal, the Ministry for Panchayat and Local Development still needs considerable strengthening of its technical capacity; technical activities are better organized in Burma and Bangladesh. There is a need for higher priority and incentives for the individual staff to move to and stay in the extremely remote localities where the individual water supply projects are being administered.

Communities

77. On the community level, there is, too, an administrative structure, centered on the water supply systems with its "executive arm" mostly in the form of the one single handpump caretaker or - as in Burma - engine pump operator.

78. The responsibilities for organising the participation of the villagers in the planning, implementation, operation and maintenance of the facilities, are increasingly laid in the hands of the village water committees or at least the village councils. These in their turn not only select the pump caretakers but also, especially again in the case of Burma, arrange for the levying of water fees, which in many cases there are paid per container of water at the pump site.

79. The training of the different persons, playing different roles in the community water supply, partly is relatively developed, e.g. in Bangladesh with the many short courses now given for handpump maintenance. The needs still are much larger than the number of community members now trained. Craftsmen such as masons and plumbers are in short supply. Well-sinkers for the teams working on contract in Bangladesh and Nepal seem to be more readily available, particularly since this is done on a commercial basis and there thus is the incentive of better pay with a higher rate of work. The important part of health education in the communities needs much further support, even though good beginnings have been made. UNICEF in this respect has helped develop methodologies and materials on a local, national basis.

80. In this context, the low degree of literacy is a problem in many parts of Nepal and Bangladesh. Also there is the need to identify the channels and personalities for conveying the life-saving messages to the villagers. The pictorial aids, such as posters, booklets and flipcharts were found effective, mainly when accompanied by verbal explanations.

81. The skills for community level workers to explain and instruct (even more so for higher level staff) was found to vary and need to be developed.

82. Especially in those areas where women still have not much of a say, there is a need to recognize and develop the ability of women to communicate and teach in order to help reach other women and children.

UNICEF support

83. Generally in terms of support to rural water supply, in all three countries, UNICEF seemed to have the strongest support and administrative structure of any of the external agencies active in the countries.

84. A major strength in Bangladesh and Nepal is the presence of UNICEF outside of the Country Offices in the capital cities, in the form of District Offices. Particularly in Bangladesh, the combination of one generalist District Representative, supported by a UNICEF-employed Water and Sanitation Project Officer (technician) in each one of the districts, seems to add to the efficiency of the work on the programmes. Their being nationals of the country greatly helps in the very close and cordial co-operation with their government counterparts we found throughout the field travel.

85. The co-ordination within the UNICEF Field Offices generally seems good. In any similar context, many a times a strong sectoral group such as the water and sanitation technical project staff on the one side and the generalist programme staff on the other side can tend to have certain communications or rather conceptual difficulties to understand each other and to co-ordinate the planning and programme aspects with one another. In the case of both Bangladesh and Nepal the fact certainly also has helped that among the project staff there are specialists, including the section chiefs, with public health experience reflected by the international professional reputation both of them personally enjoy.

86. A distinct advantage of the UNICEF organisation is the high degree of decentralisation and delegation of responsibilities. This applies particularly to the relationship between Headquarters and the Field Offices but also within the Field Offices and out to the District Offices.

87. Another important field for co-ordination within UNICEF to us seems to be that of supplies. During the early days of the Burma Dry Zone Programme with its heavy and complicated materials and equipment, errors were made in procurement. This was recognized and remedied. Since then several procurement officers during the last three to four years have been assigned to deal with water and other technical items. Recent discussions within UNICEF have led to the conclusion that there still is the need for strengthening the monitoring of and developing a mechanism for the procedure of specification and procurement in order to provide more accurate and timely services and deliveries to the project countries.

88. Communication between UNICEF Field Offices and the Headquarters of the organisation merit particular mention, since they influence not only the daily management of planning and operations but also the reporting back to the donors. To anybody working in the international field, the difficulties just to keep in touch over thousands of kilometres of distance are familiar. This has special implications for the reporting from the project work at community

level all the way to the central government authorities, from there to the UNICEF Offices, thence on to UNICEF Headquarters and from there again eventually to the donor agencies. One feature which is common for all the links in the reporting chain, is the workload on government and UNICEF staff at all levels, which often is a serious constraint to the regular flow of information as would be desirable. This applies to the feedback from Headquarters and Regional Offices to the field as well. Annex 2 on reporting practices in Bangladesh, Nepal and Burma provides further detail on these particular aspects.

Co-operation with other United Nations bodies, bilateral agencies and other organisations

89. In the three countries now assessed there also is a close co-operation and co-ordination between UNICEF, major UN organisations, (e.g. WHO, UNDP, World Bank) and some of the bilateral organisations. In Burma there is notably the Australian Development Assistance Bureau (ADAB) with a large input into the Dry Zone Project originally planned in complete co-ordination with the Government of Burma and UNICEF, without any formal agreement ever concluded between UNICEF and ADAB. Presently this co-ordination is continued through the country level IDWSSD mechanism.

90. Another case is that of the contacts with the FRG bilateral functions, apart from the direct channelling of special contributions from BMZ through UNICEF into some of the programmes. There is good contact in the different countries between the UNICEF Representatives and Staff with those of the FRG, and in some individual case, informal consultations on field experiences have been undertaken e.g. between UNICEF and the Kreditanstalt für Wiederaufbau (FRG Development Bank).

91. Another form of co-operation is that in Nepal of volunteers from organisations such as the Swiss Technical Assistance (SATA), the U.S. and Japanese Peace Corps, their UK counterpart and others, who in several cases provide on-site assistance for the design and monitoring of piped gravity schemes in remote localities. This co-operation has been functioning for many years and helps in reducing the shortage of skilled technicians.

92. Likewise, in Bangladesh a great many non-government organisations work at village level and maintain close contact and exchange experiences with UNICEF and the government. Some of these organisations contribute with often innovative technical features, such as the plastic "Rower pump", developed by the Mennonite Central Committee.

UNICEF Staff

93. The staff of UNICEF, both "regular" programme and project staff, aided by volunteers from other external organisations have a tremendous task to perform. It is difficult to measure in terms of person-hours or magnitude of

funds to administer. With the combination of advocacy and supply roles, they have to wear many hats and to tackle a host of problems, including the practical ones of logistics and their own existence in distant outposts and on long and arduous journeys, mountain and jungle treks.

94. We have found both on the UNICEF side and among the voluntary organisations without exception a hard-working, truly dedicated group of people. Those we met, including engineers, construction technicians and sanitation cum health education specialists, are technically solid people who need all the stamina they have for the often extreme physical conditions, under which they work.

95. Burma, keeping a greater national autonomy in terms of supporting staff may in our view have needed some reinforcement of the UNICEF project staff group. RWSD seems to be quite adequately staffed. ESD is in need of accelerating the ongoing process of strengthening of its own capacity. The size of the project areas and the technical complexity would well warrant some additional UNICEF staff especially for training purposes.

Effectiveness of monitoring and control system

96. Generally, with the spread of government agency and UNICEF presence throughout the countries, the monitoring and supervision of ongoing activities is relative effective in all three countries visited, especially as compared with, say, some of the Sahel countries, which have much less of an infrastructure. The effectiveness of monitoring, naturally, is very relative. There are many constraints, including those of geography with long distances and sluggish communications, which permit reports to filter through only slowly to the district centres and from there to the organisation head offices in the capital cities. Other constraints may be those of not having any proper reporting and monitoring system built up, staff not trained in reporting or no staff on location.

97. It is difficult to compare the three countries in this respect, since each of them has very different conditions and different types of water supply schemes. With the thousands of pumps in Bangladesh, it would be too difficult to keep track of each individual project for anybody above Thana level. Yet we feel that there is reasonable control at all levels concerned, especially in Bangladesh through the staff of the UNICEF Field Offices in the different districts. The individually larger projects in Nepal also are easier to keep track of with the outposted UNICEF Field Staff being so much more operative. In Burma, RWSD and ESD also seem well in control of the ongoing operations. Monitoring from UNICEF's side there will have to depend to quite an extent on the information made available from RWSD and ESD.

98. Project and programme evaluations are relatively rare and far from complete. Some of the more relevant ones have been listed in the bibliography. Procedures and methods for regular reporting and monitoring and

evaluation should be included in training schemes for the national officers, and also for UNICEF staff involved. Evaluation methodologies are now more developed and some institutions in the world conduct courses in this special field. For Bangladesh, the nearness e.g. to the International Centre for Diarrhoeal Diseases Research (ICDDR,B), makes it easy to use such a resource especially for the evaluation methodologies. Likewise, both Nepal and Burma have national institutions with good capacity for evaluations in different areas.

99. The monitoring and control of equipment and materials also seems relatively reasonable in all three countries, i.e. their location at a given moment, their use and status.

100. Another field of monitoring and control is the one of flow of funds and supplies. UNICEF provides a considerable part of both and has developed a considerable routine. As to procurement of local supplies, it seems that quality control on delivery couild be increased beyond the present practice , e.g. of the handpumps in Bangladesh. In the particular case of the Bangladesh pumps, the idea of employing an outside agent, such as Crown Agents, has been discussed but so far rejected on the grounds that the cost would be too high.

1.3 Criteria and Procedures for Future Assessments/Evaluations

101. It is advisable to have a longer period of planning before a new evaluation. Such preparations should start six to nine months before the next field visit.

102. During the period of planning, there should be more communication between the participants involved, including the Field Offices to be visited. The Terms of Reference should be agreed upon as early as possible.

103. More detailed proposals for the field trips should be sent to the UNICEF Field Offices at the earliest stage possible, and their final version of the itineraries should be "cleared" with all participants.

104. We recommend four weeks for the field visits. The members of the team should each have specific itineraries according to their specialized field of evaluation. Only part of the itinerary should be covered by the whole group travelling together.

105. For a next possible phase of evaluation, the Sudan has been foreseen as a country with good examples for rural water supply programmes with a similar comparable physical and technical background (handpump systems) but different socio-economic settings.

106. The evaluation/assessment should again cover socio-economic, health and sanitation aspects of the Water Supply Programmes but with more focus on functioning and utlization. Particular emphasis should be put on complementary components such as Health Education and Environmental Sanitation, as this would highlight behavioral and other problems that need to be addressed. An attempt should be made to find out whether a balanced approach of these basic social services takes place for the target populations.

107. The experience of a joint evaluation team consisting of independent consultants (FRG) and staff member(s) of UNICEF was encouraging and both sides enriched each other in a mutual learning process. We recommend that all members of the team are entirely set free for the time planned to do the assessment and preferably gather for finalizing their report in a location away from any office. However, a preliminary report should be prepared and discussed with office and project staff in the country. Recommendations should be prioritized in terms of their feasibility, low cost and impact (immediately and practicality) and form part of the preliminary report for discussion with project staff.

108. For the methodology it might be helpful to take into account the "Minimum Evaluation Procedures for Water Supply and Sanitation Projects" which has been published by WHO (February 1983). Although the total requirements for evaluations recommended in this document would be too comprehensive for our specific purposes, it provides a good systematic approach, from which the main elements can be chosen. The Field Offices can be informed in advance about the requirements and can prepare data and itineraries accordingly.

Recommendations

(i) UNICEF should continue its assistance to water supply programmes and projects because:

- governments as well as the communities welcome the assistance and make full use of it;

- water supply programmes are an effective entry point for other basic services;

(ii) Co-ordination of water supply programmes with other basic social services is recommended. For immediate effect, the elements of GOBI-FFF (Growth Monitoring, Oral Rehydration, Breastfeeding, Immunization, Family Spacing, Food Supplement, Female Literacy) should be strengthened and combined with the long-term aims of water supply, health education and sanitation. The tangible impact of water supply programmes would help form a good basis for the measures necessary to properly introduce GOBI-FF to the communities.

(iii) In designing further programmes, priority should be given to human resources development. This should include training, development of training methodology and materials and the promotion of human resources development for prime attention from the side of the governments.

(iv) The UNICEF support to water supply programmes should concentrate on the poorest segments of the populations and the most neglected areas.

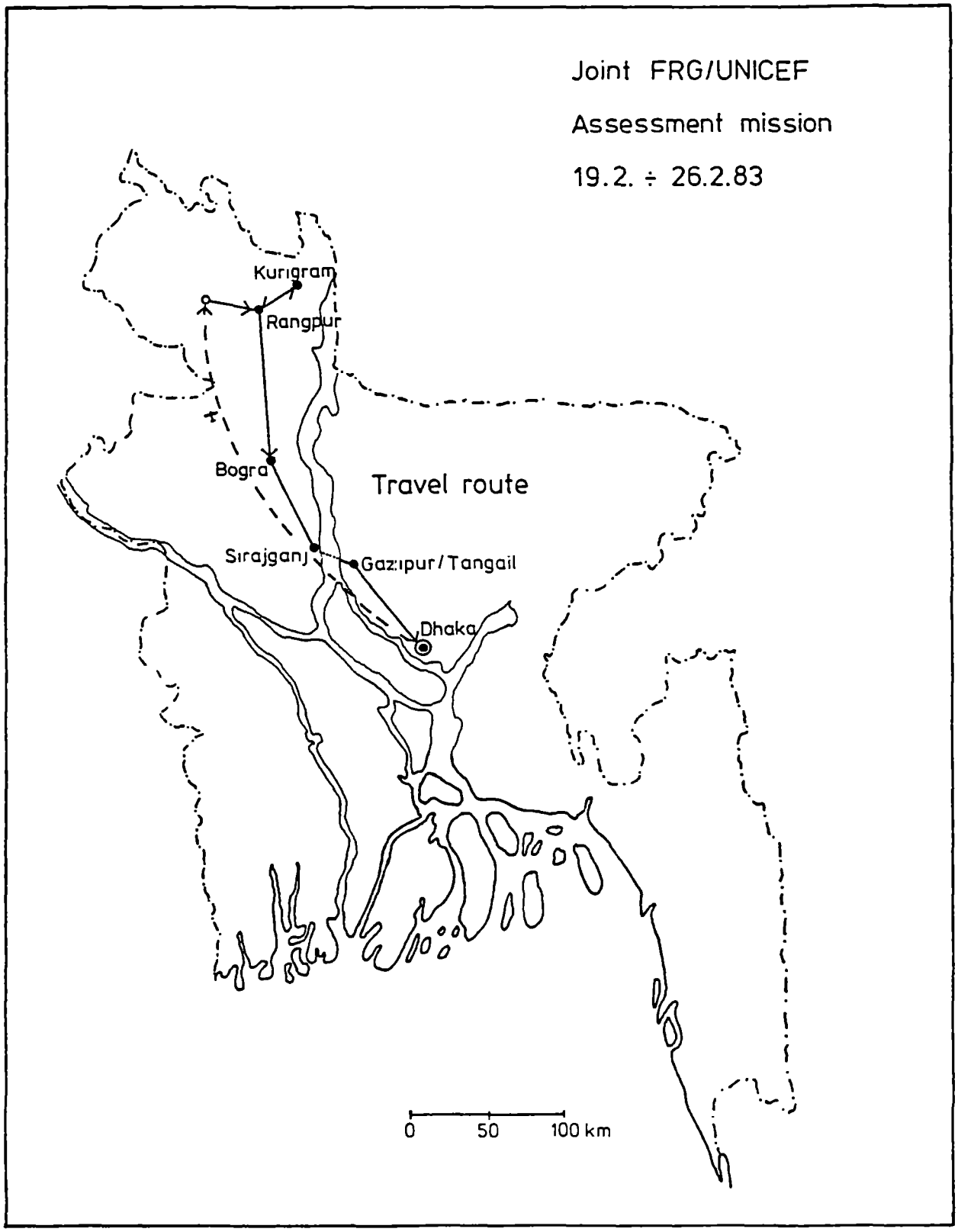
(v) UNICEF should continue to concentrate on projects using village level, low-cost technology in order to:

- ensure a minimum of operation and maintenance costs;
- avoid imports of spare parts;
- ensure continuous operation with a maximum life span of the installations.

(vi) We recommend to seek stricter adherence by UNICEF and the Governments to the obligations spelled out in the plans of operations.

(ix) In order to avoid pitfalls of overextending UNICEF and Government capacities in complex programmes, such as the Burma Dry Zone Project, careful planning and programme preparation is recommended without losing the impetus of rapid, flexible action.

BANGLADESH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2. BANGLADESH

2.1 Background Information and Determinants

2.1.1 Socio-economic Aspects

109. Bangladesh has an area of 144,000 square kilometres and a total population estimated in 1981 of 90,925,000 inhabitants. With a density on the land surface of 673 people per sq. km. Bangladesh is one of the most densely populated country in the world. The population growth is estimated to be 2.4 percent.

110. Bangladesh is categorized as being both MSA and LDC. With a per capita income of US$ 120 in 1981, the GNP is the lowest of the three countries visited. It has the second lowest income in the whole world. At the same time, Bangladesh suffers from a high inflation rate which was 16.9% on the average between 1970 and 1980 (IDA, Washington, 1982).

111. Agricultural production contributes 54% to the total production. The agricultural area covers 65% of the total surface and more than 90% of the population are living in rural areas, 75% of the population being directly employed in agriculture.

112. There is an uneven land distribution in Bangladesh. The 10% richest landowners hold 49% of all agricultural land, while the 10% poorest landowners hold only 2% of the agricultural area. It is estimated that more than 50% of the rural population is landless (owning less than one acre for cultivation). The number of landless rural people increases rapidly and with it the number of chronic destitutes:

Table 2.1
Poverty in Rural Areas of Bangladesh
As Percentage of Total Rural Population

Year	Absolute Poor	Extremely Poor
1963/64	40.2%	5.2%
1973/74	78.5%	42.1%
1976/77	92.0%	--

Source: UNICEF Bangladesh, Statistical Profile.

- "absolute poor" is defined as an income sufficient to cover only 90% of the household needs.
- "extreme poor" means an income which enables the households procure only 80% of the vital calorie requirements.

113. The population density on cultivable land with 958 persons on each sq. km. is extremely high. It seems that each person has to be supplied with food from an area of about 1000 square metres only.

114. Bangladesh has an extremely dispersed settlement structure of 65,000 villages, only 2,000 of these connected with good roads. Apart from the towns, only 200 villages are have electricity. Lying in the delta systems of the two major rivers, the Ganges and the Brahmaputra, nearly all the country is dead flat, which makes improvements of the physical infrastructure somewhat easier.

115. Rice is the most important crop, covering 80% of the total cultivated area. But in most years, the domestic rice production is not enough to feed the total nation. Food has to be imported. Other agricultural products are jute, tea and sugar cane. Animal production is less significant.

116. Sixteen percent of Bangladesh is covered by forests. Wood is increasingly exploited by rural households, which need it for firewood. This has a severe impact on the total economy of the country.

117. Together with India, Bangladesh is one of the largest producers in the world of jute. Jute and jute products are by far the most important goods for export, comprising 70% of all goods exported. Exports earn only 6% of the GNP of the country but imports are 20% in value of the GNP.

118. Bangladesh exports labour to the Arab countries of the Middle East. It is estimated that more than 100,000 Bangladeshis earn their living there, transferring money home to their families. They are the biggest foreign exchange earners for Bangladesh. The Middle East attracts mainly skilled labour, which in many cases would be urgently needed for essential positions in the government and the economy of their own home country.

119. While agriculture contributes 54% to the GNP, industry has a share of only 13% and (public) services contribute with 33%. Manufacturing is rather diversified, concentrating on food and jute processing.

120. The mining sector is still poorly developed and apart from natural gas in the eastern part of the country, there are only modest expectations for oil, peat, coal and few other minerals. For many years, Bangladesh has suffered from a high deficit of the balance of payments, which was US$ 1425 million in 1980/81. The foreign debt today is more than US$ 4 billion.

121. Altogether, the perspectives for development and economic growth for this poor area of the world do not look promising. The most realistic hope is seen in agriculture, where crop production, particularly rice, can be intensified by increasing the number of harvests in certain areas from one to two or even three harvests per year.

Demographic Data

122. Eighty-nine percent of the population of Bangladesh are Bengali. Moslems comprise 80% and Hindus 18%. There are marked differences between the religious and social groups of the country. The influence of Islam on the political, social and economic life is very important.

123. Women, who comprise 48.5% of the population, are excluded from public affairs with few rights and few possibilities to initiate any development. The disprivileged status of women in Bangladesh affects the water supply and sanitation programmes. Women would not allow themselves to be seen unveiled in public. For this reason, on market days they would rather abstain from using the safe water source of the tubewells. Therefore, arrangements for privacy at water and sanitation facilities for women should be an important requirement for all plans and designs.

124. Some 49.6% of the population in Bangladesh are children below the age 15. One-third of these children are under the age of four.*

Table 2. 2
Estimated Population by Age and Sex in 1980
(Figures in '000s)

Age	Male	Female	Total	% of Total
0 - 4	7,135	6,810	13,945	15.72
5 - 9	6,166	5,802	11,968	13.49
10 - 14	5,521	5,191	10,712	12.08
15 - 19	5,361	4,908	10,269	11.58
20 - 24	4,273	4,081	8,354	9.42
25 - 29	3,376	3,394	6,970	7.86
30 - +	13,857	12,803	26,460	29.84
All ages	45,689	42,989	88,678	100.00

Source: Statistical Pocket Book of Bangladesh, 1979.

125. Girls in Bangladesh get married at a very early age. The survey (see above) found out that among married women, 52% were married before they were 15. More than 95% had married before they were 20 years old. The median age of first marriage is estimated to be 14.7 years.

* Foundation of Research on Educational Planning and Development: The Situation of Children in Bangladesh, Dacca 1981.

126. The average number of pregnancies per women in Bangladesh is 4.46. There is an intensive campaign for family planning in Bangladesh, which is organized by a separate department of the Ministry of Health but not integrated into the rest of the health services. The family planning campaign was started in 1976.

127. Today the majority of couples are informed about contraceptive measurements. The contraceptive prevalence rate is estimated at 16% of all eligible couples. The government plans to reach a level of 38% by 1985, and 60% by 1990 (World Bank Recent Economic Development, 1982). Until now, family planning in Bangladesh has not shown a significant impact on population growth rates.

128. To summarize: Bangladesh is probably the poorest area in the world. There is an ongoing slide into even worse poverty. The only possibility for income generation for the rural masses seems to be an intensification of cultivation (three rice harvests instead of one). Up to now, this perspective seem to be more theoretical. Family planning has not succeeded in lowering the growth rate of the population. UNICEF Bangladesh bases its estimates on 90 million population for rural areas only by the end of this century. Population growth includes an increasing part of children, who make for more than 50% by now already. Altogether, these trends justify an increasing involvement of UNICEF, which has chosen Bangladesh already as its most important project country.

Education

129. The adult literacy rate is 26%, but the Government of Bangladesh puts much emphasis on improvement of the overall level of education of the whole population. Numerous informal functional educational programmes, including literacy campaigns, are included in these efforts.

130. Only about 41% of the 5 - 14 year old children are enrolled in school, and 54% of this group never went to school. Only 5% of those who went to primary school finished without repeating or other interruptions.* Of the pupils enrolled, there are about one-third more boys than girls.

131. The strong efforts of the government in expanding the provision of educational facilities to the population are remarkable. About 5% of the development budget is earmarked for education. The training of teachers and administrators, however, does not follow at the same rate so that the quality of the education system lags behind the high ratio of enrollment.

132. The Government hopes to achieve universal primary education by 1985. At the same time, the Government hopes to reach 40 million people with its various functional literacy programmes.**

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* Foundation of Research, The Situation of Children.

** World Bank. Recent Economic Developments. 1982.

133. Health education is carried out country-wide by the Bureau of Health Education, Ministry of Health. This office, which has existed since the 1950s, has expanded considerably within the last three to four years. Thanks to the numerous activities of the Bureau, it can be said that among the rural population there is a certain awareness about "personal cleanliness, use of safe water, defecation in latrines, immunization, desirable food habits" (General Education Objectives of the Bureau).

2.1.2 Health, Nutrition and Hygiene

134. General health statistics in Bangladesh are few and most of them are unreliable. A priority list of the most widespread diseases could not be found. The following table includes only those diseases which are ranked according to an unknown criteria score of a WHO publication. It can be seen that water-related diseases belong to the most important ones.

Table II.

Most Important Diseases in Bangladesh (around 1975?)
According to an Unknown Criteria Score

Diseases	Scores
Cholera	41.14
Smallpox	36.45
Pulmonary Tuberculosis	34.89
Typhoid	31.25
Dysentary/Gastroenteritis	31.24
Malaria	29.79
Avitaminosis	28.61
Protein Calorie Malnutrition	27.33
Measles	26.00
Worm Infestation	25.44
Tetanus	25.23
Diphtheria	24.68
Anemia	23.79
Pertussis	22.84
Poliomyelitis	22.69

Source: WHO, (1980): Country Paper on Health for All by the Year 2000. Bangladesh, New Delhi.

135. The infant mortality rate in Bangladesh is 140 per thousand live births (1980). For the same year, the child mortality rate was 23 per thousand. Life expectancy at birth of a Bangladeshi is only 47 years.

136. Children in Bangladesh are particularly vulnerable to water-related diseases. Normally mothers breastfeed their children, but after weaning quite often there is just not enough adequate food for the children to prevent malnutrition, diarrhoeal and other diseases. The following table shows the major causes for the death of children in Bangladesh.

Table II.4

Major Causes of Death
Percentage Within Age Group

Diseases	0-1 Years	1-4 Years	5-9 Years	10-14 Years
Tetanus	27.1%	--	--	--
Diarrhoea	--	31.8%	29.3%	20.0%
Pneumonia	15.8%	14.0%	--	--
Accidents	--	--	--	21.4%

Source: UNICEF Bangladesh (1981): Statistical Profile of Children and Mothers in Bangladesh, Dhaka

137. Compared to other countries, there are quite a number of physicians and other medical staff in Bangladesh. Quite often the auxiliary medical staff is not trained enough, has no facilities to work with, and gets an extremely low salary so there is not incentive for this kind of work. In Bangladesh, there are

- 11,000 graduate doctors,
- 450 medical assistants,
- 2,700 nurses,
- 2,471 family welfare visitors,
- 1,223 sanitary inspectors,
- 13,500 male family welfare workers,
- 12,337 female family welfare workers,
- 24,000 (unpaid) village health workers.

138. In 1980 there were 20,500 hospital beds, which makes for one bed for each 4,390 inhabitants of the country. During the same year, Bangladesh had 158 hospitals, 290 Thana health complexes, small hospitals or better health centres on Thana level, serving approximately 200,000 inhabitants. There were 2,000 family welfare centres staffed with poorly trained and paid staff. Medical services in rural areas suffer from a chronic shortage of drugs. It is estimated that only 10% of the most important drugs are regularly available.

139. More than 50% of the population suffers from malnutrition, which causes many deaths and much disability. It was estimated that in 1975/76 for 59% of all households the calorie intake was only 91% of the essential requirements (also compare Table 2.1). Annex 4 shows a more detailed picture of it.

140. The poverty of the population has its direct impact on hygienic standards. Most people in rural areas have just not enough income to buy facilities for safe water or latrines. Neither can they afford to buy enough soap to wash themselves.

141. The floods, which cover large parts of the country for two or three months during the year, are another source of pollution and make adequate hygienic standards difficult during that time.

2.1.3 Technical Aspects

142. Handpumps and tubewells were already widely in use in Bangladesh, when UNICEF in 1972 began to assist the rural water supply activities of the government.

143. The physical and socio-economic conditions in Bangladesh form the background to the low-cost handpump technology chosen. The increased use of surface water by a rapidly growing population caused a heavy pollution of the traditional water sources (rivers and ponds). The fact that an estimated 80 million people are living in about 65,000 villages, results in scattered settlement patterns. Therefore it is not feasible to install supply systems which provide water ideally close to each household.

144. The geographical conditions - flat alluvium with silt and fine sands covering about 83% of Bangladesh - are such that there is groundwater of fairly good quality so far accessible through shallow tubewells. The average depth of the alluvium is about 35 metres with variations from 18 m to 80 m. In approximately 14 percent of Bangladesh, especially in the costal areas, water of good quality is accessible through deep tubewells of an average depth of 300 m tapping confined aquifers with fresh water under formations with a high salinity. In the remaining 3 percent of Bangladesh tubewells cannot be used due to problems with high salinity, iron or other adverse geological conditions.

145. The above listed conditions clearly lead to the conclusion that tubewells and especially the shallow tubewells currently are the most economical source for drinking water in Bangladesh.

The "New No. 6 Handpump"

146. The "New No. 6 Handpump" is the standard handpump used in the shallow tubewell programme in Bangladesh. It has been tested in the UNDP/World Bank Handpump Testing Programme. A summary of the results from the tests, and a drawing are attached to this report (Annex 5).

147. The "New No. 6" handpump represents an attemtp at standardization and is seen as an improvement to older handpump models. It is low-cost and locally manufactured. By deciding to have only one type of handpump for the programme, a simplified system for production and spare parts supply could be laid.

148. Experiments with a so called "Family Pump" and an alternative "No. 4" handpump were abandoned in favor of the "New No. 6" pumps in order to simplify the logistics of spare part supply, the maintenance procedures and to reduce the overall cost per capita. The family pump did not yield enough water and influenced the water usage patterns negatively. Besides, the cost per capita was too high (about 10 US$ per person).

Deepset Handpump Tubewells

149. As the tubewell programme for the shallow areas proceeds and a good coverage of these areas will be reached in the next years, more efforts are undertaken to provide the deep well areas of Bangladesh with potable tubewell water. Thus the development of a cheap reliable deep-set handpump, again standardized for the whole of Bangladesh, is a major future target for DPHE and UNICEF.

150. These efforts are still under way. In 1976 Deep Well Specifications of DPHE (No. 0012/76) were released, proposing the "New No. 6" with a special deep-set configuration for for the upper part of the tubewell design. In 1979, new specifications (DPHE 0022/79) for the installation of the India Mark-II deep-set handpump were established.

151. Two thousand deep-set India Mark-II handpumps have been installed (costing 2000 US$ each) in a test area near Dhaka since 1979. This pump is now seen as being too expensive both from the installation and the maintenance cost point of view. For the installation (2 - 3 days) a drilling rig (4" bore hole) is needed. A mobile crew with special tools, special tripods, casings and a truck has to be equipped and trained. The maintenance procedure for replacing the relatively fast wearing cup seal alone requires a mobile crew, trucks, tools, trained people, and budget for the petrol, because the whole mechanism underground has to be pulled up and taken apart to change a cup seal worth 50 US cents. This procedure takes about one day. There are four of these mobile crews for the 2000 India Mark-II pumps installed.

152. It is easy to see that the maintenance standards cannot be held up and are just too expensive. By the year 2000, about half of Bangladesh will need lift pumps (average depth 10 -15 m) due to the lowering of the level of the groundwater increasingly used for irrigation with power pumps. A cheap and easy-to-maintain lift handpump is needed to get away from the high costs and the mobile maintenance crews.

153. Presently UNICEF jointly with the World Bank is testing the TARA force (lift) handpump; which is originally based on the IDRC/Ethiopia pump. In Annex 6 a drawing of the overall concept of the TARA pump is shown. This pump has the great advantage that, besides eliminating the need for tools to maintain the pump, it would be very inexpensive to manufacture as compared to the India Mark-II.

154. Bringing potable water to the rural population is only one of the measures needed to lower child and infant mortality and morbidity. Therefore sanitation (latrine construction) as an additional programme component has been added to the water programme. As it is beyond the scope of this exercise, technical details of latrine construction as supplied by DPHE/UNICEF are not discussed in this report. Annex 7 shows the general latrine construction concept (set sold by DPHE/UNICEF).

2.2 Project description and progress in implementation

155. In 1976, the first project was completed with the installation of 100,000 shallow and 500 deep tubewells, and the re-sinking of 60,000 choked-up tubewells for rural communities, primary schools and union family welfare centres. The second project, the sinking of 155,000 shallow tubewells and 5,000 deep tubewells by 1980, was slightly delayed by financial constraints; the sinking of 50,000 shallow tubewells was completed by mid-1980. The third project, the sinking of 60,200 shallow tubewells in 1980-1982, started very slowly due to financial constraints, but most of the target was to be met by June 1982.

156. Until 1980, the village sanitation project achieved very limited results. Only 5,600 latrines were installed in 1978, 10,000 in 1979 and 18,300 by June 1980. Major problems are the community's reluctance to use latrines, poor health education efforts promoting their use and limited latrine production capacity. However, during 1980-1981, 36,000 units were produced, indicating an increased production capacity. In addition, the idea of public community latrines is gaining acceptance and a small number are planned for the near future. Communities participate in both the water supply and sanitation projects through financial contributions and self-help pilot activities.

157. More emphasis has recently been placed on the sanitation programme and health education activities. A one-day training exercise in maintenance and basic health practices produced 200,000 volunteer tubewell caretakers during 1979-1982. More emphasis has also been placed on women's role in promoting the health benefits of safe water and sanitation.

2.3 Programme/Project Objectives

2.3.1 Socio-economic Aspects

158. The huge programme assistance to water supply and sanitation of UNICEF in Bangladesh, which is the biggest single programme UNICEF supports throughout the world (it absorbs about 3% of the total budget), is not easy to grasp, unless directly observed in the field. The general objectives in the Plan of Operations (1982-1985) concentrate on the improvement of health, health education and better applied technologies (see 2.5.2). The concentration on health is confirmed by the UNICEF officials in Bangladesh.

159. The first objective of "UNICEF's General Policies" for water supply is to fulfill the target group's basic needs for water. Without doubt, the provision of safe water to the rural population in Bangladesh can be seen as an objective in itself. Probably not the only one, which would justify the whole programme, but an important one.

160. The employment potential, which the UNICEF-assisted water supply programme offers, is not one of the programmes's objectives. Nor is the income redistribution effect of the programme formulated as an objective by the programme designers. (The local contribution almost entirely comes from the richer parts of the rural population while the whole community around the handpump has legal access to it.) These effects are rather seen as positive by-products of the programmes.

161. While not especially mentioned, the water supply programme has an important role in its functioning as entry point for other programmes (latrines, health education, PHC, etc.) of the Government with UNICEF support. From the point of view of UNICEF, it is not only an entry point towards the rural population, but as much an entry point for stimulating the Government to introduce other programmes. The important role which UNICEF Bangladesh plays as advocate for children in this country, would be only half as effective, if it were not backed by the inputs into the appealing water supply programme.

2.3.2 Health, Nutrition, and Hygiene

162. Under general objectives in the Draft Plan of Operations (1982-85) is mentioned:

> "1. To act to ameliorate the poor health of the rural population of Bangladesh; especially children who are more prone to the dangers of water-borne diseases and high worm infections, by:
>
> (i) continuing construction and maintenance of handpumps/tubewells in the rural areas of Bangladesh, with emphasis on the provision of safe water supplies in hardship and under-served areas; and
>
> (ii) strengthening and intensifying sanitation activities in the rural areas of Bangladesh, but with special attention to the slums and squatter areas of certain cities and towns.
>
> 2. To act to intensify health education and motivational activities in rural Bangladesh, to ensure the efficiency of the material and supplies involved.

3. To search for appropriate technology; and the most suitable and cost effective substitutes for existing services and materials."

163. The long history of the UNICEF-assisted water supply programme in Bangladesh, which is working country-wide, has resulted in the largest department of the Ministry of Local Government being DPHE with more than 4,000 staff members and the satisfaction for the politicians in Bangladesh that something has been done for the rural population . This political potential is used by UNICEF Bangladesh to help strengthen other social services in rural areas in order to reach a balanced approach, which again successfully leads to improvements of Government health services .

164. The most important complementary elements, sanitation and health education, are already included in the plan of operations. With primary health care and a country-wide coverage through health care facilities, still a great deal has to be done to reach the level of water supply and sanitation. The Government of Bangladesh has accepted the idea of "Health for All by the Year 2000" and WHO supports the Government in its planning process towards this goal.

165. Along with this, the World Food Programme caters to a huge nutrition programme, particularly for children all over Bangladesh.

166. It is said that the Bangladesh Rural Advancement Committee (BRAC), Dhaka, runs the most successful campaign on Oral Rehydration Therapy in Bangladesh. Within three years, 2.5 million households were taught the new therapy and controls found out that 90% of them could use the new method of treating diarrhoea.

2.3.3 Technical Aspects

167. The second Five-Year Development Plan 1980-1985 sets as its goals:

- one tubewell for every 75 persons in rural areas;
- 600,000 villages sanitation units (at least 5 per village in 1985).

168. The co-ordinated achievement of these two objectives is seen as the singlemost important means of substantially reducing the incidence of epidemics and water-borne diseases in Bangladesh. The estimated coverage (1983) was 200 persons per operable pump. Roughly half of the people use tubewells for drinking water. It is estimated that less than 10 percent use tubewell water for all domestic purposes. Less than 1 percent of the rural population has access to sanitation facilities. About 5 percent of the rural population have a fixed location for defecation.

169. Starting in 1972, UNICEF has provided assistance to:

- construction of new shallow tubewells;
- re-sinking, rehabilitation, and demanding of choked up or damaged handpump tubewells;
- construction and rehabilitation of deep handpump tubewells.

The main objectives were:

- to create an active health consciousness, to decrease water-borne diseases and to activate peoples participation and awareness of the benefits of safe drinking water;
- to improve the health and welfare of the people by providing adequate quantities of water for drinking, personal hygiene and domestic use.

170. These objectives were technically to be achieved through:

- developing a sturdy economical handpump for manufacture in Bangladesh, designed to operate for a minimum of twelve months without major maintenance or breakdowns;
- improving manufacturing methods of local handpump production;
- improving the logistics of DPHE;
- helping to improve the technical standards of maintenance;
- initiating certain studies and research which would facilitate the planning of water supply programmes (different handpumps, foundry technology, relationships between safe drinking water supply and health status).

171. Certain non-technical constraints in the past to some degree have limited the efficiency of the programme efforts:

- a joint UNICEF/Government appraisal shows that the programme implementation in 1978-1982 was quite uneven in the different programme sectors;
- the difficult economic situation of the country has limited the availability of project counterpart funds in local currency;

- administrative and procedural bottlenecks limit intersectoral co-operation and co-ordination communication among project personnel, timely decision-making, and efficient utilization of project inputs;

- additional constraints are the highly centralized administrative structures, customs clearance procedures and cumbersome and time-consuming internal logistics.

172. Internal constraints within UNICEF Dhaka (especially in 1980 - 81) such as understaffing and lack of continuity in key senior posts resulted in poor coordination among sections, inconsistency in the co-operation with Government bodies, and insufficient utilization of the information generated by the programme section and UNICEF's field organization for monitoring and programme purposes.

2.4 Analysis of Planning and Preparation

2.4.1 Socio-economic Aspects and Health, Nutrition, and Hygiene

173. As in all other countries where UNICEF is working, the organization in Bangladesh has put together its statistical profile on the living conditions of children and mothers. Apart from these basic data collection for planning, many other studies are undertaken to elucidate the background of the various programmes and projects.

174. Among the most important studies on water supply, sanitation and health are:

- UNICEF/WHO. 1977 and 1979. A Survey of Rural Bangladesh on Diarrhoeal Morbidity, Water Usage and Related Factors.

- Rahman, M. M. et al. No year. Relationship Between Water Consumption and Dysentery in Teknaf, A Rural Bangladesh Village. Dacca.

- Ahmed, F. 1981. Design Parameters for Rural Water Supplies in Bangladesh. Dacca.

- DANIDA. 1979. Drinking Water to Rural Areas in Bangladesh. Dacca.

175. UNICEF Bangladesh works closely with local scientists, consultants and institutions (University of Dhaka and the International Centre for Diarrhoeal Diseases Research, Bangladesh).

176. The most important partner in UNICEF's planning and programme preparation is the Government of Bangladesh and all steps of the programme are continuously discussed with the ministries involved. The rural population does not participate in the planning process.

177. DPHE together with UNICEF intends to engage women more in planning and for taking over responsibilities within their projects (Government of Bangladesh, International Drinking Water Supply and Sanitation Decade, 1981-90). Up to now, only few groups of women caretakers have been trained. This may mainly still be thanks to conscious promotional efforts on the side of the authorities jointly with UNICEF, rather than out of a spontaneous demand from the communities.

2.4.2 Technical Aspects

178. After the Independence of Bangladesh, UNICEF's activities first concentrated on the development of a suitable pump design (suction mode) and assisting the development of the pump manufacture locally. The next steps were directed towards the logistics of spare parts supply, the formulation of specific installation procedures and the strengthening of the organizational structure of DPHE. UNICEF then established its own district offices with UNICEF District Representative and Field Technicians supporting the work of DPHE and the hired private contractors, installing the handpumps. The current efforts give priority to the improvement of the maintenance of village level with the result that an increasing number of courses for local caretakers (including female caretakers) are now being held.

179. Special attention is now also given to the procedure for applications for new tubewells from the villages and the equal distribution of handpumps with the difficult and very poor areas getting higher priority. The current procedure requires that an application form, sold for 5 Taka, has to be filled out and given to the DPHE, Water and Sanitation Committee, which decides if a handpump can be installed or not. Thus, some areas which are very poor or not accessible can still have a satisfactory coverage within the programme. As seen in the foregoing, the long-term planning activities aim at a more wide-spread installation of lift handpumps. Testing and development are underway and the targets are clear. In order to be able to achieve a good progress commensurate with the needs, about 75,000 handpumps per year would have to be installed in the next 20 years.

2.5 Project Implementation (Installation)

2.5.1 Socio-economic Aspects and Health, Nutrition, and Hygiece

180. A written request must come from the community before any project is started. Women in Bangladesh normally do not express their need for safe water nor do they have the chance to participate in any other aspect.

181. Every community has to pay 75% of the well-sinking costs to the contractor, who does the sinking of the tubewell. In the shallow tubewell programme this can vary between 100 and 1,000 taka, depending on the depth of the well. One thousand taka is the upper limit of local contribution. In areas with deep-set handpumps, 1000 taka are paid as a lump sum. The money in most cases is provided by the richest member or two or three of the most affluent members of the user group which, however, does not entitle them to any special legal rights for the use of the handpump.

182. Nevertheless, the pump donor is highly honoured by the other villagers for having given water to the community (which is highly valued) and normally the pump will be installed next to his compound so that he will have to walk just a few metres for safe water. In cases where villagers buy handpumps on their own and install them in their compound, they have to cover the total cost, which can be up to 5,000 taka.

183. Until 1980 users had to pay only 50% of the well-sinking costs to the contractor. The increment to 75% did not have any impact on the general demand. There is no information about the price elasticity of demand for handpumps. It is recommended that information be collected on this question and in relation to this, also about the income situation of those who normally pay the user's share of the installation.

25.2 Technical Aspects

184. All procedures for sinking the tubewells, including the installation and development, are laid down in the Shallow Well Specifications formulated by UNICEF/DPHE in 1976.

The Sludger Method

185. In the soft soils of Bangladesh all that is needed to sink a tubewell is an appropriate length of 2" GI-pipe, a bamboo scaffold and a three-man team in the case of the present programme, (contractors hired by DPHE). The sinking procedure is as follows:

- digging a small pit (60 by 60 cm and 30 cm deep) above the selected site of the proposed well;
- spreading of cowdung to act as a seal; the pit is filled with water;
- the first 3 m length of G.I. pipe is then stood in one corner of the pit and filled with water;
- one man controls this well sinking-through-pumping operation ("sludging") by standing on the scaffold raising and lowering his hand over the top of the G.I. pipe as a human flap valve;

- the other two men use a bamboo pole, pivoted on the scaffold and fixed by a slipping knot to the G.I. pipe, to pump this pipe up and down, thus gradually forcing it into the ground;

- the pipe thus jets its way steadily into the ground as an intermittently stream of water and sand from the bore hole bottom is pumped to the top (splashing water more or less directly into a bucket standing in the pit hole area);

- from this bucket samples of the soil are taken for control if a suitable water-bearing layer has been encountered.

The Shallow Tubewell Construction

186. Once the required depth is reached, the G.I. pipe is withdrawn manually and the tubewell is constructed (average sinking speed is about two hours for 50 m and 10 min for the tubewell construction). The shallow tubewells are of 1-1/2" (38 mm) diameter and consist of the following parts (from top to bottom):

- top section of 6 m of 1 1/2" galvanized iron (G.I.) pipe;

- main section of 1 1/2" PVC pipe of a length varying from 9 to approximately 66 m (pipe connections are smooth joints glued together with plastic cement);

- strainer section of 1.8 m PVC pipe with fine slots (about 7/1000");

- sand trap section (60 cm).

187. After the construction has been completed, the well is developed thus:

- a temporary extra length of G.I. pipe is fitted above ground and continuously topped with water for a few minutes;

- when it is removed, the well gushes water for a while and is then ready for the mounting of the handpump;

- in order to apply extra pressure to the aquifer for developing the well, the spout is first plugged. After a few minutes of intense pumping, the plug is removed and normal pumping begins;

- the sandy discharge clears very quickly, but the regulations require an 8 hour minimum of pumping before water is drawn for drinking to ensure that all contamination (including that from the cowdung) is withdrawn.

188. The groundwater table is rarely more than three meters below ground level in most areas of the country today. The actual depth to which a tubewell has to be sunk, is the minimum depth of a good yielding aquifer with safe, potable water. (There are depth records available for every Union). If the groundwater level is more than 6.5 m below ground level, the tubewell has to be fitted with a special deep-set handpump, which also requires a different design of the top section of the tubewell.

189. After developing the well, the tubewell site is covered with a concrete platform to protect the groundwater from contamination through the waste water. A small drainage channel has to be built.

190. People's participation in the installation process is limited to a financial contribution to the cost of the well-sinking, of about 300 Taka (for the sinking of an average depth of 35 m. The calculation is based on a well-sinking cost of 3-5 Taka per m).

191. After or sometimes even before the installation, a local caretaker is selected, who is living in the village and will look after the pump and carry out minor maintenance work.

Costs for the Handpump

192. The overall cost for a completely installed handpump corresponds to about 300 US$. US$ 23 is the price of the pump at the foundry. UNICEF pays for and does the procurement of various raw materials (pig iron, high-grade hard coke) and of the other materials for the tubewell construction (PVC pipes and screens, cement). DPHE contributes by financing and organizing of the project (manpower, buildings etc.) and the transports.

Water Quality

193. The water quality is tested for taste, smell, and odor. The iron content of the well water is measured with easy-to-use HACH field laboratory testing kits. During our field trip a simple iron removal plant was visited. This construction consists of a small water tank filled with small pieces of broken brick. The water is pumped with the handpump into the tank and flows through a system of three connected, successive chambers. Through contact with the bricks and the aeration, the iron content can be reduced from 10 to 2.5 mg/l.

2.6 Operation and Maintenance (Functioning and Utilization)

2.6.1. Socio-economic Aspects

194. Little is known about the socio-economic pattern of use of the handpumps. UNICEF estimates the global national figures for rural areas in terms of users at 80 million people with 500,000 handpumps. This leads to the average figure of 160 users per handpump. The exact number of rural households which use handpumps is not known. Further study is needed to be carried out in this area, the results of which would assist staff in developing activities to increase utilization of the handpumps.

195. For getting more information on social and cultural patterns, the Masters Thesis of Mr. Farooque Ahmed shows the right direction. Investigations like this should be carried out on a national level. The significance of the water supply programme - even on a international level for comparisons - would justify larger research efforts. UNICEF is concerned about the problems of the cost of operations and maintenance as well as usage of the handpump. There is insufficient maintenance, which seems to be the main reason, why a percentage of pumps, estimated to be 20%, are out of order at any given moment. Spare parts are still paid for and delivered by UNICEF and DPHE.

2.6.2 Health, Nutrition and Hygiene

196. No one knows exactly about the impact of the installation of handpumps throughout rural Bangladesh on the improvement of health and the reduction of water-related diseases. There are no nation-wide base-line surveys available and at the same time it seems impossible to attribute the effects of one single factor such as water supply, to any decrease in diseases. There are several studies in Bangladesh, which tried to find out positive correlations between tubewell water and water-related diseases (compare 2.7.2), yet, more of such studies would not arrive at any conclusive result. This lack of more precise studies is attributable to the complex question of causes and effects of health impact of water supply and sanitation. Research on this subject is recently begun in some 20-30 communities, but the results still are far from conclusive.

197. Unfortunately, the installation of a handpump does not necessarily mean the guaranteed end-use of safe drinking water in sufficient quantities for the rural households concerned. The users carry the water in open buckets and pots to their households and store them uncovered in the houses. This makes the water subject to pollution. Children as well as adults do not strictly stick to tubewell water and sometimes use water from other sources for drinking and, in doing this, get infected.

198. It is not known, water from where and how much is used for cooking, personal hygiene, washing clothes and utensils. A Danish sociologist will work from 1983 onwards with UNICEF Bangladesh to collect more information about these factors influencing the health and social life of rural households.

199. It any case, it seems to be clear that the "hardware" (handpump) in itself is not sufficient for improvement but that the "software" (health education) makes people aware of the benefits of safe tubewell water.

200. Most platforms around the handpumps are not big enough to allow small groups of women to clean dishes and clothes on the relatively clean concrete surface. This seems to be of importance because clean surfaces to do this work, conducive to hygiene, are rare in Bangladesh, where stones or rocks do not exist in the largest part of the country.

201. Latrines are normally used, not because the users would be aware of the health reasons, but because of privacy. Therefore it sometimes happens that only the female members of the society have the privilege of using the latrine. The members of a family to use the latrine last are the children.

202. Since 1978 latrines are no longer distributed free of charge, and today customers at the selling centres have to pay 150 taka. This means that only more affluent people can afford a latrine. The demand at any rate is still much higher than the supply.

203. Surveys on the use of latrines found that about 20% of the latrine sites were not installed or did not work. "For the proper use and maintenance of all distributed latrine units an immediate education on sanitation and follow up is essential." (UNICEF/DPHE, End-use Evaluation of Water Seal Latrines, Preliminary Report, 1980.)

2.6.3 Technical Aspects

204. As recorded from the World Bank tests (New No. 6 Handpump) and as observed during our field visit, the operation of both the New No. 6 and the Tara Pump is easy, even for children down to six years of age. For the village level caretaker courses, maintenance manuals and education kits have been developed, written in Bengali. Due to the low rate of literacy, many cannot read the manuals and even have problems to understand the simple drawings (vivid sketches, not technical drawings). As a consequence most caretakers have to learn the maintenance procedures by doing.

205. During our field trip the following observations were made of the New No. 6 handpump:

- Almost all head covers were loose. The 4-bolt design requires well-machined surfaces of both the headcover and the pump body. This is not a good engineering solution. Already in 1979, the DANIDA evaluation report made the recommendation to change the design to a three-bolt connection which does not require machined surfaces.

- Often the cup seals did not seal sufficiently, causing a lower yield of the handpump.

- Both the rod and the fulcrum pin, where the handle is connected to the piston rod, respectively to the headcover, wear out very fast. They are never lubricated and very often in bad condition.

- The cotter pins were often missing (being replaced by nails or wire).

- Sometimes concrete platforms are not been built by villagers (more applicable to private handpumps in single households).

- Many public pumps along the roadside (seen from the car) seemed to be out of order.

- The pumpstand base and the G.I. pipe are often not sufficiently tightly connected.

- The excess water often is not properly drained, causing a muddy, dirty surrounding of the pumpstand.

- Due to leaking valves some pumps run dry and have to be primed by filling with contaminated water from nearby ponds, water courses, resulting in contamination of the drinking water source.

Proposed Modifications of the "New No. 6" Handpump

206. In the DANIDA evaluation report a few minor changes in the design of the "New No. 6" handpump were listed. Up to now it seems that these modifications have not been introduced into the manufacturing of the pump. These modifications, if introduced, could reasonably reduce the wear of the rod and fulcrum pins.

207. The recommended modifications were (see drawing. Annex 5):

- the fulcrum pin should be prevented from rotating in the headcover holes by casting the headcover with a small rib through which a hole for the cotter pin is drilled;

- a bush should be inserted into the handle as a bearing for the fulcrum pin;

- the wear of the outer end of the handle (rod pin) could be prevented by the same modification as proposed for the fulcrum pin;

- the fitting of the headcover should be improved either by machining of the contact surfaces of the headcover and the pump body or by introducing a changed three-bolt design. A good direct contact between headcover and pump body easily can be achieved without machining, when only three bolts are used (a three-legged chair will find support on any uneven floor, whereas a four-legged chair requires a plane floor in order to find stable support).

208. Notes on the new TARA-handpump (lift pump under development as seen in test areas near Dhaka):

- The wall thickness of the buoyant piston rod is too thin (will be changed as soon as PVC pipe with suitable wall thickness will be locally available.

- The wooden top cover of the pumpstand where the piston rod is passing through seems to be unsuited. It wears out too fast and with every stroke, water splashes through the gap between piston rod and headcover.

- Leather as a material for the piston cup seal is currently tested but up to now does not perform satisfactorily.

- The 18-hole aluminium plate for the piston valve seems to be too labourious to produce (a plate similar to the stiffener ring could probably be used).

- The discharge spout is still under development. The current shape (two straight welded pipes) seems to be a good solution.

- The development of a locally produced PVC filter screen is under way.

- There may be constraints to the operation of the TARA pump. It may be difficult to introduce this pump to the villages, as the pump stand position, straddled by the users might offend the sensitivities of the Bangladeshi women.

Iron Removal Plant

209. Although the system as described above is appropriate, relatively cheap and easy to maintain, its functioning in the villages may encounter certain problems, which would merit close monitoring and particular motivation of the village handpump caretakers, where they are installed. These plants have to be maintained once in every one or two weeks, depending on the amount of water used. If maintenance is not kept up through the necessary periodic flushing (reverse water flow) and the changing of the brick fill from time to time, the effectiveness of these plants may decrease.

2.1. Main Findings and Recommendations

210. In its more than ten-year history the water supply programme in Bangladesh has developed as the biggest single programme UNICEF assists throughout the world resulting in tangible improvements of village life in rural areas as well as on the Government of Bangladesh.

211. By means of these contributions UNICEF Bangladesh earned intangible credits which allow the organization to become more effective in other fields of basic social services and be highly respected.

212. Without a doubt the water supply programme of UNICEF in Bangladesh can be used as an important entry-point for other social services towards the rural population as well as towards the Government of Bangladesh.

213. Good co-operation seems to exist between the water section of UNICEF and the ministries of the Government of Bangladesh involved (especially DPHE and the Ministry of Health). A partnership has been developed which allows an optimal implementation of the programme.

214. UNICEF staff members have successfully advocated to make the latrine construction programme, and health education and improvements in public administration involved in water supply and related fields, important complementary programmes of the Government.

215. However, it seems that water supply is far ahead (50% of the rural population have access to a safe water supply) compared to other social services, for example:

- latrines (only 1.5% of the rural population use adequate latrines;
- there is no cold chain to enable immunisation programmes for children in rural areas;
- during most of the year, a dangerous drug shortage in rural areas prevails;
- not everybody has access to adequate medical services in rural areas.

216. We recommend UNICEF Bangladesh to develop criteria for the level of supply of basic social services which would allow a quantitative comparison between the different levels of performance.

217. This does not imply that UNICEF Bangladesh should reduce its engagement in water supply. We rather think that it is necessary and advisable to join other programme elements with water supply more than has been done in the past, while maintaining the level of support to the water supply programme. Water supply seems to be the most effective entry point for UNICEF Bangladesh to any aspect of community development.

218. In order to effect a balanced approach of social services, more co-operation between the various departments of UNICEF Bangladesh might be helpful. Besides harmonizing the work of UNICEF Bangladesh, the other sectors could use the political appeal that the UNICEF assistance of the water supply programmes had in the country.

219. More should be done to collect socio-economic data at the national level. The many studies, which have been carried out, do not as yet allow an extrapolation for the whole country. This could make the programme more efficient and sharpen the ability of the programme to improve health by means of water supply and other related inputs. There is need to know more about:

- the sizes of the user groups;
- income and wealth distribution of the villagers;
- who and how much the households contribute towards the installation of handpumps;
- which households can afford latrines and which cannot;
- the possible effects of engaging more women into the programme (caretakers, etc.).

220. Because of the significance of the water supply programme, which covers already most parts of the whole country, exceptional inputs in research are justified.

221. UNICEF Bangladesh should develop a plan to move out of subsidizing the operational costs of the handpumps in rural areas. All possible steps should be undertaken that the users themselves fully take over operation and maintenance and cover all expenditures for repairs. If this cannot be reached, it should rather be the government instead of UNICEF to support them.

222. A study might help in finding out whether the distribution of spare parts for pumps runs more efficiently and smoothly through the private market. This solution instead of a bureaucratic one could be followed, particularly when the users take over all costs of maintenance and repair.

Technical Aspects

223. Shallow tubewells and handpumps (as used in Bangladesh) are an example of a successful, appropriate low-cost technology that helps to bring safe drinking water to large parts of rural Bangladesh. In addition to this, it has enabled the increase in agricultural production through Manually Operated Shallow Tubewell Irrigation, strongly furthered through UNICEF's assistance to the "MOSTI" project some years ago, now financed with major inputs from the World Bank and USAID.

224. Groundwater as the source of water is the only potentially safe source available, although high contents of iron in some districts give the water a taste, not liked by the users. As a remedy to this, simple iron removal devices are now installed with the handpumps in iron-infested areas, making the water acceptable and used. Tubewell water basically is a safe water source. With the Bangladesh "New No. 6" handpump, there are still some risks for contamination through its design and certain practices from the users' side.

225. The choice of materials, method of manufacturing and procurement practices keep the total cost for the handpumps low.

226. The pumps appear to function fairly well at village level, yield good quantities of water and are easy to operate.

227. The maintenance procedures are simple enough for adult villagers (male or female) to manage them after a short practical training course of only one day.

228. Although an increased number of courses for local caretakers are being held and special maintenance tools and lubricants are supplied by UNICEF (at remarkable cost), the maintenance standard of the handpumps at village level still leaves room for improvement. Partly this may be resolved through redesign of certain pump details, partly through intensifying the motivation and training of handpump caretakers.

229. The capability of villagers to contribute even a small amount of money seems to be quite limited due to the extreme poverty of the villages, even to the degree that many villagers cannot afford satisfactory water containers of their own.

230. The distribution and availability of spare parts at Thana and especially Union levels seem to be unsatisfactory. There is an apparent lack of communication between the village level caretakers and district offices (due to the difficult access to the villages and no travel allowances for government offices).

231. The established site selection criteria seem to be followed (e.g. accessibility to all) but due to the settlement patterns, such factors as equal and short distances for all villagers cannot be met.

232. In spite of efforts to change the traditional water utilization patterns, these still have not changed very much up to now. There is only a vague awareness that it is better to drink tubewell water than water from other sources (without a real understanding that there is a close connection between water and health).

233. The complicated relationships between safe water supply and the health status of the people, especially children are very complicated. It is recognized that close access to adequate quantities of safe water as provided through handpumps projects contributes to improved health in the communities.

234. As it is realized that supplying safe drinking water alone is not sufficient to have an effect on people's health, a substantial effort has been made by DPHE jointly with UNICEF to establish sanitation projects with latrine construction. There are also efforts to link basic health education and primary health care to the water programme, using the handpump installations as an entry point.

235. Severe financial constraints on the government side result in relatively low income levels for government staff, leaving many of the lower level posts vacant or forcing the already employed staff to look for additional income sources to the detriment of the programme.

236. The most serious problems threatening all progress in this work are the prevailing poverty and the overpopulation. As long as the annual growth rate is as high as 2.4 percent per year, all efforts to change the overall situation in rural Bangladesh will remain extremely difficult.

Recommendations

237. UNICEF together with DPHE should try to improve the maintenance standards and the spare parts supply in order to keep up the current coverage of about 200 persons per tubewell.

238. A higher priority should be given to the areas where lift pumps are needed (current coverage about 600 persons per deep tubewell). By the year 2000 the groundwater level risks to be lowered so far that in half of Bangladesh lift pumps will have to replace the present suction pumps.

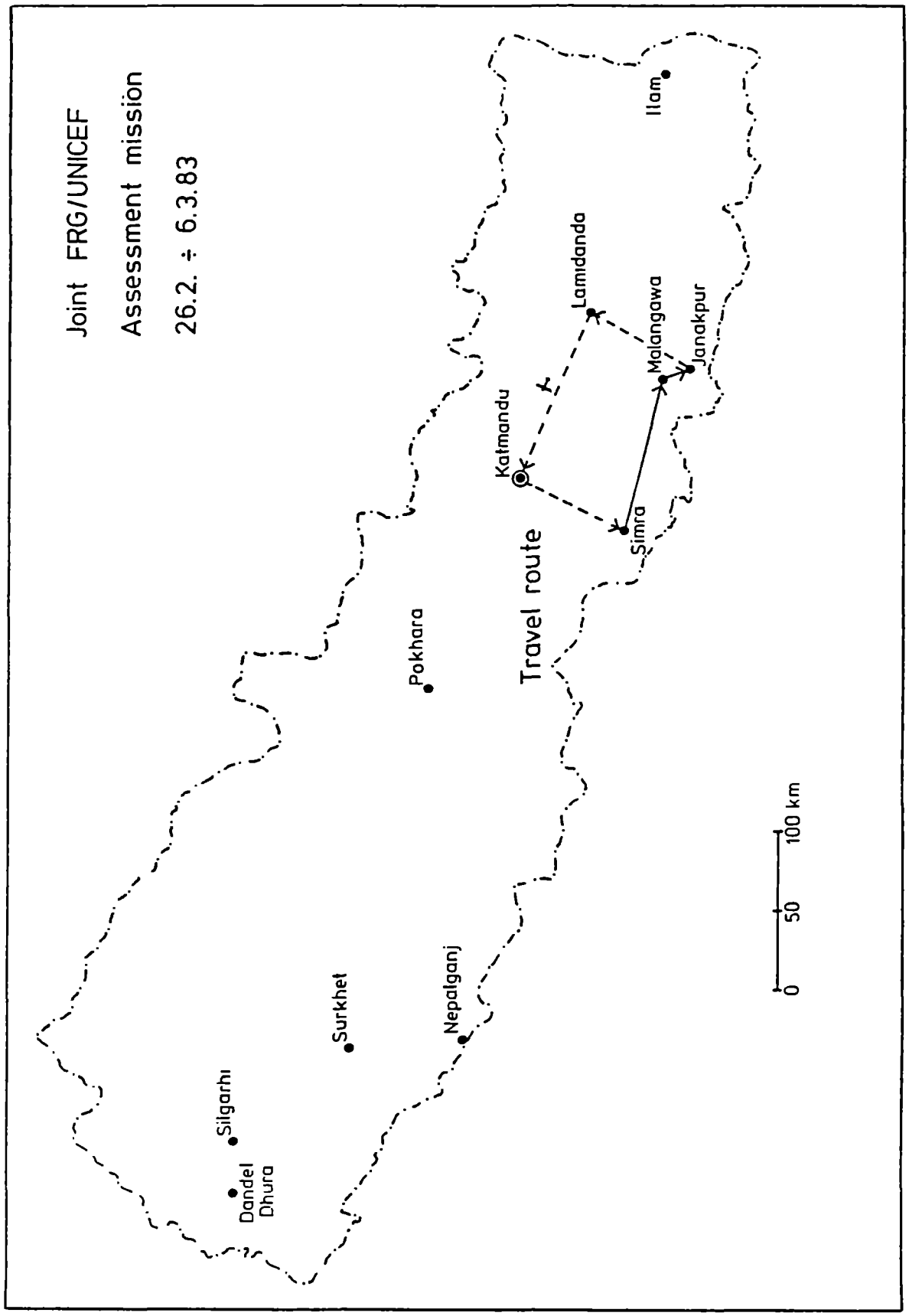
239. In order to keep maintenance costs low (programme costs to the government), spare parts should no longer be given out free. It is a general experience that if the users have to pay such costs, their awareness of the needs for the upkeep and maintenance of the water installations will be stimulated.

240. Lump sum payment by the users should be avoided, as this might result in worn out pumps or pumps that stay out of order for a long time. Instead, a fee system (water fees or general taxation) should be introduced to cover the costs.

241. Additional education efforts coming from the education or primary health care programme components with UNICEF support should help to improve the proper use of tubewell water and to change the traditional patterns of water use.

242. More caretaker courses should be held for women. Traditionally it is the women who provide the family with drinking water. As the maintenance procedures are very simple, women can easily be taught how to take care of the handpumps as their main water source.

243. The development of the TARA handpump into an even easier-to-use, cheaper and easier-to-maintain handpump, seems to be a promising approach to help alleviate the problems of water supply in Bangladesh. The experience should be publicised and the information should be given to all interested agencies dealing with tubewell installations.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3. NEPAL

3.1 Summary of Main Findings and Recommendations

244. All development efforts in Nepal, except in the Terai area, have to battle with the extremely unfavourable topography of the country, the heavy growing population pressure on limited land resources and the extreme poverty of the rural population.

245. In counteracting the serious consequences of the deforestation of Nepal, (including the disappearance of the springs that used to be the traditional water sources for the villages), UNICEF Nepal, together with His Majesty's Government and other organizations, has successfully helped to install gravity flow water supply systems for the last ten years all over the Hill and parts of the Mountain areas.

246. A key element of this programme, much more comprehensive and evident than in the two other countries visited, is community participation. There are no contractors or technicians from the Government who implement the water supply systems at the villages. Apart from technical advice and supervision by a handful of HMG and external specialists, it is the villagers themselves who do the actual work. It is they who contribute all labour forces required at the project sites. Community participation is essential also for the maintenance, because the lack of infrastructure makes it impossible for the technicians from the centres to reach far out communities for helping to repair the systems.

247. Altogether, this community participation works well, particularly during the implementation phase. There could sometimes be more involvement of the community in planning so that, later on, the community would be more motivated to take over the full responsibility for the operation and maintenance of the schemes.

248. A serious constraint is the absence of national technical specialist staff, which is not available or not prepared to work in remote rural areas far outside of the central cities and towns. The Government should do everything in its power to address this problem.

249. In the Terai, women are recruited and trained as technicians for the shallow tubewell and sanitation programmes. We were informed that they make good technicians. Their particular value is seen in their contribution to health education. Women in Nepal are less restricted socially and can communicate better with other women than any man would be able to do. The women also tend to be more sensitive to a balanced approach to basic social

services. For these reasons, UNICEF should continue and widen its support to the assignment and training of women in the fields of water supply and sanitation.

250. Water supply is well ahead of the other programmes of basic social services. Many people in rural areas have no access to medical services. Education, particularly literacy for adults (including avoidance of secondary illiteracy) and health education in remote villages is lagging. The lack of roads makes it near impossible to provide an effective cold chain for the immunization of children. For the same reason it is difficult to provide food subsidies when famine occurs, because farmers cannot fulfill even their own food requirements from their small pieces of land. UNICEF Nepal tries everything to encourage the construction and use of latrines, but the lack of awareness and materials, with the difficulties in transporting them, are serious hindrances.

251. Besides the support to programmes of basic social services, UNICEF Nepal also assists in projects for income-generation for the poorest rural segments of the communities, particularly the women. We found these activities very encouraging and necessary. This additional income, however modest, is yet another measure for improving their quality of life.

252. The organization and management of UNICEF Nepal seems to be efficient and well adapted to the complex needs of the programmes. We were impressed by the frequent and informal contacts and communication internally between the staff members, which allows for a full exchange of information and ideas. We could notice the same in the field between the UNICEF staff and the government officials, the local leaders, the craftsmen and other members of the community.

Findings (General

253. Since 1971 UNICEF is the leading external agency in the field of rural water supply in Nepal. About 300 gravity flow systems serving approximately. 300,000 people have been constructed up to 1983 at a cost of 6 million US$ with a per capita cost in the order of magnitude of US $ 20. In the Terai lowlands a tubewell and sanitation pilot programme started in 1981. UNICEF is working with the Rural Water Supply Programme under the responsibility of the Ministry of Panchayat and Local Development (MPLD).

254. During the last three years UNICEF in Nepal has analyzed its water supply and sanitation activities in order to improve technical procedures, supply, maintenance, sanitation and community participation. Out of the findings and recommendations, readjusted procedures have been formulated in three guidelines ("Standard Procedures for the Implementation of Rural Water Supply Projects", "A Policy for Sanitation" and "A Policy for Maintenance"; all by MPLD/UNICEF Kathmandu, 1982).

255. Programme progress shows various constraints. The Government structure is very centralized: the communities in the Hill regions have little opportunity to state their actual needs. Although the undertakings are stated in the project agreements, HMG is not providing the promised manpower assistance to the project, e.g. none of the government engineers' posts are filled. This limitation has had unforeseen benefits as the communities have increased their involvement in project activities.

256. The greatest single constraint to programme progress is identified as the lack of trained technical manpower at all levels. There is presently no full-time government engineer working in the programme. This lack of manpower coupled with the rapid expansion, the geographical spread and the inaccessibility of the project sites resulted in poor supervision and management in the field. In order to consolidate the programme, its spreading to other districts has been stopped for the time being.

257. A decentralization bill recently was passed by the National Panchayat to transfer much of the decision-making to the District Panchayats. UNICEF on its own side has also gone about decentralizing with the establishment of field offices (Lamidanda, Khotang and Ilam Bazar, Ilam) in order to improve project support and supervision.

Findings (Gravity flow systems)

258. The choice of technology for the programme is appropriate (gravity flow schemes in the Hills). The choices of materials and methods of procurement keep the cost for the projects as low as it possibly could be. There are standard designs for every component of the gravity flow schemes. Some modifications so as to make these designs more flexible to the locally differing conditions will be introduced. Due to poor supervision and the lack of skills, many of the older systems were poorly designed and constructed. This is hoped to be changed through the measures now taken. Altogether gravity flow schemes continue to constitute the best approach to bring safe drinking water to the Hill people.

Findings (Terai Tubewell and Sanitation Project)

259. When the tubewell and sanitation pilot project started, it had the advantage of benefiting from the experiences of the Bangladesh Handpump Programme. Through this, many mistakes in the early stages of the project could be avoided.

260. During the pilot phase nevertheless many problems on the level of administration and project organization had to be solved, as this programme was the first of its kind in Nepal.

261. For the installation of the tubewells, using the same sludger method as in Bangladesh, details, such as the slot sizes of the filter screens had to be adjusted to the existing conditions in the Terai.

262. Procurement of "New No. 6" handpumps from Bangladesh proved to be a problem of logistics. There are now efforts to produce handpumps locally since there are foundries for cast iron production in Nepal. Assistance from Bangladesh and UNIDO has been assured.

263. The demand for handpumps is high. Since the programme, however, is still in its pilot stage, the main goal to begin with, is rather to establish the necessary basis for the programme than to install as great a number of tubewells as possible.

264. The local production of latrine slabs (subsidised by UNICEF and sold at the District Selling Centres) seems to be a success since the demand is much higher than the production. (It could also mean that production lags for various reasons and cannot keep up with the demand.)

Recommendations

265. Support and encouragement to government agencies to develop and maintain their own national human resources for the project, especially on the engineering level, needs to be considerably strengtened.

266. The strategy adopted to raise the quality level of project implementation instead of raising the number of projects installed, should be kept up for the next few years.

267. After the recent review of the activities in water supply and sanitation, the subsequently formulated standard procedures should be implemented and this implementation should carefully be monitored in order to avoid repeating mistakes.

268. The variations of the standard designs for the gravity flow systems should be prepared as soon as possible to help the implementing field staff in applying optional technical solutions.

269. The training of the Water Supply Technicians, the overseers and volunteers should be improved. Special emphasis should be given to train the field staff in all matters dealing with community participation.

270. The adjustment of materials for the construction of the handpump tubewell seems to be necessary but it should be avoided to try to develop completely different, new constructions of handpumps. The material used in the pilot phase has been used for years in Bangladesh and to a certain extent proven to stand up to the problems to be solved. Since a great deal of handpump development goes on elsewhere in the world, including in nearby Bangladesh and India, possible definite finalized improvements in handpump design could later on always be introduced into any project.

3.2 Background Information and Determinants

3.2.1 Socio-economic Aspects

Ecological and Economic Background

271. Nepal, with its total surface of 140,797 square kilometres, has about 14.8 million inhabitants (1981 census). This makes for 105 persons per sq. km. Large parts of the country are covered with inaccessible mountains so that the areas, suitable for living, in reality have a far higher population density.

272. Thus about 598 people have to live on one sq. km. of arable land. The uneven distribution of the population leads to a density of 300-350 persons per arable sq. km. in the Terai region, while in the hills and mountains 1,053 persons have to live on each sq. km. of arable land (UNICEF Nepal Fact Sheet). In a country where 90% of the population rely on agriculture, this makes Nepal, together with Bangladesh, two of the most densely populated countries in the world.

273. Population growth is about 2.6%. Nepal belongs to the group of LDC and MSA.

274. The Himalaya mountain range comprises about one-quarter of the total surface. Here live only 5% to 7% of the total population. The "Hill" areas (middle mountain ranges), including the Kathmandu valley, which is regarded as the centre of the country, hold about 60% of the population, while the Terai region along the southern border covers about 20% of the total surface and accommodates 30% of the population. In this area, we find 70% of the total agricultural land of the country. There is a steady migration of small farmers from the Hills to the Terai region. The migration causes social frictions, particularly because of the pressure on the limited land resources.

275. In Nepal, more than 95% of the population are still living in rural areas, nearly all depending on agriculture. Ninety-three percent (93%) of the labour force is working in agriculture, only 2% in industry and 5% in government and community services.

276. The GNP per head in 1980 was US$ 140 . Fifty seven percent (57%) of it was produced by agriculture, 30% by services (mainly public), and only 13% by industrial activities (IDA, Washington, 1982).

277. In Nepal, 29.2% of the land is used agriculturally (1980) and provides employment and income for more than 90% of the population employed. Agriculture is not able to feed the nation, but it produces 80% of all exports. These are jute and jute products, wood, skins and rice.

278. More than half of the agricultural area is used for plough farming, which is intensive in most parts of the country. The average size of cultivated fields per rural household is less than 0.4 hectares. For reasons of tradition and religion, animal production is concentrated in the Hills. It is of minor economic importance.

279. Due to the population pressure, the forests of Nepal are diminishing rapidly and their disappearance is a serious threat to the very existence of the rural population. Wood is the only source of energy for nearly all rural households for heating, cooking, etc. Cow dung is used for manure rather than for kitchen fuel. In most areas of the Mountain and Hill areas, leaves of the tress are used as fodder for livestock because of the lack of pastures, which come second to cultivation. Forests have an essential function for retaining water in the ground. Their increasing disappearance is one major reason for the disappearance of many springs and the need for projects of gravity flow systems from other springs, which are often far from the villages, mainly found only in still untouched forest areas.

280. Besides the deforestation, the population pressure has led to severe man-made erosion. With the ensuing loss of top soils, the agricultural potential diminishes. The Himalaya mountain range is a comparatively young one. Through the constant plate tectonics movement of the Indian Ocean Plate northwards, the Himalayas - geologically speaking - are being rapidly raised over the lowlands. This results in as rapid an attack on the mountain ranges by the agents of erosion: sun, frost, glaciers, rains, streams, landslides, wind. Therefore, natural erosion has an even greater impact and is estimated to create about 60% of all erosion in Nepal.

281. Manufacturing mainly concentrates on agricultural products. There are few other resources and not much hope for the future in this field. This refers to mining as well, even though mineral exploration with external assistance still is going on.

282. However water is a viable resource for energy of Nepal, and it is said that Nepal's water resources can supply the whole Indian sub-continent with electrical energy. Two major hindrances hamper the implementation of such projects: sedimentation from soil erosion and earthquakes. Experts try to find means to overcome these.

283. Tourism is of some importance, contributing 2% of GNP, but earning 13% of all foreign exchange in 1979/80 (IMF, Nepal Recent Economic Developments, 1981).

284. "The obstacles arising from Nepal's topography for development of a transport and communication system are possibly unequalled in the world" (World Bank, Policies and Prospects, 1981). Construction of roads becomes extremely expensive in most parts of the country. Because any commodities are scarce in the Hills and Mountains, large amounts of goods are transported by human porters since there are too few donkeys, mules or horses. Besides this, Nepal is landlocked and nearly all imports and exports have to go through India, Nepal's major economic partner.

His Majesty's Government (HMG)

285. A Panchayat System recently was established to effect a more democratic mode of government. This system was confirmed by a national referendum in 1979.

286. The "Panchayats" are the traditional old village councils which are now the basis for an administrative system headed by His Majesty's Government (HMG). The Local or Village Panchayats consist of nine village wards, each Village Panchayat serving about 800 families. The District Panchayats consist of representatives from the village Panchayats. The village councils have a certain autonomy. They are supposed to motivate and stimulate the villagers. The Government thus has introduced a decentralized administration and through the Panchayats tries to overcome the old caste structure, which officially was abolished in 1963.

287. The Government services have grown considerably during the last years. There are more than 200,000 civil servants, which is about 50% of the total labour force of the country outside agriculture. The government with its 21 ministries still is highly centralized and 50% of all government employees are in Kathmandu. Contacts between the capital and the remote periphery is poor. Because of the bad infrastructure, government officials cannot travel as much as would be needed.

288. The efforts to develop Nepal started only during the 1950's. Before then, the country was strictly closed and had only minimal contact with the rest of the world. Therefore, the old traditional social structure still dominates and the wealthy members of the community are the opinion-makers and government leaders. This still does not leave much room for the participation of other groups. It also affects the rate of the development process.

289. One of the few things HMG under the circumstances can do for remote villagers is to supply them with safe water. Therefore, the present rural water supply programme with UNICEF assistance is much appreciated by the Government.

Demographic Problems

290. For centuries Nepal has been a melting pot of several major ethnic groups from the plains of India in the south and from the mountains and high plateaus of Tibet in the north. This can be seen in its ethnic diversification. About 25 different languages are spoken in the country, of which the most important are:

Nepali	spoken by	52.45% of the population
Maithali Dialects	" "	11.49% " " "
Bhojpuri	" "	6.94% " " "

Source: Author unknown (1977): The Analysis of the Population Statistics of Nepal

291. Hindus comprise 78% of the population. They form the political majority in the country with Hinduism as the predominant cultural element. This means that women can be seen in public and, that their concept of privacy may be somewhat different from that of women in a Muslim socity, e.g. Bangladesh. At the same time women still have significantly less rights than men and outside their households they are normally excluded from the decision-making process. (Acharya, M. et al. (1981): Rural Women of Nepal. Kathmandu)

292. Table III.1 gives a breakdown of UNICEF's target groups in Nepal.

Table III. 1
Child Population in Nepal 1981

0 - 14 years	comprise	44.4%	of	the	population	
0 - 4 "	"	17.16%	"	"	"	
5 - 9 "	"	14.61%	"	"	"	
10 - 14 "	"	12.65%	"	"	"	

Source: UNICEF-Nepal Fact Sheet (no year)

Education

293. The Rana regime, which ended its rule in Nepal in 1951, was opposed to universal schooling for children. After 1951, the enrollment expanded rapidly and today it is estimated that 85% of all children of the relevant age group go to primary school (IDA, Washington, 1982).

294. Yet the school attendance rate is said to be only 65%. The quality of primary education remains poor. Only one out of three teachers is fully trained. Girls do not get the same chances for education as boys. Only 30% of all pupils are girls.

295. The adult literacy rate is estimated to be one of the lowest in the world with 19%. In many of the remote Nepalese villages, the problem of secondary illiteracy is serious. These villages, cut off from the world, in the mountains, apart from textbooks for the schools, have nothing else to read and often no need to write. Their only communication channel is by way of radio. Activities of non-formal education try to overcome these constraints of development - unfortunately on a rather limited scale.

3.2.2 Health, Nutrition and Hygiene

296. The centuries of isolation and the physical inaccessibility to most of the villages in Nepal are responsible for some of the worst health conditions of the world. Infant mortality is estimated to amount to 152 of 1000 live births. Of 1000 children between 0 and 1 years of age, 23 die of diseases, malnutrition and other health problems (Nepal Fertility Survey 1976).

297. Life expectancy of the Nepalis is estimated to be only 47.5 years for males and 44.5 years for females. "The higher life expectancy for males rather than females can partly be attributed to the fact that in most rural areas, women are exposed to unusually high risks during pregnancy and delivery" (UNICEF Nepal: Fact Sheet).

298. Amongst the population, the under-fives suffer from gastro-intestinal infections, tuberculosis, measles, whooping cough, tetanus and other infectious diseases, just to mention the most important ones.

299. Because of the lack of iodine in the soil, endemic goitre and cretinism are widespread in Nepal. A survey in 1976 found that 55% of the population suffer from goitre and 5.1% from cretinism.

300. The low consumption of green leafy vegetables and the widespread hookworm infections are responsible for the fact that every fifth child under five suffers from anaemia. The deficiency of vitamin A in most regions of the country causes partial or complete blindness in many children.

301. Health statistics for Nepal further indicate that in 1977 one physician on the average had to serve 35,900 people with one nurse for 30,510 people (IDA, Washington, 1982). There is one hospital bed for 6,294 persons (World Bank, Nepal Policies and Prospects, 1981). A family planning programme has not yet shown significant results.

Table III.2
Medical Services in Nepal 1980

Services	Number
Hospitals	68
District Health Officers	48
Rural Health Posts	593
Physicians (150 of them are in Kathmandu)	450
Nurses	460
Village health workers	1,500

Source: UNICEF Nepal, Fact Sheet

302. Of all children between the ages of 6 months to 6 years, 75% suffer from moderate to severe degrees of malnutrition. Especially in remote areas of the west, periodical famines occur and airborne food supply becomes necessary.

303. It is estimated that the calorie supply in percent of the total requirement was only 89% in 1977. Children do not get enough protein after weaning. The severe lack of iron, iodine and vitamins has been mentioned already.

304. With deforestation and increasing population pressure, the access to water decreases for the rural population. Traditionally, the Nepalese used to build their villages high up on the ridges of the hills and mountains, mainly because of malaria in the valleys. Some decades ago, there were enough forests and through this enough springs to supply the rural population. Today the rainwater catchment and storing capacity of the forest vegetation in the hills and mountains has become more and more limited. Frequently women have to walk for hours downhill to lower located water points and have to carry the heavy buckets back to their homes, trudging uphill with height differences of hundreds of metres and 10 to 20 litres/kilograms of water or even more on their backs.

305. With these conditions, water has become scarce in most rural areas of Nepal. Consequently personal hygiene is decreasing. The villagers, who have to work hard just for obtaining enough drinking water, do not wash themselves nor do they wash their clothes and other utensils of their households. It is estimated that today only 10% of the rural population have reasonable access to safe drinking water.

306. Hygienic standards in rural Nepal are inadequate also because the population does not use proper latrines but mainly defecate in the open environment. Particularly in areas where the population density is high, the transmission of diseases by the fecal-oral route is evident.

3.2.3 Technical Aspects

Climate and Hydrology

307. The Terai region is a small fringe of the Northern Indian Plain and has a sub-tropical climate in the monsoon zone with an annual precipitation of up to 3,000 mm. There is easy access to groundwater as a source for safe drinking water with the water table only a few meters below the surface. The soils consist of fine sands or silts, sometimes intercalated with thin layers of coarser sediments. North of this narrow portion of the plain are the 9oothills of the Himalaya Range (Hill Region) with heights between 2,000 and 4,000 m. There is less precipitation in the foothills with the annual amount decreasing towards the west. Erosion caused by heavy deforestation is a serious problem in the foothills. The soil is washed downhill with frequent landslides scarring the hillsides. No more water is stored in the ground and springs as the traditional water sources dry up. The annual flood peaks are higher and bring coarser and larger quantities of sediments downstream as compared to former times.

Project History (Gravity Flow Systems)

308. In 1971 UNICEF began assisting in the installation of the gravity flow systems in the hilly areas of Nepal, with the work based on the experiences of SATA and other external agencies. Since then UNICEF has become the largest single donor in this field in Nepal. The main objectives of this activity are to reduce the amount of time spent by children and women for carrying water and to give the villagers access to safe drinking water sources.

Water Sources (Gravity Flow Systems)

309. In the Hills, water is traditionally drawn from unprotected springs and streams. Usually it is possible to find adequate sources above the villages to be served, enabling gravity-fed piped water systems (gravity flow systems) to be constructed. If the water source is well-protected, there is usually no need for water treatment.

Project history (Tubewell and Sanitation Programme)

310. In 1981 UNICEF started the Terai rural water supply and sanitation project with an initial two year pilot phase. In 1983 an extension of the pilot phase was agreed upon. The main objective of this activity is to establish the technical and administrative basis for a large-scale programme covering the whole Terai region by 1990 (with a ratio of 200 persons per tubewell).

Water Sources (Tubewell and Sanitation Programme)

311. In the Terai, household water is so far generally drawn from open ponds or unprotected wells (dug wells) which are polluted and constitute a major health hazard. As the groundwater table generally is high, suction handpumps can be installed in most areas. If the surrounding platform of the tubewell is properly constructed and the waste water properly drained off, this water source generally can be considered as safe.

3.3 Project Description

312. The daily burden of fetching water is often the most time-consuming domestic chore performed by mothers and children. Water is usually drawn from polluted springs, streams, and wells. With rapid environmental degradation, traditional perennial sources are drying up, and people have to walk farther for water.

313. The Government has adopted the target of supplying an additional 10.1 million people with clean water and extending sanitation facilities to 2.1 million people earlier planned to be supplied by 1990. UNICEF supports water supply activities in the hill areas and in the Terai, and assists in launching a major sanitation campaign. This programme is entirely dependent upon community participation. It responds only to requests coming from the communities themselves, and provides only necessary external assistance to enable them to construct their own systems.

314. The Government has requested UNICEF assistance to construct an additional 395 gravity-flow water systems to serve 400,000 people in the hills. The implementing ministry is responsible for the survey, design, and construction of these systems, assisted by UNICEF project engineers. The present level of manpower trained with UNICEF support is being expanded to 200 field technicians and 40 overseers. Emphasis is laid on the introduction of

maintenance systems and on sanitation in which support is given to the construction of 500 latrines in 300 schools and health posts. In response to requests from villagers, the construction of household latrines made of local materials is supported by the technicians.

315. The Government has requested UNICEF assistance for the installation of 3,700 handpump shallow tubewells for 740,000 rural people in the Terai. One objective of the programme is to develop the local manufacture of a suitable handpump. UNICEF has posted one project engineer to support the early stages of the programme, which initially is limited to four districts. Four engineers, six overseers and 48 field technicians are being trained with UNICEF support. A caretaker, who will receive maintenance and follow-up training, is nominated by the community for each pump. A sanitation education campaign is launched in each community which receives handpumps, and householders will be able to buy UNICEF-subsidised latrine concrete rings and slabs.

316. UNICEF also assists in the development of low-cost sanitation programmes in semi-urban communities.

317. UNICEF works in close collaboration with WHO, the Technical Advisory Group of the World Bank, and bilateral agencies supporting rural development projects.

3.4 Programme/Project Objectives

3.4.1 Socio-economic Aspects

318. The objectives for the water supply and sanitation programmes in Nepal are well in accordance with UNICEF policies: In the second chapter under 3.1 b) the Plan of Operations states that for 1982 - 1986 one of the objectives is:

> "to reduce the burden of water collection on mothers and children by providing a water supply within a reasonable distance from the home."

319. While in most projects the hope to fight successfully against diseases by far is the most important motivation underlying water supply and sanitation activities, in the case of the Hill and Mountain areas of Nepal, the objective to save time and energy for mothers and girls becomes more emphasized. The rapid disappearance of springs and other sources of water in the vicinity of the villages is evident under the present state of ecological catastrophe.

320. There is no detailed study available about the amount of time and energy saved for women by the provision of standposts in their villages, but from what we saw and heard, with the distances and altitudes which water carriers in the hills and mountains of Nepal have to overcome, the UNICEF input fully corresponds to these objectives.

321. In the Terai region the time- and energy-saving aspect is not ascribed the same importance. Open dug wells, handpumps, river ponds and other sources are seen in or nearby many villages. Here it is the quality of the traditional water sources that is unsatisfactory.

322. The second socio-economic objective of rural water supply in Nepal is its value as "entry point" to other activities. In the religion, history and life of the Nepalese, water is one of the most important assets of society. Projects which provide water can be sure to gain full interest and participation of the government, as well as from the population.

323. This objective is not mentioned in the plan of operation, but it is viewed as an important effect of water supply. UNICEF Nepal tries particularly to use it as an entry point to launch a country-wide sanitation programme co-ordinated with the water supply.

324. "Government policy is to involve as much community participation as possible in all rural development activities" (Plan of Operations 1982-82). In the Hills, local participation means labour. The villagers do all the construction work under the supervision of a technician. In the Terai area, monetary contributions, comparable to those in Bangladesh are requested from the villagers.

3.4.2 Health, Nutrition and Hygiene

325. Together with the time- and energy-saving objective, the "improvement of health of children and mothers by reducing the prevalence of diseases related to poor water supply " is one of the two overall objectives stated in the Plan of Operations.

326. UNICEF Nepal is particularly aware that the health status of the rural population can be raised only by an integrated approach. This came out very clearly in a "Study on Water Supply and Sanitation as Components of Primary Health Care in Nepal" produced for the UNICEF/WHO Joint Committee on Health Policy in 1978 by NEW ERA, a consulting firm in Kathmandu. In the report it is clearly stated that "water supply should not be carried out in isolation from other development programmes".

327. Paragraph 2.9 of the Plan of Operations discusses in detail the linkages of water supply with other UNICEF-assisted programmes, mentioning the fields of nutrition, health education and income-generation through e.g. family food production (vegetable gardens and orchards). With the field of income-generation, UNICEF Nepal goes beyond the basic services approach into productive activities. UNICEF Nepal sees this as an express need of the mothers and as an even better entry point than water supply.

3.4.3 Technical Aspects

Gravity Flow Systems

328. The gravity flow programme is over ten years old. Apart from the overall objectives, its implementation follows a number of specific aims, namely to:

- improve the quality of the construction and the supervision of the projects;
- improve the system for transport of materials;
- improve the spare parts supply and store-keeping systems and to change to a more decentralized way of operation;
- improve the level of skills of the project personnel and introduce a more uniform standard of project implementation;
- improve the quality of the preliminary surveys (only using experienced staff) in order to avoid unnecessary planning mistakes and to include approaches in the planning process to provide for future community participation;
- improve and standardize the whole area of financing and accounting (e.g. assure regular pay especially of field staff);
- emphasize the sanitation component of the programme. Thus every water and sanitation technician has to build his or her own latrine at the place where he or she is living or working.

Terai Tubewell and Sanitation Project

329. This is still a pilot project. The main objectives according to the project agreement between HMG and UNICEF are to:

- develop and establish the technical knowledge and procedures to sink shallow tubewells (sludger or tennis ball method);
- evaluate the best pipes, well screens and handpumps and select the most appropriate types for the existing conditions;
- develop and establish the capacity of local foundries to produce a cast iron handpump in Nepal;

- develop a system of regular maintenance and spare parts distribution;

- develop and establish the technical knowledge and procedures for construction of latrines at schools and health posts and for the promotion of subsidised household latrines;

- develop and establish management procedures, an institutional infrastructure, and a trained human resources base to spread the programme gradually on a district by district basis;

- develop and establish appropriate procedures for involving the community before, during, and after construction of the tubewell, with special emphasis on maintenance and sanitation.

3.5 Analysis of Planning and Preparation

3.5.1 Socio-Economic Aspects and Health, Nutrition and Hygienc

330. The villagers are involved in the planning process. In the "Standard Procedures for the Implementation of Rural Water Supply Projects" it is said that the "Village Panchayat should first recognize their need for a drinking water system. The request must first be approved by the Village Assembly and the request should then be made in writing to the District Panchayat Office".

> "When the Village Preparation/Feasibility survey takes place,
> The villagers should explain and discuss their water problem.
> The villagers should suggest solutions.
> The villagers and the survey team should identify and analyse
> all possible sources and discuss typical problems (water rights,
> water quality, inadequate flow, etc.).
> The villagers should form an informal survey group."

331. There are good experiences with people's participation during the planning, and it is felt that this is an important condition for the community to assume full responsibility for the water supply system during the operation.

332. Since the water supply and sanitation programme in Nepal was initiated, various studies of the socio-economic conditions of children and mothers in Nepal have been carried out. The outcome of these studies has resulted in relevant adjustments of the water supply programme, as well as of the simultaneous activities of UNICEF Nepal to help provide for a comprehensive social services approach.

333. Another report of NEW ERA, called "Children of Nepal. A Situation Analysis" (Kathmandu, 1981), was used as the general basis for the preparation of the country programmme for 1982-1986 by UNICEF Nepal. The Centre for Economic Development and Administration, Kathmandu, provided an extensive study on "Rural Women of Nepal" (1981), which had a signficiant impact on UNICEF's planning.

334. The pilot project for the installation of handpumps in the Terai is accompanied by socio-economic studies of the population. The water supply and sanitation technicians are assigned to do surveys in the villages, which have asked for water supply, in order to get more data on the target groups.

335. The above are only three examples of the many studies and other data which enter into the continuous process of planning water supply for rural areas in Nepal.

336. In October 1982 a National Conference on Water Supply and Sanitation was held in Kathmandu, during which all parties involved discussed the formation of national policies and set new standards for planning and operation. During this conference, guidelines for people's participation were confirmed.

337. The programme planners are still pre-occupied with the socio-economic problems of the gravity flow systems: The question of organizing people's participation does not yet seem to be optimally solved. A specific design problem in this context is that of a fail-safe waste-not water tap which would satisfy about 15 different socio-economic demands in one small device. Such a miracle item would be required to:

- close a system, which users feel should be permanently open;
- give just the amount of water which different users need but not more;
- be ergonometrically adapted to all users;
- act as semi-automatic washing machine;
- be used as a shower-head;
- allow children to use it;
- function occasionally as a toy;
- remain functioning at least until the end of the Water Decade, etc.

338. In the Terai, the handpump scheme still is in its pilot stage and the planners lay particular emphasis on socio-economic problems. They engaged and train female technicians and by doing so intend to upgrade the role of females among the users. Much can in this respect be learned from the experiences in Bangladesh.

339. The plans call for the co-ordination of as many projects for basic social services at the same time as possible in the same communities. Thus, schools and other common institutions in the villages are provided with materials for health education. While water supply is being installed in a village, latrines are constructed at health posts and schools.

3.5.2 Technical Aspects

Gravity Flow Systems

340. All procedures dealing with the planning and preparation have been developed during the past twelve years of programme implementation. The current situation is much better compared to that at the beginning of the programme. The ongoing efforts towards administrative decentralization make it possible to better supervise and guide the projects.

341. The procedures to select villages for the construction of gravity schemes are as follows:

- each community requesting a water system has to fill in an application form for the District Panchayat;
- the District Panchayat with the assistance of the Local Development Officer, assesses the relative priority of each request and submits a list of villages to the regional office of MPLD;
- MPLD and UNICEF engineers will conduct feasibility and detailed surveys of these villages to select the system to be constructed;
- systems selected must have the joint approval of the regional officer and the UNICEF or SATA engineer at the MPLD Regional Office.

342. The detailed survey determines the principal structure of the supply system. The overall annual planning, establishing the number of systems to be constructed, is carried out by MPLD and UNICEF and depends on the funds and manpower available.

343. Once a scheme has been approved, MPLD has to arrange and pay for the delivery of materials and the assignment of Water and Sanitation Technicians (WST) to the site.

344. For each component of the gravity flow systems there are standard designs available. It is recognized that due to the varying conditions at the different sites, more than one design should be developed in order to make the systems more flexible and to avoid any ad hoc innovations or modifications

that would not be functional. The standard design of the main system components is given in Annex 11. As a further guideline, a "Handbook On Gravity Flow Systems" has been published by UNICEF Kathmandu Office (1980).

Terai Tubewell and Sanitation Programme

345. Before the implementation of this programme, a thorough analysis was made of the situation. (Experts such as Mr. M.E. Hussein from DPHE, Bangladesh, were invited to Nepal to assist in the preparation of the programme.) All procedures dealing with the planning and preparation of this programme are now well established. Currently the extended pilot project phase is underway with many of the procedures for implementation still subject to change, following the actual day-to-day experiences.

Tubewells

346. Village Panchayats requesting tubewells have to complete an Application Form. The District Panchayat, with the assistance of the Local Development Officer, assesses the relative priority of each request and submits a list of requests to the District Office of the implementing agency. Project staff prepare the final list of communities to be served, based on the needs, technical feasibility and expected efficiency. The target is to serve 200 people per tubewell. For the pilot project, 1600 "New No. 6" suction handpumps from Bangladesh have been imported. The first recent experiences during the pilot project implementation show that there is a need to investigate the performance of the different categories of equipment which could reduce cost and lead to more efficient implementation (well screens, other types of handpumps).

347. In order to avoid the problems with imports, manufacturing of the handpumps in local foundries is planned. UNICEF will provide coke, pig iron and ferrosilicon. Experts from UNIDO and Crown Agents will assist in training the foundry technicians and help to set up the workshops. Mold patterns are now being made in Bangladesh. A drawing of the "New No. 6" Handpump is shown in Annex 5.

Latrine Construction

348. The programme aims at generating an awareness within the rural population that combining the use of latrines (with the use of safe water from the tubewells) brings better health to their families. In order to create this awareness, in every village, where a tubewell is installed, a latrine has to be constructed so as to serve as a model.

349. Interested villagers are given information and assistance by the field staff when constructing their own latrine. The basic elements (except for the superstructure, see Annex 7) are sold at the District Selling Centre at a subsidized price of 40 Nepali Rupees (about US$ 2). This system of Selling Centres is still under organization. The demand for latrine elements (slabs, etc.) for construction by the users themselves, already at this early stage has shown to be high, once the concept is introduced to an area.

UNICEF Material Assistance

350. A list of materials contributed by UNICEF in Nepal is added as Annex 9.

3.6 Project Implementation (Installation)

3.6.1 Socio-economic Aspects and Health, Nutrition, and Hygiene

351. The implementation of water supply projects in Nepal faces three major problems:

- complexities of people's participation;
- lack of national administrative and technical staff;
- almost total absence of infrastructure in most Hill areas.

352. For the implementation of gravity flow systems, community participation is of crucial importance because it is the community which does all the physical work. This is a much more intensive engagement on the side of the villagers than it is in the Terai, in Bangladesh or in Burma. It requires not only many hours of labour, but also a good organization in a co-operative spirit for this major task for the common good.

353. Long before HMG and UNICEF embarked on the programme for water supply in the Hill area of Nepal, nearly 2,000 villages had organized themselves to get water from distant sources through community-built schemes. They cased in springs and dug channels often for many kilometres from the springs to their villages. In some villages, examples of spontaneous self-help can be found and people know how to organize themselves.

354. Secondly, the demand for water supply is high. It seems to be one of the priority needs on the list of priorities, preceding roads and schools.

355. Thirdly, before a project is implemented, there must be a written request and a local water committee must be formed and must promise to contribute to the implementation, operation and maintenance of the schemes.

356. With all water supply projects, the villagers' contribution is a condition sine qua non. Their contribution is between 5% and 20% of the total expenditure for gravity flow systems. They have to dig the trenches for the pipes from the spring to each tap in the villages. They have to construct the standpost and they have to provide the unskilled labour for the technical installation of the systems. In general, community participation in Nepal shows a good record.

357. Sometimes, nevertheless, problems arise and delay the implementation or make it difficult:

- In spite of the many positive aspects mentioned above, in many cases the community holds the opinion that the water supply project is not theirs but something which comes from the outside (notably from the Government and UNICEF). This easily leads to too passive a community attitude to the project.

- The village Panchayats and under them the local Water Committees, sometimes have difficulties in organizing themselves and the households which have to contribute their share to the implementation. The performance of the Water Committees quite often depends on the personality of its leaders and on the social structure of the villages (sometimes compounded by caste problems).

- Sometimes people lose interest in properly concluding the work, when the water supply begins to serve the village, but while the construction is not yet completed. Therefore, technicians now ask the villagers to dig trenches from the village up towards the spring instead of the other way around.

- Water supply projects have become political projects because of the tremendous interest the rural population shows in them. This often results in promises from the politicians to provide water to villages, without asking for sufficient community participation. When the government and politicians offer services without asking for contributions, the communities react quickly and positively, but later find themselves in difficulties with the implementation.

- Villagers in the Hill areas of Nepal are quite often overworked rather than being underemployed. They have to save energy to make their immediate living. It was found, for example, that rural women on the average work 11 hours a day with the men working 8 hours a day. Therefore, there is hardly any time left for additional tasks.

- Secondly, local contributions are asked not only for projects of water supply. Villagers can be offered schools and health posts, agricultural support, roads, etc., with all projects requiring community participation. Particularly during the peak agricultural seasons, there is just not enough time to contribute extra labour in addition to the strenuous farm work.

- Statistics on the income situation and the cash availability of villagers in the Hill areas show that it is nearly impossible to ask for cash contributions.

- Technicians who have to manage and organize the implementation of the project need to be qualified not only in their technical fields, but also to be familiar with the aspects of human and social factors. Technical project staff without this particular experience quite often were the reason why community participation was not organized adequately in many places (Glennie, C., 1980).

3.6.2 Technical Aspects

358. The selection and construction procedures are described in the Plan of Operations (chapters 2.4 - for the gravity flow schemes - and 2.5 - for the Terai region).

Gravity Flow Systems

359. MPLD arranges and pays for the delivery of materials and the assignment of a Water Supply Technician (WST) to the site. The community provides the unskilled labour. This participation of the village in the implementation needs careful attention. A great deal of information has to be given to the villagers before, during and after the construction of the system to keep them motivated. If these motivation and information efforts can be kept up during the whole course of the implementation, the villagers will better understand the need for their own input . This is indispensable for the implementation and, further on, for the proper use and upkeep of the system by the community. The construction itself is managed by a Village Construction Committee with the assistance of the WST. The WST's are supported and supervised during regular visits by an overseer and the engineer. When surveying the construction site (only by experienced engineers), special attention should be given to the following problem areas:

- Is there a genuinely felt need for water or is this a prestige project for a few community leaders?

- Is the selection of the source appropriate (sufficient enough yield and no households deprived of irrigation or drinking water)?

- Is the distribution of the taps equally spread within the village to be served?

- Is the project feasible under the prevailing economic conditions?

- Will the system be operating as a pressure system with a proper hydraulic design?

360. The selection of the source is very important as the system otherwise may dry up during dry seasons. A careful analysis of the spring yield is necessary. The water rights have to be defined in advance, at best in a public meeting. Depriving people from their traditional water source can cause serious feelings about the system within the community. Sometimes two or three sources should be surveyed and, if necessary, be combined for one system.

361. Very important for the quality of the water supplied, is the protection of the intake. Often the intakes are near some footpath or nearby cattle-grazing area. Such sources can become polluted either through direct access by humans or animals or indirectly by polluted surface water. The protection of a spring is not always easy to keep up but it is essential for the quality of the water for keeping the pollution risks as low as possible. The reservoir tanks needed for the system, in the earlier stages of the programme suffered from a lack of standardization and from misdirected savings of cement. Many of these tanks were leaking and not properly roofed. This was improved by the introduction of a standard design. (See Annex 11 for details of the gravity system standard designs). The HDP pipes as the main means of conveying the water, with GI pipes in exposed places, need to be adequately covered. Where they are exposed, they are often slashed, either by curiosity or because the pipe is seen as a convenient water source for nearby households or roaming herds of livestock.

362. It is necessary to dig the trenches to a depth of at least 30 cm and have them properly back-filled in order to avoid the creating of gullies in the monsoon period, with the ensuring erosion and exposure of the pipes. For reducing the pressure in the systems, break pressure tanks (BPT) are constructed. Sometimes systems are working with low or no pressure (free surface flow), which makes BPT's unnecessary. A good survey and proper skills of the field staff help to avoid unnecessary additions to the construction in such cases. The standposts and the taps are subject to considerable wear and tear. The standposts should be constructed as solidly as possible. The taps can only be saved from breakage through thorough instruction of the users. Even very expensive heavy duty "waste-not" taps will be broken sooner or later, if there is no understanding for the need of handling them with tender care.

363. During our field visit to the Lamidanda area, we noted that:

- there are visible efforts to protect the water sources, the intake sites being fenced with barbed wire;
- the trenches are generally sufficiently deep, where the soil is easy to remove;
- the exposed parts of the main line, e.g. over rocky terrain or across major gullies, are constructed with G.I. pipe and wrapped with barbed wire;

- the water tanks are of solid construction, although some seepage could be observed in single location;

- the break pressure tanks are at correct locations in the system;

- there are wash-out valves in the system;

- the standposts are solidly built;

- the taps were functioning (although the waste-not taps seem to be regarded as unnecessary fixtures by the villagers and therefore held open with jammed-in sticks or ropes).

Terai Tubewell and Sanitation Programme

Tubewells

364. The tubewell-implementing agency employs local contractors to sink the wells, install the pipes and pumps and construct the well aprons. Standard contract forms for private contractors for the well-sinking are now developed. The contractor has to keep a record of the sinking procedure (see Annex 10). Project staff visit at least 50% of the sites during the sinking of the wells, inspect all completed wells and keep records (Inspection Form).

365. During our field visit we saw well-sinking with the sludger method at one or two sites. The water quality is tested with easy-to-use HACH testing kits for iron content. There were lively discussions at one of the well drilling sites about the depth of the well.

366. People knew from experience or assumed that better quality groundwater was available at greater depths (about 30 to 40 m instead of 15 to 20 m). The water raised from lower levels is supposed to have a lower iron content. Water with a higher iron content than 2 or 3 mg/l generally is disliked because of its taste. Especially the women do not like the iron-rich water, since it makes their hair look dull after washing.

367. During the field trip we made some observations:

- due to the geological conditions of the Terai, water-bearing layers of a sufficient thickness for the filter screens cannot always be found (for reasons of the thinning out of the alluvials towards the foothills in the north of the Terai);

- the drilling pipe is too often lost, getting stuck in the ground during the sinking of the wells;

- the well logs and tubewell diagrams are being used, although we could not check if this was done correctly;

- the tubewells installed have a good concrete platform but the drainage of the waste (excess) waters could be improved for avoiding muddying up the well site;

- the handpumps were generally in good condition and seemed to be used frequently.

368. The costs for one tubewell amount to about US$ 180 (handpump, well construction materials, platform, sinking and all labour costs. No costs for programme overhead are included).

Latrine Construction

369. In Annex 7 the type of latrine constructed with the subsidised basic elements, sold by the District Selling Centres, is shown. All villages served with a tubewell are subjected to intensive sanitation promotion and education campaigns in order to persuade the villagers to build and use household latrines. As soil stability in the Terai is relatively low, the pit latrines need a lining. Bamboo lining is often used instead of the expensive concrete rings as supplied by UNICEF. Each implementation agency has or will set up centres at district level for the production of concrete rings and squatting slabs (subsidized by UNICEF with up to 20 US$ per latrine). The costs for each construction set with bamboo lining is little more than 8 US$ (without the fly trap screen). UNICEF's subsidy in this case is US $ 5.40.

3.7 Operation and Maintenance (Functioning and Utilization)

3.7.1 Socio-economic Aspects of Utilization

370. Water collection and transport in Nepal almost exclusively is the task of women and girls. They carry water in buckets or pots of 10-20 litres or more. Women normally go several times a day, or at least twice (mornings and evenings) to collect water. They use the visits at the water points also to wash themselves and sometimes to wash clothes and for social interaction. The water carried home by the women is almost entirely used for drinking and cooking. Men go much more seldom to the standposts to wash themselves.

371. Users sometimes complain about the design of the standposts. They are installed as closed systems. Users try to keep the water from the standposts constantly running because they are used to open wells and springs. Quite often taps are damaged in this way. Presently UNICEF's technicians try to find better technical solutions. The standposts are not designed for people to take showers and sometimes there is not enough space for washing clothes (see 3.7.1).

372. The standposts of the villages seem to be a social meeting point, where women during mornings and evenings, use the opportunity for meeting each other and to exchange information and socialize. Especially after the heat of the day, the access to water is enjoyed and contributes to their sense of well-being.

373. It is reported that social problems (mainly caste problems) can crop up at the standposts. Users of low social status often are refused to take water from the same taps which are used by villagers of higher status.

374. There are no comprehensive studies on how much time and energy is saved through the systems which have been installed up to now. This is difficult to measure but it is evident that women benefit a great deal from having the standposts right in their villages instead of having to resort to springs and other water points, which are polluted and far off from their homes.

375. Problems of maintenance and operation, seen to be major ones in Nepal as elsewhere, where water supply is installed for the population with external aid . Fortunately, the gravity flow systems in Nepal do not need as much maintenance as a handpump installation, but if a breakdown occurs, even in a handpump scheme, the community by itself is not able to provide the adequate repairs, and technicians from the government are often too distantly located to be available to help.

3.7.2 Aspects of Health, Nutrition and Hygiene Related to Water Use

376. When a woman fetches water in a 20-litre bucket or pot for her household twice a day (with an average number of five persons per household), each household member gets 8 litres of water a day. In addition to this, an unknown, but probably even greater amount of water, is used by the women at the standposts when they collect water for their personal washing and for their laundering. Nevertheless, the total amount of water consumed per head does not meet the ideal minimum requirements of 40 litres per head per day.

377. The average distance between the water taps and the households probably still by far exceeds 100 metres so that water becomes of precious value when it has arrived at the house. With the present system, water is stored in the homes, in open buckets and pots and is therefore still in danger to become polluted.

378. For these reasons, there is no guarantee that the users really get safe water when they use it nor that they get enough to clean their dishes and to keep up proper food and personal hygiene. Secondly, there is not enough water used for washing and cooking and certain risks for health and hygiene still remain when the facilities are in full use.

379. Both for these and for other reasons, it seems to be necessary that complementary measures such as health education, sanitation and primary health care are regarded as essential and would be added to each water supply project in order to ensure positive impact on health, nutrition and hygiene. Planned co-ordination between the individual projects (for example, while installing water supply to carry out health education and latrine construction at the same time) so far, due to various constraints still is not as universally applied as would seem desirable.

3.7.3 Technical Aspects

Gravity Flow Systems

380. The operation and maintenance procedures are spelled out in the Plan of Operations.

381. As the maintenance and operation of the systems introduced at an early stage of the programme did not function as planned, revised guidelines were set up. They are now being introduced but it will take another two or three years to come into full effect.

382. During our visit in Lamidanda, we were told that the standposts, being heavily used, have frequent breakdowns. The villagers do not like the taps installed, because they either do not give enough water or they are uncomfortable to handle (water saving taps closing automatically when not held open, e.g. Jason taps, manufactured in India. Brass taps are too weak and break after a few months of operation. Talbot water-saving valves from the UK are solid, but very expensive approximately. US$ 24 a piece).

383. Generally there is relatively little maintenance required to operate the gravity systems. The drainage valves have to be opened from time to time. The water tanks should be cleaned at regular intervals and the intakes rinsed of leaves or other extraneous matter. The tapstands should be checked for leakages or damage to the concrete platforms.

Terai Tubewell and Sanitation Programme

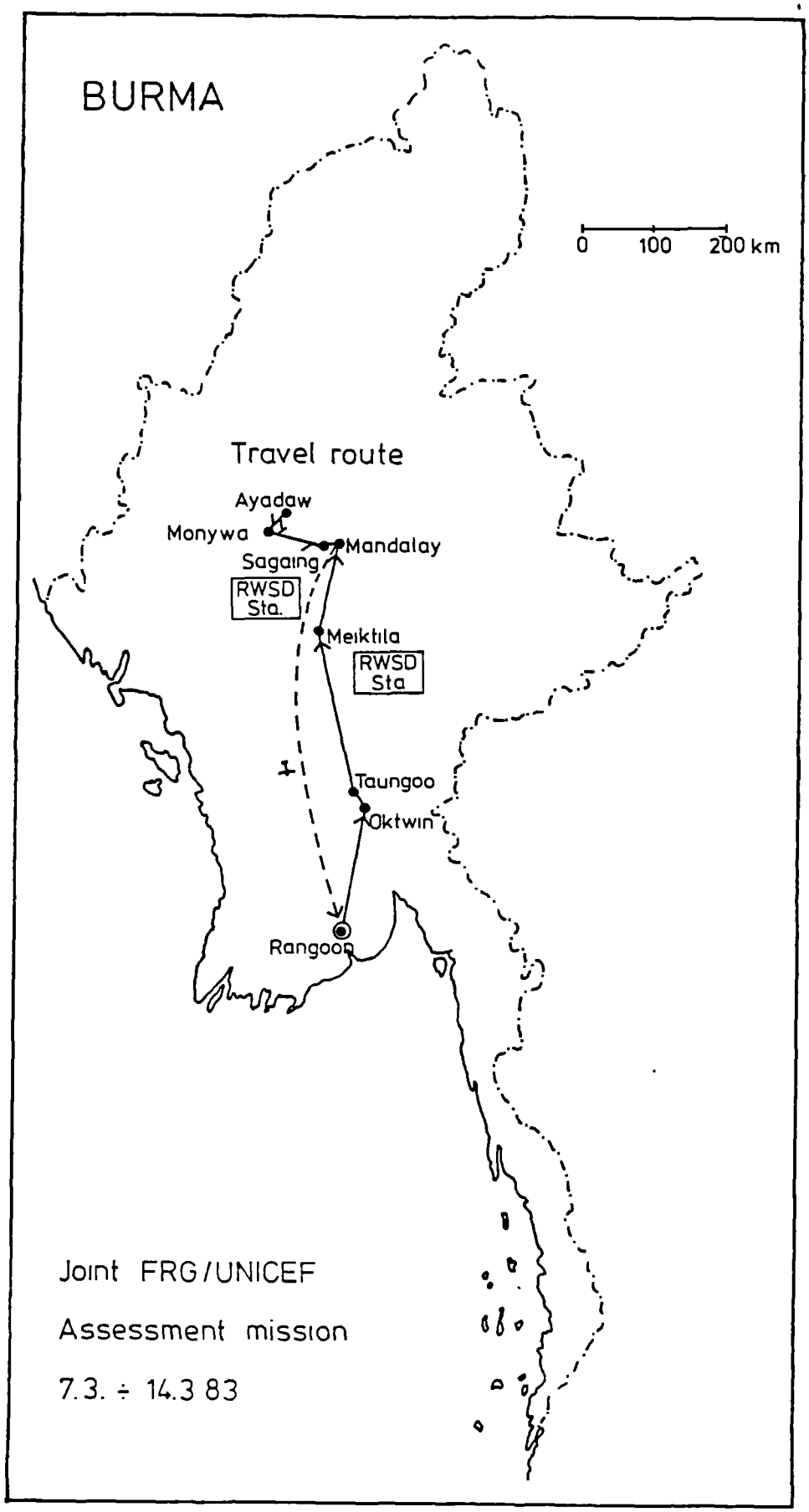
Handpump Maintenance

384. One caretaker for each handpump is selected by the villagers and trained in simple maintenance and repairs. He or she is given a set of tools and is expected to change worn-out parts. The spare parts have to be purchased by the beneficiaries from the local co-operative stores at which the Government will maintain a constant stock.

Latrines

385. The field staff of MPLD and UNICEF, while present in the villages during the installation of handpumps, are available for advice and assistance to the villagers on the construction of latrines as well.

386. For the latest experiences of design, use and maintenance of the successful VIP (Ventilated Improved Pit) Latrine, we suggest contacts to be taken with the Blair Institute in Harare, Zimbabwe, where this latrine originally was developed. Indications are that small but essential details recently have changed. Thus a better fly- and mosquito-catching effect seems to be achieved through not having a lid, thus leaving the squatting hole open. This presupposed a solid wall and roof, leaving the latrine dark in daytime.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4. BURMA

4.1 Summary of Main Findings and Recommendations

387. The water supply systems as we saw them in the Dry Zone were technically the most sophisticated and from an operations and maintenance point most costly ones we visited. We could not get a final answer neither in the literature nor in discussions with officials whether deep tubewell motor-driven pumps would be the only solution in the Dry Zone. Only a few years ago, there were thousands of handpumps in the Dry Zone. Most of the existing open dug wells are not deeper than 10 metres and the ones we saw, still had water during the dry season of the year. One factor, however, may have to be taken into account. This is the possible lowering of the water table in many parts of the Dry Zone during past decades, since also the Dry Zone of Burma has been subject to a long deforestation process with its usual consequences on the water resouces.

388. The water supply systems used in the Dry Zone are rather centralised. The average distances to the households are further off than in Bangladesh and Nepal. In many cases oxcarts still have to be used to carry water from the new water points to the household. Under these circumstances, it still takes several hours per day for one person to supply his or her household with water.

389. With the centralized water supply systems of the Dry Zone, water has to change containers several times on its way from the tap to the user (barrels on ox-carts, bucket, pot, storage pot). In order to avoid too frequent transport of water, households usually store larger quantities of water in open pots in front of the house door. Both circumstances are disadvantageous with regard to the safety of the water.

390. The Government of Burma in co-operation with UNICEF should allocate more funds and human resources for health education. There is not yet enough emphasis in health education on how to get water safely from the tap to the consumers.

391. In the case of the new water supply facilities, the communities still do not feel completely sure of their functioning. As a consequence, they store more water than necessary. This can be minimized through avoiding externally caused interruptions of water supply by providing continuous fuel supply and fast repair services.

392. For achieving a good balance in the delivery of social services and thus obtaining a positive health impact from safe water and sanitation, much still remains to be done. A beginning on a larger scale has been made with the "Latrine Construction Pilot Project", under which 15,000 sanitary latrines were built in 13 townships up to the end of 1982. For the fiscal year 1983/84, 67,600 more latrines are to be constructed. The achievements of the new pilot project in Ayadaw Township north of Monywa are the results of a concentrated effort with intensive promotion, monitoring and implementation.

393. We could clearly note that community participation in all the aspects of social and economic development of the villages in rural areas takes place at a high level in Burma as compared with the other two countries. Thanks to the unusual motivation of the population and the concerted promotional activities of the Burma Socialist Programme Party, Burma seems to be one of the very few countries where community participation functions in a more coherent way. This is particularly the case in all development investments of the community and its social institutions.

394. Apart from more difficult repairs, which are carried out by Rural Water Supply Division (RWSD), the operation and management is entirely in the hands of the Water Committee of the village and its local pump operator. The village Water Committees often seem to be in need of support for their management. RWSD, possibly with support from UNICEF, could intensify its support through e.g. models for rules and regulations, seminars and operational meetings between representatives of the committees and the operators, etc. even among a number of villages. During these meetings, the representatives of the various villages could share their experiences and learn from each other.

395. As to diesel fuel, it seems to be better that from the very beginning, the community should be made responsible for operational expenditures, instead of the present, somewhat erratic supply at different rates.

396. The technicians should take care that the community builds concrete platforms around the water taps, large enough for women to do their washing. As it is now, the ground around the water tanks often is muddy and dirty.

397. The water fees which are collected from the villagers to cover the expenses of operating the installation should be high enough to cover all the expenses of the operation and maintenance, excluding the salaries of the RWSD technicians who come for the repairs. Presently the fees collected from the villagers are not sufficient. There is no allocation for depreciation nor for spare parts, which should be included.

Technical Aspects

398. The summary of the main findings and recommendations for the technical aspects is divided into three parts: The Dry Zone Project, the Outside Dry Zone Project, and a general part.

Findings (Dry Zone)

399. In order to provide an appropriate basis for the original project planning in 1976, UNICEF relied on the inputs of three different gruops of consultants. One consisted of its own specialists, who were following through with the later supervision of UNICEF's inputs. The second one was an individual, short-term U.K. consultant, and the third group was a team of specialists from the firm of Coffey and Partners Ltd. of Australia, employed by the Australian Government (ADAB - Australian Development Assistance Bureau).

400. It seems that the U.K. drilling consultant (Lon-Worth Partnership) made a realistic appraisal of what could be achieved given RWSD's knowledge, experience and manpower in 1976. The consultant's proposal was for the drilling campaign to begin with only three rigs of 500' and three of 1,500' capacity for meeting a target of 1,700 wells in four years, as then set by the government,which may have been easier to follow. The Australian consultants somewhat later made a similar appraisal when asking for "only nominal external assistance".

401. The project progress during the first two or three years showed that a more thorough appraisal and adaption of the RWSD organization and management as well as the logistics systems and facilities, in order to more rapidly match the magnitude of the project, would have been desirable.

402. The ambitious target of 3,000 wells to be constructed in the Dry Zone was not set until the Australian Government committed a sum of A$ 11.6 million for the construction of wells under the Third Four-Year Plan.

403. Even with this almost doubling from the orginally set 1,700 wells target, the ADAB consultant concluded that "AMD (RWSD) is still capable of completing the project with only nominal external assistance" (Coffey and Partners: "Village Water Supplies Projects - Burma". Nov. 1977).

404. The technology involved, the scale and the complexity of operations would have called for intensive training before the rigs arrived. Several training courses and on-the-job training were provided between 1977 and present; less than would have been needed. Too limited advisory capacity seems to have been another constraint.

405. In April 1980 an "Assignment Report of Hydrogeological - Geophysical Consultancy with Special Reference to the Hydrogeology of the Dry Zone" prepared by a group of Israeli consultants for UNICEF Rangoon, was submitted to AMD/RWSD. This report made a thorough analysis of the existing information available on the hydrogeology of the Dry Zone and gave recommendations for the hydrogeological support to the project. These are being followed, although it seems that in practice the use of well logs still is not applied, or when applied, not in a correct way so that not all of the hydrogeological information available is properly collected and evaluated. A long term senior hydrogeologist was originally provided by UNICEF, and now provided by ADAB, to assist in the implementation of the terms recommended by the team of consultants (Ecker et al, 1980).

406. The difficulties encountered in rig procurement by UNICEF's Supply Division resulted in a certain overdimensioning of rigs.

407. For the pumps in the production wells mainly air compressors had been chosen. Air compressors often have only half of the efficiency (pumped gallons of water per gallon of fuel) of other types of pumps (e.g. helical rotor type or turbine pumps). Air compressors should only be selected in the case of a high static water level and a small drawdown versus yield. This aspect is especially important because diesel oil in Burma is scarce. Among the reasons given for the choice of air compressors were the consideration that maintenance would be easier (no moving parts down in the well) and that with a certain sand content in the water there would be less risk for frequent breakdown of the system.

408. Most pump engines seen in the field were not running at the correct speed (too slow), therefore operating uneconomically (too much fuel spent per gallon of water pumped).

409. Satisfactory repair facilities (sufficiently large workshops) for the drilling rigs do not exist at all RWSD stations. The stores and their inventory taking are not complete.

410. Most water taps seen in the villages were broken or closed with wooden plugs, sometimes wrapped with old cloth. Due to the non-uniform size of the water tanks, cases of insufficiencies in construction occur.

411. Currently, the most severe problem is the supply of diesel fuel for the engines. This keeps some water points out of function or at least considerably restricts the hours of pump operation.

412. There is no clear plan for the gradual development of community self-reliance. The chosen high technology requires a high foreign exchange demand for continued spare parts procurement.

Findings (Outside Dry Zone)

413. As the Mission's main target was to study the Dry Zone activities, only a few findings from the new Outside Dry Zone project can be summarized:

- There is potential for more low-cost technology to be applied to this project, than there is in the Dry Zone.

- As the project description gives no further information, it seems that the type(s) of handpumps to be used in this project remain(s) to be selected.

- Due to the fact that simpler technology for drilling will be used (sludger or tennis ball method), less problems with skilled manpower, logistics and organization can be expected.

- For the gravity flow schemes, a great deal of experience from Nepal is being applied, particularly as many physical and socio-economic conditions are similar in both countries.

General Findings

414. It seems that the AMD and RWSD follow their own guidelines and are not technologically influenced from external sources.

415. Travel constraints, including the shortage of diesel, are a hindrance to the monitoring of the progress of the programme by UNICEF staff members.

416. Delays in the recruitment of expatriate expert personnel through a long-drawn process to obtain visa or residence permits, at times slow UNICEF's project support considerably.

417. The difficulty in distributing books, manuals or any other written material severely hampers the support to training in the drilling programme.

Recommendations

418. In spite of all the constraints and with the great financial inputs undertaken already, UNICEF should continue with its activities in the Dry Zone, as positive results have been achieved so far.

419. UNICEF should now concentrate its input on the practical training of the drilling crews in order to help them make best use of the drilling rigs.

420. It seems that most of the recommendations given in the report on the Hydrogeology of the Dry Zone (Ecker et al, 1980) still need to be followed up. As it was beyond the possibilities of this assessment, no close analysis of RWSD's activities in the field of hydrogeology could be undertaken.

421. The handpumps for the Outside Dry Zone Project should be selected carefully. New development should be avoided to ensure a smooth implementation of the programm.

422. For future inputs in projects/programmes, the government agencies should be recommended to apply more established technological practices, especially in terms of well drilling and the standards of drilling fluids.

423. UNICEF in the Dry Zone may have attempted to promote the use of more low-cost technologies. The presently implemented projects other than the deep wells in the Dry Zone, however, are designed for community-based work with low-cost design.

4.2 Background Information and Determinants

4.2.1 Socio-economic Aspects

Economic Background

424. Burma is rich in natural resources and does not suffer from the same population pressure as do Bangladesh and Nepal. The strong traditional religious education system provides literacy, and qualified and motivated human resources. In 1980, there were 34.8 million people living on the 676.500 square kilometres total area of Burma, corresponding to 51.4 inhabitants per sq. km. The annual growth rate is 2.2%.

425. The GNP of Burma in 1980 was US$ 170 per capita. Forty-six percent (46%) of the GNP was derived from agriculture, 13% from industry and 41% from services, mainly in the public sector (IDA, Washington, 1982).

426. The centrally planned economy is divided between state enterprises (37% of GNP), co-operatives (4% of the GNP) and a private sector (60% of the GNP).

427. There was an inflation rate of about 11.2% between 1970 and 1980,. During the last years this rate seems to have slowed down.

428. Agriculture is the most important sector of the economy. In 1981/82 10.3 million hectares (= about 15.25% of the land surface) was under cultivation. On nearly half of this area rice was grown. Other important crops are sugar cane, peanuts, wheat , maize and tobacco. Burma's agricultural potential is under-utilized. Less than 50% of the areas which could potentially be cultivated are actually utilized.

429. All land is owned by the nation and the village People's Councils allocate plots to the farmers. There are a few larger farms but 86.8% of all farm households hold no more than 4 hectares or less land.

430. Burma is rich in forests. The country has about 75% -85% of the world's teak reserves. Exports of lumber and rice are the two major sources for foreign exchange.

431. The livestock and fishing industry is of some importance, contributing with about 7% to the GNP (1978). The mining sector offers quite some potential and will be developed considerably during the next 20 years. Its contribution to the GNP now is already more than 10%. This is mainly due to the national petroleum production. The manufacturing sector contributed 10.8% to the GNP in 1978/79. 55.5% of this came from state-owned factories. (Source: The Far East and Australia, 1980-81, Burma, p. 279 and following.)

Education and Religion

432. The Buddhist monastic education system since centuries back has provided a country-wide general education. Adult literacy is high with 67% but the Government is aiming at total literacy and introduced informal education programmes. The Burma Central Literacy Campaign already covers 196 of the 314 townships.

433. Today there are 21,000 primary schools. Primary schooling is compulsory for the first four years. The scholarization rate is estimated to be 85% of the 4.47 million children between the ages of 5 and 9 years. During the next years, 114 Voluntary Primary Night Schools will be established to reach 25,000 children, who cannot attend school during the day. (UNICEF Burma Annual Report 1982).

434. The quality of primary schooling can be improved: 15% of all teachers are not fully trained and with an average of 58 children per class, the teacher/pupil ratio is high. Of 100 pupils entering primary school, only 27 finish the last of the six standards, and only eight of these do so without repeating.

435. The importance of Buddhism in the daily life of every Burmese cannot be over-emphasised. There is probably no place in Burma, from where a pagoda cannot be seen. With their special architecture, pagodas dominate the landscape. A notable percentage of the population is permanently or part-time in monkhood. Monks in the street and in the villages are an omnipresent part of daily life, walking with their dark orange costume and black pots for food along the roads.

436. A sign of Buddhist charity is seen on all roads through the villages with stands with sheltered jars, from which passing travellers can drink water. These are constantly kept refilled by the villagers. Anybody passing by, can take one or two cups to satisfy his or her thirst, and the owner of the adjoining premises will be happy to refill the pot with fresh water. One underlying motive, which also is important for the villages' attitude to the operation and maintenance of the village water schemes, is that supplying water commands one of the highest, if not the highest merit for the life after this of a Buddhist.

437. The functional education of Buddhism supports development also in many other aspects. It facilitates people's training to use latrines and other hygienic practices and encourages them to participate generally in communal activities.

Government and Party

438. Burma has a socialist government, which follows strictly non-aligned policies adapted to the specific needs and traditions of the country. There are two documents which formulate the theoretical background of the general political system: "The Burmese Way to Socialism" and "The System of Correlation of Man and His Environment". In this system, religion and political/social life are combined and create a high potential for economic development. (The Far East and Australia 80/81 p. 289).

439. The government has succeeded in keeping foreign influence on a low level, completely avoiding dependence of any foreign entities, political or commercial. Within the country, most private enterprises have been nationalized and the socialist policy aims successfully at reaching more equitable distribution of incomes and assets.

440. The Government of the Socialist Republic of the Union of Burma thus follows a strict policy of non-alliance. At the same time, the country, rich in natural resources, tries to become as independent as possible from the rest of the world. The political objective to have an independent and prosperous economy seems to leave less budget allocations for social development, such as education, social services, etc.

441. The national plans for the International Drinking Water Supply and Sanitation Decade, make the individual projects, to quite a degree, an import substitution. "The programme includes six major projects for foreign capital assistance. These projects aim at making the country self-sufficient in plastic pipes, iron steel pipes, water metres, electrical motor and diesel petrol engine driven water pumps, and cement manufacture on a small scale". (National Meeting on Strategy and Detailed Planning for the International Water Supply and Sanitation Decade. Project Data Sheets, Rangoon, 1982.)

442. The Government of Burma keeps centralised control over anything affecting its internal and external affairs. This not only concerns the field of imports, but also the assignment of expatriate staff of international organisations, including UNICEF project staff. All movements of expatriate staff, including visits to field projects have to be approved by the Government at high level.

443. The control of petrol and diesel by the Government is rather strict and sometimes fuel deliveries may fall short of the actual needs for the motor-pumps so that stoppages can occur. This limits the possibilities for the villages to obtain sufficient quantities of water.

444. The Burma Socialist Programme Party is represented everywhere in the country and has its leaders in all villages. It is a powerful organization, well organized, and has a big potential in motivating and mobilizing the rural population for self-help and social tasks. This is a great asset for the water supply and sanitation programme in the wider framework of the development of the rural areas.

Demographic Data

445. In 1980, 73% of the population lived in rural areas with, 43% of the population being children below 15 years of age.

Table IV: 1
Age structure of the Burmese in 1980/81

Age	No. in '000	Percentage
0 - 4	5,338	16.6%
5 - 9	4,478	14.0%
10 - 14	3,859	12.0%
15 - more	18,426	57.4%
Totals	32,101	100.0%

Source: UNICEF Situation Analysis (1982-86)

446. Women participate much more openly and regularly in the daily life of the communities than in the two other countries visited. The percentage of educated women is higher and women are on the staff of offices, schools and health posts, .

4.2.2 Health, Nutrition, and Hygiene

447. Health indicators in Burma show: infant mortality at 101 per thousand in 1980; for the same year, child mortality (1-4 years) was 13 per thousand; life expectancy is 54 years.

448. The most prevalent diseases in infants and children are diarrhoeal diseases, malaria, protein energy malnutrition, pneumonia and skin diseases. In the central Dry Zone of the country, trachoma and leprosy are frequent.

Table 4.1
List of the Ten Most Frequently Reported Diseases in Burma

1. Diarrhoea
2. Malaria
3. Protein energy malnutrition
4. Other diseases of the respiratory system
5. Cholera
6. Perinatal morbidity and mortality
7. Injuries
8. Pneumonia
9. Tetanus
10. Pulmonary tuberculosis

Source: UNICEF Burma, Development of Basic Services for Children and Mothers in Burma, 1982-83, Situation Analysis.

449. Statistics re health services in Burma are as follows: (all figures are for 1980):

- in the country, there are 6,816 physicians; 47% of them are in government service, the others are in private practice;
- one physician has to serve on the average 4,550 inhabitants; one nurse has to serve 7,506 inhabitants;
- there are 5,000 voluntary community health workers;
- on the average one hospital bed for 1,407 people;

- 514 government hospitals;

- 1,614 health centres.

- "The various facilities are extremely well utilized. The country's overall occupancy rate for hospitals, for example, was 97.3%. The supply of doctors trained by the country's three medical schools far exceeds the number of jobs available in the country's public services."

- "There is a shortage of drugs. The country itself produces only one-fifth of the demand; the balance has to be imported. Because of foreign exchange restrictions, many drugs are imported illegally and sold on the black market. Because of the drug shortage, UNICEF drugs, donated to the public health centres, are regularly sold on the black market as well."

- "The essential immunisation programmes for children are possible in a few rural areas only, because the necessary cold chain does not exist."

- "Government finances the health services insufficiently. A considerable share of the health expenditures has to be contributed by the community and by the patients themselves."

Source: World Bank. Burma: Priorities for Continued Growth. 1982.

450. Severe malnutrition is rare in Burma but mainly because of ignorance of mothers, infants between 12 and 23 months in the weaning age suffer from mild to moderate protein energy malnutrtion (72.2% of all children). It seems that this malnutrition occurs more frequently in urban rather than rural areas (Source: UNICEF Burma, Situation Analysis of Children and Mothers).

451. Other reasons for imbalanced nutrition are:

- deficiency of iron (30% - 50% of all children suffer from moderate anemia);

- lack of iodines (in some areas in the western part of the country, more than 50% of all children suffer from goitre).

452. The hygienic status: People in rural aras enjoy washing themselves, particularly in the hot season. Under the supervision of the teachers, children in primary schools have to wash themselves every morning before

lessons start. Everywhere in the rural areas, open dug wells can be seen with villagers washing themselves by pouring water over their bodies. There is, however, no possibility of privacy so that people cannot take off their clothes when washing themselves. Only 16% of the population has access to safe water.

453. Water carrying does not seem to be quite as much a burden for women and girls in Burma as it is in Nepal. In Burma, men participate in the carrying of water. Over long distances, households use bullock carts with barrels of 200 litres. Over shorter distances, men participate in water carrying, using containers of 8 - 10 gallons, while women rather prefer pots of 5 - 8 gallons. (During our journey we quite often saw young men and women in the morning, as well as in the evening, enjoying each other's company while they were fetching water.)

454. Burmese use latrines. It is estimated that 75% of all monasteries have a clean latrine which has an important educational impact on the communities. They use fixed places for defecating and thus do not do this anywhere in the fields (Aung Tun Thet, Socio-Economic Aspects of the Pilot Latrine Construction Programme, Evaluation Study, Rangoon, 1983). Unfortunately, most of the existing latrines are open and not sealed so that infections easily can spread from them.

4.2.3 Technical details

Climate and hydrology

455. The larger part of Burma lies in the tropics. The meteorological conditions are characterized by three distinct seasons:

- hot season (pre-monsoon) March to mid-May;
- rainy season (monsoon) mid-May to October;
- cold season (winter) November to February.

456. Most of the monsoon rains, generally coming from the south-west, fall on the elevated Arakan Yoma (Range), leaving the lowlands of the Dry Zone in a "rain-shadow" (see Annex 12 for the general rainfall distribution in Burma).

457. As a result of this precipitation pattern, a dry belt is created between the Arakan Yoma Range and the Shan Plateau in the eastern part of Burma. The area between the 40 inches (1000 mm) isohyet (line of equal rainfall), is called the "Dry Zone" (located approximately between latitudes 19°N 20' and 23°N and longitudes 94°E and 96° 30' E, covering an area of about 21,600 square miles or 56,000 square kilometers). There are from 31 to 53 days with rain per year, but the rains fall primarily as light showers with only occasional heavy downpours. Apparently, most of the water from the light showers evaporates immediately after falling. The potential evapo-transpiration exceeds the average rainfall during almost every month of the year. The combination of high temperatures (day temperatures in the Mandalay areas may be up to +45° C), the low amount of annual rainfall (625 - 1,000 mm), the sandy soils and the relative depth to the water table give the Dry Zone its characteristics.

458. Most of the monsoon rains fall on the delta and on the Pegu Yoma (Range). The equally rain-rich northern and western parts of the country, called the "Hilly Region" covers about 60 percent of the land.

Geology of the Dry Zone

459. The Dry Zone of Burma is underlain by a thick series of more or less consolidated Tertiary and older sediments with an overburden of Quaternary alluvium. The predominating Tertiary sediments, ranging from the Eocene upwards, consist mainly of sandstones, claystones and shales. There are four aquifers in the Dry Zone: the Peguan, the Irrawaddian, the Alluvial, and the Volcanic. The Alluvial aquifer is the best of all in the Dry Zone yielding most of the water (fresh, seldon slightly saline water). No accurate water balance has ever been calculated and thus is not available for the Dry Zone. (For further details see report on the Hydrogeology of the Dry Zone, Ecker et al., 1980.)

Water Sources and Usage

460. The primary problem in the Dry Zone is adequate supply of potable water within reasonable distance. Villagers sometimes have to carry their drinking water from distances up to 15 miles (partly using bullock-carts). The traditional water sources are dug wells, tubewells, streams, springs and rain water "tanks" (dams).

461. Some existing tubewells are equipped with handpumps while others are power operated. Some wells have continuous uncontrolled artesian flow, since no control devices have been installed. The depths of the wells vary from a few feet in dug wells to several hundred feet in some tubewells. Some of the dug wells dry up in the dry season, while the tubewells supply water throughout the year. No clear knowledge of the potential yield of the tubewells is available as pumping tests have not been conducted in the majority of them.

462. In the Dry Zone, less than 20 percent of the total cultivated land is irrigated. A major part of the irrigation water is provided by canals and earth dam reservoirs. Only a small amount is supplied from groundwater. In most areas, agriculture is entirely dependent on the monsoon rains.

Coverage

463. In the Dry Zone, presently about 1.9 million people, in 2,453 villages, out of a population of 9.6 million have access to tubewell water. Some 25,000 people are supplied with untreated water, piped from the Irrawaddy River, because there is no possibility to use the groundwater, due to its high salinity in that very area (extending some 60 km south from Pagan/Nyaung Oo). The supply per capita in all these villages is about 6-8 gallons per day (estimated).

4.3 Project description

464. The largest input has been to the tubewell project in the Dry Zone for 3,000 villages, and for water supply to 300 rural health centres and schools, and to the station and township hospitals.

465. Between 1978 and 1981, 1,500 deep tubewells were drilled and installed with power pumps in the water-scarce Dry Zone, providing safe drinking water to 1.5 million people. The initial two years of the project were spent mainly on preparatory activities, as the 12 UNICEF-supplied rigs did not start operating until September 1979. The original target of 3,100 wells is expected to be reached in 1984.

466. Since 1978 UNICEF has maintained a number of long- and short-term technical staff to assist the rural water supply division in drilling technology, maintenance and hydrogeology.

467. UNICEF assistance to environmental sanitation during 1978-1981 was limited to providing plastic latrine bowls for the distribution through the basic health staff. After a review of data collected through field visits and joint consultation between the Environmental Sanitation Division (ESD), WHO and UNICEF, a pilot scheme has been initiated for the construction of 16,000 latrines using ferrocement slabs, and for which health education and information materials have been developed.

468. UNICEF and ESD jointly conducted a field evaluation of water supply schemes for the regional health centres, schools, and township hospital. Recommendations approved include extension of each system to the nearby communities and a training programme for pump maintenance.

469. A total of 510 rainwater collection systems will be constructed to provide safe drinking water in areas outside the Dry Zone, as an integral part of the primary school improvement programme. The Environmental Sanitation Division of the Department of Health will design and prepare installation instruction, and provide technical assistance and training in ferrocement tank construction and maintenance. Local labour and materials will be used for the construction and installation of the tanks and latrines and piped water, and for the collection and transportation of supplies from the subdepots of the Central Medical Stores. UNICEF will fund a short-term consultant to assist in designing appropriate ferrocement tanks, establishing specifications, training selected technicians and engineers, and developing construction guidelines.

470. UNICEF will provide imported materials and cement, and will fund a study tour to observe the design and implementation of such systems in Thailand and Indonesia.

471. Water supply to institutions and communities initiated during the earlier programme will continue to be implemented by the ESD, in which almost 300 water supply systems serving 200,500 people will be established. The ESD

will orgainze eight reticulation teams who will supervise communities in constructing pump houses. The community will be responsible for the operation and maintenance of the systems, under the day-to-day supervision of the village water supply and sanitation committee. UNICEF will supply pipes, fittings and pumps, and WHO will support this project by funding a fellowship on the maintenance of water supply systems.

472. In the hilly areas, covering approximately 40 per cent of Burma, potable water for domestic use is scarce. The Rural Water Supply Division (RWSD) of the Agricultural Mechanization Department is implementing a water supply scheme based on a gravity-flow system in 35 communities, serving approximately 73,500 people. Natural spring sources are exploited, and gravity-flow systems are being installed to cover a distance of three to five miles and serve two to three villages. Village committees mobilze funds, labour and local materials for construction, select standpost sites, and take repsonsibility for maintenance. During 1982-1983, a pilot scheme is being constructed in Sialtang, in the township of Tiddim in Chin State, during which the RWSD engineers and technicians are trained in the survey, design and supervision of installation. UNICEF provides the services of an experienced field-based technical project officer.

473. In the Rangoon, Irrawaddy and Pegu Division of Lower Burma, shallow hand-pump tubewells will be drilled and installed with hand-pumps. The RWSD will construct 4,000 shallow wells by 1986, serving 400,000 people. Villages will be selected for inclusion in this project according to the sixze and scarcity of water. Communities will provide labour and local materials. The RWSD field stations in Rangoon, Pegu or Tharawaddy will take responsibility for the overall co-ordination, supervision and technical support. UNICEF will provide the hand-pumps, drill pipes, PVC casings, screens, and tools for installation and maintenance.

474. The project will provide drinking water to about eight of the 93 townships in these divisions. In an effort to extend coverage to other townships, $US 1.7 million of "noted" funds is being sought for implementing a project for 5,000 shallow hand-pump tubewells to serve an additional 500,000 people. The RWSD technical staff will train village co-operative nominees in manual drilling and hand-pump maintenance. WHO will fund a study tour for tow engineers to observe hand-pump manufacturing and quality control techniques. The RWSD will construct or rehabilitate deep tubewells with power or hand-pumps.

475. In mid-1984, the RWSD will complete the drilling and installation of power pumps on the remaining 1,200 deep tubewells, serving 750,000 people, out of the 3,100 wells originally planned for completion during 1978-1982 programme.

476. During 1982-1983, RWSD will conduct a survey of old wells in the Dry Zone to prepare a long-term plan for well rehabilitation, which will be undertaken during the period 1984-1986.

477. UNICEF will continue to provide technical assistance to support the drilling and maintenance activities through one senior project officer, one drilling and maintenance engineer, two drilling superintendents for 18 months each, one workshop superintendent and one workshop supervisor master mechanic, one national project officer, and other support staff. UNICEF continued to provide technical assistance to hydrogeology until the end of 1982, when this was taken over by ADAB.

478. In Lower Burma, the RWSD will rehabilitate 1,710 existing wells serving 908,000 people as Phase I of a "noted" project already approved (E/ICEF/P/L.1862). Six teams will be formed to clean and redevelop wells, and four teams will be equipped to redrill the existing wells or drill new ones. Deep well hand-pumps, at a ratio of one per 150 persons, and power pumps, one per village whose population exceeds 800, will be installed; community pump operators will be trained by the RWSD.

479. The Department of Medical Research will undertake a long-term study through field surveys and data collected through basic health services staff, to monitor and evaluate the effects of improved water supply and sanitation facilities on the health of the villages, with emphasis on diarrhoeal diseases.

480. The ESD will undertake a household and school latrine project in which 400,000 household latrines and 2,500 school latrines, serving 300,000 people, will be installed. In the first half of 1982, a pilot project to construct 16,000 latrines in 11 townships distributed over the country's five geographical zones was initiated. An alternative strategy of manufacturing and selling latrine slabs through co-operative societies will be tried out.

481. After training, village sanitation workers or co-operative societies will produce latrine slabs from cement and chicken wire mesh.

482. The Health Education Bureau will train basic health services staff in supportive health education and will produce and distribute materials such as posters and booklets.

483. The pilot project is expected to establish the most appropriate low-cost latrine designs. After a careful assessment, the household and school latrine programme is expected to expand its coverage from 1983 onwards to 400,000 latrines by 1986.

4.4 Programme/Project Objectives

4.4.1 Socio-Economic Aspects and Health, Nutrition, and Hygiene

484. The Ministry of Health in its "Plan of Action of Drinking Water Supply and Environmental Sanitation (1982-86)" describes its objectives:

"(a) to improve the health and socio-economic conditions among the population served.

(b) to reduce the drudgery of women and children collecting and carrying water over long distances.

(c) to reduce the incidence of water-related diseases among the population served."

485. To improve health and to reduce the incidence of water-related diseases are the most important objectives for the water supply programmes. Especially in the dry season, in the Dry Zone, the lack of water contributes to spread diseases such as trachoma.

486. The replacement of unprotected dug wells, ponds, rivers, steams, lakes and channels through properly constructed tubewells is an essential pre-condition for providing the rural population with safe water. At the same time, this is not a guarantee for safe water to reach the user. The new sources of safe water for parts of the communities still sometimes are far off from the households. Water still needs to be carried by bullock carts and buckets and in most cases water is stored in open jars close to the front doors.

487. Progress with the complementary programmes which are essential to improve the health status of the rural population, seems to be rather slow and, as far as sanitation is concerned, not yet beyond the pilot phase The way in which this pilot phase has been initiated, however, bodes well for the future, provided the momentum is kept up from the pilot project.

488. Health education seems to be of particular importance. In this field, the government would have to allocate more money and manpower. Health education still is rather centralized and not yet goes to reach the village level to the extent needed. Compared to this, the curative medical services are well advanced in Burma (compare IV 3.2).

489. Objective "(b) to save time and energy for women and children" seems to be of a shade less importance than for the women of the mountain areas of Nepal for example. However, we are informed that in certain places in the Dry Zone the villagers used to fetch water from distances of up to 25 kilometres. Under IV 3.2 it was mentioned already that men participate in water carrying at locations where water sources are far from the households, bullock carts are used to quite an extent.

490. The operational target of the Government of Burma for water supply for rural households is the provision of 20 gallons per person per day, and for health institutions of 60 gallons per day, which seems very high. We doubt whether the population (or the health workers) can make use of these quantities when the technical facilities of the users to handle these quantities to their end-use might be limited and involve too much work.

4.4.2 Technical Aspects

Activities in Water Supply

491. Rural water supply projects were implemented by the Government of Burma since 1953, originally through its Rural Sanitation and Water Board. In 1972 this was re-organized into the Rural Water Supply Division (RWSD), under the Agricultural Mechanisation Department (AMD) of the Ministry of Agriculture.

492. By 1962 about 2,570 tubewells had been installed in the Pegu, Rangoon and Irrawaddy Divisions in the Delta area (to the south of the Dry Zone) serving about 18 percent of the total population (peak of yearly installation about 700 wells).

493. After 1962, Government priorities were shifted to the Dry Zone, where 3,666 tubewells equipped with handpumps had been completed by 1977.

Dry Zone (Sagaing, Magwe and Mandalay Divisions)

494. In 1978 the Government's Third Four-Year Development Plan period (1978/79 and 1981/82) started with external assistance to the Dry Zone Project, using UNICEF's general resources and noted funds (FRG), combined with a co-ordinated bilateral input from Australia through ADAB. The final government target was to drill 3,000 power-pump equipped deep wells for drinking water in the Dry Zone with 2.1 million beneficaries.

495. The Dry Zone project by December 1982 had reached 1606 completed units (2,2086 well drilled successfully). An additional programme for 1,500 wells planned for US$ 21.778 million, (1982-1985) has been started. For the rehabilitation of old wells in the Dry Zone (290 wells in 1984-1986, costing US$ 2.247 million) there is an additional proposal.

"Outside the Dry Zone Project" (Pegu, Irrawaddy and Rangoon Divisions)

496. Almost all of the tubewells drilled prior to 1977 were fitted with handpumps. Due to the variety of pumps (four to six, or even more), the lack of standardization and the absence of local manufacture of essential spares, and with an average number of 450 persons using each well daily, most of these handpumps (80 percent) are out of order.

497. There is a Plan of Operation with three different technical elements:

- rehabilition of 1,710 old wells by replacing with new pump units (handpumps and motor driven pumps) at a cost of about US$ 840,000 for 691,190 people

- drilling of 900 new wells (plan of action under preparation)

- shallow handpump tubewells (4,000 with 45 metres average depth),to be sunk with the sludger method; cost about US$ 2 million; 400,000 beneficiaries.

Sialtang piped water supply

498. A gravity flow system with intakes, main pipe line, ground storage tanks and public standposts, has been planned and is now implemented in the Chin hills (Town of Tiddim and five villages, about 20,000 people, project cost US$ 1.1 million).

Note on the programme activities

499. As part of the planning process for the 1982-1986 programme (Plan of Operations), UNICEF presented to RWSD/AMD the following analysis:

- The Dry Zone service coverage is over 60% which exceeds the National IDWSSD target of 50%. The coverage in the other areas of the country is less than 10% except for Pegu Division.

- The diesel oil requirements for 3,000 wells in the Dry Zone represent 2 to 3% of the present total diesel oil input of the refineries in the country. Therefore, further expansion in energy consuming systems must be carefully reviewed.

- Simpler, less costly technologies can easily be adapted to serve a larger population in the next four years. Especially, manual sinking of shallow handpump tubewells, gravity flow schemes, rainwater collection, etc.

- The simpler technologies can be implemented with a substantially smaller expansion in manpower within the Government implementing agencies.

- High technology solutions would create an unnecessarily high foreign exchange demand for continued spare parts procurement.

4.5 Analysis of Planning and Preparation

4.5.1 Socio-Economic Aspects and Health, Nutrition, and Hygiene

500. With its single-party system, Burma has an operational political instrument, which allows central planning, including centrally planned local contributions. It seems that this instrument works rather efficiently.

501. For the planning and preparation of the programmes in Burma, some studies and research have been undertaken or are planned with UNICEF support. A more comprehensive investigation of health impacts of tubewell water is

going on from 1982 to 1985. The study has a total budget of $51,000 and is organized by the Department of Medical Research (Myint, T.M., "Research Protocol on Health Impact Study of the Tubewell Water Supply Project 1982-85", Rangoon, 1982).

4.5.2 Technical aspects

Dry Zone project - drilling activities

502. By January 1983, 2,086 wells out of the 3,000 wells planned for 1978 - 1982 had been successfully drilled (241 were unsuccessful). Out of the 3,293 planned pumping units, only 1,606 so far had been installed (January '83). This shortfall in relation to government plans was created by a number of constraints, summarised as follows:

(i) late arrival of rigs (1979). Hitches and constraints in the rig procurement. Need for training in operation and maintenance of drill drigs (UNICEF and RWSD);

(ii) use of local clay instead of bentonite for the straight rotary mud drilling fluid;

(iii) too many and oversized rigs with inadequate management capacity;

(iv) insufficient repair facilities (RWSD);

(v) inadequate stores, and staff for the stores operation and logistics;

(vi) need for more stringency in drilling methods, maintenance practices and logistics, including spare parts management (RWSD);

(vii) need for improved control, check-up or follow-up of equipment or placed orders and for increased priority as to quantity and quality of staff for storing/logistics (both UNICEF and RWSD);

(viii) too few training courses;

(xi) In the intitial phase of the Dry Zone drilling activities, the wells were drilled without any previous knowledge of the hydrogeological conditions, the depths to water level and the water quality;

(x) The lithological description of the drilled section is based only on the description of cuttings by the well siter or the driller without any correlation with geophysical well logs. Because of this system, several thin, potentially water-bearing layers may be neglected in the lithological description and the depth to boundaries between different layers cannot be accurate;

(xi) In some boreholes, the well screens were not located at the optimum depths, due to inaccuracies in the lithological description by the driller;

(xii) The data included in the inventory can contribute to adequate hydrogeological forecasts for new wells. The forecasts can help the station managers to plan for drilling programmes in a more rational way.

Drilling rigs

503. The planning of the drill rig procurement was influenced by the switching from 1,600 to 3,000 wells to be drilled. Lack of background information on the hydrogeological conditions, mistakes, now of historic relevance only, and difficulties in communication between UNICEF Rangoon and the Supply Division at UNICEF Headquarters caused all of twelve drilling rigs to be for 1500' sent to Burma (instead of specified nine rigs for 1500' and three for 750'). They were oversized (weighted average hole depth under 500'), arrived late, were not equipped with any essential spare parts, partly with the wrong supplementary equipment, and due to the size (too bulky and heavy for the road conditions in Burma) causing problems when moving between the well sites.

Pumping units

504. Already in the first stages of the project, it was clearly stated by the Australian consultants Coffey and Partners that air-lifting as a pumping method is inefficient and rarely used anywhere in the world for permanent installations. The reasons given by RWSD for the use of air compressors may justify their choice to a certain degree (relatively easy to maintain, no need for exactly straight, vertical boreholes).

505. There are severe supply problems as to the fuel. The villagers are not necessarily willing or able to pay for the quantities of fuel required for obtaining satisfactory outputs of water. The relatively only small quantities of water produced would make it less effective to reach the objectives of improving the health level of the rural population.

506. In the UNICEF report (1978) on the drilling activities for the 3,000 water wells, it was stated that handpumps were not to be used in this programme. The main reason was that handpumps would not deliver enough water

(quantity) and that in the course of the construction of new wells on a long term basis, diesel driven pumps or air compressors were a better solution. These two points at this stage could not be argued with, but it should have been recognized that:

- the pump technology would have been selected with lower-cost alternatives;
- fuel supply and payment for the operation and maintenance would be a serious problem in Burma;
- handpumps might have been a feasible and cheaper alternative at least in cases where the water table would be closer than, say 30 metres from the ground;
- a wider spread of the installations could have been made possible by installing more water points with simpler means;
- handpumps are easier to maintain and do not require expensive spare parts which may have to be procured in other countries.

4.6 Project Implementation (Installation)

4.6.1 Socio-economic Aspects and Health, Nutrition and Hygiene

507. For various reasons, the potential of people's participation in water projects is considerable:

(a) Government needs its funds for central tasks such as administration, defense and other budget items in order to make its economy independent. Therefore, the main contribution for development of rural services has to come from the communities instead of the government.

(b) It was already said that the Burma Socialist Programme Party is a powerful organization to mobilize and strongly motivate people to participate. Government officials can and do use this as a tool to promote specific projects, which facilitates an energetic implementation.

(c) A national law ensures that at least 25% of all crops harvested by the farmers have to be sold to the government. This guarantees that every farmer has some cash income, which he also can use for social investments in his village.

(d) Buddhist traditional values together with modern socialist ideas, stimulate individual contributions towards society. If this is done in connection with water supply, the donor (giving money, material or labour) can be sure that his contribution is highly

regarded by the community. Therefore, one wealthy man of a village is quite often happy to pay for the whole share of the community towards installation of the water supply system. Money e.g. collected during celebrations in homage of the "nats" (protective spirits) may also be used for such purposes.

(e) According to the constitution, people's participation is a duty under the law.

508. Table IV 2 demonstrates how much the communities are involved in the water supply programmes. This is not only the case with water supply for the villagers themselves, but even more with the institutional water suppply under the auspices of the Ministry of Health.

Table IV: 2
Contributions Towards Water Supply
and Sanitation Programmes
(in '000 $ for 1982-86)

Contributor	WS&S for Inst.	% of Inst.	WS&S for Household	% of Household
Government	341.5	2.6%	5,230	16.0%
Community	9,683.5	75.0%	6,820	20.9%
UNICEF	2,856.8	22.1%	11,950	36.6%
WHO	17.6	.1%	15	--
Australia	--	--	8,610	26.4%
TOTAL	12,899.4	100.0%	32,625	100.0%

Source: Plans of Action of the Ministry of Health and Ministry of Agriculture. 1982-86.

509. At the village level, a "Village Water and Sanitation Committee" is organized, which cares for the local contributions. Contributions are in cash, in local material for construction and in labour. When the drilling teams are in the villages, the communities have to take care of them . The total drilling costs for one pump station for a community is estimated to be about 4.000 kyats. The committees are supported by the local leaders of the party and government officials, such as the township medical officers and the engineers and technicians of RWSD.

4.6.2 Technical Aspects

Store facilities

510. The spare parts stores at the RWSD stations (completed in late 1980) still are a problem area. Only by the end of 1981, the stores were equipped with shelves to handle the spare parts more properly. The present system has the unpacking done by AMD/RWSD in Rangoon for inventory before the parts are sent to the stations. This leaves items unprotected. This procedure has part of the supplies exposed to e.g. bird droppings and attacks by rodents (gnawing of plastic components, etc.) which ruins some parts before they ever have been used.

511. A visit to the stores in Meiktila and Sagaing and previous reports showed that the stores and logistics have improved but still are in need of attention.

Dry Zone Water Supply Systems

512. Although there are standard designs for the general layout of the water points, each one visited looked quite different. There is nothing wrong with individual designs but certain standards of craftsmanship should be followed.

513. One water tank collapsed just before the Mission arrived. It had been filled to the top (due to the static water pressure/forces on the walls). There were apparent reasons for this failure: not enough cement used for the mortar, a permeable plaster and an insufficient foundation for the walls of the tank. It probably was an isolated event and an unlucky coincidence with the arrival of the Mission on that very date but indicates the need for better design, control of construction practices and training in design and craftsmanship.

514. Water tap arrangements vary from one gushing "opening" (without a proper functioning tap) to 12-tap arrangements. The facility needed for filling barrels on bullock carts directly from the pumps or water tanks often was missing. No exact figures as to how much water per hour was pumped and how many hours the pumps were operated could be obtained from the records seen during the field trip.

4.7 Operation and Maintenance (Functioning and Utilization)

4.7.1 Socio-Economic Aspects and Health, Nutrition, and Hygiene

515. Up to now, it is not precisely known to what degree tubewell water supply projects have an impact on improving the health of the villagers. From 1982 - 1985, an in-depth study will be undertaken by the Department of Medical Research, together with the parties involved in the programme of water supply. In the "Research Protocol on Health Impact Study of the Tube Well Water Supply Project, 1982-85 (Rangoon, 1982)", the following hypothesis will

be tested over four years: "The availability and adequate use of safe tube-well supply round the year would decrease the incidence of the number of specific indicator conditions which in turn would improve the health status of the community." The total amount of the research budget will be $51,000.

516. In the Dry Zone of Burma, the new water supply systems are still often far off from the households, so that bullock carts for water carrying are still needed. On its way from the tap to the mouth, water is poured from container to container several times and is stored in open jars, thereby becoming exposed to pollution. The risk is high of endangering water, which comes safe at the tap, during the different steps of its transfer to consumption.

517. Under the circumstances, health education with particular emphasis on sanitary practices (cleaning containers, storing water properly, etc.) seems more important than ever in order to minimise the risk mentioned above.

518. Every Water Committee organises its own operation at village level. There are no rules or regulations prescribed by government or on the district or township levels. There are differences between the single villages with a lack of uniform procedures, risking to lead to administrative breakdowns, lack of fuel, irregular or insufficient fee collection, etc. It might be helpful to give the villagers more guidance and advice on such matters from the side of the authorities.

4.7.2 Technical Aspects

Dry Zone Project

Pumping Units

519. Caretakers are responsible for minor maintenance activities on the village level. For the regular services or major repairs, RWSD has its own mobile maintenance crews. The specific problem of the high fuel consumption of the air compressors is discussed in Chapter 4.5.2. Generally, the pumps seem to be well maintained.

Drilling rigs

520. The problems of the operation and maintenance of the drilling rigs are discussed in various chapters. As no training programme could be prepared in advance and no instructor was provided from the supplier for training and practice in the handling and operation of the equipment, this still is not quite correctly operated. This resulted in frequent breakdowns and heavy wear of the equipment. Contrary to some claims, these breakdowns are not due to inherent faults of the machines themselves, but rather would have to be ascribed to incorrect handling of equipment and lack of maintenance.

521. Another factor, why maintenance still is not as good as it could be, is that the maintenance handbooks and manuals delivered to Burma seem not to have been distributed. There is also the problem that too few people within RWSD are able to read the manuals written in English. A translation of the essential ones into Burmese still needs to be arranged.

Spare parts/logistics

522. The main problems with spare parts and logistics in the project implementation are:

- parts orders are not timely; needs are not researched in sufficient detail; orders are too large to be handled economically, causing standstills or delays in the operation of the drilling rigs;

- need for monitoring and forecasts of needs for individual spare parts;

- parts ordered by RWSD Headquarters instead of the Stations, resulting in parts often not required.

Outside the Dry Zone

523. During our brief passing through Lower Burma (from Rangoon northward to Taungoo), we had an opportunity to see some examples of "pre-project" conditions, which are expected to improve with the progress of the recently initiated "Outside Dry Zone" Project. Thus, the Mission had the chance to visit some older artesian wells, a handpump and latrines at a school, the water supply and sanitation facilities of a hospital, and a RWSD water jetting rigs in operation. Some observations indicate the present state of these installations:

- the water of the freely flowing artesian wells did not have proper disposal of excess water, resulting in a muddy surrounding of the well; it seems that the well had been drilled but no follow-up measures had been taken;

- the handpump of the school was functioning; the latrines were used but nobody took care of the overfilled excreta pit holes which furthermore were open beneath the wooden cabin on stilts above. Our later impressions from Ayadaw (Monywa) show what improvements really can be done with proper water supply and latrines;

- the water supply of hospitals visited was in a bad condition: the water source was not protected; the water tank was not clean; the latrines were dirty and in bad condition; the latrine pits were filled to the top with excreta;

- the water jetting rig was working; it was the second attempt in this village to find water (first hole drilled was about 50 m away). The simplicity of this slow but reliable method will make it very useful in the future expansion of the "Outside Dry Zone" Project.

ABBREVIATIONS

ADAB	Australian Development Assistance Bureau
AMD	Agricultural Mechanization Department (Burma)
BMZ	Bundesministerium für Wirtschaftliche Zusammenarbeit (FRG)
CIF	Cost, Insurance, Freight
CWSS	Community Water Supply Systems
DANIDA	Danish International Development Agency
DG	Director General
DMR	Department of Medical Research (Burma)
DPHE	Department of Public Health Engineering (Bangladesh)
DTO	District Technical Offices
DWSS	Department of Water Supply and Sewerage (Nepal)
EE	Executive Engineer (DPHE)
ESD	Environmental Sanitation Division (Burma)
FERD	Foreign Economics Relations Department (Burma)
FRG	Federal Republic of Germany
GDP	Gross Domestic Product
GI	Galvanised Iron
GTZ	Gesellschaft für Technische Zusammenarbeit (FRG)
GVS	German Volunteer Service
HDP	High Density Polyethylene
HMG	His Majesty's Government (Nepal)
IDWSSD	International Drinking Water Supply and Sanitation Decade (1981-1990)
IRC	International Reference Centre for Community Water Supply and Sanitation (The Hague, The Netherlands)

/...

LDD	Local Development Department (Nepal)
LDC	Least Developed Country
MPLD	Ministry of Panchayat and Local Development (Nepal)
MSAC	Most Serious Affected Country
NDP	National Development Product
NR	Nepalese Rupees
PHC	Primary Health Care
PVC	Polyvinyl Chloride
RHC	Regional Health Centre
RWSD	Rural Water Supply Division (Burma)
SAE	Sub-Assistance Engineer
SATA	Swiss Association for Technical Assistance
SDE	Sub-divisional Engineeer
TMO	Township Medical Officer
UDR	UNICEF District Representative
UNCDF	United Nations Capital Development Fund
VSSC	Village Sanitation Selling Centres
WES	Water and Environmental Sanitation
WSS	Water Supply and Sanitation
WST	Water and Sanitation Technicians

List of Annexes

Annex 1

Terms of Reference for the Joint Assessment/Evaluation of UNICEF-Assisted Rural Water Supply Projects in Bangladesh, Nepal and Burma

Introduction

1. During 1981 the Ministry of Economic Cooperation of the Federal Republic of Germany expressed an interest in carrying out, jointly with UNICEF, an evaluation of projects that UNICEF is assisting in the field of water-supply and sanitation. The Ministry informed UNICEF that they had undertaken evaluations of water-supply projects on behalf of OECD countries which were being financed on a bilateral basis and they wished to extend their experience in evaluations to cover projects which were being assisted on a multilateral basis, as well. The Ministry further indicated that these evaluations would constitute a learning experience which would be useful to them and that they were not particularly interested in evaluation projects being financed by the Government of the Federal Republic of Germany.

2. UNICEF indicated to the Ministry that while such joint evaluation with donor governments were a relatively new experience, they would be happy to extend their support and cooperation to the activity. It was also indicated that as UNICEF provides assistance to government projects and there are no "UNICEF Projects" as such, the proposed evaluation activities will need to consider the perspectives and sensitivities of cooperating governments. Furthermore that, the Terms of Reference of the joint assessment/evaluation should also incorporate concerns, issues and priorities which are of interest to UNICEF in order that UNICEF can fully benefit from the experience and expertise of the Ministry of Overseas Cooperation on these points.

3. The following Terms of Reference were agreed upon for the joint assessment/evaluation of UNICEF-assisted rural water-supply projects in meetings held between representatives of the Federal Ministry for Economic Cooperation of the Government of the Federal Republic of Germany and UNICEF, in New York between the 10 and 11 January 1983.

Objectives of the Evaluation

The objectives of the evaluation will be the following:

4. To carry out an assessment of selected UNICEF-assisted water-supply projects in Bangladesh, Burma and Nepal in order to: (a) improve the planning and implementation of water supply projects which are being assisted by UNICEF; (b) to share knowledge, expertise and experience between the Government of the Federal Republic of Germany and UNICEF on critical issues related to the planning, implementation and impact of water-supply projects.

Scope of the Evalation

5. The evaluation will cover rural water-supply projects and their linkages to other supporting activities e.g. sanitation, primary health care, child nutrition, etc. Pumping systems with emphasis on low cost handpumps will be evaluated. The evaluation will cover on-going and completed project(s) in each country.

Methodology for the evaluation.

6. In view of limitations in time no rigid methodology is proposed.

Subjects to be addressed by the evaluation.
(See Enclosure for detailed criteria)

7. a. Programme/Project objectives
   b. Analysis of Planning and Preparation (with emphasis on cost effectiveness and appropriateness of technology.)
   c. Project implementation (installation).
   d. Operation and maintenance -functioning and utilization. (How can projects be made self-sustaining? How can their use by target-groups, e.g. women, and children, be improved?).
   e Significance of the project.
   f. Recommendations for future action.

8. The above subjects will embrace, where possible, discussion of issues and concerns listed in Enclosure item no. 6.

9. Participants.

The evaluation will be carried out by a team comprising Mr. Martin G. Beyer, Senior Policy Specialist (Drinking Water and Sanitation) of UNICEF. Another member from UNICEF, will be nominated by the country office where the evaluation is being undertaken. The participants from the Federal Republic of Germany will be Mr. Hartmut Sacher, Consultant, Water Supply and Sanitation, and Dr. Heinecke Werner, Consultant, Social Sciences. A local expert from each country, to be nominated, will cover the field of environmental sanitation, health, nutrition, and hygiene, and will advise the team on the assessment of community participation, and other related socio-cultural aspects.

Duration of the evaluation.

10. The duration of the evaluation will be for approximately three weeks as per this schedule attached.

Countries

11. The countries selected for carrying out the evaluation are Bangladesh, Nepal and Burma.

12. Output of the Evaluation

The output of this evaluation will be a report containing findings, conclusions and recommendations, as per the objectives of the evaluation described above. Draft finding and conclusion will be discussed and reviewed with government and field office at the country level on the conclusion of the country level evaluation activities.

Enclosures to Terms of Reference

Criteria for Assessment/Evaluation of UNICEF-Assisted Rural Water Supply Projects In Bangladesh, Nepal and Burma

Socio-Economic Effects (Dr.Werner)

1.
- Participation of Target Groups during planning, implementation and operation
- Employment Effects
- Distribution of Income and Assets
  - x income effects of the fee system
  - x access of income groups to facilities
- Demonstration Effect of the Project
- Time Saving
  - x amount of time saved
  - x alternative occupations in
    - formal labour
    - informal labour
    - education
    - others
- Change of Role of Women, Girls
  - x through alternative occupation
  - x through participation
- Aspects of Education

2. Effects on Health, Nutrition, Hygiene (local expert)

An attempt will be made to assess the effect of the water-supply projects on health, nutrition and hygiene. This work will be undertaken, not through a scientifically rigourous survey methodology, but by reviewing existing information including base line studies and evaluation, field observation and consultation with specialists in the field. The criteria for this assessment could include a drop in infant and child mortality rates; a drop in water borne and water-related diseases; and water usage. This work will be undertaken with reference to the criteria established for the significant assessment stated in paragraph 5 of this enclosure.

3. Management including economic and financial operations (Mr. Beyer).

- Project administrative structure and its functioning
- staff (appropriateness, efficiency)
- staff skills including specialised skills for mobilizing community participation, promoting inter-sectoral coordination, etc.

- effectiveness of monitoring and control system
- equipment of administration and maintenance (repair crews, offices, vehicles)
- peoples participation
- organization and functioning of recurrent budget
- system of fees and contributions of users
- sources of the recurrent budget
  x local
  x government
  x foreign donors
- declared reserves for
  x expansion
  x overhead expenditures
  x depreciation
  x contingencies
- direct employment effects
- indirect productive effects
  x demand for local labour
  x demand for local spare parts
- impact on imports (spare parts, fuel)

4.Technical Evaluation (Mr. Sacher)

4.1 Planning and Implementation

- Appropriateness of project selection and design;
- Choice of technology;
- Appropriateness of construction;
- Project cost, including per capita cost;
- Management and operations of the project;
- Maintenance and repairs;
- Availability of complementary inputs if any (fuel, electricity, in the case of water, skilled manpower, etc.);

4.2. Functioning and Utilization

Quantity of water.
- adequacy of water source
- capacity of equipment and machinery
- adequacy of storage capacity
- adequacy of distribution system
- water outlets
- leakages, etc.

Water quality
- bacteriology
- chemical
- taste, smell, odor
- suitability of water source

Reliability of water source
- appropriate
- adequacy of operation and maintenance e.g. sufficiency of funds, manpower, back-up support, fuel, O+M etc.

Distance
- adequacy of distribution network
- ease of access to facility

Physical environment.
- Conservation of resources
- pollution

Use of water
- livestock, irrigation
- other purposes

5. Assessment of Significance

- Significance of the national programme of water supply
- Significance of the contribution of UNICEF

a. How many rural households, schools, and other institutions have been supplied with water?

b. How many litres per person are available in each system visited?

c. Adequacy of distribution of water-supply among different income groups?

d. What are the direct and indirect employment and income generation effects?

e. Time saved by bringing water closer to households and how much of this saved time is spent on productive alternative occupations?

f. Is there any evidence of improvement of the health status?

g. To what extent did the users participate in planning, implementation and management? To what extent was this entry point for other fields?

h. Was the technology applied transferred to and used in other projects (governments, other donors)?

i. Was the programme approach replicated? (Government, other donors, etc.)

6.Other important Issues and Concerns

- As water-supply is often considered as an 'entry point' for mobilizing community level action, how can water-supply and sanitation projects be used as a catalyst to mobilize community interest and action in programmes of child health and nutrition, which are mentioned in the current State of the World's Children Report (1982)

- In what ways can national capacities be built for improving the planning and executing of water and sanitation projects?

- How can the cost of these projects be further reduced? Simpler and more cost effective technologies? Improved management and operation? Reduction of wastage?

- How can maintenance and operation of projects be improved? How can maintenance and operation be monitored?

  How can these projects be made self-sustaining? Ways to meet replacement cost of equipment?

- How can coverage and utilisation of services be expanded? How can the poor segments of society be provided with services and encouraged to utilise them?

- Ways to assess project impact using simple methods. What are the methodologies for rapid assessment/evaluation like the one in hand?

Annex 1.2

Extract from the Programme Manual
on UNICEF Policies,
Water Supply and Sanitation
First Draft, 29 March 1983
(PDPD/NN/199/83)

C. WATER SUPPLY AND ENVIRONMENTAL SANITATION

I. Introduction

6.48 Children under 15 years of age constitute between 40 and 50 percent of the world's population. Nearly half of these are infants and young children (under 5 years of age). This latter group is most vulnerable to water-borne and water-related diseases. In most developing countries, diarrhoea, dysentery and other diseases related to unhygienic conditions constitute a principal cause of infant mortality. The vicious cycle of diarrhoeal diseases/malnutrition and infant morbidity/mortality, is closely linked to the lack of safe water in adequate quantities and the corresponding lack of environmental sanitation, including the proper disposal of excreta and other wastes. This is often found in combination with the lack of health and nutrition education resulting in poor personal and food hygiene. Thus, the provision of safe water is one of the most effective and economical ways to help child health. Some other benefits of safe water are also relevant to children's well-being. An accessible water supply lessens the drudgery of mothers, frees time for other activities and encourages self-help community efforts. However, the provision of safe drinking water alone is not sufficient to control the incidence of water-borne and water-related diseases. Also involved are personal hygiene, appropriate disposal of excreta, household cleanliness, food storage and handling, disposal of solid wastes (garbage) and the environment around the house. Thus, in addition to the supply of safe water, there must be a combination of efforts to provide means of waste disposal and to educate the public on proper personal and food hygiene.

6.49 In keeping with its work for improving the well-being of children and women, UNICEF supports the development of drinking water supply and environmental sanitation in rural areas and urban slums and shanty towns in developing countries.

II. Objectives

6.50 UNICEF supports programmes for water supply and environmental sanitation as a component of Primary Health Care within the context of integrated national development plans. The objectives of UNICEF's co-operation in this field are: (i) the provision of safe and adequate quantities of potable water within reasonable access from the individual households in a community; and (ii) the promotion of environmental sanitation, especially disposal of waste water and human waste (e.g. by provision of water-seal plans and slabs for latrines); and (iii) the promotion of health and sanitation education.

6.51 UNICEF policies aim at complementarity of action within the framework of the International Drinking Water Supply and Sanitation Decade, 1981-1990. UNICEF's activities are carried out in co-ordination with UNDP, the World Bank, WHO, and with governmental and non-governmental organizations at the country, regional, and international levels.

III. Strategy

6.52 UNICEF's co-operation in the field of water supply and environmental sanitation is directed to building national capacities to provide safe water supplies and promote environmental sanitation through the provision of technical, financial and material support to national planning and programming.

Special attention is given at the programme level on the linkage between the provision of safe water supplies and health education which focuses on proper personal and food hygiene.

IV. Priority Activities

6.53 UNICEF's assistance to water supply and environmental sanitation programmes consists of advocacy as well as programme and project support. The advocacy role of UNICEF is specifically linked to the cycle of planning, programming, monitoring and evaluation in individual programmes and projects. Advocacy is also conducted on global and inter-country levels through various channels of communication and policy elaboration such as conferences, seminars and workshops. Direct programme and project support consists of both a supply function and the provision of non-supply assistance such as funds for training and health education.

6.54 Priority Activities in the field of water supply and environmental sanitation include:

(i) Advocacy and promotion of government policies in water supply and environmental sanitation "illustrated" and supported by appropriately programmed inputs of materials, equipment, "know-how" and training in water programmes with an area, provincial or national spread of the benefits;

(ii) Assistance in the development of strategies and approaches at all levels - national, provincial, district and community;

(iii) Strengthening government capacities for innovative planning, management, human resource development, application of suitable technologies and inter-sectoral co-ordination in water supply and environmental sanitation programmes;

(iv) Promotion of community participation, especially the participation of women, in

- identification of needs and solutions;
- planning;
- implementation, including the management, operation, and upkeep of facilities, establishment of repair and replacement systems, and full or partial contribution to the costs; and
- training activities on the proper usage and upkeep of the water and sanitation installations and on personal and food hygiene;

(v) Assistance to health and sanitation education and the training of community level workers.

(vi) Promotion and assistance to the application of simple, low-cost, appropriate technology for the provision of water supply and sanitation;

(vii) In the case of emergencies, provision of potable water supply and sanitation measures which are designed to lead to medium and long-term solutions for rehabilitation and further development;

(viii) Provision of supplies. The supply action should follow the criteria elaborated below:

- Timely action: Delays in delivery can cause governments and communites to lose impetus (and interest) in their implementation of water supply and sanitation programmes and projects.

- Local procurement, when in accordance with UNICEF supply policies, is recommended in order to save time and to stimulate local manufacturers.

- Appropriate specifications: Depending on physical and user conditions, specifications should follow the below criteria:

  Low-cost items: This allows larger spread of installations (larger coverage of population), under the normally very tight allocations.

User-oriented/adapted/acceptable equipment and materials:

This is important for the appropriate full use by the communities of items, such as handpumps, simple well digging or drilling equipment (e.g. augers) and latrines. User-oriented laboratory and field tests of e.g. handpumps (as carried out under the UNDP/World Bank Global Handpump Testing and Development Project 1980-85) should be mandatory before procurement on a larger scale. Note that user acceptance can vary widely with individual project areas.

Cost-efficiency: A careful weighing of cost vs. longevity (sturdiness, etc.) of the equipment should be undertaken before specification and procurement.

Time-saving equipment: Rapid methods for larger coverage should be utilized (e.g. water well drilling with down-the-hole equipment in hard rocks instead of cable-tool rigs, wherever possible in this particular case allowing 30-40 times a greater speed for well sinking).

- Simple operation, maintenance and repairs: The programmes, plans, designs, specifications, and procurement should foresee the installation of the simplest systems possible (e.g. spring protection, gravity feed pipe systems, protected dug or drilled wells, water lift with handpumps or hydraulic rams, VIP, double vault composting or other simple latrines). Designs should facilitate community (village) level operation and maintenance ("VLOM").

- Standardization: In order to avoid large and complicated stocks of spare parts and elaborate maintenance systems on the national level, stadardization of equipment and materials should be sought.

- Local manufacture is to be promoted, involving both development of local skills and a national industry. The production should be at a competitive level as compared to products that otherwise would have to be imported. (Examples: The manufacture of handpumps in India, Bangladesh, Malawi, PVC pipes in the Yemen Arab Republic and Zimbabwe, waste-not valves in India, etc.).

Annex 2: Reporting Procedures

Bangladesh

UNICEF Bangladesh is the largest among the 110 field offices of UNICEF world-wide. It employs 252 staff members of which 50-60 are professionals.

Fifty percent (50%) of the total budget of UNICEF Bangladesh come from special contributions from various donors, particularly Scandinavian countries and Switzerland. Unfortunately, quite often funds in trust come in limited amounts such as $100,000. Each of the many donors want a report and most of them have special requests as to individual reporting. It is estimated that for the programme under operation, about 450-500 reports will have to be written by the field office in Bangladesh to satisfy the donors. This is said to be a tremendous workload which needs special staffing. Additionally, free reporting is sometimes limited by government of the recipient country, which for UNICEF quite often makes it difficult to satisfy the information need of the donor.

UNICEF is probably the only international organization which is truly decentralized. Concerning the information policy, the field offices do not have to follow the policy guidelines of the Headquarters in New York to the letter. UNICEF Bangladesh tries to report to donors every six months. UNICEF Bangladesh agrees that the present arrangement of processing of information by UNICEF Headquarters to the various donors is the best procedure. The direct communication between field offices and donors (even through their local embassies) is not advisable because of frequent staff changes. Attempts by UNICEF to introduce a uniform reporting system have been rejected by various donors. The establishment of a new reporting officer at the UNICEF Bangladesh office still needs approval from UNICEF Headquarters.

Nepal

Nearly all funds used for water supply and sanitation projects in the Hill areas come from special contributions. So UNICEF has to write special reports for each donor, which is among the tasks of the Head of the Water Supply and Sanitation Section.

Normally, as required by UNICEF Headquarters, reports are written once a year in November. However, if the donor asks for special reports, these are prepared twice a year. The procedure of UNICEF Nepal to write reports to donors is as follows:

> There are general reports on all projects, sent via UNICEF Headquarters, New York, to the donors. At the same time, donors are asked whether they are satisfied with these standardized reports. Only in cases where donors are not satisfied with these standardized reports, special reports are written for them and special questions put by them are answered.

Up to now, donors have had only few complaints about these reporting procedures. Complaints from donors mainly concern financial accounts. Reports about financial accounts are all written by UNICEF Headquarters and not by the field office.

Burma

In 1982, there have been quite a few staff changes at the UNICEF Burma field office. Mr. Allen became Programme Officer (Water/Sanitation), responsible for the co-ordination of the UNICEF Water Supply and Sanitation inputs in July 1982, transferred from a previous posting in Africa. During the same month he received a request from UNICEF Headquarters to write a special report for the BMZ (FRG) on the programme components funded from the FRG special contribution for water supply. Because of his own need for an introductory period, he could write that report only in September 1982. It was then forwarded to Headquarters and reached the German donor only in November.

Normally UNICEF Burma reports once a year, in November, on all projects and writes special reports for special contributions. Mr. Allen had not heard of any special FRG requirements, except that in 1982 the BMZ requested the annual report earlier than usual.

Mr. Allen had not heard of any criticism about the standardized reporting system of UNICEF Burma in the fields of water supply and sanitation. No complaints about limiting the reporting to once a year have reached UNICEF Burma. The only observations noted, have been on possible delays of reporting or about the contents of the reports.

Expenditures for water supply projects in 1982 had been delayed because for technical and administrative causes lying with the Government of Burma. At the end of February, however, all funds earmarked in 1982 had been spent properly and completely..

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In all three countries, UNICEF staff members pointed out that they would be very interested in and grateful to any feedbacks and comments on their reports.

Annex 3

Country Itineraries and Lists of Persons Met

Joint FRG/UNICEF Assessment of
UNICEF-Assisted Rural Water Supply Projects in
Bangladesh, Nepal and Burma (17 Feb. - 16 March 1983)

Participants

MB =	Martin Beyer	UNICEF (Senior Adviser WES)
HW =	Heinecke Werner	FRG Consultant (Socio-Economist)
HS =	Hartmut Sacher	FRG Consultant (Civil Engineer)

Annex 3.1.1: Detailed Itinerary in Bangladesh

Date	Location	Programme / Travel Notes
17.2	Leave Germany	via Paris. New Delhi (HW and HS)
18.2	Arrive Dhaka	arriving Dhaka with delay (6 p.m. instead of 10:00 a.m.)
19.2	Dhaka	First briefing with Mr. K. Gibbs (Chief WES Section/Programme) from 10 a.m. to 4 p.m.
20.2	Dhaka	Meeting with Mr. K. Gibbs and Mr. W. K. Journey (World Bank) demonstration of TARA handpump
21.2	Dhaka	MB arrives from NY; discussion of UNICEF Bangladesh Water and Santitation Programme with Mr. Gibbs.
22.2	Dhaka-Rangpur	Flight/drive to Rangpur; discussion with UDR, EE and SDE of DPHE; visit test sanitation project area.
23.2	Rangpur-Kurigram-Bogra	Meet SDE, SAE Kurigram: visit iron removal plant; sludger method demonstration; discussion with Thana WSS committee
24.2	Bogra-Shazadpur-Siranjganj	Discussion with EE, SDE (DPHE Bogra) and UDR Bogra-Pabna; visit store Bogra; visit men's and women's caretaker training courses at Shazadpur.
25.2	Sirajganj-Tangil-Dhaka	Demonstration of TARA handpump at Gazipur/Tangil (test sites)
26.2	Leave Dhaka for Kathmandu	Final discussions with Mr. K. Gibbs

Annex 3.1.2 - List of Persons Met in Bangladesh

Mr. Uffe König	UNICEF Representative
Mr. Joseph Sclafani	Senior Programme Co-ordinator
Mr. Kenneth R. Gibbs	Project officer, (Chief, Water and Sanitation)
Mr. A.S. Azad	Assistant Programme Officer
Mr. Stanley R. Hall	Assistant Project Officer (Water)
Mr. Jahangir Kabir	Assistant Programme Officer
Mr. Aminul Islam	
Mr. Aptab Hossain	
Mr. Ibnul Hassan	
Mr. Osman Ghani	
Mr. Ishaque Ali	
MD. Ibrahim	
MD. Mofazzal Hossain	
A.K.M. Nurol Amin	
MD. Kamruzzaman	
Sharif Uddin Ahmed	
MD. Abdul Baki	

Annex 3.2.1: Detailed Itinerary in Nepal

Date	Location	Programme / Travel Notes
26.2	Leave Dhaka for Kathmandu	Arrive Kathmandu: first briefing with Mr. Colin Glennie
27.2	Kathmandu-Simra Malangwa	Visit foundry near Simra (local handpump production planned); drive to Malangwa
28.2	Malangwa-Janakpur	DWSS tubewell programme; programme sites demonstration sludger method; latrine programme/construction
1.3	Janakpur-Lamidanda	Visit DWSS office and store; visit primary school Lamindada
2.3	Lamidanda	Visit gravity flow scheme Kharpa Thimki, Khotang District, Eastern Region
3.3	Lamidanda	Visit gravity flow scheme Tirpa/Khotang District, Eastern Region
4.3	Lamidanda-Kathmandu	Flight to Kathmandu; meeting UNICEF/SATA/WES staff; meeting Decade national group;
5.3	Kathmandu	Visit Sanitation project (Vanessa Tobin) near Kathmandu
6.3	Bhaktapur - Leave Kathmandu	Visit GTZ/project area of Bhaktapur; Visit UNICEF greeting card factory.

Annex 3.2.2 - List of Persons Met in Nepal

Mr. Malcolm Kennedy	UNICEF Representative
Mrs. Maria Diamanti	Programme Officer (Education and Social Services)
Mr. Stewart McNab	Programme Officer (Health and Applied Nutrition)
Mr. William Matheson	Project Officer (Education Programme Adviser
Mr. Fergus MacIntosh	Programme Officer
Mr. Colin Glennie	Project Officer (Water and Environmental Sanitation)
Miss Vanessa Tobin	Assistant Programme Officer (Sanitation)
Mr. Prem Subba	Assistant Project Officer (Water and Environmental Sanitation)
Mr. Datta Tray Roy	Assistant Project Support, and Communications Officer
Mr. Lawrence D. Robertson	Project Officer, Malangawa, Nepal
Mr. Henk Van Norden	Assistant Project Officer (WES) Biratnager, Nepal
Mr. Erik Baetings	Assistant Project Officer (WES) Lamidanda, Nepal
Mr. Bhai Raja Sakya	Assistant Project Officer (WES) Surkhet, Nepal
Mr. Niranjan Shrestha	Assistant Project Officer (WES) Illam, Nepal
Raghvendra Upadhyay	
Bhai Raja Salya	
Secretary Sherta, MPLD	

Annex 3.3.1: Detailed Itinerary in Burma

Date	Location	Programme / Travel Notes
7.3	Bangkok-Rangoon	Meeting Department of Public Health (DG) and Asst. Director ESD; meeting IDWSSD technical support team (UNDP/WHO) at UNICEF office.
8.3	Rangoon-Taungoo	Artesian wells, handpumps (Oktwin Township; RHC/school water supply; water-jetting rigs; meet Dry Zone project staff.
9.3	Taungoo-Sagaing-Meiktila	RWSD compressor and Station Hospital water supply; Thinpangon (mono pump); Meiktila RWDS Station and Store.
10.3	Meiktila-Sagaing-Monywa	Sagaing Station and Store; water supply installations en route.
11.3	Monywa-Ayadaw-Mandalay	Meet TMO, visit latrine construction pilot project villages; RHC/Schools.
12.3	Mandalay-Rangoon	Return to Rangoon; rest and review field trip; HW leaves for Germany.
13.3	Rangoon	Rest and review field trip.
14.3	Rangoon-Bangkok	Meeting DG of AMD, Director RWSD and concerned agencies (ESD, DMR, FERD, ADAB, WHO, UNDP, UNICEF).
15.3	Bangkok	Meeting with UNICEF staff members, regional and country office, Bangkok. End of Mission.

Annex 3.3.2 - List of Persons Met in Burma

Mr. Haavald K. Kuloy	UNICEF Representative
Mr. Guy B. Scandlen	Programme Officer (Education/Social Welfare)
Mr. Lars Wadstein	Project Co-ordinator
Mr. Steven Allen	Programme Officer (Water/Sanitation)
U Ngwe Thein	Assistant Project Officer (Water/Sanitation)
Mr. Samphy Lhalungpa	Assistant Project Support, Communications, and Information Officer
U Aung Min Human	Assistant Programme Officer (Water/Sanitation)
Mr. William Lee	Project Officer (Instructor for Maintenance)
Mr. Allen D. Bush	Project Officer (Drilling Engineer)

Annex 3.4 - List of Persons Met in Thailand

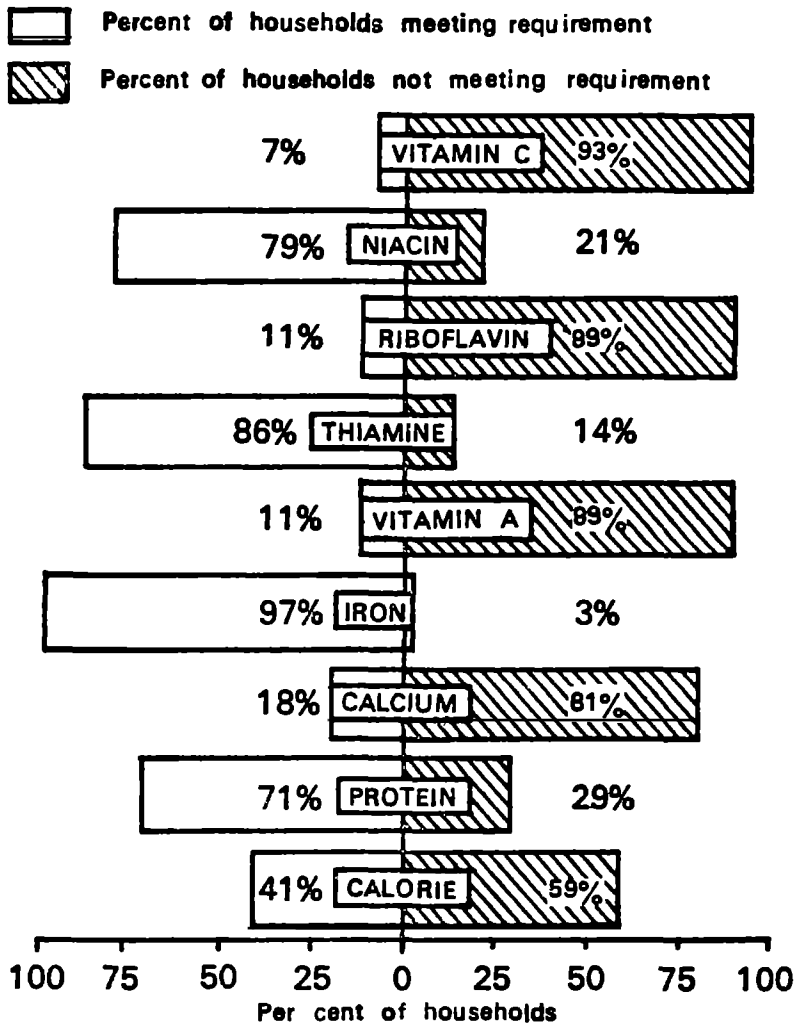
Office of the Director - Bangkok, Thailand

Mrs. Titi Memet-Tanumidjaja	UNICEF Regional Director
Ms. Johanna Strieck	Regional Auditor
Mr. Lawrence Ostlund	Supply Officer
Ms. Jane Bunnag	Regional Programme Support and Communications Officer

Annex 4

FIGURE

PER CENT OF HOUSEHOLDS MEETING AND NOT MEETING DIFFERENT NUTRITIONAL REQUIREMENTS

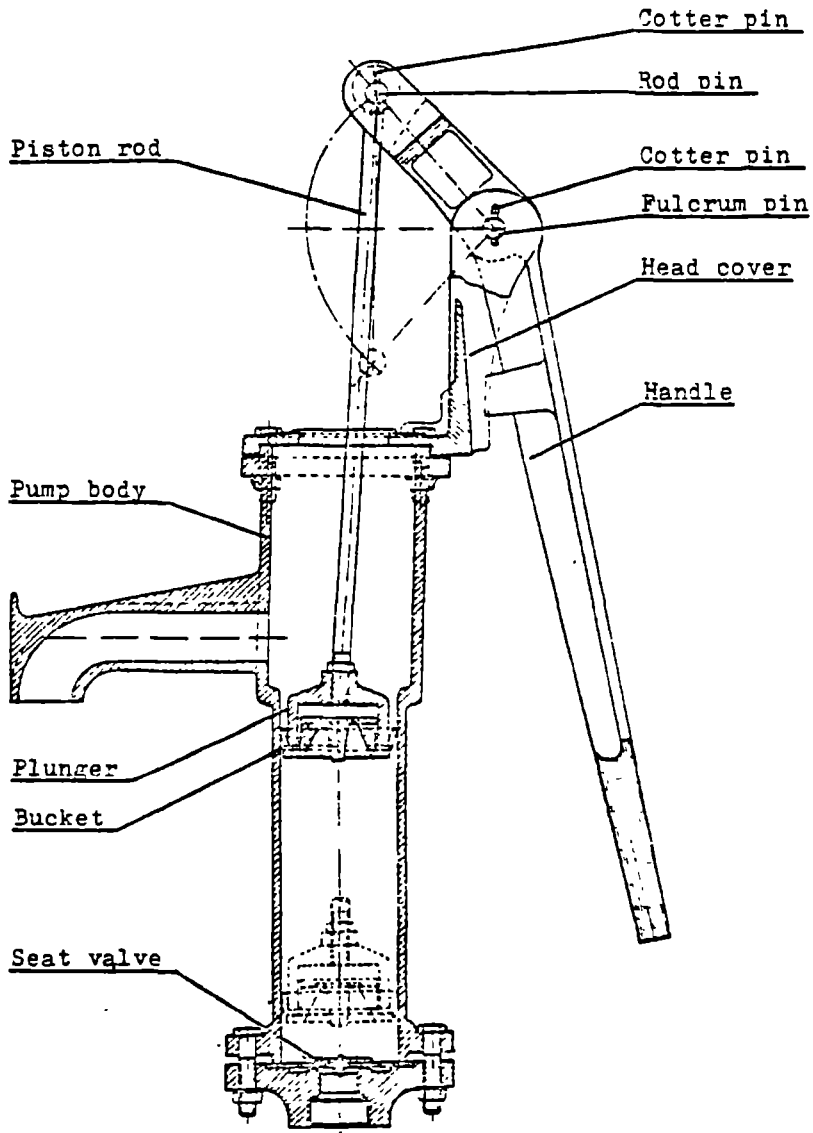


Source : Nutrition Survey of Rural Bangladesh 1975/76
Institute of Nutrition and Food Science
University of Dacca.

Annex 5. Notes on the New No. 6 Handpump, Bangladesh

Technical drawing and extracts from the World Bank Handpump Testing Programme (Consumers Association, England conducted the test in 1980).

NEW NO 6 HANDPUMP



Joint FRG/UNICEF

Assessment mission

19.2. ÷ 26.2.83

1. Ordering and delivery

Quotation:	13 weeks
Delivery:	5 weeks
	18 weeks

2. Cost of pumps (including carriage, insurance, etc.)

Two pumps: CIF London US$ 464,00
(Free of charge by UNICEF, Dacca)
local price approx.: US$ 29,00 (ex factory)

3. Inspection and measurement

3.1 Packing

Open wooden packing case with corrugated cardboard liner (rated as very suitable for export / overland transportation)

Remarks in the report:
These pumps were well packed, in a single wooden packing case with corrugated cardboard lining. The cardboard liner would be adversely affected by water, but it and its contents were well supported by the wooden case.

3.2 Defects on delivery

Component or feature	No. of pumps affected	Defects
Piston to rod joint	1	Locknut not tight enough
Piston	1	End cap not tight enough
Cylinder tops	2	Loose - spring washers had been placed under the bolt heads; should be under the nuts

3.3 Literature

No literature supplied.

3.4.1 Weight and Measures

Pump Stand	Drop* Pipe	Nominal Cylinder Bore	Actual Pump Stroke	Nominal Volume per Stroke	Drop** Pipe size
(kg)	(kg/m)	(mm)	(mm)	(ml)	(mm)
31,0	3,8	90	219	1393	37,5

* including couplings ** or 1 1/2 inches

3.4.2 Cylinder Bores

A surface roughness average of 2.4 (m) was measured for the two samples. (The IRC handbook on handpumps, Technical Paper Series, No. 10, suggests that good quality machined cast iron should have a surface finish in the range of 1.3 to 5.1 m). No significant taper or ovality was found.

3.4.3 Ergonomic Measurements

Handle Height Max (mm)	Handle Height Min (mm)	Plinth Height (mm)	Angular Movement of Handle (degrees)	Handle Height (mm)	Velocity Ratio of Handle	Height of Spout (mm)
1190	400	280	100	595	4.7:1	583

4. Engeneering Assessment

Pumps stripped down to their component parts and each part examined for suitability of design, choice of materials and manufacturing process and workmanship. -- The assembled pump was then assessed for potential safety hazards, resistance to contamination by foreign matter and surface water, resistance to abuse (including pilferage) and ease of maintenance and repair. -- The manufacturing process and the level of skill required are summarized.

4.1 Materials

COMPONENT	MATERIAL(S)
Pumpstand	Cast iron
Handle	Cast iron
Piston	Cast iron
Cup seal	Moulded PVC
Base valve	Leather

4.2 Manufacturing process and skills

Iron foundry	2
Steel forging and welding	2
Simple machining	2
Leather cutting and forming	2
Rubber/plastics moulding	2
	10 SCORE

(second lowest score within the twelve tested handpumps: range 8 to 27)

Rating is based on the following 5-point scale:
very high skill = 5 very low skill = 1

4.3 Maintenance and repair

Rating: 5 (very difficult = 1 and very easy = 5)
Comments: This pump was rated to be easy to repair and to need a minimum of maintenance.

4.4 Resistance to contamination

Rating 2: (rating very poor =1 and very good =5)
Comments: Due to the construction the pumpstand is open at the top (where connecting rod passes through pump top).

4.5 Resistance to abuse

Rating 2: (rating very poor = 1 and very good = 5)
Comments: Cast iron handle and pump top susceptible to accidental damage - attachment to rising main potentially weak, whole pump might be too easily detached. Pins and bolts too easy to remove.

4.6 Potentail savety hazards

Split pins, with sharp ends, are used to retain the pivot pins for the handle.

4.7 Suggested design improvements

The cylinder top casting should be robustly webbed at the roots of the fulcrum extentions.
A sliding plate on the connecting rod (in the manner of the UNICEF Bandung handpump from Indonesia) would help to prevent contamination.
The diameter of the rising main (drop pipe) should be increased and/or cast mounting lugs should be provided on the pumpstand.
The handle should be more robustly designed or made in a more resilient material (such as wood).

5. User trial

More details see original report and chapter 8 in this annex.

Here: Observations

Many users were pleasantly surprised by the performance of this pump, contrasted with its crude appearance. It delivered plenty of water for each stroke, and the handle movement allowed arms, shoulders, back and legs to contribute. Some disliked the roughness of the handle.

6. Pump performance

Leakage test:	0.25	ml/min
Average volume per stroke:	1.26	l
Average work done per stroke:	134.3	Joules
Average efficiency:	63.6	%

Note: Three performance tests at 20, 30, and 40 strokes per minutes against 7 m actual head were carried out. The above listed results are the average values of these three tests.

Detailed results:

Strokes per minute	20	30	40	Average
Volume per stroke (l)	1.30	1.20	1.29	1.26
Work per/stroke (Joule)	148	121	134	134.3
Efficiency (%)	59	67	65	63.6

7. Endurance

No failures and no apparent problems within the first 1000 hours of operation (test conditions: clean water, ph 7.2, 7 m actual head, 30 strokes per minute, simple harmonic motion). The New No. 6 pump showed a marked deterioration in performance.

Volume flow after 1000 hours:

Strokes per minute	20	30	40	average
Volume l per stroke	0.58	0.86	1.05	0.83

Dismantling the pump showed a rather stiff cup seal and a mis-shapened piston valve. The cup seal only was replaced but this produced no significant improvement. The complete piston assembly was replaced and the pump retested. This restored the performance of the pump.
After restoring the check valve the leakage rate dropped from 4 to 1.3 ml/min.

Other comments after the test:
- most parts beginning to rust
- cylinder bore noticeably less rough than when new (0.24 m compared to 2.4).

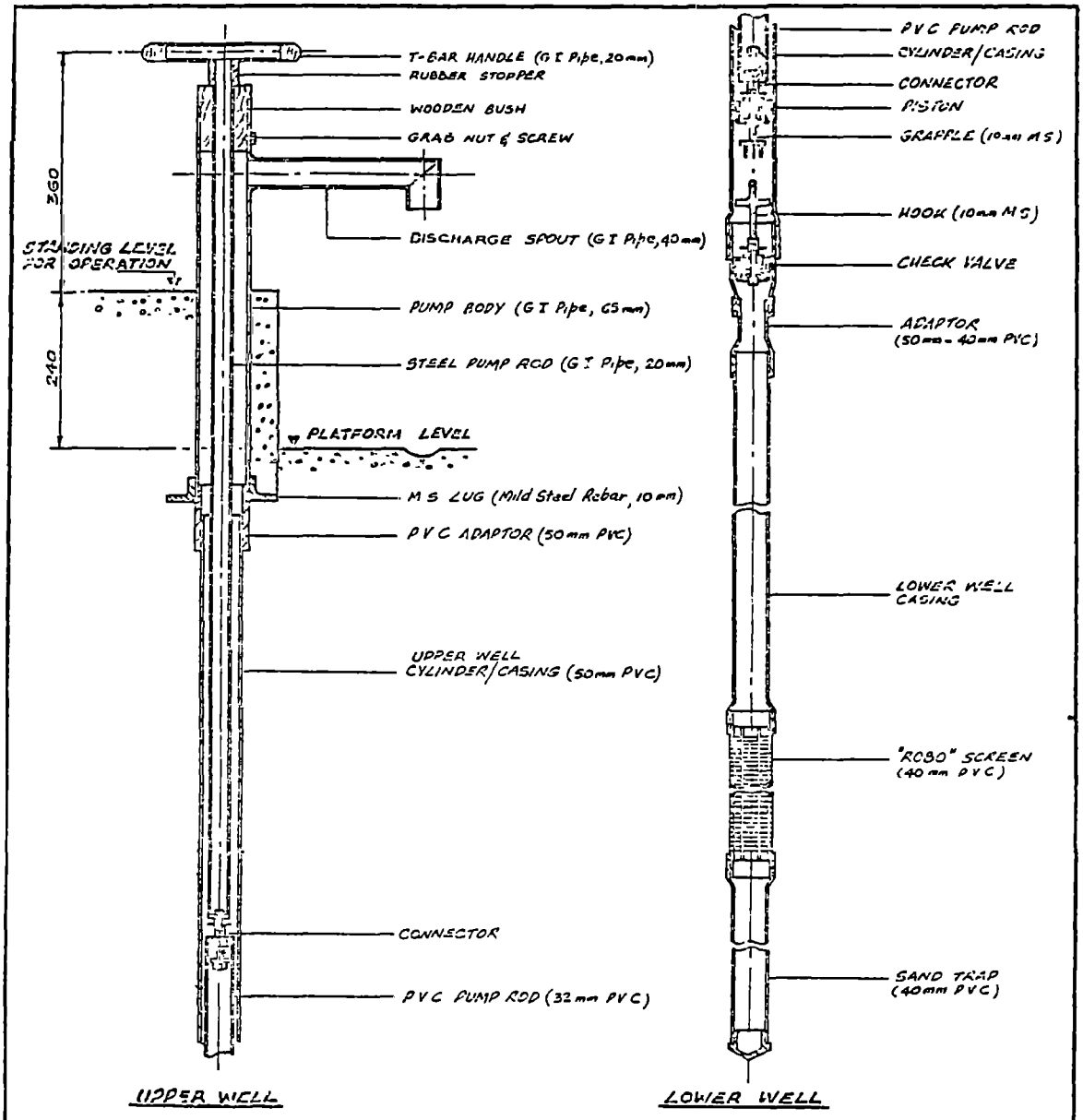
8. User response

(For detailed results refer to the original report).

User responses (question and answer):

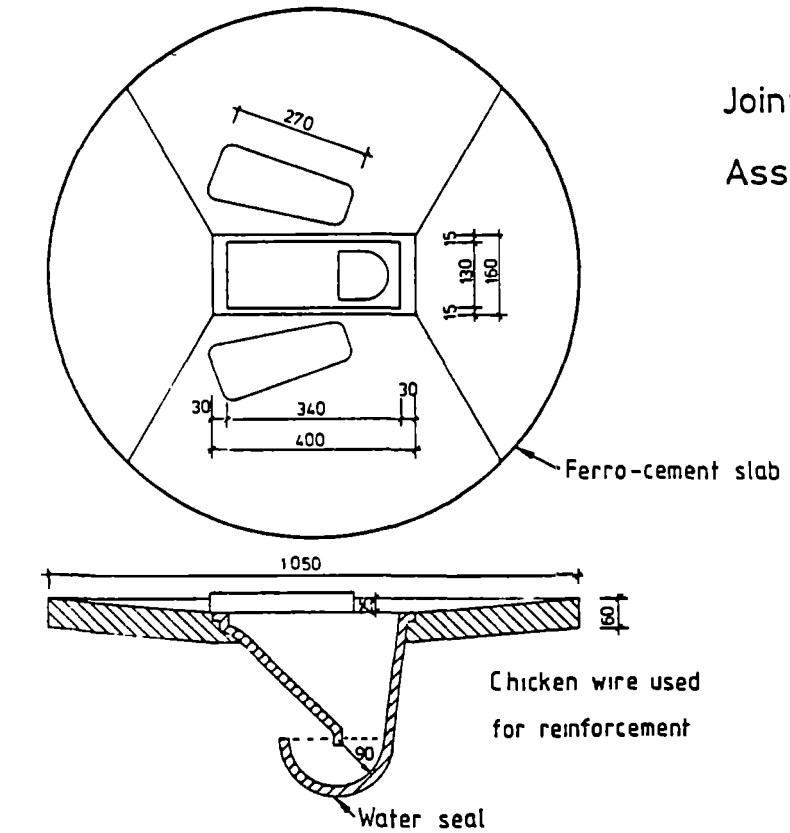
Suitability of handle:	about right
Handle comfort:	mean (tendency to worse)
Effort required to workpump:	better than mean
How easy to operate pump overall:	better than mean
Meantime taken to fill bucket (10 l):	19.9 (seconds)
Mean number of strokes to fill bucket:	9.8

Annex 6: Drawings of the TARA Force Mode Handpump, Bangladesh



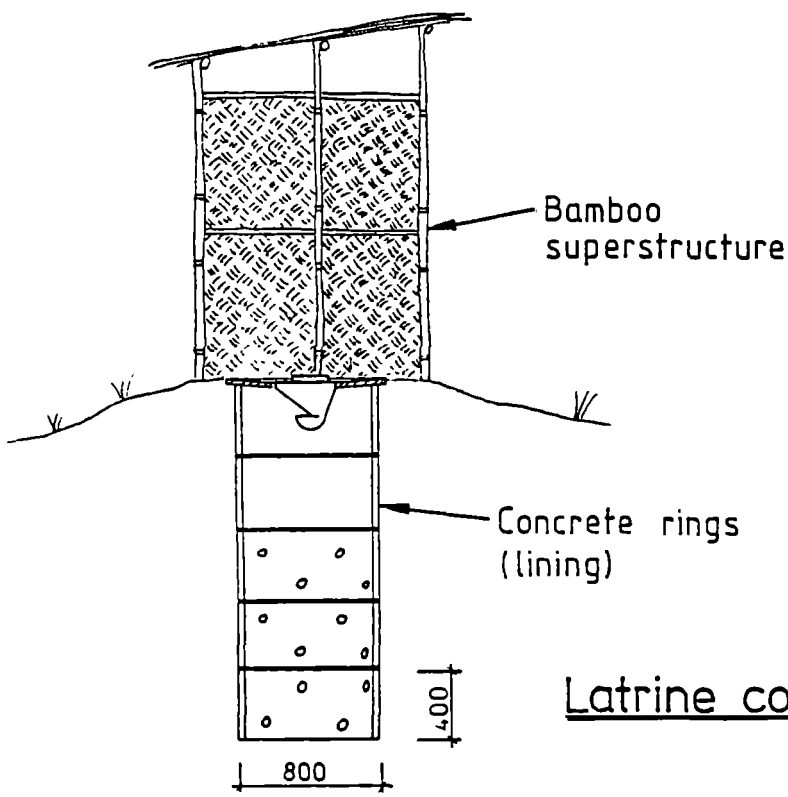
	SIGNATURE	DATE	
Joint FRG/UNICEF	DESIGNED BY		UNICEF G.P.O. BOX 58 DHAKA BANGLADESH
Assessment mission	DRAWN BY	1/11/82	BANGLADESH DEEP-SET HANDPUMP MARK I
19.2. - 26.2.83	CHECKED BY		TITLE: COMPLETE HANDPUMP AND TUBEWELL ASSEMBLY
	APPROVED BY	24/83	SCALE 1:8 · DRG. NO. T C1 · REV.

Annex 7: Water Sealed Latrine (General Construction)



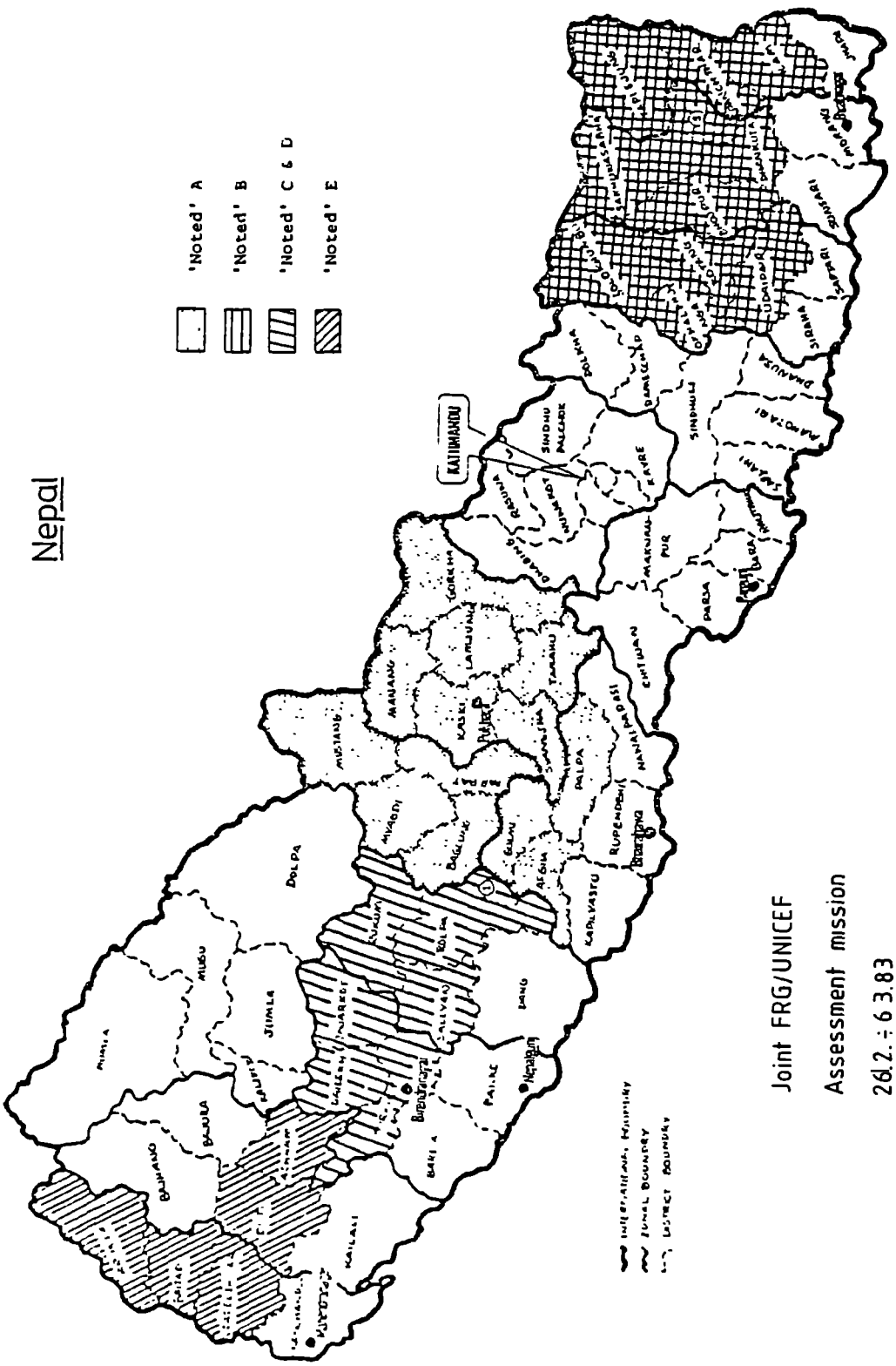
Joint FRG/UNICEF

Assessment mission



Latrine construction [mm]

Annex 8 Map of Nepal, with Districts and "Noted Fund" Project Areas



Annex 9.

List of UNICEF Material Assistance/Contribution in Nepal

- HDP pipes and fittings
- GI pipes and fittings
- Brass fittings
- Cement
- Handpumps and handpump development costs
- Filter screens and sandtraps
- Latrine construction materials
- Imported spare parts
- Vehicles
- Charge for quality control
- Technicians' salaries
- Sanitation promotion materials
- Training, equipment for training
- Other cash assistance
- Consultancies and special studies
- Temporary subsidy of Government manpower costs

Annex 10 Form for the Well Log and Tubewell Diagram

Form No. 02/82

TERAI RURAL WATER SUPPLY AND SANITATION PROJECT

WELL LOG AND TUBEWELL DIAGRAM

Joint FRG/UNICEF
Assessment mission
26.3 ÷ 6 3 83

Panchayat Name _____ Ward No. _____
Village _____ District _____
Tubewell No. _____ Report By _____ Date _____

FIELD LOG

0 m

(State color of soil)

10m

20m

30m

40m

TUBEWELL DIAGRAM

10m

20m

30m

40m

WATER QUALITY

Iron content	PPM
E. Coli	
Taste (acceptable)	Yes/No
Odor (objectionable)	Yes/NO

LEGEND

- Clay (CL) 0.002 mm
- Silt (ST) 0.002-0.06 mm
- Fine Sand (FS) 0.06-0.2 mm
- Medium Sand (MS) 0.2-0.6 mm
- Course Sand (CS) 0.6-2.0 mm

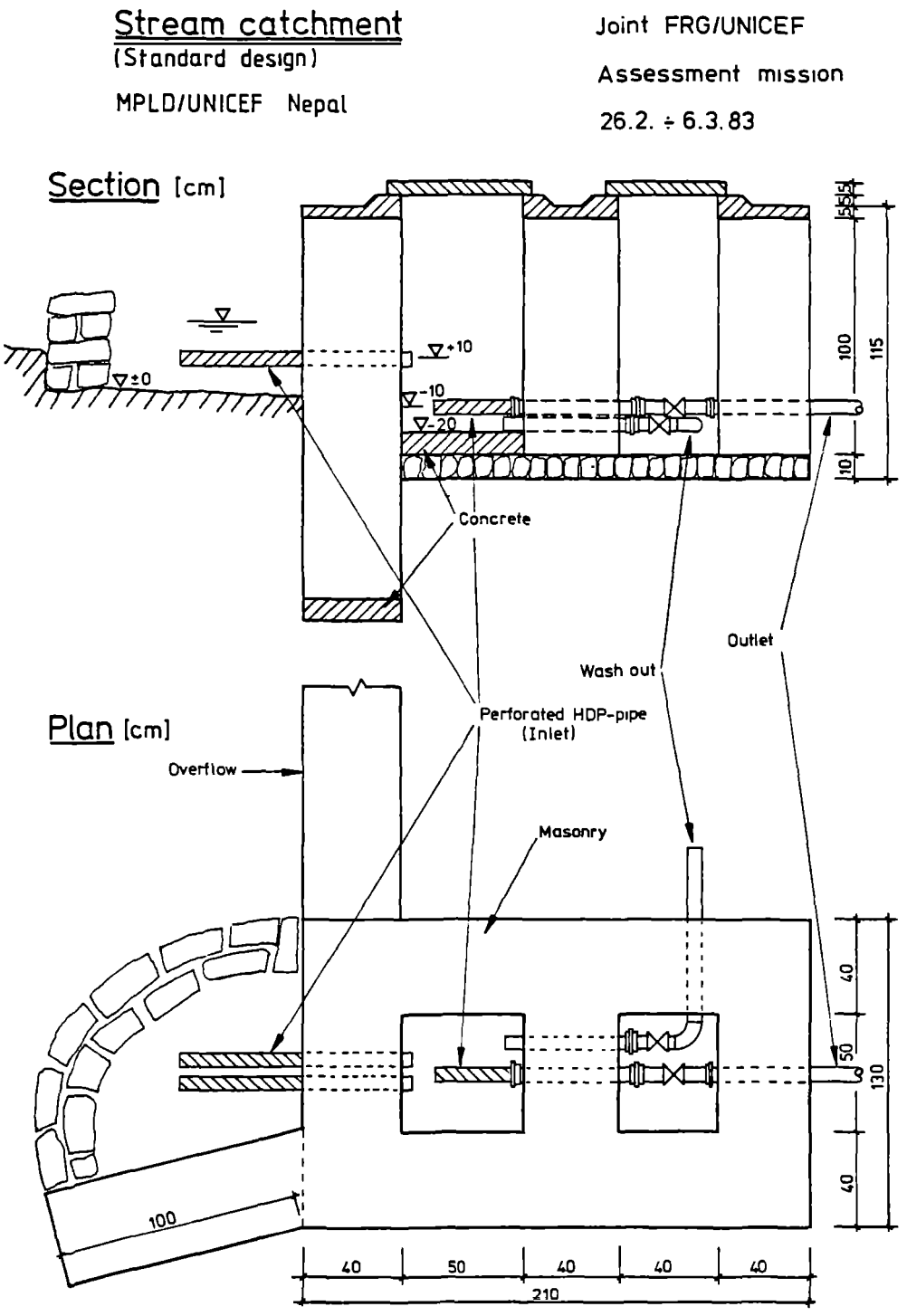
Static Water Level: _____

Date. _____

Remarks:

Signature: _____

Annex 11 Standard Designs for the Gravity Flow Systems in Nepal
11.1 Stream Catchment

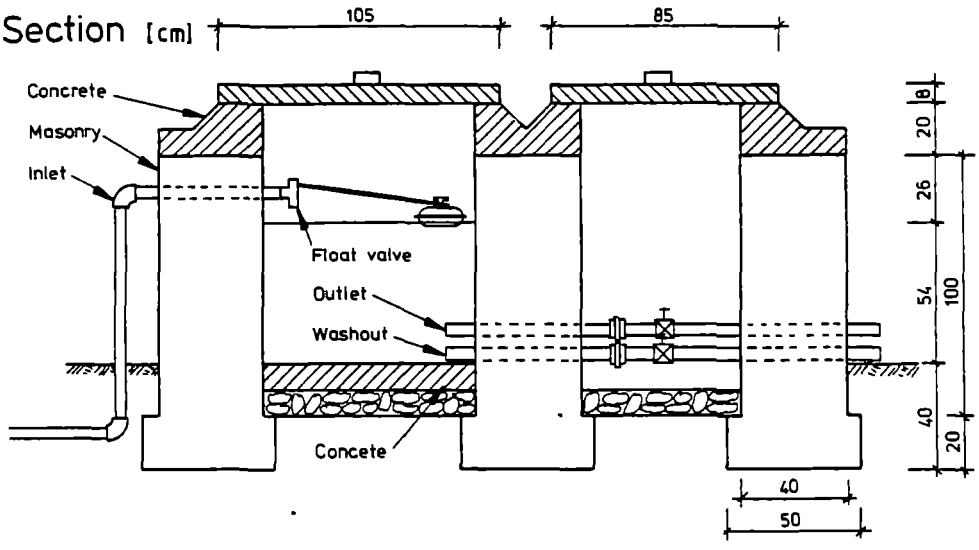


Annex 11.2: Break Pressure Tank

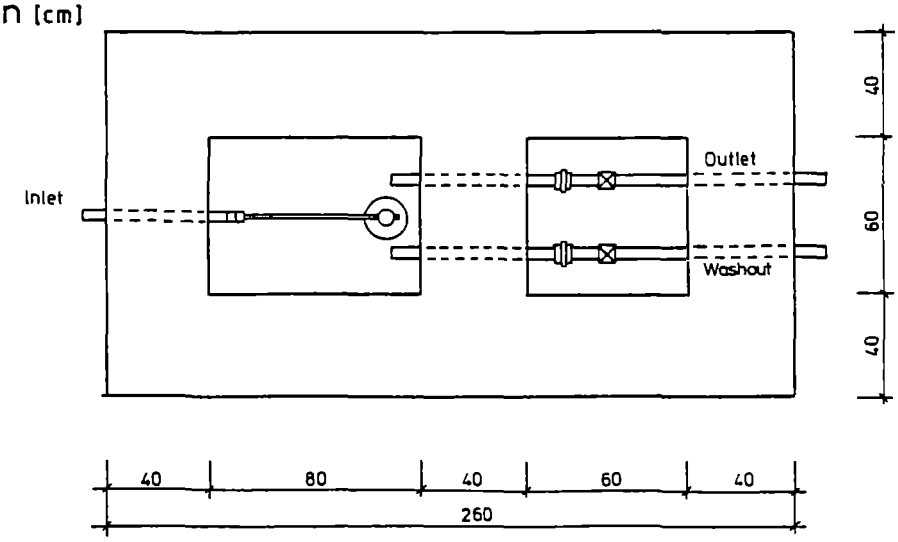
Break pressure tank (Standard design)

MPLD/UNICEF Nepal

Section [cm]



Plan [cm]

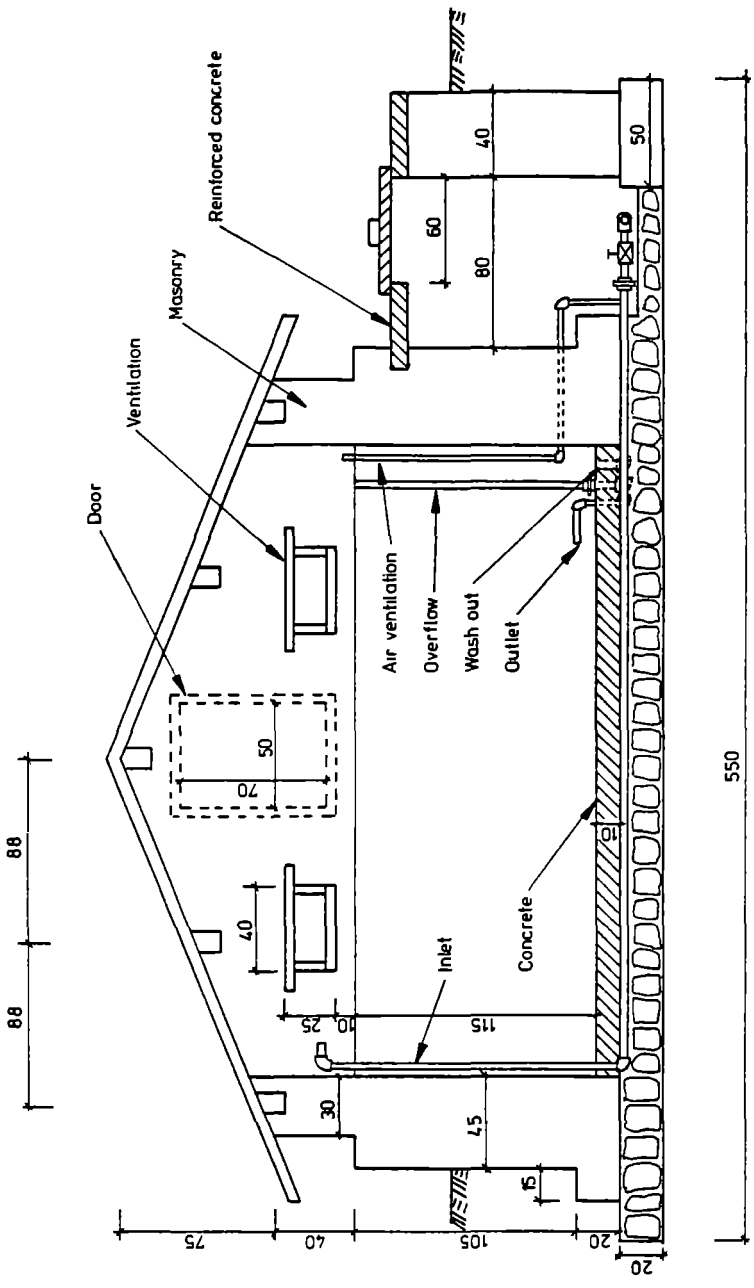


Joint FRG/UNICEF

Assessment mission

26.2 ÷ 63.83

Annex 11.3. Reservoir Tank



Reservoir tank (Standard design) Joint FRG/UNICEF

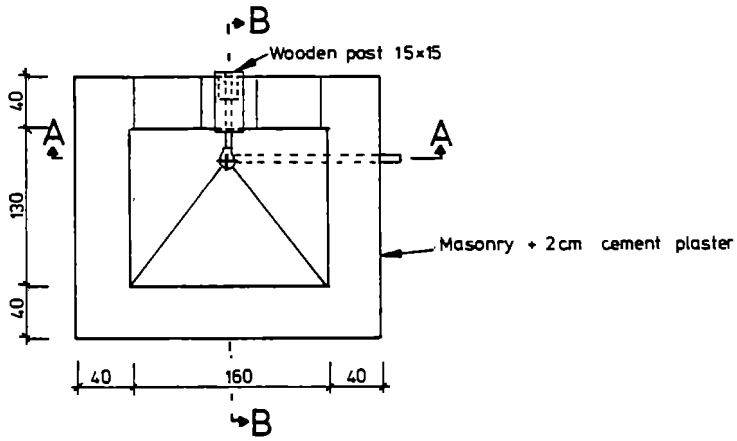
MPLD/UNICEF Nepal Assessment mission

Section (cm) 26.2.÷6.3.83

Annex 11.4: Tapstand

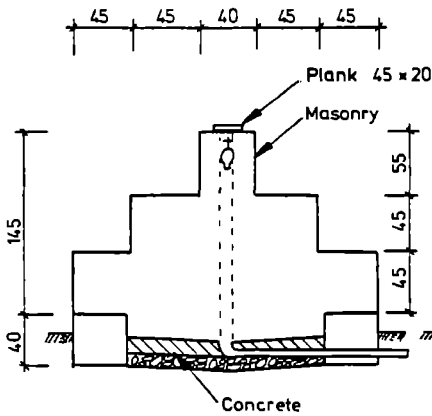
Tapstand (Standard design)

MPLD/UNICEF Nepal

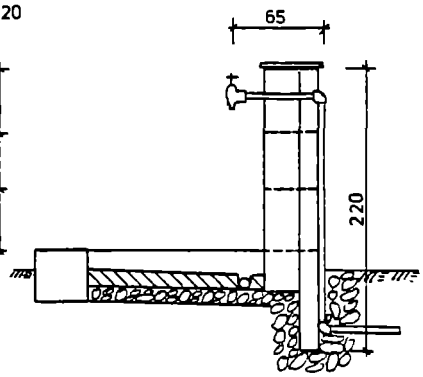


Plan [cm]

Section A-A [cm]



Section B-B [cm]

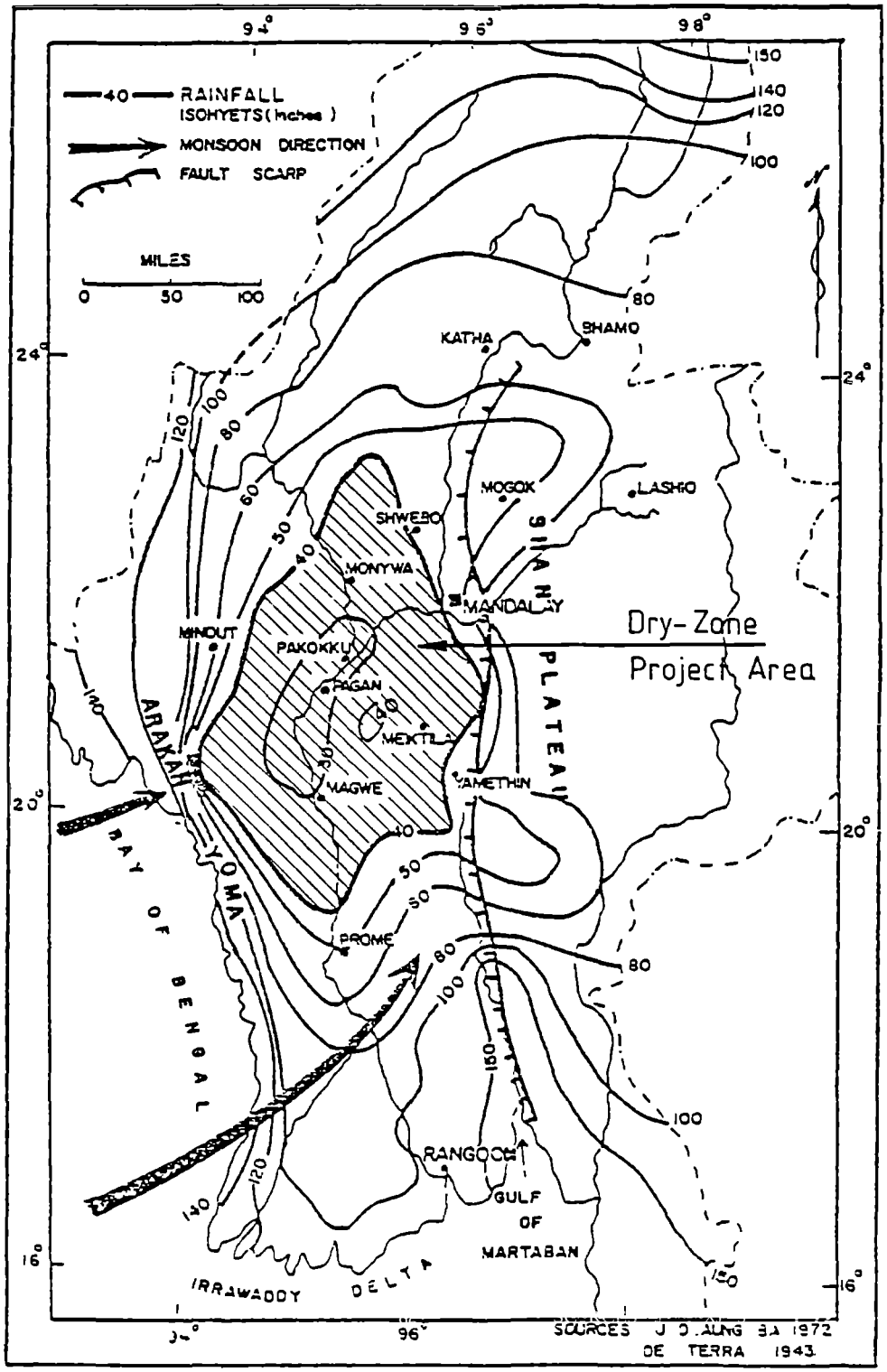


Joint FRG/UNICEF

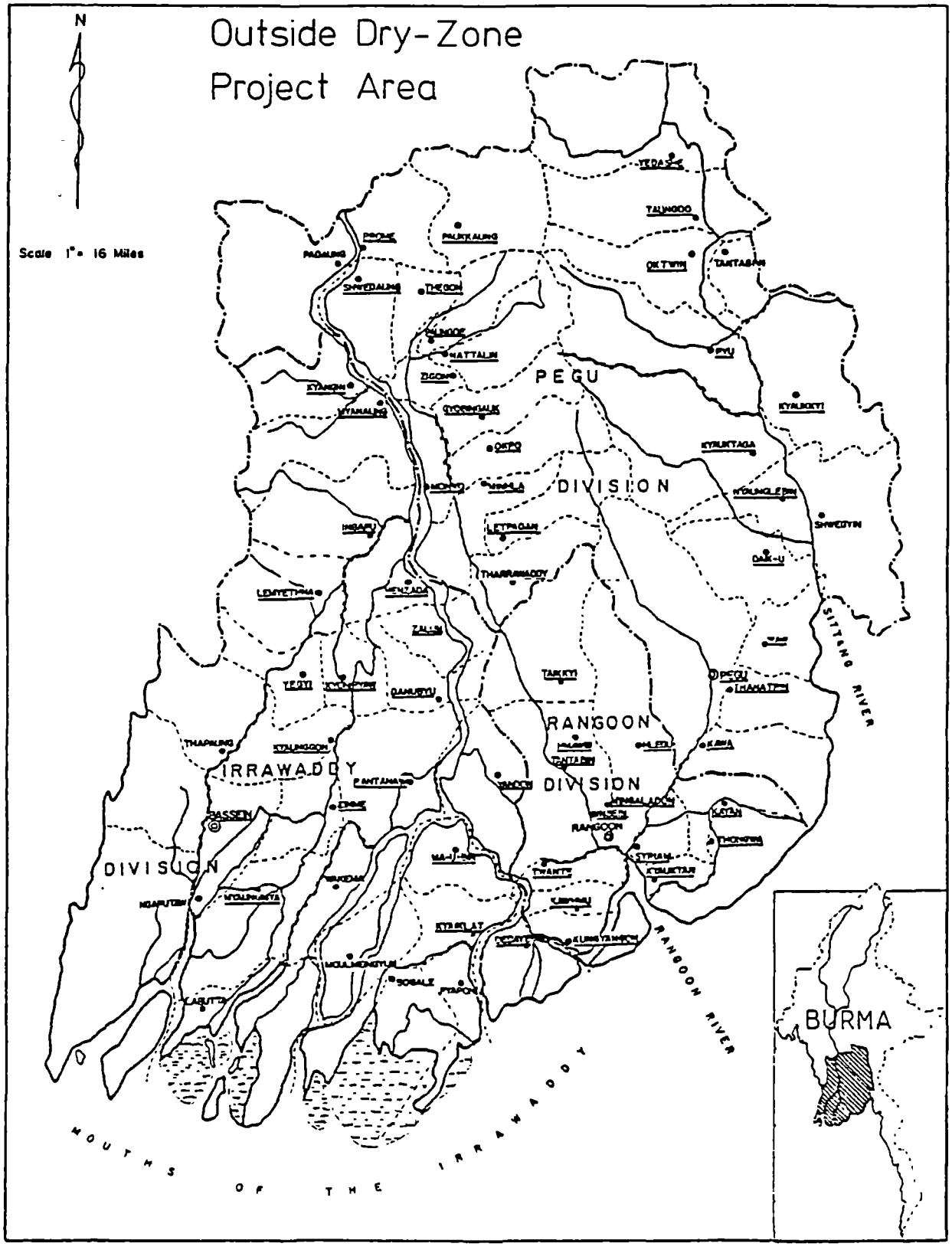
Assessment mission

26.2 - 6.3 83

Annex 12: Rainfall Distribution in Burma



Annex 13: Outside Dry Zone Project Area



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