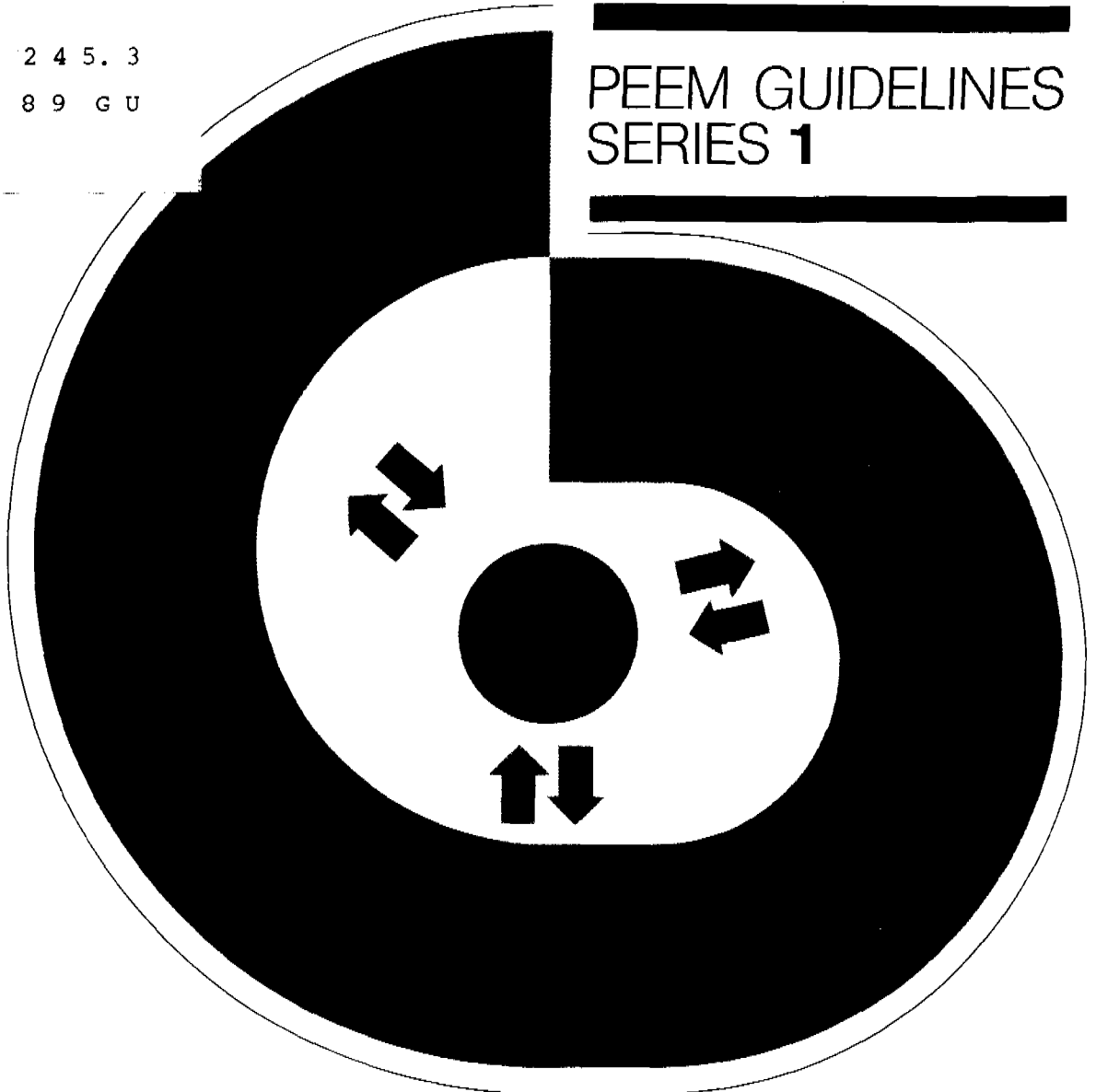


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PEEM GUIDELINES SERIES 1



Guidelines for the
INCORPORATION OF HEALTH SAFEGUARDS
into irrigation projects
through intersectoral cooperation



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**Joint WHO/FAO/UNEP Panel of Experts on Environmental
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**Guidelines for the
Incorporation of Health Safeguards
into Irrigation Projects
through Intersectoral Cooperation**

with special reference to the vector-borne diseases

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About PEEM

The Panel of Experts on Environmental Management for Vector Control (PEEM) was established in 1981 as a joint activity of the World Health Organization, the Food and Agriculture Organization of the United Nations and the United Nations Environment Programme. The Panel's objective is to create an institutional framework for effective interagency and intersectoral collaboration by bringing together various organizations and institutions involved in health, water and land development and the protection of the environment, with a view to promoting the extended use of environmental management measures for disease vector control in development projects. PEEM's secretariat is at WHO, Geneva, Switzerland.

The PEEM guidelines series contains guidelines and manuals that have been prepared under the auspices of the Panel, usually in follow-up of a technical discussion held at one of the annual Panel meetings. Publications in this series aim to give technical guidance to a multidisciplinary audience whose responsibilities have an interface with the vector-borne disease implications of development projects.

About the author

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The issue of this document does not constitute formal publication, and the statements and views expressed in it are the responsibility of the author alone and do not necessarily reflect the policies of the three participating organizations. The designations employed and the maps in annex 1 do not imply the expression of any opinion whatsoever on the part of the three agencies concerning the legal status of any country, territory, city or area or its authorities, or concerning the delimitation of its frontiers or boundaries.

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Preface

Objectives And Target Audience

These guidelines are written for policy makers, planners and managers who find that an irrigation project has come within their area of responsibility, but who are themselves neither irrigation nor health specialists. In addition, it will also be useful to those who are specialists in one aspect and who want to know about others. Both the health and the engineering targets are discussed within an economic framework, for irrigation projects are usually costly, and they have to be carefully assessed to see that the expected benefits will indeed flow and will outweigh the costs.

Since responsibilities for planning occur at many levels, it is assumed the audience may be working in any one of the following:

- national ministries or public authorities responsible for health, water resources or agricultural development, or in ministries of planning, finance, etc.
- regional, provincial or district development authorities
- development banks, other multi- or bilateral agencies or international development institutions
- non-governmental organizations (NGOs) active in the field of water resources development, health or environmental matters
- consulting firms active in the field of water resources development
- large construction firms.

The Design Of The Guidelines

For the benefit of those unfamiliar with the main health risks and counter-measures **Chapter 1** gives a brief overview of:

- the main vector-borne diseases which are associated with irrigation development
- the circumstances in which they are likely to pose significant health problems
- a brief review of measures that can be taken for their prevention and control.

The overview aims to alert planners who are not specialists in health to the need for collaboration between agricultural and health authorities. Equally, it aims to alert health planners to the possible impact of irrigation projects, so that they can actively seek a role in their planning.

Those already familiar with these matters can turn to **Chapter 2** which looks at the economic aspects with which planners are particularly concerned. It looks briefly at the economic benefits of health, and at problems in the economic analysis of costs and benefits.

After this introduction, the publication proceeds to its main purpose, which is to give guidance on the types of collaborative, intersectoral action that need to be undertaken at different stages in the project cycle, so that the most effective and economic measures can be selected and promoted at the appropriate time. In **Chapter 3** this is illustrated by reference to the different stages through which a large, new irrigation project is identified, planned, implemented and evaluated. It will be shown that two of the four most important moments in time when cost-effective health measures can be introduced come early in the planning cycle, so it is very important that these opportu-

nities are not missed. Intersectoral collaboration is particularly crucial in:

- the drawing up of **Terms of Reference** prior to feasibility studies
- **the feasibility study** (at the end of which many of the design features important to health will be settled)
- **the financial negotiations** which establish the resources available in different ministries.

However, it is also emphasized that much of the benefits, both on the economic side and the health side, will depend on **maintenance and monitoring during the operational phase**, which should be the longest period in the life of the scheme.

In **Chapter 4** the important additional health considerations introduced by a **resettlement** component are considered, and points requiring special attention in this type of project are briefly outlined.

Chapter 5 considers the different measures and institutions which have to be used when we are dealing with **small-scale informal irrigation**. This is often initiated by farmers, is less under government control, and is carried out by persons with considerably less professional skill than those engaged in large projects. Nevertheless, these small schemes have important benefits.

Chapter 6 looks at the different style of planning that is appropriate for the **rehabilitation** of old schemes. It concludes with a section on standards that is also referred to in earlier chapters.

Planners will be able to identify the section of the guidelines that applies to their own particular situation, either by reference to the type of scheme concerned, or by reference to the stage in the project cycle.

Useful further references including more detailed guidelines for professional engineering or health planners are listed in the bibliography. **Annex 1** shows the geographical areas where the diseases described in the guidelines are prevalent. A checklist of major steps for the prevention and control of vector-borne diseases at each phase

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of the project cycle is given in **Annex 2**. In **Annex 3**, three memoranda of understanding between the irrigation authorities and the health sector in the Philippines are presented.

The guidelines are not intended to be a manual on irrigation planning or a detailed guide to the methods of providing health safeguards. They confine themselves to the areas where irrigation and health overlap. It is recognized that irrigation planning is complex, and that a successful project must take into account the needs and wishes of the people in the project area, the abilities and resources of the ministries most concerned with operation and maintenance, and the physical and technical aspects of the local resources of land and water. Those who need more detailed information will find references in the bibliography.

These guidelines are the first in a series of guidelines produced under the auspices of the joint WHO/FAO/UNEP Panel of Experts on Environmental Management for Vector Control (PEEM). The second document in this series, *Guidelines for Forecasting the Vector-borne Disease Implications of Water Resources Development*, will be published shortly¹. It is strongly recommended that those in charge of the prefeasibility and feasibility studies of a water resource development project are provided with copies of the forecasting guidelines. Under preparation are guidelines for carrying out cost-effectiveness analyses of vector control operations. At appropriate places in the text, cross-reference will be made to these guidelines as well as to the WHO Manual on Environmental Management for Mosquito Control.

¹ M.H. Birley, 1989. *Guidelines for Forecasting the Vector-borne Disease Implications of Water Resources Development*. PEEM Guidelines Series 2, VBC/89.6, World Health Organization, Geneva.

Chapter 1

Health and Irrigation - the Linkages

The Links Between Irrigation And Health

This publication aims to alert planners to the linkages between irrigation and health, and to the collaboration between government departments which is needed to secure the advantages of increased agricultural production and a better health status in a cost-effective way.

A good irrigation scheme will provide greater security of water supply over a longer period of the year. It will enable farmers to accept the risk of using a higher level of inputs, so that they can produce a larger volume and/or more valuable crops, to the benefit of both themselves and their country. Amongst the human health benefits should be improved diets resulting from an increased production of staple foods, new opportunities of growing fruits and vegetables and increased purchasing power for foods not produced on the farm. Improved incomes should also positively affect health status by enabling people to spend more on clothing, housing, recreation and health. Further information on the general linkages between agriculture and health is available from WHO (see Lipton and de Kadt, 1988).

Other beneficial side-effects of irrigation can be new fishing areas, the possible development of recreation areas alongside reservoirs and canals, and better facilities for feeding and watering the domestic livestock which can also improve diet and income considerably. Unfortunately, almost nothing is known about the general impact on nutrition and health of specific agricultural projects, and this makes it difficult to quantify benefits (Lipton and de Kadt, *ibid*).

However, we often find that health has either been ignored, or has been considered a separate item in the development of agricultural projects. Insufficient care has been taken to avoid the negative effects of irrigation on health. These occur because irrigation leads to changes in the distribution of areas of standing and flowing water and in the location of human settlements, and to a modified micro-climate.

As examples, open canals, drainage ditches and the borrow pits created when earth is dug out to build embankments, roads and other structures all provide attractive breeding places for mosquitoes and snails. Some types of irrigation, such as sprinkler and drip systems, create fewer health hazards, but they are not suitable in many locations.

When the scheme is completed, this is frequently followed by changes in the pattern or density of human settlement. Together, the ecological and demographic changes affect the epidemiology of water associated vector-borne diseases.

The Importance Of Intersectoral Collaboration In Irrigation Planning And Operation

To gain the full benefits irrigation can bring to health and production, we need to combat any adverse impacts from water-associated disease. This can be done by a combination of activities including:

- appropriate engineering design in the initial stages of the project
- planning and implementing certain measures during the operation of the project.

The selection of the most cost-effective measures to combat disease and to reduce infection to a socially acceptable level requires co-operation during the selection, design and operation of the project amongst:

- ❖ Government health, irrigation, agriculture, veterinary, and educational personnel
- ❖ the people living in the area, or moving to it
- ❖ the local authorities in the area concerned.

Even if the necessary measures have been identified, it will not be possible to carry them out unless **all** the ministries and public bodies involved have:

- committed adequate resources in finance and personnel to the agreed plan of action, and
- have ensured the passage of any necessary legislation.

This illustrates the absolute need for intersectoral and interdisciplinary planning at all stages. With proper precautions adverse health impacts can be avoided or mitigated. The chief points to watch for are:

- ❖ the spread of water-related disease
- ❖ the stress, mental and physical, caused by resettlement
- ❖ the diseases associated with construction camps
- ❖ adverse nutritional effects, particularly if water previously used for fishing disappears, or if there is compulsion to grow only cash crops.

The last two will not be treated in detail, as the incorporation of safeguards to prevent the breeding of water-related vectors of disease is the main focus of this guideline. It is worth stressing, however, that a major health hazard of some types of irrigation scheme is associated with the displacement of people from their homes and livelihoods, particularly in schemes involving the creation of reservoirs. The guidelines provide some information on integrated planning for these situations in Chapter 4.

Domestic water supply and improved sanitation can sometimes also be incorporated into irrigation planning, thereby bringing great health benefits though the access to improved water supplies for drinking and general cleanliness. Here, naturally, the quality of the water is of great importance, and the issue is elaborated on below.

Types Of Water-related Diseases, Their Importance And Geographic Distribution

Water-borne and water-washed diseases

Water-related diseases can be divided into four main groups (Feachem *et al.*, 1980). The first two are the water-borne and water-washed diseases (diarrhoeal diseases, typhoid fever, guineaworm etc). These are extremely important both in terms of the numbers of people becoming ill (morbidity) and the numbers dying (mortality). In the long term they can be controlled mainly by a combination of education and improved water supplies, sanitation and housing. The provision of a new irrigation water supply can sometimes be combined at little extra cost with improved domestic water supplies.

However, people should be discouraged from using the water in canals, drains and reservoirs for drinking and washing. Apart from the danger that it may have become polluted and unsafe for drinking, direct human contact with such water needs to be avoided in some countries because of the dangers posed by certain vector-borne diseases. Water from wells is normally safer for drinking than surface water. People will, however, use irrigation water for drinking and washing unless there is a safer and more convenient supply. Furthermore, as irrigation generally creates a greater density of human settlement, there will be a greater demand for a safe domestic water supply.

These connections between domestic water supplies and irrigation form one illustration of the need for intersectoral planning mechanisms. Departments responsible for irrigation, health, new settlements and education will be more effective if they work together. Very often governments will already be working to improve domestic water supplies in both irrigated and rain-fed agricultural areas and in both rural and urban environments. It is therefore a matter of linking irrigation planning with these existing programmes and providing for their expansion where necessary.

A survey of experience and practice in multipurpose use of irrigation water - for example in combination with domestic needs, or sanitation, or livestock needs will be found in Yoder (1983). It gives examples of what has to be guarded against, as well as of mutual benefits.

In cases where waste water is being re-used for irrigation, special precautions are necessary. These are not further discussed in this guideline, but reference is made to WHO (1989a).

Water-based and water-related diseases

Water-borne and water-washed diseases are not especially characteristic of an irrigated environment. By contrast, the other two groups of water-related diseases, the water-based and water-related vector-borne diseases, are most likely to be found in areas where irrigation has introduced large new water surface areas. These include:

- malaria
- schistosomiasis (bilharzia)
- lymphatic filariasis (elephantiasis)
- onchocerciasis (river blindness)
- Japanese encephalitis and some other viral diseases transmitted by insects.

The geographical areas at risk from these diseases are shown in the maps in Annex 1, which have been taken from the Atlas of the Global Distribution of Schistosomiasis (Doumenge *et al.*, 1987) and from a recent WHO publication on the geographical distribution of arthropod-borne diseases and their principal vectors (WHO, 1989b). The reader is advised to look at these maps to see whether the irrigation scheme with which he/she is concerned is in one of these areas. If it is, more detailed information should be sought. This will generally be available from the health authorities of the country concerned. The guidelines for forecasting the vector-borne disease implications of water resources development (Birley, 1989) contain datasheets on these diseases. A summary of the *Anopheles* species responsible for malaria transmission in different countries and the types of habitat favoured by the snail species carrying schistosomes is available in Oomen, de Wolf and Jobin (1988).

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Mosquito species that are vectors of yellow fever and dengue fever breed mainly in urban environments. They may be indirectly associated with irrigation if this leads to an increase in the density of settlements.

The common characteristic of the vector-borne diseases is that the pathogens causing the disease are transmitted to man via an insect or snail. The type of vector associated with each is shown in Table 1. The vectors spend part or all of their lives in or near water (bottom section of Table 1), but different vectors prefer different types of aquatic habitat. For example, all the vectors except simuliid blackflies may be associated with irrigation ditches and canals; anopheline mosquitoes, the vectors of malaria, occupy a great variety of aquatic environments. This is the general picture.

It is very important to consult the national specialist vector control authorities because the individual species within each broad category of vector are very specific in their distribution and the precise circumstances under which they breed.

Of the 30 or so water-related diseases the first four listed below have been singled out by the World Bank (1987) as of particular importance, because they either:

- cause death and/or severe disability, or
- a large proportion of the population at risk becomes ill, or
- they are particularly difficult to control once they become widespread or when they are endemic, or
- the resulting ill health lasts a long time.

The fifth, Japanese encephalitis, is also very important, but in a more restricted geographic area.

Malaria

This is by far the most important of the diseases under discussion, both in terms of the numbers of people annually infected, whose quality of life and working capacity are reduced, and in terms of the death rate from it. Worldwide some 2 billion people live in areas where they are

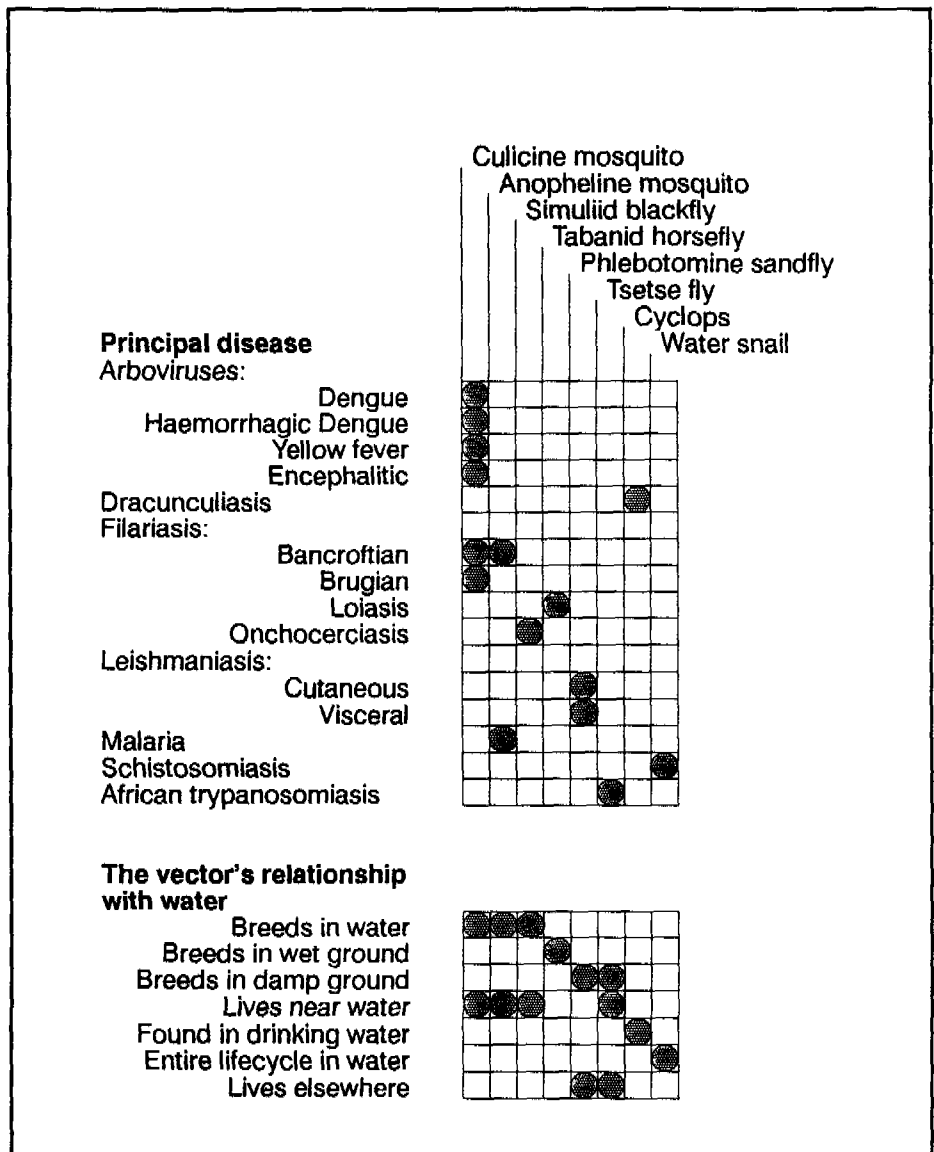


Table 1. Association between vector, disease and water.

Source: Birley, M.H. (1989)

at risk from malaria, and the total number of cases is (conservatively) estimated at 100 million a year. Chemotherapy has become difficult because the parasite has become resistant to certain drugs in various parts of the world. Interruption of disease transmission using chemi-

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cal methods of vector control is hampered, because many mosquito vector species have become resistant to insecticides and anti-pesticide sentiment is increasing all over the world. This makes it all the more important to prevent and control malaria by other methods, including either eliminating the water habitats where the vector breeds, or, making them unsuitable for breeding purposes.

Schistosomiasis

This disease is almost as widespread as malaria but rarely causes immediate death. An estimated 200 million people are infected, and transmission occurs in 74 countries. The infection is particularly common in children who play in the water inhabited by the snail intermediate host. Severe infection at this age leads to longterm damage to the bladder, kidneys and liver, which may be the cause of death many years after the original infection. Heavy infections at any age can make people feel unwell and affects working capacity. The possibilities for effective drug treatment have recently greatly improved.

Filariasis

This is a widespread debilitating but non-fatal disease transmitted by culicine mosquitos (or, in some areas, by anopheline mosquitoes). The parasitic filarial worms live in the lymph vessels which drain fluids from the extremities. Their obstruction eventually leads to swelling and deformity of the limbs (elephantiasis) and in some cases of the male genital organs.

Onchocerciasis

The importance of this disease lies not only in its severely debilitating nature, but also in its economic repercussions. For many years before the successful Onchocerciasis Control Programme started, fertile river valleys where the disease had been rampant remained uninhabited. As the popular name 'river blindness' implies, infection can lead to blindness after many years of exposure. Initially, its symptoms are skin lesions accompanied by severe itching. It occurs mainly in West Africa south of the Sahara, but there are a number of foci in Central and South America. It is transmitted by simuliid blackflies which breed in fast flowing oxygenated parts of rivers. Spillways of dams may provide man-made breeding places.

Japanese encephalitis

This acute virus disease is restricted to China, South East and South Asia (for exact distribution see map in Annex 1) and its distribution is closely related to flooded rice ecosystems. Its vectors, culicine mosquitoes, preferentially breed in flooded rice fields. Around 30% of those who develop the disease (especially children under 10 years of age) die. Many of those who survive have such severe mental damage as to be incapable of looking after themselves. Pigs are important amplifying hosts of the virus, and pig rearing therefore contributes to maintaining the threat of infection to man.

The Types Of Irrigation Scheme Most Associated With Health Hazards

The risk that one or more of these diseases is introduced or has an increased impact is most likely in schemes where:

- Soils present drainage problems and drainage channels are absent or not well maintained
 - Rice or sugar-cane is cultivated
 - Reservoirs are constructed or borrow pits are left with stagnant water
 - Canals are unlined or have unchecked vegetation growth
- and where
- There is settlement of new immigrants or resettlement of residents into more compact settlements. People without immunity may come into contact with a new disease, or they may bring a new source of infection with them, or in new, more dense settlements, disease transmission may be facilitated.

Integrated Control Of Vector-borne Diseases

The control of vector-borne diseases can be achieved in a number of ways, some of which are mutually reinforcing. Three types of measure can be distinguished:

- measures aimed at the **pathogen**: immunization (only available for Japanese encephalitis, not for the other four disease mentioned above); prophylactic or curative use of drugs
- measures aimed at reducing **vector densities** or **vector lifespan** to interrupt or decrease transmission: chemical, biological and environmental control
- measures aimed at reducing **man/vector** or **man/pathogen contact**: health education, personal protection measures and mosquito proofing of houses.

Within the categories of chemical and biological vector control, a distinction can be made between:

- ❖ larviciding - killing of immature, aquatic stages of mosquito vectors. Larviciding may be carried out by chemical or biological methods
- ❖ aduiciding - killing of adult vectors. Aduiciding is a strictly chemical method and consists of either spraying of internal housewalls with residual insecticides such as DDT, or fogging houses with insecticides with a knock-down effect.

These two tactics can be contrasted with **environmental management** which aims at reducing the number of breeding sites. Environmental control depends on either or both of the following methods:

- permanent or long-term physical transformation of land, water and vegetation aimed at preventing, eliminating or reducing vector habitats (**environmental modification**), and/or
- recurrent activities aimed at producing temporary conditions unfavourable to the breeding of vectors (**environmental manipulation**).

Planning is required to see that the most cost-effective methods for a particular situation are selected, and that these methods are chosen in good time, while the options are still open. For example, some environmental management methods can only be selected at the design stage. This applies, for example, to the control structures provided for the canals, to the steepness of water channel banks, or to the sites and layout of new settlements. Good choices at this stage may reduce the cost of maintaining acceptable levels of health during the operational phase. In any case reliance on chemotherapy alone is likely to be both costly and ineffective, since people will easily become re-infected if the habitat has not changed. Blanket mollusciding to kill intermediate host snails of *Schistosoma* species is likely to be extremely expensive.

Monitoring is always required, to ensure that the preventive methods selected are still needed, and if needed, still maintained, and if maintained, still effective and still the cheapest/best option.

The variety of methods of control, and the ministries or departments that might be involved in planning, budgeting, monitoring and operation are shown in Figure 1. Some further detail of particular types of action can be found in the checklist in Annex 2. Specific environmental management measures are covered in WHO (1982).

Useful case studies of the planning process as carried out in Mauritania, the USA, the Sudan, Puerto Rico, Iran, Indonesia, Niger, the Philippines and Sri Lanka are available in Oomen *et al, ibid*.

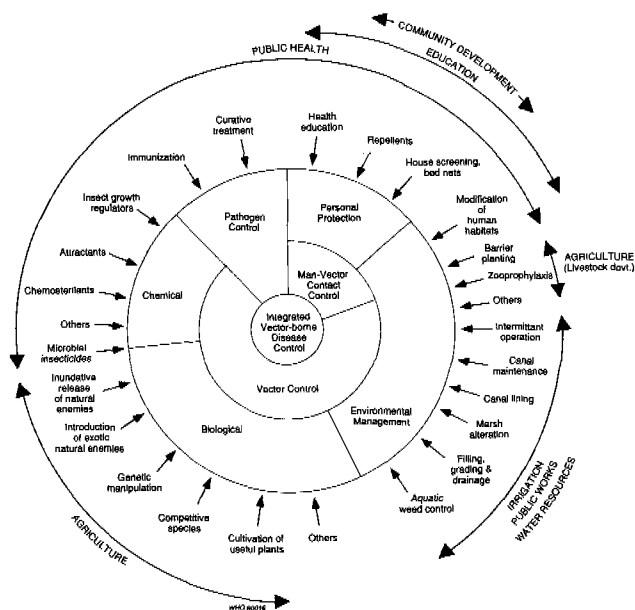


Fig 1. Developed from: Axtell, F.O. "Principles of integrated pest management (IPM) in relation to mosquito control" (*Mosquito News*, 39: 708-718, 1972)

Figure 1. The concept of integrated vector-borne disease control.

Changes In The Organization Of Health Services

It is important to highlight here a change in the organization of the health services that is taking place in many countries. In the 1950s and 1960s programmes were organized to deal with one specific disease (notably malaria), in what is termed a vertical strategy. In the past decade, there has been a trend to integrate such disease control programmes into the general health services, basically on grounds of economics and equity. This shift towards horizontal, community-based health services is in conformity with the strategy of Health for All by the year 2000, unanimously adopted by the Member States of the World Health Organization. When the horizontal strategy has been adopted Primary Health Care centres become the corner stone of the health services, and this has to be taken into account in designing the interaction with authorities responsible for irrigation. However, there are generally still centres within ministries or universities of most countries which have special expertise in the disease concerned and which can be consulted.

Chapter 2

Economic Aspects

Assessing The Economic Benefits

The economic benefits of an irrigation project, which will also bring health benefits, come from the **additional** production it generates. It is therefore vital that the economic assessment takes properly into account the present income streams from:

- areas that will be converted into reservoirs
- areas that will be deprived of their existing water supplies
- the existing production in the area that can potentially be irrigated.

One has to consider the likely development of these areas in the future, without the project, before deciding if the project is economically justified. This is particularly important in the case of projects which involve a large reservoir. Such projects give rise to many problems, as we shall see in Chapter 4. This is not only because a large shoreline provides new habitats for disease vectors, but also because they usually involve resettlement with its attendant social and political stresses. The economics of a scheme have to be very carefully examined, particularly where the potentially irrigable area is less than 4 times the size of the reservoir.

Another danger signal is a design which includes a feeder canal that is very lengthy in relation to the size of the area to be irrigated. Particularly for small schemes below 1000 ha this can pose great maintenance problems, which may threaten economic viability because of the cost of maintenance or the absence of the necessary labour

resources, leading to the danger that without adequate maintenance the planned outputs are not achieved. It can also produce health problems for people living alongside.

Economic And Social Importance Of The Health Status

Substantial economic losses have been noted in the past resulting from low health status. For example, in parts of Nepal, India and Afghanistan certain lands could not be developed in part due to malaria, but once the disease was brought under control, there was a phenomenal growth in settlement and agricultural production (Sharma, 1987). The same effect has been noted in relation to onchocerciasis and its control in West Africa (Pant, 1987). In 1974 over 20% of the normal labour force on the Gezira (Sudan) was down with malaria, and soldiers and students had to be brought in to save the cotton crop. On the Bura scheme in Kenya, malarial deaths amongst children were one of the main reasons why many of the first settlers abandoned the scheme.

While such cases make it evident there is a substantial economic loss through ill health, it is difficult to quantify this. Some attempts have been made; in Cameroon both health and productivity observations were made on rice-growers and it was found that a 10% reduction in the incidence of urinary schistosomiasis could result in a 4% increase in production (Audibert, 1986).

However, health is not simply an economic matter. Good health and the ability to raise healthy children are benefits which most governments wish for their people; health is one of the final objectives of policies orientated towards development. Governments will in any case be authorizing national expenditure on direct health services, and will be interested in obtaining indirect health benefits from other types of government expenditure.

Problems In The Economic Analysis

There are problems in applying standard methods of economic analysis to the selection of the right combination of control methods to minimize a health problem. It is usually difficult to quantify health benefits. A crude estimate of production lost through the number of days away from work can, however, often be made.

Capital vs Recurrent Costs

More importantly, there are difficulties in making comparisons between capital intensive and recurrent cost intensive methods of tackling a problem. For example, some health measures are high in recurrent costs, e.g., chemical control of vectors or case detection and drug treatment. If the Internal Rate of Return is used in project appraisal, future recurrent costs may be discounted to the extent that they are given an unrealistically low weighting in comparison with, for example, initially more expensive environmental engineering methods which would limit the need for recurrent expenditure. As a result a design may be selected which is not sustainable in the long term. The feasibility of a given level of recurrent costs, taken into account the likely development of the budgets of the responsible authorities, whether these are on the health side or the irrigation side, should always be carefully examined. If government recurrent revenues are a scarce resource they can be given a higher shadow price than initial capital which may be available as a grant or at a preferential interest rate. A more radical method involves giving higher priority to estimates of financial cash flows in selecting the combination of measures, on the grounds that economic benefits will not flow unless the resources and incentives for good management are present (Tiffen, 1987).

Dual Benefits

Because it is often difficult to separate the agricultural and the health costs and benefits it is best if they are considered together when a new project or a new method of operation or maintenance is under study. For example, lining a canal may both improve agricultural production through saving water, and reduce costs of treatment for schistosomiasis.

Problems In Evaluating Health In Economic Terms

Some of the problems in evaluating health are similar to those in evaluating environmental gains and losses. For example, it may be useful to look at the 'next best' solution in order to gauge the cost of a health improvement which is desirable on social rather than economic grounds. Various techniques for this and for cost-effectiveness analysis are suggested in *Economic Analysis of the Environmental Impact of Development Projects*, Asian Development Bank Economic Staff Paper No. 31. The financial and economic aspects of environmental management for vector control have been discussed in the report of the 6th PEEM meeting (1986).

It is relatively easy to make cost-effectiveness studies to compare two different methods of tackling the same problem when both involve recurrent costs. For example, morbidity control of schistosomiasis by use of drugs can be compared with control by molluscicides to kill the intermediate host snails. The former is now considered more cost-effective. Guidelines for carrying out cost-effectiveness studies of vector control programmes are under preparation for publication in the PEEM guidelines series.

Financing Recurrent Costs Of Health And Irrigation

There is a further interesting relationship between methods of financing irrigation and health. Health is much more likely to be safeguarded on a well-maintained and well-operated irrigation system where water is properly controlled. There is some evidence that on irrigation schemes where the dues collected from the farmers are kept within the scheme and used for local operation and maintenance costs, operation and maintenance are better than on schemes where farmers' payments go to the central treasury and where there is no direct relationship between what farmers pay and the services they receive. (Small, 1987) Farmers are often prepared to pay more for a good service, and this applies to health as well as irrigation. The choice of financing method is therefore important, though it is often limited by

the general administrative policies of the country concerned, or by political considerations.

Where farmers do make a direct payment to the scheme authority their willingness to pay for good maintenance may depend on their knowledge of the linkages between health and water. Health education can help increase willingness to pay.

Chapter 3

Incorporating Health Safeguards into Large New Irrigation Projects

Planning Processes For Large New Schemes

A large new irrigation project is such a major undertaking that it requires careful planning and complex investigations. There are two main types of scheme: those which bring irrigation to an area already quite densely settled by farmers practising rain-fed farming, and resettlement schemes, where the land was previously not much used for farming, and where it is planned to bring in additional settlers from outside the area. There is often a degree of resettlement even in the first type of scheme, because some land will be taken for reservoirs and other irrigation infrastructure. The greater the degree of resettlement necessary, the more complex the project and the more acute the health aspects, so that we shall give particular attention to these problems in chapter 4.

Large schemes, with or without resettlement, require negotiations between various ministries. As they are often partially funded from external sources such as the major development banks, there will also be negotiations between the government and the bank. The development banks tend to operate according to the well-known concept of the project cycle:

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- identification
- preparation
- appraisal
- negotiation
- implementation
- evaluation

It has to be emphasized that this represents the view of the development banks. At a certain point in time a loan is made after due consideration (the first 4 stages). The project is then implemented. Normally a bank's last action is to evaluate whether the funds were spent according to plan, and whether the loan seems to be achieving its final objective. In the case of an irrigation project this is normally an increase in agricultural production and the raising of farm incomes. The evaluation is usually made soon after loan disbursement has been completed, at a stage when a project has been operating only a short time. A diagram of the conventional project cycle concept is shown in figure 2.

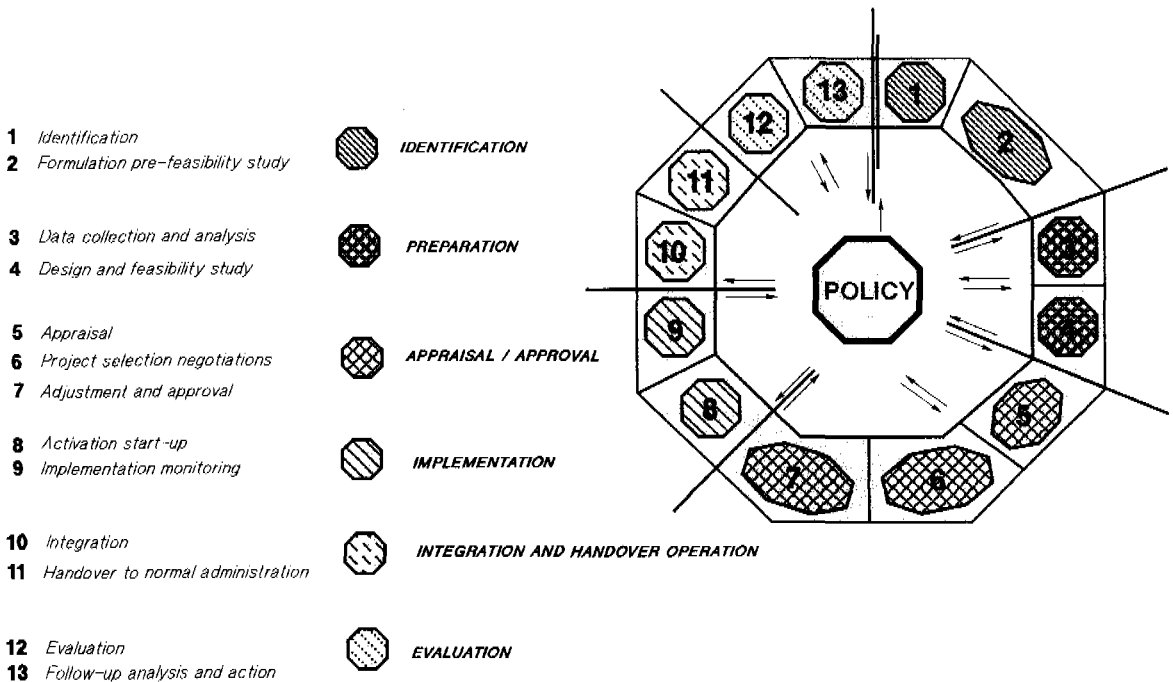


Figure 2. The conventional project cycle concept

There are shortcomings to planning processes based simply on the formal project cycle. The chief failing is that it does not give enough emphasis to the most important period in the project's life, the long period of years after implementation. This is when it is operated and should be maintained, in order to continue to produce benefits. The design during the preparation phase is often not sufficiently influenced by the consideration of problems during the operational phase. These can include:

- lack of motivation and interest by the farmers who are supposed to benefit, because the project does not meet their real needs given the particular circumstances of the project area
- lack of recurrent funds for operation and maintenance by the main ministry concerned, a situation which can be worsened by a design selected to minimize capital costs
- lack of recurrent funds and essential facilities by other ministries whose tasks have a direct bearing on the scheme, but who were not sufficiently consulted at the preparation stage.

Those interested in an analysis of the reasons why irrigation projects do not always fully achieve their final objectives, and in methods of improving the preparation process can consult Tiffen (1986). The improvements, which are already part of the normal practice in some countries, include:

- ❖ more consultation with the farmers or their representatives in the early planning stages and during the monitoring of the operational phase,
- ❖ more intersectoral planning at the provincial or district level, so that other ministries who may be concerned can raise important aspects, and also, adjust their priorities and budgets. Some countries with elected bodies at this level have a mechanism here through which consultation with the beneficiaries can take place in addition to interministerial coordination,
- ❖ more monitoring at all stages, during implementation and above all during the years of operation, so that if there are changes in

external circumstances (such as new marketing opportunities which change the desirable cropping pattern, or new disease or vector control methods) these can be incorporated either in new operational practices, or in any new constructions during the later stages of implementation, or in the next major rehabilitation. Consultation with the users is an important aspect of this monitoring,

- ❖ whenever possible the adoption of a phased plan of implementation, so that improvements which practice shows to be desirable, or which changes in external circumstances indicate, can be incorporated into the later phases.

The modern view of planning, and the practice in many countries, therefore stresses the negotiation process, not only between borrower and lender, but also between planners and beneficiaries, and between the initiating ministry and other ministries. This leads to an expanded view of the project cycle, as shown in figure 3. It illustrates that

- at certain points in the project cycle there are important decision points for national level authorities, who may also be negotiating with external funding agencies.
- at many more points there is a need for a two-way exchange of opinions and information between the potential users, the initiating ministry and other involved ministries, at the level of the project region.

The negotiations and discussions will affect the shape and content of the project. It will undergo modification certainly during the identification and appraisal stages, but possibly also during the implementation stage, and almost certainly during the long operational phase.

Institutional Implications Of Intersectoral Planning And Consultation

In a very large scheme it is best to have some formal consultative mechanism. This has two desirable elements:

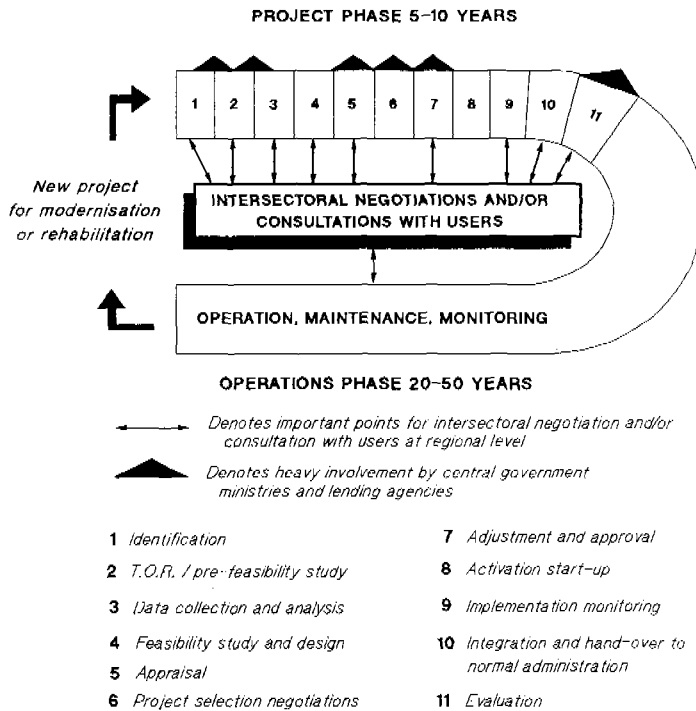
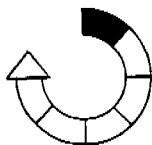


Figure 3. The expanded and updated view of the project cycle concept

- ❖ **an intersectoral committee or advisory body** through which the lead ministry regularly meets representatives of other involved ministries and of the local authorities in the area concerned. It may be necessary that this operates at two levels - in the region concerned, and at national level. The first concern of the intersectoral committee should be with the Terms of Reference for a feasibility study. If the project is implemented this committee may become the Advisory Board for the Project authority.
- ❖ **a mechanism for consulting the farmers** already living in the area, who may have to be moved because of the creation of reservoirs and ancillary structures and those who may be resettled in the scheme when it is completed. This mechanism can be informal at the feasibility study stage, but it is desirable to formalize it during implementation (formation of elected bodies where suitable ones do not exist, regular exchange of information with existing representative institutions at the local level, etc). The organizations set up for consultation can then be transformed after implementation to enable the farmers to play a role in operation and maintenance.

Planning Stages



Identification phase

Very often only one ministry or organization is responsible for identifying the sites of possible new schemes. It is usually the ministry concerned with the development of water resources, or a river basin development authority, but in some countries it may be the Ministry of Agriculture. The planners responsible should use a short checklist to see if vector-borne disease and other health problems are likely to occur, from their knowledge of conditions on other irrigation schemes in the country, by reference to the maps in Annex 1, by noting if a large reservoir is likely to be necessary, and by checking the other points mentioned in chapter 1, page 19.

If it is decided that the site is worth further investigation, it is very important that arrangements are made for consultation with other concerned ministries, and with local people and organizations prior to drawing up **Terms of Reference (TORs)** for a pre-feasibility or feasibility study. It is here that countries with good mechanisms for planning and consultation at the district or provincial level have an advantage, since these should provide a routine mechanism for intersectoral planning that knows and takes into account local needs and priorities. If there is no such mechanism available, the initiating ministry should make *ad hoc* arrangements for the necessary consultations. It should be remembered that even in countries with no vector-borne diseases there are likely to be health implications relating to settlements and domestic water supplies.

The TORs have very great importance for the proper conduct of the next stages. If outside consulting firms are used, they will plan the duration of the inputs of the different specialists on the basis of the TORs, and they will be bound to pay heed to any inclusions or exclusions. If the TORs do not mention health aspects, these may never be properly investigated.

The TORs should specify, amongst other things, that account should be taken of:

- present and likely future health conditions in the project area
- health conditions associated with irrigation schemes elsewhere in the country
- the need to provide a scheme that can be operated and maintained within the financial and staffing resources that are likely to be available, in the Ministry of Health as well as in the ministries directly concerned with the project operation
- financial arrangements, e.g. whether the funding for health safeguards and maintenance should come from central ministry revenues or from contributions in payments or work by the beneficiaries
- any increase in the supply of water for domestic use and livestock purposes that might be desirable.

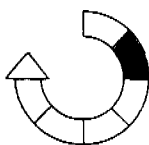
In some countries, regional health budgets will automatically be increased if there is a population build-up; in others, there will need to be special budgetary provision, at any rate for capital costs of additional measures needed. The TORs need therefore to take account of budgetary procedures in the country concerned.

Good maintenance during the operational phase is important both for agricultural and health purposes. Good maintenance demands revenues. These are often raised at least in part from the farmers. Farmers are also generally given responsibility for contributing work to some maintenance activities. It cannot be sufficiently emphasized that farmers will only contribute work and money if they see the scheme as profitable from their point of view, and as a better alternative than other income-earning possibilities open to them. The Terms of Reference should therefore also specify that:

- cropping patterns are considered not only in the light of government requirements, but also in the light of farmers' profits.
The more important lending banks may now specify health as one aspect to be included in the TOR and a good consulting firm with a

knowledge of the country concerned may try to negotiate alterations to the TORs if it sees that some important aspect has been omitted. **The TORs are, however, basically the responsibility of the authorities commissioning the study.**

Once it has been decided that the scheme should go forward for further studies, health planners should review the existing sources of information on health status and disease risks in the area likely to be affected. The more information that can be made available to those responsible for the pre-feasibility or feasibility studies, the better.



The Preparation phase: pre-feasibility, feasibility study; broad design

The preparation of a very large and complex scheme may include a **pre-feasibility study** which reviews an outline of the various options, and identifies important knowledge gaps, as well as a full feasibility study for the preferred option. For a smaller scheme it is normal to move straight to a feasibility study.

At the pre-feasibility study stage a rapid, in-breadth rather than in-depth health risk assessment should be carried out, applying the methodology proposed in the Guidelines for Forecasting the Vector-borne Disease Implications of Water Resources Development (Birley, 1989). It should include a preliminary forecast of diseases that may increase or diminish in conditions of increased population density, increased water distribution and increased agricultural production. It should also uncover gaps in the existing information base which will require specific efforts of data collection or expert consultant assessments during the full feasibility study phase.

The interval between the two feasibility studies offers further opportunities for consultation between the sectoral ministries whose domain of interest is of relevance to the project, and for thorough discussion with the local authorities and the representatives of farm-

ers' organizations and other possible interested groups such as traders in agricultural products. **The aim will be to ensure that an expensive feasibility study is only embarked on if all concerned feel that the type of project envisaged is desirable.** In the opinion of many people, the consideration of the results of the pre-feasibility study is the last time at which it is politically feasible to stop a large project. After the feasibility study stage, the project may have acquired so much political backing that it is only possible to modify it, not to abandon it.

The **outputs** that ought to be obtained from a full **feasibility study** are presented in the boxes.

a prediction and approximate quantification of health impact (environmental and health impact assessment). For this it will be necessary to consult the appropriate national bodies. Within the Ministry of Health in many countries there may be Vector-borne Disease Units, Virus Research Units, Epidemiology Units, etc, or there may be specialist research institutes or university departments. It will be particularly important to collect information about health problems on other irrigation schemes in the same country, and this may be available either from the irrigation authority or the health authority in the area concerned, or in the local government. At this stage, the forecasting guidelines (Birley, 1989) may well provide a useful framework for an in-depth rather than an in-breadth assessment focusing on the potential problems identified in the pre-feasibility study.

a costing of environmental and/or alternative measures for minimizing health risks (see Mills and Phillips, under prep.). The environmental measures will include many that can only be incorporated at the design and construction phase, either as a permanent construction feature, or as a design which makes possible certain types of operational procedure (eg intermittent canal operation). The alternative methods will often make calls on the budgets of ministries different from the initiating ministry (e.g. Community Development, Education, Health, as shown in figure 1).

a selection of a cost-effective and appropriate design, and recommendations on operational and maintenance systems. The design and construction features that can be incorporated in order to limit creation of snail and mosquito habitats are discussed in Pike (1987), McJunkin (1975) and the publications of WHO and FAO listed in the bibliography. Particular reference is made to the WHO Manual on Environmental Management for Mosquito Control (1982).

recommendations on health resources and activities and of any related agricultural or veterinary practices or educational campaigns needed to give the greatest combination of benefits in relation to the capital and recurrent costs incurred by the contributing farmers and ministries.

a schedule of the expected influx of work-force into the project area, with an indication of place of their origin. Through the Ministry of Health the health status in the areas of origin must be determined to see (a) whether the work-force is likely to introduce diseases not present in the project area, or (b) whether the work-force is likely to be susceptible (i.e., non-immune) to diseases present in the project area. In the first case funds will have to be allocated to the establishment of a sound screening system of all workers coming in; in the second case the work-force will have to be properly vaccinated, or, if no vaccine is available, given prophylactic drug treatment, or, if no prophylactic drugs are available, a system of case detection and treatment will have to be deployed.

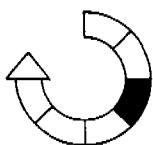
a recommendation on the phasing of implementation which preferably allows for some of the practices or construction types new to the country concerned to be tested out in a first phase covering part of the final project area. This would clearly allow for the possibility that future phases may be redesigned if the monitoring of the results from the first phase shows this to be needed, or if in the meantime, new information or technology becomes available.

a statement of the **monitoring systems, institutional organization and legal requirements** for the recommended project form, with careful attention to the likely availability of the necessary qualified staff and recurrent revenue resources. This should naturally include a health monitoring system, with an indication of the resources needed by the health sector to carry it out, and the institutional mechanism for conveying information on health problems to the bodies responsible for irrigation operation and maintenance. A few key indicators to measure the effect of the project in terms of productivity, welfare and environmental impact should be suggested, so that data can be regularly collected to guide management decisions and to provide, at a later stage, for the evaluation of the project. In the case of the general effects on health, the selection of the right indicators, or the proxies for them, is not easy. If data is routinely and reliably collected on morbidity or height/weight ratios for infants and young children, these may serve as the proxy. (See also Lipton and de Kadt, 1988). Specifically for the vector-borne diseases, vector densities, infection rates of vectors, vector bloodmeal analyses and vector resistance to insecticides may be measured.

a recommendation on the institutional arrangements for the construction, implementation and operational period. With a very complex large project it is usually desirable to have a Project Authority with the power to integrate engineering, agricultural and health aspects of the implementation sequence. This is likely to be even more advisable in the case of a project with a large resettlement component, where timing is very critical. However, there should also be a plan for the situation at the end of implementation, when it is customary to hand over project assets to the normal operating ministries, (e.g. health clinics to the Ministry of Health, roads to the local authority or Ministry of Transport). With projects for areas already settled by farmers practising rainfed agriculture, it is likely that ministries such as Health and Education have a programme in the area, and construction can be left to a lead ministry with some arrangement for an inter-ministerial committee for co-ordination. As already noted, it is desirable that the Project Authority Board or the Inter-ministerial Committee include representatives of the beneficiaries, or else of a ministry in close touch with local feeling, such as Local Government or Home Affairs.

In the case of very large projects, in particular multipurpose projects, an expatriate construction crew may be brought in. Internationally operating construction firms usually provide adequate health services for which often temporary facilities are erected. It is worthwhile to negotiate, at the planning stage, that these facilities be designed in such a way that they may be of lasting use to the resident communities when the project becomes operational. Pre-fabricated structures can be easily rebuilt in the vicinity of new settlements and contribute substantially as a capital input into the strengthening of health services.

Recommended checklists for the preparation stage can be found in Birley (1989) as already mentioned, in Bottrall (1985, for a checklist which includes considerations on operation and maintenance), Environmental Resources Ltd (1983, very strongly recommended for an assessment that does not limit itself to vector-borne diseases; one of its main check lists is included in this document as Annex 2). Other important works will be found in the bibliography.



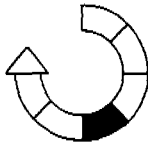
Appraisal and Financial Negotiation phases

The appraisal of the feasibility study needs to be conducted by several bodies from different viewpoints. The ministries which are given a role in project implementation will want to check that they have indeed the assumed level of financial or staff resources, or that they will acquire them under the plan, and that proper provision can be made in their own forward plans, given their other priorities and commitments. For example, if the Ministry of Health will require extra resources in terms of staff, equipment, or training, it will wish to see that funding for this has been included in the application for a grant or loan.

The ministry which has taken the lead in promoting the project should ensure that all the necessary agreements are in place, and that arrangements can be made for any legislative changes. An example of such intersectoral arrangements used in the Philippines is given in Annex 3.

The regional level planning bodies should review the feasibility study to see that it does not claim resources already ear-marked for other regional projects, that it is still in reasonable accord with the known wishes and capabilities of the intended beneficiaries, and that it does not make assumptions that are optimistic in view of previous experience in the region.

The financing agency will also appraise the feasibility study from its own perspective, and may recommend changes taking into account general experience with this type of project, and to improve the likelihood of objectives being achieved with a satisfactory economic return. Many financing agencies including the World Bank have policies about the environment and a requirement that the health situation should not be adversely affected. The importance of examining carefully recurrent costs has already been stressed in Chapter 2.



Detailed Design, Construction and Implementation phase

During the construction phase it is possible that a large, imported work-force containing a high proportion of unaccompanied males will be brought into the project area. The necessary health and educational measures should have been planned in the preceding phase. Monitoring will be required to see that the precautions taken are effective. Apart from sexually-transmitted diseases, there is the risk that the workers introduce other diseases previously not present in the area. However, the greater problem is the reverse, that those coming in will suffer from severe attacks of locally endemic diseases.

There will also be engineering monitoring requirements to see that construction standards are upheld. If this is not done, the maintenance and operation of the project will become difficult and expensive, with consequent losses of agricultural production and increased health threats.

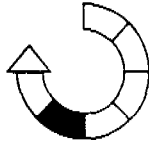
Some important details of design may be finalized at this stage, for example, the layout of the water-courses serving the farms, foot-bridges, clothes washing facilities, etc. There should be separate provision for activities such as clothes washing, so that people are not using the canals for this purpose in areas where schistosomiasis is prevalent. It is important that this detailed design is done as near to the field as possible, and in consultation with the users. If a water-course respects as much as possible existing field and village boundaries, it will probably be easier for farmers to organize communal maintenance. If a footbridge gives convenient access to a much used community facility, the population is less likely to splash through snail-infested water. Transmission of many diseases is particularly likely to occur in a few places where there is intense human activity near or with the water.

The implementation phase will also cover a period when part of the project has been completed. Instant monitoring will be particularly necessary to see if the recommended management practices are feasible, if farmers are on course to obtain the projected incomes, and if unforeseen problems are arising, including unpredicted health effects.

At the end of the implementation phase it is desirable to make arrangements for local co-ordination and information exchange when the authority responsible for implementation is dissolved and normal operation passes to sectoral ministries or local authorities. As already stressed, it is essential that this hand-over should have been provided for in the project design, and that all ministries involved have made their plans for the additional commitments.

It is also important that the monitoring techniques and the information base built up during implementation are transferred from the Project Authority to the ministries or other organizations taking over part of the operation. These latter will need budgetary provisions or an income from fees which is sufficient to carry them out; methods should not be used during implementation which are financially impossible during operation.

Health education will be particularly important so that people have motivation to do as much as they can to protect themselves by sensible use of their existing resources.



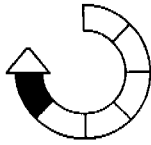
Evaluation phase

In the traditional project cycle, evaluation comes after implementation, and this may be a requirement of the lending agency. This is indeed a good time for an in-depth review of the experience to-date, and of the degree to which actuality matches up with plans. If the experience is unfavourable, this in-depth evaluation should provide the opportunity to review operational plans and if necessary add new elements.

The evaluation generally aims to assess the impact on beneficiaries; it would be important to measure as far as possible changes in health status as well as changes in incomes. Medical personnel in the country concerned should be able to suggest indicators; there may be yearly records in local clinics of, for example, the number of cases of malaria treated, the amount of chloroquin handed out or, in more general terms, the weight of newborns or child mortality.

It would also be necessary to consult with the beneficiaries and with the scheme personnel to find the reason for any shortfall in expectations. Because revenues are so important for good maintenance, it is particularly necessary to note if cash flows are as expected and whether, for example, farmers are paying fees at the level intended and at a level sufficient for meeting operation and maintenance (O&M) costs. If farmers are having problems with this level of fees, it may be necessary to review, for example, the staffing levels of the agency concerned. It is generally better to cut staffing levels than to cut the equipment and materials without which staff cannot work.

It would, however, be a mistake to think that evaluation, which in a sense is a review of the previous monitoring arrangements, should cease at this point. Monitoring will also be required during the operational phase, and project authorities will continue to be able to make adjustments during this phase to management as well as disease control methods.



Operational phase

The operational phase is the most important and longest-lasting part of a project, as a glance at figure 3 shows. The net economic gain to a country will depend entirely on the output during this phase. The two great influences on output are:

- the level of achievable farm incomes, which provides farmers with the incentives to make use of the new infrastructure, and
- the level of maintenance which keeps the infrastructure in productive condition.

Both of these have health aspects: incomes influence general health status, and maintenance affects the amount of seepage, weed growth and slow-moving or stagnant water, which provide habitats for disease vectors. It is vital to appreciate that good maintenance has both production benefits and health benefits.

Figure 1 has given some indication of the responsibilities for operation and maintenance which normally fall to the irrigation authority, and which besides providing for the reliable supply of water to the farms, also have health implications. Some types of water management may help to create conditions unfavourable to disease vectors. Figure 1 also shows that from the health point of view it may be desirable to add some special control methods such as chemical or biological larviciding of mosquito vectors and mollusciciding of the intermediate hosts of *Schistosoma*.

Particular attention therefore needs to be given to:

- ❖ **maintenance**, and methods of monitoring maintenance, of canals, reservoir banks, ancillary structures and drains. It may be necessary to provide special health protection measures for the workers engaged in canal maintenance, since they will be in

closest contact with disease vectors and pathogens. In so far as this maintenance is carried out by farmers, they will need advice on health precautions, and this needs to be incorporated into the agricultural extension programme.

- ❖ **scheduling of water distribution** and prevention of wastage
- ❖ **health education**, and other health prevention and control measures, including monitoring of the number of cases of water-related disease and diseases related to farming practices.
- ❖ **revenue collection**, since this may affect the funds for operation and maintenance arrangements
- ❖ causes of changes in **cropping intensity** or **falls in yield** of the most profitable crops, since this will affect farmers' incomes and their interest in making payments and carrying out their share of maintenance.

The checklist in Annex 2, the checklist in Bottrall (1985) and the operational sections of the other documents listed in the bibliography will be found helpful during this phase.

An irrigation scheme may introduce health hazards unrelated to vector-borne disease. For example, very often the increased security of water induces farmers to increase their use of agricultural inputs such as fertilizers, herbicides, fungicides and pesticides. If the health authorities notice an increase in accidents related to the unsafe use of these chemicals, they will need to alert the agricultural extension authorities.

Similarly, the use of these chemicals may cause pollution of water used for human or animal consumption and changes in the method of application may be necessary. Any effects of this sort should be picked up by the health monitoring system that should have been established as part of the institutional arrangements for the new scheme.

During the monitoring of the operational phase it is particularly important to see if the predictions of the planning stages are being

realized, or if new elements are entering the situation, e.g., an unpredicted disease coming into prominence, or information on a new treatment or preventative measure that reduces costs or renders some previous safeguard unnecessary. Countries that have district level or provincial level planning co-ordination arrangements will have an advantage in the existence of a regular forum for the exchange of information between ministries and the adaptation of methods to deal with a changing health situation. Methods of information exchange and research at national level are discussed in Chapter 6.

During the operational phase it is inevitable that changes will be made in the project. For example, cropping patterns and, therefore, water distribution will alter as farmers respond to new economic circumstances. Good channels of communication between the farmers and the operating authority are therefore important if water scheduling is to keep abreast of changes in need, and avoid wastage. Good channels of communication are also important for the monitoring of maintenance, since farmers will be the first to notice water shortages caused, for example, by seepage.

Standards, Legislation And Research

The problem with planning that is based on a project cycle is that it leads to considering each project phase as a separate event, rather than as a part of a programme. In reality, many countries have their own standards for construction, for environmental protection, settlement design, etc., which apply to all their irrigation projects, and, indeed, to projects of many different types. These standards may be enforceable by law. They are normally also backed by some kind of research organization which is responsible for testing new technology and deciding when changes in standards are appropriate. The function of standards and legislation is further considered in Chapter 6.5 on rehabilitation and modernization. Here, we merely note their obvious importance in the design of new projects.

Chapter 4

Large Formal Schemes with a Resettlement Component

It is impossible to do justice to the many problems of resettlement in terms of a section of this guideline. It is necessary, however, to emphasize that it increases adverse effects on health in terms of both quantity and variety of risk. The most recent easily available guideline on the subject is from the World Bank (see Cernea, 1988).

It is particularly difficult in such projects to phase all activities. One chain of activities leads to the creation of a reservoir, the flooding of a large area, and the displacement of farmers and other residents. Another series of activities displaces farmers through the construction of canals, headquarters areas, etc. Usually under the control of a separate group of persons there is another series of activities concerning the registration of land and property losses in the areas taken over, the agreeing of levels of compensation, the finding of alternative income-earning activities for the dispossessed people, the construction of new settlements with all necessary facilities and the preparation of new farm land. The construction chains and the compensation and resettlement chains have to be synchronized. Since the reservoir area and the command area may be quite separate, and since the command area may be already inhabited, it may not be possible to resettle the displaced persons there.

Because of the likelihood of crises, it is useful if the coordinating Committee or Board which is overseeing implementation has access to at least one powerful politician or ministry. Rapid decisions may be

Guidelines for Intersectoral Cooperation

needed for a change of course, or for bringing in additional resources, (e.g. when unexpected problems arise, or when delays in one phase of work threaten to disrupt the timetable of other parts of the programme).

It should also be remembered that even the farmers in the command area may have their normal rainfed agriculture and livestock-rearing disrupted during construction in the command area, and they may be unable to maintain their families during this time. Other farmers may be affected by the diversion of a river from its former course, or the reduction or alteration in river flows due to the new dam, while not themselves benefiting from the new scheme.

In all such cases there will be health effects from stress, and from poor diets due to the interruption of income-generating activities and the dislocation of food farming. The sequencing of activities in such a way that the areas taken over do not have to be evacuated until the new settlement areas are ready, or until all property has been properly measured, registered and compensated, is extremely difficult. There is a critical path which can be easily disrupted, and enough time has to be built into the planning to allow some flexibility to meet unexpected hitches. A good publication on this is by Butcher (1972), for FAO.

A major health problem may arise if the new settlers have not built up any immunity to the diseases which are endemic in the area where they are to establish themselves. This happens, for example, if the reservoir area is at a high altitude where malaria is uncommon, and the command area is in the plains where malaria is endemic.

People may also have a problem adjusting to a new diet. The rainfed staple food they used in their area of origin may not be appropriate to the irrigated area. Generally they will make the adjustment over time, but it may help if they are allowed to grow their preferred food, even if it is not the crop that gives the highest return. In the past it has happened that irrigation schemes have been designed to produce cash crops, without considering sufficiently the degree of risk that food prices might spiral out of reach of the farmers if there is a bad crop in the adjacent rainfed areas that are supposed to supply the settlers with staple food.

One advantage of a resettlement scheme is that it may offer opportunities for designing new settlements that take health needs into account. For example, the new villages can be located so that there is a suitable distance between housing areas and water areas likely to provide habitats for disease vectors. It may be possible to provide a higher level of provision of water for domestic and livestock needs than people had in their previous villages. However, there have been frequent problems because the type of housing provided is not considered suitable by the settlers, or because it does not provide for their domestic livestock.

Some particularly important considerations are presented in the following boxes:

Because of the complexity, and the critical path of the sequence of implementational actions, it is particularly important to have a **strong project authority**, with powers to take emergency action and to over-rule other ministries, and with an adequate financial reserve for emergencies.

Resettlement is an enormously **stressful experience**, which will undermine people's general resistance to disease, particularly if this is worsened by disruption in their food supplies. They need to be treated with great consideration, even if given generous compensation. The stress can be reduced, but not eliminated, by careful attention to channels of communication, seeing that they know what is happening, and when it is happening, and by taking into consideration as much as possible their own preferences on resettlement. Medical staff may need extra training to deal with the increase in stress-related illness.

In new settlement planning a choice has to be made between **building houses** for people, and giving them the **means to build houses** for themselves. The latter is often best and cheapest. However, planning the location of the village, and the layout of facilities, can be a very important determinant of the incidence of disease. The provision of essential services at least to the level normal in the country concerned should be ensured.

The **time requirement** is often underestimated (this may be partly a consequence of planning to boost the Internal Rate of Return). This leads to decisions being taken hastily to meet a series of crises. Planning for phased development of the new command area is often advantageous.

Experience shows that the **numbers involved** and the **costs of compensation** have been frequently underestimated. Apart from the hardship and injustice to the people concerned, this can provoke civil unrest. Every effort should be made during the feasibility study to get an accurate assessment of the numbers of people and value of assets in:

- areas to be used for reservoirs or other infrastructure
- areas from where water will be diverted
- the new command area.

It will be necessary to make an accurate assessment of fair levels of compensation for the loss of property and income streams (land, housing, trees, fixed equipment, livestock, small businesses etc) and to ensure that provision is made for this in the financial plans. The compensation requirement is usually regarded as the responsibility of the government concerned, and is not normally provided by external loan finance.

Chapter 5

Small-scale Schemes and Informal Irrigation

Types Of Small Scheme, And Their Benefits

The types of scheme we are considering here are those which cover less than about 300 hectares, and where a large input of professional engineering skill is usually neither available, nor economic.

It is difficult to provide guidelines for the incorporation of health safeguards into small scale irrigation projects for two reasons. One is that much of the activity is spontaneous by individual farmers and small groups, so that governments are often not aware of what is going on. This is not necessarily bad. Farmer initiative and farmer investment can be immensely beneficial to the nation as a whole and it can easily be cramped or hindered by too much bureaucratic interference, by inappropriately detailed legislation, or by the imposition of the kind of standards which are necessary on a large-scale government-sponsored scheme, but which may not be within the technical competence or the financial resources of those undertaking individual or small group investments. The alternatives are often not between a crude scheme belonging to and operated by the people themselves and a well-designed and financed government scheme, but between a crude scheme and nothing.

It is important to realize that there are important benefits to small-scale farmer-initiated irrigation, and that these extend to health. It is

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often undertaken so that farmers can have a more secure food supply and so that they can enrich their diet with fresh food throughout the year. Consequently there are important nutritional benefits, besides the more generalized health benefits which a higher income usually brings. Many farmer-initiated small schemes focus on high value crops such as fruits and vegetables, which earn a considerable income.

The second major difficulty is the great variety of small-scale, farmer-initiated irrigation. It includes an individual using a simple lever device to irrigate a patch of vegetables by a stream; group activity in draining a swamp; building a small dam or constructing a weir and small canal to divert water from a river to irrigate tens or hundreds of hectares; individually or group owned wells, with water hauled up by bucket or lifted by diesel or electric pump, (either as a sole source of irrigation water, or as a supplement to an existing gravity supply). There are also various methods of partial control of water, and the use of flood recession water or water retentive soils in the dry season, which are also considered as *informal irrigation*.

In some countries these are traditional activities and over the generations farmers have built up considerable skill and knowledge. In others it is only because of more recent population growth and pressure on the land that people are being forced to exploit new resources. Nevertheless, even in these latter countries, farmers are often building on some degree of trial and experience, and it is all too easy to underestimate their knowledge of the environment they are manipulating.

From the health point of view the major dangers are from:

- schemes depending on dams and reservoirs. Many small reservoirs will have a longer shoreline and a shallower depth than one large reservoir with the same total surface area, and it is shallow plant-infested water near the shoreline that is the main health hazard, being the main vector breeding area, and the main area of man-water contact.
- types of irrigation that necessarily involve man-water contact, such as dipping a calabash into a pond, or standing in water, as with some rice schemes.

Fortunately, it is likely that more small-scale irrigation depends on wells than on reservoirs. Wherever pumping is involved, farmers are likely to be careful not to waste water, because of the energy cost.

Actors Involved In Irrigation And Health In Small-scale Irrigation

It follows from the above that the actors involved in the development of small-scale irrigation are very different from those involved in large schemes. They start with the farmers, as individuals or as groups. Amongst these, there may be some particularly influential individuals, either because of their wealth, or simply because of their ability to spot new opportunities. Farmers may or may not receive advice or funds from other local organizations, typically from village or district level government organizations, or from non-governmental organizations (NGOs) such as religious organizations, and local and international charities interested in helping the poorer sections of the community to help themselves. In some countries there may be banks specializing in agricultural loans who will be playing an active role.

Implications For Planners

The main implication of the above is that the level of health and engineering expertise available to a multitude of small schemes is very much less than what can be reasonably be expected on a large scheme. The only engineer likely to be available will be the District Engineer, who will also be responsible for roads, bridges and a host of other matters. (A few countries have a specialist irrigation engineer at this level, but he may not be concerned with the informal sector). The only health advisor may be the man or woman who staffs the local clinic, supplemented by whatever the school teacher and the agricultural extension assistant may be able to bring from their own training.

As a result the two main ways to improve the health impact will be through the development of appropriate standards, and through health education.

Standards For Small-scale Irrigation

In countries where there are many small dams and reservoirs it will be helpful to develop a national standard of reasonable minimum requirements for the embankment and the shore-line area. This standard should include techniques known to minimize habitats for disease vectors. It will have to be incorporated into the education of the professional engineers who may be serving at district level, so that they can in turn do as much as possible in the way of inspection, advice and enforcement. The standard will then also serve as a criterion which Banks and NGOs can incorporate into their agreements with farmers who approach them for funds or advice. Similar standards can be set for other structures.

It is essential that the standard is confined to the reasonable minimum for the country concerned; if it is set too high the health benefits of irrigation through improved nutrition and general welfare will be lost. Some water-related disease will probably exist in the area even before the advent of small-scale irrigation. The initial aim should be to impose the regulations that contain it at this level, rather than eliminating it completely, if this target is more likely to be within the limit of available resources. It will be necessary to find the right balance that enables farmers to use their limited resources for investment in a profitable activity, while at the same time, preventing their health status from deteriorating as a result of the increase in some health risks. It is, of course, to be hoped that as national prosperity increases, the organization responsible for standards will raise these step by step.

Standards, legislation and training are further discussed in chapter 6, page 62.

In circumstances where most small-scale irrigation is organized by a group rather than by individuals, it may be possible to develop model bylaws which groups can be advised to adopt as part of their own constitution or internal rules. For example, washing in canals may be made punishable by a fine to be imposed by the officers of the irrigation association. Alternatively, village Councils can be advised to adopt such bylaws.

Health Education And Intersectoral Cooperation

Health education in small-scale irrigation is too important to be left only to the health professionals. The prime actors are the farmers, and they must be reached through as many intermediaries as possible.

Most countries have arrangements whereby district or provincial agricultural extension or community development or health staff are called to headquarters from time to time for in-service training. Engineering and health staff could, for example, be asked to teach some of the courses for agricultural extension or community development assistants, so that these know the health benefits of good drainage, and the dangers of using irrigation ditches for drinking and washing water. This will enable them to advise farmers. School-teachers should be another important target, since they are generally influential in rural areas. The aim must be to use all possible channels to get the message to farmers about steps they should take to safeguard their own health and that of their families.

Monitoring The Health Impact Of Small-scale Irrigation

The only people likely to be available to monitor the health impact of small-scale irrigation are the persons in charge of village level health facilities. It should be the responsibility of the Agricultural Department at provincial or district level to warn their Health counterparts when irrigated agriculture is increasing. The responsible Health Officer will then need to ensure that his subordinate staff know which diseases are involved, and that their record keeping systems are such that the higher authorities can be alerted if there is any major increase in water-related disease.

Chapter 6

Incorporation of Health Safeguards into Rehabilitation or Modernization of Irrigation Schemes

Trends in irrigation development

While the 1960s and 1970s presented a picture of rapid irrigation development world-wide, the pace of development has noticeably slowed down in the 1980s. A shift is discernable, particularly in the countries of South and South East Asia, from development of new irrigation schemes to the rehabilitation and modernization of existing ones. This trend is directly related to the success of the earlier development which has led to food self-sufficiency and a reduced need to invest in new development. In other parts of the world, notably some countries in Africa, increased food production is still imperative. Where rainfall is inadequate or unreliable one of the means being used to secure this is to bring new areas under irrigation.

Rehabilitation had been defined as the restoration of dilapidated facilities; modernization implies changes in the system to meet new needs, to improve standards or to utilize a more effective technology. Rehabilitation projects commonly comprise elements of both rehabilitation and modernization, and for the sake of brevity we will in the remainder of this chapter refer to rehabilitation, taking this to include modernization. In addition to changes in technologies, new management systems may be introduced. There is today increased interest in

the social, financial and production implications of the rehabilitation process (Abernethy, 1987).

Obviously, rehabilitation of irrigation schemes offers an excellent opportunity to incorporate remedial measures for any existing irrigation-associated disease problems.

Differences In The Planning Process New Development vs. Rehabilitation

Existence of experienced personnel

One of the most striking differences between a new project and one for rehabilitation is the existence of experienced people in the field. These include:

- **experienced irrigators** who may have formed farmers' associations or water user associations, through which they can be easily consulted. If not, special surveys can be made.
- **village councils** and on large schemes **local government authorities** at higher levels who know the social, economic and political problems caused by the deterioration or inadequacy of existing facilities
- **experienced irrigation professionals** at all levels of the scheme (the lowest level official having the most detailed knowledge of local problems)
- **experienced health personnel** whose records will probably show the variation in health problems during different phases of the scheme's operation, in different areas of the scheme, and in different seasons.

Existing levels of infrastructure

The second important way in which an existing scheme differs from a new scheme is that the most expensive infrastructure already exists, and will not affect the economic rate of return of improvements. It is therefore possible that a high rate of return will be found for improvements in certain key areas where they were too expensive to form part

of the initial programme. Typical examples are linings of parts of canals, or the installation of drainage, which can both improve agricultural productivity and reduce health risks.

Compared with the situation at the beginning of a new scheme, there should also be increased levels of wealth and experience and improved access to markets amongst the farmers concerned. This may be conducive to the introduction of higher technology solutions such as buried pipe-lines, use of supplementary well irrigation, use of drip or sprinkler systems, which may save water as well as eliminate some health risks.

Because the largest infrastructural elements are already provided, (for example the dam and reservoir), it may be more feasible than at the initial stage to plan for rehabilitating the scheme in stages, giving proper trials to new techniques, and taking advantage of experience gained in the sectors dealt with subsequently.

A phased approach is also less likely to disrupt existing production, which will be important from the point of view not only of the livelihoods of the families concerned, but also from the national view.

Changes in the surrounding environment

A third difference from a new project is that the existing project is likely to have changed the environment both in the project area and in the area immediately surrounding it. This will apply not only to the physical environment (eg new areas affected by water-logging or salinisation) but also to the social environment. In particular, new towns may have sprung up or existing ones may have increased in size, for a successful project usually leads to an increase in demand for services, processing industries, consumer goods industries, etc. These new towns may have very unsatisfactory health and sanitation standards, particularly if they are short of water. It may be desirable to save water on the irrigation scheme for the use of urban consumers, who will probably be able to pay a higher unit rate for the water they consume. However, if this affects farmers' rights to certain quantities of water, in law or in custom, it will require careful negotiation and compensation. In some cases a rehabilitation will be able to save water for urban use without reducing the amount available to farmers. (An example from the USA is cited in Tiffen, 1987).

Changes in the institutional situation

The fourth important difference with the new project situation is the probability that in many countries any original project authority has been incorporated into normal district/provincial administration. All the ministries concerned will have experienced the effect of the irrigation scheme on their particular concerns, and they may have objectives which can be economically attained as part of the rehabilitation programme. This will include Health, but also other ministries, e.g. Transport. Therefore, intersectoral collaboration is still required.

The Modern View Of Rehabilitation Planning

The most important stage in a rehabilitation programme is the first, during which the diagnosis of the existing problems is made. The diagnosis will be facilitated by consultation with the experienced personnel mentioned above. This will, of course, be accompanied by additional expert investigations, leading to proposed solutions.

The diagnosis must be accompanied by a re-definition of the scheme's objectives, in the light of the needs of the various parties (farmers and government departments), and in consideration of the willingness of the different parties to pay for a given level of improvement in particular aspects of the scheme's functioning. The diagnosis should therefore be followed by a process of negotiation on objectives and cost sharing. The emphasis on who is willing to pay for what is very important since we can all agree that high targets are desirable if we do not have to contribute to the costs of achieving them. The process described above is quite normal in the more industrialized countries and is beginning to become more common elsewhere. This was very apparent from the papers given at the 1987 Congress of the International Commission on Irrigation and Drainage (summarized in Tiffen, 1987). A paper given by T R Haider suggested the following steps should be taken:

- ❖ a survey of the system (diagnosis, which includes consultation)
- ❖ alternative proposals, and discussion of their positive and negative aspects
- ❖ comments and feedback from interested parties, if necessary through the constitution of an appropriate committee.

This allows for the selection of the most appropriate proposal, on which further design work and an environmental impact assessment is based.

Implications For Financing Agencies, Central Governments, Local Governments And Regional Planning Authorities

This view of rehabilitation has important implications for planning and financing agencies.

Firstly, the planning stages require time, because of the process of fact-finding, consultation, review, and negotiation. They may or may not require more man-months than traditional project planning; they will certainly require the man-months to be spread over a longer period. Funds will be needed to finance this process, whether from normal government revenues, or from an aid grant or loan. It is likely to be more expensive than the type of planning that produces a single blueprint for implementation, but since the planning process rarely costs more than 5% of the total project cost, additional money spent at this stage is well used if it achieves an outcome that is more effective and cheaper for construction or operation.

Secondly, the recommendation that rehabilitation can be undertaken in stages over different project sectors, altering methods as technologies are proven, or as changes occur in the external environment, can create problems for the normal time horizons of lending agencies, (3 to 5 years). It may require a sequence of smaller loans over a longer period of years, which from their point of view is more costly to administer. However, it may be much more cost-effective in the long run.

Thirdly, the role of intersectoral planning at the sub-national level is very important, if other ministries are to be able to take advantage of the opportunity that rehabilitation provides to secure improvements in the matters for which they have jurisdiction. This concerns health, but is not exclusive to health.

Fourthly, there is a most important place for the representatives of the users, as advisers on present problems and future needs, as those who will be responsible for some aspects of future operation and maintenance, and as those who will contribute to the capital and recurrent costs of improvements. In different countries they may be constituted and consulted through Water User Associations, through self-managing Irrigation Districts on the USA model, or through the local level village and district authorities of the irrigated area.

Standards, Legislation, Research And Training

What has been said above is not meant to deny or minimize the importance of a central government ministry such as a Ministry of Irrigation or of Health, which will be the national repository of expertise and information in its field. The Ministry of Irrigation, or of Agriculture when irrigation is a Department within this Ministry, will be the leading ministry in a large rehabilitation. It will also be the source of advice to rehabilitations of small-scale schemes that may be undertaken by local authorities or private sector organizations. Furthermore, at any one time, it is likely to be responsible for more than one rehabilitation project. It will therefore have an important role in setting standards (and in revising them as new information or new technology becomes available). These standards may be incorporated into legislation, in which case the Ministry is also likely to have an inspectorate to see that standards for such items as construction, environmental protection, protective measures for workers engaged in hazardous operations, etc, are adhered to. An example of a standard which includes techniques known to minimise habitats for disease vectors is that of the American Society for Agricultural Engineers, Standard No. EP267.

Other ministries such as Health or Housing, may have responsibilities for setting environmental standards in villages and other settlements. In different countries environmental protection measures such as weed control, spraying, etc will be the responsibility of different ministries, which may set their own standards.

It has to be emphasized that standards must be enforced, and that this is a prime responsibility of the ministry concerned. There are examples of rehabilitations where the construction contractor has been permitted to get away with such poor workmanship that effective maintenance becomes either very expensive, or even nearly impossible. In cases where Water User Associations or Irrigation Districts become responsible for the works, pay for maintenance and contribute to the costs of construction, they will have a keen interest in seeing that the construction is done to a proper standard. This has been demonstrated in relation to rehabilitation works carried out for farmer-managed communal schemes by the National Irrigation Administration of the Philippines. Providing the motivation for effective supervision of construction contracts can be a problem when operation and maintenance costs are paid out of general Treasury revenues. High level political and ministerial direction may be needed to provide the institutional reforms required to ensure staff are properly rewarded for enforcing standards.

When there is a very widespread health problem connected with irrigation, it can be useful to set up a Council or similar body, to carry out research, recommend standards, and give advice. This is particularly useful for vector-borne diseases precisely because they can be controlled by measures which are the responsibility of different ministries. The Philippines, for example, has a Schistosomiasis Control Council with the Minister of Health as Chairman (see Annex 3). In addition to representatives of four ministries it includes the President of the Philippines Medical Association and the Administrator of the National Irrigation Administration.

Examples of different institutional arrangements in the way countries tackle the need for integrated measures for health enhancement are given in the report of the fourth PEEM meeting (1984).

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Standards are applied and enforced by professionals who need the appropriate training. There should be good links between the institutions which develop national standards and the universities and other bodies responsible for training professionals, or for carrying out in-service courses. WHO has promoted the development of a curriculum and syllabus on disease vector management for inclusion in engineering courses (WHO, 1987).

Bibliography

Abdu, K. M., Haridi, A. M., El-Gaddal, A. A. and Jobin, W. R., 1987. Intensification of Irrigated Agriculture in the Sudan and Transmission of Malaria and Bilharzia'', *ICID Bulletin* 36, 2: 24-34, International Commission on Irrigation and Drainage (ICID), Delhi

Abernethy, C., 1987. Trends in irrigation development and their implications for vector-borne disease control strategies. In: *Effects of Agricultural Development on Vector-borne Diseases*, Document AGL/MISC/12/87, FAO, Rome.

Audibert, M., 1986. Agricultural Non-wage Production and Health Status: A Case Study in a Tropical Environment. *Journal of Development Economics* 24: 275-291.

Birley, M.H., 1989. *Guidelines for Forecasting the Vector-borne Disease Implications of Water Resources Development*. Joint WHO/FAO/UNEP Panel of Experts on Environmental Management for Vector Control. PEEM Guidelines Series, document VBC/89.6, WHO, Geneva.

Bottrall, A.F., 1985. Managing Large Irrigation Systems: a Problem of Political Economy, *AAU Occasional Paper 5*, Overseas Development Institute, London.

Butcher, D.A.P., 1972. An Organizational Manual for Resettlement. FAO, Rome.

Cernca, M.M., 1988. Involuntary Resettlement in Development Projects: Policy guidelines in World Bank-financed Projects. *World Bank Technical Paper No 80*, World Bank, Washington D.C.

Dixon, J.A. *et al.*, 1986. Economic Analysis of the Environmental Impact of Development Projects. *Asian Development Bank Economic Staff Paper No. 31*, ADB, Manila.

Doumenge, J.P., Mott, K.E., Cheung, C., Villenave, D., Chapuis, O., Perrin, M.F. and Reaud Thomas, G., 1987. Atlas of the Global Distribution of Schistosomiasis, CEGET/CNRS - WHO, Talence/Geneva.

Guidelines for Intersectoral Cooperation

Environmental Resources Ltd, 1983. *Environmental Health Impact Assessment of Irrigation Agricultural Development Projects*, World Health Organization, Regional Office for Europe, Copenhagen.

Feachem, R, M McGarry and D Mara (eds.). 1977. *Water, Wastes and Health in Hot Climates*. John Wiley, New York.

Feachem, R., Bradley, D.J., Garelick, H. and Mara, D.D. 1980. Health aspects of excreta and sullage management. *Appropriate Technology for Water Supply and Sanitation series*, World Bank, Washington D.C.

Food and Agriculture Organization, 1987. *Effects of Agricultural Development on Vector-borne Diseases*. Edited version of Working Papers presented to 7th Annual Meeting of the Joint WHO/FAO/UNEP Panel of Experts on Environmental Management for Vector Control, document AGL/MISC/87.12, FAO, Rome.

Gratz, N, 1987. *Proceeds of the Workshop on Assessment of Human Health Risks in Irrigation and Water Resource Development Projects*. World Bank, Washington D.C..

International Irrigation Management Institute, 1986. *Proceedings of the Workshop on Irrigation and Vector-borne Disease Transmission*, Kandy, Sri Lanka.

Lipton, M. and de Kadt, E., 1988. *Agriculture - Health Linkages*. WHO Offset Publication No. 104, World Health Organization, Geneva.

International Rice Research Institute, 1988. *Vector-borne Disease control in Humans Through Rice Agroecosystem Management*. IRRI, in collaboration with WHO/FAO/UNEP PEEM, Los Banos, the Philippines.

Mather, T H, 1984. *Environmental Management for Vector Control in Rice Fields*, *FAO Irrigation and Drainage Paper 41*, Food and Agriculture Organization of the United Nations, Rome.

McJunkin, E.G., 1975. *Water, Engineers, Development and Disease in the Tropics*. *USAID/csd-1888*, United States Agency for International Development, Washington D.C..

Mills, A. and Phillips, M., in prep. *Guidelines for carrying out Cost-effectiveness Studies of Vector Control Operations*, Joint WHO/FAO/UNEP Panel of Experts on Environmental Management for Vector Control. PEEM Guidelines Series, WHO, Geneva.

Music, S. and Olivares, J., 1987. The *Ex-ante* Evaluation of the Health Impacts in the Irrigation Projects, in: J Olivares, *Options and Investment Priorities in Irrigation Development*, The World Bank, Washington D.C.

Olivares, J. 1986. The Assessment of Water Resources Projects Involving Economic, Social and Environmental Costs and Benefits: The World Bank's View. *Natural Resources Forum*, 10:2. United Nations, New York.

Oomen, J.M.V., de Wolf, J. and Jobin, W.R., 1988. *Health and Irrigation*, ILRI publication 45, Vol 2. International Institute for Land Reclamation and Improvement, Wageningen, the Netherlands.

Pant, C., 1987. Vector-Borne Diseases of Man and their Socio-economic Impact. *Insect Sci. Applic.* 8, 4/5/6: 655-664.

PEEM (Panel of Experts on Environmental Management for Vector Control), 1984. *Report of the Fourth Meeting*. Part II, Technical Discussion - Institutional Arrangements to Ensure the Incorporation of Health and Environmental Safeguards in Water Resources Development Projects. VBC/84.5, World Health Organization, Geneva.

PEEM, 1986. *Report of the Sixth Meeting*. Part I. Technical Discussion - Financial and Economic Aspects of Environmental Management and its Cost-effectiveness as a Vector Control Measure. VBC/86.2, World Health Organization, Geneva.

Pike, E.G., 1987. *Engineering against Schistosomiasis/bilharzia*. MacMillan, London.

Sharma, V.P., 1987. The Green Revolution in India and Ecological Succession of Malaria Vectors. In: *Effects of Agricultural Development on Vector-borne Diseases*. Document AGL/MISC/12/87, Food and Agriculture Organization of the United Nations, Rome.

Small, L.S., 1987. Irrigation financing policies to promote improved operations and maintenance: the role of the farmer. In: *Selected working papers for the 3rd, 4th, 5th and 6th PEEM meeting*, document VBC/87.3, WHO, Geneva.

Stanley, N.F. and Alpers, M.P., eds., 1975. *Man-made Lakes and Human Health*. Academic Press, London.

Tech, C.L., (1988). Health and environmental programmes: institutional arrangements for their implementation in water resource development

Guidelines for Intersectoral Cooperation

projects in the Philippines, in: *Selected working papers for the 3rd, 4th, 5th and 6th PEEM meeting*, document VBC/87.3, WHO, Geneva.

Tiffen, M., 1986. *Improving the Socio-Economic and Institutional Content of Irrigation Feasibility Studies*, Overseas Development Institute, London.

Tiffen, M., 1987. The Dominance of the Internal Rate of Return as a Planning Criterion and the Treatment of O & M Costs in Feasibility Studies, *ODI-IIIMI Irrigation Management Network Paper 87/1b*, Overseas Development Institute, London.

Tiffen, M., 1987. Rehabilitation and Participation: The views of the Engineers, *ODI-IIIMI Irrigation Management Network Paper 87/3b*, Overseas Development Institute, London.

World Health Organization, 1980. Environmental management for vector control. Third report of the WHO Expert Committee on Vector Biology and Control, Technical Report Series 649, Geneva.

World Health Organization, 1982. *Manual on Environmental Management for Mosquito Control*. WHO Offset Publication No 66, Geneva.

World Health Organization, 1987. *Proposed Curriculum on Disease Vector Management in Water Resources Development Projects for Inclusion in Engineering Courses*. VBC/87.1, Geneva.

World Health Organization, 1989a. *Health guidelines for the use of waste water in agriculture and aquaculture*. Report of a WHO Scientific Group, Technical Report Series 778, WHO, Geneva.

World Health Organization, 1989b. *Geographical distribution of arthropod-borne diseases and their principal vectors*, Document WHO/VBC/89.967, WHO, Geneva.

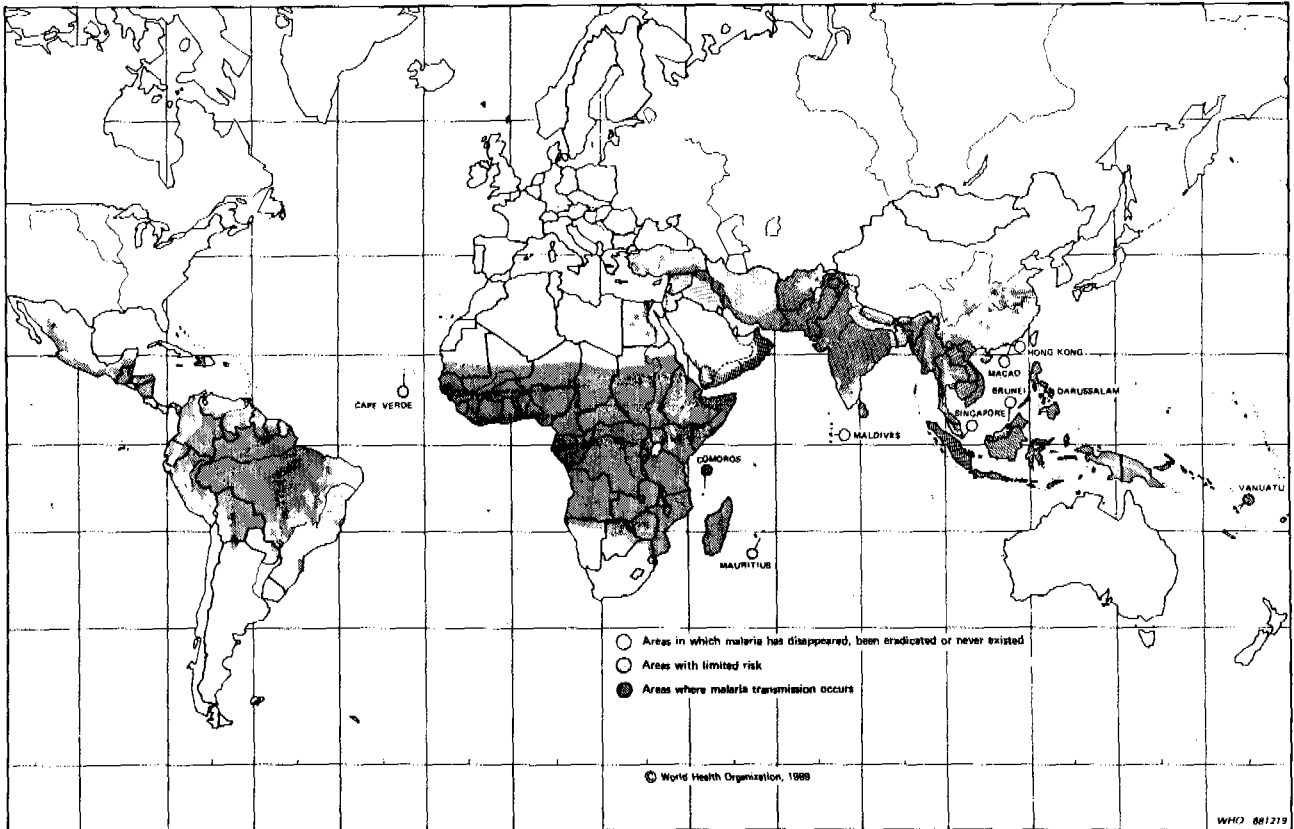
Yoder, R., 1983. Non-agricultural Uses of Irrigation Systems: Past Experience and Implications for Planning and Design. *ODI Irrigation Management Network Paper 7e*. Overseas Development Institute, London.

Annex 1

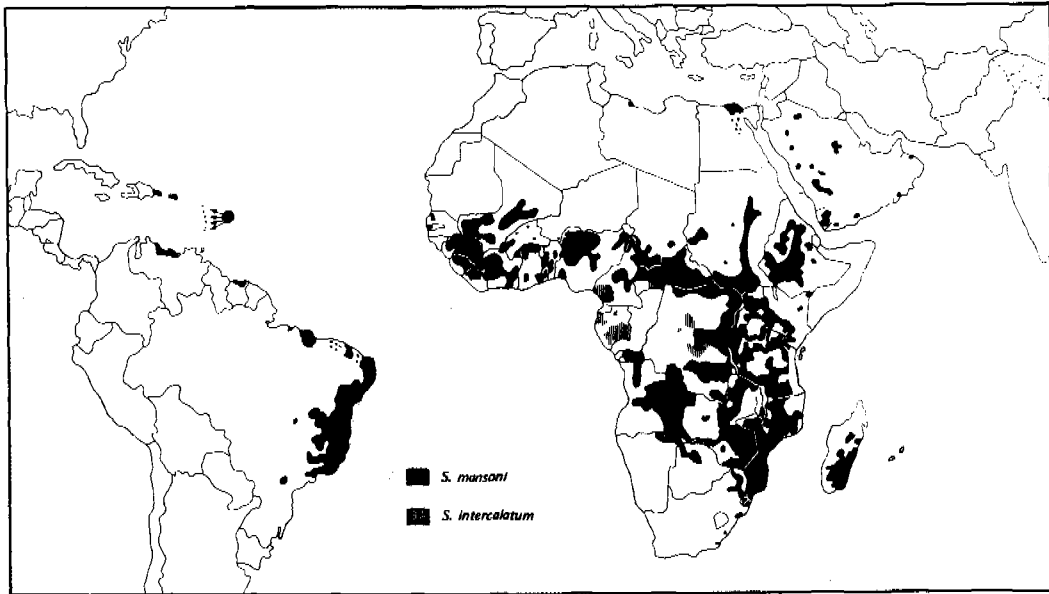
Maps showing the geographical distribution of five major arthropod-borne or snail-borne diseases.

I. MALARIA

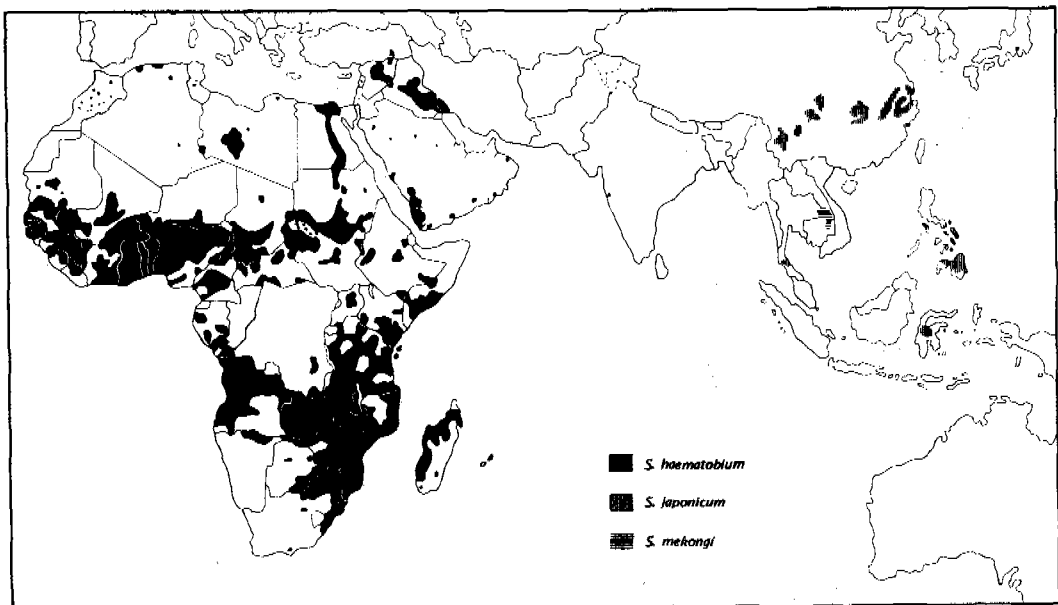
Map 1 Epidemiological Assessment of Status of Malaria, 1987



II. SCHISTOSOMIASIS



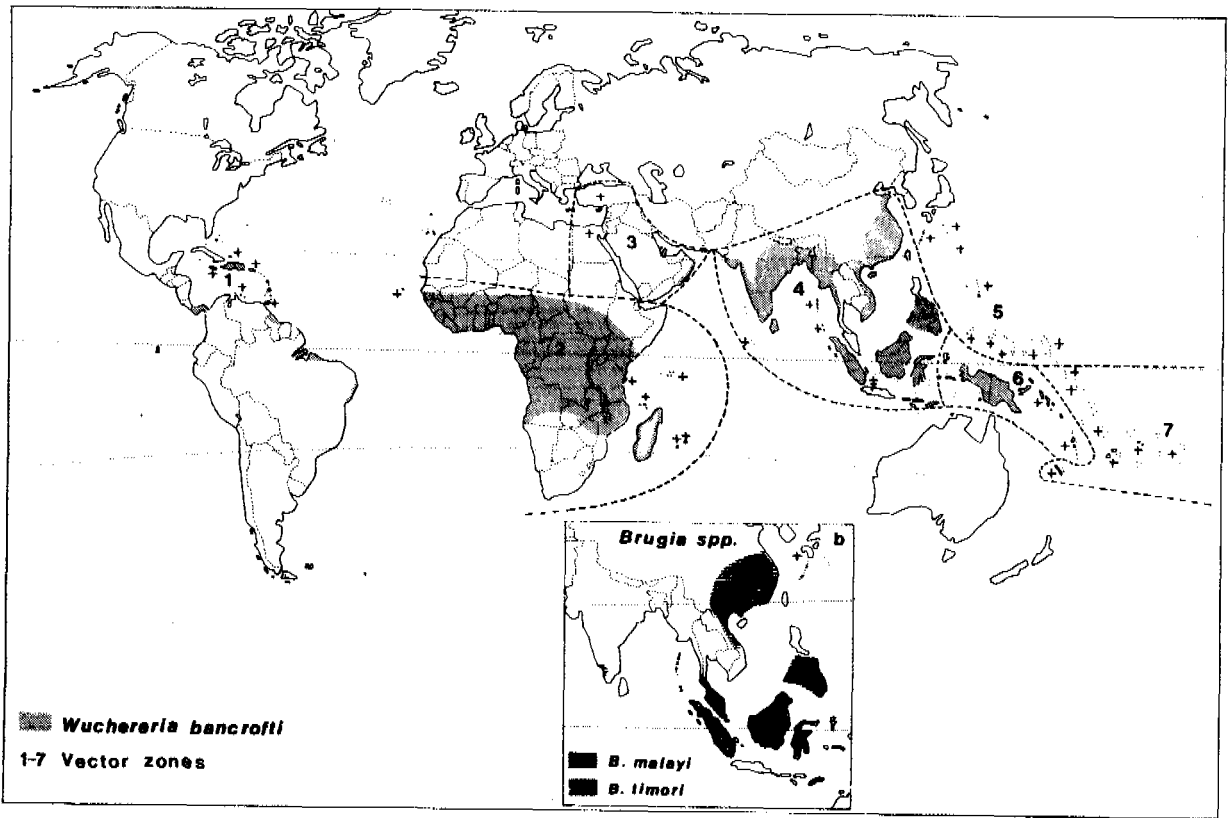
Global distribution of schistosomiasis due to *Schistosoma mansoni* and *S. intercalatum*, 1985
Distribution mondiale de la schistosomiase due à *Schistosoma mansoni* et *S. intercalatum*, 1985



Global distribution of schistosomiasis due to *Schistosoma haematobium* and *S. japonicum*, 1985
Distribution mondiale de la schistosomiase due à *Schistosoma haematobium* et *S. japonicum*, 1985

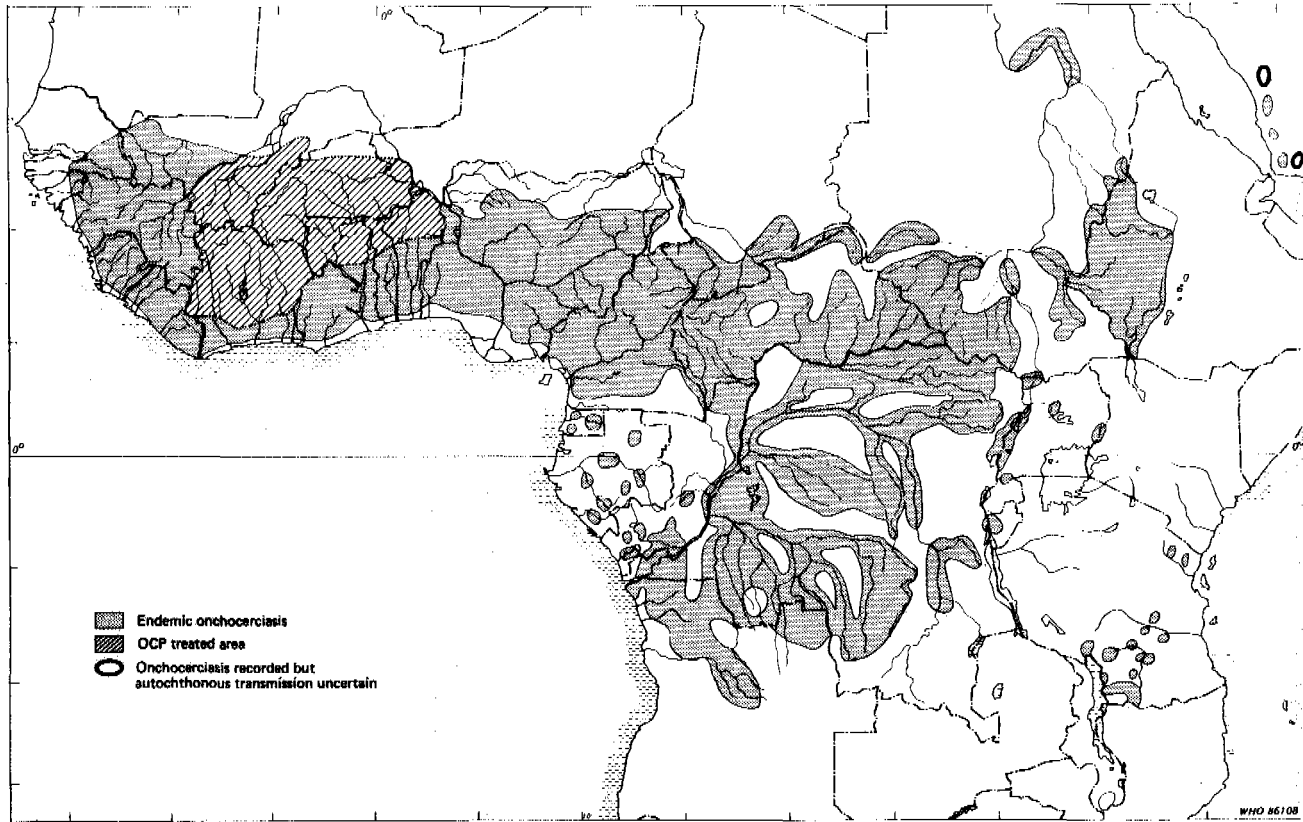
III. FILARIASIS

Distribution of Human Lymphatic Filarial Parasites in the Major Endemic Zones



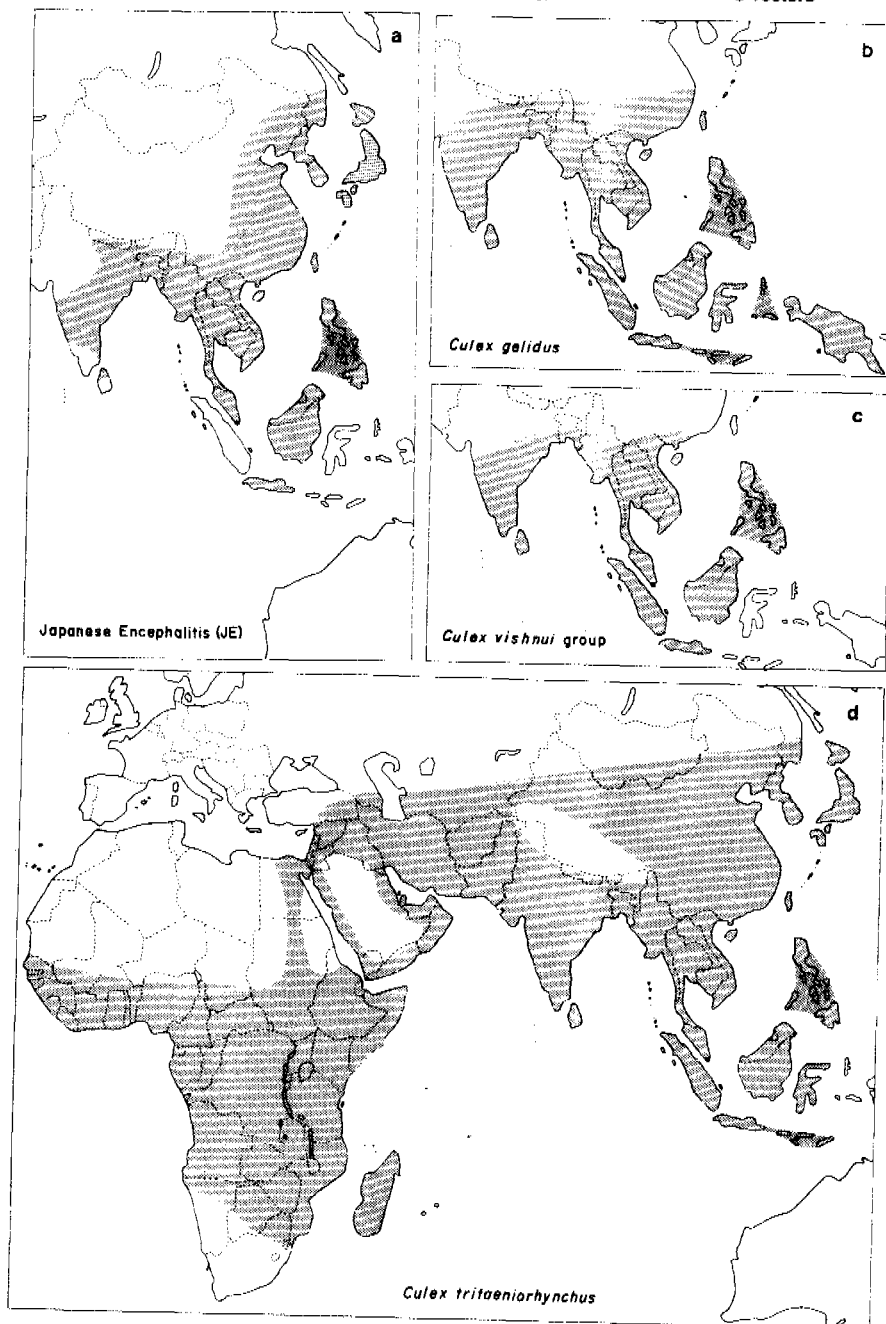
IV. ONCHOCERCIASIS

Map 49 Geographical Distribution of Onchocerciasis in Africa and the Arabian Peninsula



V. JAPANESE ENCEPHALITIS

Map 17 Extent of Japanese Encephalitis Endemicity, and Distribution of the Vectors



Annex 2

Checklist
of
major steps for the prevention and control of
vector-borne diseases at each phase of
water resource development projects

Planning phase

(1) Review of existing information on health and related subjects

(a) Epidemiology: morbidity and mortality rates, geographical distribution, vector ecology.

(b) Health and medical services: facilities, staff, special projects and programmes; degree of development, capacity and coverage.

(c) Human population and its characteristics: agricultural, migrant, nomadic, etc; population growth, importance of migratory movement, displacement within the project area.

(d) Cattle: numbers and economic importance, prevalent diseases.

(e) Community and housing patterns: location, design, construction materials.

(f) Sanitation: water supply, excreta and wastes disposal facilities.

(g) Climatic patterns: temperature, rainfall, humidity, wind, etc.

(h) Water: surface water and ground water, quality, pollution, abundance and seasonal variation, floods and droughts, seasonal variation in temperature.

(i) Soil: physical and chemical characteristics, including permeability, stability, salt content, etc.

(j) Flora and Fauna: Natural and cultivated aquatic and land vegetation; domestic and wild animals.

(k) Economy: national and local; sources and level of income.

(l) Topographical maps: contour lines, roads, villages, etc., of the region and the watershed, design plans of the proposed project, etc.

(2) Surveys: to check existing information or fill in gaps in knowledge; assessment and collection of basic data by specialists

(a) Detailed epidemiology of major existing diseases and biology and ecology of principal vectors

(b) Health and medical services, disease and vector control programmes and activities, evaluation of effectiveness and resources.

(c) Human and cattle movement: migratory currents, their origins and paths.

(d) Sanitation: actual and potential sources of water supply, investigation of groundwater sources, actual and potential sources and routes of pollution, practices involving water contact, and methods of excreta disposal, cattle watering and manure disposal.

(e) Existing and proposed agricultural crops and practices: irrigation methods, suitable crops, rotation in cultivation and irrigation, use of pesticides and fertilizers, their kind and amount.

(f) Local economy: present status and prospects for future development.

(g) Socio-cultural patterns: present level and possible disturbance produced by the project.

(h) engineering and operational reconnaissance and mapping for ecological, hydrological and geological soil studies.

(i) Contact with agencies operating in the project area, their type of activities and possibility of assistance and coordination.

(3) Decision-making for the prevention and control of diseases

(a) Review of project proposals and preliminary designs and options.

(b) Identification of existing health problems.

(c) Prediction of possible future problems and of their health effects.

(d) Determination of the importance and extent of actual and potential health problems to establish an order of priority in prevention and control operations.

(e) Feasibility studies of control measures, including cost-effectiveness and cost-benefit analyses.

(f) Selection of village sites and types of water supply and excreta disposal installation.

(g) Selection of methods of vector and disease control and estimates of manpower and organizational requirements.

(h) Organization of displaced and immigrant population and estimates for the provision of water supply, sanitation and other health facilities.

Design phase

(1) Establishment of design criteria to minimize health hazards and to achieve the objectives of the health programme.

(2) Evaluation of preliminary project designs and alternatives.

(3) Establishment of proposed practices of water management and their effects on vector habitats.

(4) Preliminary design and options for canal lining overpasses and other health structures.

(5) Final detailed design of works in the reservoir:

(a) Shoreline modification and improvement.

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(b) Clearance and disposal of trees and brush, of man-made structures and fences.

(c) Relocation of roads, villages, cemeteries, shrines, etc.

(d) Discharge structures sized for water-level regulation and downstream flushing.

(6) Final detailed design of works in irrigation schemes.

(a) Equalizing reservoirs and night-storage ponds, when necessary.

(b) Canals and drains.

(c) Regulating structures, gates, sluices, etc., and distributing chambers.

(d) On-farm water use.

(e) Groundwater use and control.

(f) Potential for incorporating domestic water supply.

(7) Final detailed design of measures and works in communities.

(a) Selection of sites for new communities distant from water sources.

(b) Provision of safe, adequate and convenient water supply and sewage disposal systems.

(c) Recreation: provision of safe ponds as alternative to infected water bodies, sports grounds, etc.

(d) Other protective measures, such as house screening, surface water drainage, general sanitation, and public laundry installations.

(8) Provisions for maintenance activities and their financing.

(9) Environmental management

(a) Regulating structures for measurement and control of water discharge and velocity

(b) Gates required for rapid drying and flushing of irrigation subsystems.

(c) Adjustment of water salinity in coastal breeding sites through the installation and operation of gates.

(d) Water level regulation in small reservoirs by means of automatic siphon spillways.

(e) Safe crossings and bridges over canals and drains.

(f) Lining of canals and drains, closed or subsurface conduits.

(10) Enhancement and simplification of chemical and biological control

(a) Design of dispensers for chemical application attached to or incorporated into regulating structures, metal rakes and screens against snails.

(b) Access roads and paths for surveillance and spraying, clear water lanes and landing of boats.

(11) Health education of the public and development of community participation.

(12) Health facilities: dispensaries and hospitals.

Construction phase

(1) Health protection of the construction labour force.

(2) Special facilities for disease control and treatment at the construction site.

(3) Adequate housing and sanitary facilities for construction workers and their families.

(4) Surveillance of infections in imported manpower and local population.

(5) Monitoring, vaccination, treatment of local population and elimination and control of endemic diseases, especially those with potential for intensification with project operation.

(6) Environmental protection, erosion, spillage, air and water pollution, disposal of wastes, aesthetic alterations, etc.

(7) Inspection to ensure that construction is carried out according to health designs.

(8) Health education of the public and development of community participation.

Operations phase

(1) Allocation of funds, assignment of staff and implementation of disease control programmes.

(2) Surveillance, screening and treatment of infected persons.

(3) Establishment of rule curves and schedules for the control of mosquitoes, snails, flies, weeds, etc.

(4) Establishment of practices and schedules for water level regulation.

(5) Maintenance and modernization of structures and other works.

(6) Application of chemical and biological methods for vector and weed control.

(7) Drainage of all water collections around the reservoir.

(8) Prevention and correction of excessive seepage.

(9) On-farm water management.

(10) Operations, maintenance, improvement and development of water supply and sewage disposal systems, general sanitation.

(11) Health education of the public and development of community participation.

(12) Evaluation of vector and disease pattern changes, efficacy of control programmes, study and implementation of amendments or alterations to improve results.

(13) Preparation of periodic and special reports for information purposes.

Source: WHO, 1980.

MEMORANDUM OF AGREEMENT

This Memorandum of Agreement entered into by and between:

NATIONAL IRRIGATION ADMINISTRATION, herein represented by **ALFREDO L. JUNIO**, with offices at E. de los Santos Avenue, Quezon City, hereinafter referred to as the **NIA**

and

MINISTRY OF HEALTH, herein represented by **CLEMENTE S. GATMAITAN, M.D., M.P.H.** Minister with offices at San Lazaro Compound, Manila, hereinafter referred to as the **MOH**;

-WITNESSETH-

WHEREAS, the Government through the National Irrigation Administration has programmed the implementation of the Second Davao del Norte Irrigation Project in Davao del Norte, Mindanao, with a bank loan from the Asian Development Bank, hereinafter referred to as the ADB;

WHEREAS, in the implementation of the project, the NIA, being the project proponent is agreed to be the principal executing agency and the MOH, as the executing agency for Public Health;

WHEREAS, there is a need for a coordinative effort between the NIA and the MOH to effectively carry out the implementation of the project;

NOW, THEREFORE, for and in consideration of the foregoing premises, the parties hereby agree as follows:

1. OBLIGATIONS OF NIA

1. In coordination with the MOH, to plan, design and construct the necessary drainage works to achieve the objective of the schistosomiasis control.
2. To provide financing for the foreign currency requirement for the implementation of the health services and schistosomiasis control programme in the project, out of the loan proceeds obtained from the ADB.
3. Procure, on behalf of the MOH, the necessary laboratory equipment such as microscope, vehicles, etc., and necessary drugs and chemicals reimbursable from and to the extent of the loan proceeds allocated to MOH, to effectively carry out the project.

4. NIA shall turn over to MOH the equipment, vehicles, and drugs purchased under the loan and such equipment and vehicles shall eventually become MOH property upon completion of the project.

5. Provide reasonable incentive/honorarium in accordance with the rates approved by NIA to appropriate number of personnel to be fielded by MOH who will be actually involved in the schistosomiasis prevention and control within the project area to the extent that such incentives shall be allowed only during the prosecution and up to the completion of the Second Davao del Norte Irrigation Project.

6. Provide technical assistance for the construction of the necessary health infrastructure and facilities like rural health centers, for the effective performance of the MOH personnel in their assigned tasks.

II. OBLIGATIONS OF MOH

1. MOH shall prepare and submit to ADB, in consultation with NIA, a detailed implementation plan for the health component of the project and assist or advise NIA in the preparation of its plans for drainage and for the operation and maintenance of canals in the project area in order to increase their impact on schistosomiasis control.

2. Provide financing for the local currency requirement of the health component including the construction of health infrastructures and facilities, out of its budget over the implementation period of about five years.

3. Provide for the assignment of necessary personnel with adequate pecuniary and other incentives to assure the participation of sufficient personnel as well as to execute and complete the construction of health infrastructures required to meet the health service needs of the population in the project area.

4. Provide repair and maintenance services to the health infrastructures constructed including equipment and vehicles procured through this project, out of its own fund.

5. Continue to provide personnel, equipment, and drugs and chemicals as necessary for general rural health care in the project area after project completion.

IN WITNESS WHEREOF, the parties hereto have set their signatures this day of 1978.

(SGD.) CLEMENTE S. GATMAITAN
Minister
Ministry of Health

(SGD.) ALFREDO L. JUNIO
Administrator
National Irrigation Administration

MEMORANDUM OF AGREEMENT

This Memorandum of Agreement entered into by and between:

The NATIONAL IRRIGATION ADMINISTRATION represented by FIORELLO R. ESTUAR, Administrator, with offices at E. de los Santos Avenue, Government Center, Quezon City, hereinafter referred to as the NIA;

and

The MINISTRY OF PUBLIC WORKS & HIGHWAYS represented by JESUS S. HIPO-LITO, Minister, with offices at Bonifacio Drive, Port Area, Manila, hereinafter referred to as the MPWH.

-WITNESSETH-

WHEREAS, the Philippine Government through the National Irrigation Administration has programmed the implementation of the Third Davao Irrigation Project in the province of Davao del Norte with a loan from the Asian Development Bank, hereinafter referred to as the ADB;

WHEREAS, the said loan has been provided on the terms and conditions stipulated in the Loan Agreement dated 3 November 1982 between the Republic of the Philippines and the Asian Development Bank;

WHEREAS, in the implementation of the project, the NIA being the project proponent has agreed to be the Principal Executing Agency, and the MPWH as the Executing Agency for Rural Water Supply System Component;

WHEREAS, there is a need for a coordinative effort between the NIA & the MPWH to effectively carry out the implementation of the project.

NOW, THEREFORE, for and in consideration of the foregoing premises, the parties hereby agree as follows:

I. OBLIGATIONS OF MPWH:

1. In accordance with the provisions of Schedule 1 & 6 of the Loan Agreements, MPWH shall, in coordination with NIA, be responsible for the construction of approximately two hundred seventy four (274) units of Level I tubewells for installation in about 51 Barangays; construction of approximately 1050 Level I shallow wells for installation in the schistosomiasis endemic parts of the project; and construction of two (2) units of Level II systems for Nabunturan Poblacion at depths ranging from 30 m to 100 m.

2. MPWH shall submit to the Bank for approval, within three (3) months of the Effective Date of the Loan, a detailed implementation plan, including site selection, construction schedule and schedule for procurement of necessary equipments for the implementation of Rural Water Supply System Component of the project.

3. In accordance with Section 6, Schedule 6 of the Loan Agreements, MPWH shall establish a suitably staffed Project Office at Tagun within three (3) months of the Effective Date of the Loan. This project office shall be headed by an Officer-in-Charge. The Officer-in-Charge shall coordinate with the NIA Project Manager on matters concerning the project.

4. MPWH shall be responsible for the procurement of the equipment and materials necessary for the implementation of the Rural Water Supply of the project. Such procurement shall be carried out in accordance with the procedures set forth in Schedule 4 of the Loan Agreement.

5. MPWH shall be responsible for providing the local currency requirements of the Rural Water Supply System which shall be included in its yearly budgets covering the implementation period of the project and to assure that such funds shall be made available as and when needed to ensure the successful implementation of the project.

6. MPWH shall maintain a separate record and account adequate to identify the goods and services financed out of the proceeds of the loan, to disclose the use thereof in the project, to record the progress and cost of the project and to reflect in accordance with consistently maintained sound accounting practices the operation and financial condition relevant to the implementation of the Rural Water Supply System component. These accounts will be audited annually, in accordance with sound auditing principles, by auditors acceptable to the Bank and certified copies of the audited accounts and the auditor's reports will be furnished to the Bank within six (6) months after the end of each fiscal year.

7. All applications for withdrawal of loan proceeds from the loan account for the purpose of financing expenditures on the Rural Water Supply System of the project shall be made through NIA. MPWH shall be responsible for the preparation of all the necessary supporting documents. MPWH shall ensure that all goods financed out of such proceeds are used exclusively in carrying out the agency's respective components.

8. Pursuant to the provisions of Schedule 5 of the Loan Agreement, MPWH shall in coordination with NIA, be responsible in hiring and engaging the Consultant required for the implementation of Rural Water Supply Systems of the project.

9. Pursuant to the provisions of Section 17, Schedule 6 of the Loan Agreement, MPWH, through its Provincial Office and the Rural Water Works Development Corporation, shall organize water users' groups in the project area and provide assistance to these groups in the operation and maintenance of the water supply systems in the Project Area.

II. OBLIGATIONS OF NIA

1. NIA shall provide assistance, as may be needed, in the implementation of the procedures to be followed relative to procurement of the equipment and materials for the rural water supply system of the project. Such procurement shall be carried out in accordance with the procedures set forth in Schedule 4 of the Loan Agreement.

2. For the purpose of withdrawal from the Loan proceeds, NIA shall be responsible for the submittal of the applications to ADB for financing of expenditures on the Rural Water Supply System. NIA shall ensure that all goods financed out of such proceeds are used exclusively in carrying out the agency's respective components.

3. NIA shall provide coordination and other technical assistance as may be needed in the execution of the portion of the project for which MPWH is responsible.

IN WITNESS WHEREOF, the parties hereto have set their signatures this 1st day of February 1983.

(SGD.) JESUS S. HIPOLITO
Minister
Ministry of Public Works & Highways

(SGD.) FIORELLO R. ESTUAR
Administrator
National Irrigation Administration

MEMORANDUM OF AGREEMENT

This AGREEMENT made and entered into this _____ day of June 1980 at Diliman, Quezon City. Metro Manila by and between:

The NATIONAL IRRIGATION ADMINISTRATION, with principal office at E. de los Santos Avenue, Diliman, Quezon City, represented herein by the Administrator, FIORELLO R. Estuar, hereinafter referred to as NIA;

and

The MINISTRY OF HEALTH, with principal office at San Lázaro Compound, Sta. Cruz, Manila, represented herein by the Minister, ENRIQUE M. Garcia, hereinafter referred to as MOH;

- WITNESSETH -

WHEREAS, the World Bank has granted the NIA on 29 March 1980 a US\$ 71.0 M loan to partially finance the Philippine Medium Scale Irrigation Project which would provide for the construction of irrigation facilities to benefit some 38 000 hectares of riceland in the Provinces of Oriental Mindoro, Occidental Mindoro and Palawan;

WHEREAS, the strengthening of the Malaria Control Unit in Palawan is an integral component of the project;

WHEREAS, the project envisages a provision of US\$ 400 000 to strengthen the anti-malaria campaign in Palawan specifically in the Municipalities of Aborlan and Narra where the Malagaog and Batang-Batang River Irrigation Projects are situated;

WHEREAS, the Malaria Eradication Service of the MOH which is responsible for monitoring and control of the disease in the affected area would direct the program under the project;

WHEREAS, provision would be made under the project for an information campaign to alert the population to the dangers of the disease and supply information on prevention and treatment;

WHEREAS, the NIA and MOH must enter into an agreement acceptable to the World Bank by 31 December 1980, for the implementation of the malarial control component of the Project;

WHEREAS, the NIA will commence with the implementation of the Philippine Medium Scale Irrigation Project on 1 July 1980;

NOW, THEREFORE, for an in consideration of the terms and conditions set forth, the parties have agreed as follows:

I. Project Personnel

1. Considering the limited tenure of five years and the location of the project, it would be difficult for MOH to attract qualified personnel at the government civil service salaries and to overcome this problem, the Malaria Control Team personnel below the zone chief category would be employed and paid by NIA based on the following NIA standard position and qualification and would be detailed to MOH:

NIA Equivalent

a. Sector Chief	Const. Foreman	College Graduate
b. Med. Lab. Tech.	Lab. Technician	College Graduate
c. Squad Leader	Leadman	High Sch. Graduate
d. Driver	Driver	(Complete primary grades)

2. That while on detail, all personnel will be under the administrative control and technical supervision of the MOH.

3. That personnel from zone chief category and above who will be engaged in the implementation of the program would be paid by MOH, however, NIA would provide honoraria which would be fixed by the Director, MES, MOH and NIA Project Manager.

4. That the recruitment and fielding of personnel would be made in time for the 1 July 1980 start of the activities.

II. Disbursement of Fund

5. Payment of salaries, wages, honoraria and travelling expenses of aforesaid personnel will be made through the NIA disbursing officer after approval of MOH and NIA officer. The NIA officer will see to it that expenditures are properly costed. Semi-annual and annual reports of disbursement would be made available for evaluation.

III. Procurement of Equipment, Supplies and Materials

6. Procurement of all equipment, supplies and materials would be made through the NIA. MOH would program the uses and submit to NIA requisition and issue voucher in due time.

IV. Use of Vehicle and Equipment

7. Vehicles and equipment would continue to be used by MOH after the project completion or during the operation and maintenance phase of the irrigation system. Memorandum receipt of all items turned over to MOH would be prepared.

8. Since project implementation will start on 1 July 1980 when vehicles, equipment, supplies and materials are still in the procurement process, MOH would furnish priority requirements needed to be replaced when procured stock will be available.

9. That NIA would provide the requirements for fuel and oil, maintenance and minor repairs of the vehicle duly assigned by MOH as stipulated in Item IB-8 of this agreement, based on the NIA rules and regulations in the control of the usage of vehicle.

V. Monitoring and Reporting

10. MOH would furnish NIA a program of work picturing target quantities and work schedules as well as materials and supplies needed. In case a revision of the plan has been made, a revised program should be furnished. The implementation schedule in the form of a bar chart would be very helpful.

11. A monthly status report of activities and accomplishments would be furnished by MOH to NIA.

12. Communications to NIA pertaining to project implementation should be addressed to the Project Manager, Philippine Medium Scale Irrigation Project, and to the Director, Malaria Eradication Service for the MOH and that communications at the provincial level or the project area should be addressed to the Unit Chief, MES, Puerto Princesa, Palawan, for MOH and to the Division Chief of NIA at Narra, Palawan.

VI. Mutual Requirement

13. That both parties would designate project coordinators to facilitate monitoring of project activities.

14. That NIA and MOH shall regularly inform each other on the latest development concerning the project.

15. That this agreement may be modified any time upon subsequent written agreement between the parties.

In witness whereof, the parties have hereunto set their hands and seal this day of June 1980 at Quezon City, Metro Manila, Philippines.

NATIONAL IRRIGATION
ADMINISTRATION

(SGD.) FIORELLO R. ESTUAR
Acting Administrator

MINISTRY OF HEALTH

(SGD-) ENRIQUE M. GARCIA
Minister