SRI LANKA

THE NATIONAL WATER SUPPLY AND DRAINAGE BOARD

MARKET TOWN WATER SUPPLY JAFFNA PROJECT

INTRODUCTORY TRAINING MANUAL

AID PROJECT NO. 383-0063

ENGINEERING - SCIENCE
DESIGN · RESEARCH · PLANNING
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MANUAL

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INTRODUCTION TO MANUAL OF MARKET TOWN WATER SUPPLY - JAFFNA PROJECT

The Democratic Socialist Republic of Sri Lanka and the United States of America, acting through the Agency for International Development (AID), entered into a loan and grant Agreement in August, 1980 for the Market Town Water Supply - Jaffna Project. In December 1981 the National Water Supply & Drainage Board acting for the Government entered into a Contract with Engineering-Science Companies of Arcadia, California to provide the technical and engineering services necessary to implement the Project.

GOALS OF PROJECT

There are three major goals of the Project, namely:

1. Design and construct water supply systems for the two "Market Towns", Point Pedro and Chavakachcheri.
2. Prepare a master plan for the development and management of water resources and improvement in sanitation conditions for the Jaffna Peninsula and islands.
3. Provide training in the fields of Public Health, water supply and sanitation.

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INTRODUCTION TO MARKET

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WATER LABORATORY

The Project provides for planning,equipping and training personnel for a water laboratory for the Jaffna Region. The NWS&DB, Water Resources Regional Engineer and the Jaffna Superintendent of Health Services have agreed that there should be established, under the Superintendent of Health Services, one well equipped and staffed water laboratory which will be responsible for "surveillance" of health aspects of water and to provide bateriological and certain basic water chemical analyses for all three Agencies.

TRAINING PROGRAM

The three most directly concerned agencies, with much co-operation from the University of Jaffna and other authorities, officials and institutions, have developed the training programs. The goal is to provide practical training for each of the groups which are most concerned with water supplies, excreta and wastewater disposal and public health.

To achieve maximum benefits from the total "Market Town Project",it is necessary that all workers who are trained, know the best methods of protecting public health, improving environmental health and providing water which is safe and acceptable for human consumption. This involves:

1. Providing the best water and sanitation systems which can be obtained.
2. Operation and maintenance to get the best results obtainable.
3. Public health education to teach the public how they can do their part toward providing the best and safest water and sanitation systems which are practically obtainable.

TRAINING PLAN

The National Water Supply & Drainage Board is responsible for the training program. Engineering-Science, through its Training Co-ordinator and professional staff, was responsible for co-ordinating a training team of authorities in public health, environmental control, water supplies, water resources, sanitation and education.

It was decided to divide the training program into three major parts.

1. Training Manuals in two languages, to broadly cover the whole subject.
2. Two, one-day, general sessions on June 8 and 10, where the total program is presented by officials and professionals who are fully familiar with the Region's problem and possible solutions.
3. Special sessions of groups of about 15, divided into 5 similar professional, technical and worker groups. These will range from two to 15 days. They will include a maximum of field trips, demonstrations, group discussion, problem solving and "take-home" educational materials.

B. FUNDS

Funds are being requested for transportation and expenses for participants. For invited groups who are not on a regular salary, a moderate amount of rupees are requested so they do not lose wages while attending.

SPECIAL PROBLEMS OF JAFFNA REGION

Studies for the Master Plan have shown that there are several special problems which are peculiar to the Jaffna Region. There are a combination of conditions which produce an unusually severe water supply problem for the Region.

1. Long Dry Periods

The total annual rainfall of about 50 inches takes place in three months. For 9 months it is hot and dry, producing high rates of evaporation from lagoons, ponds, plants and soil.

2. Salt Problems

In much of the area there is but a few feet of soil over a limestone rock formation. While some of that rock is dense and hard, much is cracked, broken and soft. Into this type rock, the sea water exists at various depths, sometimes to nearly sea level in much of the area. When dug or drilled wells are pumped, there is a tenderdendy for the salt water to rise and mingle with the fresh water which has accumulated from rainfall. Depending upon local conditions, there is a tendency for the wells to produce salty or brackish water. In some areas, the salt concentration changes with the seasons. There, toward the end of the long dry season,the salt concentration is highest, at the end of the rainy season it is lowest.

Salt from the ocean or salty seas can enter well water in either of two ways. In many countries, when wells are pumped too much, the groundwater level drops

to below sea level. Then salt water flows into the wells. This is sometimes called "saltwater intrusion".

Studies in the Jaffna Region tend to indicate the wells become salty because the underlying deep lager of saltwater is brought up by pumping from certain wells. This is called up-coning. (See Figure 1)

Fresh Water - Saline Water Existence In Oceanic Islands

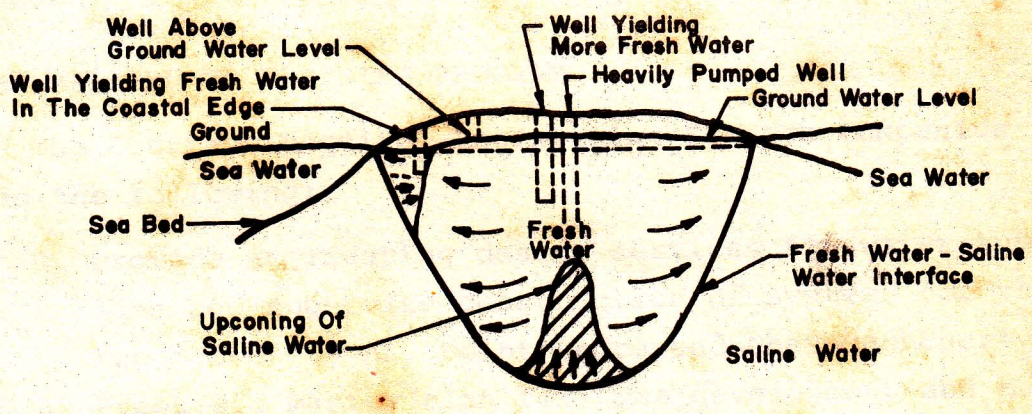
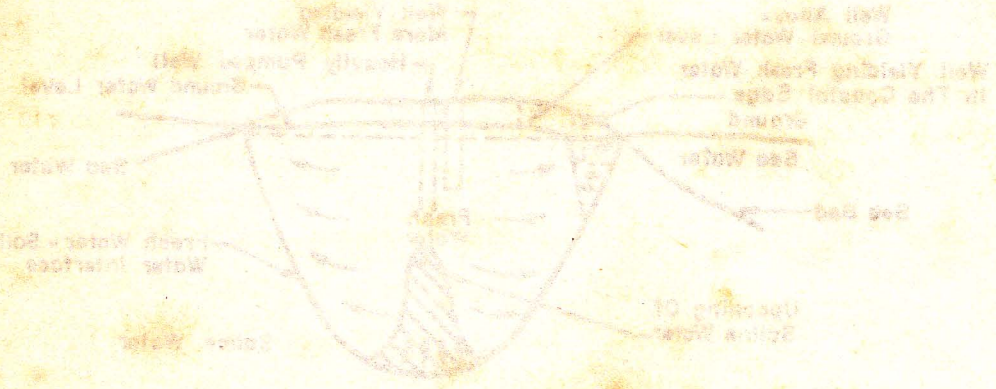


FIGURE 1

Source: Water Resources Board, Jaffna.



3. LIMESTONE FORMATIONS

Ordinary soils of sand, loam and rather fine grained material act as efficient filters to remove disease-causing bacteria. On the other hand, there is some hazard that bacteria will travel for many hundred of meters in creviced, seamy limestone. This must be considered both in the locating of wells and in the planning and building of sanitation facilities.

It is generally wise to chlorinate all public water supplies which are located in limestone formations.

4. IRRIGATION AND AGRICULTURAL USE

The concentration of produce crops where wells can be used to irrigate reduces the amount of fresh-water that is available for drinking and sanitary purposes. Crop fertilization as at the Jaffna wells, results in extra high "polution" from fertilizers, especially nitrates.

D. TASKS RELATED TO TRAINING PROGRAM

The Contract requires Engineering-Science Companies to do the following:

1. Provide engineering design services for water supplies and supervise construction of systems for the two market towns, Point Pedro and Chavakachcheri.
2. Prepare a master plan for "The development and management of water resources and improvement in sanitation conditions for the Jaffna Peninsula and Islands.

The Contract requires the Consultant to Determine the feasibility of:

1. "Constructing a surface reservoir on the mainland to serve the domestic needs of the Jaffna Peninsula and Islands".
2. "Converting the salt water lagoons on the Jaffna Peninsula to fresh water lagoons"

3. "Stopping or reducing the spring discharge of fresh water to the sea from the Jaffna Peninsula".
4. "Injecting fresh water to the underlying sandstone acquifer of the Jaffna Peninsula by deep wells".

Also, of especial importance to this Training Program, the tasks to be performed include:

"Assessment of the environmental effects of providing water supply and sanitation facilities for the Jaffna Peninsula and Islands by the Year 2000".

"An investigation and analysis of the sanitation conditions and practices of the Jaffna Peninsula and Islands".

"An investigation and analysis of the pollution of ground water on the Jaffna Peninsula and Islands".

A high priority item concerns measures to conserve and avoid waste of fresh water. That involves public participation which can be promoted by the participants of the training program.

E. WATER AND HEALTH

Water-Borne Disease

Most people realize that there are several common, serious diseases which result from drinking contaminated water.

Primary Cause

In almost all cases, the diseases are caused by contamination from excreta (feces or urine) from a person who is or was previously sick with a water-borne disease.

The specific diseases will be covered later in this Manual, but they will be listed here:

COMMON WATER BORNE DISEASES

Typhoid and para-typhoid fever - sometimes called "enteric fevers".

3. "Stopping or reducing the spring discharge of fresh water to the sea from the Jaffna Peninsula".

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COMMON WATER BORNE DISEASES

1. Typhoid and para-typhoid fever - sometimes called enteric fevers.

Cholera -

Infectious (viral) hepatitis
Ameebic dysentery - recently some cases have also caused problems like infectious hepatitis

Bacillary dysentory -

One form of "shegellosis" (bacillary dysentery) is producing serious illness.

Other Enteric Diseases

Various forms of diarrhea are caused by virus
A rather newly discovered disease - not common in Jaffna, Giardiosis - is even in the U.S.A., causing more diarrheal disease than any other disease organism.

All of these type of diseases can also be caused by consuming almost any contaminated food or drink, as well as by water.

F. COMMON CAUSES OF CONTAMINATION

Medical science has developed various preventive vaccinations and injections which should be utilized, as may be recommended.

However, the best prevention is by environmental health control measures. These take advantage of knowledge of how the tiny disease producing "micro-organisms" - bacteria, virus, and protozoa get from excreta to the victim.

The most common paths are:

1. Direct Contamination

Defacation or urination into water which may be used for drinking, irrigating or washing certain vegetables, or harvesting fish which may be eaten without thorough cooking, is a serious problem.

2. Indirect Contamination

Pour-flush vaults, septic tanks, cesspools or soakage systems:

a) Overflowing into water which may be used for drinking.

b) Underground Contamination

Locating excreta disposal systems where they may contaminate near-by wells, or drain into channels in limestone.

c) Hand Contamination

A most common cause is the human hand which has been contaminated by excreta and then not thoroughly washed with soap and water.

i. Wells

Open wells are subject to serious contamination by all hands which touch the rope or bucket. Also they are exposed to entrance of drainage and contamination. The Training Program will demonstrate, in the Jaffna Region, wells with tight covers and easy-to-use hand pumps. These are safe, convenient and well appreciated by the people.

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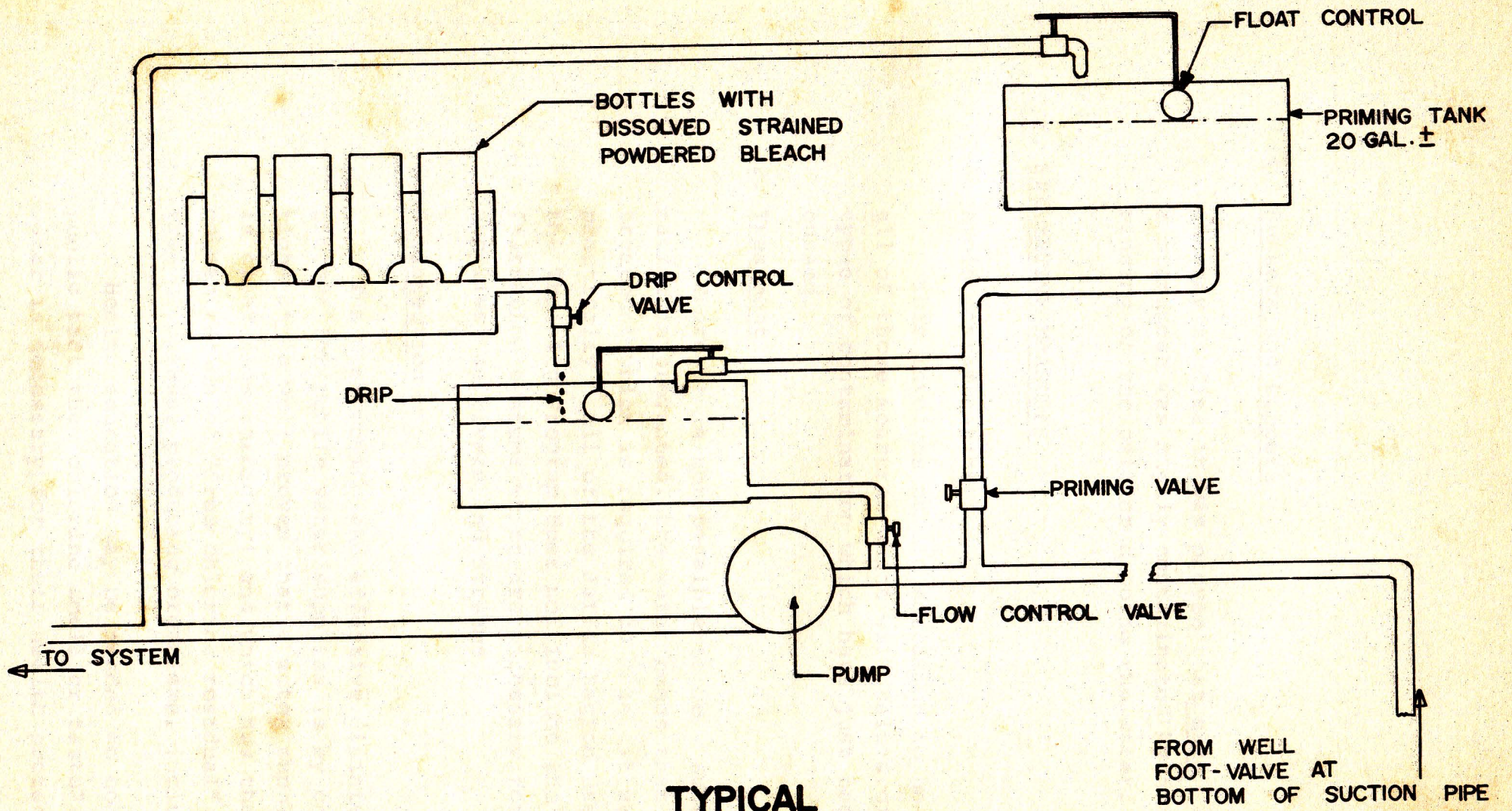

TYPICAL DRIP CHLORINATION ON UNICEF FUNDED PUBLIC WATER SUPPLY SYSTEMS

ii. Buckets and Dippers

In many studies it was proven that safe water from a standpost was highly contaminated by hands during rinsing of the pail or dipping the water.

F. PREVENTIVE MEASURES

1, Avoid contamination.

This involves public education to be aimed at all of those measures which will help avoid the types of contamination which have just been discussed.

2. Treatment

Where it is not possible to be sure, contamination is prevented, the water needs that degree of treatment which is required to make it safe. Since practically all of the Jaffna Region uses well water, the Training Program does not include the types of filtration systems which are necessary for "surface supplies" as rivers and streams.

3. Disinfection

The most common and effective disinfecting process for public water supplies is by chlorination. It is well proven that a water supply which is clear (low turbidity) and which has the correct concentration of "free chlorine residual" will be free of disease producing organisms, including virus.

Health education may be needed to convince the public that the "chlorine smell or taste" in their water is necessary for their health protection.

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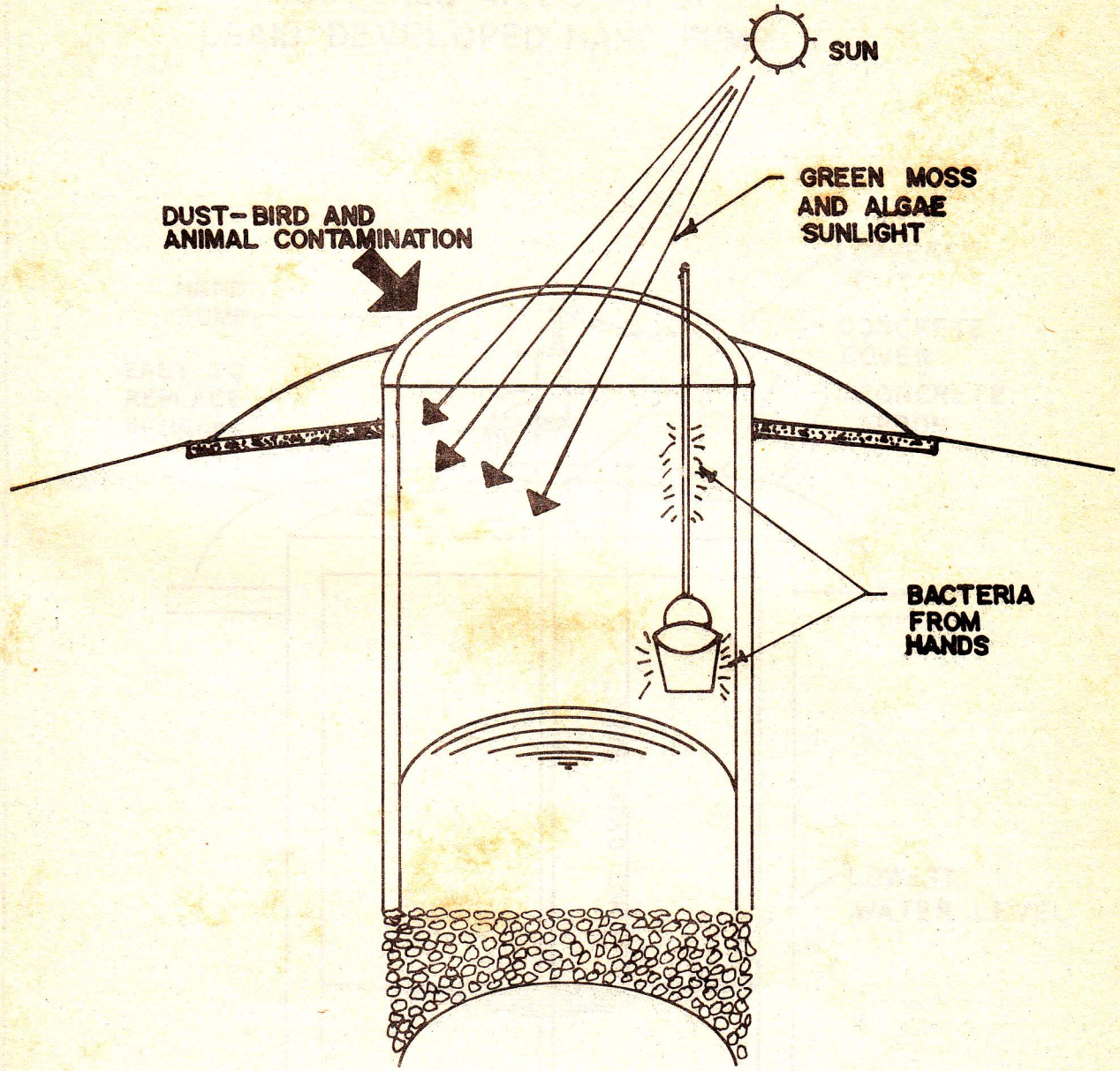
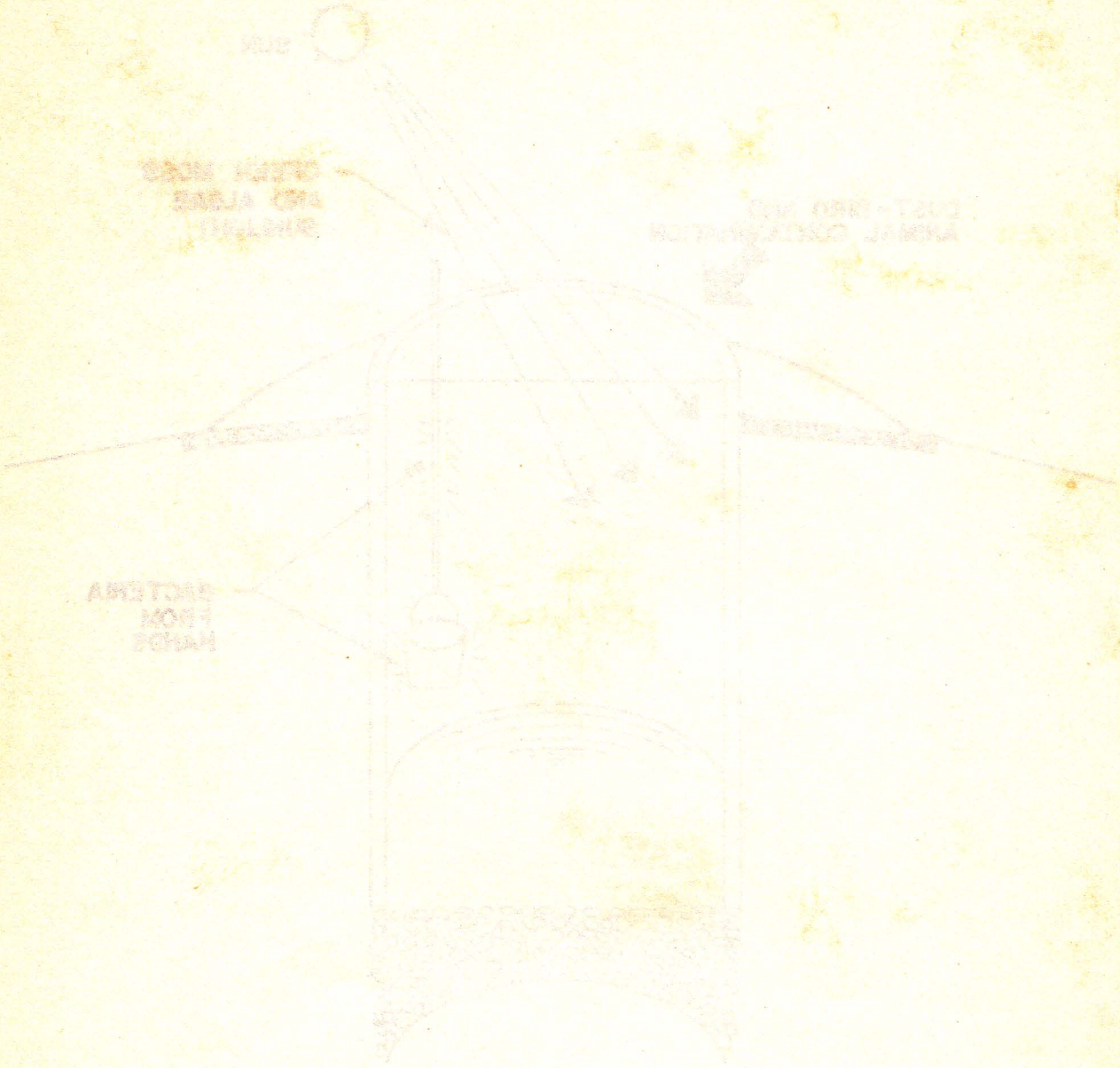
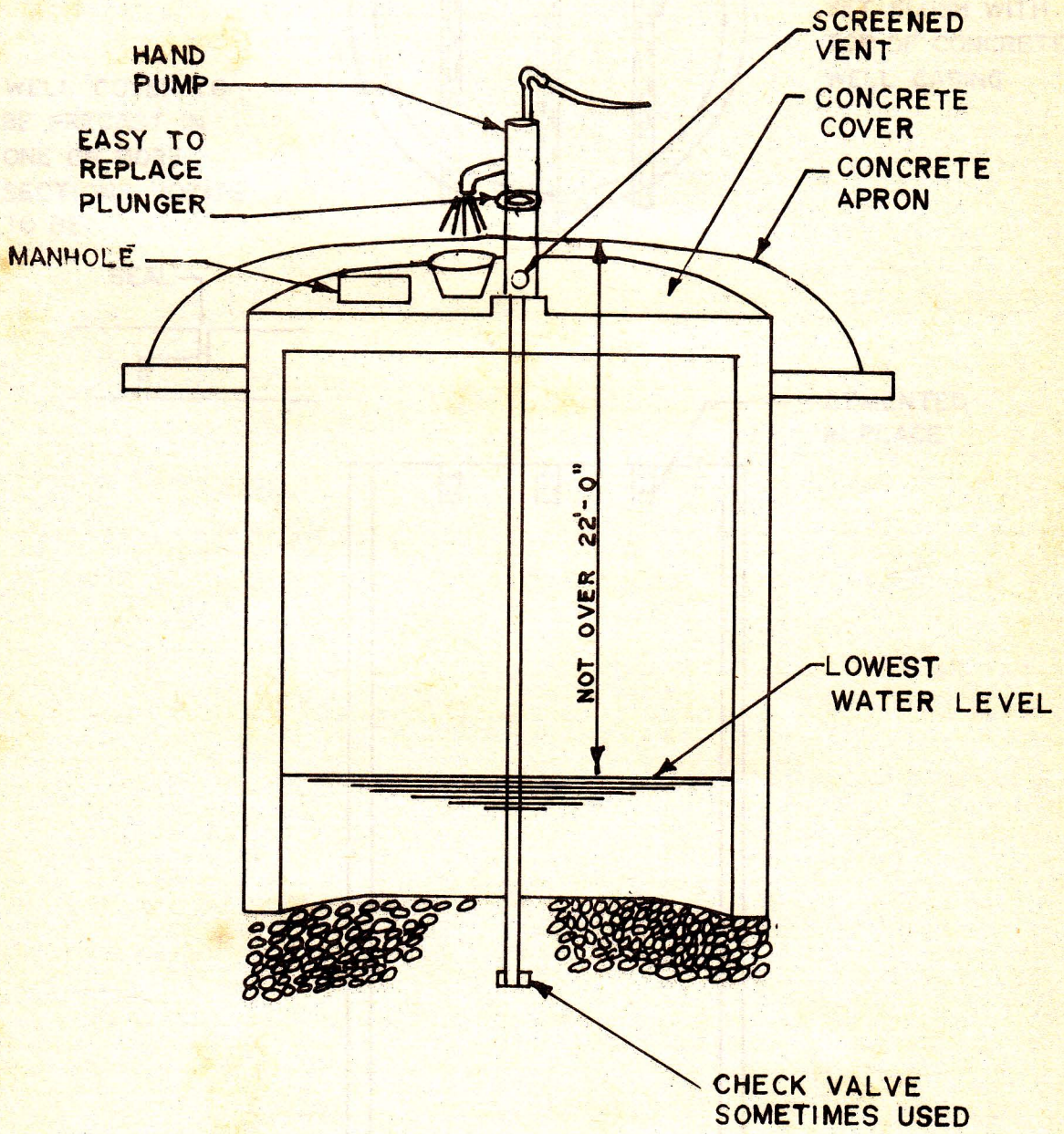
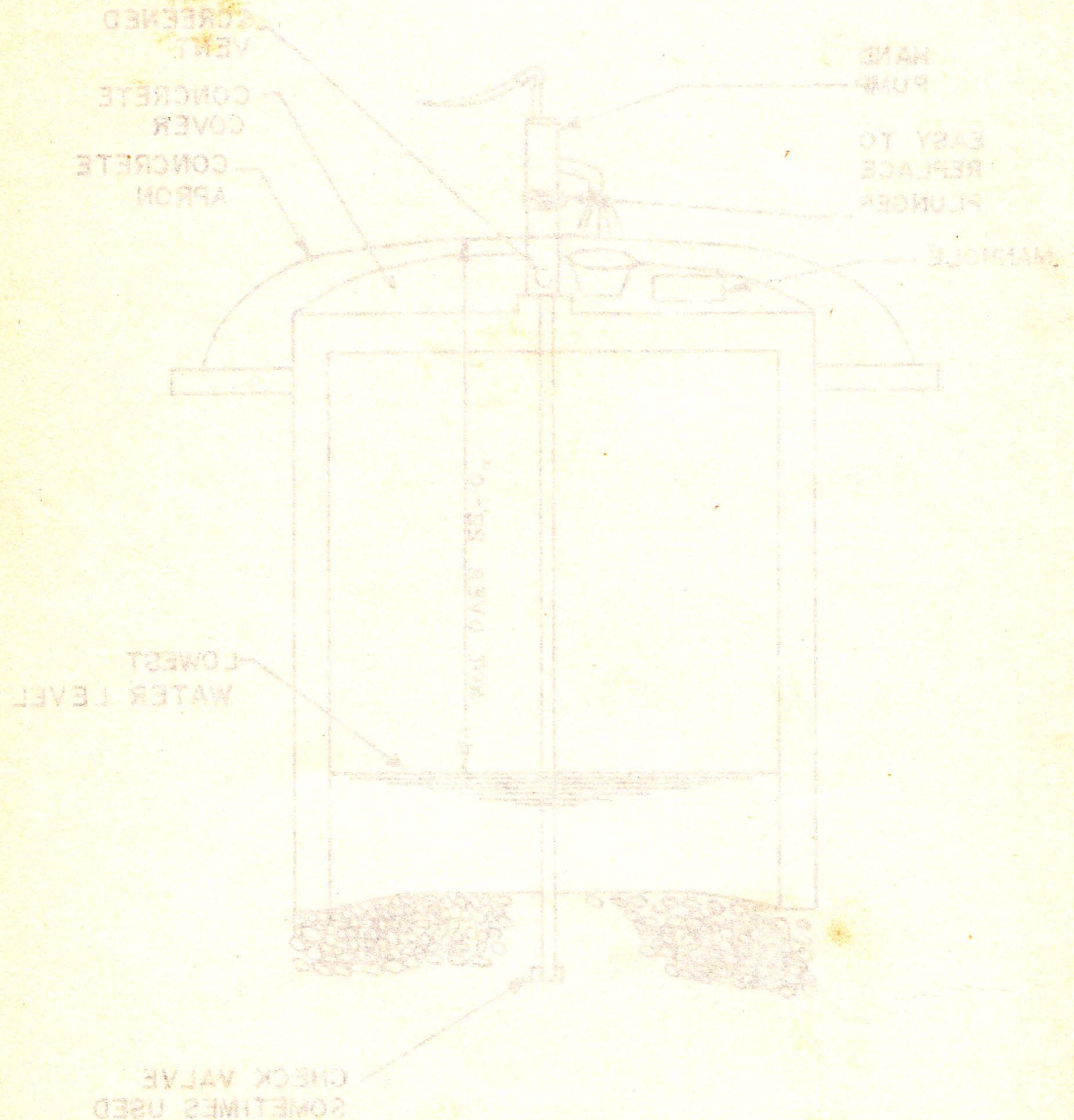


DUG SHALLOW WELL -
ALWAYS CONTAMINATED

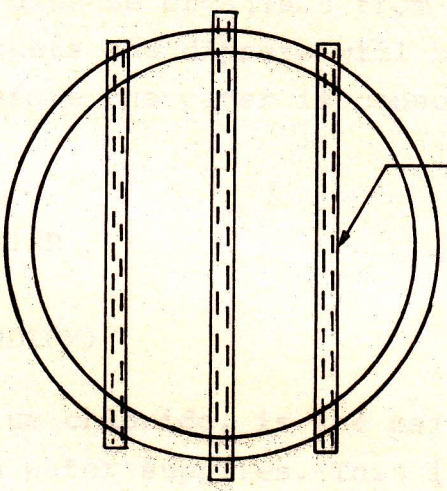


COVERED WELL WITH USAID DEVELOPED HAND PUMP



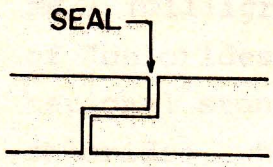


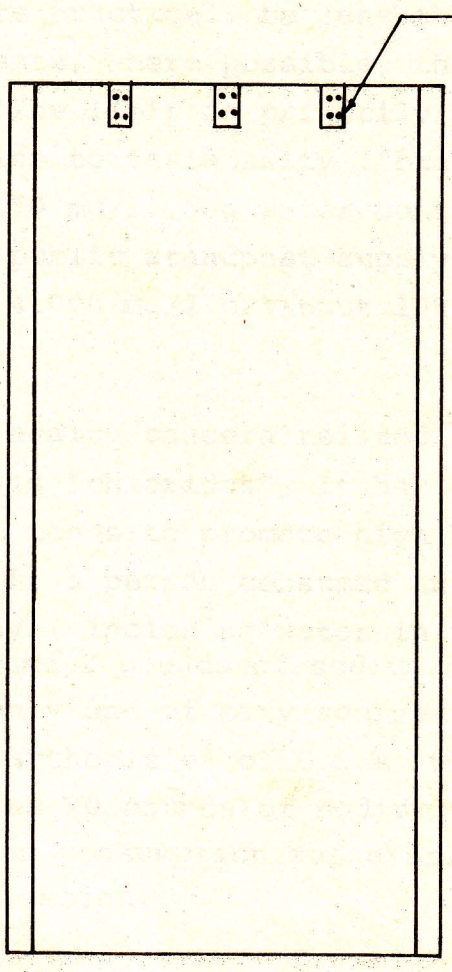
SUPPORTS FOR COVERING LARGE DIAMETER WELLS

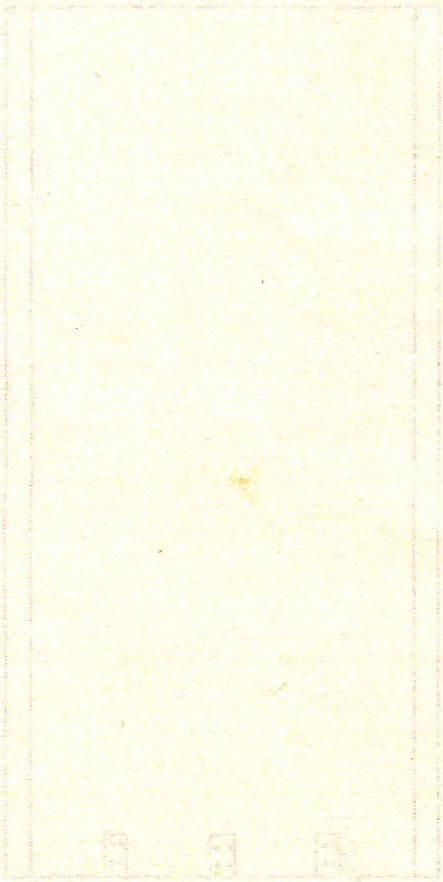


4" X 8" REINFORCED, PRECAST BEAMS, SET FLUSH WITH TOP OF CONCRETE WELL CASING.

WELL COVER TO BE PRECAST IN ONE OR MORE SECTIONS. JOINTS TO BE:







A "chlorine residual" is especially desirable in stand-post water supplies. That chlorine provides some assurance that disease organisms from contaminated hands which touch buckets and dippers will be destroyed by the chlorine before the water is consumed.

CHEMICALS IN WATER

"CHLORIDES" (SODIUM)

Salt, sodium chloride, is the main chemical "pollutant" of the Region's water supplies. This is expressed as mg/l (milligrams per liter) or p.p.m (parts per million) of "chlorides". The World Health Organisation's International standards for drinking water recommend that chlorides, where practical, be less than 200 mg/l. The standard suggests, where possible, the limit be no higher than 600 mg/l. The limit is primarily based upon the fact that water begins to taste salty ("brackish") when there is more than 250 mg/l. Sea water contains 35,000 mg/l chlorides. One public standpost supply in the Jaffna region reaches 4,000 mg/l or about 10% as much salt as sea water.

A primary health concern related to chlorides is the sodium element in "chlorides". It has been found that too much sodium tends to promote high blood pressure (hypertension). If a person consumed an average of 2 liters of water per day (including water in foods and beverages), he would consume 2 pounds of sodium per year.

Water is only one of many sources of sodium. A recent article quoted authorities of U.S.A. who said the average American consumes 20 pounds of sodium per year. It was said that high sodium consumption was a primary cause of high rates of hypertension.

A "chlorine headway" is especially desirable in standpipe water supplies. That chlorine provides some assurance that disease organisms from contaminated hands which touch hydrants and valves will be destroyed by the chlorine before the water is consumed.

Among the sources of sodium are baking soda, preservatives in meats like bacon and ham, and a variety of sources. One is excessive use of salt in foods.

Based upon the above studies the amount of sodium in even highly brackish Jaffna Region water, would contribute only about 10% of the total salt intake of the average American.

NITRATES

Health Effects

An important chemical for crop fertilizers, is nitrate compounds (No_3). These are also produced by use or dispose of with human and anumal excreta and manure Nitrates are highly soluble (like chlorides) and are not removed by passing water through normal soil or rock formations. Once water containing nitrates gets through the top few feet of soil they continue to percolate or flow downward until they enter the groundwater supply.

The main source of nitrates in the Regions well water supplies is from agricultural fertilizers, mainly urea. The highest levels of nitrates in Jaffna Region groundwater are in areas where produce like chillie, beans, and other crops are irrigated by well water and are artificially fertilized. A map has been prepared by the Water Resources Board Jaffna staff. The Jaffna Municipal wells are in an area of high nitrates. Practically all other public water supply schemes in the region have very low nitrate concentrations.

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The area with the highest density of pour-flush latrine pits, septic tank and seepage systems (which

add nitrates to groundwater) are in the Jaffna Municipality. There are over 10,000 wells in this area but most are too brackish for regular human consumption, so nitrates are of little concern.

CONCENTRATIONS OF NITRATES IN JAFFNA PUBLIC SUPPLES

The only public supplies which are now known to contain high nitrate concentrations are the Jaffna Municipality wells which supply standposts, the Hospital and limited other buildings. The concentrations have been steadily rising. The WHO recommended limit is 45 mg/l as nitrates. The Jaffna wells now contain over three times that amount.

Studies of the volume of rain water per acre which enters, the groundwater supply; along with the average pounds of fertilizer (nitrogen as nitrate) applied per year; and adjusted for amount of nitrogen used by Plant roots or lost, show the following;

Nitrate concentrations are above recommended limits only in irrigated, concentrated agricultural areas.

The amount of nitrates applied to once-a-year paddy land does not produce serious concentrations of nitrates in the water.

HEALTH EFFECTS OF NITRATES

Only infants of three months or younger, who are fed formulas made with high-nitrate water or who otherwise regularly consume such water are affected. Breast milk, even from mothers who drink water with high nitrates, is reasonably free of nitrates.

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A rather small percent of the infants who consume water with high nitrates are affected. However, since the problem was first recognized in the mid 1940's, well over 2,000 cases were reported from the Americas and Europe. About 8 to 10% of the cases were fatal.

The effects are due to certain natural biochemical precesses. The infant's digestive tract tends to convert ("reduce") nitrates (NO_3) to nitrates (NO_2). This occurrs only during infancy.

Nitrites in the blood convert the oxygen transporting hemoglobin to methemoglobin, which cannot transport oxygen. This form of oxygen starvation causes a characteristic blue colour of the skin. The disease is therefore called methemoglobinemia or "blue babies".

Interviews with the medical authorities of the Jaffna Region Health Departments, hospitals and Jaffna University has failed to produce any medial authority who has seen a blue baby in the region.

Controls

Locating Wells

Since non-brackish water is scarce, it is not always possible or desirable to reject a well water supply because of high nitrates. However, future water resources planning should keep in mind the fact that it is highly desirable to avoid locating new municipal wells in areas subject to high nitrate concentrations from irrigated agricultural fertilization practices.

AGRICULTURAL USE

The rate of fertilizer application recommended by the Department of Agriculture for non-irrigated crop lands such as paddies would not cause nitrate concentrations to reach the WHO maximum.

Even for irrigated croplands the levels would not seriously exceed such levels. However, the actual rate of application may often be double or more than double the recommended rate. This relates to the desire and need for owners of expensive lands to produce the maximum possible value in crops.

Maps prepared by the Water Resources Board's former Chief Engineer indicate excessive nitrates in groundwater under large areas of agricultural produce growing lands. Tests by a Professor of Jaffna University show that in some such areas (fortunately not where public water supply wells are located) levels have reached over four times WHO recommended limit.

PRECAUTIONS

WHO standards note that the amount of water which would be consumed by certain infants of a community would be very small. So it is stated that parents could be advised of the locations where low nitrate containing water could be obtained for such infants. So far, that policy would apply primarily to those public supplies which serve the Jaffna Municipality. For infant parents who use private wells in irrigated areas, health officials can consult the water resources maps and data so as to provide advice to parents of infants who are fed water.

HOW SANITATION EFFECTS HEALTH

DISEASES FROM EXCRETA

The water-borne diseases which were discussed in the the part of this report which covered water supplies are call caused by persons drinking water, or consuming water or food which was exposed to contamination by human excreta, either directly or indirectly.

Major Goal

The major goals of sanitation are to:

1. Provide convenient and sanitary latrines or toilets.
2. Dispose of excreta so it does not contaminate drinking water supplies or waters which are used for bathing, fishing or human contact
3. Protect the excreta from contact by flies or animals which could thereby contaminate foods.
4. Assure that humans do not come into contact with excreta.

Special Problems from Intestinal Parasites (worms)

In addition to the water-borne diseases, human excreta commonly contains small eggs or small forms of worms which cause infection with intestinal parasites. Among the most common in Jaffna are:

1. Hook worm

Small forms of hookworm from human excreta which is deposited on the soil can live for months. Then, when a bare human foot steps on the soil, the small form of hookworm attaches itself to and penetrates the bare foot, to enter the blood stream. It finally accumulates, and grows and multiplies in

the digestive system where it lives on blood. Severe cases cause so much loss of blood as to produce anemia and loss of energy.

2. Round Worm

Round worms can develop and multiply within the human digestive system to produce as much as a few pounds of large worms (up to over 2 inches long). These consume enough of the victims food supply to produce malnutrition.

The worms, in severe cases, can crawl out of the persons nose, mouth and ears.

Where human excreta is allowed to contaminate floors, soil or surfaces which are touched by humans, small eggs of the round worm can get on hands and then be swallowed. (There are other worms which are also "intestinal parasites)

Sanitation's Role in Controlling Intestinal Parasites.
Pour-Flush Latrines

Ceylon is credited in the World Health Organization's publication on "Excreta Disposal" as having pioneered in building "pour-flush latrines" over 50 years ago. The main features of this system are:

1. Simple and low cost
2. Requires only a small amount of water
3. Easy to keep sanitary
4. A water-seal prevents escape of odors from the excreta-collecting vault.
5. Excreta is protected from contact by flies and domestic animals.
6. Can be installed and used where no public sewers are available.

Other Systems

The Conservancy System has served a very useful purpose and should not be abandoned until a suitable substitute can be provided. This system can protect the public against both water-borne diseases and intestinal worms.

The system is most necessary in the densely developed, older areas of the Jaffna Region's cities and towns. There, until public sewers can be provided, there is usually not enough room for the vaults and soakage cesspools which are necessary for pour-flush latrines. Also conservancy systems do not require the few liters a day of water for the "pour-flush", and this water conservation is necessary where all water must be carried for some distance from public stand-posts.

"Modern Plumbing"

Because of the shortage of fresh drinking water it is not wise to install modern flush toilets which require several gallons of water per flush, except where a separate brackish water supply is available for sanitation.

Also, water flushed plumbing systems will cause health hazards from over-flowing septic tanks, except where public sewers are installed, or where there is adequate open space and suitable, porous soil to dispose of the wastewater.

HEALTH EDUCATION

Health education by Midwives, Public Health Inspectors and Nurses, and in the schools, are all important in a program to improve sanitation and to reduce the existing large

numbers of cases of intestinal diseases and worms. This health education must be accompanied by a program which convinces the people and their leaders to do all they can to provide suitable latrines and excreta disposal systems.

Then, parents, teachers and all concerned persons should teach and promote sanitary practices, accompanied by medical treatment to eliminate the intestinal parasites and to reduce the intestines disease rates.

WATER TREATMENT

Filtration

Fortunately most of the Jaffna Region can get its drinking water from wells,so it is not normally necessary to provide expensive and complicated water treatment plants. However, a few of the well-water supplies contain enough dissolved iron (and sometimes manganese) to justify use of special treatment processes.

Since the rock formations are usually limestone, this results in waters which are not "acid", but are slightly alkaline. It tends to be rather easy to remove dissolved iron from such waters. By mixing the water with air, as it flows over special "aerating" surfaces, the dissolved iron converts to small particles which can be strained out by flowing through a few feet of sand (sand filters). A few such systems are used.

Disinfection

The most important step in water treatment, from a Health viewpoint, is disinfection. This is accomplished

by adding a small amount of material which kills or destroys the bacteria, protozoa and viruses (micro-organisms) which can cause disease (these are called "pathogens")

The most common, by far, is chlorine. Also of less common use is iodine. At some larger treatment plants a special from of oxygen gas (ozone) is coming into more common use.

Long experience (nearly 80 years) has proven that a small amount of chlorine in the right form added and allowed to stand for half an hour in a clear water, will protect against water borne infectious diseases.

CHLORINATION

Chlorine can be obtained in several forms:

1. Liquifised gas. This is the form of chlorine which is used at larger water plants. Cylinders can be obtained in sizes ranging from 100 pounds to over a ton. The gas is toxic and corrosive, somewhat heavier than air, and can cause severe lung damage or death.

However, when properly installed, and when operators are provided with special protective equipment, and are properly trained, this is a good system. Liquid chlorine is produced in Sri Lanka.

However, all but the largest system in the Jaffna Region should probably be equipped to use a form of chlorine liquid or powder as is discussed below.

Chlorine-containing Powders

The most commonly used water-chlorination compound for small water systems of Jaffna and Sri Lanka towns and smaller cities is a powdered bleach. This is usually mixed with water, strained and then is "metered" into the water supply system by a simple device which can be a special pump or can be a "home-made" unit which can be easily made and operated.

CHLORINE TEST

When water contains enough chlorine to kill bacteria it produces a slight chlorine odour, and sometimes a taste. An important part of health education is to convince the public that this odor or taste is their assurance that the water will not cause intestinal infection.

A simple test for chlorine is based upon the fact that, when a few drops special colorless dye is added to a tube of the water containing the right form of chlorine, a yellow color develops. The amount of color can be compared with colored glass "standards" to actually measure the concentration.

A. SANITARY SURVEY

The World Health Organization's Standards state that the most important step in evaluating the health aspects of a water supply is the sanitary survey. The steps in this process are:

Chlorine-containing Powders

The most commonly used dry chlorine compound for small water systems of 1000 and less than 5000 and smaller cities is powdered bleaching powder mixed with water, stirred and then "metered" into the water supply system by a simple device which can be a special pump or can be a "home-made" unit which can be easily made and operated.

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A. SANITARY SURVEY

The World Health Organization's standards state that the most important step in evaluating the health aspects of a water supply is the sanitary survey. The steps in this process are:

1. Source

Where does the water come from?

a) Source not safe without treatment

i. Rivers, ponds, pools, lagoons and open source.

ii. Open wells or springs, especially those from which water is obtained by buckets and ropes, or dipping.

iii. Wells in certain types of limestone in which contamination can travel through cracks, crevices or channels for long distances.

b) Source which should be chlorinated

i. Any water from public standposts is subject to contamination from the container, or by handling and dipping. However, if the water contains the right amount of chlorine, small amounts of contamination as from dippers, may be controlled by the chlorine in the water. For this reason, water in standpost systems should usually contain the right amount of chlorine.

ii. Water which has been filtered, as for iron and manganese removal.

iii. Public water supplies should generally be chlorinated. This is desirable because most systems will not be under constant pressure for 24 hours a day. During periods of no pressure, contamination can enter the system by "cross-connections" and leakage. Chlorine helps reduce the health hazard from such contamination.

1. Source

Where does the water come from?

a) Source not safe without treatment

i. Rivers, ponds, pools, lagoons and open sources.

ii. Open-mouthed springs, especially those from which water is obtained by buckets and ropes, or dipped.

iii. Wells in certain types of limestone in which contamination can travel through cracks or crevices for quite long distances.

b) Source which should be chlorinated

i. Any water from public standpipes is subject to contamination from the container, or by handling and dipping. However, if the water contains the right amount of chlorine, small amounts of contamination as from dipping, may be controlled by the chlorine in the water. For this reason, water in standpipe systems should usually contain the right amount of chlorine.

ii. Water which has been filtered, as for iron and manganese removal.

iii. Public water supplies should generally be chlorinated. This is desirable because most systems will not be under constant pressure for 24 hours a day. During periods of no pressure, contamination can enter the system by "cross-connections" and leakage. Chlorine helps reduce the health hazard from such contamination.

2. Treatment

a) Is treatment adequate?

b) Does operator understand his responsibilities?

c) Is there appropriate field testing equipment and is it properly used as for chlorine?

d) Are there adequate supplies?

e) Are records kept of tests and special actions or problems?

3. Storage

i. Are all storage tanks, elevated tanks, etc. properly covered and are vents screened?

ii. Are storage tanks chlorinated after cleaning and repairs?

4. Distribution System

a) Pressure 24 hours per day?

i. If not, has a cross-connection survey been made to avoid serious contamination hazards?

ii. Is it practical to provide 24 hour-a-day service?

iii. Is there a system for chlorinating wells, pumps, distribution system pipes and storage tanks after possible contamination during construction, installation or repairs?

b) SURVEILLANCE

1. Is there a program for regular surveillance by competent personnel?

2. Treatment

a) Is treatment adequate?

b) Does operator understand his responsibilities?

c) Is there appropriate field testing equipment and
   is it presently used as for chlorine?

d) Are there adequate supplies?

e) Are records kept of tests and operating problems
   or problems?

3. Storage

a) Are all storage tanks, elevated tanks, etc. properly
   covered and are vents screened?

b. Are storage tanks chlorinated after cleaning and
   repairs?

4. Distribution System

a) Pressure 24 hours per day?

b. If not, has a cross-connection survey been made
   to avoid serious contamination hazards?

c. Is it practical to provide 24 hour-day service?

d. Is there a system for chlorinating wells, pumps,
   distribution system pipes and storage tanks after
   possible contamination during construction,
   installation or repairs?

5) SURVEILLANCE

a. Is there a program for regular surveillance by
   competent personnel?

2. Has a formal program been established for collaboration between surveillance personnel and the operating agency?

3. Laboratory

a) Bacteriological

i. Regular sampling and testing for coliform and fecal coli form according to WHO produres.

ii. Program of follow up with operating agency in case of unsatisfactory samples.

b) Chemical

i. Establish policies on which chemicals will be tested, and frequency for:
Chlorides
Nitrates
Iron
Hardness
Other?

c) Physical (As necessary)

Turbidity
Color
Odor
Taste
Other

d) Special Surveillance

As may be necessary, special samples for toxic or potential cancer or health problem-causing chemicals, as from agricultural or industrial activities.

Cc) Co-ordination and Corrective Action

1. Roles of various agencies.
   a) Copies of regional health data routinely sent to national health office for review.
   b) Copies of reports to Regional NWSDB also sent to national health office.
   c) Establish policies for relationships with responsible local officials
   d) Relationships established between regional Health Superintendent's office and local MOH's and PHI's.
   e) Responsibilities fixed as to:
      i. who should do routine surveillance sampling?
      ii. Precedures so operating agencies can also submit samples for analysis.
      iii. Policies whereby local PHI's can have laboratory service in accordance with established policies.

2. Special Epidemiological Studies

   a) Policies so water surveillance personnel, records and laboratory facilities are available to MOH's and Epidemiologist in case of a suspected water-borne disease outbreak.
   b) Policies so operating agency will be especially active in assuring that supply is chlorinated during suspected outbreak of water-borne disease.

D.. Special Policies on Sampling

1. General Policy

   a) No bacteriological sampling of non-public wells which are not properly covered and equipped with

c) Communication and Corrective Action

suitable pumping equipment.

b) Always test "chlorinated supplies" for chlorine residual before taking bacteriological sample.

2. Special Policies

Chemical sampling and testing arranged according to special needs, for instance:

a) Iron or manganese where these present a problem or where iron removal systems are used

b) Seasonal sampling for chlorides and nitrates to establish minimum and maximum concentrations according to seasons, past records, etc.

c) Close collaboration between laboratory and:

NWSDB
Local operating agencies
Water Resources Board
Agriculture Department
Others, as needed.

E. Other Sampling

1. Ocean sampling.

Special "Most probable number-MPM" sampling to determine water quality where sea food is harvested in areas subject to focal contamination.

2. Special Sampling

a) Testing of covered, hand-pump and power-pumped wells at hospitals, hotels public buildings and where used by "community".

suitable pumping equipment.

b) Always take chlorinated supplies for chlorine residual determination at bacteriological sample point.

c) Special problems

Chemical sampling and testing arranged according to special needs, for instance:

a) Iron or manganese where these present a problem or where iron removal systems are used

b) Seasonal sampling for chlorides and nitrates to establish maximum concentrations according to seasons, part records, and

c) Close collaboration between laboratory and:

MW/DR

Local operating agencies

Water Resources Board

Agriculture Department

Others, as needed.

B. Other Sampling

1) Ocean sampling.

Special "Most probable number-MPN" sampling to determine water quality where sea food is harvested in areas subject to fecal contamination.

2. Special Sampling

a) Testing of covered, hand-pump and power-pumped wells

At hospitals, hotels public buildings and where used by "community".

b) Special Tests

i. In limestone areas to judge travel of contamination

ii. Of covered, sanitary wells in areas of excreta disposal systems which could cause bacteriological contamination.

SANITATION PROGRAMS.

SEWERAGE FOR DENSELY DEVELOPED AND SPECIAL AREAS OF JAFFNA REGION

"PROBLEM AREAS"

An examination of condition of the Jaffna Urban area and of certain business areas of Chavakachcheri and Point Pedro shows that many buildings are so close together that there is not enough room for soakage systems for pour-flush toilets and wastewater.

1. At a meeting on planning the Mayor of Jaffna expressed concern about this problem.

The MOH of the Point Pedro area stated that a significant enteric disease threat exists in the valvedditturai area along the ocean a few miles to the west of Point Pedro. Living units of fishermen and their families are so close together they do not have room to build pour-flush latrines. As a result many people defecate on the beach and in the sea. This is another place where consideration should be given to using pour-flush latrine - septic tank systems. The septic tanks could drain to small - diameter plastic pipe (1½ inch diameter). The liquid could possibly be disposed of in shallow seepage beds built in the sand a few feet above high tide and where protected from wave action. For larger system, stabilization ponds would be recommended. At the Point Pedro Base Hospital and Health Centre, they are now laying pipes and drains, partly to correct problems due to the failure of existing seepage systems built in the shallow soil (one foot or less deep) over laying rather solid limestone. This is another critical situation where septic tanks and shallow, small diameter sewers should convey the sewage to suitable disposal areas, either subsurface or stabilization ponds. Similar shallow limestone formations exist in other built-up areas of the Point Pedro district.

SEWERAGE SYSTEMS

There are two major problems associated with use of conventional public sewers. The first is that the land is quite flat so conventional sewers must normally be laid at "minimum grade". Grades are of special concern because pour-flush toilets do not provide enough water for transporting solids.

To partly correct the above problems, some communities as in Africa, twenty years ago, began installing "aqua-privies" that were used in place of ordinary pour-flush latrines. These have the same advantage as pour-flush toilets, since their design produces a "water seal" which

prevents odors from escaping from the squat - plate seal or trap. Water consumption is also low. The aqua privy actually functions like a septic tank so solids are retained for periodic pumping (every few years). Sullage and ablution water can also flow through the pour-flush vault to drain to the sewer, thereby producting additional flushing action in the sewer. However, since the people of Sri Lanka seem to favor pour-flush latrines, the accompanying drawings indicate that septic tanks installed as part of such systems can be used with small - diameter sewers. Also, wastewater can be discharged through such tanks.

Sewer pipes can be of rather small diameter (1½ to 2 inches). Clean-out openings can substitute for the more expensive manholes. Tractor - drawn tank carts can be used, as necessary, to provide periodic flushing of the sewers.

The sewers can be designed to flow to stabilitation ponds or other suitable disposal systems. When properly designed the ponds produce treatment which eliminates most disease - producing micro organisms and intestinal parasistes. The liquid leaving the pond system can be discharged in to the sea, especially where a distance maintained to sea - food harvesting and bathing areas.

While the liquid from the pond system is, from a health standpoint, suitable for use for irrigation or fish culture, much of the water from private, shallow wells, used for "sanitation", is so salty that normally it should drain to the ocean.

In areas like the older section of the Jaffna Municipality, consideration could be given to building several stabilization pond systems along the shallow tidal - flat area. The berms could be protected from wave action with rock "rip-rap". These could be so spaced as to minimize the need for pumping. However, pumping should not be major problem because of the anticitated liquid character of the sewage and the low water usage that would be anticitated.

Sewers serving more modern districts may best be of conventional type. Then, as at certain buildings like modern hotels, hospitals, etc., private well systems can provide enough water for modern flush toilets and plumbing systems.

STABILIZATION POND DESIGN

During the past twenty or more years the stabilization pond has become well accepted in both lesser developed and developed countries. Studies in various countries, including India, Malaysia, South Africa and USA have produced design data and operational experience which are quite reliable. Among their advantages are:

(1) No electricity is needed except if pumping is necessary.

(2) There are no mechanical parts to require repair.

(3) Maintenance costs are low.

Total pond areas for the warm and high - solar - radiation climates like Jaffna, would be considerably less than 1 acre per 4000 population.

For an initial sewered population of 24,000, 6 acres would be required. This could be divided into 3 ponds, each of 2 acres. The total pond area would be about 600 feet long, along the shore and 400 feet seeward. The water depth would be about 4½ feet (1½ M).

An alternative plan for parts of Jaffna Municipality would provide for the sewers ro discharge through a preliminary pond in a suitable area and the the partly treated sewage would drain or be pumped to part of the moats around the old fort. Only a small amount of berms would be necessary and there would be no odor or unsightly conditions.

Tests are necessary to decide whether any special lining (like clay) is necessary to assure the ponds are reasonably water - tight. Also, calculations must be made to be sure that the daily flow during the most dry and hot weather, will add more water to the pond system than is lost by evaporation.

(3) No electricity is needed except if pumping is necessary.

(4) There are no mechanical parts to require repair.

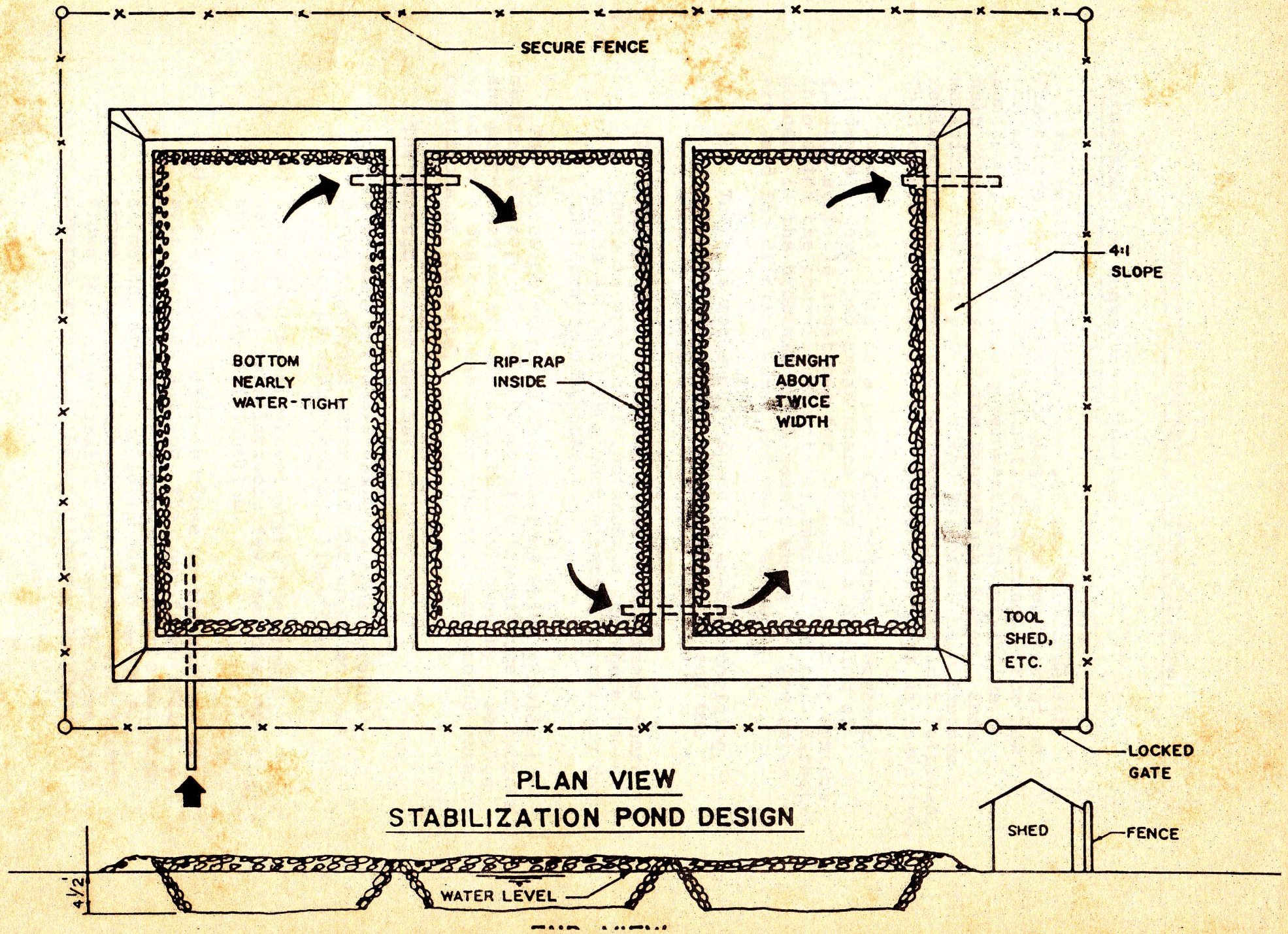
(5) Multi-use concept.

Natural pond areas for the warm and high-water recreation activities like bathing, would be considerably less than 1 acre for 5000 population.

For an initial anticipated population of 24,000, 8 acres would be required. This should be divided into 3 ponds, each of 2.7 acres. The total pond area would be about 500 feet long, along the middle and 600 feet downwind. The water depth would be about 15 feet (15 M).

An alternative plan for Pasig of Quezon Municipality would provide for the sewage to discharge through a preliminary pond in a suitable area and the partly treated effluent would drain or be pumped to part of the moats around the old fort. Only a small amount of bypass would be necessary and there would be no odor or unsightly conditions.

These are tentative methods only and specific timing (like day) is necessary to assure the ponds are responsibly water - clear. Also, calculations must be made to find out the daily flow during the most dry and hot weather, will add more water to the pond system than is lost by evaporation.


SECURE FENCE
4:1
SLOPE
BOTTOM
NEARLY
WATER-TIGHT
RIP-RAP
INSIDE
LENGHT
ABOUT
TWICE
WIDTH
TOOL
SHED,
ETC.
LOCKED
GATE
PLAN VIEW
STABILIZATION POND DESIGN
SHED
FENCE
4 1/2'
WATER LEVEL

CONSERVANCY (BUCKET) SYSTEM (C,L,Senn)

Replacement of Conservancy Systems

The Health Department, through its Public Health Inspectors, is actively encouraging the replacement of conservancy systems with pour-flush latrines. For new construction there is a government grant of 250 Rs.to help finance the cost of the pour-flush system. Some municipal councils provide a 250 Rs. grant help finance replacement of conservancy systems with pour-flush latrines, This covers only part of the cost but serves as an incentive.

In general, this is a desirable program. However, in densely developed areas there may be a problem of finding suitable locations for the seepage pits or systems into which the pour-flush units discharge. Of more direct concern is the problems which result where shallow wells are used for drinking water and where either:

(1) There is not enough space to enable providing adequate separation between the well and the seepage systems.

(2) The system must be installed in limestone where there is practically no seepage and where there may be a hazard from contamination travelling for considerable distances.

The following sketches show designs which provide a septic tank type of vault to receive the mixture of excreta and pour-flush water. This is then followed by a seepage system of a design suitable for the soil and ground water conditions of the site.

The seepage system can be:

(1) A seepage pit where there is considerable depth to ground water and the upper soil is sandy or permeable and not limestone.

(2) A shallow bed of gravel where the ground water level is relatively few feet deep or the soil depth is shallow.

(3) Where ground water is close to the surface or soil depth is shallow, the pour-flush toilet can be sufficiently elevated to enable building a "mounds system" of 18 inches of sandy soil, above which the aqua privy's septic tank drain flows into a perforated pipe, set in gravel and covered with soil (See following sketches).

VACUUM TANK TRUCKS

The World Bank "Appropriate Technology for Water Supply and Sanitation" (Dec. 1980) contains the following illustration of a vacuum type system to replace pail or bucket conservancy systems. Such pimping trucks are very much needed for the Jaffna Region, to pump out septic tanks, and vaults for pour-flush latrines.

An analysis was made of the vacuum tank pumping system. The World Bank publication notes that vacuum or pumping tank trucks are used extensively in Japan and Taiwan. The systems apparently consist of a water-tight holding tank and a latrine arrangement somewhat like a pour-flush system. The publication states that household tanks are pumped each two weeks.

The well-known WHO publication "Excreta Disposal ---", by Wagner and Lanoix (1958) gives data on the volume accumilated in an aqua privy. This would be comparable to a pour-flush latrine. Their recommended design figure is 2 imp. gallons per person per day (minimum of 1 imp. gallon per person per day).

For a family of 6 this would mean 16 gallons per family per day. For two week pumping intervals, this would mean 224 U.S. gallons. (One M^3 = about 262 gal). If the tank truck has capacity of 1000 gallons (4 tons), it could pump 4 systems per load. If it could make 3 trips per day, 5 days per week, each truck could pump 12 x 5 = 60 systems per week.

If systems are pumped once each 2 weeks, each truck would be able to service about 120 houses. The cost of such service would be excessive.

If pour-flush latrines discharge through septic tanks having a capacity of about 1½ M^3, according to the Wagner and Lanoix publication, the septic tank would need pumping only once in 6 years or more years.

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ALTERNATIVE DESIGNS FOR VAULT TOILETS

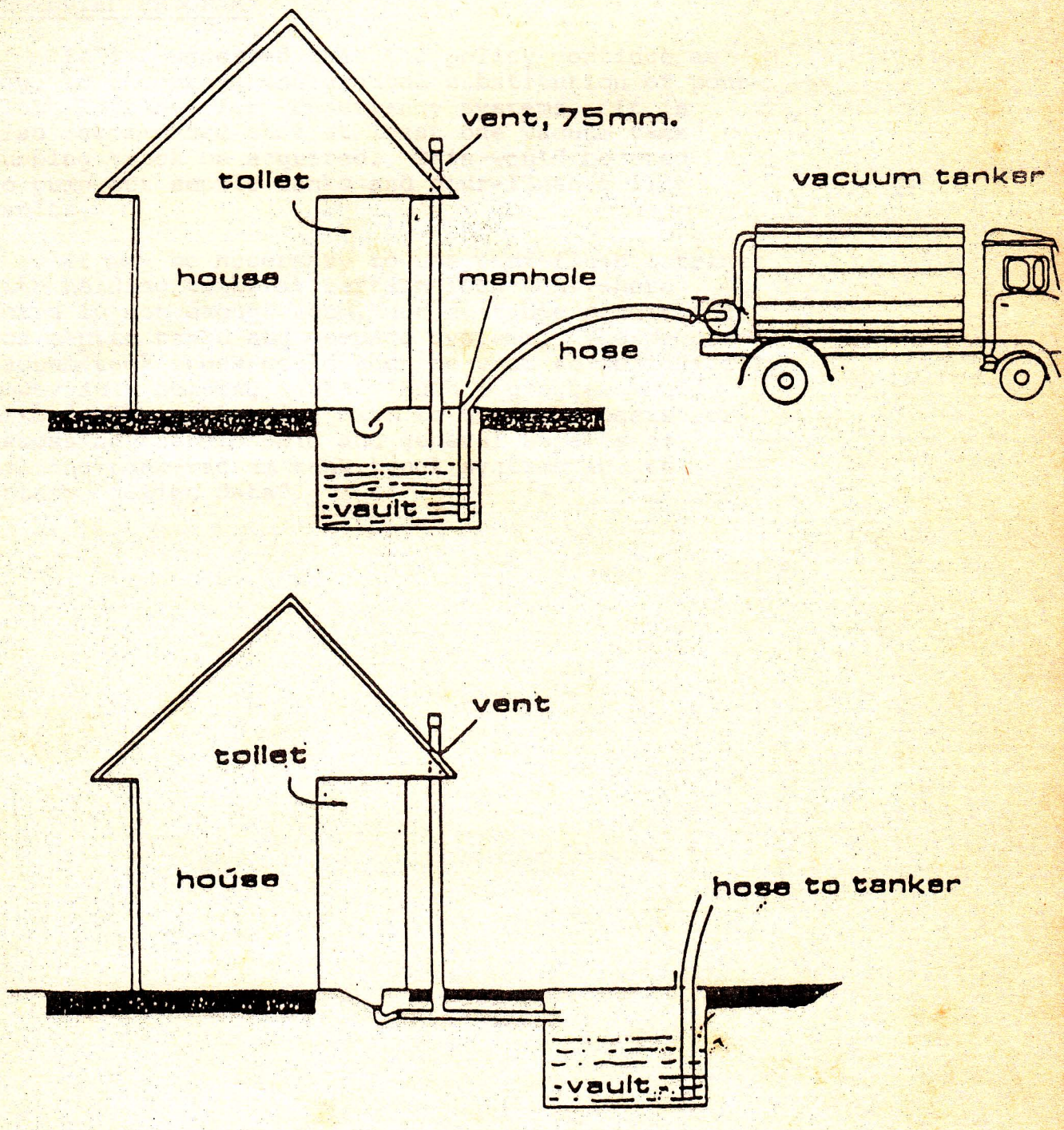
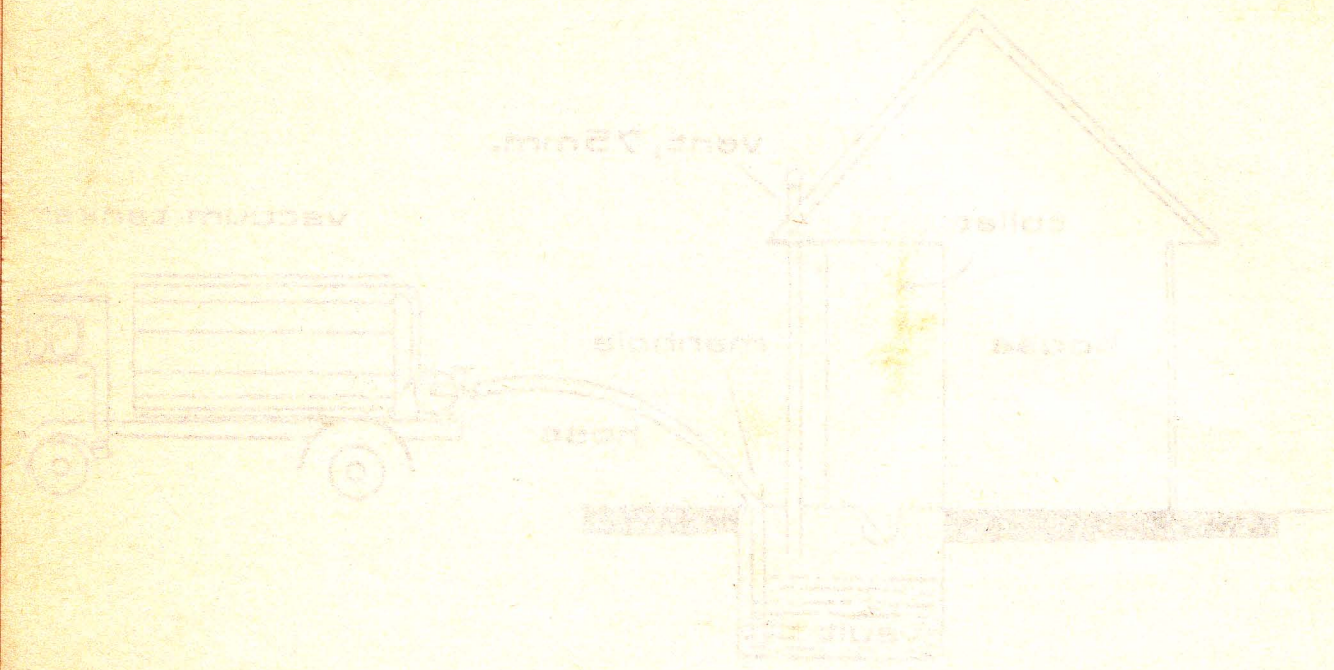
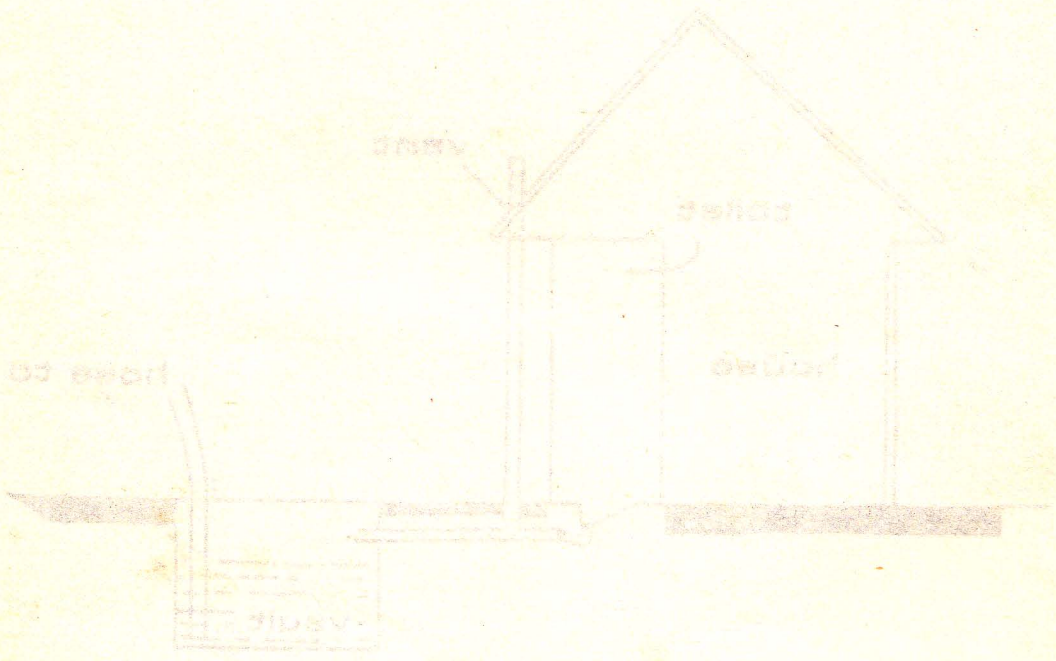


FIG 11.1





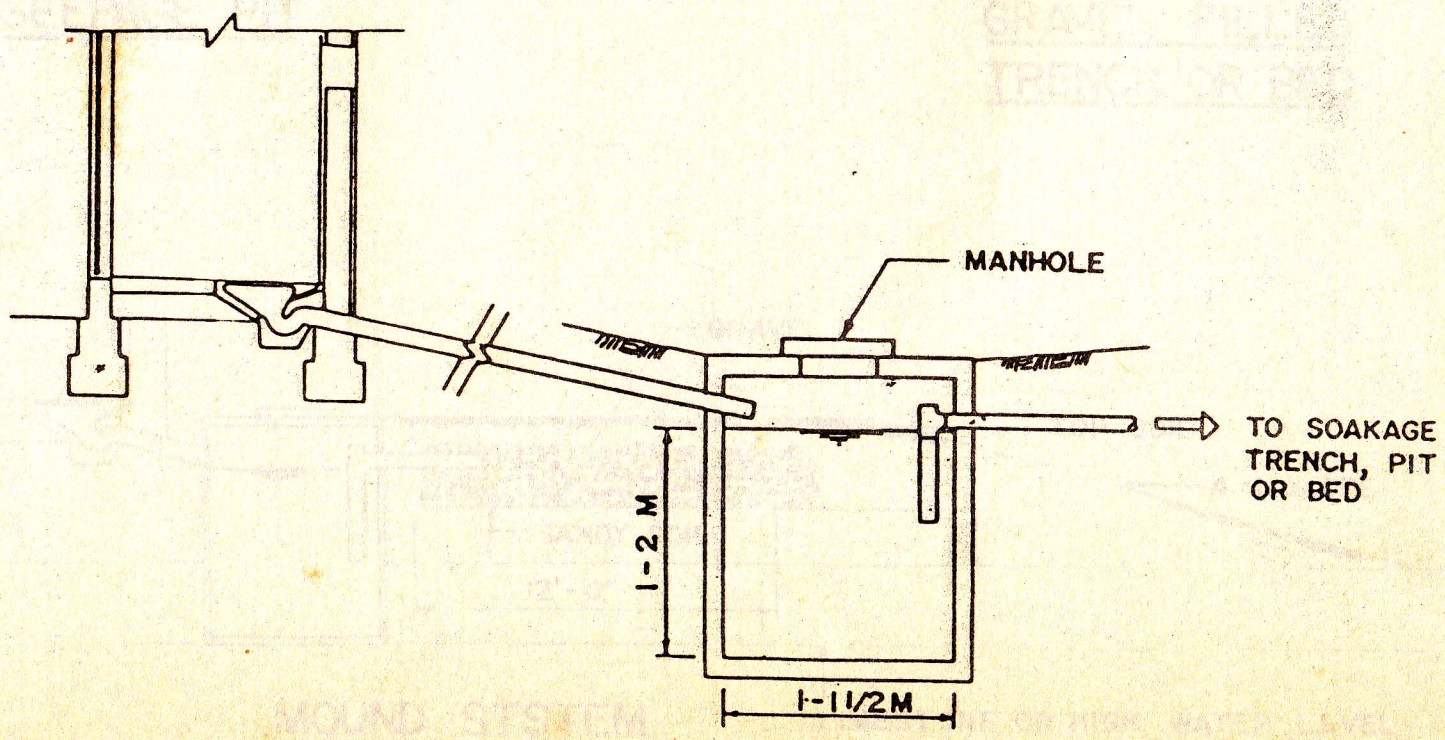
SUGGESTED PROGRAM

It is suggested that the policy continue as now, to encourage the gradual substitution of pour-flush latrines for conservancy systems. It is also recommended that at least one vacuum tank pumping truck be acquired. This would be used to pump out septic tanks and pour-flush toilet vaults.

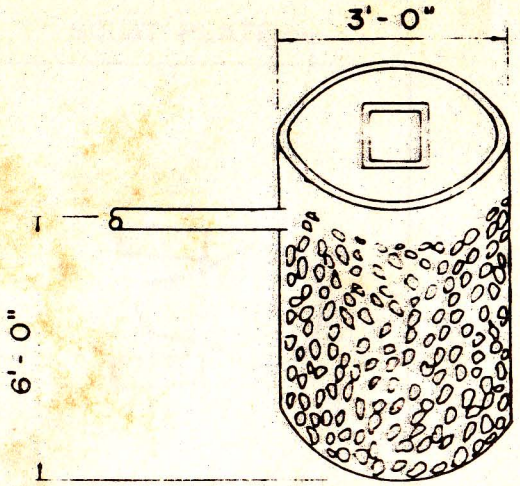
It may be necessary to use pour-flush latrines with holding tanks at certain locations where there is not enough room, nor suitable conditions for septic tanks and seepage systems. The proposed vacuum tank truck could then be used to periodically empty such holding tanks. Such a program would also enable collecting data to use as a basis for assessing the economic and general aspects of holding tank-vacuum tank truck systems and to obtain "design data".

SUGGESTED PROGRAM

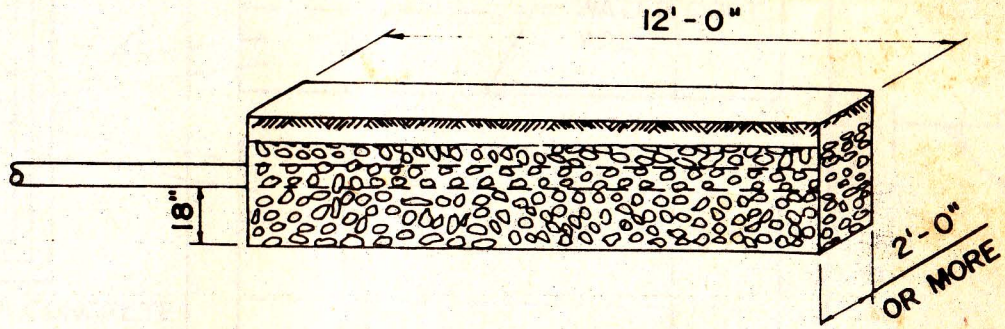
SEPTIC TANK AND SOAKAGE SYSTEM
FROM POUR FLUSH LATRINE



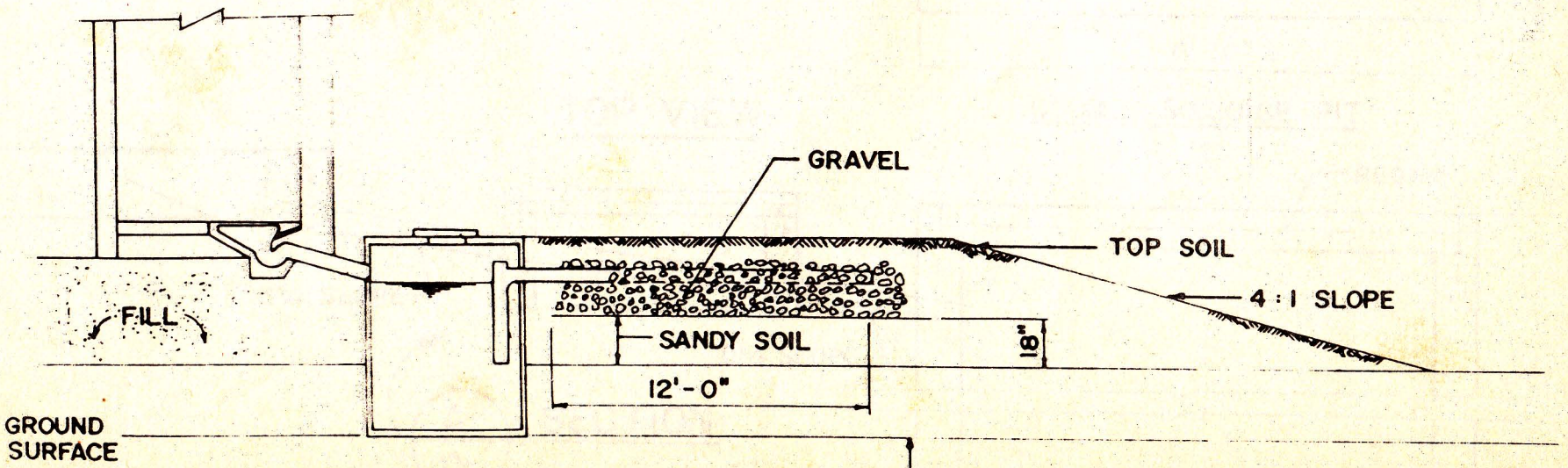
SEPTIC TANK AND SOAKAGE SYSTEM
FROM FOOT HEIGHT INSTALLATION



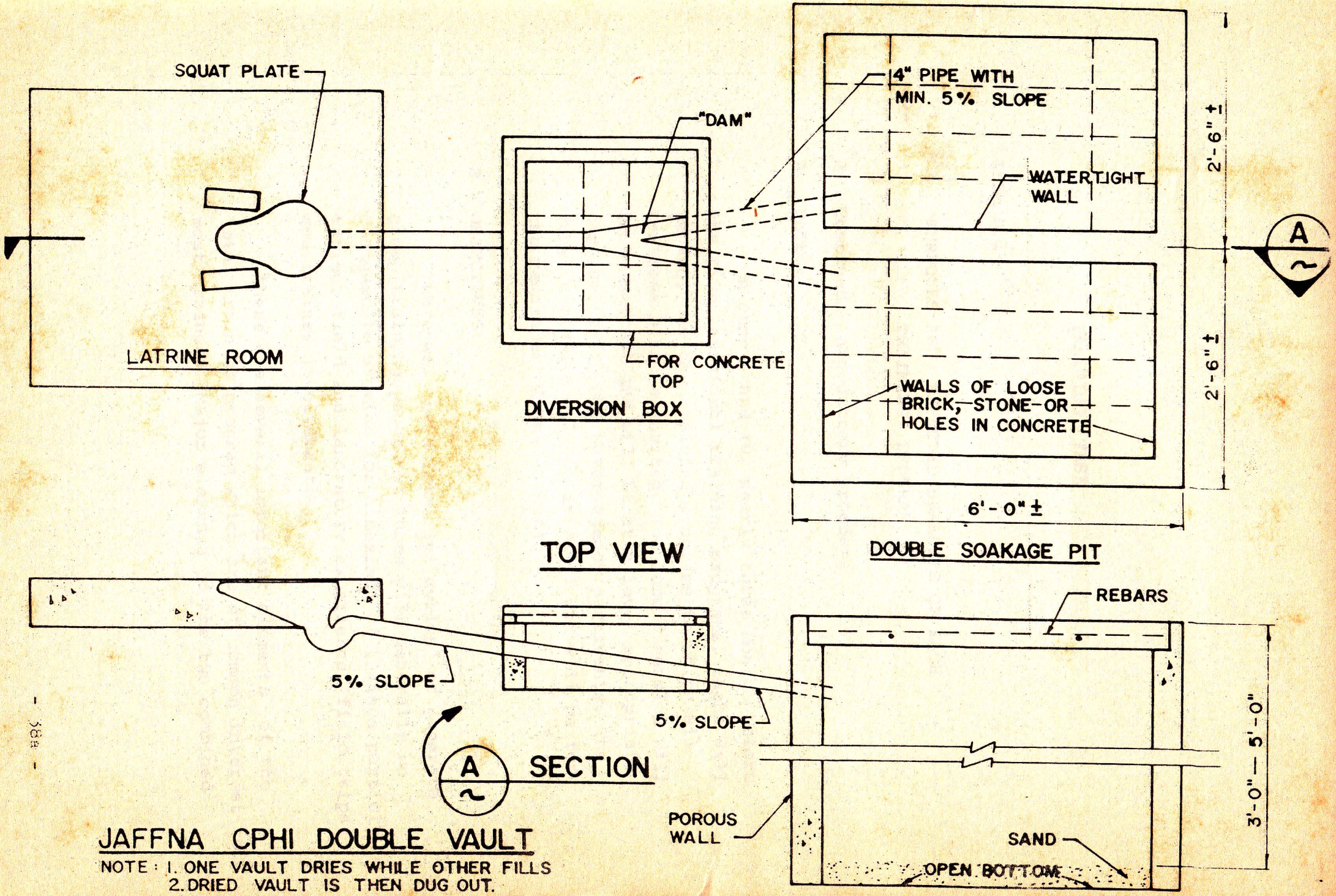
SEEPAGE PIT



GRAVEL FILLED
TRENCH OR BED



MOUND STSTEM



JAFFNA CPHI DOUBLE VAULT

NOTE : 1. ONE VAULT DRIES WHILE OTHER FILLS
2. DRIED VAULT IS THEN DUG OUT.

ITALIAN CHAIR DOUBLE ANNEX
SECTION
TOP VIEW
DOUBLE SOCKET PLUG
DOUBLE BRACKET
WALL BRACKET
STAPLE TWOS

TRAINING TASK

ITEM B.1

PURPOSES AND EXPECTED BENEFITS OF EACH TRAINING PROGRAM

I. Combined, introductory programs

A. DATES:

On June 8 and 10, nearly three months before the five individual training programs, there will be two, one-day training programs to which all trainees will be invited. The June 8 session will be in English and will be at a level appropriate for the Health and Water Agency particants. The June 10 session will be in Tamil and will be for the remainder of the workers.

B. OBJECTIVES:

There will be a total 16 "cycles" or separate group training programs. Those will generally be designed to provide for a maximum of trainee partici-tation, field and laboratory experience, field trips and trainee involvement.

There are several important elements of the total training program which are of common interest to most trainees. Major elements of the two combined

ITEM D.1

TRAINING TASK

PURPOSES AND ANTICIPATED BENEFITS OF EACH

TRAINING PROGRAM

A. DATES:

B. OBJECTIVES:

There will be a total of 16 "cycles" or separate group training programs. Those will generally be designed to provide for a maximum of training participation, field and laboratory experience, field trips and trainee involvement.

There are several important elements of the total training program which are of common interest to most trainees. Major elements of the two combined

training programs can best be presented by officials and professional persons who could not make presentations at each of the 16 individual sessions.

1. COMBINED PROGRAMS

The objectives of the two combined session is to:

a) Afford trainees the opportunity to learn of the total Project and of their roles, from top persons.

b) Present principal special problems of Jaffna area and otline both Project and Particant roles in dealing with these problems, including:

a. Brackish water and resulting shortage of fresh, potable water.

b. Health problems from water and inadequate sanitation.

c) Provide a simplified presentation on corrective measures developed by Project:

i. Potential means of securing more fresh water for drinking and cooking.

ii. Give brief presentation on measures to improve health quality of water by covering wells, chlorinating public supplies and improved health education.

iii. Outline appropriate technology to improve sanitation and to eventually replace conservancy systems.

d) Prepare for individual group training by:

i. Seeking advice by organizing small discussion groups

ii. Requesting suggestions for program planning and for selecting sites for field trips.

e. Advise of plans for group sessions

i. To be in areas where trainees work, in-so-far-as-possible.

ii. To provide transportation and pay for special expenses of trainees.

iii. To announce allowances for those whose salary for training time would not be paid by governmental agencies.

iv. To briefly present plans for training "faculty", manuals, special facilities, demonstrations, etc.

SPECIAL GROUP PROGRAMS

The following is a summary of the Training Program Plan. This is based on Appendix "A" of the Contract.

SPECIAL TRAINING CLASSES

Appendix "A" of the Contract provides for five special "class-room" and "field" training programs. The plan calls for classes for not to exceed 15 per group. The duration varies from 3 days for Conservancy Workers to 3 weeks for water operational personnel.

Group	Total No. Trainees	No.day each*	No.of groups	Total group days
Public Health Inspectors & NWSDB staff	69	6	5	25
Public Health Midwives	45	5	3	12
Conservnacy workers	100	3	5	10
Masons	50		3	12
Water System Operation and Maintenance Personnel	20	15	2	28
	284	33	18	87

* Includes the one day "general session"

SPECIAL TRAINING CLASSES

Appendix "A" of the Contract provides for five special "class-room" and "field" training programs. The plan calls for classes not to exceed 15 per group. The duration varies from 3 days for Conservancy Workers to 3 weeks for water Operational personnel.

Group	Total No. Trainees	No. day each	No. of Groups	Total man days
Public Health Inspectors & NWSOB staff	60	5	3	75
Public Health Nurses	45	5	3	75
Conservancy workers	100	3	5	10
Nurses	50		3	15
Water System Operation and Maintenance Personnel	10	15	2	75
	265	43	16	370

* Includes the one day "General session"

SPECIAL TRAINING GROUPS - TRAINING PERIODS
AND OBJECTIVES

PUBLIC HEALTH INSPECTORS, ENGINEERING ASSISTANTS AND TECHNICAL ASSISTANTS OF NATIONAL WATER SUPPLY AND DRAINAGE BORAD

Training Period: Introduction Session on June 8 1982, plus 5 days in September.

Objectives:

1. To train the particants in the role of water in health and disease; how water becomes polluted. Methods of pollution prevention; understanding principles and significance of results of analysis of drinking water for bacteria and chemicals.
2. Training to understand the principles and methods of excreta, wastewater and sewage collection and disposal; reviewing the relationship of proper waste disposal to health protection.
3. Providing methedologies and knowledge of how to use public education techniques to obtain public support for improved systems and to secure improved health benefits from proper water supplies and sanitation facilities.
4. Teach how to make calculations, do field tests, take bacteriological samples, all related to improved water supplies and sanitation.
5. Train in detailed steps in making "sanitary surveys" of water supplies.

6. Provide methods for particitants to teach the public and public officials how to achieve improved water supplies and sanitation.

7. To present the legal and financial aspects of water supplies, sanitation control and improvement programs.

PUBLIC HEALTH MIDWIVES

Training Period: June 8 introductory session plus 4 days.

Objectives:

To train particants in water and sanitation improvement programs with particular emphasis on effects on health. The goal is to provide effective and practical methods of helping particants inform and persuade their clients in methods of handling, storing, boil and cool and otherwise providing safe water; to review the relationships of water and sanitation in health promotion and protection; to help develop an understanding of the value of safe water and good sanitation, so as to promote water conservation and to encourage public willingness to pay for improvements and to do their parts to secure better health and sanitation practices.

Emphasis is on the importance of sanitation as an integral element of disease and infection prevention.

SYSTEMS OPERATION AND MAINTENANCE
FOR ADMINISTRATORS/SUPERVISORS AND WATCHERS

Training Period: June 8 introductory session, plus 3 weeks.

Objectives:

To utilize the educational resources of the NWSDB, Ministry of Health, International and of educational specialists to provide training and educational experiences in the dual role of providing both efficient water supply operation and of obtaining maximum health protection by good water supply planning, design, operation and maintenance.

The goal is to assure that trainees are fully capable of conducting those operation, maintenance, testing and public education functions which are necessary to accomplish the above objectives.

The program will include both demonstrations, lectures, observations and actual experience in the various tasks which are the responsibilities of the particants.

MASONS

Training Period: Introductory session on either June 8 or 10, plus 3 days.

Objectives:

To train particants so they fully understand the various alternative technologies for latrine construction

Training Period: June 6 introductory session, plus 3 weeks.

Objectives:

To utilize the educational resources of the MWSDB, Ministry of Health, International and of educational specialists to provide training and educational exposure in the dual role of providing both effluent water supply operation and of obtaining maximum health protection by good water supply planning, design, operation and maintenance.

The goal is to assure that trainees are fully capable of conducting those operation, maintenance, testing and public education functions which are necessary to accomplish the above objectives.

The program will include both demonstrations, lectures, observations and actual experience in the various tasks which are the responsibilities of the participants.

MASONS

Training Period: Introductory session on either June 8 or 10, plus 3 days.

Objectives:

To train participants so they fully understand the various alternative techniques for laying construction

and wastewater disposal under various site conditions. To teach and provide experience in soil examination, percolation testing and system design for various situation, to teach the relationship between latrine location and water supplies.

To teach the principal of "covered wells" and demonstrate methods of construction.

CONSERVANCY WORKERS

Training Period: Introductory program on June 10 plus two days.

Objectives

To recognize the importance of conservancy programs to public health and convenience. To provide basic knowledge of the importance of safe water supplies and sanitary excreta disposal in prevention of disease and infection.

To demonstrate various alternate methods of excreta disposal and emphasize, the importance of proper maintenance, operation and periodic emptying of vaults, tanks and systems which are necessary parts of such systems.

A major element is to teach particants the importance of :

1. Personal protection by being vaccinated and innoculated.
2. Hygienic practices which protect themselves and the public from the disease hazards of excreta.

APPENDIX

Many excellent Sri Lanka publications and agencies have provided valuable information for use in preparation of this Manual. This APPENDIX includes copies of some such information and advice. The first pages are taken from the Sri Lanka Family Planning Manual. This publication is being used by all Sri Lanka Health Workers. So many requests for copies have been received from international and national agencies that no copies are now available. However, a Tamil translation is at the printer and copies are expected. When available, selected pages will be copied and distributed to Tamil speaking Project Trainees.

This Manual contains those pages which provide information which is most directly related to this Project.

APPENDIX

FAMILY HEALTH

IN

SRI LANKA

FOREWORD

This Manual is for you, the Family Health Worker. It is a Work Manual; it is to help you in your work. You can refer to it, and remind yourself of things in your day-to-day work.

The Family Health Programme tries to look after the health of every family in Sri Lanka. We think of the mother, the father, and the children as a unit. We want them to feel that they, as a family, are working towards good health. If a mother is pregnant she needs ante-natal care; if a child is ill, he or she needs treatment; if the family is badly nourished, they all need help. We want to think of each of these cases, not as an individual woman, with a special problem, or a single ill child, but as members of a family who need help in a particular part of their family life together. For example, helping the parents to find out about contraception is a way of helping their family life, as a whole.

Family Health is one attempt to help people plan their lives; to plan for good health, a good life, and a happy family as part of a healthy nation.

The Family Health Programme covers particular aspects of the health of families. These aspects of health are the most important at this particular time. They are: care of mothers, care of babies and children, immunization, environmental health, nutrition, health education and family planning. Out of the many different aspects of health, the programme considers these the most important in Sri Lanka at the moment. But we can change the programme if we need to. We can add other aspects of health, or, if one is no longer so important, we can leave it out. In this way it has recently been decided to include the prevention and control of venereal diseases in the programme, as an important aspect of Family Health.

The most important part of Family Health is to recognise what things might go wrong in a family's life, and then to take preventive measures. The Manual is written specially to help you do that.

The Manual should answer 3 questions for you.

1. What Can I Do?
2. When and Where?
3. How?

A diligent use of the Manual will assist you to provide good Family Health Care, thereby helping every family in Sri Lanka.

S. Y. S. B. Herat
Assistant Director (Maternal and Child Health)
M.B.B.S. (Cey.), M.O.G. (Cey.),
D. (Obs.), R.C.O.G. (Gt. Bri.)

Responsibilities of Public Health Midwives.

VIII ENVIRONMENTAL SANITATION

- Note the environmental conditions affecting the total health of individual, family and community.
- Observe during home visits insanitary methods of waste disposal and advise remedy (10.4).
- During home visits observe the water supplies in the area, whether there is contamination and any pollution (10.1).
- Observe insanitary dwellings and houses under construction during home visits and notify the P.H.I. (10.9).
- Discuss with mother what the environmental problems are that affect the health of the family.
- Educate mothers in good house keeping.
- Advise on storing food and protecting it from dust and flies (10.7).
- Educate mothers in hygienic preparation and handling of food (6.8 & 6.9).
- Advise on the cleanliness of cooking utensils, washing, airing, sunning.
- Explain to the mother the importance of a pre-school latrine in habit training.
- Explain the necessity of getting wells purified if they get contaminated (10.2).
- Show how to maintain cleanliness in the house (10.10).
- Help parents in obtaining a free pre-school squatting plate and guide them in the construction.
- Assist mother in the proper use and maintenance of sanitary latrine (10.4).
- Demonstrate how water should be boiled and stored for drinking purposes.

Duties of Public Health Inspector.

III SANITATION

A. Control of Water Supplies

- Give attention to pipe-borne water supplies and see whether chlorination is being carried out (10.1).
- Send samples for chemical and bacteriological examination of suspect sources (10.2).
- Control chlorination of wells (10.3).
- Give health education regarding use of boiled cooled water.
- Encourage people to construct more wells as close to the house as possible.

B. Control of Waste Disposal

- *Human Excreta* : Promote the construction of latrines in the area (10.4).
- *Refuse* : Supervise the aesthetic and useful disposal of refuse (10.5).

C. **Control of Milk Supplies** (10.6).
D. **Control of Food Handling** (10.7).
E. **Control of Insects and Animals** (10.8).
F. **Housing** (10.9).

- Assist Head of Institution to Plan, Implement and Evaluate the Family Health Educational Programme.
- Undertake a quota of family health education activities in the medical institutions : These may be—
  (*a*) Group education activities for minor staff and patients.
  (*b*) Individual counselling for O. P. D. patients.

VII ORGANIZED HEALTH EDUCATION

General

- Take the full responsibility of leadership and plan the Health Education Service Programme with the Public Health Nurse and Public Health Midwives in your area.
- Assist Public Health Nurse and Public Health Midwives to identify leaders in the area (13.10).
- Obtain the co-operation of the community leaders such as :
  (a) Religious Leaders
  (b) Chairmen of Local Bodies
  (c) Heads of Schools
  (d) Grama Sevakas
  (e) Other village based field officers, e.g., R. D. O O.
  (f) Office bearers of Voluntry Organizations in the area.
  (g) Office bearers of all Statutory Organizations such as Janata Committees, Productivity and Development Councils.
  (h) Other hidden leaders who could influence the people in the community.
- Organize special mass educational activities in the community:
  (a) Film Shows
  (b) Exhibitions
  (c) Seminars
  (d) Demonstrations, etc.

CHAPTER TEN

ENVIRONMENTAL SANITATION

10.1 Water

DRINKING WATER SOURCES

Most of the rural population of Sri Lanka depend on dug-wells for their water supply, but many people also use rivers, irrigation canals, ponds, springs and rain water for their water supply.

Few villages have a modern piped water supply system, or deep wells; although these are safer regarding water quality.

In most of the cases these sources of water are polluted; or as in the case of springs and rain water, which are not originally polluted, the water is polluted when taken from the source to be used.

DUG-WELLS

Dug-wells are usually polluted. When the dug-well is provided with a hand-pump and covered with a slab, the situation is better.

Regarding dug-wells, the Inspectors should check the following :

- Location of the well

  The location of the well with reference to existing latrines or other possible source of contamination is important; this also includes the slope of the ground surface and of the water table.

- Method of pumping; or how to take water out of the well. The method should be inspected, to avoid any possible contamination.

- Drainage

  The well should have good drainage around it.

- Cover

  The well should be covered, preferably by a concrete slab; this should be heavy enough, so that it isn't easily knocked off.

- Parapet

  The parapet is a wall built around the well above the ground surface, to avoid contamination from rain water and waste water entering the well.

- Lining

  The well should have at least three metres length of interior lining from the surface down, to protect the well from surface infiltrations.

- Surrounding platform

  The surrounding platform is to avoid contamination by users of the well. It should be of concrete.

SPRINGS

When a spring is the water source, we might expect the water to be safe; but the catchment area should be free of possible human and animal contamination. To achieve this, the catchment area should be protected.

Additional surface water running to the spring should be avoided.

PONDS

When ponds are used, the protection of the catchment area is very important; special importance should be given to keep rain water running on the ground surface away from the pond.

RIVERS AND IRRIGATION CANALS

The water of these sources is usually polluted; the water should be treated. As the treatment of water is difficult, we can boil the water for 15 to 20 minutes before drinking, or we can use a home-made system of chlorination.

RAIN WATER

When rain water is used, the Inspector, should check the catching system, that is the roof, pipes, containers, etc. The system should be free from possible human or animal (including birds) contamination, also free from dust, or leaves that could get into the water. Containers should be kept closed; better, protected with a fine screen.

Special consideration should be taken after the dry season finishes; that is just before the rainy season starts.

10.2 Purification of Water

There are 3 general methods of purification of water on an individual or domestic scale.

- Boiling
- Chemical disinfection
- Filtration

These methods can be used singly or in combination.

Boiling destroy all forms of disease organisms usually encountered in water—bacteria, spores, viruses, cysts or ova.

Chlorine is a useful disinfectant for drinking water; and effective against the bacteria commonly associated with water-borne diseases. In the usual dose it is *not* effective against certain cysts and ova.

The usual Chlorine products are:

- Calcium Hypochlorite. It has several commercial names: "Percloron", "HTH", "Alcablanc", etc. It is a powder with a chlorine concentration of 40% to 70%.
- Sodium Hypochlorite. It is a yellow liquid with a chlorine concentration from 12% to 15%.

The disinfection action of the chlorine is affected by the following factors which must be kept in mind;

- The nature of the micro organisms to be destroyed. Bacterias are more easily destroyed than amoebas and spores.
- Contact time
  The necessary contact time varies according to the physical water characteristics.
- Water temperature
  Disinfection is more rapid with the rise of temperature.
- Concentration of the product to be used
  The concentration is an important factor to determine the amount of the product necessary for a specific disinfection.
- pH
  If the water is alkaline more chlorine is needed; the amount of chlorine needed is in direct relation to the alkalinity of the water.
- Other physical conditions of the water
  The turbidity of the water is also in direct relation to the amount of chlorine to be used, for more turbid waters, more chlorine should be used.

The initial dosage of chlorine could be considered as follows:

1. For very contaminated waters: from 2.5 to 3 parts per million of free chlorine.
2. For surface clean water: from 1.2 to 2 parts per million of free chlorine.
3. Water in Dams, without algaes: 1 to 5 parts per million of free chlorine.
4. Filtrated water from wells or rain water: 0.5 to 1 parts per million of free chlorine.

The residual chlorine is the chlorine which is free in the water after the disinfection is produced. It is measured by clor comparatores. The residual chlorine for drinking water should be 0.2 parts per million.

To add the chlorine to the water we should know the volume of water to be disinfected. To disinfect wells or reservoirs, a solution of 1% is used which can be diluted to the convenient concentration.

After we know the volume of water to be disinfected, and the concentration or p.p.m. of water selected, we use the following formula, to know the amount of chlorine that we need to add.

$$P = \frac{C \times L}{B \times 10}$$

Where: P = grams of commercial product.
C = parts per million selected.
L = volume in litres of the water to be chlorinated.
B = % of free chlorine of the commercial products.

10.3 How to Chlorinate Wells

- Use Tropical Chloride of Lime (TCL or Bleaching Powder).
- Calculate the amount of water in the well:
  $D^2 \times W \times 5 =$ gallons of water in the well.
  Where D = Diameter of well *in feet*
  W = Depth of water *in feet*.
- Use 1/2 to 1 ounce TCL for every 1000 gallons of water.
  (During epidemics or for badly contaminated wells, use 1 oz. TCL per gals. water).
  This dosage is for fresh TCL when Chlorine content is 33%. If there is a loss of Chlorine due to bad storage the dosage has to be proportionately increased.
- Mix the TCL in a bucket of water.
  Lower it into the well.
  Agitate the water with the bucket.
- After 1/2 hour take a sample of water from the well. Test it with *Orthotoluidine*.
- Add 1 ml of orthotoluidine to 100 ml of water.
- *Orange*: chlorinated.
- Lemon yellow: adequate.
- No colour: inadequate.
- Don't use the well for 12 hours after chlorinating it.
- *Dechlorination:* Add Sodium Thiosulphate to the water.

10.4 Waste Disposal

SEPTIC TANKS

Septic tanks are used in small villages and in city areas: the following points should be considered for the construction of a septic tank.

Location

A septic tank is 100% water tight. It can be close to a well. But the *Seepage* or *Soakage* or *Percolation pit* should be generally 50 feet away from a water source, to avoid contamination. If the soil is sandy, however, the seepage pit only needs to be 20 feet away from the water source.

– Limitation

A septic tank provides a place for decomposing or digesting sewage of human excrement and kitchen and laundry waste. Grease should be avoided; use a grease trap to prevent grease entering the tank.

Other materials such as cloth of any kind, paper, other than toilet paper, metals, plastics, etc. are not readily decomposed; therefore they should not be flushed into the tank. Waste from milk or water-softeners should not go to the septic tank.

- **Cleaning**

The frequency at which a tank needs cleaning depends upon:
- The size of the tank in relation to the daily volume of sewage.
- The kind and quality of solids in the tank.

Under normal operating conditions a tank should serve from 5 to 10 years between cleanings. For a new tank inspection should be made once a year until experience indicates the frequency of cleaning necessary.

Seepage Pits

A seepage pit is a hole in the ground walled up with porous material and covered with earth. The most common application is in areas where there is an impervious layer of clay or hardpan close to the surface with a porous layer of soil beneath. A seepage pit should not be used if the water table is less than 3 metres below the surface or if there is danger of contaminating a water supply.

Squatting Plates

Squatting plates made of cement do not provide moisture, earth and warmth for the development of hookworm eggs; these plates can be easily cleaned and dried.

Deep Pits

— the site should not be less than 30 feet from the house in hard, dry, soil.
— the pit must be at least 20 feet deep.

10.5 Refuse

Disposal of household refuse in a sanitary manner is important from a health point of view. Careless handling of garbage attracts rats and other rodents and provides breeding places for flies and sometimes mosquitoes.
In cities, refuse is collected at regular intervals and hauled away to disposal point.
In rural areas the problem is one for the individual family to work out.

— **Burning**

Burning, as ordinarily practised, is seldom satisfactory except for papers and other combustible materials. Wet garbage schh as food scraps and refuse from dressed meat will not burn properly unless first dried.

Burn papers and other combustible refuse in suitable enclosures; this greatly reduces the volume to be buried or otherwise disposed of.

— **Burying**

Bury wet garbage under several centimetres of soil. This is satisfactory and not expensive, especially for rural homes; but it must be done at a safe distance, 20 metres or more, from the water supply.

If refuse is thrown away on the surface, it should be done at a considerable distance from human habitation.

— **Pits**

Covered pits provide a safe means of refuse disposal, if correctly located and properly constructed.
For convenience the pit should be located as near to the buildings as possible without endangering the water supply.
It should be at least 35 metres away from any well and down-hill from it. If it is covered with at least 30 centimetres of dirt, or equipped with a tight lid, odours will not be a nuisance.

The earth over the pit should be graded upwards towards the centre and good surface drainage should be provided for the area around the pit.
If located on a slope, a diversion ditch should be made above the pit.

Home Composting (Rural areas) 2 pit system or 4 pit system.
Composting (Urban areas) Both hygienic and economical.

Although any kind of refuse can be disposed of in a pit, it is best to use it only for wet garbage and such things as dead birds, dead farm animals, and refuse from dressed meat. Papers, tin cans, bottles, etc., which do not readily decompose will quickly fill the pit.

Containers

Convenient and sanitary containers for holding garbage until final disposal are important. Outdoor cans should be water-tight; put the tin where dogs or rodents cannot disturb it.

REMEMBER

Refer to the relevant Bye-laws of the Local Authority. Make a note of these here:

_____

_____

_____

_____

_____

_____

10.6 Milk

Milk control can be divided in 3 parts:
- The Cow Stable.
- The Milk House.
- Handling the Milk.

The Cow Stable

- Stables should be ventilated and lighted.
  A common recommendation is to have 0.36 square metres (4 square feet) of window area per cow.
- Stables should be protected from flies.
  Manure, decaying hay and straw, and especially spoiled ensilage provide excellent fly-breeding materials.

The Milk House

- The milk house or milk room is a separate room in which the milk is strained, cooled, stored and handled, and where the washing and storage of containers and utensils are done.
- The location of the milk house in relation to the barn is important. The most satisfactory location for the milk house appears to be near the centre of the cow stable with only a short, ventilated, covered passageway between the two.
  The floor, and walls of the milk house should be easy to clean and wash. Concrete floors are preferable.
- Running water should be available. Washing facilities for utensils are necessary.
- Windows should have appropriate screens.
- Adequate drainage for water and waste milk should be provided.

Handling the Milk

- Collecting the milk. In some instances, milk is bottled raw. Special attention should be paid to washing the bottles.
- When milk is transported from the milk house to the village, it is important to check not only the cleanliness of the cans but the condition of the trucks which are transporting the cans.

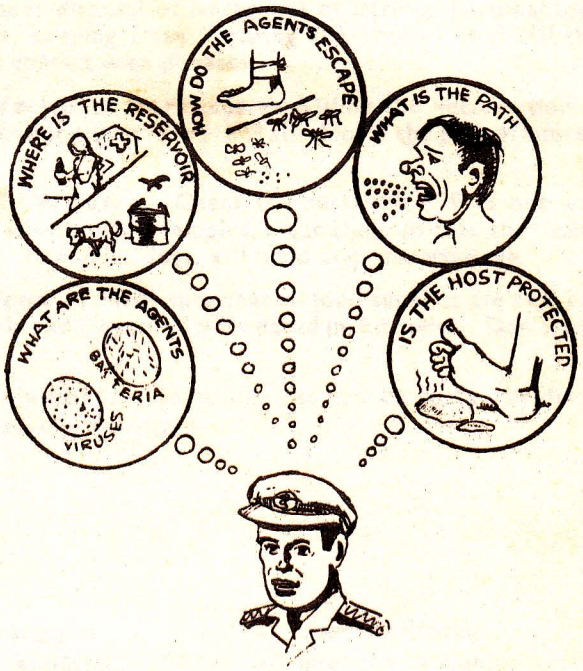
CHAPTER ELEVEN

COMMUNICABLE DISEASES & IMMUNIZATION

11.1 Introduction

Some diseases can travel from person to person or from things or animals to people. These are communicable diseases.
We can't stop them by treating sick people, because the disease travels on. We must stop these diseases in their travels, or we must make everyone immune.

11.2 These are the Questions to Ask :



- *What are the agents of infection ?*
  Viruses, bacteria, worms, etc.
- *Where is the reservoir of infection ?*
  Sick people, carriers (without symptoms), animals, insects, etc.
- *How do the agents escape from the reservoir ?*
  Through the respiratory tract, the intestinal tract, open wounds, insect bites, dirty syringes, etc.
- *What is the path of infection ?*
  How is the infection transferred ?
  Through coughing, direct contact, etc.
- *Is the host protected ?*
  Is he likely to come in contact with the disease ?
  Has he been immunized ? Does he take care of his personal hygiene, etc. ?
  Work out the path of infection and try to block it.

11.4 Ways of Preventing the Spread of Communicable Diseases

A. Isolation & Treatment — Isolate a patient and treat him quickly. He can't come into contact with others, and so he can't spread the disease.

B. Surveillance — Supervise the patient's contacts. How can the disease spread? Who has he passed it on to?

C. Immunization — Effective immunization can block the pathway of infection. The disease cannot spread from person to person.

D. Disinfection of Clothes and Bedding — Many diseases are spread by touching contaminated clothes and bedding. A patient can re-infect himself, after he is cured.

E. Environmental Sanitation — This covers a lot of things. Supervision of wells and drinking water—can the water get contaminated? Decontamination of infected or suspected water; disposal of faeces; use of latrines, personal hygiene— washing hands, wearing shoes, keeping clean, cleaning the houses, etc. All these mean that people don't come in contact with diseases.

F. Control of Vector or Parasites — Killing the vectors (for example mosquitoes) or the parasites (for example, worms) also blocks the path of infection. Then the disease can't spread.

G. Detection of Carriers — Check the reservoir. Find out who or what is carrying the disease. Check blood samples, treat them so that they can't carry the disease to other people. Immunize dogs, kill rabid dogs, for example.

H. Control of Food — Make sure that all food supplies are not contaminated. See that food is properly and hygienically prepared in kitchens. Don't let infected people handle food.

I. Sterilize Equipment — Some diseases can be spread by dirty syringes, etc. Make sure all equipment is sterilized.

11.5 Immunity

Active :	(*a*) Natural	— after the illness.
	(*b*) Artificial	— after the vaccine.
Passive :	(*a*) Natural	— from the mother. Lasts about 6 months.
	(*b*) Artificial	— immuniztiaon. Lasts only 2–3 weeks.

Place	Defect	Description, Signs and Symptoms	Action to be taken
	Roundworms	Infection from unwashed fingers or fruits and vegetables eaten raw or half-cooked. Young larva in lungs cause cough, blood stained sputum, eosinophilic. Adults in intestine cause protruding abdomen, loss of appetite, debility, retarded growth, intestinal obstruction.	Advise— 1. Treat infected. 2. Use toilets and prevent pollution of soil. 3. Treat night soil before using as fertiliser. 4. Wash hands with soap before touching food. 5. Keep finger nails short and clean. 6. Wash all fruits and vegetables well.
	Hookworm	Infection by young larva entering through skin. Causes itching and inflamation at site of entry. Adults in intestine cause anaemia and debility from blood loss.	Advise— 1. Treat infected. 2. Use toilets and prevent soil pollution. 3. Use footwear wherever possible.

11.19 Communicable Diseases

1. Disease	Cholera	Dysentery	Encephalitis
2. Causative Organisms	Vibrio cholera-biotype El Tor	Shigella dysenteree, fleuxneri, boydii, sonnei.	Several viruses can give the same syndrome.
3. Source of Infection	Faeces & Vomitus of patients & faeces of carriers.	Faeces of patients or carriers.	Depends on the causative organisms.
4. Mode of Spread	Faecal oral spread, usually by water, food, flies or unclean hands.	Faecal oral spread, usually through hands, food, flies & water, in that order.	Variable.
5. Incubation Period	2 - 5 days.	1 - 7 days.	
6. Symptoms	Severe diarrhoea with passage of large quantity of watery stools followed by vomiting. Patient may become dehydrated and dangerously ill in a few hours.	Fever & diarrhoea with tenesmus and colic. Frequently blood and mucus in stools.	Fever & headache. Patient becomes dull and drowsy and finally becomes unconscious with fits.
7. Period of Infectivity	As long as vibrios are present in stools. Usually about one week in untreated cases. But treated with antibiotics patients are non-infectious in 24-48 hours.	As long as organisms are present in the faeces, usually a few weeks in untreated cases.	Depends on the infectious agent.
8. Exclusion of Contacts	Isolate contacts at home for 5 days and treat with tetracycline.	Nil	—

9. Preventive Measures	Immediately notify all suspect cases. Isolate & treat energetically with I.V. fluids & tetracycline. Disinfect stools, vomitus & clothes. Environmental Sanitation: Boil water, chlorinate wells. Personal hygiene: Use of oral re-hydration in the early phase of the disease will prevent patient becoming severely ill.	Treat with antibiotics. Disinfect stools. Environmental Sanitation: Wash hands, boil water. Personal hygiene: Use of oral re-hydration in early phase of disease.	Notifiable. Depends on the causative organisms. One of the identified causes of encephalitis is Japanese encephalitis which is a mosquito-borne disease transmitted to man from vertebrate hosts. Control of the vector.
10. Complications	Kidney failure and death if not adequately treated with proper fluids.	Death due to dehydration or toxaemia.	High death rate and residual brain damage.
11. Diagnosis	Examination of rectal swabs for vibrios.	Examination of stools microscopically or by culture.	Isolation of virus or serological examination.

1. Disease	Enteric Fever	Filariasis
2. Causative Organisms	Salmonella typhii and Para typhii A.	Wuchereria bancrofti (filarial worm).
3. Source of Infection	Stools or urine of patients and carriers.	Persons with circulating microfilaria in blood.
4. Mode of Spread	Person to person contact, unclean hands, contamination of food or water, flies.	Mosquito-culex fatigans is infected by microfilarae when sucking blood from a carrier; mosquito is infective after two weeks.
5. Incubation Period	2–3 weeks.	Repeated bites from infected mosquito necessary for a person to develop disease.
6. Symptoms	Headache & continued fever. Any continued fever should be suspected of typhoid.	Fever with rigor. Red patches or streaks on limbs. Enlargement of lymph glands, swelling of parts of limbs, sometimes Elephantiasis.
7. Period of Infectivity	As long as typhoid bacilli are passed in faeces or urine. Proper treatment usually terminates carriage.	Patients with symptoms are usually not infective. All those with microfilarae in blood are infective till treated.
8. Exclusion of Contacts	Nil	Nil
9. Preventive Measures	Notify. Isolate patient, disinfect excreta, proper treatment, environmental sanitation, boil water, hand-washing. Detection and supervision of typhoid carriers. Immunization—T.A.B. two doses at intervals of one month.	Parasite control—Regular blood examination of people and treating them with carbamayne. Vector control—prevention of breeding of mosquitoes and attack on adults with insecticides.

10. Complications	Toxaemia. Haemorrhage from intestines. Perforation of intestines.	Elephantiasis.
11. Diagnosis	Blood for culture. Stools for culture. Blood for Widal test	Examination of blood films taken at night.

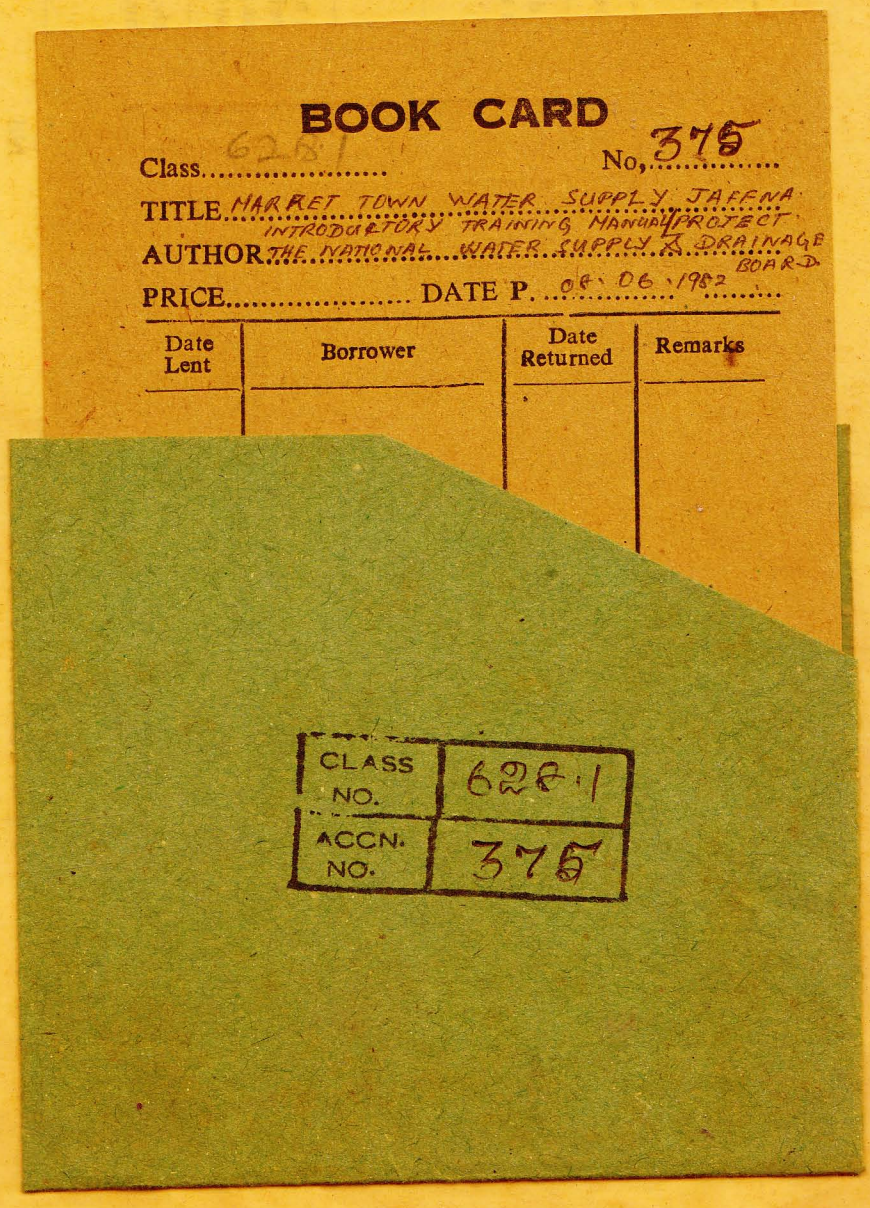
1. Disease	Food Poisoning Salmonella	Food Poisoning Staphylococcal	Food Poisoning Clostridium Perfringens
2. Causative Organisms	Various species of Salmonella organisms.	Staphylococcus.	Clostridium Welchii or Perfringens.
3. Source of Infection	Usually animal carriers or human carriers.	Persons with infected wounds or nasal and skin carriers.	Organisms usually present in human and animal feces.
4. Mode of Spread	Fish or meat infected at source contaminates hands or kitchen environment from which prepared food is contaminated.	Cooked food is infected by a person carrying the organisms in the skin or in a wound.	Raw meat or fish infected at source. Cooking kills the vegetate organisms. Spores germinate on cooling and produce an infective dose.
5. Incubation Period	8 72 hours.	1/2 6 hours.	8–24 hours.
6. Symptoms	Fever, abdominal pain, nausea, vomiting and diarrhoea.	Nausea, vomiting, giddiness, prostration and sometimes diarrhoea.	Abdominal pain and mild to severe diarrhoea.
7. Period of Infectivity	As long as organisms are present in faeces.	Not infective.	Not infective.
8. Exclusion of Contacts	Nil	Nil	Nil

1. Disease	Food Poisoning Salmonella	Food Poisoning Staphylococcal	Food Poisoning Clostridium Perfringens
2. Causative Organism	Various species of Salmonella organisms.	Staphylococcus.	Clostridium Welchii or Bacillus Perfringens
3. Source of Infection	Usually animal carriers or human carriers.	Persons with infected wounds or nasal and skin carriers.	Organism usually present in human and animal faeces.
4. Mode of Spread	Fish or meat infected at source contaminate hands of kitchen personnel from which prepared food is contaminated.	Cooked food infected by a person carrying the organisms in the skin or in a wound.	Placement of fish infected at source Cooking kills the vegetate organisms Spores germinate on cooling and produce an infective dose.
5. Incubation Period	8 - 72 hours.	Up to 8 hours	8 - 24 hours.
6. Symptoms	Fever, abdominal pain, nausea, vomiting and diarrhoea.	Nausea - vomiting - dizziness, prostration and sometimes diarrhoea.	Abdominal pain and mild to severe diarrhoea.
7. Period of Infectivity	As long as organisms are present in faeces.	Not infective.	Not infective.
8. Exclusion of Contacts	Nil	Nil	Nil

1. Disease	Hepatitis (Infectious, Hepatitis A)	Hepatitis (Serum, Hepatitis B)
2. Causative Organisms	VIRUS A.	VIRUS B.
3. Source of Infection	Faeces of patient or carrier or blood.	Blood of patient.
4. Mode of Spread	Faecal oral spread. Person to person contact. Contamination of food or water and unclean hands. May be spread by syringes and needles.	Usually transmitted by use of syringes or needles.
5. Incubation Period	10–60 days.	60–180 days.
6. Symptoms	Loss of apetite, nausea, fever, vomiting, yellow coloration (jaundice) of eyes and urine. Many cases are mild without jaundice. Many symptomless infections.	Same symptoms and more common in adults.
7. Period of Infectivity	Latter half of incubation period to two weeks after onset of jaundice.	Blood is infective many weeks before onset of symptoms and throughout the actual stage and sometimes for years as a close carrier.
8. Exclusion of Contacts	Nil	Nil
9. Preventive Measures	Notify. Environmental sanitation. Personal hygiene and hand-washing. Sanitary disposal of faeces and urine. Administration of gamma globulin to those immediate contacts who are rehabilitated.	Notify. Heat sterilize all syringes and needles by boiling for 20 minutes. Reject blood donors with a history of hepatitis. If possible screen blood donors for australia antigen.
10. Complications	Chronic liver disease. Acute liver failure.	Chronic liver disease. Acute liver failure.
11. Diagnosis	Clinical.	Clinical. Examination of blood for Australia antigen.

10. Complications	Mothers developing rubella ir Ist three months infect foetus giving rise to defective vision, hearing, heart diseases, mental retarding.	Advanced anaemia leading to heart failure.	Pneumonia.
11. Diagnosis	Isolation of virus from throat and blood during the predominal period and Ist day of rash. Serological tests—two specimens of blood.	Examination of stools for worm eggs.	Throat swab or throat washings for virus culture. Two specimens of blood—acute and convalescent.

1. Disease	Rabies	Roundworm Infestation (Ascariases)
2. Causative Organisms	Virus of Rabies.	Roundworm or Ascaris lumbri coides.
3. Sources of Infection	Usually dogs who have developed the infection.	Usually children who harbour the worm.
4. Mode of Spread	Bite of a rabid dog or other animal, due to contamination of wound with infective saliva.	Eggs are passed in faeces and development occurs in the soil. After about 10 days eggs are infective and swallowed with contaminated hands or food.
5. Incubation Period	3–6 weeks. Sometimes even 1 year.	Several weeks or months depending on load of infection.
6. Symptoms	Pain at site of bite. Patient becomes nervous and tense with rapid respiration. Develops spasms of body due to whiff of air or noise. Inability to swallow; generalysed spasms and paralysis.	With mild infection, symptoms are vague or absent. Worms passed in stools. In heavy infection, digestive disturbances, abdominal pain, vomiting, restlessness, toxaemia.
7. Period of Infectivity	Virus present in secretions till death; no known case contracting infection from a human being.	As long as there are worms, people are infective. The worm lives 6 months to 1 year. The soil may be infective for months or an year depending on the soil.
8. Exclusion of Contacts	Nil	Nil
9. Preventive Measures	Notify. No treatment known—death is certain. If dog is suspected, keep under observation. If dead or killed, send brain for examination. In man wash bite well and disinfect. Administer hyper-immune serum and anti-rabies vaccine daily for 2–3 weeks.	Environmental Sanitation. Provision of latrines to prevent soil contamination. Personal hygiene; children to be educated to wash hands before taking food. Children to be treated with to expel worms.
10. Complications	If symptoms develop, death is certain.	Intestinal obstruction due to worms.
11. Diagnosis	i. Clinical. ii. Examination of brain. iii. Culture of virus from saliva.	Examination of stools for worm eggs.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