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FEASIBILITY OF LOCAL MANUFACTURE OF THE AID HAND-OPERATED WATER PUMP AND OTHER TECHNOLOGY APPROPRIATE FOR RURAL WATER SUPPLY PROGRAMS IN THE PHILIPPINES

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Summary

The purpose of this report is to present the findings of a three-man team that visited the Republic of the Philippines between the dates March 3 and March 24, 1979. The objective of the trip was to investigate the feasibility of local manufacture of the AID hand-operated water pump and other hardware (the Roboscreen, the Robovalve and the Robometer) that might be appropriate for use in the Philippines for rural water supply programs.

There is an obvious need for effective rural water supply programs in the Philippines. The country's population has been growing at an annual rate of approximately three percent over the last decade and in 1976 was about 43.7 million (12.7 million or 29 percent in urban areas and 31 million or 71 percent in rural communities). During the next five years, the population is expected, on the average, to increase by 1.3 million per year with the urban sector increasing by 0.5 million and the rural sector by 0.8 million annually. Water and sanitation related diseases remain a significant health problem (of the ten leading causes of morbidity between 1970 and 1975, gastroenteritis was third with a rate of 545 cases per 100,000 population and dysentery was eighth with a rate of about 48 per 100,000). At the present time, some 23.8 million people (55% of the total population) utilize water often of doubtful quality from various sources such as open wells, rain water cisterns, lakes and streams.

Recognizing the need for rural water resources development, a task force on rural water supply under the National Rural Water Council has been established (March 1978). The broad responsibility of the task force is to provide technical, institutional and financial assistance to water associations and cooperatives for the development of rural water supplies. The task force expects to drill 10,000 shallow wells and equip them with screens and hand pumps in 1979. The anticipated number of wells to be completed by the task force in subsequent years is significantly higher. It is estimated that a total of 500,000 wells will be completed in the next twenty years, 60 percent of which are shallow and the remaining 40 percent deep wells.

Because the need is great for rural water supply programs, the Government of the Philippines and various international agencies are hurriedly organizing and implementing programs that will respond to a presidential mandate that no family shall be more than 500 meters from a safe water source. The following

represent recent major efforts directed towards partially meeting the need for safe water by the Philippine rural citizens:

Barangay Water I Program (BWP)
Local Water Utilities Administration (LWUA)
Panay Unified Services for Health (PUSH)
Bicol Integrated Health
Task Force on Rural Water Supply
International Bank for Reconstruction and Development (IBRD)
Canadian Government Assistance Program
IDRC/ISSI Field Testing of the Waterloo Pump

In summary, the need for a cost-effective hand pump, faucet, meter and screen is readily apparent in the light of the need for rural water supplies. Most of the water supply systems in rural communities will be provided by hand-operated water pumps or small-scale piped systems. Presently available shallow-well pumps ("Dragon" and pitcher type) are not suitable for multi-family or village-wide use. The need for a cost-effective shallow-well and deep-well hand pump, such as the AID pump, for multi-family use is apparent from the extensive rural water supply programs envisioned by the Philippine government. The lack of cost effective screens presently precludes the use of screens from hand pump well installations. An inexpensive screen, such as the Roboscreen, is needed if wells are to provide a reliable, long-term water supply. Faucets/valves are available in hardware stores, but most are of inferior quality and do not seal properly after 2-3 months, thus leading to wastage of water.

In order to determine the manufacturing capabilities in the Philippines of the AID hand pump, plastic screens, water faucets and water meters, the authors visited numerous wholesale and retail establishments, foundries, machine shops and plastic manufacturers in the metro Manila area, Cebu and Iloilo.

In Manila, four foundries were visited. One, Tri-Star Metal Industries, would be highly recommended for manufacturing the AID hand pump. Tri-Star is a young and dynamic company that has been in operation for a little over two years. The average management age is 30-32 years. The foundry is orderly and clean with good working conditions for its employees.

Tri-Star's plant is complete with laboratory and testing equipment. The pattern shop appeared to be excellent and the machine shop was well-equipped with some twenty-four lathes, five drilling machines, two milling machines, a large planing machine and an eight-foot vertical lathe. It is presently awaiting the delivery of new equipment, including centrifugal molding machines from the United States. The management showed a definite interest in manufacturing the AID pump and a visual inspection of their castings suggested that the AID pump is well within the company's capabilities. The estimated price for an initial order of 50 AID pumps is $60-$65 and this unit price would most likely drop below $50 with larger quantities (100 or more pumps per order) after initial development costs are recovered.

In Cebu, two foundries were visited. Metaphil, Inc., was the most adequate for the manufacture of the AID hand pump. Personal observations of the plant facilities and management of the company revealed competence and quality consciousness that lead to the conclusion that Metaphil would be a suitable AID pump manufacturer.

The estimated price for the AID hand pump at Metaphil would be $80, a somewhat unreasonably high figure. Therefore, the $80 should be negotiated downward or an alternate foundry be found before AID pumps are manufactured in Cebu. It is felt, further, that if alternate foundries are found with sufficient quality, competitive pressure will force Metaphil to lower its estimated cost for manufacture of the AID pump.

In Iloilo, two foundries were also investigated, New Commonwealth Foundry Shop and Strachan and MacMurray, Ltd. Strachan and MacMurray, Ltd., did not appear overly interested in producing the AID hand pump because it's specialty is large castings for sugarcane processing plants. On the other hand, the manager of New Commonwealth Foundry Shop, Mr. Limneo Ang, appeared extremely interested in manufacturing the AID pump and knowledgeable of the requirements for producings a quality pump. The facilities observed were admirable with modern equipment, skilled labor and finished products that denoted quality castings and machining. The foundry is also expanding and has the capacity for increased volumes of production.

An estimate of the price for manufacturing the AID pump at New Commonwealth was $60-$65 on the initial order. Mr. Ang believes that subsequent orders would enable lower prices as his employees become more efficient in the

production of the pump and larger orders (greater than 100 units) would bring about economies of scale that would help to also lower the price. If AID pumps should be manufactured in Iloilo, New Commonwelath would be suitable.

In Manila, two plastic manufacturing companies, Moldex Products, Inc., and Neltex Development Co., were visited. Moldex Products is operating at full capacity and carrying a considerable backlog; therefore, management showed little interest in getting involved in producing the various Robo devices.

Neltex Development Co. is a complete and high quality plastic manufacturing facility including two plants, the first handling extrusion (pipes) and the second equipped for injection molding (pipe fittings) with a complete tool and die shop. Neltex estimates that a two-inch Roboscreen can be manufactured for about $1.00 per linear foot. Imported PVC screen (eight percent open area) of the same diameter costs approximately $7.50 per linear foot. The cost of comparable diameter metal screen is about $35.00 per linear foot. The household PVC Robovalve is estimated to cost about $.75 compared to $1.00 for the cheapest locally available faucet.

It is concluded that the manufacturing capabilities of foundries and machine shops explored in the Philippines for possible production of the AID hand pump are diverse; however, the following foundries represent quality and would most likely produce a very satisfactory AID pump:

1. Tri-Star Metal Industries, Manila
2. Metaphil, Inc., Cebu
3. New Commonwealth Foundry Shop, Iloilo

The Roboscreen and Robovalve can be manufactured by Neltex Development Co. Neltex is also fully capable of producing the Robometer. It is felt at this point that the present Robometer design is going to need definite LDC adaptation. However, the Office of Health and the Office of Engineering at AID/Washington believe that the time is right to incorporate these designs into local manufacturing, put the meter into a controlled, well-monitored LDC consumer-stressing situation, readapt the designs with the local manufacturer, reinstall readapted designs and evaluate consumer acceptance of the meter.

INTRODUCTION

The purpose of this report is to present the findings of a three-man team (Mr. Phillip W. Potts, Mr. Robert Knight and Dr. Yaron M. Sternberg) that visited the Republic of the Philippines between the dates March 3 and March 24, 1979. The objective of the trip was to investigate the feasibility of local manufacture of the AID hand-operated water pump and other hardware (the Roboscreen, the Robovalve and the Robometer) that might be appropriate for use in the Philippines for rural water supply programs.

While travelling through the Philippines, interviewing local government and international development agency representatives and observing water pumps commercially available, it appears that there is a definite need for a locally manufactured pump (such as the AID hand pump) that is cost-effective, has low-maintenance requirements, is sturdy and durable enough for use by multi-family users and is flexible enough to meet various local situations (for instance, convertible to use with windmills or water tower storage systems). The AID hand pump has been successfully introduced in Nicaragua, Costa Rica, the Dominican Republic and Indonesia. These programs have shown that the AID hand pump is very adaptable to local manufacture in many developing countries and offers many benefits (spare parts availability, easy maintenance, low cost, durability, employment generation, increase of local income and the reduction of foreign exchange outflow). The AID hand pump consists of a shallow-well version (the plunger or piston and its cylinder located above the water level) and a deep-well version (the plunger or piston and its cylinder located below the water level). Both versions are single-action, reciprocating, positive displacement type pumps.

The Robovalve and Roboscreen, although new in their development, appear to be promising for use and acceptance in the Philippines. Even though the Roboscreen (a PVC well screen) has never been tested in the field, one Philippine PVC manufacturer has already begun setting up the mechanism for production within his plant because he foresees a high volume market for such a product. The same manufacturer is also anxious to get into the production of the Robo-

valve (plastic faucet) and is willing to absorb some of the cost of finalizing the design before it is field tested.[1/]

The Robometer (a device for metering water) has also received a positive response in the Philippines. Existing water meters are labor intensive, expensive and a high maintenance item. On the other hand, the Robometer is a user-activated meter that does not depend on meter reading and billing for collecting payment for water used. It is activated by an external device (a small cylinder of compressed gas) which can be purchased by the user at any approved store. In this system, payment is received prior to water use while with ordinary billing systems charges are assessed for water used after the water is consumed. In addition to the elimination of the need for meter reading, billing and collection of payment, the user-activated meter will also help reduce revenue losses because of possible corrupt or inefficient water meter readers. Only on occasions when infrequent maintenance is required will the user come into contact with an employee of the water supply agency.

[1/] Representatives of the national and local governments have expressed strong interest in the above items. At the present time, no PVC screen is produced in the Philippines. Faucets/valves are available in hardware stores but most are of inferior quality and do not seal properly after 2-3 months, thus leading to wastage of water.

THE NEED FOR EFFECTIVE RURAL WATER SUPPLY PROGRAMS IN THE PHILIPPINES

The Philippines is a country of some 7,100 islands. Eleven large islands account for about 95 percent of the total land area of 115,830 square miles and two islands (Luzon and Mindanao), alone, account for 66 percent of the total land area.

There are 421 principal river basins with drainage areas greater than 40 square kilometers, including 18 major river basins with drainage areas above 1,600 square kilometers and 59 natural lakes. Extensive ground water resources are available in the Philippines with four major ground water basins of areas ranging from 6,000 to 10,000 square kilometers (a number of small ground water basins have also been identified). Although the total known ground water basin area is estimated at 50,000 square kilometers and the country is endowed with abundant water resources (except for the Central Visayas Region), local shortages occur in regions where the demand may be larger than the available supply.

The country's population has been growing at an annual rate of approximately three percent over the last decade and in 1976 was about 43.7 million (12.7 million or 29 percent in urban areas and 31 million or 71 percent in rural communities).

The country is divided into 72 provinces embracing some 1,500 municipalities. There are 328 municipalities with populations above 30,000 each, 300 municipalities have between 20,000 and 30,000 and 872 municipalities with less than 20,000. Each municipality encompasses a number of barangays (villages) in the Philippines. During the next five years, the population is expected, on the average, to increase by 1.3 million per year with the urban sector increasing by 0.5 million and the rural sector by 0.8 million annually.

Water and sanitation related diseases remain a significant health problem in the Philippines. Crude death and infant mortality declined steadily at an annual rate of 3.5 percent from the early 1920s to 1970, but both increased by more than 30 percent over the next five years (the rates are, for 1975, 10.5 and 78.0 per thousand, respectively). Of the ten leading causes of morbidity between 1970 and 1975, gastroenteritis was third with a rate of 545 cases per 100,000 population and dysentery (all forms) was eighth with a rate of

about 48 per 100,000. Cholera (El Tor) varied from 1,000 to 6,000 cases per year with 200 to 700 deaths. Typhoid varied from 1,000 to 5,000 cases annually with 200 to 600 deaths. Infant mortality was bout 74 per 1,000 live births and life expectancy at birth was about 60 years.

The percentage of total population served by water supply systems increased from 38 percent in 1970 to 45 percent in 1976 and proposed present plans project these figures to 62 percent and 82 percent, respectively, for 1982 and 1987. While urban coverage was already high in 1970 (71 percent), only 26 percent of the rural population had access to safe water supply systems at that time. According to the 10-year development plan (1978-1987) by the Philippine government, this 26 percent should increase to 55 percent by 1982 and 80 percent by 1987. This projection represents a tremendous investment in rural community water supplies and will place a large burden on equipment that can be applied in a cost-effective manner.

At the present time some 23.8 million people (55% of the total population) utilize water often of doubtful quality from various sources such as open wells, rain water cisterns, lakes and streams. An unknown but certainly a sizable number of persons in small urban communities and rural areas have safe or potentially safe water supplies from private sources such as shallow and deep wells with hand pumps. (Data on the water resources of small communities in the rural areas is not available.)

Unfortunately, there is no agency in charge of overall planning and implementation of community water supply systems and waste disposal systems. At the central government level six organizations are directly involved in various ways: the Metropolitan Water Works and Sewage System (MWSS); the Local Water Utilities Administration (LWUA); the Bureau of Public Works (BPW) which is within the Department of Public Works, Transportation and Communications; the Environmental Sanitation Division of the Department of Health (DOH); the Department of Local Government and Community Development (DLGCD) and the National Economic Development Authority (NEDA).

In broad terms water supply and sanitation is divided into three levels: one dealing with metropolitan Manila (MWSS), the second dealing with water districts serving the larger urban communities with populations in excess of 20,000 (LWUA), and a third "grey area" dealing with the rural population and

small provincial urban communities where the responsibilities are somewhat unclear and overlapping between various agencies.

The Wells and Springs Branch of the Bureau of Public Works has over the years (since 1945) constructed a total of 27,000 deep wells and developed 2200 springs. During the period 1972-1976, the branch rehabilitated 7,000 wells, drilled 2,321 wells and developed 109 springs. During 1977, 823 new wells were constructed and 1,300 rehabilitated. Its present well drilling capacity, according to Wells and Springs Branch officials, does not exceed 1,000 deep wells per year with the existing 70 power and 90 manual rigs. Previously planned targets of 3,000 new wells plus 4,500 well rehabilitations per year could not be attained due to lack of funds for new drilling rigs. It is estimated that 15-20 percent of the wells are out of order at any one time and, to date, there has been no attempt by the government to obtain community contributions to pay for construction, maintenance or rehabilitation costs by the Bureau of Public Works for these wells.

Recognizing the need for rural water resources development, a task force on rural water supply under the National Rural Water Council has been established (March 1978). The broad responsibility of the task force is to provide technical, institutional and financial assistance to water associations and cooperatives for the development of rural water supplies. The task force expects to drill 10,000 shallow wells and equip them with screens and hand pumps in 1979. The anticipated number of wells to be completed by the task force in subsequent years is significantly higher. It is estimated that a total of 500,000 wells will be completed in the next twenty years, 60 percent of which are shallow and the remaining 40 percent deep wells.

Improper well design, careless construction and faulty hand pumps have contributed to well failures and increased maintenance problems. Well screens are not commonly used; when wells are developed, they are not properly designed in terms of yields or the kind and quality of aquifer material. For perhaps a majority of cases, wells are not properly developed nor are they adequately cased to proper depth, thus permitting caving and subsequent well failures. Also, well casings are not always grouted, presenting a serious risk of bacteriological contamination.

A sector study of IBRD/WHO recommends that (1) well construction techniques be improved, (2) different and less costly materials for well casings and

screens such as PVC pipe be investigated and (3) hand pumps which may be cheaper and more durable than the presently used "Dragon" pump be pilot tested.

In summary, the need for a cost-effective hand pump, faucet, meter and screen is readily apparent in light of the need for rural water supplies. Most of the water supply systems in rural communities will be provided by hand-operated water pumps or small-scale piped systems. The presently available shallow-well pumps ("Dragon" and pitcher type) are not suitable for multi-family or village-wide use because experience in various locales throughout the world has indicated a high degree of failure and material costs under intensive use. The need for a cost-effective shallow-well and deep-well pump, such as the AID pump, for multi-family use is apparent from the extensive rural water supply programs envisioned by the Philippine government. The lack of cost effective screens presently precludes the use of screens from hand pump well installation. An inexpensive screen, such as the Roboscreen, is needed if wells are to provide a reliable, long-term water supply. Faucets/valves are available in hardware stores, but most are of inferior quality and do not seal properly after 2-3 months, thus leading to wastage of water.

PRESENT RURAL WATER SUPPLY PROGRAMS IN THE PHILIPPINES

The need is great in the Philippines for rural water supply programs. However, only in the past several years have such programs received their due attention. As a result, the Government of the Philippines and various international agencies are hurriedly organizing and implementing programs that will respond to a presidential mandate that no family shall be more than 500 meters from a safe water source. Because of the high priority rural water supply programs are now beginning to receive, the next two decades will require increasing levels of funding, technical assistance, hardware, innovative and high-impact approaches, as well as skilled engineers, technicians and managerial personnel for the Philippines.

The following discusses recent major efforts directed towards partially meeting the need for safe water by the Philippine rural citizens.

Barangay Water I Program (BWP)

Reliable community water systems in most of the Philippines are either non-existent or provide water which is considered unsafe for human consumption. The Barangay Water Program is a national program sponsored by USAID and the Government of the Philippines. It is designed to develop local government capacity to plan, design, finance and implement small rural water supply systems and develop within the systems the indigenous capacity for management, operation, maintenance and repair.

The program provides funding for the implementation of projects on a fixed-amount reimburseable basis. In 1977, seven provinces representing approximately one million population each began pilot projects that constructed four piped water systems serving some 25,000 people. In 1978, six additional provinces and five chartered cities entered the program and undertook the planning, organization, design and construction of another 18 systems. In 1979, nine provinces and two cities joined the program for a total of 29 local government units participating in the project. It is contemplated that between 60 and 80 more water systems will be constructed in late 1979 and 1980 as part of the calendar year 1979 program.

Piped water systems will continue to be the major focus of this program. However, in the calendar year 1979, 300 hand-operated pump systems are also

planned and an additional 600 hand pumps will be installed in 1980. Based on the success of the initial effort with hand pumps, a determination will be made as to the magnitude of future efforts for well development and pump installation. The critical factors in this determination will be the following:

1. An adequate pump design that can be manufactured locally, and

2. A pump that can be installed and maintained through local government and community capacities.

As mentioned earlier, the program is jointly sponsored by the Government of the Philippines and USAID. In 1977, the program was funded entirely by the Philippine government for $1.5 million. In 1978, a loan was authorized by USAID for $3 million to provide funding over a three-year period for fixed reimbursement of projects. The $3 million is complemented by an equivalent amount of money provided by the Philippine government for operations, personnel, personnel training and other program-related costs. The $3 million, three-year loan was subsequently compressed to two years. This first loan will be followed with a second loan of $15 million for infrastructure development in accordance with previously mentioned program objectives.

The decision to institute a well/hand pump component to the Barangay Water Program was based on the following:

1. There are numerous areas in the Philippines that cannot be served by systems requiring electricity.

2. There are numerous areas in the Philippines that cannot be economically feasible for piped water systems.

3. It is beneficial to provide new local government units experience in their first year of participation with a lower level of technology in construction, organization and planning. Thus, it will be easier to advance to a higher level of technology in their second year of participation.

4. In order to provide financial flexibility within the Barangay Water Program, provinces/cities are often given tentative allocations which cannot be fully expended in a given fiscal year; therefore, the installation of hand pumps offers the possibility of using a small amount of funds which would be insufficient for a full-fledged piped water system.

5. In adding a hand pump component to the Barangay Water Program political motivation has played a major role. In the Philippines there are 43 million people, of which nearly 20 million live outside of any coverage by piped water systems or facilities.

Local Water Utilities Administration (LWUA)

This program is partially funded by USAID and established the Local Water Utilities Administration on the national level and water districts at the local level (outside metro Manila). The USAID loan is financing 50 percent of the project costs including training and consultant services, commodities and construction costs for the improvement of five provincial water works systems.

Of the five local systems being constructed, all are providing piped water benefits to the residents of the service area. Two are complete, two are 95 percent complete and the remaining one is 80 percent complete.

While the program does not include the use of hand-operated water pumps because of the size of the communities being served (at least 15,000 population), there is a need within it for improved well screens, water faucets and water meters. In discussions with Mr. Carlos Leaño and his LWUA staff, a strong interest has been expressed in the field testing of the Robo devices within urban areas of the Philippines. The LWUA is presently putting in five to six systems per year with some 2,000 connections for each system. This means that the LWUA would typically need the following on an annual basis:

1.	Corporation stops	12,000 (2000 connections x 6 systems)
2.	Faucets	36,000 (could range between 30,000 and 60,000)
3.	Well screens	6,000-10,000 feet
4.	Water meters	10,000-12,000
5.	Hand pumps	None

In regard to the 10,000-12,000 water meters, LWUA is presently using three models -- Kent, Liberty and Arad. These meters are 1 1/2 inch diameter and cost approximately 130 pesos, 100 pesos and 90 pesos, respectively (a peso is equivalent to about U.S.$.14). None of the meters are holding up very well in the field.

Panay Unified Services for Health (PUSH)

This USAID program will place 1,800 indigenous health workers over a three-year period in economically depressed rural barangays. Their function will be to assist the Barangay residents to develop water resources, waste disposal systems and to facilitate health delivery in immunizations, nutrition, family planning, referrals and basic first aid. Between 1,000 and 1,500 hand-operated water pumps will be installed annually over a three-year period in rural communities of up to 850 population. It is anticipated that an equal number of well screens will be needed for this activity.

Bicol Integrated Health

The primary purpose of this USAID program is to improve the health and nutritional status of the rural population and reduce birth rates in Camarines Sur and Albay provinces. This includes improved sanitary environment and household water supplies and more effective health, nutrition, population, sanitation and water services to rural barangays, delivered through an economical delivery system largely supported by local resources and local institutions. Partially subsidized Barangay Health Aides recruited from the indigenous population will serve as the primary change agents and these will be supported by mobile health teams.

As with the Panay Unified Services for Health program, this program will install between 1,000 and 1,500 hand-operated water pumps and well screens annually over a three-year period in rural communities of up to 850 population.

Task Force on Rural Water Supply

The Task Force on Rural Water Supply was established by President Marcos under his Letter of Instruction No. 683 (March 1978). The purpose of the task force is to provide technical, institutional and financial assistance to water associations and cooperatives whose function is to construct, operate and maintain water supply systems in the rural areas of the Philippines.

One of the first programs to be carried out by the Task Force is the installation of 10,000 wells, hand pumps and well screens in rural areas during 1979 and an additional 10,000 during 1980. The Task Force views the program as a large pilot project; however, it is unclear where the proposed well/hand pump

sites will be or what government agency will be responsible for the drilling of wells and installation of pumps.

To date, the Task Force has installed no hand pumps or screens. The proposed hand pump for the project is a modification of the "Dragon" pump with a stainless steel cylinder found throughout southeast Asia and estimated to cost approximately $20 each. The proposed pump has not been field tested and the prototype of this pump appears to be much too light to withstand the abuse that this hand pump will be subjected to under intensive multi-family use in a rural community environment in the Philippines. If this prototype is used, it will represent, essentially, a significant wasting of precious local currency on a device that is going to require a costly operation and maintenance program to make equipment function over a reasonable length of time (10-20 years).

International Bank for Reconstruction and Development (IBRD)

The International Bank for Reconstruction and Development is planning to loan $1.8 million to the Government of the Philippines for rural water supply programs. No specific plans for the disbursement of the funds are available. Discussions with Task Force personnel indicate that the loan will be used for levels I (hand pumps, covered springs and other point source development), II (piped water to community standposts), and III (piped water to individual houses) water systems although no definite sites have been selected.

Canadian Government Assistance

The Canadian government is providing limited funds for drilling and completing deep-well hand pump/well installations. The assistance is not clearly defined and consists basically of the Canadian Ambassador providing a number of provinces with 10,000 pesos ($1,429) per well for a total of five to ten wells per year. The total number of wells completed under this program is estimated at 30.

IDRC/ISSI Field Testing of the Waterloo Pump

The Institute for Small-Scale Industry at the University of the Philippines is testing components of a pump developed by the University of Waterloo (Waterloo, Canada) and funded by the International Development Research Centre of Ottawa, Canada. The field test is similar to the methodology used by Georgia Tech in Nicaragua and Costa Rica for the same pump components (piston

assembly, foot valve and PVC cylinder) supplied to Georgia Tech by the International Development Research Centre. Unfortunately, the Institute for Small-Scale Industry has not received specific instructions of how to prepare the upper pump structure and well structure and the project is moving very slowly. Nevertheless, 30 pumps will be field tested in three selected areas of the Philippines, namely:

1. Southern Tagalog
2. Central Luzon
3. Tacloban

There is obviously a tremendous amount of activity underway or being planned for rural water supply programs involving hand-operated water pumps, water meters, well screens and reliable water faucets. However, as described in the next section of this report, there is no readily available evidence that such reliable, cost-effective, low maintenance and locally manufactured hardware exists in the Philippines.

AID HAND PUMP AND ASSOCIATED HARDWARE MANUFACTURING CAPABILITIES IN THE PHILIPPINES

In order to determine the manufacturing capabilities in the Philippines of the AID hand pump, plastic screens, water faucets and water meters, the authors visited numerous wholesale and retail establishments, foundries, machine shops and plastic manufacturers in the metro Manila area, Cebu and Iloilo.

Visits to wholesale and retail dealers of hand-operated water pumps showed an apparent abundance of inexpensive, light-duty, poorly designed, single-family type hand pumps with an obvious short-life expectancy. The low-cost ($10-$80) pumps afford the market a high volume turnover and it is estimated that over 100,000 of these inexpensive pumps are sold on the retail market annually. These pumps, furthermore, are reported to require frequent repairs, especially cup replacement, due to excessively rough cylinder walls (cup replacement is necessary on an average of every three to six months).

Long-term cost of the above-mentioned, inexpensive pumps is probably much greater than when a higher quality, heavy-duty, possibly more expensive, pump is purchased initially. Unfortunately, no cost-effective, heavy-duty, multi-family, locally manufactured, hand-operated water pump (for shallow wells or for deep wells) is currently available in the Philippines.

In Manila four foundries were visited to investigate the feasibility of manufacturing the AID pump:

1. Tri-Star Metal Industries, 210 Sabaneros Street, Binondo, Manila -- This is a young and dynamic company that has been in operation for a little over two years. The average management age is 30-32 years. The foundry is orderly and clean with good working conditions for its employees.

The plant is complete with laboratory and testing equipment. The pattern shop appeared to be excellent and the machine shop was well-equipped with some twenty-four lathes, five drilling machines, two milling machines, a large planing machine and an eight-foot vertical lathe. It is presently awaiting the delivery of new equipment, including centrifugal molding machines from the United States. The management (Mr. Herman Laurel, Mr. Leong Lam and Mr. Crisanto Lomuntad) showed a definite interest in manufacturing the

AID pump and a visual inspection of their castings suggested that the AID pump is well within the company's capabilities. The estimated price for an initial order of 50 AID pumps is $60-$65 and this unit price would most likely drop below $50 with larger quantities (100 or more pumps per order) after initial development costs are recovered.

2. UNNO Steel Products Company, 139 Joy Street, Grace Village, Quezon City -- This foundry was well-equipped with casting and machining facilities but was principally concerned with brass castings. The manager, Mr. Danilo N. Sy, emphasized his interest in brass deep-well cylinders and did not choose to diversify into cast iron water pumps at this time.

3. Avenue Manufacturing Company, Inc., 1131-33 E. De Los Santos Avenue, Quezon City -- This foundry was impressive with its iron casting facilities but had no machining facilities (machining was subcontracted). Mr. Roger Chua, the owner, showed little interest in manufacturing the AID pump as the foundry was already operating at close to full capacity.

4. Occidental Foundry Corporation, km 16 MacArthur Highway, Malanday, Valenzuela, Bulacan -- Occidental manufactures approximately 30,000 pitcher-type hand pumps, as well as 2,000 brass deep-well cylinders annually. The quality of the castings observed in the plant varied considerably and would be unacceptable in manufacture of the AID pump. In addition, the manager, Mr. Co Kim Chu, indicated his preference towards promoting his existing product line of pitcher pumps and brass deep-well cylinders rather than becoming involved in the manufacture of the AID hand pump. If Occidental had been more interested in the manufacture of the AID hand pump and if its quality had been more acceptable, the estimated price for small-quantity orders would be approximately $40.

In Cebu, two foundries were also visited to investigate the feasibility of the manufacture of the AID hand pump:

1. Metaphil, Inc., M. J. Cuenco Avenue, Corner Manalili Street, P. O. Box 722, Cebu City -- Metaphil Inc., as described in detail under Appendix A, is more than adequate for the manufacture of the AID hand pump. Personal observations of the plant facilities and management of the company revealed competence and quality consciousness that lead to the conclusion that Metaphil would be a suitable AID pump manufacturer.

The estimated price for the AID pump, if manufactured by Metaphil, would be $80, an unreasonably high figure. Therefore, the $80 should be negotiated downward or an alternate foundry be found before AID pumps are manufactured in Cebu. It is felt, further, that if alternate foundries are found with sufficient quality, competitive pressure will force Metaphil to lower its estimated cost for manufacture of the AID pump.

2. Pacific Foundry Shop Company, M.S. Cuenco Avenue, Hipodromo, Cebu City -- Pacific Foundry was somewhat unimpressive with castings of poor quality (voids and inclusions). The machinery was of a low calibre, having five lathes, one milling machine, a shaper and two drill presses, all of considerable age and poorly maintained condition. It was concluded that this facility would not be suitable for production of the AID pump.

In Iloilo, two foundries were visited to investigate the feasibility of the manufacture of the AID hand pump:

1. New Commonwealth Foundry Shop, 108 Arsenal Street, Iloilo City -- The manager of this foundry, Mr. Limneo Ang, appeared extremely interested in manufacturing the AID pump and knowledgeable of the requirements for producing a quality pump. The facilities observed were admirable with modern equipment, skilled labor and finished products that denoted quality castings and machining. The foundry is also expanding and has the capacity for increased volumes of production.

An estimate of the price for manufacturing the AID pump at New Commonwealth was $60-$65 on the initial order. Mr. Ang believes that subsequent orders would enable lower prices as his employees become more efficient in the production of the pump and larger orders (greater than 100 units) would bring about economies of scale that would help to also lower the price. If AID pumps should be manufactured in Iloilo, New Commonwealth Foundry Shop would be suitable.

New Commonwealth Foundry Shop had the following equipment:

16 lathes	1 shaper
1 milling machine	2 radial drills
1 boring machine	2 electric hacksaws
1 fixed grinder	3 portable grinders
2 portable drills	1 centrifugal casting (molding) machine

2. Strachan and MacMurray, Ltd., Iloilo City -- The manager of this foundry, Mr. Felix F. Bermejo, would not quote an estimated price for manufacturing the AID pump and did not appear overly interested in producing it because his specialty is large castings for sugarcane processing plants. Nevertheless, the facilities at this foundry were excellent, with the following equipment:

18 lathes	1 planer
2 drills	3 milling machines
4 shapers	1 sand (mold) mixer
2 vertical slotters	1 electric hacksaw
2 boring machines	2 vertical boring lathes

In Manila, two plastic manufacturing companies were visited in order to evaluate the feasibility of manufacturing the Roboscreen, the Robovalve and Robometer:

1. Neltex Development Co., Inc., 146-148 National Highway, Pamplona, Las Piñas, Manila -- Neltex is a complete and high quality plastic manufacturing facility including two plants, the first handling extrusion (pipes) and the second equipped for injection molding (pipe fittings) with a complete tool and die shop.

The tool and die facility, although lacking some of the sophisticated equipment found in more modern plants, produced a variety of first class dies. Neltex management is interested in producing the various Robodevices and has extruded a two-inch Roboscreen sample, thus proving its interest and competence. It is clear that Neltex also has the capability to produce the Robovalve and the Robometer. The company is reputable for producing high quality PVC (poly vinyl chloride) hardware; and, although it is operating at full capacity (three shifts per day, seven days per week), management recognizes the need and market for the cost-effective Robo products.

Neltex estimates that a two-inch Roboscreen can be manufactured for about $1.00 per linear foot. Imported PVC screen (eight percent open area) of the same diameter costs approximately $7.50 per linear foot. The cost of comparable diameter metal screen is about $35.00 per linear foot. The household PVC Robovalve is estimated to cost about $.75 compared to $1.00 for the cheapest locally available faucet.

2. Moldex Products, Inc., 3 West Sixth, Quezon City -- This company is strictly a plastic extrusion facility. Sample screens at the factory were large diameter polyethylene pipes (6"-24"), various pipe fitting, etc. The company produces items of poor quality due to part of the raw material being recycled polyethylene.

At present, Moldex is operating at full capacity and carrying a considerable backlog. Management showed little interest in getting involved in producing the various Robo devices.

CONCLUSIONS AND RECOMMENDATIONS

The need for effective rural water supply programs in the Philippines is great. Although the country is endowed with abundant water resources, local shortages occur in regions where the demand may be larger than the available supply. During the next five years the population is expected, on the average, to increase by 1.3 million per year with the urban sector increasing by 0.5 million and the rural sector by 0.8 million annually. Water and sanitation related diseases definitely remain a significant health problem. Only 26 percent of the rural population in 1970 had access to safe water supply systems; however, according to a ten-year development plan (1978-1987) by the Philippine government, this 26 percent should increase to 55 percent by 1982 and 82 percent by 1987. Further, in order to provide safer, cleaner water to all rural citizens, it is estimated that 500,000 wells with hand pumps alone will be needed.

Fortunately, numerous major efforts are being directed towards meeting the tremendous challenge of providing safer water to all citizens (urban and rural) by the year 2000. Because of the high priority rural water supply programs are now beginning to receive, the next two decades will require increasing levels of funding, technical assistance, hardware, innovative and high-impact approaches, as well as skilled engineers, technicians and managerial personnel for the Philippines. This includes reliable, cost-effective, low maintenance and locally manufactured hardware such as hand-operated water pumps, well screens, water faucets and water meters.

The presently available shallow-well pumps are either pitcher pumps or Dragon-type pumps. Neither is suitable for multi-family use. Even under light usage (single family), the cups (leather, rubber or plastic) are replaced every three to six months. The pumps have a life expectancy of one to three years, depending on usage and degree of maintenance.

No appropriate heavy-duty pump for wells with water levels ranging from 30 to 150 feet is available unless imported (requiring long purchasing lead time and expensive capital investment, as well as increased foreign exchange requirements).

For wells with depths of 150 to 400 or 500 feet, deep-well cylinders are used (imported Clayton-Mark or local copies) with indigenous upper structures

that are adequate but can be improved upon. The imported Clayton-Mark cylinders, as with imported pumps, require long purchasing lead time, are expensive ($70) and require increased foreign exchange. Local copies of the Clayton-Mark cylinder are cheaper ($40) but require changing of the cups every three to six months because of rough cylinder walls.

Well screens are used only on large capacity well installations. The screens normally used are manually slotted casings of low percentage open area and poor slot width quality. The need for a screen is recognized by most people associated with groundwater supply, but the high cost of imported screens severely limits their use. Thus, the Roboscreen offers a tremendous opportunity to Philippine groundwater developers.

Water valves/faucets are available at most hardware stores in the Philippines; however, the bulk of them are expensive ($1-$2), of poor quality and leak profusely after a short time. The washers in such facets are usually never replaced and the inner components normally wear out after six months.

A wide variety of water meters are available in the Philippines. Malfunctions and maintenance problems are encountered with both the direct drive and magnetic drive meters. There is a great need for a much simpler water meter for Philippine use and, at this point, the Robometer appears to be a very interesting, innovative and cost-effective intervention. This opinion is shared by LWUA executive engineering personnel which expressed a strong interest in the testing of a device such as the Robometer.

Local Manufacturing Capabilities

The manufacturing capabilities of foundries and machine shops explored for possible production of the AID hand pump are diverse. Many foundries manufacture products of poor quality and low price and are operating at close to capacity or are expanding their operations. On the other hand, the following foundries represent quality and would most likely produce a very satisfactory AID pump:

1. Tri-Star Metal Industries, Manila
2. Metaphil, Inc., Cebu
3. New Commonwealth Foundry Shop, Iloilo

Tri-Star estimates an order of 50 AID pumps would have a unit price of $60-$65. Metaphil is unreasonably high with an estimated unit price for 50 pumps to be $80. New Commonwealth Foundry Shop also estimates an order of 50 AID pumps would have a unit price of $60-$65. It is believed that after these foundries have become familiar with manufacturing the AID pump and become more efficient in their operations, along with higher numbers of pumps per order, that the unit price for the pump should drop below $50. In the case of Metaphil, competitive pressure might have to be extended or an alternate supplier found to convince the company management that its pricing policies are not competitive.

It is suggested, at this point, that the capabilities of Tri-Star Metal Industries, Metaphil or an alternate supplier in Cebu and New Commonwealth Foundry Shop be tested in the field. This can be done by placing an order with each foundry for between 50 and 100 pumps, installing the pumps in rural areas, monitoring pump performance and readapting them and then engaging in a final analysis and evaluation for a twelve-month period. If weaknesses were to become apparent in the field performance of the pumps, feedback would be relayed to the manufacturer in order that he can tighten his quality control to prevent, or lessen, reoccurrences of problem areas. By the end of the field monitoring period the pump manufacturers should be self-sufficient and capable of manufacturing a quality AID pump without external assistance.

The Roboscreen and Robovalve can be manufactured by Neltex Development Co., Inc. This company has demonstrated a strong interest in these devices and has the capabilities for manufacturing high quality goods. Neltex management estimates that the cost of two-inch Roboscreen will be approximately $1.00 per linear foot while the estimated cost for the household Robovalve will be about $.75 each. It is suggested that the screen be installed at the same test sites as the AID hand pumps. In this manner, the screen and the pump can be more efficiently evaluated in a cost-effective manner. Robovalves should be installed in selected sites in areas where USAID has active programs (for example, PUSH, Bicol, etc.). It is further suggested that some 1,000 units be manufactured and field tested.

Neltex is also fully capable of producing the Robometer. It is felt at this point that the present water meter (Robometer) designs are going to need definite LDC adaptation. The Office of Health and the Office of Engineering

at AID/Washington believe that the time is right to incorporate these designs into local manufacturing, put the meter into a controlled, well-monitored LDC consumer-stressing situation, readapt the designs with the local manufacturer, reinstall readapted designs and evaluate consumer acceptance of the meter.

Because the AID deep-well pump is not suitable for extra deep wells (150 feet or more in depth), it is felt that Neltex would also be very suitable as supplier of AID pump cylinders that are modified (longer in length for more stroke, additional leather cups and perhaps a longer-lasting foot valve) to meet local situations. These modified cylinders would be cheaper and last much longer than what is presently available on the commercial market. The cylinders would be used in conjunction with concrete upper well structures and wooden handles of 20-25 foot length that are already quite common in the Philippines.

FROM: Erramon I. Aboitiz/Metaphil, Inc.

TO: Professor Phil Potts/Georgia Institute of Technology

SUBJECT: COMPANY PROFILE - METAPHIL

I. BUSINESS:

In general our business is to provide a broad range of industrial plant facilities and equipment, replacement parts, and specialized engineering services. Our three (3) operating divisions are:

A. Machining
B. Construction and Fabrication
C. Foundry

To date, our foundry is the third largest commercial foundry in the Philippines. We also own an engine rebuilding shop geared solely for the engine rebuilding trade for the automotive, marine and industrial prime movers.

Our division principally serve industrial and commercial as distinguised from the consumer and governement sector.

We sell largely on a direct jobbing basis to domestic customers through our regional sales offices in a major industrial centers throughout the Philippines.

II. BACKGROUND:

1964 - Hi*Speed Engineering Works
Principal Partners: Charlie Ng & Family
William Uy & Family
John S. Co
Po Sin Kiat
Business: Engine Rebuilding
Employess: 11

1972 - Machine Shop Established
Largest and most equiped in the Visayas and Mindanao.
Plant Site Area: exceeding one (1) hectare

1975 - Construction; holder of category A license

1976 - Foundry established
Employees: approximately 200

(late)1978 - Metaphil, Incorporated
Division Ownership: Aboitiz Group 60%
Ng, Uy, Co, Po Son Kiat Group 40%
Employees: approximately 700

III. METAPHILS GENERAL OBJECTIVES

a) To provide products of superior value in terms of quality and service
b) To deliver above average returns to investors.
c) To establishea reputation as a responsible, progressive and important partner of the customers we serve.

IV. MANAGEMENT:

President: Luis Aboitiz, Jr.
Executive Vice-Pres: Manuel Tio
Vice Presidents: Charlie Ng - Machining Div. & Engine Rebuilding

John Co - Construction and Fabrication
William Uy - Foundry Division
Erramon Aboitiz - Purchasing, Shipping, credit and Collections

** Please see attached Bio-Data.

V. PLANT FACILITIES:

A. Industrial Machine & Fabrication

Total Floor Area: 3,949 square meters

Comments:

Machinery and equipment geared for manufacturing ferrous and non-ferrous components needed in various industries. The plant layout is sectionalized as follows:

Left side:	Light to medium heavy machining section
Midway left:	Heavy machining section
Midway right:	Sheet metal works, press works and metal forming section

The light and medium heavy equipment section has the capacity to do machining jobs from minimum of 10mm diameter to maximum 450mm diameter parts, supplemented by auto capstan for bar work and engine lathes of varied capacities. The production capacity per month on a single shift ranges from 20-30 tons.

On the heavy machining section, most lathes are of the vertical type having capacities ranging from 600mm diameter to 3000 mm diameter parts which are mostly casted. This section has also medium to large size shapers. Production capacity per month on a single shift range from 30-40 tons.

In the sheet metals section and equipment for shearing, forming, rolling, edging and an array of welding machines used in the assemble of the units.

The machine shop has equipment for field fabrication and steel construction.

Only Metaphil has these machineries outside Metro Manila:

Bullard Multi-Spindle Automatic:
a) Maximum diameter of work - 20" ø
b) Capacity: 50-100 brake drums per day

Sonderman Vertical Boring Mills:
a) Maximum diameter of work - 102" ø

Keans Horizontal Boring Machine
a) Maximum height of boring bar - 31"
b) Maximum length of work - 84"

Kitchen & Wade Multi-Drill

a) 8-spindle drills

Stirk Production Planer
a) Maximum width - 42"
b) Maximum stroke - 11 pc.
c) 4 tool boxes

Storm Vulcan Crankshaft Rebuilder
a) Maximum length of crankshaft - 84"
b) Maximum stroke

Churchill Redman Profile Lathe
Kopp Profile Mill
Drummond Maximatic
Centrifugal Reb/abbitting Machine
Forging Hammer

There are 8 overhead cranes to facilitate the handling of bulky and heavy

materials and equipment.

The construction division undertakes:

Welded steel tanks	Elevator/excalator installation
Conveyor systems	Factory installation
Tank on tower	Plant maintenance
Tank on truck	Engineering services
Stainless condensers	Barge & Ship repairs
Dump bodies	Ship metal fabrication
TV/Transmission towers	Sounding & related marine works
Structural steel frames	Turn key projects
Pipeline installation	
Pile driving	

A. Foundry:

Total Floor Area: Approximately 2,650 square meters

Comments:

Handles the melting and casting of ferrous and non-ferrous alloys.

There are two (2) melting furnaces, one with a capacity of 1-1/2 tons, the other 1/2 ton. The furnaces are automatically controlled from a panel board. Make: Inductotherm variable induction power MARK IV. Both furnaces are of the tilting type and have good qualities and that the melt can be totally emptied, unlike the conventional furnaces requiring a residual of melt to remain in the crucible and topping it again for the next melt.

At present, the melting capacity of the foundry on a single shift is six (6) tons per day or 156 tons per month of 26 working day.

There are at present investments being made to automize operations in the foundry especially in sand preparation and the cleaning section. These improvements would enable the foundry to Increase its capacity to 200 tons per month.

There are three (3) overhead cranes for handling bulky scrap metals, finished castings and pouring laddles.

Metallurgical inspection is done through a Rank Hilger compøuterized spectrometer that determines metal composition in less than 30 seconds.

Foundry Division Cast:

Carbon steel	Marine Bronze Propeller
Manganese steel	ChromeMoly steel
High heat stainless steel type HH & HR	
13-2-1 alloy	Stainless steel 304 & 316
Ni-hard	
Gray Iron	
White iron	
Tiger Bronze	
Phosphor Bronze	

Our products are comparable to the originals in quality and performance. They are, by Industry sewed as ff:

Sugar Industry:

a) Cane car wheels and axle assy.
b) Cane car bronze bearings
c) Trash plate bars toes and scraper
d) Mill roll flange and bearings
e) Sprockets and bearings
f) Conveyor slots, pins, bushings and rollers
g) Pump casing and impellers
h) Cane knives, hubs and blades

Mining Industries:

a) Ball mill truss and wear plates
b) Cast iron grinding balls
c) Development and production cars
d) Sprockets and gears
e) Shears, hubs, and drums
f) Jaw crusher manganese parts
g) Scraper bodies
h) Liners

Paper and Allied Industrial

a) Grate bar
b) Stainless steel parts
c) Pump casing and impellers and bushing
d) Propellers
e) Conveying chips
f) Bearer bars

Shipping

a) Van containers
b) Sheave blocks
c) Goosenecks, padeyes, shackles
d) Marine propellers

Fabrication and Construction Contracts Completed:

Marubeni Corporation	2,983,108	Fabrication of Sugar mill equipm,ent of 4,000 TPD for Upsumco & Busco
United Planters Sugar Milling Company	4,120,000	Roller crushers and Pier work
La Paz Daisue Cons't	1,211,650	Construction of Tanks and
Biophil Plant Ormoc		structural steel building
Pacific Cement Corp.	193,400	Conveyor and Machinery Installation

Related Activities with the various Aboitiz 3 Company Enterprises as a compliment:

Cebu Shipyard:
Various castings, ship renovation & pier side repair;
Machining which CSEW cannot handle;
Subcontracting;
Ship propulsion repairs & fabrication
Gorones Development Corp:
Construction and erection
Power Companies:
Fabrication, erection, maintenance and repairs