HANDPUMP APPLICATIONS ON RURAL WATER SUPPLY IN THE PHILIPPINES

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BACKGROUND

Country Profile

The Philippines is comprised of more than 7,100 islands with a total land area of 300,720 square kilometers. Almost 95 percent of the land is located in eleven of the largest islands with two, Luzon and Mindanao, accounting for two thirds of the total land area. A Map is shown in the following page for reference.

Mild tropical climate characterize the country through the year. Average annual temperature varied from a maximum of 32 degrees to a minimum of 22 degrees centigrade, while relative humidity varies from a low of 76 percent to a high of 83 percent.

In 1980, the population of the country was estimated at 49 million, with an annual growth rate of 2.8 percent.

In 1982, the Gross National Product (GNP) was placed at P336, 016M ($40M). Agriculture, fishing and forestry contributed 26 percent of this figure; industry, 36 percent and other services accounted for the remaining 38 percent. Average per capita income was P6,622.00 ($367.88).

Indicators of the quality of life in the country, especially health conditions and health facilities, have been generally satisfactory and continue to improve.

Existing Water Supply Situation

As of 1981, an estimated 53 percent of the total population of the Philippines were being served by public water supply. The service average was 82 percent of the population in Metro Manila and its adjoining areas, with only 47 percent in the rural areas. The rest of the population depended mainly on water from open wells, rain water

cisterns, lakes, rivers and streams, many of which were of doubtful quality.

Levels of Water Service

The Philippine government provides three levels of water service to the people, namely:

a. Level I - Point source (A well or a developed spring serving about 50 households or lesser)

b. Level II - Communal Faucet System (A system composed of a source, a piped distribution network and communal faucets)

c. Level III - Waterworks System (A system with a source, a piped distribution network and household connections or individual taps)

Illustrations of these levels of water service are shown in Annex I.

The type of service provided to a community depends largely on such factors as population density, source of water, acceptability of the proposed project to the end-users, and development cost.

Rural Population Coverage

There are around 45,672 public wells in the country, of which 31,250 are in the rural areas serving an estimated 14 million inhabitants.

There are more than 3,000 development springs, serving around 5.4 million persons, mostly in the rural areas. The country abounds in springs but most of them are located far from clusters of population.

Communal faucets or public standpipe systems numbering 1,469 serve around 900,000 persons in the rural areas. Majority of the water sources are deep wells and developed springs.

Water Resources Conditions

The Philippines has abundant water resources, having an average annual precipitation of 2,260 mm, an average annual run-off of about 256,900 million cubic meters with 90 percent available of the time, and large reservoirs of groundwater covering some 50,000 square kilometers concentrated mostly beneath its major river basins. The distribution of these water resources varies widely with time and location to the archipelagic nature of the country's geography and climatic conditions.

Institutional Arrangements

The government has rationalized the water supply sector as follows:

The National Water Resources Council (NWRC) formulates all framework plans and policies for water supply in the country.

The Metropolitan Waterworks and Sewerage System (MWSS) provides water supply in Metro Manila and other contiguous areas that may be added to its jurisdiction according to its charter.

The Local Water Utilities Administration (LWUA) remains responsible for the creation of water districts which provide water supply to areas with a population of 20,000 or more.

The Rural Waterworks Development Corporation (RWDC) provides water supply in the rural sector and other areas not covered by MWSS and the LWUA.

The Ministry of Public Works and Highways (MPWH) serves as the principal implementing arm of the RWDC for engineering and construction.

The Ministry of Local Government (MLG) implements the Barangay Water Program with financial assistance from the US Agency for International Development (US-AID).

The Ministry of Health (MOH) promotes safe water supply and exercises surveillance on the quality of water.

Rural Water Supply Program

The rationalization of the water supply sector paved the way for the formulation of the Rural Water Supply and Sanitation Master Plan for the period 1982 - 2000. This master plan embodies specific policies, targets, and action programs for the provision of potable water supply to the rural communities. It also provides the framework for coordination development activities by all entities concerned within this sector.

Considering the extent of the water supply needs and the resources that can be mobilized to meet these requirements in the shortest possible time, the following targets have been set.

a. Immediate Targets - By the end of 1984, all barangays in the country shall have a minimum of Level I service ; all existing non-operational public wells shall be rehabilitated replaced, or repaired jointly by the government and the end-users ; about 50 percent of the poblaciones and 10 percent of the rural barangays shall have at least Level II service ; and about 25 percent of the poblaciones shall have Level III service.

b. Intermediate Targets. By the end of 1986, about 30 percent of the rural barangays shall have a minimum of Level II service ; the incremental demand for repair and rehabilitation of wells shall be met ; all sitios or clusters of population with 50 house-

holds or more shall have a minimum of Level II service.

c. Long range Targets. By the end of 1990, about 50 percent of all barangays shall have a minimum of Level II service; by the end of 1995, all poblaciones shall have Level III service; and by the year 2000, 70 percent of the sitios or clusters of population shall have a minimum of Level III service, while 30 percent shall maintain the Level I service.

The required investments in order to attain the aforementioned targets are enumerated hereunder by stage of implementation (figures are presented in million pesos, as of December 1981).

Level of Water Service	Stage I (1982-1985)	Stage II (1986-1990)	Stage III (1990-2000)	Total (1982-200)
Level I	416.54	317.84	642.06	1,376.54
Construction	375.84	299.84	630.06	1,305.74
Shallow Wells	61.95	71.41	84.71	228.07
Deep Wells	245.96	184.03	309.60	739.59
Springs	59.18	21.15	121.50	201.83
Others	8.75	23.25	104.25	136.25
Rehabilitation	40.80	18.00	12.00	70.80
Level II	999.32	968.22	1,411.41	3,378.95
Source Development	199.32	193.22	281.41	673.95
Distribution	800.00	775.00	1,130.00	2,705.00

STANDARD WATER WELL DESIGNS

The most widely used water supply source in the country today is groundwater extracted from wells and springs. The three types of wells commonly used in the Philippines are:

Shallow Wells

A well with cast iron suction pump, with either 38 mmϕ (1/2"ϕ) PVC casing pipes and screens or 50mmϕ (2"ϕ) GI casing

pipes and well point. Single purpose or multi-purpose hand pumps maybe used. This type of well is applicable in cases wherein water level is not more than 6 meters (20') deep and it has an average well depth of 12 meters (40'). The service coverage is up to 30 households. It cannot be upgraded as source for Level II system.

Intermediate Well

A well with 46mmØ (1 13/16"Ø) cylinder pump (also known as medium duty hand pump) and 100 mmØ (3/8"Ø) sucker rods on 50 mm0 (2"Ø) GI casing pipe with well point and wooden handle. It is applicable for wells where the water level is more than 6 meters (20') up to 30 meters (98') deep. The average well depth is 50 meters (165') and the average cylinder setting is 25 meters deep. It cannot be upgraded as source for Level II system.

Deep Well

A well with larger diameter steel or block iron casing pipes and screens, suction pipes with cylinder, sucker rods and wooden handle. It is applicable for wells where the water level is more than 20 meters (98'). The average well depth is 60 meters (197'). It can be converted as source for Level II system.

DRILLING EQUIPMENT AND METHODS

There are two kinds of equipment widely used in drilling wells, the percussion rig and the rotary rig. Experience in well drilling are aptly described as follows:

Percussion Type

The percussion rig, which drills boreholes by repeatedly dropping a heavy weight into them, may be of the mechanical or manual type. In constructing a well by a mechanical percussion rig, the drilling tools, well casing screen, and other materials used are suspended and manipulated from derrick. The percussion bit is then alternately dropped and raised on and out of the borehole to loosen the ground. The loosened particles are then brought to the surface by means of a bailer. This operation is continued until the desired depth of the well being constructed is reached.

On the other hand, the manual type of the drilling rig is suspended through a pulley and tied on top of a tripod which is operated by a man who alternately pulls and releases the rope connected to the drill bit. The drill bit is hoisted up when the rope is pulled and drops when the rope is released. The alternate raising and dropping of the drill bit loosen the ground. The loosened particles are then brought to the surface by means of bailer or a similar tool.

Manual methods of drilling are not always successful in constructing

a well especially in areas where ground water level is very deep. In such case, a light-jet percussion rig are being used to drill holes 38 (1 1/2) to 150 mm (6') in diameter and up to a depth of 70 (230') meters. This portable light rig can drill through soft rock and hardpan. Operation technique is simple and can be learned easily. Wells drilled with this type of rig cost much cheaper than a borehole drilled with a standard percussion rig.

Rotary Rig

Rotary rigs are more varied in construction and operation. In normal rotary process, mud is pumped down to the center of the drill stem or shaft. The mud returns through the annular space between the drill stem and the borehole walls carrying with it loosened materials from the bit. The pressure of the flow forces mud into the borehole wall which seals and supports it. Other rotary methods use water and high pressure pumps or compressed air to blow the loosened materials to the surface in these types of rotary drilling, a variety of bits is used, from the simple roller bit work, to the diamond drill for more complex work. A bit tipped with industrial diamonds penetrate the hardest rock formations.

The advantage of the rotary rig over the percussion rig is that the former drills faster and can penetrate harder rocks. The rotary rig, however, is more expensive than the percussion rig.

HAND PUMPS

In view of the hydrogeologic condition of the country, several millions of people in the Philippines depend on hand pumps for their drinking water requirements. Major hand pumps programs are underway. There is now a growing awareness of the important role hand pumps play in providing acceptable drinking water supply to millions of people in the rural areas and urban fringes.

Existing hand pumps in the country today are generally categorized into two: shallow well hand pumps and deep well hand pumps. Shallow wells are fitted with surface mounted cast iron hand pumps. On the other hand, deep wells are fitted with medium or heavy duty hand pumps.

There are two kinds of shallow well hand pumps - the single-purpose and the multi-purpose hand pumps.

Like shallow well hand pumps, there are two kinds of deep well hand pumps - the medium duty and the heavy duty hand pumps.

Specifications and graphic illustrations of hand pumps are shown in Annex 2.

Presented below are the different situations wherein hand pumps are applied.

Type of Water Facility	Applications
1. Single-purpose shallow well pump	This is suitable in areas where the water level is not more than 6 meters (20') deep. It is also applicable in places where people fetches water in containers for their requirements. It can serve up to 30 households with an average investment cost of P110.00 ($6.11) per household.
2. Multi-purpose shallow well pump	This is suitable in areas where water level is not more than 6 meters deep. It is applicable in areas where people fetches water in containers and hoses (because of the provision of a nozzle in the pump). It can also serve up to 30 households with an average investment cost of P110.00 per household.
3. Medium-duty deep well hand pump	This type of hand pump is applicable in areas where the water level is more than 6 meters (20') deep and with an average cylinder setting of 25 meters, (82'). It is also applicable in areas where the water system will not be converted into a communal faucet system (Level II). It can serve up to 50 households with an average investment requirement cost of about P300.00 per household.
4. Heavy-duty deep well hand pump	This is usable in areas where the water level is more than 30 meters (98') and with an average cylinder setting of 40 meters (130'). It is applicable in areas where the water system will be converted into a communal faucet system (Level II). It can serve up to 50 households with an average investment cost of about P850.00.

ISSUES

1. Traditional hand pump designs (i.e. deep well hand pump and jet-matic hand pump) are widely used. Other designs, particularly the medium duty deep well pump, depp well pump using PVC casings and screen, and Blair pump, are being adopted at a snail pace and it requires acceleration considering its field suitability and lower costs.
2. With a program of construction about 10,000 wells per year and with about 250 mechanized drilling machines optimum utilization of drilling machine is inevitable.
3. Although there are several cases wherein water-users effectively maintain their hand pumps, in most instances they are not maintained properly. The same predicament is being experienced in pump repairs.
4. There is no accurate measure of water consumption or water flow in hand pumps except on estimate of per capita consumption within the service area, notwithstanding water used for other purposes outside of domestic use and excess water.
5. Local pump manufacturers can easily produce hand pumps that are bid on large quantities but are relatively hesitant to participate in the development of hand pumps due to the non-profitability of such undertaking.
6. Hand pumps produced are laboratory tested by the manufacturers themselves because the Government does not have the facilities for such tests. There is no measure to check the accuracy of the test certificates except field trials.
7. Villagers or water-users generally accept only hand pumps which they are familiar of and are apprehensive to accept new designs.
8. Turnover of well drillers and system operators is indispensable, hence, the dire need for regular training program on well drilling and system operation and maintenance.
9. Drilling and hand pump costs continue to increase at a high rate (25 percent annually) never experienced in the past.

Knowing pretty well the resources available as well as the implementation constraints, I can conclude the following:

CONCLUSIONS

1. With the hydrogeologic condition of the country, the Philippines will continue to avail greatly on groundwater sources for its drinking water supply needs especially in the rural areas.

2. Standard designs of wells and hand pumps will be improved or modified as a result of researches being conducted with due consideration on field suitability (water users can easily operate and maintain the system) and cost.

3. Water users accept new or improved designs of hand pumps provided adequate and proper information dissemination campaign (i.e. features, benefits, previous experience) is undertaken.

4. Testing and evaluation of hand pumps should be a continuing undertaking so as to develop and attain the most suitable type, at the least cost possible.

5. Institution building should further be strengthened.

6. Longer warranty period is requested by the government from manufacturers to guarantee quality of workmanship on hand pumps being produced.

7. There is a big necessity to monitor periodically (semi-annually) a reasonable random sample of villages using hand pumps in order to establish historical data on operation and maintenance practices and costs which may serve as inputs on planning activities. Possible improvement/s in operation and maintenance can likewise be instituted.

8. Village Caretaker's Log Book or registry book of information on the operation, maintenance and repair of water facilities is indespensable and should be continuously developed.