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A novel water system

INTRODUCTION

Barangay Water Program (BWP) is the 'novel' one. Government of the Philippines (GOP) and the United States Agency for International Development (USAID) are jointly funding this rural water supply program. The program has been in operation since 1978 and is scheduled to be terminated by the end of 1985 (time of this writing is August 85) A new USAID financed project is expected to serve the rural water sector in future. Under this program during the last 6.5 years, approx 600,000 people has been provided with water supply services through more than 1100 completed projects. BWP's potential beneficiaries could be as large as 1.2 M people.

This paper will describe briefly the program concentrating mainly on the special features that constituted its 'novelty'. A rather detail presentation is made about using standard designs, drawings and forms.

It is to be mentioned that the opinions and conclusions expressed later are the author's own, and not those of either USAID, BWP or Sheladia Associates, Inc. The procedures, numbers and other facts cited in this article are from BWP's manuals and internal documents though. The author is currently engaged as an engineering consultant to USAID/Philippines for this project.

WHY CALL IT NOVEL

The American Heritage dictionary defines 'novel' as something 'strikingly new, unusual or different'. This program is definitely an unusual one with its approach and objective being different from other water supply programs. This is a water supply program where water supply is NOT the MAIN objective even. It's primary objective was to develop the institutional capabilities of the local government units (LGU) like provincial or city governments. And developing institutional capabilities have helped in tapping the vast human resources of the LGUs, which in turn have helped the program to become one of the most successful water supply program in the country. Another novel idea was to introduce the system of the users paying for their water, a concept which is rather alien in the rural areas of the Philippines. A project is not considered viable unless it is determined that the potential users are capable (and willing) to generate enough revenue to meet at least the operating expenses of the system.

PROGRAM DESCRIPTION

The program is administered as a special project of the Ministry of local Government (MLG) by a Manila-based project management office. This office is also referred to as 'BWP' in this text. BWP implements the program through the LGUs with the help of its own staff and the assistance of several consultant groups.

BWP offers three levels of services. Level I service provides handpumps to a cluster of houses with 30-120 people. Levels II and III services provide water source, storage tank, distribution system and public faucets (for Lv II) and individual house connections (for Lv III); are designed to provide 60 and 100 liters/capita/day (avg) respectively for communities upto 10,000 people and are usually referred to as 'water systems'.

When the barangay (or village) people feel the need of a water supply system they approach to the LGU officials who conduct the necessary feasibility and preliminary engineering surveys to determine the suitability and viability of the project. When BWP approves it as a viable project, LGU prepares the final design and contract (or construction) documents. BWP approves the final design and issues orders to proceed with the construction. The LGU then enters into a contract with a contractor for the construction of the system or proceeds with the preparation of constructing it under the administration. Majority of the systems are built by the contractors though. Construction monitoring is done by the LGU with the help of BWP, USAID and the various consultants. At the end the LGU accepts the project from the contractor if found acceptable during a joint inspection of the contractor, LGU, BWP, USAID and one of the consultant group. The project is turned over to the consumers, represented by their Rural Waterworks and Sanitation Association (RWSA), by the LGU at a later date. Subsequently the contractor is paid by the LGU, the LGU is reimbursed by the GOP through MLG/BWP and GOP is reimbursed by the USAID.

During this period of construction related activities, institutional development works were going on also. The community was being organized to form its own Rural Waterworks and Sanitation Association (RWSA). They were being trained in community participation, management-operation-maintenance of water system, special skills like bookkeeping, budget preparation, etc. They are expected to, and often do, take part in the feasibility survey, preliminary engineering report, final design and final inspection.

A provincial or city evaluation team (PET or CET) is to visit the turned-over projects periodically to monitor the activities and to help manage the system.

NOVEL FEATURES

Strengthening LGUs:

One of the main objective of BWP was to strenghthen the institutional capabilities of the LGUs. A water supply program was chosen as a means to achieve that goal. In order to build a water system, the LGU has to learn and practice the activities related to project identification, planning (both short and long term), design a project, implementing the same, and a whole lot of other development related activities. As usual BWP's experience has been mixed: some LGUs have done better than others. Improvements in the institutional capabilities of the LGUs have helped in the growth of project development and impelementation. The most important part of this feature is that BWP would leave a very potent legacy in the form of several institutions who are not only capable of delivering a water systems but also equipped to handle other developmental projects.

Water Bills

Traditionally in the rural areas of the Philippines, people has considered water as a free commodity because it is a gift of GOD. It is the duty of the authorities to provide water, free of charges of course. Over the years the meager resources of the Government has been strained very much to pay for that 'free' service. BWP program was initiated to educate the people so that they accept the idea that they are obliged to pay for the services related to the delivery of water, just like they do for electricity. It seems that majority of the people has accepted the concept and willingly pay a monthly fee. That fee is supposed to cover the operating expenses and monthly amortization amount. Sometimes the fee may be less than that, but definetely more than what is needed for all operating expenses. Here also the result is mixed: some RWSAs are able to collect more than others. That difference is partly due to the lingering attitude about free water and partly due to economic conditions, quality of service and RWSA leadership.

Standard Designs, Drawings and Forms

Most of the people involved in the BWP program were inexperienced in the design and construction of water systems. There has always been a heavy turn-over of personnel involved in the program resulting in the loss of trained and experienced staff. A procedure had to be developed so that even these inexperienced staff (engineers and others) can deliver a safe and good water system. Standard designs, drawings and forms were some of the design aides developed to assist the staff. It involved in pre-designing many components, drawing standard details for many common items and developing forms to lead one step-by-step through a complicated analysis. Bulk of the work can be accomplished easily by judiciously choosing and assemblying these elements. It is like buying a suit (with the closest fit) off the rack and when making minor alterations to it. The finished product will be reasonably good without the services of a master tailor for every individual client.

Standard designs were produced for many major components within BWP's context.

A storage tank is a major and important component of any water system. Both on-ground and overhead, steel and concrete, type tanks have been used in BWP projects. It takes lot of time and skill to properly design one. So standard designs for the storage tanks were developed and distributed to the LGUs for their use. Now any engineer, even the inexperienced ones, can easily design one by knowing only the required capacity and height. Capacity may be determined by the number of beneficiaries and height, from the hydraulic analysis of the distribution system. All he has to do is to use the table shown in Fig. 1 (Elevated Steel Tanks) and other related designs to produce a detailed and complete design of an overhead steel storage tank within a short period of time. The designer is advised to choose the next higher size and height from the table in case the required ones are not on the standard set.

Cable suspensions are used to cross a natural low area like a river or a deep gorge which is quite common in rural water supply systems as many times a distant spring is tapped as the source of water to avail of a gravity-fed supply. Cost of pumping water is one of the most critical factor in the survival of a rural water system. But again the design of that is usually beyond the capabilities of most of the engineers involved in the program. But now they can design the right structure easily by using Fig. 2 (Cable Suspension) and related design. The design has been made for both concrete and steel supports.

Friction loss tables have been developed showing the various types of pipes and the related friction losses. The design flows have been listed at small increments. An example is shown in Table 1, Friction Loss for uPVC pipes. A designer may determine the friction loss for any combination of flow and pipesize of uPVC pipes from this table. He is advised to use the next higher flow if his design flow is not listed in the table. Sacrificing a little bit of accuracy the designer eliminates the tedious process of using nomographs, which they are less familiar with anyway. Similar tables have been developed for PE and GI pipes also.

This paper refers to only two or three examples of using predesigned components due to space limitations. Even the cited examples are just one small part of the whole design. BWP standard design includes designs of wells, slow sand filters, office buildings, and numerous others in addition to those mentioned above.

Standard details have been developed for various items encountered in a rural water system. These include all the structures for which standard designs have been prepared and others. BWP's book of Standard Designs and Drawings contain more than 150 sheets. Each structure is detailed as needed. Most of the time a designer can just photocopy the standard designs and details and mark the appropriate ones being used. For example, from these standard drawings, one can produce all the necessary construction drawings of an overhead steel storage tank of say 68,000 liter capacity, 8.1 meter high, with details like reinforcement of the footings, column-tank connections, pad plate for the overflow pipe, etc. without knowing much about the design of a storage tank.

Standard forms were developed for feasibility survey, preliminary engineering report, construction inspection checklist, final inspection checklist, etc. Lack of space prevents showing examples of these forms. But these forms were developed so that one can analyze a complex condition or perform a detailed task without proper appreciation of all the rationale behind them.

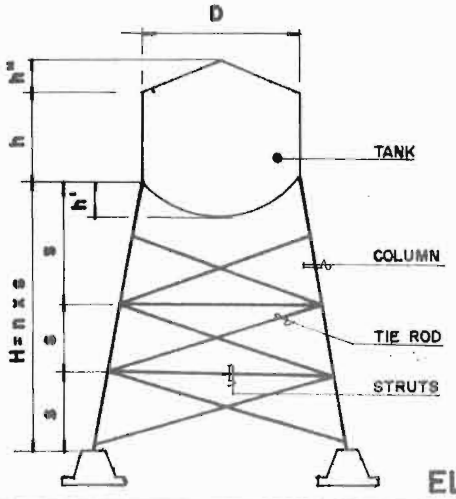
TIPS FOR FUTURE PROJECTS

The success (or even the viability) of any country depends on the historic situations at the time of political, social, económical and technical conditions there. Yet there are enough 'universal' features in the rural water supply area to transcend the site-specific constraints. Judicious modifications of the details must be made though. BWP's experience may be reviewed from this perspective and may be gainfully used in other projects, as it should be.

An active and alert community participation is necessary for the success of any program. It is imperative to develop the social and organizational institutions first rather than emphasizing on the speedy construction of as many projects as possible. But these institutions need not (and can not) develop fully before launching construction phase. People become more interested in any program when they see the physical dimensions of the program and start enjoying it's benefits. All trainings must be provided on a repeatative basis over a long period of time. Level of service has to be compatible with the liking and expectations of the people. BWP tried to introduce a relatively inexpensive low pressure low flow (0.4 lpm) system. It was abandoned due to consumer rejection despite its cost advantage. Lv II services should be considered only as a temporary phase. Every Lv II project completed under BWP has undergone transformation of various degrees to Lv III. System components, mainly distribution system, became inadequate and quality of service deteriorated. It resulted lower consumer satisfaction and sometimes even threatening the viability of the projects. Wells should be installed with outmost care. Any savings in the cost of well construction resulting from compromised quality is a false one. Many times more would have to be spent later to restore proper service. For the ultimate viability, a project must be self-sufficient; it can not depend on the dole-outs of external agencies. Maintenance activities should have equal, if not more, importance as construction activities in any program. Above all a knowledgeable, interested and dedicated leadership is essential for the successful fruition and implementation of any program.

CONCLUSION

This paper was neither intended to, nor did, portray a complete picture of the BWP program. Four pages are not enough for that. The program has seen its share of success and failures. This paper has focussed only on a small area of the program by trying to expound on the idea of having standard designs, drawings and forms and using them advantageously. Using those allowed the inexperienced engineers to be productively involved in the design without jeopardizing the safety of the system. Non-engineers may also use the various forms and follow step-by-step to arrive at a reasonable conclusion. Experienced staff may use these to save time



TANK SIZE

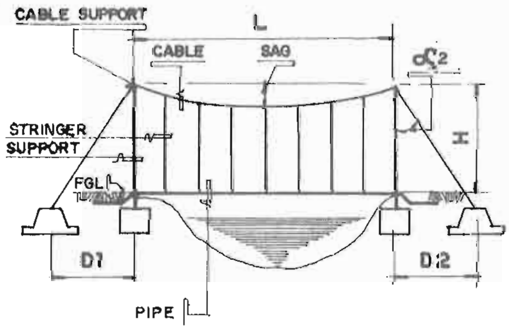
CAPACITY liters	DIAM. D (m)	HEIGHTS (m)			PLATE THICKNESS	
		h	h'	h"	bottom	shell & roof
22 700	2.9	2.45	1.45	0.5	7mm	5mm
68 000	4.20	3.65	2.10	0.70	7mm	5mm

SUPERSTRUCTURE & DIMENSION

TANK CAPACITY (liters)	height H(m)	S (m)	n	column	strut(mm) 2∠'s	tie rod (mm)
22 700	6.6	2.2	3	W6 x 20	76x76x6	22
68 000	8.1	2.7	3	W8 x 24	100x90x8	30

ELEVATED STEEL TANK

FIGURE 1



CABLE STRUCTURE

L(m)	PIPE DIA. (mm)	CABLE			STRINGER		H'(m) min.	α2
		sag (m)	dia. (mm)	length (m)	nos.	dia(mm)		
20	150	1.0	13	20.13	9	6	1.5	35°±
30	200	1.2	16	30.13	14	6	1.7	35°±

NOTE :
BOTH CABLE SUPPORTS MUST BE AT THE SAME ELEVATION

CABLE SUSPENSION

FIGURE 2

TABLE 1

FRICTION LOSS uPVC PIPES,[1] m/100m

FLOW Q, LPM	DIAMETER mm								
	75	90	110	125	140	160	180	200	225
50	0.15	0.06	0.02	-	-	-	-	-	-
100	0.54	0.21	0.08	0.04	0.02	-	-	-	-
150	1.15	0.44	0.16	0.09	0.05	-	-	-	-
800	-	-	3.57	1.91	1.09	0.51	0.40	0.21	0.12
900	-	-	4.44	2.37	1.36	0.71	0.49	0.24	0.14
1 000	-	-	5.39	2.88	1.65	0.84	0.59	0.29	0.16

NOTE :
(1) NOMINAL DIAM. SDR 18 PIPES

E X A M P L E S

and reduce the chances of mistakes and omissions. These also provided a degree of standardization in an otherwise vastly decentralized project. It is difficult to measure the adverse effects of using those predesigned elements. One potential risk may be the lack of incentive for the LGU engineers to know the whys and hows. That attitude has to be overcome by proper trainings. On the otherhand, BWP experience shows that the LGU engineers have become more interested to learn the details after using the standards. The author wants to conclude this paper with the hope that these discussion would be of some help to somebody.