

CHAPTER ONE



INTRODUCTION

1.1 Need for Water-Works

In Thailand, adequate public water supplies in urban and rural areas outside Bangkok Metropolitan are lacking. It is estimated that only 2.6 million inhabitants in those areas which is about 1 % of total population are served with piped-water systems. The vast majority of the unserved population depends on any available water sources, such as rivers, canals, ponds and wells, all of which are subjected to potential risks of contamination and aiding transmission of diseases. There are many great areas where water scarcity is chronic, where people have to travel for kilometers to fetch water for survival.

Water is not only one of the essential needs for human existence, it also acts as a stimulant for national development. There are possibly two principal effects of public water systems in communities. They are the amenity that improves the quality of life, and the promotion to economic development. In the first case, they reduce the labor in collecting water, enhance sanitary conditions and reduce diseases. In the second, they satisfy the demands of local business and industry and hence

promote economic prosperity in those small communities. Another indirect effect is that the consequent increase in the better living condition in those areas may allure the inhabitants not to migrate into Bangkok Metropolitan area which leads to many physical and social problems such as water pollution, traffic congestion, poor housing, unemployment and crime. All these degraded conditions cause great losses to the country annually.

1.2 Previous Works of National Agencies

The situation as described above has resulted in the need for tremendous improvement in water supply for urban as well as in rural areas. The Government of Thailand being concerned with this problem, has arranged various programs with an exact target to provide clean water for all communities throughout the country. They are proposed in long-range plan and included in all National Economic and Social Development Plans.

Many water-works has been constructed to implement these programs. For example, a regional Potable Water Project which began in 1962 and ended in 1966, offered 165 water systems serving approximately 480,000 population in some 357 communities. Water supplies under these programs can be divided into two main systems, according to the region served. They are:

1.2.1 Rural Water systems assisting approximately 31 million rural inhabitants to have improved water supplies can be

roughly divided into two groups: non-piped with many types of water supplies and piped water supplies.

Communities with less than 1,000 population are assisted in obtaining improved water supplies by a number of Government agencies. These are not piped systems but improved dugged or drilled wells with hand pumps, storage tanks for rain water, and construction of small surface ponds or storage reservoirs. The Government agencies engaged in these works are:

- a. The Ground Water Division of the Ministry of Industry.
- b. The Sanitation Division of the Ministry of Health.
- c. Deep Well Drilling Section of the Provincial Water Supply Division of the Ministry of Interior.
- d. Accelerated Rural Development of the Ministry of Interior.
- e. The Department of Local Administration of the Ministry of Interior.
- f. The Department of Community Development of the Ministry of Interior.

The activities of the six agencies are coordinated at the provincial level by a committee headed by the provincial planning officers, and also at the National level by a "Clean Water Committee". Most often these water works are provided for the urgent elimination of water scarcity. Some water works with low quality equipment or temporary structures usually break down

within 2 or 3 years of service and hence iterating investments are needed reflecting little progress. Among these types of works, shallow and deep wells with only a hand pump per well are considered to be most suitable for small communities. Previous works already constructed from the beginning to the present year are shown in Table 1.

Communities with population from about 2,000 to 5,000 are being provided with piped water supplies by the Rural Water Supply Division, of the Ministry of Health. There are 538 such water works supplying 2,190 villages with a population of 1,440,000. Raw water either ground or surface from nearest sources to the communities is treated in standard design plants and distributed to consumers' dwellings either with or without meter. Operation, maintenance and management of these water-works are supervised by local district officers trained by technical staff of RWS. Lack of skilled operators and high tariffs as thought by consumers make these water-works of more than fifty have intermittently shut down or discontinuously operated for all year service.

1.2.2 Urban water systems refer to systems which serve population in Municipalities and Sanitary Districts outside Bangkok Metropolitan Area throughout Thailand. These water-works are under central administration by the Provincial Water Supply Division of the Public Works Department in the Ministry of

Interior. There are 166 water-works owned by PWS. The other 52 water-works are concession-granted to some Municipalities, Sanitary Districts or private enterprises. For those it owns the PWS plans, designs, constructs and supervises the systems in service. Water served for 1,440,600 population in these communities is usually provided on a 24-hour basis with adequate

Table 1 Rural Water Supply for communities with less than 1,000 population

Type of Works	Number of works	Number of villages served	Number of population served	Remarks
<u>Shallow Wells</u> (1 for 10 households)				
Department of Local Administration	26,585	2,353	1,541,930	
Community Development Department	4,899	433	284,142	
Accelerated Rural Development	1,805	168	104,690	
<u>Standard Ponds</u> (1 for 80 households)				
Royal Irrigation Department	590	418	273,760	

Type of Works	Number of works	Number of villages served	Number of population served	Remarks
Accelerated Rural Development	808	289	189,312	
Community Development Department	1	-	464	
<u>Improvement of Existing Ponds</u> (1 for 150 households)				
Department of Local Administration	4,555	6,046	3,962,850	
Accelerated Rural Development	137	182	119,190	
Community Development Department	34	45	29,580	
<u>1.5 m³ Steel Tanks</u> (1 for 6 households)				
Department of Local Administration	18,390	976	640,006	
Community Development Department	41	2	1,426	

Type of Works	Number of works	Number of villages served	Number of population served	Remarks
<u>150 m³ Concrete Tanks</u> (1 for 30 households) Department of Local Administration	643	168	110,316	
<u>Deep Wells</u> (1 for 50 households) Public Works Depart- ment	1,496	662	433,840	
Mineral Resources Department	6,718	2,972	1,948,220	
Accelerated Rural Development	1,551	686	449,790	
Community Development Department	44	19	12,760	
<u>Rural Water Supply</u> (1 for 460 households) Health Department	538	2,190	1,435,384	
<u>Village Water Supply</u> (1 for 35 households) Health Department	10,431	3,231	2,117,493	

Type of Works	Number of works	Number of villages served	Number of population served	Remarks
Community Development Department	118	36	23,954	
<u>Dykes and Reservoirs</u> Accelerated Rural Department	129	-	-	

Source : NESDB

pressures. In general, the quality of service seems to be satisfactory. The quality of water produced also meets the standards for domestic uses. Both capital costs for construction and installation to bring the projects to completion and annual costs for operations, maintenance and replacement to fulfill the requirements of water-quality management of these water-works with perfect collection, purification and distribution facilities for communities in municipal and sanitary areas are slightly high.

It is obviously seen that the cost of public water supplies give some concept of the magnitude of engineering activity and responsibility associated with their design and con-

struction. Whichever known method of water purification technique is introduced to achieve high level of quality, the costs mount enlargingly. The mount of investment in physical plant depends upon many factors: nature, proximity, and abundance of suitable water sources; need for water treatment; availability and price of labor and materials; size and construction conditions of the systems; habits of the people; and characteristics of the area served. Wide difference in these factors make great variation in both capital and annual costs. Considering that future requirement for well-functioning piped water supply in urban and rural communities will be wide spreading, the aim of this study is to provide current and past background information on some of the economic and engineering technological aspects of these investments, especially those aspects concerned systems planning and management in water-supply field in Thailand particularly those resembling the conditions which the water-works under the responsibility of PWSA or urban water works.

1.3 The Provincial Water Supply Division

1.3.1 Brief History In 1897, King Rama V enacted the local Sanitation Regulation and set up the Sanitation Department within the Ministry of Interior. This established Department was responsible for all sanitation activities including the provision of safe drinking water. To carry out this latter part of its responsibility, the Department hired a French engineer "De La

Rotier" who recommended the first piped water supply in Bangkok. After six years of construction, this water supply system went into operation in 1914. The Department extended pipe lines to serve people in Thonburi in 1917.

In 1942, Sanitation Department was successively promoted to be Ministry of Public Health. Provision of potable water was still an activity of Ministry of Interior and the Bangkok Water works came under the administrative control of Department of Public Works.

In 1940, the Department of Public Works took responsibility for the two urban water supplies constructed at Nakhon Pathom and Nakhon Sawan. Later, a smaller unit responsible for water-works outside Bangkok Metropolitan Area became the Provincial Water Supply Division.

The influence of Bangkok Water works on the development of provincial water systems was extensive, and almost all of the earlier provincial water-works practices were based on this first experience. These pioneer water-works were constructed at Saen Suk or Bang Saen district, Nakhon Rajsimma, Phisanulok, Sara Buri, Kaeng Khoi, Khon Kaen, Udorn Thani, Utai Thani, Pattani, Potharam and Had Choasamran during the year 1950-1955. After construction was completed most of these water-works have been granted concession to local municipalities.

Under the contract between PWS and the Asiatic Company, many water-works were built for almost every Municipalities during 1955-1960.

Since then, the number of water-works in the urban areas have increased rapidly. Now PWS has extended its services to all provinces in the municipal and sanitary areas throughout the country by its own staff. Up to 1975, there are 166 water-works in operation and 12 more are being constructed under the direct control of PWS.

1.3.2 Administration of PWS There are three main subdivisions and three sections in this Division as shown in Figure I.

These three main subdivision are:

a. The Technical and Planning embracing the planning and design for construction of new projects and expansion of existing water-works under allocated budgets, and also providing technological advices involving water supply to Government agencies. The subdivision consists of the following units:

- Projecting and Planning Unit This unit makes planning decision for alternative projects and plans for conservation of raw water sources.

- Surveying Unit This unit prepares information and data of the survey of selective communities which are necessary for the Design Unit.

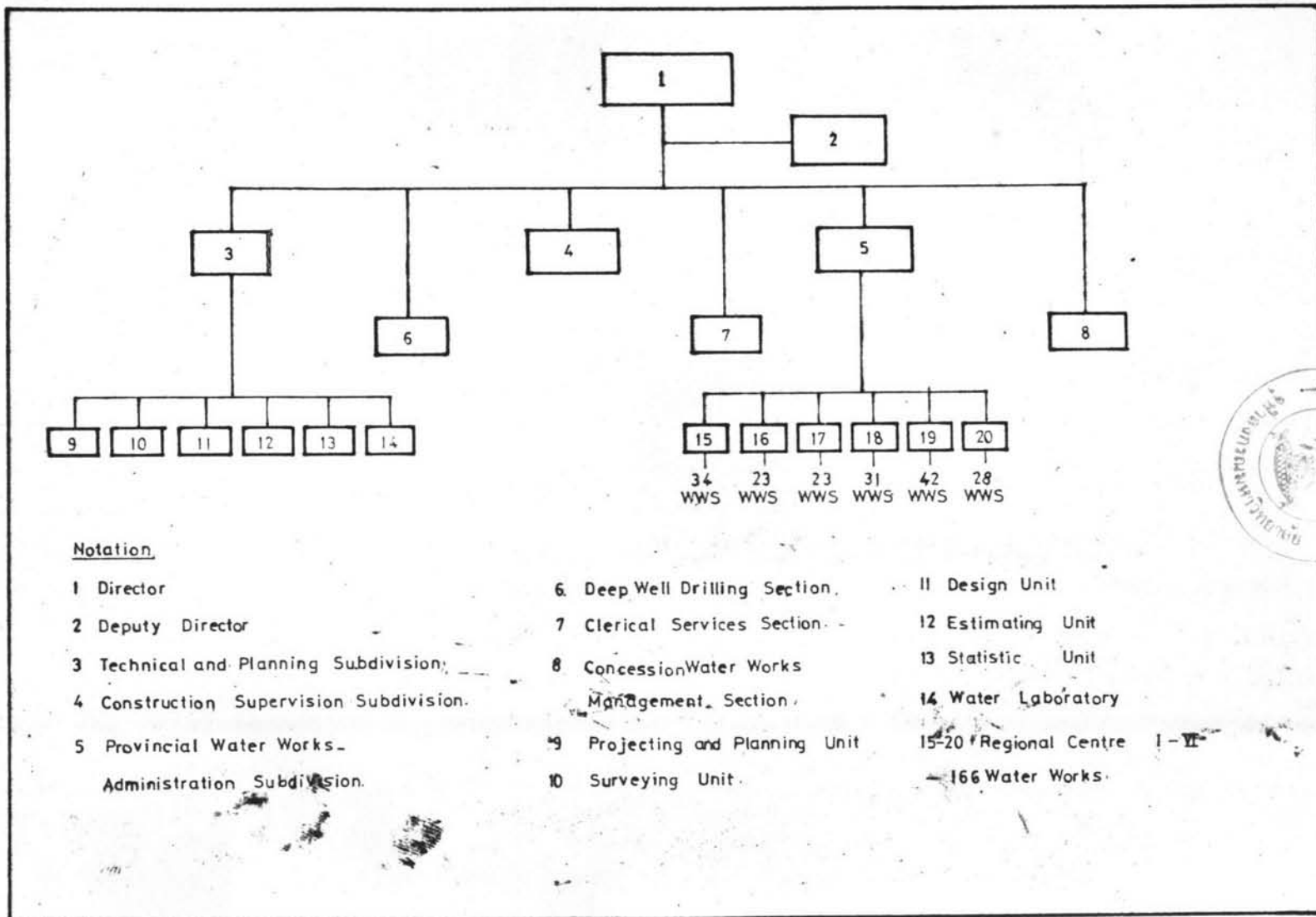


FIGURE 1 Organization chart for Provincial Water Supply Division.

- Design Unit This unit prepares the engineering details and drawings of selective projects for bids.

- Estimating Unit This unit makes a guided estimate of construction costs after the designs and specifications have been accepted.

- Statistic Unit This unit collects all records and provides information of water-supply field.

- Water Laboratory The Laboratory analyses the physical, chemical and bacteriological characteristics of both raw and treated water.

b. The Provincial Water Works Administration taking responsibility for all aspects of supervision of the PWSE's own water-works as providing technological supports for efficient operation, personel and financial management. The subdivision consists of six Regional Centers as for decentralized administration purpose.

- Six Regional Centers These centers act as coordinators between central administration and individual water-works. Each center takes responsibility for supervision of assigned water-works of about 30.

- Individual Water-Works Each water-works gives direct service to customers within the area served. These duties include operating the plants, providing household connection, undertaking the meter management and collecting rates.

c. Construction Supervision dealing with the supervision

of construction to make sure that the contractors perform the bidded works in accordance with plan and specification.

The other three sections are:

a. Clerical Services providing legislative, financial and personel services for the Division.

b. Deep Well Drilling providing well drilling activities for searching of raw water sources and supplying water for rural communities as proposed by National Community Water Projects.

c. Concession Water-Works Management conceding and supervising the concession to all water-works except Metropolitan Water-Works advising the technical side of management of the concession water-works.

1.3.3 Financial Budget The financial budget for all activities of PWSO is composed of two parts:

a. Annual Fiscal Budget Government allocates fiscal budget for this Division averaging about P220 million annually. This budget is spent for the following items:

- Expansion of existing plants owned by PWSO about 50 % of the total amount.

- Construction of new water-works about 30 % of the total amount.

- Overhead expenditure about 8 % of the total amount.

- Miscellaneous including Deep Well Drilling and Concession Management expenditure about 12 % of the total amount.

b. Revolving Fund which was established in 1961 to receive the revenues from and pay for the operating expenses of the PWSO owned system. Government capital contributions to the fund ended in 1969 totalled $\text{฿}9.9$ million. Fund's budget is about $\text{฿}160$ million annually.

1.4 Objective and Scope of Study

The main objective of this study is to examine the quantitative investment behaviours of urban water-works which serve in municipal and sanitary areas in Thailand.

Since the study is aimed at those involved system planning and management in water supply field, some economic characteristics are observed. The scale of investment can be approached by determination of all compositions of both capital and annual costs which is influenced by many variable factors.

For PWSO's view point, the goal or benefit should be of pure economic efficiency or the maximization of returns on investments to PWSO on the basis of assuring fair water rates to its customers. This leads to study of past revenues and an establishment of water rate schedule for different classes of customers.

Corresponding with above objective, the following factors needed to be analysed:

a. to determine various economic scale factors for construction systems in the water-works;

b. to establish the capacity-cost functions for the construction systems in the water-works;

c. to formulate models for determining all components of operation, maintenance and replacement costs and also to determine total unit costs of treated water;

d. to determine optimal design periods for the purification plant in the water-works;

e. to determine the relationship of water demand over time and inhabitants in various observed area;

f. to determine the relationship of bulk population and population served by these water works over time to water demand;

g. to compare rate structure suggested and the existing.

Other factors which necessarily involves the implementation of the study or the analysis and evaluation of these water-works are also occasionally supplemented in this thesis.